CLINICAL DECISION MAKING BY PARAMEDICS IN EMERGENCY RAPID SEQUENCE INTUBATION

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DECLARATION

The author hereby declares that the content of this research project is the author's own unaided original work, except where specific indication is given to the contrary (by reference). This work has not been previously submitted to the Durban University of Technology or any other University.

Signature: 

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ABSTRACT

Purpose

Paramedic clinical decision making (CDM) surrounding emergency airway management of the critically ill or injured patient in the pre-hospital environment is poorly understood. In order to deliver pre-hospital care effectively it is necessary to understand how paramedics make clinical decisions in this area and determine what influences clinical practice. This study primarily investigated the factors influencing paramedic CDM in the context of advanced emergency airway management with specific focus on the newly introduced skill of rapid sequence intubation (RSI). An evaluation of the correct application of RSI guidelines, the determination of the need for their review and the identification of measures to enhance CDM around RSI were secondary research questions.

Methodology

The study was conducted in the interpretive paradigm using a case study approach to develop grounded theory. Four paramedic participants who had successfully completed a Baccalaureus Technologiae: Emergency Medical Care, were interviewed to collect rich textual data for analysis. Other sources of data included clinical details captured on a purpose-designed patient report form, clinical expert panel review and researcher review of the patient report forms. The data was analyzed using interpretive methods in order to answer the research questions, resulting in the development of a comprehensive conceptual model.

Results

Many factors influence paramedic CDM in relation to RSI when managing a critically ill or injured patient. The core category; the timing of clinical decisions surrounding RSI, was fundamental to the outcome of the RSI process and the patient. The study found that paramedics do generally follow the recommended guidelines for RSI although there were some gaps in the way these guidelines were applied. The study also identified the need to review the current RSI guidelines and further found specific key areas that need to be addressed in order to improve clinical practice.

Conclusions and recommendations

Emergency airway management of a critically ill or injured patient is a difficult task requiring successive execution of multiple critical decisions and tasks and that small errors at critical decision points may quickly magnify to result in airway compromise and patient death. Six key recommendations were made to enhance and improve paramedic clinical decision making.

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CHAPTER ONE

CONTEXTUALIZING THE STUDY

1.1. Introduction

This chapter serves to equip the reader with the necessary background information for understanding the context within which this research study is set. You will find that this chapter will take you through an overview of the research problem within the pre-hospital context resulting in the formulation of the research question. The research questions followed by the rationale for the study should seem clearer, once the context is grasped. This chapter is concluded with explication of the assumptions and delimitations of the study.

For easy reading, the pronouns ‘he’ and ‘his’ will be used throughout this document but represents both the male and female gender.

1.2. Background to the research problem

This section will provide the reader with a description of the background to problem that is being researched

1.2.1. History of rapid sequence intubation

Rapid sequence intubation originated as the anaesthesia technique known as “rapid sequence induction”, first described by Stept and Safar (1970:633) as a sequence of fifteen steps to rapidly induce anaesthesia and prevent aspiration in patients with full stomachs that is to definitively secure the patients airway by placing an endotracheal tube between the vocal cords. While there are many different methods for accomplishing RSI, all strategies universally include the combination of a sedative / induction agent with a neuromuscular-blocking agent, followed by the placement of an endotracheal tube under direct laryngoscopy (Walls, 1993:1008).

The abbreviation ‘RSI’ used to stand for both ‘rapid sequence induction (of anaesthesia)’ and ‘rapid sequence intubation (of the trachea)’. The term ‘rapid sequence induction’ emphasizes the use of a balanced anaesthetic including neuromuscular blockade to provide amnesia, anaesthesia, and ablation of airway reflexes whilst safely securing an airway (Seppelt, 2004:106).

The term ‘rapid sequence intubation’ emphasizes above all else the placement of a tube in the trachea to prevent aspiration by minimizing the time delay from loss of consciousness and/or airway reflexes, to placement of the tube. This term has been misused in many protocols such as ‘*RSI after morphine and midazolam’* where pharmacologically there was unlikely to have been any effect from the drugs at the time of laryngoscopy (Bishop, 1999:2000).

1.2.2. Risks associated with RSI

Whether it is performed in the back of an ambulance or in a hospital emergency unit, RSI provides quick sedation, facilitates rapid airway control, allows for physiologic control of the patient and minimizes the risk of adverse effects such as aspiration, intracranial hypertension (Wang, O'Connor & Domeier, 2001:41) and significant hypotension (Davis, Kimbro & Vilke, 2001:163, Choi, Wong & Lau, 2004:700).

However, RSI is a complex procedure that also includes confirmation of endotracheal tube placement, continuous post-RSI monitoring and on-going airway care. (Walls, 2004: 29). The RSI practitioner must also prepare for a failed intubation attempt, as paralytic agents like suxamethonium render the patient paralyzed and apnoeic. The failed intubation drill involves alternative procedures such as the insertion of an intermediate/alternative airway device, surgically inserting a tube through the cricothyroid membrane, or retrograde intubation (Walls, 1993:1008).

A body of evidence suggests that the risks associated with invasive airway management may outweigh any benefits with regard to oxygenation and airway protection (Walls, 1993:1008, Sing, Rotondo, Zonies, Schwab, Kauder, Ross & Brathwaite, 1998:598, Wang, O'connor & Domeier, 2001:40, Ochs, Davis, Hoyt, Bailey, Marshall & Rosen, 2002:159, Davis, et al. 2003:444). This is not universally accepted and does not represent accepted South African EMS practice (Professional Board for Emergency Care Practitioners, 2003). (*See Ch. 2, Sec. 2.3*). Nevertheless, the process of simply placing an endotracheal tube prior to arrival at hospital must receive careful consideration given the potentially adverse physiological effects imposed upon the patient during the procedure (Walls, 1993:1008, Sing, et al. 1998:598, Wang, O'Connor & Domeier, 2001:40, Ochs, et al. 2002:159, Davis, et al. 2003:444).

1.2.3. Questions surrounding the intubation of patients in the pre-hospital setting

Clinical interventions that are suitable and effective in the hospital are often assumed to be as good in the pre-hospital environment, however the uncontrolled nature of the pre-hospital environment may play a role in determining suitability of certain clinical interventions. Intubation has for many years been considered a skill that was life-saving in the first few minutes of an emergency. However, intubation itself in the pre-hospital environment has not been formally evaluated in terms of medium to long term benefit for the critically ill or injured patient. A number of questions arise in this regard – namely, where patients should be intubated, by what methods and by whom.

Emergency advanced airway management can be regarded as an invasive procedure, considering that it involves the introduction of artificial devices into deep anatomical structures, for life-saving purposes. In an ideal world all medical and paramedical personnel responding to a critically ill or injured patient who requires definitive airway management, should be experts in advanced airway management. This of course is impossible, so the question then becomes "how do we balance cost, training and availability of our personnel to maximise the benefits to our patients?" To answer part of this question, it is important to know how well developed pre-hospital systems are in any particular geographic location, including availability and appropriate use of aero-medical services and whether paramedics are themselves trained to perform advanced procedures or rely on pre-hospital responses by doctors.

Another question that arises is "what experience and training do the doctors actually have?" and "should such procedures only be performed by doctors?" Evidence indicates that junior or 'non-expert' doctors may themselves become a liability in the dangerous pre-hospital environment (Seppelt, 2004:106). Therefore, the only people who should be intubating critically ill or injured patients are those who are adequately trained and experienced in advanced airway management. This would include knowledge regarding suitable drugs for intubation and appropriate training in the use of alternative airways for failed intubation, involving at least one supra-glottic and one sub-glottic approach to the airway as described by Munford and Garner (2000:7).

1.2.4. Paramedic pre-hospital rapid sequence intubation in South Africa

In October 2004, the Health Professions Council of South Africa: Professional Board for Emergency Care Practitioners (PBECP) introduced RSI as a new skill to be conducted by B.Tech.: Emergency Medical Care (BTEMC) graduates. The initial introduction has taken place under the guidance of the Durban University of Technology's Department of Emergency Medical Care and Rescue (DEMCR) in February 2007 (Health Professions Council of South Africa, 2004; Pieters, 2007).

In view of the associated risks and in the interests of safeguarding patients, the DEMCR has been tasked to assist with the development of a quality assurance and governance mechanism for this new skill, which may only be performed by its BTEMC graduates within this research project (Pieters, 2007). The results from the research project will then provide the framework for setting up the quality assurance and governance mechanism.

1.2.5. Clinical decision making involved in RSI

A key requirement for the safe conduct of RSI is sound clinical decision making (CDM). This is because multiple decisions need to be made during the process of RSI, and an incorrect decision may result in the death of the patient (*See 1.2.2*). For example, the recognition of the need to intubate may seem uncomplicated compared with the task of selecting which pharmacological agent(s) to administer, and at what dose, especially when time is of the essence. The choice of agents is made more difficult by the complexity of resuscitation haemodynamics and the disjointed and fragmented information available at the moment of intubation.

Although RSI guidelines have been drawn up by the DEMCR, there is still no simple algorithmic answer for every patient (see Ch. 8, Sec. 8.3.1.11). This problem is highlighted by Wang and associates, who proposed a single decision algorithmic approach to pre-hospital airway management, arguing that it is unlikely rescuers will identify every possible difficult airway or corrective technique (Wang, Kupas, Greenwood, Pinchalk, Mullins, Gluckman, Sweeney & Hostler, 2005:146). This complexity makes CDM in relation to RSI very challenging for the paramedic.

In view of the importance of sound decision making, it became clear that it was necessary to understand how paramedics made decisions surrounding the performance of an RSI. Such an understanding should contribute to the development of a governance mechanism. However, I found that paramedic CDM has not been the subject of systematic, sustained research. Little is known of how paramedics make judgements and decisions, and how they deal with the risk and uncertainty that they commonly face in caring for critically ill and injured patients in the environment in which they work. With respect to the former, the paramedic functions as an extension of the hospital emergency unit and provides emergency services for diverse patient populations. The environment is fraught with challenges such as noise, poor lighting, unsterile conditions, extremes of weather and terrain, and sometimes volatile violent situations (Shaban, Smith & Cumming, 2004).

Furthermore, although prescribed clinical guidelines do exist (Professional Board for Emergency Care Practitioners, 2003), they may not always apply to a specific individual in an emergency situation. This again highlights the need for paramedics to be skilled in CDM and be able to implement appropriate interventions. This is especially important in the South African context where paramedics are autonomous practitioners.

1.2.6. Clinical decision making in general

In view of the lack of research into CDM by paramedics, a literature review of CDM in general was undertaken. A brief overview of the concept of CDM follows, in order to support the development of the research purpose in 1.5.

Clinical decision making (CDM) is a complex process whereby practitioners determine the type of information they collect, recognise problems according to the indicators identified during information gathering, and decide upon appropriate interventions to address those problems (Tanner, Padrick, Westfall and Putzier, 1987). The complexity of the process is due to the variations in clinical indicators, the magnitude of information to be processed, and the difficulty in predicting outcomes (Pardue, 1987; Hancock and Durham, 2007).

CDM may be influenced by several factors including past personal and clinical experiences (Cioffi, 2001:591; Shaban, 2005b; Hancock and Durham, 2007:21), self-confidence and competence (Castle, Garton & Kenward, 2007:664), and the availability of equipment and medications (Doran, Tortella, Drivet & Lavery, 1995:259). These factors may serve to enhance or impede clinical decision making (Pardue, 1987).

Whilst descriptions of judgement and decision making (JDM) are varied across disciplines, professions and philosophies, there is no one universal or ‘true’ definition of JDM. Representations of the constructs of JDM include clinical decision making, clinical judgement, clinical inference, clinical reasoning and diagnostic reasoning. (Shaban, 2005b). For the purposes of this project, I have chosen the term ‘clinical decision making’ due to the nature of the multitude of decisions that must be made by the paramedic, in his own professional environment.

1.2.7. Paramedic pre-hospital airway management training

This section has been introduced to highlight the differences in paramedic airway management training across the world. Training is directly related to the questions and concerns raised with regards to clinical decision making surrounding RSI.

Pre-hospital airway management training for paramedics is highly variable across the world. In the San Diego Rapid Sequence Intubation Trial (Davis, Hoyt, Ochs, Fortlage, Holbrook, Marshall and Rosen, 2003:444) the only training in advanced airway management was with mannequins. In contrast, a paramedic system in Bellingham County, Washington State (Wang, Davis, Wayne & Delbridge, 2004a:366) provided a training programme where paramedics received didactic teaching and practiced on models. They then performed a minimum of twenty intubations in the operating theatre. This was followed by periods of in-field supervision, on-going case review and annual refreshers.

In the South African context, paramedics (advanced life support [ALS] practitioners) are trained to undertake endotracheal intubation using direct laryngoscopy, together with the use of sedative drugs to obtain intubating conditions in the absence of complete paralysis. In an attempt to overcome this lack of paralysis, it has become common practice to significantly increase doses of sedation without consideration of cerebral perfusion pressures, depressed ventilation and associated carbon dioxide retention (Warner, 1996:74). In my own involvement and experience with paramedic education and training in South Africa, I have found that paramedics are trained in airway management using multiple airway management simulators within a structured education program.

The programme includes theory lectures, practical skills training and work integrated learning usually throughout the duration of the training programme.

The Durban University of Technology offers a Baccalaureus Technologiae programme in Emergency Medical Care (BTEMC), which strongly addresses the issues of proper airway management training. This program recruits experienced paramedics that have already completed a three-year National Diploma in Emergency Medical Care (NDEMC). The major module of this program focuses on advanced airway management with significant emphasis on RSI. The module includes didactic theory and practical sessions, operating theatre shifts, including insertion of supra-glottic airway devices. The focus of the rigorous training after the initial theoretical education is to promote good clinical skills development and enhance the practitioner’s clinical decision making ability. It must be noted that these learners already have a wealth of experience in standard endotracheal intubation and general airway management before starting the training program.

1.3. Background of the researcher and interest in the study

I have been involved with emergency medical care practice since 1994 and spent the past fourteen years developing as an individual practitioner with a strong focus and desire to improve the profession, both from an operational and education and training perspective. I currently hold a Bachelor's Degree in Technology in Emergency Medical Care and have been extensively involved in emergency medical service (EMS) education, training and development since 1999.

As noted in 1.2.4, the PPBECP authorized paramedic RSI as a new procedure to be introduced by the DEMCR. I became the vehicle within the DEMCR that was responsible for the introduction of this new procedure. This has led to the development of specific guidelines for advanced airway management. Further details on the introduction of this skill can be found in Chapter Two (Sec. 2.4). Since then, my interest in RSI has grown tremendously and I am dedicated to ensuring that the performance of this new procedure continues to be quality improved.

Over the years I have become increasingly interested in clinical decision making (CDM) and clinical governance, neither of which can exist independently. I have been teaching on the National Diploma: Emergency Medical Care program for the past four years, and during that period it has become evident that there is a need for better clinical decision making by these practitioners e.g. students seem to get caught up in the excitement of performing 'fancy' procedures like endotracheal intubation and needle inter-costal decompression, that they downplay the importance of thorough clinical analysis. This results in a practitioner becoming somewhat robotic. My primary concern is that CDM cannot be taught, but certain rules and guidelines can be given to would-be practitioners to assist in making clinical decisions. General issues, like critical reflection on clinical decisions, need to be something that a practitioner grows into, with experience, but which must be emphasised in the education and training.

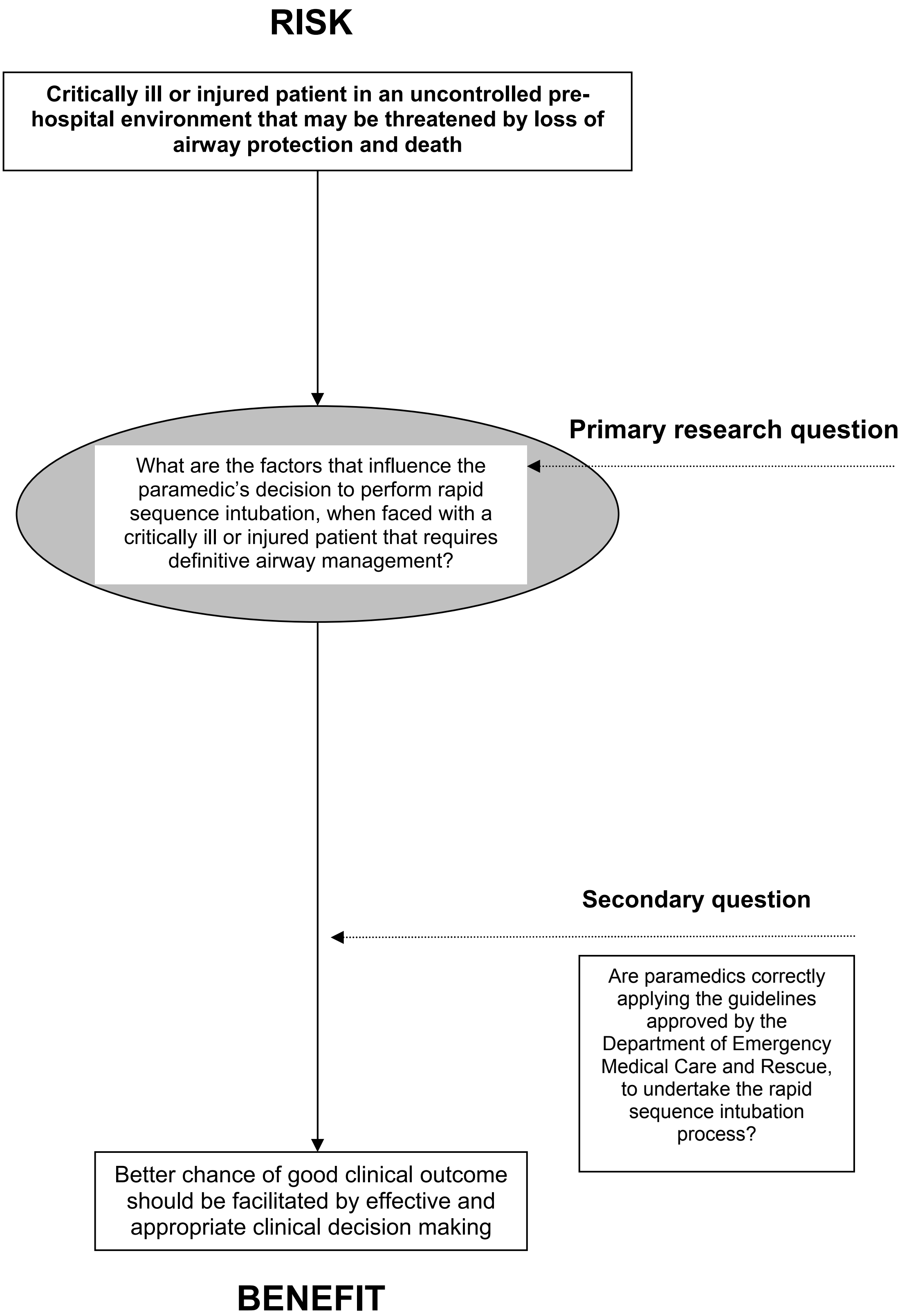
In order to facilitate sound CDM by practitioners it is necessary to understand the manner in which they make decisions. I realised that an important step in gaining such an understanding would be to establish the presence or absence of key issues and factors surrounding the decision making process. An opportunity to investigate these factors was presented by PBECP's decision to introduce the new skill, rapid sequence intubation (RSI), to paramedic practitioners.

1.4. Formulation of the primary and secondary research questions

The research project primarily focused on the paramedics' ability to make good clinical decisions about the emergency airway needs of their patients, within an environment that is very challenging in many respects. Clinical decisions in an emergency environment require swift yet precise decision making to ensure that the patient gets the best treatment. This may be easier said than done, as there are many confounding factors that may influence these clinical decisions. The goal then is to answer the main identifiable question as to what factors influence the paramedic's decision to perform rapid sequence intubation, when faced with a critically ill or injured patient that requires definitive airway management.

Once the primary decision to RSI is made, it is followed by a multitude of other clinical and non-clinical decisions, which must be made in accordance with approved guidelines. The time frame for these secondary decisions extends from making the decision to RSI to delivery of the patient to hospital. *Figure 1-1* depicts the risk-benefit dynamic for clinical decision making surrounding RSI. The risk of the general pre-hospital environmental factors may contribute to a decreased benefit of good clinical outcome for the patient. The primary research question should highlight the risk factors associated with CDM related to pre-hospital RSI, in order to eventually mitigate against decreased benefit to the patient. This mitigation will take the form of recommendations to the PBECP to improve or enhance CDM surrounding RSI.

Fig. 1-1: The risk-benefit dynamic of clinical decision making surrounding RSI



1.5. Purpose of this study

The purpose of this study is to understand clinical decision making surrounding the process of rapid sequence intubation administered by South African paramedics (advanced life support practitioners) who have obtained the B.Tech.: Emergency Medical Care degree through the Durban University of Technology and identify measures to enhance this decision making.

1.5.1. Primary research question:

What are the factors that influence the paramedic's clinical decision making surrounding rapid sequence intubation, when faced with a critically ill or injured patient that requires definitive airway management?

1.5.2. Secondary research questions

1.5.2.1. First secondary question

Are paramedics correctly applying the guidelines approved by the Department of Emergency Medical Care and Rescue, to undertake the rapid sequence intubation process?

1.5.2.2. Second secondary question

Is there a need for review of the rapid sequence intubation guidelines set out by the Department of Emergency Medical Care and Rescue?

1.5.2.3. Third secondary question

What measures can be put in place to enhance clinical decision making surrounding rapid sequence intubation?

1.6. Rationale for the study

1.6.1. The necessity for changing practice

South African paramedics who have not completed the BTEMC, will typically use HPCSA approved medications to facilitate definitive airway management via 'sedation only' assisted intubation. The current approved medications (Professional Board for Emergency Care Practitioners, 2003) do not accomplish neuromuscular blockade and in addition are potent hypotensive agents (Neal, 1997:54). In an attempt to overcome this lack of paralysis it has become common practice to increase doses of sedation in an attempt to achieve intubating conditions without consideration of cerebral perfusion pressures, depressed ventilation and associated carbon dioxide retention (Warner, 1996:75). This project will address this issue by identifying the factors that contribute to this type of practice and make recommendations to address the issues concerned.

1.6.2. Professional board requirement

The Professional Board for Emergency Care Practitioners has implemented pre-hospital rapid sequence intubation through the Department of Emergency Medical Care and Rescue only, with the intention of national roll-out of the procedure. This implementation has been confined to the DEMCR since this is the only institution in the country that has been authorised to operationalise paramedic performed RSI. When RSI is performed by well trained personnel in a controlled environment, like a hospital's trauma unit or operating theatre, it can improve patient outcome. The pre-hospital environment however can be unstable and RSI in this context can be dangerous, if not performed sensibly. It is therefore of critical importance on the part of the paramedic to weigh up the risks versus benefits before making the decision to undertake RSI.

We need to therefore understand how paramedics make these decisions, so that we can better understand this context, in order to decide how to safely roll out the procedure. This study satisfies the needs of the PBECP with regard to monitoring of the addition of RSI to the scope of practice for B.Tech.: Emergency Medical Care graduates (*See Ch.2, Sec. 2.4)*).

1.6.3. Paucity of research

Although there is a trend towards pre-hospital RSI practice internationally, there may be several factors (both clinical and non-clinical) that may influence this intervention in the South African context. No research on the characteristics, experiences and significance of South African paramedic practice in general exists, and there is a paucity of literature concerning CDM by paramedics. It is therefore necessary to explore these factors in order to improve practice and better understand the conditions under which South African paramedics have to function and make decisions.

1.6.4. Use of results

This study should contribute to the initiation of a quality improvement system and performance review, building on international research data. Furthermore, the results will be provided to the PBECP, to facilitate the further development of the guideline for safe implementation of pre-hospital RSI nationally.

1.7. Assumptions and delimitations

1.7.1. Assumptions

In order to expressly answer the research questions, the following assumptions have been made:

1.7.1.1. All paramedics involved in the study treat their critically ill or injured patients with the ultimate goal of a better clinical outcome.

1.7.1.2. All interviewees will respond to interview questions with honesty and integrity.

1.7.2. Delimitations

In addition to the assumptions, it must be noted that the study design allows for extraction of data specific to advanced airway management of critically ill or injured patients. This study has set out to collect data on a range of patient conditions where RSI may have been used, although all cases in this study turned out to be exclusively head-injured patients with and without some other form of trauma. This however is still the most commonly studied sub-set of patients, regarding RSI.

1.8. Glossary of terms and commonly used abbreviations

(ALS) Advanced Life Support	A category of pre-hospital case practice performed only by registered paramedics who are certificated as either a Critical Care Assistant or a graduate with a National Diploma in Emergency Medical Care
(BTEMC) Bachelor of Technology: Emergency Medical Care	A two year part-time qualification accessible to practitioners who hold a National Diploma: Emergency Medical Care. On completion the graduate is eligible to register as an Emergency Care Practitioner with the Professional Board for Emergency Care Practitioners.
(CCA) Critical Care Assistant	A short-course qualification that allows operational emergency care providers to upgrade to advanced life support practice
(CDM) Clinical decision making	An essential function of the paramedic; optimal care depends on keen diagnostic acumen and thoughtful analysis trade-offs between the benefits and risks of treatments (Kassirer and Kopelman, 1991).
(ECP) Emergency Care Practitioner	A registered ALS provider who has completed a B.Tech Degree in Emergency Medical Care. This is person is registered on the new register opened by the Professional Board for Emergency Care Practitioners for this purpose.
(EMS) Emergency Medical Service	A health system component that functions to provide emergency care to critically ill or injured patients and to deliver these patients to definitive health care facilities
(ETI) Endotracheal intubation	The placement of a purpose-made tube in the trachea

(HPCSA) Health Professions Council of South Africa	A regulatory body whose role is to protect the public and to guide the health professions
(NDEMC) National Diploma: Emergency Medical Care	A three year qualification that prepares the learner for advanced life support practice
(PBECP) Professional Board for Emergency Care Practitioners	A professional body that regulates pre-hospital emergency care practice.
(RSI) Rapid sequence intubation	A clinical procedure involving pharmacological sedation and paralysis, followed by physically placing an endotracheal tube just past the vocal cords.
Bag-valve-mask ventilation	The manual delivery of artificial breaths to a patient using a hand-held device called a bag-valve-mask.
Capnography	The measurement of end tidal carbon dioxide waveforms and readings, using a specialised device.
Induction drug/agent	A drug/medicine that causes a state of anaesthesia, without muscle paralysis
Intermediate airway device	A specially designed airway device that serves as a bail-out device in the event of failed endotracheal intubation. Examples of these devices include the Laryngeal Mask Airway® and the Combitube®.
Mechanical ventilation	The use of an artificical respiratory device to take over or assist a patient’s breathing effort.
Paralytic drug/agent	A drug/medicine that induces complete muscle paralysis
Paramedic	A pre-hospital clinical practitioner, capable of advanced life support clinical practice
Pulse oximetry	The measurement of oxygen saturation with a specialised device using a distal probe attached to the patient's digit

Secondary confirmation	Devices/methods used to confirm placement of the endotracheal tube in the trachea, e.g. end-tidal carbon-dioxide monitoring, oesophageal detection device, chest auscultation, etc.
Sedation drug/agent	A drug/medicine that induces a state of reduced level of consciousness, without muscle paralysis
Surgical cricothyrotomy	An emergency procedure that may be undertaken in the event of failed intubation involving the incision of the cricothyroid membrane and the insertion of a small diameter tracheal tube.

CHAPTER TWO

ENVIRONMENT OF THE STUDY

2.1. Introduction

This chapter has been written to provide the reader with an understanding of the events leading up to this study. In order to appreciate the clinical context of this study it is necessary for the reader to become familiar with all of the events leading up to it.

The chapter begins by explaining how current EMS systems operate, including the class structure of practitioners, followed by an explanation of the researcher's involvement with the PBECP. This chapter then goes on to describe the development of written guidelines for advanced airway management followed by explaining the researcher's involvement with implementing the new skill proposed by the PBECP.

2.2. What makes an emergency medical service (EMS) tick?

2.2.1. EMS in South Africa

In South Africa, the EMS systems vary across different parts of the country, but one thing that is consistent is the class structure of practitioners. There are three essential levels of practice which include basic, intermediate and advanced life support.

2.2.2. Levels of practice

Basic and intermediate life support practitioners are registered with the PBECP as supervised practitioners, whilst the advanced life support (ALS) practitioners fall into the category of independent practitioners. What this simply means is that ALS practitioners are required to make clinical decisions autonomously.

2.2.3. Differences between ALS practitioners

There are currently two types of ALS practitioners. The first type, called a Critical Care Assistant (CCA) is trained through a short course route, after he has completed the basic and intermediate levels and has obtained some operational experience. The second type is the graduate of a National Diploma tertiary education program undertaken over three years. Both types of practitioners are registered on the ‘PARAMEDIC’ register with the PBECP, and both have the same scope of practice.

2.2.4. Opening of new register by the PBECP

In 2007, a new register for Emergency Care Practitioners (ECP) was opened. Practitioners that completed the B.Tech: Emergency Medical Care are eligible for registration as ECPs. The new register entailed an increased scope of professional practice, to include pre-hospital rapid sequence intubation and pre-hospital thrombolysis.

2.3. Current airway management practice

2.3.1. Scope of practice

Paramedic practitioners are currently authorized to undertake endotracheal intubation with and without sedation drugs, using laryngoscopy and other accepted techniques. These practitioners are also authorized to use intermediate airway devices and utilize capnography and pulse oximetry.

2.3.2. Protocol versus guideline

The PBECP provides a protocol for the above practice, but encourages practitioners to use them as a guideline only. Sound clinical judgement is still expected from these practitioners during the making of clinical decisions for their patients. The nature of a protocol implies that practitioners should follow a step-wise approach. Whilst there is a need for this in certain ALS procedures, the algorithmic approach should not replace the practitioner's lateral thinking.

2.3.3. Bad practice in emergency airway management

Over the years, paramedic practitioners have developed bad habits and bad practice with regards to intubation with sedation. Unacceptably high doses of drugs are used on patients to achieve intubating conditions. This has been the researcher's observation as both an operational paramedic and a lecturer that gets regular feedback from students who work in the field. The sedation drugs that paramedic practitioners are authorized to use include midazolam, diazepam and lorazepam. Currently many practitioners combine midazolam with morphine to achieve a synergistic sedating effect in order to assist endotracheal intubation. This practice is fraught with complications (*See Ch. 1; Sec. 1.2.7*) and has never been approved by the PBECP, yet it continues.

2.4. Introduction of RSI

2.4.1. PBECP approval of RSI

In 2004, the PBECP approved the introduction of paramedic RSI, provided that it was within a research project, and be performed only by practitioners that successfully completed the BTEMC program. This was necessary to ensure control and some degree of governance. In order for the PBECP to get approval from the HPCSA, the latest evidence was presented to make the case for best practice in terms of the need for paramedic RSI.

The aim of introducing RSI was to replace current unsafe practice as discussed in (2.3.3.) above.

2.4.2. Education and training already in place

One of the key modules on the BTEMC program, called ‘Intensive Care’, provides the learner with comprehensive evidence based education for advanced airway management. A significant focus of this module is to equip the learner with the tools necessary to undertake RSI in the pre-hospital environment. This focus comprises of extensive scientific paper reviews, clinical expert instruction, scenario-based learning and operating theatre duties. There is currently no minimum general paramedic experience requirement for entry onto the BTEMC program. The current only minimum requirement is the completion of the NDEMC program.

2.4.3. Implementation of RSI

The DEMCR tasked the researcher with overseeing the implementation of RSI. The implementation was initially confined to the Durban area, but was subsequently restricted to the Durban University of Technology, due to lack of minimum RSI equipment requirements. The DEMCR operates an advanced life support vehicle manned by ECPs only. This vehicle is equipped with multi-parameter monitoring devices, a comprehensive difficult airway kit, a mechanical ventilator and a refrigeration system for the RSI drugs.

2.4.4. Quality assurance and clinical governance of RSI

The researcher set out to put in place a system that would ensure that RSI would be reasonably safely practiced. A meeting was scheduled with the Anaesthetics Departments of Addington Hospital and Nelson Mandela Medical School, to involve clinical experts in the quality assurance and clinical governance of RSI.

This was a very successful meeting which resulted in full support of the practice by these departments.

2.4.5. Addressing the time-gap in training

Although the BTEMC graduates had already received the education, training and experiential learning to undertake RSI, the researcher set out to develop comprehensive but focused guidelines for this practice. The researcher realized that there was a significant time-gap between these practitioners graduating and the introduction of RSI. This gap needed to be addressed.

2.5. Airway management workshop

2.5.1. Involving the experts

The researcher co-ordinated a clinical airway management workshop in collaboration with the two anaesthetics departments previously mentioned, to add value to the training and also to assist with acceptance of the new scope of practice by the medical fraternity.

2.5.2. Workshop agenda

The workshop set out to re-visit the RSI process and re-skill practitioners on the necessary procedures. The workshop was a big success, attended by fourteen paramedics (now ECP's). A practical and theory assessment was conducted a few weeks after the workshop to ensure that it was safe to send the practitioners out to practice RSI. All practitioners were examined by an anaesthetist, and resulted in a one hundred percent success rate.

The workshop included a thirty-minute lecture presentation by Dr. Eric Hodgson, followed by a skills demonstration and practice session. The demonstrations included video laryngoscopy, surgical airway techniques, insertion of intermediate airway devices and bag-valve-mask ventilation techniques. Post-workshop, the training aids were made available for any practitioner that needed to brush up on his skills.

2.6. Development of guidelines for advanced airway management

2.6.1. Developing the guidelines

The researcher was responsible, under the ambit of the DEMCR, for development of the current advanced airway management guidelines. These guidelines were developed after an extensive review of literature, international recommendations and interactions with clinical experts. The guidelines were intended to be a tool to assist practitioners with clinical decision-making surrounding rapid sequence intubation. An extensive review of other existing international RSI and difficult airway guidelines were interrogated to establish the most safe, practical and simple guideline for local practice.

2.6.2. Future of the guidelines

These guidelines will be submitted to the Professional Board for Emergency Care Practitioners (PBECP) to serve as a handbook for practitioners registering as Emergency Care Practitioners (ECP). These guidelines will continue to be developed and updated to ensure best practice.

2.7. Airway management registry

2.7.1. Need for a registry

The researcher has also developed an airway management registry as a means to improve clinical governance and collect data for further research. The need for starting a registry of this sort is truly urgent, if the profession is to advance based on its own research.

2.7.2. Reporting of data

The researcher has also developed specifically designed patient report forms for collecting of data and reporting of RSI. Currently, all RSI cases that get undertaken are reviewed by the researcher in consultation with external experts.

2.8. Conclusion

The implementation of paramedic RSI has been met with both positive and negative criticism, both from the pre-hospital and general medical fraternity. It has become quite clear to the researcher that the education, training and ongoing review of RSI practice are the key factors in ensuring a successful implementation. This study hopes to set the benchmark for all other institutions that wish to implement paramedic RSI safely.

CHAPTER THREE

LITERATURE REVIEW

3.1. Introduction

This chapter discusses the literature related to the study of clinical decision making and rapid sequence intubation. The main aim of the review of literature in this chapter is to provide the reader with an overview of topics and issues related to this study in order to shed some light on the background of the study.

3.2. Search strategies

The literature search was an on-going process that was carried out regularly to keep up with developments in the research area. A review of the literature was conducted, using the library at the Durban University of Technology, where subject headings and catalogues were searched. An extensive internet search was performed using defined criteria to locate studies and reports that directly related to the research area. This was challenging as there was very little literature on the key research aspects of clinical decision making by paramedics. The search involved the Google Scholar® search engine and the following databases; Science Direct® , Proquest® , Pubmed® and Medline®.

According to Shojania and Olmstead (2002:187), searches that incorporate medical subject heading (MeSH) terms consistently yield more articles than searches by title or text words. The following MeSH terms were used during the searches; paramedic clinical decision making, rapid sequence intubation decision, decision making, clinical judgement, emergency intubation and emergency clinical decision making. These terms provided very extensive results that included clinical decision making in emergency airway management, by doctors and nurses alike. There were very limited sources of literature on paramedic judgment and clinical decision making.

Apart from the straight searches, the researcher also followed up on references listed in papers that were found. The researcher also located abstracts in Pubmed® and then obtained the full versions from Science Direct® and Proquest®. Experts also provided the researcher with scientific papers and confirmed that the researcher had located all the important papers on RSI that they were aware of.

3.2.1. Criteria for acceptance or rejection of literature

The following criteria that were used to determine acceptance or rejection of literature are indicated hereafter:

Literature was accepted if the source was recognised and reliable and if the literature discussed:

- general emergency airway management;
- paramedic airway management;
- emergency decision making;
- emergency nurse decision making;
- cognitive psychology; and/or
- general paramedic decision making.

Literature was rejected if the source was unreliable and:

- lacked focus on emergency decision making;
- showed obvious author bias;
- was irrelevant to the study; and/or
- was not translatable from another language.

3.3. General clinical decision making

This section is intended to provide the reader with a general understanding of what clinical decision making is and also provide an overview of the theories and processes associated with this phenomenon.

3.3.1. What is clinical decision making?

Clinical decision making is the essential function of the clinician where optimal patient care is dependent on good diagnostic skills and thoughtful analysis of the trade-offs between the benefits and the risks of treatments.

'Clinical decision making occurs when one course of action is selected over all other options where critical thinking is an essential component of clinical decision making' (Gerdtz and Bucknall, 1999: 50).

3.3.2. Theories of decision making

Croskerry (2000: 1223) explained that there are 'three major skills sets in the performance repertoire of emergency physicians: procedural, affective and cognitive' and noted that 'emergency medicine is predominantly action-orientated and that procedural skills' like intubation 'are therefore, the most important of the three'. Croskerry (2000: 1223) went on to point out that procedural skills comprise a relatively small part of the overall activity of emergency physicians and that most of their time is actually engaged in cognitive behaviour. This phenomenon may be extrapolated to the paramedic, as he faces very similar situations in similar contexts. Croskerry (2000: 1224) also states that proficiency in the cognitive domain, compared with that in procedural skills, is less easily defined, involves a broader range of possibilities, and would appear to be less easily taught.

Lauri and Salantera (2002:93) state that most research in nursing science is based on either analytical decision making theory or information processing theory. For the former, human decision making follows a systematic process which allows for decisions to be reached by situational analysis. Information processing theory in contrast, is based on studies of human problem solving that rely on the earlier knowledge an individual has gained about the issues and areas concerned. This theory is defined in medicine and nursing as a hypothetico-deductive process of determining patient's problems with use of diagnostic reasoning (Tanner, Padrick, Westfall and Putzier, 1987:358).

For the paramedic decision making, both theories of analytical decision making and information processing may possibly be integrated, as there may be some degree of overlap between these two theories. This however remains to be explored.

3.3.3. Cognitive processes in decision making

Lauri and Salantera (2002:94) indicate that there are two essential types of cognitive processes that occur in relation to decision making. The first type is the analytical cognitive process, which involves a step-by-step, conscious, logically defensible decision making process. The second type is the intuitive cognitive process which is typically understood as a decision making process without the use of a conscious, logically defensible, step-by-step process. This process includes rapid information processing, simultaneous cue use, pattern recognition and the evaluation of cues at a perceptual level. Making decisions in the intuitive paradigm, is based on immediate apprehension of the key elements of a situation and on decisions based on that apprehension.

According to Cioffi (2001:592), heuristics, a rapid form of cognitive reasoning used under conditions of uncertainty, is an influential contribution for viewing nurses' judgements and their decision making process. From a cognitive perspective, Tversky and Kahneman (1973:207; 1974:1124) show that 'subjective probability judgements' (heuristics) are relied upon in uncertain decision making situations. This theory may possibly be extrapolated to the emergency situations that paramedics are faced with. This is however not isolated, that is, other theories discussed in 3.3.2 may also be applicable to paramedic decision making.

Chapman and Elstein (2000: 184) highlight the fact that many decisions involve uncertainty where judging the likelihood of events may be difficult. In this case the clinician must make an intuitive estimate of the probability based on the information available.

3.3.4. Previous experience and decision making

In a study of the use of past experiences in clinical decision making in emergency situations, Cioffi (2001:591) concluded that clinical experience is of primary importance to the development of skilled nurse practitioners. This may possibly be extrapolated to paramedic practice, as they are also required to develop into skilled practitioners.

Radwin (1998:590) found that nurses applied what they had learned from previous practice situations and that the gaining and application of knowledge over a period of time enhanced the development of skilled clinical knowledge.

According to Kassirer and Kopelman (1991: 42), experts or experienced clinical practitioners use compiled mental procedures to build a representation of the clinical problem in terms of basic principles; they store problem–solving procedures; they organize these stored procedures around efficient strategies; and they use domain-specific heuristics to limit searches. Novice clinicians in contrast, have been noted to build elaborate causal or pathophysiological scripts because their mental library of compiled scripts is limited by experience. These authors also noted that novices in medicine develop the more efficient decision-making or problem-solving strategies characteristic of the expert as they gain experience and store more compiled scripts.

Dawson (2000: 239) hypothesised that the level of general experience of physicians does not seem to have a strong effect on the accuracy of physicians' judgements about prognosis, however the degree of specific experience may be a more important consideration.

3.3.5. Critical thinking and clinical decision making

Essentially, critical thinking is about the analysis of data whereas a clinical decision is about how that data is used in the delivery of clinical care (Gerdtz and Bucknall, 1999: 50).

A pilot study conducted by Hicks, Merritt and Elstein, examined the relationship of 54 nurses' education level, years of experience and critical thinking ability to consistency in clinical decision making. The study showed that education and experience were not associated with increased critical thinking ability, nor was critical thinking ability associated with decision making consistency. The authors however concluded that more investigation is needed to determine appropriate ways of measuring critical thinking abilities in practicing nurses.

The ability of a paramedic to think critically may be of fundamental importance when managing the critically ill or injured patient. This ability is yet to be assessed against consistency in clinical decision making during emergency airway management of a critically ill or injured patient. What is more important though, is that the critical thinking ability of paramedics remains to be assessed, using the appropriate tool.

3.4. Rapid-sequence-intubation

This section aims to explain the phenomenon of rapid sequence intubation in relation to both the hospital and pre-hospital environments.

3.4.1. What is rapid sequence intubation?

Rapid sequence 'induction' originated as a sequence of fifteen steps to rapidly induce anaesthesia and prevent aspiration in patients with full stomachs, and was first described by Stept and Safar (1970:633). Today this same technique, referred to as rapid sequence 'intubation' (RSI), is used to facilitate rapid placement of an endotracheal tube in a critically ill or injured patient and is considered by the International Liaison Committee on Resuscitation (2005:213) to be the gold standard in emergency medicine. The rapid placement of the endotracheal tube is followed by post-intubation management, which may include on-going sedation, paralysis and mechanical ventilation. The first report of paramedic performed RSI was made by Hedges and associates (Hedges, Dronen, Feero, Hawkins, Syverud and Schultz, 1988:469), however paramedic-initiated RSI is currently only performed in a small number of EMS systems around the world.

3.4.2. When is RSI indicated?

In order to effectively facilitate endotracheal intubation, patients may need to be paralyzed using neuromuscular blocking agents (NMBA's) thereby inhibiting resistance to laryngoscopy and passage of the endotracheal tube (Walls and Murphy, 2004:200). Without RSI techniques, patients may retain protective reflexes (e.g. gag reflex) that can instigate a physiological response resulting in, amongst others, increased intra-cranial pressure. Currently, the PBECP only allows the use of RSI by B.Tech graduates (of DEMCR only), leaving other paramedics to rely on 'sedation-only' intubation (Pieters, 2007; see Ch. 2, Sec. 2.4).

3.4.3. RSI versus conventional intubation

The PBECP licenses paramedics to independently practice emergency medicine, within prescribed protocols. Historically, advanced life support paramedics were trained to function as supervised skills-based practitioners. However, since 2000, paramedics have been licensed as independent practitioners. Paramedics are licensed to carry out several medical procedures specific to airway management, including endotracheal intubation (oral/nasal/blind nasal/retrograde and tactile), intermediate airway device insertion, surgical and needle crichothyrotomy, mechanical ventilation, capnography, pulse oximetry and administration of Schedule 1 to 7 medications (Professional Board for Emergency Care Practitioners, 2003).

Paramedics frequently manage critically ill or injured patients suitable for RSI, with head-injuries being potentially the largest single patient group. This is the researchers own experience. Other conditions that may benefit from paramedic-initiated RSI include near fatal asthma, cardiac failure and polytrauma (Walls and Murphy, 2004: 200).

Typically general ALS providers will use approved drugs/medications to facilitate definitive airway management via 'sedation only' assisted intubation (*see Ch.2,* *Sec. 2.3)*. The approved medications for sedation assisted intubation include midazolam, diazepam and morphine sulphate (Professional Board for Emergency Care Practitioners, 2003). These agents do not accomplish neuromuscular blockade and in addition are potent hypotensive agents (Neal, 1997:54).

Over the years, bad practice has developed to overcome this lack of paralysis. Sedation doses are significantly increased to achieve intubating conditions without consideration of serious potential adverse effects, which include derangement of cerebral perfusion pressures, depressed ventilation and associated carbon dioxide retention (Warner, 1996:74).

The fundamental difference between RSI and ‘sedation only’ endotracheal intubation is that with latter the attending paramedic relies on high dose sedation as opposed to neuro-muscular blocking agents. This practice can result in hypotension, reduced cerebral perfusion and prolonged sedation making failed intubation more difficult to manage.

3.5. Risks associated with RSI

This section will provide an overview of firstly the general risks associated with RSI, followed by pre-hospital RSI risks with specific emphasis on traumatic brain injury.

3.5.1. General risks associated with RSI

The primary risk with any patient receiving RSI is respiratory arrest leading to hypoxia and death, in the event of failed protection of the airway, i.e. failure to place a device in the airway to facilitate oxygenation and ventilation of the patient. Other general risks include (Walls and Murphy, 2004):

- hyperkalaemia;
- malignant hyperthermia;
- bradycardia / tachycardia;
- raised intra-cranial and intra-ocular pressure and
- hypotension / hypertension

3.5.2. RSI risks associated with the pre-hospital environment

The risks of RSI that are associated with the pre-hospital environment are the same as the general risks as noted in 3.5.1, but also include the primary problems associated with pre-hospital intubation and ventilation, which are hypoxaemia and hypocapnia.

3.5.2.1 Pre-hospital RSI risks in traumatic brain injury

The pre-hospital risks of hypoxaemia and hypotension are particularly of concern in the patient with traumatic brain injury, as either will worsen the outcome (Walls and Murphy, 2004:253). In the head-injured patient, secondary brain injury results from treatable and preventable factors such as cerebral ischemia, hypoxia, raised intra-cranial pressure and hypotension (Ma, 2004:553).

3.5.2.1.1 Hypoxaemia: This occurs due to a prolonged absence of oxygen supply to the tissues. It primarily results from the obstruction of or trauma to the patient's respiratory system, resulting in less or no oxygen getting through to the pulmonary capillaries. It is therefore necessary for quick decision making to mitigate against this, by means of basic and then followed by advanced airway techniques. Prolonged hypoxaemia causes significant secondary brain injury. That is, it worsens tissue oedema resulting in an expansion of the brain mass, with subsequent increases in intra-cranial pressure. This negatively impacts on the outcome of the patient and may result in death (Davis et. al, 2004: 9).

3.5.2.1.2 Hypocapnia: This is a state of decreased carbon dioxide levels in the blood, which can result from iatrogenic hyperventilation of the patient. By increasing the ventilatory rate even slightly, the patient will physiologically lose more carbon dioxide. This state results in cerebral vascular constriction, thereby reducing blood flow to the brain. In a traumatic brain injury with existing brain swelling, reduced blood flow will further contribute to cerebral ischaemia (Ma, 2004:555). This may negatively affect the outcome of the patient.

3.5.2.1.3 Hypotension: This is defined as a systolic blood pressure below 90 mmHg. In a critically ill or injured patient, haemodynamic stability becomes unpredictable in the pre-hospital environment. It is therefore crucial that no further harm comes to the patient. Certain medications administered during airway management, have the potential to cause hypotension (Choi, Wong and Lau, 2004:700, Davis, Kimbro and Vilke, 2001:163). Hypotension in turn results in reduced cerebral perfusion pressure, further contributing to cerebral ischemia and swelling.

3.5.2.1.4 Cerebral perfusion: As explained in the three preceding sections, hypoxaemia, hypocapnia and hypotension have a negative impact on intra-cranial stability. When these three factors work in synergy to decrease cerebral perfusion pressure, as a result of poor clinical practice, the prognosis of the patient may worsen.

3.5.2.1.5 Other pre-hospital RSI risks in traumatic brain injury

Apart from the above, a reflex sympathetic response to laryngoscopy (RSRL) is stimulated by the rich sensory innervation of the supraglottic larynx. This is caused by the use of the laryngoscope and particularly the attempted placement of an endotracheal tube, which results in an afferent discharge that increases the release of catecholamines (Walls and Murphy, 2004). This catecholamine surge leads to increased heart rate and blood pressure (Ganong, 2001:595), significantly enhancing cerebral blood flow. These haemodynamic changes may contribute to increased intra-cranial pressure, particularly if autoregulation is impaired as the case may be in traumatic brain injury (Jagoda and Bruns, 2004:262). It is therefore necessary to blunt this response using appropriate medications.

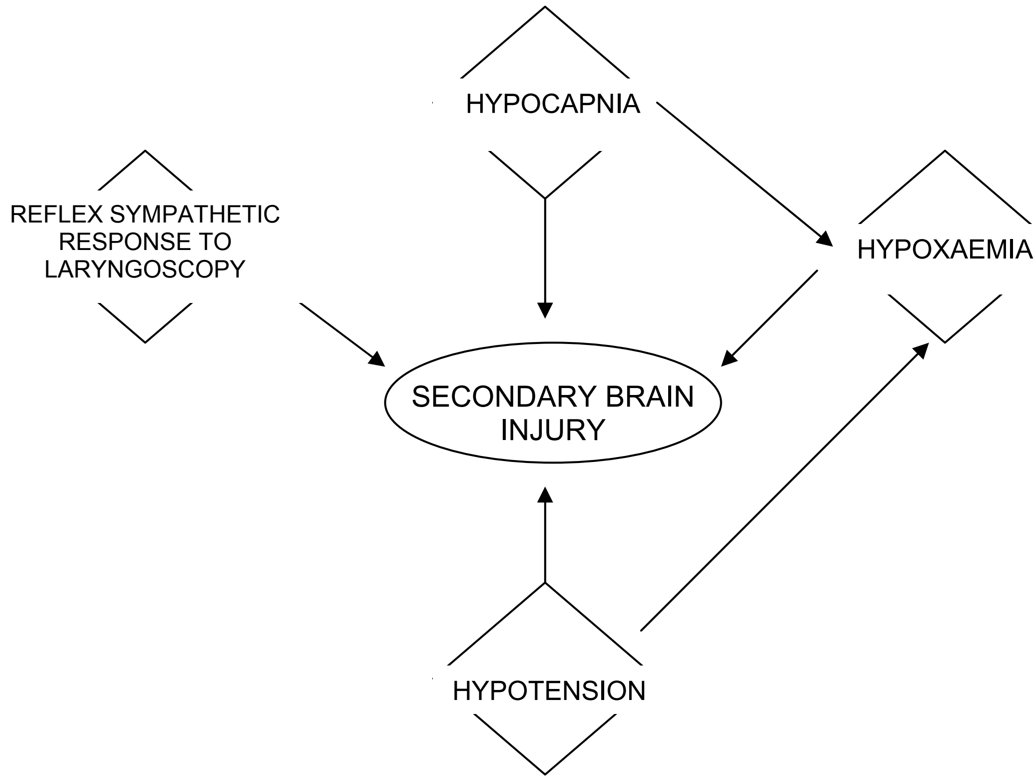


Figure 3-1: The cycle of events that contribute to secondary brain injury

3.5.2.1.6. Contributors to secondary brain injury

Figure 3-1 represents all the factors discussed in 3.5.2 and depicts the synergistic relationships that may contribute to secondary brain injury during emergency management of the patient's airway.

3.6. The correct application of the RSI process

The purpose of this section is to describe the correct RSI procedures to be followed, which is an indication of some of the key decisions that have to be made. These key decisions are the basis for these procedural guidelines and will be used for Objective 3 and 4 (second and third secondary research questions). This has contributed to forming the basis for development of the advanced airway management guidelines described in Ch. 2, Sec. 2.6.

The correct application of RSI is encompassed by:

- correct patient selection;
- correct selection of medications;
- use of approved clinical techniques;
- recognition and correct management of failed intubation; and
- appropriate ventilation strategies.

Each of these is discussed in detail hereafter.

3.6.1. Patient selection

Wang, O'Connor and Domeier (2001:40) stated that 'RSI may be appropriate for use on patients who require urgent endotracheal intubation, but show evidence of incomplete relaxation, making conditions for conventional intubation sub-optimal.'

Sing, et. al. (1998:598) provide more specific indications for pre-hospital RSI, namely, combativeness (in a seriously ill or injured patient), and /or hypoventilation (< 10 breaths/minute), and/or depressed level of consciousness (Glasgow Coma

Scale < 10/15) including head injury. These indications are also agreed upon by other experts (Wang, O'Connor and Domeier, 2001:43; Walls and Murphy, 2004:2; Wang, Domeier, Kupas, Greenwood and O'Connor, 2004:59). These are definite clinical indicators for the critically ill or injured patient, as this type of patient very quickly deteriorates with rapid loss of airway protection. This is especially true for the head-injured patient (Walls, 1993:1008, Klemen and Grmec, 2006:1250).

Walls and Murphy (2004:18) state that prior to RSI, the patient must be assessed for potential airway difficulties as failed intubation following paralysis can result in a 'can't intubate, can't ventilate situation', that can be rapidly lethal. In the 'can't ventilate' situation the patient's oxygen saturation cannot be maintained above 90% with bag-valve-mask ventilation after failed intubation attempts. This constitutes a failed airway and calls for emergency bail out measures. These measures include rapid insertion of alternative airway devices and/or emergency cricothyrotomy.

The American Society of Anaesthesiologists recommends a three step algorithm to assess the likelihood of a difficult intubation (Benumof, 1996: 90). The first step is to assess the size of the tongue relative to the pharynx (the Mallampati score), followed by assessment of neck mobility, and lastly, measurement of the thyromental distance (Benumof, 1996:90, Levitan, Everett and Ochroch, 2004:307).

Helm and associates (Helm, Hossfeld, Schafer, Hoitz and Lampl, 2006:67) conducted a prospective study involving pre-hospital endotracheal intubation of

342 patients. Difficulties associated with endotracheal intubation included blood in the airway (19.9%), vomit/debris (15.8%) and secretions (13.8%) in the upper airway, patient position (9.6%), anatomical reasons (11.7%) and surrounding conditions (9.1%). Surrounding conditions included limited access to patients on arrival at scene (20.2%) and limited access to patients during intubation attempt (9.6%).

The DEMCR advocates the same principles applied by the American Society of Anaesthesiologists. The general indications for RSI, as documented in the DEMCR prescribed airway management guidelines are:

- respiratory failure;
- loss of gag reflex or protective airway reflex;
- Glasgow Coma Scale of < 7/15;
- severe head trauma;
- combative patient (after ruling out reversible causes);
- spinal cord injury;
- asthma or severe respiratory illness; and
- status epilepticus (not responding to other therapy.

3.6.2. Correct selection of medications

Recognition of the need to intubate may seem simple compared with the task of selecting which medications to give, and what dose, at a time when seconds count. The choice of medications is made more difficult by the complexity of resuscitation haemodynamics.

In a study conducted by Davis, Kimbro and Vilke (2001:163), the authors concluded that the use of midazolam with pre-hospital RSI is associated with a dose-related incidence of hypotension. In the study, a total of 219 patients receiving midazolam were evaluated in the final data set. The cohort consisted of 75 patients who received a dose of 0.1mg / kg and 144 patients who received the same dose, but had a ceiling of 5mg. Analysis of the first group revealed that there was a greater incidence of hypotension (19.7%) as compared to the second group (7.6%) within the sub-group of patients with traumatic brain injury. The study concluded that either midazolam doses be reduced or use alternative neuro-protective agents in the pre-hospital arena.

Choi, Wong and Lau (2004:700) reported that midazolam is more likely to cause hypotension than etomidate in emergency department rapid sequence intubation. In their study, a total of 160 cases were collected in two phases, with 77 receiving midazolam and 83 receiving etomidate. The dose of midazolam given ranged from 2mg to 4mg as a bolus, while the dose of etomidate was 0.2 mg-0.3mg / kg. A decrease in mean systolic blood pressure by approximately 10% within five minutes after intubation was observed in the midazolam group. There was no statistically significant decrease in mean systolic blood pressure in the etomidate group. The authors concluded that midazolam, even in low doses, was more likely than etomidate to cause significant hypotension when used as an induction agent for RSI, and that etomidate was a better alternative.

Whilst etomidate may have been reported to be the better alternative to midazolam for primary induction, etomidate should not be used for post-intubation on-going sedation (Sivilotti, 2006:351). Walls and Murphy (2004: 194) highlight that, continuous infusions of etomidate cause reversible blockade of 11-beta-hydroxylase, which decreases both serum cortisol and aldosterone levels.

Whilst Sivilotti (2006:352) proposes carefully titrated boluses of propofol mixed with ketamine for on-going sedation, the DEMCR advocates carefully titrated small boluses of midazolam mixed with ketamine, or midazolam mixed with morphine, depending on the clinical condition of the patient. This recommendation is due to the fact that propofol causes a direct reduction in blood pressure through vasodilation and direct myocardial depression, resulting in a decrease in cerebral perfusion pressure (Schneider and Caro, 2004: 196), which may be detrimental to a compromised / unstable patient, which is usually the norm in the pre-hospital environment.

The DEMCR recommends two induction agents, etomidate and ketamine. The former is likely to be used for the majority of patients, especially the head-trauma patient. Succinylcholine should be the primary paralytic, and then the choice between etomidate and ketamine must be made. Longer-acting paralytics like vecuronium or rocuronium should be avoided as primary paralytic agents, as these agents will render the patient apnoeic for twenty to forty minutes and may result in severe hypoxaemia and death, if the patient is not immediately intubated or if ventilation is not maintained. The choice of induction agent must take into consideration the patient’s haemodynamic stability and general clinical condition, as both drugs have different haemodynamic profiles. Succinylcholine is recommended for primary paralysis, whilst vecuronium and rocuronium are advocated for post-intubation paralysis for the reasons mentioned above.

3.6.3. Clinical techniques for placement confirmation

In order to recognize an oesophageal placement of the endotracheal tube or confirm tracheal placement, several methods / techniques should be employed. These methods include chest auscultation, visualization, and capnography (Sing et. al., 1998:598; Austin, 2000:90). Other methods include colorimetric end-tidal carbon dioxide ($EtCO_2$) monitoring and the use of oesophageal detection / bulb aspiration devices (Wang and Yealy, 2002:168; Garza, Gratton, Coontz, Noble and Ma, 2003:251; Wang, et al. 2004b:58). At least two methods should be used to confirm placement (Katz and Falk, 2001:32). The $EtCO_2$ monitoring allows the practitioner to not only confirm correct placement of the tube, but also allows identification of later possible dislodgement of the endotracheal tube. This requires on-going $EtCO_2$ monitoring in the patient.

The DEMCR advocates all of the afore-mentioned techniques and further discourages the use of any one of them in isolation, as this can result in an unrecognized oesophageal intubation.

3.6.4. Management of failed intubation

According to Wang et. al. (2004b:58) failed intubation is defined as all attempts at endotracheal intubation (ETI) being unsuccessful. The definition of ‘unsuccessful’ is indicated by the practitioner being unable to correctly place the tube in the trachea within thirty seconds of the last positive pressure ventilation. Wang, et. al

(2004b:58) document the reasons for failed intubation as being inadequate patient relaxation, disrupted anatomy, bodily fluids obscuring the view of vocal cords, limited access to patient, equipment failure and inability to expose vocal cords during laryngoscopy (*see 3.6.1*).

It is important that the treating paramedic is proficient in the use of the self-inflating bag-valve-mask as the clinical management in a failed intubation reverts to basic intermittent positive pressure ventilation with cricoid pressure, until an alternative airway can be instituted. Wang, et. al. (2004a:366) support this statement and further recommend that RSI providers be proficient in the use of at least one intermediate airway device (i.e. either a laryngeal mask airway (LMA), double-lumen airway like the Combitube® or a laryngeal tube). Hulme and Perkins (2005:742) also reported that the frequency with which the LMA was used in a retrospective case series by emergency doctors for critical airway problems, supports the expansion of LMA use throughout the ambulance service.

South African graduate paramedics are trained in the use of all of the devices mentioned. They are also trained to be proficient in alternative invasive airway techniques, including needle and surgical crichothyrotomy (Professional Board for Emergency Care Practitioners, 2003).

3.6.5. Ventilation strategies

Early definitive control of the airway, by RSI and ventilation, should reduce the likelihood of hypoxaemia, hypocapnia and hypercapnia, and may prevent secondary brain injury (Helm, Hauke and Lampl, 2002). In the pre-hospital setting, patients can usually be well oxygenated as a result of RSI. However, the concern lies with the quality of pre-hospital ventilation, as this may affect patient outcome. Helm and associates (Helm, Schuster, Hauke and Lampl, 2003:327) conducted a two year prospective randomized study in trauma patients treated before hospital admission by the medical team of the Helicopter Emergency Medical Service. In this study, a mechanical ventilator (DRAGER Oxylog 2000) was used to undertake ventilation of patients, in conjunction with $EtCO_2$ monitoring. Ventilation was adjusted in accordance with the $EtCO_2$ monitor to achieve 30-35mmHg for the haemodynamically stable patient, and 25-30 mmHg in the haemodynamically unstable patient. It was concluded that pre-hospital ventilation should be undertaken in a controlled manner, using a mechanical device in conjunction with $EtCO_2$ monitoring which allows target $EtCO_2$ values that are adaptable to the patient's physiological state.

Davis, et. al. (2004b:1) showed that hypocapnia and severe hypoxia during paramedic RSI of head-injured patients are associated with an increase in mortality. In Davis' study, paramedics were taught standard ventilation parameters of 12 breaths/minute and a tidal volume of 800ml; practice with a stopwatch and spirometer was incorporated into the training session. Mechanical ventilation was not used. The study demonstrated a relationship between hypocapnia and increased mortality, which appeared to be a result of excessively high ventilation rates despite protocols designed to target a ventilatory rate of 12 breaths/minute.

In a study conducted by Warner and associates. (Warner, Cuschieri, Copass, Jurkovich and Bulger, 2007:1330), it was reaffirmed that a target ventilation range of between 30 and 35 mmHg was associated with lower mortality after severe traumatic brain injury. In the study, all ground paramedics used a standard bag-valve-mask for post-intubation ventilation. Pre-hospital end-tidal carbon dioxide ($EtCO_2$) monitoring was not used. The primary purpose of the study was to establish the target $EtCO_2$ range to be applied when using pre-hospital monitoring devices. In order to do this, arterial blood gas analysis was performed on arrival of each patient at the participating hospital.

It was concluded that hyperventilation is common among intubated trauma patients, with only 30% of patients falling into the target range on arrival at hospital. The best outcome was seen in the target range. It was concluded that both hyperventilation and hypoventilation may be equally detrimental. The authors reflected that reliability of pre-hospital EtCO2 monitoring to accurately reflect ventilation status in the brain injured patient remains to be determined.

When comparing large scale studies (Helm, et al. 2003:327; Davis, et al. 2004b:1; Warner, et al. 2007:1330), it is clear that mechanical ventilation is superior and more consistent than manual bag-valve-mask ventilation. Consistency in ventilation is crucial, especially if the patient's ventilation status is to stay in the target range as previously described by Warner and associates. (Warner, et al. 2007:130). It therefore makes senses, that until pre-hospital $EtCO_2$ can be correlated with blood gas analysis on hospital arrival, paramedics should default to the most consistent mode of ventilation.

In the South African EMS climate, paramedics usually begin supporting ventilation of patients using a self-inflating manual bag-valve-mask. This manual intervention can be irregular and inconsistent, especially if undertaken by lay rescuers. Helm, Hauke and Lampl (2002:345) indicate that with this type of ventilation, “it is not possible to measure minute volume, and the ‘quality’ of ventilation depends on the experience and skill of the person ‘squeezing’ the bag-valve-mask device.” Ventilation is therefore a clinical intervention requiring individual patient assessment.

Portable mechanical ventilators are available in the South African pre-hospital setting, but mostly tend to get used for inter-hospital transfers, and very seldom for emergency post-intubation ventilation. Based on the researcher’s own clinical operational experience, this can be probably be attributed to either short transport times to hospital, poor availability of mechanical ventilators, and the fact that ventilators take some time to assemble. Appropriate use of these mechanical ventilators in the emergency setting, should reduce the incidence of complications associated with manual self-inflating bag-valve-mask ventilation.

The DEMCR strongly recommends the routine use of mechanical ventilators in conjunction with pulse oximetry and capnometry, to maintain adequate oxygenation and ventilation. The approved ventilation strategies are to maintain the patient’s $EtCO_2$ in the 30 – 35 mmHg range. Ventilator settings should be adjusted according to the patient’s weight and clinical condition, but should aim to stay within the recommended $EtCO_2$ parameters.

3.7. Current controversies in emergency airway management

This section will outline the controversies gleaned from the literature regarding emergency airway management of patients in the pre-hospital environment.

3.7.1. Studies surrounding rapid sequence intubation

Many RSI studies that have described pre-hospital RSI have used mainly retrospective single-site, descriptive designs (Hedges, et al. 1988:469; Graham and Meyer, 1997:219; Slater, Weiss, Ernst and Haynes, 1998:588; Sing, et al. 1998:598; Wayne and Friedland, 1999:107; Pace and Fuller, 2000:568; Ochs, et al. 2002:159). It was found that only one study conducted a prospective multi-centered evaluation of out-of-hospital endotracheal intubation. This was conducted by Wang and associates (Wang, Kupas, Paris, Bates and Yealy, 2003:49).

In most previous studies the paramedics, nurses or doctors were supervised practitioners. It is therefore difficult to generalize these findings to the South African EMS climate, as paramedics function as independent practitioners. Independent practice indicates full autonomy to make clinical decisions for the patient.

Airway management in emergency medicine remains a topic which stimulates emotion and controversy. Seppelt (2004:106) highlights that much of the controversy with trauma airway management is intimately linked with the related issues of territory, personnel, staffing and politics. Based on this statement, this author poses the questions of; 'who should be intubating trauma patients?'; 'where should these patients be intubated?' and 'what training is required to do this?'.

The medical literature must therefore be interpreted in this light. Paramedics seem to perform poorly in some studies (Bradley, Billows and Olinger, 1998:26, Gausche, Lewis and Stratton, 2000:783,) and well in others (Wang, et al. 2004:366). The reasons for the differences in paramedic performance, remains unclear and may be the result of training or possibly author bias, since most authors are not paramedics.

3.7.2. The San Diego RSI trial

This section is intended to provide an overview of one of the landmark paramedic RSI trials which produced some very controversial results.

3.7.2.1. Description of the San Diego RSI Trial

The landmark San Diego paramedic RSI trial (Ochs, et al. 2002:159) prospectively enrolled patients from across the San Diego county over the period November 1998 through October 1999. The trial was designed to explore the impact of succinylcholine-assisted endotracheal intubation on outcome in severely head-injured patients. The results from this trial have raised questions regarding not just pre-hospital RSI but also the practice of pre-hospital endotracheal intubation.

In this trial, adult head-injured patients with a Glasgow Coma Scale (GCS) score of $\leq$ 8/15 were eligible, with paramedics first attempting ETI without RSI medications. Midazolam and succinylcholine were administered in the presence of intact airway reflexes or a clenched jaw. The Combitube® was used as a salvage device if ETI could not be accomplished within three attempts.

After the trial ran for one year, an improvement in intubation success rate was noted as compared to the preceding year's data. Despite the improvement in intubation success rate, the initial outcomes analysis suggested that paramedic RSI of head injured patients was associated with an increase in mortality and decrease in good outcomes versus matched historical controls (Davis, et. al. 2003:444).

It is unclear whether the increase in mortality associated with paramedic RSI represents a sub-optimal performance of the procedure by inexperienced personnel, or an adverse effect of ETI and positive pressure ventilation in general.

3.7.2.2. Hyperventilation and hypoxia

During the trial, one agency instituted the use of quantitative end-tidal carbon dioxide monitoring ($EtCO_2$) and went on to show that 79% and 59% of patients were hyperventilated and severely hyperventilated respectively. Logistic regression analysis confirmed an association between hyperventilation and increased mortality. The only RSI sub-group *without* increased mortality included patients who underwent paramedic RSI but were subsequently evacuated by air. It was noted that the air medical personnel had substantial experience using $EtCO_2$ to guide ventilation.

Desaturations were observed in more than half of a subset of 51 patients and an increase in mortality was associated with deep desaturations (Dunford, Davis, Ochs, Doney and Hoyt, 2003:721; Davis, Dunford, Poste, Ochs, Holbrook, Fortlarge, Size, Kennedy and Hoyt, 2004:1). The possibility exists that aspiration, before or after the RSI may have affected patient outcome.

3.7.2.3. Paramedic training

In the San Diego trial, paramedics received a single seven-hour mannequin-based training session; operating theatre training was not used. Other studies used supplemental airway training including the use of operating room time as part of their RSI program (Hedges, et al. 1988:469, Sing, et al. 1998:598, Wayne and Friedland, 1999:107, Pace and Fuller, 2000:568).

3.7.2.4. Trial conclusions

The San Diego trial recorded very controversial results regarding the use of RSI by paramedics. It is quite clear in this trial that it is the clinical management (see 3.7.2.2) after RSI that is dangerous and not RSI itself; although many may argue that RSI is inclusive of pre-RSI and post-RSI management. It is very evident that training plays a major role in determining successful use of RSI. The San Diego trial demonstrated that the practice of inadequately trained paramedics who attempted drug-assisted intubation led to hypoxia, hypotension and aspiration on induction and hyperventilation after tube placement. The Whatcom Medic One emergency service in Washington, provided stringent training on RSI to its paramedics, with the result that during actual RSI cases, there have been no reports of desaturations and bradycardia (Wang et. al, 2004a: 373) as compared to the San Diego Trial.

3.8. Papers that supported and rejected paramedic performed RSI

None of the papers located, completely supported or rejected the practice of paramedic RSI, as it is the preferred method of definitive airway management. None of the scientific papers found made a strong case for autonomous paramedic performed RSI.

The author recommendations across the literature were very similar with specific aspects that were generally very strongly emphasised These aspects were:

- appropriate training methods and continuing education;
- medical direction and supervision;
- availability of resources for patient monitoring, drug storage and delivery;
- the need for effective pre-oxygenation;
- confirmation and monitoring of endotracheal tube placement;
- standardized RSI protocols;
- backup rescue airway methods; and
- continuing quality assurance and performance review.

(Wang, et al. 2001:40; Dunford, et al. 2003:721; Wang, et al. 2004a:366; Domeier, Chudnofsky and Frederiksen, 2004:118; Wang, et al. 2004b:58; Swanson, Fosnocht and Barton, 2005:41; Davis, Fakhry, Wang, Bulger, Domeier, Trask, Bochicchio, Hauda and Robinson, 2007:1).

3.9. Clinical decision making and RSI

Although a vast amount of research exists in the area of clinical decision making (CDM), especially by nurses, little has been published on CDM by paramedics. No published research that specifically addresses CDM by paramedics surrounding RSI was identified. Therefore, there is no clear understanding of the processes paramedics use to make either general and more specifically, RSI clinical decisions and the factors that affect them.

According to Shaban (2005b), the complexity of clinical situations faced by paramedics has not been previously examined. These clinical situations are complicated by the existence of multiple contexts, significant levels of uncertainty, risk and the critical nature of time. Most of these factors make the clinical judgement process very intricate.

Wang, et al. (2005:146) proposed a simplified single decision algorithmic approach to all pre-hospital airway management situations, as a tool to reduce the incidence of airway management process errors. Whilst this approach is not specific to RSI only, it does allow for the RSI decision within the algorithm, that is to say that the algorithm is a generic airway management decision tree with the option of drug-facilitated intubation which encompasses RSI. The major concern with this approach is that it seems to discount the situational complexity as described by Shaban (2005b) and assumes that the practitioner will immediately be able to assess the need for airway or ventilatory support.

Wang et. al. (2005:147) do agree though that “airway management is a difficult task requiring successive execution of multiple critical decisions and tasks” and that “small errors at critical decision points may quickly magnify to result in airway compromise and patient death.” Whilst the intention of the proposed algorithm is to reduce clinical errors, we cannot ignore the fact the clinical decision making pathway in this context is really an airway management decision continuum within a much larger clinical decision continuum. This in itself makes clinical decision making very challenging, as the end of this continuum should represent a better outcome for the patient.

More research is clearly needed in the area of clinical decision making surrounding RSI, hence the motivation for this project.

3.10. Conclusion

Paramedic clinical decision making surrounding RSI is a crucial turning point in the profession of emergency care in South Africa, especially in the light of a very new procedure being introduced into paramedic practice. There is generally a paucity of research in the area of paramedic clinical decision making and furthermore a need for more research on pre-hospital RSI in South Africa. These two areas combined may provide the starting point for much needed pre-hospital research in this country.

CHAPTER FOUR

STUDY DESIGN AND METHODOLOGY

4.1. Introduction

This chapter will provide the reader with an explanation of how this study was designed with the specific methodology that was followed.

4.2. Study design

As befits an intensive analysis, the focus of case studies is typically on determining the dynamics of why an individual thinks, behaves or develops in a particular manner rather than on what his or her status, progress or actions are (Polit and Beck, 2006).

According to Terre Blanche and Durrheim (1999) the case study approach is descriptive in nature and provides rich data about individuals or particular situations. Case studies also have the advantage of allowing new ideas and hypotheses to emerge from careful detailed observation (Terre Blanche and Durrheim, 1999). This approach was used as it is appropriate for this study and also consistent with assumptions of the naturalistic paradigm.

The case study approach was used to develop grounded theory within the naturalistic paradigm, as described by Strauss and Corbin (Polit and Beck, 2006). The Strauss and Corbin approach was selected as it is conducive to full conceptual description of the CDM process surrounding RSI. Theory, in this approach is regarded as 'identifying the relationship between concepts, and presenting a systematic view of the phenomenon being examined, in order to explain what is going on' (Holloway and Wheeler, 1996).

What mostly differentiates grounded theory from much other research is that it is explicitly emergent. It does not test a hypothesis, but rather sets out to find what theory accounts for the research situation as it is (Polit and Beck, 2006). Constant comparison is the heart of the process, which leads to development of a conceptual model.

This method is appropriate, as the structure, description and meaning of the phenomenon of CDM by paramedics surrounding RSI is sought. Furthermore, the use of an interpretive paradigm is appropriate in view of the relative lack of knowledge of the CDM phenomenon in this particular paramedic context.

A qualitative approach as described by Polit and Beck (2006) and Holloway and Wheeler (1996), was chosen, as this study lends itself to a multiple-reality of clinical decision making that is subjective, and constructed by individuals. The design allowed the researcher to interact with those being researched and the findings were the creation of this interaction. The qualitative paradigm was particularly suitable for the study as it sought patterns through reliance on thick descriptive narrative information that forged emerging interpretations grounded in the participants' experiences.

The conceptual model which explains the factors influencing the CDM process around RSI will eventually provide a framework for the PBECP, which will allow us to understand how experienced and well trained paramedics make these decisions, so that we can better understand this context in order to decide how to safely roll out the procedure.

4.2.1. Unit of analysis

Case studies are in-depth investigations of a single entity or a small number of entities, which may be an individual, group, family or other social unit (Polit and Beck, 2006). Holloway and Wheeler (1996) define the case study as an examination of a specific phenomenon, such as a program, event, a person, a process, an institution, or a social group.

The primary unit of analysis in this study was the CDM process by which individual paramedics reached the decision as to whether or not to conduct an RSI. In this study, each participant together with their individual RSI patient reports was considered a case.

4.2.2. Units of observation

The four units of observation that were used are listed hereafter.

First unit of observation: In-depth interviews with paramedics provided a data source to understand the paramedics' clinical decision making process and evaluate the actual clinical performance of pre-hospital rapid sequence intubation.

Second unit of observation: Data pertaining to the performance of RSIs recorded on a patient report form was used. These forms were purpose-designed to capture the salient issues surrounding the clinical application of RSI.

Third unit of observation: The expert checklist which included expert comments, formed the third data source, which allowed analysis of the clinical actions of the paramedic.

Fourth unit of observation: The researcher scrutinized each RSI patient report form for correctness of RSI application against the DEMCR guidelines.

4.3. Study setting

This section will provide the reader with a background to the study and explain the context in which the study takes place

4.3.1. Professional Board approval

The PBECP has approved the use of new pharmacological agents for paramedics, who have completed the B.Tech.: Emergency Medical Care. The training for awarding of this degree is not consistent across the institutions offering this programme, and has thus led the PBECP to the decision to confine the practice of RSI to the Durban University of Technology's Department of Emergency Medical Care and Rescue. This institution, unlike other South African universities of technology, has put its BTEMC students through a rigorous training program, including work integrated learning time in hospitals' operating theatres.

The DEMCR has established links with anaesthetic departments at the Nelson Mandela School of Medicine and Addington Hospital, and has received full support from medical experts to promulgate paramedic RSI. A further airway management workshop has been conducted to ensure skills competency and knowledge retention of the paramedics that had completed the BTEMC program. These paramedics were again assessed in a simulated environment, by a specialist anaesthetist, to ensure good clinical practice.

4.3.2. Location of the study

This study was confined to the university-based emergency medical care department (DEMCR) of the Durban University of Technology which operates an emergency response vehicle (Techmed), which is fully equipped for RSI intervention. The vehicle is equipped with full advanced life support medical equipment and includes multi-parametric monitoring, intermediate airway support and portable mechanical ventilation. Paramedics who work on this vehicle perform, on average, between two and three RSI interventions per month.

4.4. Sampling strategy

The greatest strength of case studies is the depth that is possible when a limited number of individuals are being investigated (Polit and Beck, 2006). Case study research is not sampling research, however cases are selected so as to maximize what can be learned (Tellis, 1997).

Four paramedics were sampled for the study. Purposive sampling was used for selection of the paramedics to be included in the study. Although, according to Patton (Polit and Beck, 2006), there are several strategies within purposive sampling, this study fits the criterion sampling strategy, as it involved studying cases that met a predetermined criteria of importance.

In this situation the criteria that had to be met were that they must:

- be practicing paramedics;
- currently hold a BTEMC degree from the DUT;
- be working on the Techmed vehicle; and
- have performed an RSI.

A key informant was purposively selected to be interviewed first, to highlight issues that could be explored with other participants. This paramedic has been closely involved with and was highly knowledgeable about the development and introduction of paramedic performed RSI, and one who had a very good holistic perspective of the processes and systems of the pre-hospital environment.

Thereafter, three paramedics were invited to participate in the study. Two of these paramedics had substantial clinical experience, and this therefore allowed them to draw from a range of emergency situations, when describing their experiences. One had less experience than the other two.

Three experts in the field of emergency airway management were consulted to determine whether the participants were correctly applying the RSI guideline, and to also identify possible issues surrounding the use of RSI in particular situations. Criterion sampling was applied in choosing these clinicians to provide expert clinical input for each reported case of RSI undertaken by each participant. In this situation, the criterion that had to be met was that each clinician must have been a recognised clinical authority in emergency airway management.

The following experts were consulted:

1. A specialist anaesthetist at a Durban hospital who has a special interest in out-of-hospital RSI, and has been closely involved with development and training of the BTEMC qualified paramedics involved in the study.

2. An emergency care nurse consultant from a London hospital who holds an MSc: Cardiology, is also a registered paramedic and is very closely involved with the graduate paramedic training.

3. A registered paramedic who holds a BTEMC and is currently a PhD student. He has a keen interest in airway management and has been intensively involved with the development of paramedic training at the Durban University of Technology, and has been the architect of paramedic RSI.

4.5. Data collection

Polit and Beck (2006) emphasize that case study research is not simply anecdotal descriptions of a particular incident or patient, but is a disciplined process that typically requires systematic data collection. Holloway and Wheeler (1996) state that case studies use a number of sources for data collection like observation, documentary sources and interviews, so that they can be illuminated from all sides.

As noted in 4.2.2 the sources of data in this study were:

1. patient report forms which related to the first and second secondary questions (*see Ch. 1, Sec. 1.5.2.1 and 1.5.2.2)*
2. individual in-depth interviews which related to the primary research question (s*ee Ch. 1, Sec. 1.5.1)* and the third secondary question (*see Ch. 1, Sec. 1.5.2.3);*
3. clinical expert input which related to the first and second secondary questions *(see Ch. 1, Sec. 1.5.2.1 and 1.5.2.2)*; and
4. researcher review of patient report forms which related to the first and second secondary questions *(see Ch. 1, Sec. 1.5.2.1 and 1.5.2.2).*

The first three data sources were triangulated (see. Figure 4-1), with the fourth adding to the development of a conceptual model.

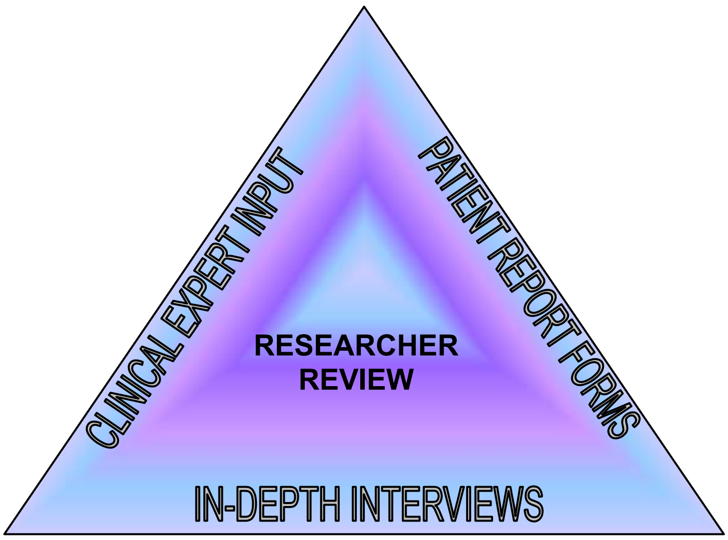


Figure 4-1: Triangulation of primary data sources accompanied by the researcher review to develop a conceptual model

4.5.1. Patient report forms

A purpose-designed patient report form was formulated by the researcher, to capture salient information about the RSI process and clinical events that would make for rich discussion during interviews with the participants. Discussion of these forms in the interviews was aimed at checking for correct application of RSI against the prescribed DEMCR guidelines and understanding the clinical decision making process that was followed for each RSI. The form was developed after rigorous literature consultation, anecdotal reviews, expert opinion and personal reflection. The form had already been pre-tested and piloted on the DEMCR's Techmed response vehicle. The final version is shown in Annexure 1. After piloting, only one minor change was made, which pertained to the inclusion of a form field for '*approximate age*'. Each participant was required to complete this form for every patient to whom he/she administered the RSI intervention, for the duration of the study. A total of eight forms were completed.

4.5.2. In-depth individual interviews

A digitally recorded interview with each of the four paramedics began after the participant confirmed understanding of the research question and the interview style. A significant rapport already existed between the researcher and the participants, hence it was assumed that the interviews would be non-threatening and relaxed. The interviews were semi-structured and aimed to understand the participants' RSI experiences and review the individual clinical cases in relation to current DEMCR guidelines for RSI.

In an effort to answer the first research question, the following questions were posed to the participants at stages of the interview:

- Tell me about your first experience with RSI.
- Can you describe some of the particular challenges that you might have had during the management of your patient?
- Do you believe that you have been adequately prepared for undertaking RSI? Please elaborate.
- In hindsight, is there anything you would have done differently during the RSI process?
- Can you emphasise some of the aspects that ran fairly smoothly during your clinical intervention.
- Additional questions leading from comments from the participants.

Member checks were conducted after primary analysis of the data to ensure that the researcher had correctly interpreted the interview data.

The researcher's primary role was to obtain insight into the participants' experience through engaged, profound listening (Sorrel and Redmond, 1995). Two types of probes were used to maintain interview flow: recapitulation and the silent probe (Sorrel and Redmond, 1995). Recapitulation allowed the researcher to lead the participant back to the original statement. A silent probe or purposeful silence helped restore a comfortable pace during the interview.

4.5.3. Expert clinical input

This was undertaken by means of a checklist for each case recorded on a patient report form (See Annexure 2). The checklist designed by the researcher, includes verification of correct application of RSI by the paramedic and also allows for comment on any adverse events that might have occurred as a result of paramedic RSI. This checklist was pre-tested and was piloted by one of the members of the expert panel. As a result, a minor adjustment was made which consisted of splitting the form into two separate parts.

The above-mentioned expert clinical input was aimed at addressing the second and third research questions.

4.5.4. Researcher review

Each RSI patient report form was scrutinized by the researcher for correctness of RSI application against the DEMCR guidelines. This was appropriate since the researcher is an experienced paramedic, is involved in RSI training, and was responsible for the development of the DEMCR RSI protocol. This was undertaken using the same checklist as the clinical experts, described in 4.5.3. The data generated was interrogated during the interviews with each paramedic respectively.

Data collection took place over a seven month period, from 02 July 2007 to 06 February 2008.

4.6. Data analysis

4.6.1. Qualitative analysis

The widely used grounded theory analytical approach, as described by Strauss and Corbin (Polit and Beck, 2006), was used for this study. A constant comparative method of data analysis was undertaken. This involved the simultaneous collection, coding and analysis of data. Coding is a process used to conceptualize data into patterns or concepts. Open coding, which may be the actual words used by the participants, was used in the first stage of the constant comparative analysis to capture what was going on in the data.

Open coding was achieved by cutting the words and phrases out of the interview transcripts and then sticking them on a wall. This provided the researcher with a holistic view of the data because the researcher was easily able to see all the categories for each participant. As the analysis progressed, the words and phrases were moved around until subcategories and categories, as well as linkages between them, were identified. This was the axial coding stage. A conditional relationship guide and reflective coding matrix described by Wilson Scott (2004) was applied in order to relate the categories to each other. Selective coding began thereafter by tabulating the categories identified for the four participant categories in a spreadsheet document to allow identification of a core category. Throughout the coding and analysis process, memos were used to document ideas about the data, categories and emerging conceptual scheme. This system helped to preserve ideas for further analysis later. The outcome of the process described above was a full conceptual description which is consistent with the approach used by Strauss and Corbin (Polit and Beck: 2006).

The data obtained from the expert's checklist and the patient report form was not quantitatively analysed, but served to assist the understanding of the clinical decision making process.

Difficulty in generalizing from case studies has been considered a major shortcoming of this method. However, the focus on design, as the driving definition of case studies provides useful advice for dealing with this problem. The remedy as suggested by Yin (1999) is to consider a case study, as a unit, to be equivalent to an experiment, as a unit. Under this assumption, the problem of generalizing from case studies is no different from the problem of generalizing from experiments, where hypotheses and theory are the vehicles for generalization. To this end, this type of research is not 'theory driven' but is 'driven to theory.'

4.7. Trustworthiness of the study

Guba’s and Lincoln's criteria (Polit and Beck: 2006) for trustworthiness were utilized to establish the trustworthiness of the study. The manner in which these criteria were addressed is explained hereafter.

4.7.1. Credibility

This study’s credibility was addressed by:

- clear identification of research participants;
- triangulation of data sources; and
- the researcher's own personal reflection of the CDM process

4.7.2. Transferability

This study’s transferability was addressed by description of a comprehensive research decision trail and detailed description of the research setting that should allow other researchers to decide whether the cases in this study are transferable to other settings.

4.7.3. Dependability

A study will be dependable as long as the credibility is ensured. For this study, the clearly defined methodological and analytical choices provide a means of establishing an audit trail, hence making the study dependable.

4.7.4. Confirmability

The confirmability of the study's findings has been ensured by the availability of:

- the study’s raw data, which is stored on the researcher’s password protected computer, but can be made available for scrutiny;
- the analysed data, which is available both electronically and in the cut-pieces as described in 4.6.1;
- the original proposal for the study which resides at the Faculty of Health Sciences offices at the Durban University of Technology; and
- evidence to support processes and tool development, namely:
    - evidence of letters and e-mail communications between the researcher, participants and the expert panel members;
    - draft and final copies of the patient report form.

4.8. Conclusion

The design and methodology of this study was based on the initial broad proposal and then further developed to incorporate specific strategies necessary to provide an understanding of the clinical decision making surrounding RSI. It has been accompanied by critical reflection on the part of the researcher, to eventually integrate the data into a meaningful whole.

CHAPTER FIVE

CASE STUDY OF PARTICIPANT ONE

THE KEY INFORMANT

5.1. Introduction

The purpose of this chapter is to present the findings for Case One derived from the first participant's data. From here on, the first participant will be referred to as 'P1'.

This chapter will start off detailing the background of the participant, followed by a description of the clinical circumstances in which the participant performed the RSIs. An appreciation of the participant's background is essential to understanding the responses received during the interview. The clinical circumstances will be illuminated by the actual clinical case details obtained from the relevant patient report form. Both the participant's background and the clinical circumstances contribute to an understanding of the clinical decisions that were made.

A discussion of the categories that emerged during data analysis for this participant will then take place. The links between the emerged categories will thereafter be explained.

In this chapter, the data presented only addresses the primary research question, namely:

"What are the factors that influence the paramedic's clinical decision making surrounding rapid sequence intubation, when faced with a critically ill or injured patient that requires definitive airway management?"

.

The results for secondary questions 1 to 4 will follow in Chapter 9.

Discussion of the data has been integrated with the supporting and contradictory literature where relevant. Reference will also be made to relevant literature that has been reviewed in Chapter 3.

The researcher has identified literature concurrently with the data collection and analysis as is appropriate for grounded theory (Polit and Beck, 2006).

The general approach to the discussion in this chapter will also apply to all other participants in Chapters Six to Eight

5.2. Background to Case One

5.2.1. <u>Background of the participant</u>

This participant is a registered paramedic, and is currently a doctoral student developing clinical quality standards for emergency services. He has been extensively involved in paramedic education and training as well as also previously serving on the Professional Board for Emergency Care Practitioners: *"…I'm an unusual case in some regards, because I was in some ways the architect of this entire new skill ... so I've obviously spent far more time than the average paramedic who's being introduced to the skill for the first time, …well considering the pros and cons of RSI and the best approaches and the conditions that need to be in place for it to happen safely".*

Over the last nine years, P1 has spent a great deal of time and effort developing the South African programme for the BTEMC. He also made a significant contribution to the creation of professional autonomy for paramedic practitioners. P1's international experience in the clinical governance environment adds an additional dimension to his own clinical decision making ability. P1 has worked in an emergency medical service in Europe, as the service's clinical director which entailed being the clinical governance lead. He has brought a lot of his international experience into the Department of Emergency Medical Care.

P1 spends a lot of his time on research and is constantly challenging himself with new ideas. The researcher is very closely affiliated with P1 and has a well established rapport with him. For this reason, P1 was able to disclose a great deal of rich information on his own thoughts about clinical decision making.

This participant has a strong personality, but is also friendly and easy to talk to. He was interviewed in the researcher's office, face to face and was most co-operative and forthcoming with real thought-provoking information. There was absolutely no prompting required during the interview, and the participant responded well to the questions asked. At no point in the interview did the participant become uncomfortable or uneasy. The interview lasted about forty minutes.

This participant served as the key informant to this study for the following reasons:

- P1 conducted more than one RSI and has had the most experience in RSI of all the participants.
- P1 has an established reputation as one of the better practitioners and thinkers in the profession and seems to have a great appreciation of clinical decision making.
- P1 has in many ways been the architect of paramedic RSI.

5.2.2. <u>Clinical context of the participant's RSI patient cases</u>

SUMMARY OF FIRST RSI PATIENT REPORT FORM

Type of incident	:	Female pedestrian run over by a light motor vehicle
Time of day	:	Late evening
Weather conditions	:	Dry
Traffic conditions	:	Middle of the road in the central business district with lots of traffic and crowding
Other environmental conditions	:	Other ambulance crew on scene
Patient vital signs	:	Pulse = 140 beats per minute
		Blood pressure = 140 / 90 mmHg
		Respiratory rate = 6 breaths per minute
		O_2 saturation = Unrecordable
General clinical condition	:	Isolated severe head trauma with airway reflex and ventilatory effort compromised

The *"…first patient was umm... a female patient who'd been run over umm...and... she had quite severe head injuries lowered GCS. I can't remember if she had any other injuries. Probably a few minor things but, primarily a head injury".* This case was quite chaotic, since it was *"in the middle of the road umm...and there was a lot of traffic and um... sort of noise... ".*

Trying to make any sort of decision under these conditions can be very challenging.

The RSI process, including the actual intubation, was relatively easier than previous standard intubations, and the participant was happier that the patient was now being managed more appropriately as compared to standard bad practice: "…*intubation with paralysis has been easier than I would have expected than intubation with just sedation only... it was the first time that we'd be able to manage the patient properly you know ... so we had or managed that particular class of patient for years and years and years and the reason why I started this process almost nine years ago was because we had put patients at risk during our intubation attempts particularly for head injuries…"*

In the last part of the quote above, P1 is referring to the old practice of sedation-only intubation.

SUMMARY OF SECOND PATIENT REPORT FORM

Type of incident	:	Blunt assault
Time of day	:	Evening
Weather conditions	:	Dry
Traffic conditions	:	None. Deserted car park.
Other environmental conditions	:	No influence of crowd.
Patient vital signs	:	Pulse = 80 beats per minute
		Blood pressure = 150 / 100 mmHg
		Respiratory rate = 8 breaths per minute
		O_2 saturation = 95%
General clinical condition	:	Isolated severe head trauma with airway reflex and ventilatory effort compromised.
Specific problems encountered	:	Patient had anatomical airway difficulty i.e. dental overbite and a short neck.

5.3. Categories identified for Case One

Two groups of categories were identified, namely non-clinical and clinical. The clinical categories are defined as any clinical event or intervention that has a direct bearing on the clinical management of the patient. The non-clinical categories are defined as all other situational and environmental factors that may affect decision making and hence the clinical management of the patient.

These groups of categories will also be identified for all other participants to be discussed in Chapters Six to Eight.

5.3.1. NON-CLINICAL CATEGORIES

Nine non-clinical categories were identified. These categories will be presented in a chronological order.

5.3.1.1. Previous RSI experience

It has already been noted in 5.2.1 that this participant has had previous experience of RSIs. As with any procedure, the more that it is undertaken or observed, the better the chance that the practitioner will have of being successful each time (Radwin, 1998:590; Cioffi, 2001:591): *"…I've assisted an RSI in hospital but then I've not made the decision to RSI but have been part of the negotiation to RSI. I have intubated someone who'd been paralyzed but I've never autonomously made the decision that RSI was appropriate."* So even though he has not independently made the decision to RSI, he did have prior experience of the procedure.

Despite this experience, the decision making however maybe be different each time, due to the unpredictability of the pre-hospital setting: *"…The second time was better but only because ... clinically the patients were very similar. The second patient was a blunt head trauma from an assault umm… it was slightly better because it was in a deserted car park, so there wasn't the influence of crowd and traffic…"*

5.3.1.2. Learning from past RSI experiences

The practitioner must be able to gather knowledge and decision making skills from past experiences, to enhance and improve the ability to make better clinical decisions *(*Radwin, 1998:590). This principle seems to apply to decision making surrounding RSI. P1 clearly demonstrates this: *"…we had spent quite some time following the first intubation, talking about the process and reflecting on it umm... it felt... I felt more confident to do the second one. I was very happy it was indicated and because we'd had a live run through with reflection I felt that the chances of it being successful were improved, which turned out to be absolutely fine."*

Reflection or run-through of a previous RSI seems to have had a great impact on the decision-making ability and confidence of P1. Reflective practice may be a key factor surrounding clinical decision making in RSI.

5.3.1.3. Education and training

Education may be defined as activities aimed at developing the knowledge, moral values and understanding required in all the aspects of life rather than knowledge and skills related to a limited field of activity (Jerling, 1999:2). Training is defined as the systematic process of changing the behaviour and/or attitudes of people in a certain direction to increase goal achievement (Jerling, 1992:3). In any profession, education and training should lay the foundation for good decision making. However, it is only over the last few years that the tertiary education system has introduced clinical evidence as a strong basis for paramedic education and training, which allows learners to think beyond just a protocol prescribed by a professional board. In the past, the education system has been quite different, and evidence-based-medicine has been downplayed (Christopher, 2007:95). Historically, there seems to have been more focus on a skills-based approach as compared to sound evidence-based training: *"…unfortunately the nature of the profession is such that historical, traditional and authoritarian knowledge is far more valuable than evidence, and so it spreads...and that's how we've ended up like this."*

This participant alludes to the problem of inappropriate use of certain medications. In the past, the practice of certain authority figures coupled with traditional bad practice, have led to the current situation of inappropriate use of morphine and midazolam for endotracheal intubation. Clinical evidence has historically tended not to be used to guide best practice in the emergency care profession in South Africa. This issue is discussed later in this chapter (*See 5.3.2.5*).

P1 certainly demonstrates his ability to reflect on his own education and training, and to use that to his advantage when required to make clinical decisions: *"…I had an opportunity to attend an RSI course run by the military and they spent a huge amount of time on testing the decision making by presenting scenarios some of which...for some of which it was appropriate to have RSI and for some* *of which it wasn't appropriate to RSI. I think, that, coupled with extensive simulated patient experience umm... made me think about things along slightly different lines umm... it made me understand the importance of preoxygenation ... it made me understand the importance of haemodynamic stability in a patient prior to RSI umm... and probably most importantly... really hammered home the theoretical concept or what up to that point had been theoretical concepts of how important preparation was..."*

"We've done a range of scenarios just to make sure that our thinking was clear."

Clearly P1 felt that this type of RSI course was successful in preparing him as it emphasised testing decision making with the use of different scenarios. He also raises the issue of training to facilitate deciding whether or not to RSI.

5.3.1.4. Planning for RSI

Planning for undertaking RSI in the prehospital context entails more than just checking and pre-configuring all the necessary equipment but also requires that the practitioner be au fait with the necessary steps to follow through with RSI.

This can be better achieved after undertaking at least one RSI case: *"...we've also configured our equipment to facilitate the way RSI should be conducted. So it is possible to make it as close as possible to ideal conditions... you never will get it exactly the same because its not a classroom, its the road. Umm... but if you prepare in advance and you plan.......... I need to make sure that I'm on my best game to get the tube down because they will desaturate very quickly and just making that kind of decision.... and I think that comes with experience."*

P1 is alluding to the fact that previous RSI experience helped him to better plan and be more prepared for RSI. He also indicates that good planning makes the decision to undertake RSI that much easier, when proper prior plans have been made.

5.3.1.5. The physical environment

Generally, the prehospital environment can be very challenging, with multiple stimuli (Shaban, 2005b; Wang, et al. 2005:147) which could affect the cognitive process of CDM: *"…It was somewhat chaotic to be honest because it was in the middle of the road umm...and there was a lot of traffic and um... sort of noise."*

P1 indicates that the general environment was difficult to work in, with a barrage of stimuli that may cloud cognitive processes.

Other factors that may hamper CDM are stressors like the lack of crowd control and hostile environments, which may force the relocation of the patient to a less ideal environment: *"…on a subsequent RSI we elected to RSI in the ambulance which is less ideal because of access to the patient and cramped conditions, but it was better than attempting to RSI outside with all the crowd problems that were ensuing outside."*

5.3.1.6. Assistance

Having the appropriately qualified person to assist with undertaking RSI is of critical importance. This person should be well trained and able to effectively assist the paramedic. This participant was fortunate to have a well trained assistant, who was very familiar with RSI, and one that did not need any formal direction: *"…In a straight forward RSI, if there is such a thing, one that's unremarkable and goes very smoothly probably the assistant isn't that important um... as long as they are able to administer the amount of drug that you request... when you request it, and they know how to do cricoid pressure and can hand you stuff … then beyond that there is not much specialist training required. I think where the assistant comes in is... certainly if you have a failed intubation attempt and what even in the unremarkable intubation, what the skilled assistant gives you, is the confidence to go ahead and do the RSI because you know that should something go wrong, you've got someone who can help you err...work on the airway."*

This participant mentions that the assistant isn't that important, and this is probably because he has a false sense of competence amongst other possible assistants. As mentioned earlier, this participant has repeatedly undertaken RSI with the same assistant, who is far more competent, knowledgeable and better qualified than the typical assistant. P1 is indicating what the level of confidence is for an uncomplicated RSI compared with a failed one. Having a skilled assistant can give you confidence because you know you have a competent helper in the event of problems developing. It can never be known though, when this will happen, so in essence a good assistant is always needed. When the assistant is less competent or a novice then the paramedic may not only be less confident, he may also need to put in more effort . O'Reilly (1993) suggested that experienced nurses encounter the additional effort of teaching and supporting inexperienced nurses. This required additional effort may have an effect on confidence of the paramedic in making swift clinical decisions and also being prepared for airway management difficulties.

After doing a member check with the participant, it was clarified that P1 viewed the presence of a trained and competent assistant as being a fundamental requirement for improved RSI success and stated that the assistant should always be present, since a failed intubation is not predictable.

5.3.1.7. Confidence

For any kind of decision to be made, one needs to have a certain level of self-confidence. Having total confidence can be difficult in an environment where there seems to be chaos, with multiple pieces of information being thrown at you. The element of confidence goes hand in hand with good planning and preparation. Confidence however does not necessarily mean that the practitioner is always competent. Castle, Garton and Kenward (2007:664) showed that there was a mismatch between confidence and competence regarding basic life support amongst three types of clinical practitioners and recommended changes to training programmes to address the mismatch. These authors asked their study participants to rate their level of confidence on a Likert scale of 1-5 (1=no confidence to 5=very confident) with the result that thirty percent of health care assistants (HCAs), fifty percent of registered nurses (RNs) and seventy five percent of doctors rated their confidence to perform basic life support (BLS) as either confident or very confident.. The lack of confidence expressed by the HCAs was also reflected in their competence when assessed performing BLS.

A practitioner will surely be less confident, knowing that his equipment and assistance are not in readiness: *"…making sure that all my equipment was ready in the event of failed intubation, it allowed me to think about why I was doing it and to be very clear in my own mind that it was appropriate to implement RSI in that patient, and that the risk benefit ratio was in favour of benefits and that's what went through my mind when I was doing it."*

This participant seemed very confident in his ability to undertake the RSI for the first time, but there was an element of nervousness, which is understandable, considering the environment he was working in and the risks associated with RSI: "*...mm... so it was exciting. I would be lying if I said I wasn't nervous about giving neuromuscular blockade for the first time outside the hospital…"*
It was clear from the tone of his voice that in the P1's nervous excitement, he was still very serious about undertaking the RSI.

5.3.1.8. Professional autonomy

P1 was very passionate about paramedics having professional autonomy, but at the same time showed concern that this autonomy is easily abused: *"I'd prefer to see autonomous practitioners providing RSI umm...under safe conditions because they are educated and responsible to decide when it's appropriate... ….what we run a risk of is under the banner of autonomy people doing what they think is right when the evidence demonstrates that what they think is right may not be."*

The professional board for emergency practitioners expects the practice of autonomous practitioners to be evidence-based, however past decisions and knowledge have not necessarily been based on this *(See 5.3.1.3.)*.

Having professional autonomy indicates that responsible and appropriate clinical decision making must take place. This means that the practitioner may have to solely make decisions under greatly stressful situations. There may be room for consultation during RSI to check decisions being made, but this may prove to be too time consuming in the emergency situation: *"Based on my experience, I don't think it... a paramedic... another paramedic, a doctor, whoever would have added any value to the decision making process I went through, but I can only speak for myself …. I think bringing in additional people erodes professional autonomy umm... and the emergent nature of RSI one…one could argue that there isn't time for that."*

5.3.1.9. Clinical governance of RSI

Since RSI is a prehospital procedure in its infancy and given the associated risks, it stands to reason that a good clinical governance system must be in place to ensure safe and professional practice. Wang, et al. (2001:40) concluded in a position paper that systems utilizing RSI must have an active quality assurance / quality control programme to help assess and maintain the quality of RSI performance and recommended the use of database tracking of all system intubations.

This is confirmed by Participant 1, who notes: *"…I think also what's probably more important is that individual prehospital care systems have to have a governance system in place to monitor to measure, to assure the quality of the clinical services that are being offered and that by and large does not exist in Africa... in South Africa."*

P1 is prioritizing levels of importance in clinical governance systems. He believes that clinical governance within individual prehospital care systems or ambulance service providers are more important than having just a national regulatory professional board.

It is clear that this participant's previous experience and interactions at a professional board level are influencing his comments. He believes that having a proper clinical governance system in place, may ensure that practitioners are more wary when making clinical decisions surrounding RSI. He is simply stating that practitioners can be given autonomy but remain accountable for their actions and decisions, as long as those decisions and actions are based on current clinical evidence (*See 5.3.1.8*).

5.3.2. CLINICAL CATEGORIES

Twelve clinical categories were identified. These categories will be presented in a chronological order.

5.3.2.1. Making the decision to intubate

(Tanner, et. al. (1987:358) highlighted that individuals rely on earlier knowledge gained about the issues and areas concerned when using a hypothetico-deductive process of determining patient's problems with use of diagnostic reasoning. It is quite clear for this participant, that a lot of thought went into making a decision to intubate the critically ill and injured patient: *"…there are lots of things that you have to consider. So, its not just a binary thing, sort of a dichotomous Yes or No, it's this, this... the decision is binary in the end, but before you get to that point in the end, there's lots of things that you have to consider..."*

Gerdtz and Bucknall (1999: 50) state that a clinician's capacity to make relevant observations, to identify actual and potential problems, to intervene appropriately and to prioritize care, all demand decision-making and critical thinking ability. It seems that P1 possess both of these attributes.

There are also logistical considerations that contribute to the eventual decision to intubate, and it is usually a case of balancing the risk of the considerations versus the benefit to the patient: *"…if I was in the unfortunate situation where I had limited oxygen supply then I would think twice about RSIing … umm...that* *shouldn't happen, but it could happen if I came across a patient with something like that um... if I was uncomfortable that I would have a transporting vehicle before my own oxygen supply ... before I ran out, I would think carefully about RSIing the patient ...I'm not saying I wouldn't do it, but I would think carefully about that as a consideration..."*

The things that must be considered may include both clinical and non-clinical factors. This shows a clear link between the two major categories being discussed. Making the decision to intubate is influenced by many planning issues as discussed in 5.3.1.4.

5.3.2.2. The clinical condition of the patient

The clinical condition of the patient is probably the main factor that makes one decide whether to RSI or not *(See Ch. 3, Sec. 3.6.1)*. The decision to RSI should be primarily based on a compromised airway: *"…the reason we were intubating her was because she had umm...low GCS and had a compromised airway rather than ventilation, so whilst we were preoxygenating her, we were using manual techniques to maintain an airway."*

P1's reference to manual techniques indicates the use of a bag-valve-mask device together with pressure on the cricoid cartilage to facilitate ventilation and minimise the risk of aspiration until an endotracheal tube is passed.

It is clear from the above statement of this participant, that the clinical condition indicates the need for the RSI and that the clinical condition sets off a series of interventions that must take place to ensure that the end result of placing an endotracheal tube is successful

5.3.2.3. The need for speed of intubation

The clinical condition of the patient coupled with the nature of the prehospital environment often dictates that the paramedic speedily pass an endotracheal tube, simply because time is of the essence, in the near-terminal patient. Determining the severity of the patient's condition in this situation requires swift decision making, or else it may be too late. Patients that are about to deteriorate into cardiac arrest require rapid protection of their airway: *"...I think the crash intubation is the preterminal patient and it's obvious you put...shove a tube down. Umm... and I classify that patient really as just a difficult cardiac arrest intubation… ".*

These situations may not even offer the luxury of pre-oxygenating the patient over a few minutes, which is best practice to ensure patient safety (Walls and Murphy, 2004:24): *"...one of the biggest decisions that goes through my mind when I am in the process of RSIing and that's the process of making the decision to RSI is the degree of emergence of the airway... so how compromised the airway slash ventilatory status is weighed up against the length of time that we preoxygenate to make the RSI attempt safe, if that makes sense..."*

It is clear that sub-decisions of primary decisions must be made (*See 5.3.2.1*). Pre-oxygenation is a key area of preparation of the patient for RSI to reduce the risk of patient desaturation (*See 5.3.2.8.*).

Although P1 is very cognisant of the above kind of patient and the decisions involved, he is yet to encounter them: *"Luckily the cases that I've done so far, the answers weighed in favour of waiting five minutes so making sure they're very* *saturated and now I'm prepared to do the RSI. I've yet to have a patient where I've tended in the opposite direction and started to wait to tend towards the crash intubation scenario…"*

Speed is of the essence in most emergency cases. In the case of the preterminal patient with a compromised airway it becomes imperative that an ETT is passed as soon as possible. Good practice is to preoxygenate, but this is not always possible as in the crash intubation scenario.

The degree of emergence of a patient's airway (see Fig. 5-1) may rest on three important legs, namely:

- the degree of compromised airway;
- the ventilatory status and
- length of time to preoxygenate to make RSI safe

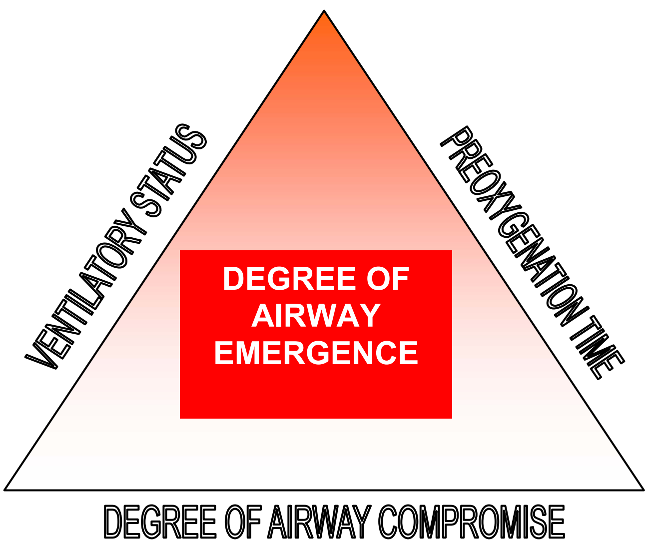


Fig. 5-1: Triangle of factors affecting the degree of emergence

5.3.2.4. Evaluation of the patient's airway

Initially, broad decisions to undertake RSI must be made, followed by more specific clinical decisions to confirm whether the initial decision to RSI is correct or not. Evaluating a patient's airway plays a major role in making the decision to undertake RSI (Levitan, Everett and Ochroch, 2004:307; Walls and Murphy, 2004:18). However, this participant emphasises that the prehospital environment is not the ideal place for evaluating the airway by direct laryngoscopy: *"…in an ambulance where it is very, very cramped and the conditions for laryngoscopy are not ideal ... "*

Encountering secretions or blood in the airway (Helm, Hossfeld, Schafer, Hoitz and Lampl, 2006:67) also influences the decision to RSI, depending on the severity of the obstruction. This participant however did not encounter a high degree of severity with airway obstruction by blood or secretions: *"…there was a little bit of blood in the oropharynx, but... nothing to write home about..."*

5.3.2.5. Making the choice between RSI and sedation-only-intubation (SOI)

The decision to use RSI instead of SOI should be an automatic one, for most patients requiring emergency intubation. However, there a sub-set of patients that may not respond well to RSI, and possibly deteriorate This sub-set of patients include those with potassium abnormalities and those with endogenous pseudocholinesterase deficiency (Walls and Murphy, 2004:22), although these may be somewhat difficult to identify in the pre-hospital environment. This is why it is absolutely important for the practitioner to select RSI candidates on a patient by patient basis, as the context of patients' clinical presentations varies: *"The* *decision to RSI is a clinical presentation in a context... I think you'd need to take it on a patient by patient basis um... clearly if you're using neuromuscular blocker agents and sedation to intubate someone then the objective is to get an endotracheal tube through the vocal cords..."*

For this participant, the use of sedation-only-intubation was never an option *(See Ch. 3, Sec. 3.4.3 and Ch. 1, Sec. 1.2.5)*, as was quite clear to him that any patient requiring intubation, requires RSI or rapid transport to hospital where the intubation can be done: *"...given her circumstances, probably um... transported her using manual airway techniques...there's no way I would have sedated her umm... so depending on her airway either done manual airway techniques or put her in the left lateral position and transported her like that..."*

Although there is no literature specific to delaying RSI until arrival at hospital, Wang, O'Connor and Domeier (2001: 44), suggest that proximity to hospital and transport times should influence whether there is a need for a pre-hospital RSI programme at all. Whilst this may be an important, it cannot be applied to the current South African health system because it cannot be assumed that all the receiving hospitals are equipped to undertake RSI in their emergency units.

P1 seems to be and has been very responsible in his decision making, and therefore does not subscribe to historical bad practice: *"…The decision making should theoretically be the same (as sedation-only intubation) but historically the decision making has not been as thorough for the midazolam-morphine patient. The decision making has been very simple...'I must get a tube between the vocal cords, and I'll use whatever polypharmacy I can to achieve that'* *whereas that's not the case with RSI...well certainly not the case of an RSI performed by a responsible clinician..."*

The participant is alluding to the fact that in the past, a great deal of emphasis has been placed on endotracheal intubation as just a mechanical skill which has led to practitioners intubating patients with disregard for the physiological consequences thereof *(See Ch. 3, Sec. 3.5.)*.

Other factors certainly come into play when deciding to RSI in the prehospital environment. One of the major considerations is the proximity to the hospital, where one hopes that RSI can be performed in a more controlled environment. This however may not always be possible. Familiarity with the surrounding hospitals' emergency units may be a key factor when making this decision: *"Our proximity to hospital and my belief or my confidence that the hospital would implement RSI on arrival would also influence my decision because prehospitally it's not the optimum place for doing RSI. So if I'm right outside Albert Luthuli hospital, I might opt to transport the patient rapidly into the hospital and let the hospital do the RSI or me do the RSI in their environment. But lots of other conditions...you know...lots of other things come into that umm... the decision making process, because I'd need to be confident that the RSI would actually happen in that environment..."*

The participant is also inferring that the receiving hospital's emergency department may not offer the appropriate level of care i.e. they may resort to sedation-only intubation and therefore confidence in the receiving facility is also a factor in decision-making.

5.3.2.6. Use of drugs

The use of appropriate drugs in the correct weight-based dosages are extremely important for patient safety and a successful RSI. However, calculating the exact dose may be difficult, as most times, the weight of the patient must be estimated based on their size under challenging conditions: *"…Whether he was a hundred kilogram person is another issue, but he was big enough to warrant the full dose..."*

Estimating drug doses based on the size of the patient is yet another clinical decision that must be. These patients are usually too ill to disclose their weight and estimation of weight can be difficult when there is poor lighting and if the patient is found in an awkard position.

5.3.2.7. Inappropriate use of morphine and midazolam

This category is regarded as a factor affecting clinical decision making in that it has been an overarching problem in the EMS in South Africa which has led many new practitioners to follow this practice, despite being trained otherwise. It seems that some trainee paramedics follow the practice of other experienced practitioners simply because it seems like it works quickly and intubation is achieved. This specific problem is different from sedation-only intubation since much higher than normal doses of both morphine and midazolam tend to get used for facilitating endotracheal intubation. In fact, morphine was never intended for use in sedation-intubation. Over many years, a common inappropriate practice of combining morphine and midazolam to achieve intubating conditions in critically ill or injured patients has occurred. This current bad practice has never been approved by the professional board, has no clinical evidence to support it, but still continues as standard practice. The reason for this practice appears to be that paramedics are issued with inappropriate drugs for drug-assisted intubation. No scientific articles supporting or documenting this practice could be located. This practice is especially a problem with the head injured patient *(See Ch. 3, Sec. 3.5.2.1.3)*. Participant 1 describes this practice. : *"…I think I've only used midazolam once or twice to facilitate intubation and then very, very low dose midazolam. But what anecdotally is...is...what we've become aware of is that umm... midazolam was err... approved for use as a sedative agent I think up to a maximum dose of 5mg which is really the awake sedation dose that's used in hospital."*

"Umm...however umm... in the attempt to take a drug that's not the best drug for achieving intubating conditions and make it better, it's being combined with morphine to achieve a synergistic effect and what we end up with is a potent hypotensive agent err... with a long half life...and it's being used to intubate patients and also one that takes some time to actually ...to act which means that we have stacking of drugs because they get repeated doses in order to achieve intubating conditions and at the end of the day, hopefully once they've intubated but when they fail to intubate, we then end up with massive potentiation of high dose midazolam... It's clearly not safe, it's never been approved by the professional board and is a perversion of practice."

5.3.2.8. Preparation of the patient for RSI

Preparing the patient for the RSI procedure, once the decision to RSI has been made, can either be very rapid, or fairly calm. During this stage there are many other clinical decisions to be made. Walls and Murphy (2004:23-26) highlight the variance in patient preparation issues and argue that this variance is dependent on the severity of the clinical condition and degree of airway compromise. Decisions regarding essential clinical interventions like preoxygenation and pre-medication have to be swiftly made, once the initial decision to RSI has been made. The importance of these interventions can sometimes be downplayed because of the stress of knowing that the practitioner is about to paralyze the patient. It is therefore essential that the practitioner gathers his thoughts and focuses on the entire process, which was the case with P1: *"…we took a long time to preoxygenate the patient before we attempted the RSI so it forced us to slow down the intubation attempt where previously we'd be slamming drugs down trying to get the tube down quickly because we wanted to RSI... umm... RSI under safe conditions we, we, we...waited at least five minutes preoxygenation and so I found that made the whole process calmer…. I was thankful of the discipline of preoxygenation and preparation because as well as using that time to assess the patient for probability of successful intubation , making sure that all my equipment was ready in the event of failed intubation, it allowed me to think about why I was doing it…"*

P1 highlights the fact that in previous practice, little consideration was given to preoxygenation of the patient. He also alludes to the fact that he spent time checking his decisions.

5.3.2.9. Post-intubation management

After successfully placing the endotracheal tube, a number of decisions have to be made regarding the ongoing management in terms of the patient's stability (Walls and Murphy, 2004:27). The RSI process certainly does not end after placing the tube, but extends to ensuring that the patient is adequately oxygenated and ventilated *(see Ch. 3, Sec. 3.6.5).* Specific medications must also be administered to ensure that the patient does not wake up and start to fight the mechanical ventilator. The paramedic must carefully time the medications administered to prevent this from occurring: *"…We arrived at umm... the casualty department, handed the patient over and as expected, the patient was beginning to stir because both the induction agent and paralytic agent were wearing off..."*

As discussed in 5.3.2.5, the proximity to hospital must also be considered in terms of on-going paralysis of the patient. The recommended medications have a relatively short half-life and may start to wear off before or on arrival at hospital. It may also be argued that post-intubation paralysis may not even be necessary if the receiving hospital is less than a few minutes away. The assumption though, is that the receiving hospital will manage the patient appropriately.

5.3.2.10. Hospital reception of patient

Currently, almost none of the surrounding hospitals have been formally made aware of prehospital use of paralytic agents. All anaesthetists will agree that almost any patient getting intubated requires a paralytic agent, to smoothly carry out the intubation. The problem is that anaesthetists generally do not work in hospital emergency units. The doctors and nurses who are found in these units are not necessarily familiar with these types of drugs: *"…caught the hospital by surprise because they were used to patients coming in under very heavy sedation and we had to spend a little bit time explaining that there had been a change in practice …"*

The practice of paramedics can sometimes be challenged, primarily because of misinformation and lack of understanding of paramedic training: *"To be honest however, the third one that I did, there was a slight challenge over the umm... dosage that we gave of sux. They were amazed that we gave two hundred milligrams of sux but accepted when I explained the rationale for slightly higher that normal dose of sux in the prehospital context to rapidly flatten patients to improve their chance of successful RSI."*

The use of suxamethonium by emergency doctors in most local hospitals is rare and is usually reserved for use by an anaesthetist, who is usually not present in the emergency unit. This may lead to more questions by the emergency doctor regarding its use by paramedics.

5.3.2.11. Who is the RSIing clinician?

Roles and responsibilities often get blurred in an emergency situation, although it is critically important that roles in RSI are clear. When roles are clearly delineated, the process may follow through a lot more smoothly. Prior to deciding on whether to use RSI or not, we must first determine who is responsible for making that decision: *"…I've always, often thought to myself…. in my mind...who is the RSIing clinician? Is it the person who delivers the drugs? Is it the person who intubates? But actually, it's the person who makes the decision but under his authority the RSI takes place..."*

Once the primary decision to go ahead with RSI is made, it thereafter must be decided who administers the drugs, and who performs the actual intubation. It makes sense that the most experienced intubater should perform the intubations, whilst the primary RSI decision-maker oversees the process. The primary RSI decision-maker may also very well be the person who undertakes the intubation or administers the drugs: *"…in my case, since I've done the intubations um... the skilled assistant has administered the drugs on my behalf though I think it's kind of irrelevant who does it. I think the responsibility rests with the person who makes the decision that RSI is gonna happen and initiates it..."*

There is no current literature available related to this category and it remains an area for further research.

5.3.2.12. <u>Seriousness of the RSI process</u>

The consequences of RSI can be very severe if decision making is poor and errors occur and if it is not thought through adequately. Therefore, CDM must be taken very seriously, even for the very experienced practitioner. Participant 1 expresses this very clearly: *"…RSI is unlike most of the procedures that we've done historically and traditionally because the consequences of error in RSI are severe as many things are, but we're taking a person from a particular clinical presentation and for effectively ten or eleven minutes, making them worse to make them better…the decision to RSI can't be taken lightly. The clinicians that do RSI need to have considered the gravity of that skill and also be well versed in the different types of situations where RSI is appropriate and what to do if they fail..."*

5.4. Conclusion

A total of 21 categories were identified from the interview with the first participant. It is very clear that for P1 there exists a multitude of factors that affect clinical decision making surrounding RSI

The integration of the identified categories will be discussed in Chapter 9.

CHAPTER SIX

CASE STUDY OF PARTICIPANT TWO

6.1. Introduction

The purpose of this chapter is to explore the findings embedded in the data received through the second participant. From here on, the second participant will be referred to as “P2”.

This chapter will start off detailing the background of the participant, followed by a description of the clinical context in which the participant functioned. A discussion of the categories that emerged during data analysis will then take place.

This chapter will follow the same format as used in the discussion of Chapter 5 (*see Ch. 5, Sec. 5.1).*

6.2. Background of the Case Two

6.2.1. Background to the participant

This participant is a registered paramedic, and has completed the BTEMC programme as well as also participating in an additional RSI workshop arranged by the researcher. P2 is currently involved in paramedic education and training and has many years of operational experience as an advanced life support practitioner: *"I've got all the experience … I've been working for over twelve years…. I think more than that… operationally…"*

P2 has emerged as an advanced life support practitioner from the era when it was acceptable practice to use 'inappropriate' drugs to achieve intubating conditions. This was a result of the historical non-evidence based approach to emergency medical care *(see Ch. 5, Sec. 5.3.1.3)*.

The researcher has a good collegial relationship with this participant who works in the same department. The interview with P2 was conducted in the researcher's office, face-to-face, and lasted about fifty minutes. The participant was comfortable during the interview, and as he has a very easy-going personality he was very easy to talk to. He was able to provide an answer for all the questions posed, with a fair amount of ease.

Some prompting in certain questions was required to clarify questions. He did seem somewhat intimidated by certain questions. This was noticed by his momentary hesitation during some of the sentence construction. There were also some contradictions in parts of the responses, which were later clarified by a member check. During the member check, the participant confirmed that he was not really intimidated by the questions, but rather took a bit more time to answer them completely.

6.2.2. Clinical context of the participant's RSI case

SUMMARY OF RSI PATIENT REPORT FORM

Type of incident	:	Male passenger involved in a light motor vehicle collision. The crew responding consisted of Participant 2 and final year paramedic students, undertaking an experiential learning duty.
Time of day	:	Evening
Weather conditions	:	Dry
Traffic conditions	:	Lots of traffic
Other environmental conditions	:	Chaotic with more than one patient needing medical attention and four people already dead on the scene
Patient vital signs	:	Pulse = 112 beats per minute Blood pressure = 130 / 80 mmHg Respiratory rate = 18 breaths per minute O_2 saturation = 93%
General clinical condition	:	Isolated severe head trauma with potential for a compromised airway
Specific problems encountered	:	Blood and secretions in the airway with decreased neck mobility

This particular case involved a male patient who was a passenger in one of the vehicles involved in a high-impact collision. The nature of the case was immediately distressing, as there were four other people that were already dead as a result of the same collision. On initial viewing of a scene like this, the practitioner may become overwhelmed by the enormity of the situation. To have to make rapid clinical decisions under such conditions can be extremely difficult even for experienced practitioners. The scale of the incident is indicated in when he comments: *"…there were four other patients that were dead when we got there…and…and…this one was the only red code…and initially…initially it didn't look that serious but then I realized, if there were four people that were dead from this one accident, it means that there must have been severe trauma to them…"*

6.3. Categories identified from this participant's interview

The categories that were identified were classified into two broad groups, namely clinical and non-clinical. Chapter Five *(Sec. 5.3)* provides the explanation of the definition of these groups.

6.3.1. NON-CLINICAL CATEGORIES

Eight non-clinical categories were identified. These categories will be presented in a chronological order.

6.3.1.1. General experience

Cioffi (2001:591) showed that practitioners use past experiences in their decision making process by comparing the current situation to previously experienced situations held in their memory. This is apparent with P2, who has not carried out an RSI itself previously, but has a wealth of general advanced life support and airway management experience. This certainly plays a significant role in his decision making ability: *"The thing is, when I actually decided to do that, I realized you know what… I've got all the experience… I've been working for over twelve years… I think more than that… operationally… and I've been intubating all my life…all these years, and I just thought to myself … this is actually gonna make your life easier you know, err... and I said let me just go ahead with my instincts based on the experience that I had operationally."*

6.3.1.2. Education and training

Education and training is a key factor contributing to good clinical decision-making: *"It's a combination of experience and the training that backs you up."*

The way a practitioner is trained may impact on the way clinical decisions are made. Christopher (2007:96) showed that advanced life support practitioners trained with a skills-based approach seemed to function strictly within prescribed practitioner protocols, with little room for lateral decision making.

P2 was very comfortable that his own education and training had adequately prepared him for making clinical decisions surrounding RSI, but expressed concern about being supported by the current emergency service systems in terms of provision of appropriate medical equipment. He notes that without the proper equipment, being properly trained will not be sufficient to do RSIs safely: *"Yes, it's more than adequate. The B.Tech training at this institution... or the institution that I trained at, is more than adequate to... to... it's just that…the training is adequate……but….if…if I trained, well I did train here…..if I was working operationally, and I know the services that are operating in Durban and I know what type of equipment they have. You could have all the training in the world but if you don't have your supporting equipment…then it's gonna be a disaster."*

In this quote, P2 is acknowledging the importance of education and training, but that on its own it is not sufficient for undertaking RSIs safely.

6.3.1.3. Planning for RSI

Having the correct RSI equipment and medications planned and prepared in advance may remove the uncertainty of a successful procedure. Many considerations must be made, especially in terms of practicalities of cold storage of drugs and quick access to alternative airway devices.

Poor planning of RSI logistics can lead to delays in patient management and frustration which can seriously hamper the ongoing clinical decision-making and may contribute to or result in an unsuccessful procedure with consequent deterioration in the patient's condition deterioration. This is particularly relevant given the need for speedy actions.

"Luckily with the unit that we have, we've got a separate... err... err… okay what you want to call it... difficult airway bag, which I mean…is all well laid out… the challenge was…which is easily mitigated against…err…we were not…we were using the flask. Can you remember… we were using the stainless steel flask as a means of refrigerating the drug? The drugs were kept loosely in the flask, which meant that I had to decant all the contents to get to the specific drug... emm… so some of it fell on the floor… then we had the amps covered in gauze to prevent them from breaking and there was a bit of frustration because I had to unpack each gauze to find out which amp was which. So in the heat of the moment you can confuse drugs very easily."

The participant is referring to measures that were taken by the DEMCR to facilitate cold storage of RSI medications, specifically a stainless steel flask. However, when it was used in the field situation it was not practical and clearly needed improvement to avoid errors in drug administration.

Equipment provision is actually part of forward planning for RSI, which EMS systems must acknowledge. Without the prerequisite equipment, RSI cannot be performed safely, even if the practitioner is well trained *(see 6.3.1.2)*.

6.3.1.4. The physical environment

The pre-hospital environment can be very stressful for the practitioner. Its uncontrolled and unpredictable physical nature, combined with psychological stressors such as seeing badly damaged bodies, render the ability to make effective and efficient clinical decisions quite challenging for the lone practitioner (Shaban, 2005b, Wang, et al. 2005:147): *"the scene was a bit chaotic because there were more than one patient….there were four other patients that were dead when we got there…and…and…this one was the only red code……. as we were intubating, the helicopter was landing…there was a lot of crowd around. They had to do the crowd control…cordon the area off."*

This participant provides a good description of the somewhat chaotic environment within which the practitioner is required to think clearly.

6.3.1.5. Scene management

Besides having to making clinical decisions about the patient, the practitioner is often required to co-ordinate all the surrounding events on an emergency scene, especially if he is the first to arrive: *"…we were the first on scene… so after I got my bearings and sorted out the broad issues, I realized that this is the patient that needed the most attention….I went and took a quick look around to get the* *size-up of the scene and then I came back to this patient…so that must have taken about five minutes."*

During this chaotic decision making, both clinical and non-clinical tasks may need to be delegated if there are other appropriate personnel available: *"I told my students to go and take care of him…they started the normal ABCs, bagging and err…. err… getting the IV ready… "*

Environmental/scene factors also impact on ease of decision-making. Expecting the first practitioner on scene to decide to instigate RSI, whilst also managing the scene places additional demands on decision making. This situation can sometimes not be avoided, or at least not until other assistance arrives and may encourage the practitioner to emphasize single-patient management over scene management or vice versa.

6.3.1.6. Assistance

The participant acknowledged that having an assistant makes the RSI process easier, although the assistant should be appropriately trained: *"Maybe that's why it made this experience much easier because I had students that were fresh."* *"They definitely need to be specifically trained... I think it could be just as quick. Maybe that was due to having two other people there. You should have at least one other person there."*

P2 is also referring to the fact that intubation with RSI as compared to sedation-only intubation takes about the same time to achieve, as long as there is at least one trained assistant.

P2 was fortunate that the assistants were third year paramedic students who were very familiar with intubation, and failed airway techniques. When RSI is conducted in hospital, there may be several clinicians in a controlled environment to undertake the process. This has been the researcher's own experience.

Having adequate assistance is therefore a support, which should have a positive influence on the quality of decision making and ability to decide in a pressurised situation.

6.3.1.7. Confidence

Being confident in a stressful situation entails having a fair amount of experience in similar situations. However, the practitioner must be confidently competent. (Castle, Garton and Kenward (2007:664) showed that only one of three types of clinicians was both confident and competent at undertaking basic life support, with other two types mismatched *(see Ch. 5, Sec. 5.3.1.7)*. When undertaking RSI for the first time, just knowing what to do and when to do it may help the practitioner's confidence, although there may be some degree of hesitancy to actually decide to follow through with it: *"Once you get over the initial hesitancy of doing the first one…doing…actually performing, but then if you put things in context and you should just end up relying on your training and experience and everything should fall into place."*

P2 admitted that there was initially an element of anxiety associated with making the decision to RSI and actually doing it. His anxiety was allayed and confidence augmented by having a pocket guide to confirm his clinical decisions: *"Yes, I was* *scared initially and actually….although I knew the drug doses and….exactly what needed to be done, I had my little….what can you call it…aide memoir, in my pocket, which I double checked with…and once I double checked, then realized you know, it was smooth sailing after that. So I think something important here to realize is that…that aide memoir that I had…err…just double checking with that, just boosted my confidence and there was nothing to worry about after that."*

Wang and Katz (2007: 238) conclude that pre-hospital endotracheal intubation which is commonly depicted as a skills-based task is actually a cognitively complex procedure that draws largely on rules-based and knowledge-based processes. Having an aide memoir to simply these complex decisions may certainly increase confidence levels as it did in the case of P2.

Confidence is not the opposite of indecision. Most practitioners will have some degree of discomfort or trepidation when undertaking a new skill or process for the first time if there are risks associated with it. Being confident is really a state of mind combined with the right sort of planning for the clinical process. If self-confidence is lacking though, then the chances of things going wrong may escalate: *"You know…as with any skill you're performing…em…I would say eighty percent is your mindset… er... er... which basically boils down to confidence, okay… and confidence comes with maturity , it comes with experience and comes with your training. I think if any of those three factors are missing, then ultimately now, if your confidence is lacking then there's a chance of things going wrong."*

6.3.1.8. Clinical governance of RSI

A clinical governance system can be tiered, in the sense that the system can be directed from the professional board, by the directors of emergency services or at ground level by senior officers (Wang, et al. 2001:40, Dunford, et al. 2003:721, Wang, et al. 2004a:366). A governance system should certainly create a sense of responsible decision making amongst prehospital practitioners. If practitioners know that they have to be accountable for their decisions then it stands to reason that they will be more careful and become more responsible practitioners. In the current EMS climate in South Africa, the governance system may need to be very rigid initially to get practitioners to realize the importance of accountability.

P2 expresses concern about the need for clinical governance within emergency services: *"There's absolutely nobody from the board perspective…governing what paramedics do on the road. They've been issued with a protocol, but no one is policing it to see whether the protocols are being followed. Okay, you get the provincial ambulance service and you get the private…ideally I would…you would want the board to be more involved with the management of the different services, to make sure that clinical governance is being conducted."*

As discussed in the previous paragraph, clinical governance at an EMS system level should compel practitioners to be more responsible in their decision making. Having a professional board insist on clinical governance at an EMS system level may even further improve accountability and responsible decision making. By having this, practitioners stand to lose professional certification if personal accountability is ignored.

6.3.2. CLINICAL CATEGORIES

Nine clinical categories were identified. These categories will be presented in a chronological order.

6.3.2.1. Making the decision to intubate

P2 reflects that making the decision to pass an endotracheal tube into a patient's airway is easier when the need is blatantly obvious, compared to when the patient has a higher level of consciousness and is temporarily maintaining a reasonably patent airway. The decision-making in this regard can be much more challenging and requires careful thought as other factors like proximity to hospital and the direction of the clinical course must be considered before deciding on the intubation. An algorithmic approach as proposed by Wang, et al. (2005:146) may be beneficial in this kind of situation: *"…Also, the type of patient, with a GCS of four…….you know…it's easier to make a decision to intubate when someone's GCS is four.*

A totally different case if someone's GCS was much higher. Err…someone's actually…maybe… looking at you and actually talking to you." This may be a case of a pre-emptive intubation e.g. an at risk airway in a burns patient versus a crash intubation eg. a severe traumatic brain injury with obvious airway compromise. A crash intubation rarely requires drugs except maybe a paralytic agent. The pre-emptive intubation decision entails quick early thinking to prevent general deterioration of the patient. This decision may be more difficult in the sense that patients who require pre-emptive intubation may appear to be clinically stable, but then suddenly crash because of rapid airway compromise.

P2 demonstrates a sense of urgency about getting the patient to hospital as soon as possible, but it is also evident that the absence or delay of a transport medium will not delay or deter protecting the patient's airway: *"…when you decide to intubate…you can intubate, you can RSI, you can sedate…but you know the emphasis is on getting this patient to hospital. You gotta have a means of transport. You can't be sitting on a scene, waiting two hours for an ambulance, and you've only got two portable oxygen cylinders and now they suddenly run out. You've gotta have all your logistics in place before you do it. Having said that, if you didn't have your ambulance there, you would still have to intubate, you would still have to ventilate, regardless."*

To clarify, P2 is saying that the decision is made taking into account the logistics involved i.e. time to get to a facility, transport and sufficient oxygen. P2 however indicates that it is possible that even if it is not known how the patient was getting to hospital and how long it would take and whether there was sufficient oxygen, he would still have to do it or the patient would deteriorate and die.

Therefore, he is noting that one may decide to delay doing the RSI if other things were not in place and delay for as long as possible until it is no longer safe i.e. the risks of not intubating outweigh the benefit of waiting. Not intubating the patient carries the risk of desaturation, possible aspiration, ventilation perfusion mismatch and overall hypoxaemia.

It is clear here that the decision is being influenced by non-clinical factors, which emphasizes a definite link between the general clinical and non-clinical categories.

The above statement again reflects a risk-benefit situation, which requires all options having to be carefully weighed up against each other in order to reach a sound decision.

<u>6.3.2.2. The clinical condition of the patient</u>

Many factors surrounding the patient's clinical condition need to be considered when making the decision to RSI *(see Ch. 3, Sec. 3.6.1 and Ch. 5, Sec. 5.3.2.1)*. The immediately obvious signs may tell the practitioner that RSI is indicated, although this can sometimes be dangerous when other clinical indicators like circulatory factors are ignored. A typical example of this is a polytraumatised patient with an abdominal muscular tamponade. Administration of a paralytic agent to this kind of patient may cause release of the tamponade, possibly resulting in exsanguination of the patient. Simpson, Popat and Carrie (2001: 311) state that the reduction in intra-abdominal pressure resulting from muscular relaxation can also cause renewed bleeding by removing pressure 'tamponade'.

This was fortunately not the case for P2, as there were clear signs of an isolated head injury that urgently needed airway protection: *"As I said, his GCS was four. The main reason we wanted to RSI him was because of his head injury and the chances of him gagging..."*

<u>6.3.2.3. Evaluation of the patient's airway</u>

A key component to making the right decision regarding whether to instigate RSI or not, hinges on the confidence of the practitioner that they will be able to successfully intubate the patient. In order to be confident of this, a thorough but quick evaluation of the patient's airway is of critical importance. The airway evaluation must be conducted using accepted techniques such as the Mallampati scoring and the "LEMON" law as described by Walls (2004:75) *(see Ch. 3, Sec. 3.6.1)*. Any sign that could indicate impending intubation difficulty, should be seriously considered prior to paralyzing the patient: *"…the airway was not difficult. It wasn't a difficult airway if you look at the whole Mallampati score and all that. It was fairly straight forward. There was no trauma to the airway… there was no trauma or any disfigurement. It was a pretty normal looking oropharynx…"*

Profuse secretions or blood in the airway may deter the practitioner from going ahead with RSI depending on the severity of the obstruction, and the ability to effectively control or remove the obstruction. P2 was however not concerned about the airway obstruction and still went ahead with the RSI, probably because he had realized the importance of securing the airway quickly. Basically, he had to weigh the risk against the benefit, i.e. if he opted not to intubate, the patient would probably die: *"…had a lot of secretions, saliva and blood in his mouth and you could you could hear it…err...I mean even from a distance when you hear that, you realize that this patient probably needs a tube..."*

It is clear that P2 began assessing the patient from a distance, using all his senses. He could hear that the airway was at risk because of the noise he could hear from a distance, almost as though his sub-conscious mind was telling him that something was seriously wrong with the patient. What is being portrayed here is an expert clinician assessing the whole environment, looking at the scene, picking up on the mechanism of injury, all alerting him to the fact that the incident is potentially serious. This is then reinforced by the obvious sounds of an obstructed airway.

6.3.2.4. Making the choice between RSI and sedation-only-intubation (SOI)

Although P2 has previously had 'success' with sedation-only intubation, he consciously now considered and decided that RSI would be a better option (Walls and Murphy, 2004:22), in light of his experience: *"I've had success with it (sedation-intubation)….although now with our B.Tech training, you realize that getting the tube down is not a …doesn't necessarily mean a successful intubation and you know all the side effects that go with it…problems yeah…..I was thinking the RSI route..."*

P2 shows responsibility through reflection in his decision making, and therefore seems to be moving away from historical bad practice *(see Sec. 6.2.1)*: "…*because err…err… you know judging from experience especially with a head injured patient, they tend to clench and gag and cough when you try to intubate the normal, the normal route….so this would have been the perfect….this was the perfect candidate for RSI."*

P2 is referring to the typical clinical presentation of a severe head injury where RSI is the most appropriate in relation to current practice of combining morphine with midazolam to achieve intubating conditions *(see 6.3.2.5 and Ch.3, Sec. 3.4.3)*.

6.3.2.5. Inappropriate use of morphine and midazolam

P2 has not admitted to subscribing to current bad practice of combining Morphine with Midazolam, but certainly confirms that he has used higher doses of midazolam to achieve intubating conditions: *"I've only used morphine, I mean midazolam... seven point five, yes, although I've used more before." "I've had success with it."*

P2 has come to the realization that the alternative of RSI is the correct and safer way to invasively manage a patient's emergent airway (*see Ch. 3, Sec. 3.4.3*): *"…although now with our B.Tech training, you realize that getting the tube down is not a …doesn't necessarily mean a successful intubation and you know all the side effects (see Ch. 3, Sec. 3.5) that go with it…problems yeah."*

6.3.2.6. Preparing medication

Having RSI medications in readiness is another key component of conducting RSI correctly. The consideration of having a pre-filled syringe with the appropriate drug may possibly speed up the process, and remove the added stress associated with time delays during which drugs are drawn up into the syringes. However, P2 was fairly convinced that it made little or no difference to the RSI process: *"Ehhh…I mean for me personally, drawing up a drug doesn't take forever. It's much of a muchness, whether I have the drug drawn up or err…pre-drawn up or whether I draw it up myself. So, you know, I can't really comment on that until I do more, but it didn't…I don't think it significantly…had any outcome, whether it was drawn or not."*

What is important here is that P2 didn't feel that it had a negative influence on this situation. He obviously feels you need to have the correct drugs and be able to quickly identify them *(see 6.3.1.3)* but does not think that drawing them up wastes time, probably due to his general experience. He does reserve complete judgement on this issue though, until he undertakes further RSI cases.

It must be noted though that the time taken to prepare equipment for RSI is usually the time when the patient is being pre-oxygenated, which indicates that there should be little or no time wastage.

6.3.2.7. Post-intubation management

The main aim, immediately after successful intubation has occurred, is to get the patient to hospital where other definitive management strategies can commence. Most other interventions can take place en-route to hospital: *"…from the time that you realize that you've got a compromised patient… er.… it actually should be quicker… aim to package and stabilize within ten to fifteen minutes… that would be the ideal."*

When patients receive RSI, they should be mechanically ventilated to ensure consistent ventilation and near-normal capnometry readings (Helm, Hauke and Lampl, 2002; Helm, Schuster, Hauke and Lampl, 2003:327). P2 started off manually ventilating the patient in conjunction with the capnometer: *"I had two students with me. One intubated and the other one was doing the bagging….we were bagging in conjunction with the end tidal* CO_2 *… "*

P2 decided to follow correct practice and mechanically ventilate the patient prior to transportation by helicopter: *"...what we did was, before loading we put him onto a ventilator... "*

Ongoing paralysis by administration of a longer acting paralytic agent like Vecuronium may be necessary to facilitate ventilation. In order to effectively decide on this, the practitioner must stay at the patient's side until mechanical ventilation is taken over by the hospital staff.

P2 however elected not to go with the helicopter to hospital, after mechanical ventilation was started. This decision was affected by the actual need for on-going paralysis and transport time to hospital: *"...I was concerned that once he was intubated….what would happen if his GCS picked up and he tried to extubate himself, so he needed ongoing paralysis……had ongoing paralysis in my mind…err…but that ended up being unnecessary….. I don't think I would have let this patient…or handed over the patient to somebody else, if it was a long transport time."*

P2's decision to withhold medications for on-going paralysis was influenced by the factors of the 'need' for it and proximity to hospital. The 'need' for on-going paralysis should however not even be questioned. All patients that are to be mechanically ventilated must be paralyzed to facilitate effective and consistent ventilation *(see Ch. 3, Sec. 3.6.5)*.

6.3.2.8. Who is the RSIing clinician?

As discussed in the case of P1 (*see Ch. 5, Sec. 5.3.2.11*), the RSI clinical decision-maker should be overall responsible for the clinical management of the patient's airway and arguably the rest of the patient, when there is no other equally or higher qualified practitioner on the scene. This may be the case for most scenarios in the current EMS environment. Although P2 corroborates P1's idea (*see Ch. 5, Sec. 5.3.2.11*) that the RSI decision-maker does not necessarily have to do the intubation, there exists the danger of the assistant being insufficiently experienced to do so. This is even more concerning in an experiential learning situation like this one.

In the case of P2, he himself made the decision to RSI, but allowed a student to undertake the actual intubation: *"…I let one my final year students intubate because…mmm…err…the reasoning was that I would let her attempt once and if it wasn't….err…because there was no comp….err... no err err…the airway was not difficult….….intubation itself is a mechanical skill…".* Although it may seem like the practitioner has an extra pair of hands to intubate, the concern is that the complexity of the decision making is increased. The logic behind this is that the extra pair of hands does not come with an extra pair of experienced eyes. There is a calculated risk associated with allowing a student paramedic to intubate. The responsibility still lies with P2. The practitioner now needs to be more vigilant, should the student fail to intubate and compromise the patient.

In differentiating between a psychomotor skill and cognitive ability, P2 indicates that a lot of thought must be given to the actual intubation process, and that it may not be enough just to be skilled at it: *"…obviously there's a lot of thinking behind the intubation…that should be left for someone who's more highly trained, not necessarily skilled…more highly trained."*

The complexity of the decision making that took place was probably not realized because the process was relatively smooth, with no intubation problems: *"…it was much more simple and straight forward than what I would have err… err... expected…. err…err…to be a bit more complicated…"*

The practitioner anticipated that his first RSI would be more complicated than it actually was. However, this is likely to be due to the experience and education that he had received *(see 6.3.1.1 and 6.3.1.2)*.

6.3.2.9. Seriousness of the RSI process

P2 seems to downplay the seriousness of the RSI process especially regarding confirmation of endotracheal tube placement. This is probably because of his sense of security in his operational experience. The dangers of unrecognized failed intubations are very serious and should never be taken for granted. P2 makes the case for the prevention of time wastage, but if well prepared, this is certainly not an issue.

"To be honest with you, I've been….this maybe the wrong thing...I've been intubating for so long now…err…you know…for me personally, even if I had to do other intubations from now onwards I'll actually…some…some...it depends on the patient but if you're intubating and you can see the tube going through the chords, and if you auscultate and em… I was dead certain that I was… that we were in the right place, and then the end tidal CO_2 did help obviously. I think you're just gonna become over-cautious and every time you take the tube off or the bag off to put something in its place, you're just wasting more time."

The risk-benefit ratio with regards to properly confirming successful intubation definitely weighs in favour of patient benefits, when correctly undertaken

6.4. Conclusion

A total of 17 categories were identified from the interview with participant two. From the category generation, it is clear that as with Participant 1 (*see Ch. 5, Sec. 5.4*), there are a great many factors that come into play during RSI clinical decision making.

The integration of these categories will be discussed in Chapter 9.

CHAPTER SEVEN

CASE STUDY OF PARTICIPANT THREE

7.1. Introduction

The purpose of this chapter is to explore the findings embedded in the data received through the third participant. From here on, the third participant will be referred to as "P3".

This chapter will initially provide details of the background of the participant, followed by a description of the clinical circumstances in which the participant functioned. A discussion of the categories that emerged during data analysis will then take place.

This chapter's discussion will follow the same approach as that used in Chapter 5 *(see Ch. 5, Sec. 5.1)*.

7.2. Background of Case Three

7.2.1. Background of the participant

This participant is a registered paramedic, who has completed the BTEMC program as well as participating in an additional RSI workshop arranged by the researcher. After qualifying as a paramedic, the participant became involved in paramedic education and training.

As a result of completing the BTEMC program immediately after obtaining the National Diploma, P3 had minimal clinical exposure between becoming a paramedic and then being authorized to perform RSI. P3 had limited clinical experience up to the point of actually undertaking this particular clinical case. Realizing that he was lacking clinical experience, he decided to relinquish his career as an educator. He is currently an operational advanced life support practitioner.

The participant was very comfortable with the researcher because of an existing good collegial relationship. The participant has a rather retiring demeanour and had to be coaxed into expressing the issues surrounding the clinical case. At times his answers were quite short, resulting in the need to change the interview style a little. The dialogue had to be stimulated by using certain prompts to elicit additional information.

The interview was conducted telephonically, as the participant had relocated to a different province. The interview lasted just over forty minutes. During the telephone conversation, both the researcher and the participant were in closed rooms and were not disturbed.

7.2.2. Clinical context of the participant's RSI patient case

SUMMARY OF RSI PATIENT REPORT FORM

Type of incident	:	Male driver involved in a light motor vehicle collision. The crew responding consisted of Participant 3 and final year paramedic students, undertaking an experiential learning duty.
Time of day	:	Late night
Weather conditions	:	Dry
Traffic conditions	:	Lots of traffic
Other environmental conditions	:	Poor lighting and a few other advanced life support practitioners looking over the shoulder of P3.
Patient vital signs	:	Pulse = 106 beats per minute Blood pressure = 140 / 90 mmHg Respiratory rate = 8 breaths per minute O_2 saturation = 97%
General clinical condition	:	Severe head trauma with potential for a compromised airway and associated polytrauma
Specific problems encountered	:	Blood in the airway

P3 was required to respond to a motor vehicle collision with two vehicles involved. The patient, who was the driver of one of the vehicles, had sustained head trauma combined with some fractured limbs, and was very unresponsive: *"…got a call err...from Province…MVA there by the xxx* (location removed to preserve confidentiality). *When we got there, everyone else was there. We got a patient…em…he was apparently one of the drivers from the two vehicles that were involved. When we checked him out…he had….mm…we queried a head injury. He did not have any CSF from the nose or ears or anything like that. He had a fractured tib fib, a fractured em…humerus…left side. His GCS was about….four. "*

There were several other advanced life support practitioners on the same scene: *"Em…Oh my gosh, there were three…there were about four…two from 'PEMS1', one from 'PEMS2' and me."*

There were students present on this case, who were working with P3 for experiential learning purposes. P3 was responsible for guiding this experiential learning under his authority.

The terms 'PEMS1' and PEMS2 represent two different private organizations whose names have been removed for confidentiality purposes.

7.3. **Categories identified for Case Three**

As with the previous cases, two broad group of categories were identified, namely clinical and non-clinical. See Ch. 5, Sec. 5.3 for an explanation of the category identification.

7.3.1. NON-CLINICAL CATEGORIES

Seven non-clinical categories were identified. These categories will be presented in a foreseeable chronological order.

7.3.1.1. General experience

P3 generally has limited operational experience and has not worked in an environment where this was possible: *"I didn't have much experience, you know when I qualified and it also depends where you're working…you don't really get enough intubations, you know to make you comfortable."*

P3 is alluding to gaining more confidence when he says that doing more intubations may make him feel more comfortable. It must be noted as well that P3 had very limited general airway management experience as compared to all other participants in the study.

The participant did not have the components of previous general practice to draw on as described by Radwin (1998:590) who found that nurses applied what they had learned from previous practice situations and that the gaining and application of knowledge over a period of time enhanced the development of skilled clinical knowledge. In particular, experience of performing intubations, which in an emergency can make practice more automatic. P3 has not been exposed to RSI itself previously, but has gained a sense of understanding of the process based on other people's experience. P3 had only been exposed to RSI in a simulated environment during training: *"I've spoken to a couple of other paramedics who have RSI'd before, and I mean I've heard you know, how it all goes... "*.

The lack of general operational experience coupled with a lack of self-confidence could result in risky or poorly developed clinical decision making *(see Ch. 3, Sec. 3.3.4)*.

7.3.1.2. Education and training

P3 was quite confident that his education and training was adequate, although the RSI decision making ability might have been better if there was some sort of experiential learning in the prehospital environment.: *"It would have been much nicer if one of the trainers, like you or whoever else would work with us on the road…I don't know, a couple of hours…show us how to RSI a real patient in the pre-hospital environment…maybe if we went and RSI'd you know…like training on a real patient with you or whoever our trainer would have been…not in hospital you know….I think it would have been better. Because it's different…it's more different RSIing in the pre-hospital context than it is in theatre, because there everything is much more (controlled)…"*

According to Christie and Jones (1995:158), the learning cycle proceeds from concrete experience to observations and reflections, through the formulation of abstract concepts and generalizations to the testing of the implications of these concepts in new experiences. When students are involved in the concrete experience of examining and treating a patient, they draw upon existing knowledge as they observe and interpret patient cues. Within the examination and management of a single patient, diagnostic and therapeutic hypotheses are tested through on-going examination, management and re-assessment; across a number of patients, and the consistency of patterns are also continually being tested. It is for this reason that clinical reasoning or decision making is an experiential learning activity.

In the RSI learning cycle, the advanced life support practitioner who already has existing knowledge and skills of advanced airway management is then exposed to new concepts and teachings about RSI. They relate these to the existing knowledge and build on it further. This newly developed knowledge is then applied in practice, which in turn is reflected upon to improve practice.

Education and training, which is certainly a major influential factor, may only partly prepare a practitioner for good clinical-decision making. The onus is on the practitioner to be able to gain experience, reflective ability and develop more mature thinking.

7.3.1.3. Planning for RSI

Forward planning for RSI is absolutely important. In this case P3 indicated that he was prepared for a failed intubation: *"Well I had the LMA ready. I just had the difficult airway bag open."*

Although P3 was prepared for difficult airway management he downplays the importance of forward planning and preparation. In an unpredictable environment, the practitioner cannot afford to take any risks. The bail out airway devices should be prepared and ready to place in the airway at the first sign of intubation difficulty. Whilst having them available close-by may create a sense of security for the practitioner, the patient certainly does not benefit from another minute or two wasted to prepare the device, after endotracheal intubation has failed: *"I just had the difficult airway bag open. I think it also depends on how you view the airway. The airway was fairly easy. I thought it would be….I didn't have a difficult airway…I thought I shouldn't have a problem with it. I had the difficult airway bag open in any case."*

In this case, just having the difficult airway bag does not constitute readiness for failed airway management. Walls and Murphy (2004: 80) clearly state that there is no single indicator, combination of indicators, or even weighted scoring system of indicators that can be relied on to guarantee success or predict inevitable failure for oral intubation. It is therefore very necessary to be in complete readiness for the possibility of a failed intubation. This basically indicates that P3 should have had the alternative airway devices prepared for immediate insertion in the event of failed intubation

P3 argues that apart from general equipment pre-preparation, time is limited for preparation for RSI, in terms of laying out RSI equipment in a systematic fashion. The reasons cited for this were primarily the nature of the prehospital environment as previously discussed (*see 7.3.1.4*): *“Well, um…you prepare your equipment alright, you know standard intubation, but you don’t really have the time to prepare….”*

7.3.1.4. The physical environment

P3 clearly emphasizes that the prehospital environment can be quite challenging in terms of lighting, space and surgical cleanliness. There is also the risk to the practitioner, in terms of exposure to body fluids (*see Ch. 5, Sec. 5.3.1.5 and Ch. 6., Sec. 6.3.1.4*): *"two vehicles that were involved... I mean it was at night okay…while we're trying to intubate outside, before we go to the ambulance…you can't really do it there because it's not clean and you know it's just too busy. Even when you get to the ambulance, you've got three students and there's not much space to play around with….. there's like blood on the floor and everything else... ".*

Making good clinical decisions under these circumstances can be quite overwhelming, especially in the face of risk to exposure to possibly contaminated body fluids.

7.3.1.5. Assistance

P3 had the assistance of two final year paramedic students for this particular case: *"...we was working with two third year students..."*

The availability of clinical assistance may be invaluable in the context of RSI. However, these assistants need to be adequately skilled in aspects relevant to RSI, if they are to be of real help. The untrained RSI assistant may be more trouble than it's worth, as the decision-maker may need to have a continually watchful eye on the assistant to ensure that the correct process is followed. *(see Ch. 5, Sec. 5.3.1.6 and Ch. 6, Sec. 6.3.1.6)*. Having students to assist with clinical management can be most useful, although it can compound the complexity of the decision making as the practitioner cannot make the assumption that the students will do everything correctly. This creates added responsibilities for the practitioner. All decisions should be made by the practitioner to ensure a better patient outcome. The practitioner in this context is trying to guide the students' learning but remains legally responsible for decisions and their effects on the patient.

7.3.1.6. Concern about opinions of colleagues

According to May and Dennis (1995:307), a person's ego, self-concept, and emotional state all influence decision making. A person who is tense and frustrated may not structure the task environment as effectively as when feeling relaxed and integrated. Similarly, a person's value system and socio-cultural background influences the structuring of the task environment.

The context in which P3 was required to make clinical decisions was particularly challenging in that he was being observed by other practitioners, which could be off putting: *"…Er…I was the only ALS with my students, and there were er…people obviously watching... "*

P3 was also subjected to criticism by other paramedics, which greatly affected the CDM in terms of his self-trust: *"Um... well, besides the fact that you know, 'I think you're making the wrong decision or' … obviously they're not saying it to me but were talking among themselves or they would look at each other and like in a way …"*

The participant felt that the onlookers were passing remarks amongst themselves about him and his ability to make good decisions about the patient's clinical management.

Intimidation was a key factor, which later led to poor decision making *(see 7.3.2.4)*: *"Intimidation and also what they said as soon as I turned around or whatever…It was the drugs that I used. Not the dormicum and morphine obviously, but….because they asked 'what are you giving' I said well it's an RSI drug, and they like 'hmmm' you know."*

P3 was under undue pressure during major clinical-decision making, which may have resulted in the failed intubation situation that ensued: *"I felt that they wanted to put me on the spot and made me feel that I'm not capable of doing it."*

When P3 felt that he was being put on the spot, his emotional state may have become fragile, with the internal threat and fear of appearing incompetent to his peers. May and Dennis (1995: 307) state that a person's emotional state, value system and socio-cultural background influence decision making.

Apart from the need to improve lighting conditions, it seems as though P3 moved his patient from the roadside into the back of the ambulance in order to get away from the source of the intimidation: "*…trying to intubate outside, before we go to the ambulance…you can't really do it there because it's not clean and you know it's just too busy..." "I asked the guy to close the door of the ambulance, but I could still see them standing at the window."*

It was certainly the right decision to move into to the ambulance where lighting conditions were better, as it is very difficult to operate in such a situation. What must also be remembered though, is that RSI was a new skill and so there was scepticism about it amongst other practitioners *(see Ch. 2, Sec. 2.7.2)*.

7.3.1.7. Confidence

P3 indicated that he was fairly confident in his approach to RSI and seemed to use other people's experience to convince himself that the procedure would be easy-going: *"...Um…not really (scared) actually, because I kind of…I've spoken to a couple of other paramedics who have RSI'd before, and I mean I've heard you know, how it all goes."*

Although P3 initially indicated that there wasn't any element of fear, later on, after discussion, the participant reflected further about his encounter. P3 seemed to be doubtful of his clinical decisions: *"Maybe if I had to start with etomidate and everything, maybe I wouldn't have been scared, but I wasn't really stuck…I don't know….not being sure or not really trusting my judgement..."*

As described in the analyses of the interviews with P1 and P2 (*See Ch. 5, Sec. 5.3.1.7 and Ch. 6, Sec. 6.3.1.7*), confidence may not necessarily mean that the practitioner is competent in decision making. In the case of P3 however, decision making competence may have been seriously hampered by issues of intimidation and self-concept (*See 7.3.1.6*)

7.3.2. CLINICAL CATEGORIES

Twelve clinical categories were identified. These categories will be presented in a chronological order.

7.3.2.1. Making the decision to intubate

According to Walls (2004:1), the decision to intubate should be based on a failure of airway maintenance or protection, a failure of ventilation or oxygenation or the expectation that the patient will clinically deteriorate.

Considering the decision of whether to intubate or not based on the patient's clinical condition followed by the decision of when to perform the actual intubation is determined by a series of rapidly unfolding events: *"…he started to go down….We were trying to prevent any aspiration that may occur later. His sats were ninety two initially, but were ninety nine while we were bagging. To try and prevent aspiration, we had to secure the airway."*

At this stage, P3 seems to have had already made the decision to secure the patient's airway by endotracheal intubation, based on the start of clinical deterioration of the patient, as described by Walls (2004:1).

The added stress of an uncertain situation where the practitioner must decide on whether to wait for patient deterioration or intervene is very challenging. Within the decision to intervene after airway evaluation or "sit and wait", there other clinical interventions must also take place: *"…he was clenching …and we had to get up a line and everything and he started to go down. We put in an OP airway…he accepted, and we started bagging."*

7.3.2.2. The clinical condition of the patient

The general clinical condition of the patient remains the primary indicator for guiding decisions surrounding invasive airway management. (*see Ch. 5, Sec. 5.3.1.11 and Ch. 6, Sec. 6.3.1.10*) *"..the patient's GCS was very low….he had….mm…we queried a head injury. He did not have any CSF from the nose or ears or anything like that. He had a fractured tib fib, a fractured em…humerus…left side. His GCS was about….four. Four being the verbal, as he was moaning due to painful stimulus. He was breathing em... em... spontaneously by himself. His sats were quite close, round about ninety two……at that point in time…because he still… when we got there, he still… I mean he was moaning and everything... still had a gag reflex, but then like five minutes later he was clenching"*

Deterioration of a patient's ability to protect his own airway can be very rapid (Walls, 2004:3) and it is therefore important to constantly reassess the patient's ability to do so.

This patient posed other non-airway challenges requiring rapid decisions regarding clinical interventions to ensure overall better patient outcome. This in itself makes RSI decision making immediately more complex.

7.3.2.3. Evaluation of the patient's airway

P3 did encounter some blood in the airway, which might have made the intubation more difficult (Helm, Hossfeld, Schafer, Hoitz and Lampl, 2006:67), resulting in the need for a second attempt. P3 did not seem to have a full appreciation of the risk of a failed intubation because of blood in the airway: *"…it (the airway) was quite clear. There were just a few, but it was still quite clear….We did suction on the first try, but by the second try we didn't really have to…there wasn't enough blood to have to suction out….It was you know a regular, average guy…patient….Um….not really (a difficult airway), besides the clenching…when the laryngoscope was inserted."*

7.3.2.4. Making the choice between RSI and sedation-only-intubation (SOI)

As discussed in the findings for this category for P1 and P2, it is clear that there should be no doubt about the preference of the use of RSI over SOI, especially in a head-injured patient, (*see Ch. 5, Sec. 5.3.2.5. and Ch. 6, Sec. 6.3.2.4*).

P3 may have been remissive of his patient responsibilities, by allowing the students to decide on the need for and the method of intubation: *"Well….I didn't really think of RSIing immediately…right. You know the students decided to intubate the patient, obviously using dormicum and morphine."*

It is readily apparent that the students relied on the use of methods with which they were familiar and as seen in use by other non-B.Tech qualified paramedics.

P3 may have found comfort in the fact that the students had already decided to use morphine and midazolam for intubation, even though he was aware that RSI might have been indicated: *"I could have RSI'd the first hand, and not have given the dormicum and morphine. It was just that the morphine…they had drawn it up already…and you know…"*
Midazolam (dormicum) at 2 – 3 mg is an acceptable agent to use for RSI, provided that it is supported with succinylcholine, as was used during the San Diego RSI trial (Davis et. al. 2004: 2).

P3 seemed to pass the responsibility on to the students, possibly because of fear of facing the decision to RSI: *"I thought okay…let's try that out. I mean even if I did think of RSIing, there were no challenges that I would have faced…"*

After discussion, P3 acknowledged that RSI should have been primarily undertaken, instead of the more problematic sedation-only intubation method: *"I think it would have been better, opting to RSI first…to intubate."*

<u>7.3.2.5. Inappropriate use of Morphine and Midazolam</u>

The primary reason that RSI was introduced for pre-hospital practitioners was to replace current bad practice with regards to the use of high-dose morphine and midazolam to facilitate intubation. Therefore, when there is a choice between RSI and sedation-only intubation, it makes sense to choose RSI as this therapy involves sedation with paralysis and is proven to be more effective (*see Ch. 3, Sec. 3.4.3*).

May and Dennis (1995:305) argue that in familiar situations and in many standardized situations, decisions are almost automatic and are based on existing decision rules. However, in unfamiliar situations and open decisions, there may be no pattern or conflicting patterns.

For P3 this situation was familiar by the clinical presentation, hence the primary decision to intubate the patient. The situation was however also unfamiliar in the sense that he was being watched and indirectly questioned by other practitioners watching him treat the patient. P3 may have had conflicting decision patterns during his time on the scene of the accident. The conflict may have arisen during the decision to use succinylcholine, whilst his colleagues were whispering amongst themselves, questioning his management (see 7.3.1.6).

In the case of P3, the decision making was quite poor and weak. It was a decision almost by omission (*see 7.3.2.10*). The decision to allow the use of morphine and midazolam by the students, was not questioned, but was willingly agreed to by P3. This in itself calls for a self-review of the practitioner's ability to make clinical decisions.

It is unsafe for a practitioner to allow patient management to be dictated by a student, who may not have a comprehensive understanding of the risks associated with certain practices: *"…when I got back they had already drawn up dormicum and morphine…so I said okay, go ahead with it."…"…started with five milligrams dormicum and five milligrams morphine…."* (and had to add) *"…three dorms and two morphine."* (but was still unable to intubate).

The doses of midazolam and morphine had to be rapidly escalated to attempt to achieve intubating conditions, but still failed to do so. This rapid escalation of doses is not in line with recommended PBECP guidelines (PBECP, 2003). As discussed in 7.3.2.4, it is acceptable to use small doses (2-3mg) of only midazolam for RSI, provided that it is followed by succinylcholine. This however was not practiced appropriately.

7.3.2.6. Preparation of the patient for RSI

Managing the patient's presenting condition overall is a major consideration during the RSI process. The practitioner must ensure that the patient receives the best care possible prior to following through with RSI. General basic airway protection by means of manual pressure on the cricoid cartilage to prevent aspiration is crucial to attempt to improve the patient's condition prior to intubation: *"Um…we…we had cricoid pressure while bagging."*

Some patients may require pretreatment with specific drugs, such as atropine or lignocaine, but not in this case: *"I didn't think it was necessary (to pretreat) for anything else."*

General clinical decision making regarding a critically injured/ill patient is further complicated by the additional complexities of the CDM surrounding RSI alone. This simply means that all other aspects of clinical patient management decisions will usually follow airway management decisions. An example of this would be the decision of whether or not to administer a paralytic agent (succinylcholine) to a patient that has an abdominal muscular tamponade following trauma. Although this is not a contra-indication to succinylcholine use, it certainly directly affects decisions regarding further management of the intra-abdominal haemorrhage.

7.3.2.7. Consequences of actions and interventions

P3 had elected to undertake sedation-only intubation for the head-injured patient, resulting in a failed intubation: *"…umm…we initially started with five milligrams dormicum and five milligrams morphine."… "... it wasn't (sufficient)."…"Nope (did not eventually manage to intubate)…"*

P3 had then realized that the decision to use sedation-only intubation for this patient resulted in a failed intubation, and this led to the need for another major decision to paralyze the patient: *"I gave er...sux….after a minute or so, I got the tube down….the patient was flat."* P3 seemed to opt for paralysis primarily because the patient wasn't relaxed: *"The patient still bit on the laryngoscope…"* This action was inappropriate and dangerous, as a muscle paralysis was induced immediately after two failed intubation attempts, without evaluating for the possibility of a difficult airway *(see 7.3.2.3)* and without being completely prepared *(see 7.3.1.3)* for another failed intubation attempt in a paralyzed patient.

Whilst administering the succinylcholine (sux) may have been appropriate in terms of achieving intubating conditions, it was very risky in the way it was used, as discussed in the previous paragraph. Essentially the consequence of a poor earlier decision *(see 7.3.2.5)* and intervention led to the need for a further decision.

7.3.2.8. Confirmation of successful intubation

As described in the review of literature (see *Ch. 3, Sec. 3.6.3*), the practitioner must be certain that the endotracheal tube has been successfully placed in the patient's trachea.

P3 decided to confirm correct placement of the endotracheal tube using the traditional method of auscultation combined with a newer method of capnometry: *"Um……….auscultation and end tidal CO_2… "*

The traditional method of auscultation in isolation is fraught with unreliability, in an environment that is usually noisy. However, the use of end tidal CO_2 monitoring was appropriate.

After the researcher emphasized the importance of secondary confirmation of endotracheal intubation, P3 acknowledged that using additional secondary confirmation devices would be beneficial: *"…I would have used the…what do you call it? I would have used a sats monitor and um…what do you call that syringe thingy?"*

P3 is referring to an oesophageal detector device *(see Ch. 3, Sec. 3.6.3)* which is used to aspirate air through the inserted tracheal tube to confirm that it has been successfully placed in the trachea.

7.3.2.9. Post-intubation management

The importance of post-intubation mechanical ventilation and ongoing sedation and paralysis cannot be emphasized enough. A number of decisions following successful intubation must be made regarding this (*see Ch. 5, Sec. 5.3.2.10 and Ch. 6, Sec. 6.3.2.7*).

P3 demonstrates a very flustered clinical decision making thought process. He acknowledged the need for consistent ventilation, yet elected not to institute mechanical ventilation: *"Er…well equal chest rise and also I told them to ventilate at five…one every five seconds…."Um….the ventilator would have taken much longer, with the connections and everything, and we were like seven minutes from hospital, so I didn't think it was necessary, but we did call dispatch and they informed xxx hospital* (name removed to protect confidentiality) *of what was going on and what we were bringing, and they had like everything planned."*

P3's rationale for this was the close proximity to hospital. Although the drug for on-going paralysis was already aspirated into a syringe, P3 didn't think it would be necessary to use it. The decision making here seems a bit insular and unstructured. It seems that P3 was comfortable that he was going through the steps of RSI, although somewhat unstructured and incomplete, he downplayed the importance and necessity of good clinical management in terms of immediate mechanical ventilation.

7.3.2.10. Who is the RSIing clinician?

As discussed previously (*see 7.3.2.5*), the participant did not consciously decide that sedation-only intubation was indicated, but was swayed by the actions and decision of the students: *"Well….I didn't really think of RSIing immediately…right. You know the students decided to intubate the patient, obviously using dormicum and morphine. I thought okay…let's try that out."*

It was only after things started to go wrong that P3 was forced to make a decision to RSI. It is evident that the RSIing clinician is the person that must make the decision to RSI, as also described by P1 and P2 (*see Ch. 5, Sec. 5.3.2.11 and Ch. 6, Sec. 6.3.2.8*).

In this case roles were initially reversed. P3 eventually had to perform the actual intubation, after two failed attempts by the student: *"Yes, it was the same student that tried twice."* At this point, P3 assumes the role of the RSIing clinician.

7.3.2.11. Reflection on the RSI process

"Interpreting the experience, searching for critical incidents and patterns, thinking laterally of other ways of doing and critically analyzing, becomes an essential form of reflective practice" (Ryan, 1995:256).

Improved CDM for RSI may be facilitated by reflection on individual clinical practice. After discussion of his actions during the interview, P3 eventually conceded that he had made an inappropriate decision to initially go ahead with sedation-only intubation: *"Emm… instead of giving the dormicum and morphine, because obviously we know with that guy…especially a head injured* *patient…Well, I would have used etomidate…Well, I would omit the dormicum and morphine."*

P3 also realized that mechanical ventilation should be the gold standard: *"Well, obviously a ventilator would have been a better choice."*

Ryan (1995:256) states that "thinking about one's thinking which is known as metacognition, will enrich the individual's store and foundation of experience and will promote critical reflection on one's reasoning ability."

P3 has demonstrated that he does possess some critical reflective thinking ability which will lead to improving his own experience. What needs to be improved though is his ability to reflect on how he reflects on his own clinical experiences.

7.3.2.12. Seriousness of the RSI process

Whilst P2 downplays the seriousness of RSI because of general experience (*see Ch. 6, Sec. 6.3.2.9*), P3 seems to do the same, although he lacks general operational experience *(see 7.3.1.1)*.

This seems to stem from a lack of operational experience and possibly the associated reflective practice ability: *"I think it's fairly simple if you know your stuff."*

The more experienced P1 however, was very concerned about the clinically serious nature of the RSI process (*see Ch. 5, Sec. 5.3.2.12)*.

7.4. Conclusion

A total of 19 categories were identified from the interview with the third participant. It is very clear that for P3 there exists a multitude of factors that affect clinical decision making surrounding RSI, with the key element of clinical experience being a major factor.

The integration of the identified categories will be discussed in Chapter 9.

CHAPTER EIGHT

CASE STUDY OF PARTICIPANT FOUR

8.1. Introduction

The purpose of this chapter is to explore the findings embedded in the data received through the fourth participant. From here on, the fourth participant will be referred to as “P4”.

This chapter will first detail the background of the participant and will then proceed with a description of the clinical circumstances in which the participant functioned. A discussion of the categories that emerged during data analysis will then take place.

This chapter’s discussion will follow the approach as used in Chapter 5 *(see Ch. 5, Sec. 5.1)*.

8.2. Background of Case Four

8.2.1. Background of the participant

This participant is a registered paramedic, and has completed the BTEMC program as well as participating in an additional RSI workshop arranged by the researcher. P4 has been involved in paramedic education and training for about four years and is currently an educator in the same discipline at a university in Europe. P4 is also a unique participant, because he has been involved specifically with advanced airway management training for a few years.

P4 has accumulated a wealth of operational experience as he has been practicing as an advanced life support practitioner since 2001. This participant has had a slightly different experience with RSI as compared to the other three participants. There were two patients for whom P4 elected to undertake RSI and one patient which he decided not to. Therefore, three cases were discussed during the interview, two of which involved RSI and one involved the decision not to RSI. These patient cases will not be discussed on an individual basis. Instead, the experiences will be integrated into a discussion of the issues surrounding RSI clinical decision making.

P4 has a very direct, yet friendly personality. The interview was conducted telephonically, as the participant had relocated to Europe. It must be noted though that the interview took place almost six months after the actual clinical cases were managed. This resulted in some difficulties in recalling specific events. However, the participant felt that recalling the decision making was not affected.

Furthermore, the patient records were used in the interview to augment recollection of events.

8.2.2. Clinical context of the participant's RSI cases

SUMMARY OF FIRST RSI PATIENT REPORT FORM

Type of incident	:	Male driver involved in light motor vehicle collision with a tree.
Time of day	:	Daylight hours
Weather conditions	:	Dry
Traffic conditions	:	Controlled
Other environmental conditions	:	Patient was trapped in the vehicle requiring extrication with the 'jaws of life'.
Patient vital signs	:	Pulse = Within normal range Blood pressure = Within normal range Respiratory rate = 12 – 18 bpm O_2 saturation = Not recorded
General clinical condition	:	Isolated severe head trauma with potential airway compromise

For the first patient, P4 was required to respond to a motor vehicle collision. A car had crashed into a tree, leaving one male patient in a serious condition. The patient, who was the driver of the vehicle, had sustained head trauma and was entrapped in the vehicle. The fire department had to cut away parts of the vehicle in order to extricate him from the vehicle.

"It was um…daytime. It was either a Friday or Saturday, probably a Saturday, I'm not sure…but it was daylight hours. We got on scene, there was a single vehicle…I think it was a BMW convertible…um…crashed into a tree. It was near xx (name of location removed to protect confidentiality*). A single occupant…male…Indian….Um…the vehicle…I think it was a convertible. Actually it might not have been…maybe the fire department cut the roof off. Fire department were on scene already…and the car had quite a bit of damage to it. He was entrapped in the car…there was a lot of front-end damage and driver's side impact. So…we were there during the extrication."*

SUMMARY OF SECOND RSI PATIENT REPORT FORM

Type of incident	:	Male pedestrian run over by a light motor vehicle
Time of day	:	Evening
Weather conditions	:	Dry
Traffic conditions	:	Safe
Other environmental conditions	:	Another paramedic already on the scene that had already had an unsuccessful attempt at intubating the patient.
Patient vital signs	:	Pulse = 100 beats per minute Blood pressure = 110 mmHg systolic Respiratory rate = 0 breaths per minute O_2 saturation = 100%
General clinical condition	:	Severe head trauma with potential for airway compromise.
Other specific problems	:	Blood in the airway

On the second patient case, P4 had to treat a pedestrian, who had been hit by a light motor vehicle, but was already being treated by another paramedic: *"I arrived on the scene of a…of a pedestrian with a head injury…there was already another paramedic on scene with two third year national diploma students…um…CCA qualified paramedic, who happened to be a RPL on the diploma course* (see Ch. 2, Sec. 2.2.3). *They were…I had with me a newly qualified B. Tech. who happened to be a member of the department…no real autonomous clinical experience she had. I had, I think two third year students* *with me. Anyway I sent…we, we…as we got there the paramedic and the others that was on the scene wanted to…they were about to draw up the drugs to sedate the patient. They had already attempted an intubation on this patient, and the patient was gagging. I stepped in and said, "let's RSI the patient.""*

"…the patient had an isolated head injury…no, no not…had a head injury and also had an arm fracture and a leg fracture…um…both of which were open. She needed…she was umm…not maintaining her own airway…umm...unresponsive… umm…needing…a little bit of moaning to pain and so on, but not…there was some blood in her airway…not maintaining. We weren't happy that she was maintaining her own airway. We didn't do a great detailed assessment because I trusted the paramedic who already assessed her that she needed to be intubated. My, my….when I saw her, I agreed. So then, this one was better…what we did is we err…the one paramedic…the paramedic who had been working on the patient…he ended up taking over control of the entire scene and the rest of the patient, the non-airway part of the patient. So making sure that all the spinal boards and stretchers got there, which ambulance to go to hospital as well as bandaging and splinting of the patient. Umm…the newly qualified B. Tech paramedic umm…drew up the drugs….again we had a piece of paper. I recall we used etomidate and sux on this patient. We had a student do the intubation, and I oversaw the whole RSI procedure. So what would happen is…I think I actually…I think I administered the drugs, but she drew them up. I confirmed with her how much she was drawing up…what drugs umm…and basically just double checked everything that went on."

SUMMARY OF THIRD RSI PATIENT REPORT FORM

Type of incident	:	Male pedestrian run over by a light motor vehicle
Time of day	:	Evening
Weather conditions	:	Dry
Traffic conditions	:	Controlled
Other environmental conditions	:	Non-specific
Patient vital signs	:	Pulse = Within normal range
		Blood pressure = Within normal range
		Respiratory rate = Within normal range
		O_2 saturation = >95%
General clinical condition	:	Isolated severe head trauma with potential for airway compromise

On the third patient case, P4 had to treat another pedestrian, who had been hit by a light motor vehicle: *"It was a head injured patient….isolated head injury…um…motor vehicle. He was a pedestrian in a motor vehicle accident. He had a Glasgow coma scale of eight okay, or seven…"*

"This patient…he had no blood in his airway, but he was…he was really largely unresponsive… "

"… this patient had umm…was maintaining saturation. He was breathing on his own…we weren't having to ventilate for him. Umm…and the rest of his vital signs were stable…his heart rate and blood pressure were perfectly acceptable."

8.3. Categories identified for Case Four

See Ch. 5, Sec. 5.3. for an explanation of how categories were identified.

8.3.1. NON-CLINICAL CATEGORIES

Eleven non-clinical categories were identified. They will be presented in a possible chronological order.

8.3.1.1. General experience

P4 has been exposed to the emergency care environment for many years, which can help to shape the ability of practitioners to make and learn from their clinical decisions throughout their careers, provided that they reflect on their practice which should be evidence based, otherwise it could be poor practice with repetition of mistakes *(see 8.3.3)*: *"I was twenty three when I started my diploma and I did it over five years, part-time umm…while working full-time as a fireman and an ambulanceman. I was intermediate life support level, so I was working with basic life support on the ambulance, so I was in charge of most of the scenes I went to, except where paramedics came. So I think I had…in my personal experience, I think I had quite a um…quite a good background in the EMS before I did my diploma.*

Both Radwin (1998:590) and Cioffi (2001:591) described the positive role of individuals' experience in future decision making. This issue has consistently appeared with P2 and P3 also noting it (s*ee Ch. 6, Sec. 6.3.1.1 and Ch. 7, Sec. 7.3.1.1*). General experience or 'learning by doing' as described by Hart

(1995:290), is significantly linked to the development of knowledge, understanding and skills.

8.3.1.2. Previous RSI experience

General airway management experience differs from previous RSI experience in the sense that RSI being a new procedure carries a certain amount of anxiety when undertaking it for the first time. Even the experienced practitioner may be a little anxious the first time around. This participant has had the opportunity to undertake more than one RSI procedure. *"There was the first RSI when I wasn't supposed to do RSI, but we did….then there's the second one which we did RSI, and then there was the other one where we could have but we elected not to."* Electing not to undertake RSI is a direct clinical decision that may need to be made and may be influenced by education and training *(see 8.3.1.4)*, previous RSI experience, proximity to hospital and confidence *(see 8.3.1.9)* in making the decision not to RSI.

8.3.1.3. Learning from past RSI experiences

As in the case of P1 (s*ee Ch. 5, Sec. 5.3.1.2*) P4 has demonstrated the ability to learn from previous experiences, and is not afraid to admit his mistakes: *"I look back and there's…I've made quite a number of mistakes in the beginning and there was quite a few places where I didn't necessarily make the right decision or I could have done it better."*

Despite learning from mistakes, previous mistake from general airway management cases was repeated: "*We did not use the ventilator….Bad habit!... I just forgot about the ventilator…*"

Although P4 indicates that he has a bad habit of not using the mechanical ventilator in post-intubation management, he demonstrates in the interview that he has reflected on this particular RSI experience and has changed his decision making. The interview with P4 may have served as a debriefing session.

Ryan (1995: 256) suggests that debriefing can 'illuminate the fieldwork experience' and further suggested that 'interpreting the experience, searching for critical incidents and patterns, thinking laterally of other ways of doing, critically analysing, comparing and contrasting other sessions and other experiences, becomes an essential form of reflective practice.'

8.3.1.4. Education and training

P4 is a unique participant in terms of the fact that he has substantial experience in educating paramedic students in emergency airway management. Despite this, P4 realized that there were some gaps in his own education, which strained his decision making abilities: *"I just think there needs to be more on the whole post-intubation management. I think a lot of emphasis needs to be placed on identi…umm…considering an airway and scenario training…whether its paper-based scenarios or simulation manikin-based scenarios, I think there needs to be a lot more umm…practice ones of those of when you would make the decision, and what your whole process will be."*

It is clear that even for an experienced practitioner like P4, the education and training plays a key role in shaping good clinical decision making. P4 emphasizes the particular issues that didn't go well in his own clinical cases. These were the issues of airway evaluation (*see 8.3.2.5*) and post-intubation management (*see 8.3.2.12*).

8.3.1.5. Planning for RSI

P4 seemed to have thought through the planning and placement of his equipment and devices for the first case: *"You know, I did have the other planning things in place. I had um….my…I did check the tube with…placement using end tidal CO_2, which I think …you know and I had set up my umm…my alternative airway device so I had them ready in case of a failed airway…"*

The planning was not so good on the subsequent case: *"...we RSI'd this patient, intubated easily umm…we did not however prepare our ventilator…just forgot about the ventilator…" " If good planning is undertaking, then room for error is marginal."*

Unlike for the first and second patient, this shows that by not preparing the ventilator, he forgot it later when the circumstances were more stressful. Therefore, CDM was affected by a lack of planning. The converse was true for the other two patients.

P4 was pre-prepared with a mini-drug checklist that he personally used to guide his decision making regarding drug doses: *"I can tell you that I gave the correct dosage because I had my piece of paper with me."*

In order to facilitate improved decision making to flourish, the planning for RSI must be consistent. Every case presentation after reflection will allow the practitioner to plan better for subsequent cases. Refshauge and Higgs (1995: 112) indicate that the review of the clinical reasoning associated with each case reflected upon, will 'raise the awareness of the individual's thinking and develop an enhanced capacity for responsible self-direction and decision making.'

8.3.1.6. The physical environment

The challenging factors associated with the pre-hospital environment vary across different situations as seen with all other participants (s*ee Ch. 5, Sec. 5.3.1.5, Ch. 6, Sec. 6.3.1.4 and Ch. 7, Sec. 7.3.1.4*).

In P4's first patient case, the environment forced him to slow down, because access to the patient was limited and delayed: *"…we just couldn't intubate him in the vehicle. …He was entrapped in the car…Um…I wouldn't have…I would not have thought…occurred to me, to try and intubate in the vehicle. It's difficult and I certainly wouldn't have RSI'd him there…"*

The time of day also affects how and when clinical decisions are made: *"...it was daylight hours. We got on scene, there was a single vehicle…I think it was a BMW convertible…um…crashed into a tree." (Patient One)*

It is probably far more difficult to manage a patient at night in the dark, especially in rural locations. However, P4 does not appear to have experienced such difficulties with his second patient because of the availability of lighting equipment. On P4's second case, lighting conditions were quite different: *"We had clear easy access to the patient. Umm…it was at night umm…but we had head-torches."*

Crowding of people on an emergency scene can make it very difficult for the practitioner to concentrate on making the right clinical decisions and fear of making errors may act as an additional stressor. However, this was not a problem during the treatment of the second patient. *"Okay, the second patient…a much better scenario….." "We didn't have any crowd problems…as good conditions as you can get really."*

P4 is alluding to the fact that he has previously experienced crowd problems which might have made the conditions for decision making difficult.

Although the clinical decision making on P4's first case might have been initially challenging as the patient was entrapped by the crashed vehicle, he still thought that the environment was better than some of the previous types of environments that he'd been exposed to. The quote that follows was made after the patient was extricated from the vehicle in which he was entrapped: *"... we had him outside, so we a three hundred and sixty degree view of the patient. We had him flat and…we had full daylight you know. It was a near perfect environment."*

8.3.1.7. Scene management

On his first RSI case this participant, similarly to P2 (*see Ch. 6, Sec. 6.3.1.5*), had to take responsibility for the patient and the entire emergency scene: *"on the first one, I was running the entire scene from having the patient cut out of the car* *to getting him packaged…which hospital they're going to…which ambulance is going to take us…and who is doing what."*

With so many decisions having to be made almost simultaneously, it can be very difficult for the same person to make sound major clinical decisions as well.

On the second RSI case, P4 was fortunate to have another paramedic who was able to take over the scene management, thus allowing himself to focus on clinical decision making for his patient: *"On this one, there was another paramedic who was running the entire scene, except for the RSI…except for the airway management….and I think that made it so much easier."*

The influencing factor of scene management adds to the complexity of primary clinical decision making. Watts (1995:210) emphasizes that the clinician has only limited ability to identify, isolate, control and manipulate all the factors that may influence the effects of treatment.

8.3.1.8. Assistance

As noted in 8.3.1.7, P4 had a lot of difficulty making clinical decisions for his first patient primarily because of having to manage the entire emergency scene and treat the patient: *"I had with me two students um…one who was going to be attempting the intubation, he was a third year student and one second year student who was pretty sharp, who we were getting, running around, doing all of the other stuff. We had other ambulance crews helping to get immobilization equipment ready."*

Having the right assistant is very important, as he or she needs to be thinking on the same level as that of the practitioner, to ensure a safe and efficient process. Ideally this is achieved through independent training, skill drills and by working closely together, to ensure a smooth process. However, the latter is difficult in the prehospital arena (apart from helicopter based services). Although no references could be found relating to improving paramedic-assistant synergy, it is recommended in the position paper by Wang et. al. (2001: 43), that regular training by means of either adequate clinical experience or supplemental training in the operating room or using appropriate training models is required to maintain RSI technique proficiency: *"...yes the ideal is that you wouldn't…your assistant would be somebody you work with often and if he hasn't been formally taught, you will have taught him the steps, but that's not the reality. It's certainly not the reality where we were working there and it's not the reality with single crew paramedic vehicles, which is common or where paramedics have their crews changing often, which also is pretty common."*

P4 expressed the opinion that having another equally qualified assistant would assist clinical decision making by virtue of the fact that that person would be double-checking decisions made: *"It would have been really nice to have another clinician there at the same time that I was. You know just another set of…a mind…<u>"maybe he's tensioning"</u>…when we were having the oxygenation problem.*

…so in the back of your mind, you've always got someone, and there will always be somebody who's saying, <u>"are you sure you should be doing that?"</u>"

The underlined quotes within the quote above represent another practitioner communicating with P4.

Both P1 and P2 also acknowledge that having an appropriately trained assistant makes the RSI process, and therefore the CDM, easier and more efficient (*see Ch. 5, Sec. 5.3.1.6 and Ch 6, Sec. 6.3.1.6*).

8.3.1.9. Confidence

Typically, P4 exudes confidence. This together with his operational experience is a good combination for effective CDM: *"…I was a little bit nervous not having used it before, but I was confident enough…..I think I was probably a little overwhelmed by the…you know.…it was all the decisions…." (Patient One)*

Like P1 *(see Ch. 5, Sec. 5.3.1.7)*, he was confident in his ability but still a bit nervous as he indicates that there were lots of decisions to be made.

Because of experience, P4 showed no element of apprehension of undertaking RSI for the first time: *"I have been scared on a medical procedure before…on my first cardioversion…okay. Umm…and I've been scared when I've given that other drug…the one that slows fast heart rates down…This, I wasn't nervous about okay, because um…I know that, I stopped the guy breathing, yes, but that's not my main aim. I'm stopping his…I've put tubes down people's mouths who's not breathing….that happens often. That's not a problem. All I'm doing is making the intubation easier…and I think that may be the thing. It might be a lot easier to RSI, once you've had hundreds of intubations under your belt."*

P4 alludes to the fact that he might have been a bit nervous about stopping the patient's breathing, but he was confident performing the intubation as he was experienced. The quote above clearly shows that RSI consists of 'building blocks' of skills that ALS practitioners already have plus new ones. Endotracheal intubation is not a new skill.

P4 he is confident because he does not feel that RSI is much different to what he is already comfortable about doing.

Although P4 was very confident during the RSI process, his competence comes under scrutiny especially regarding the first patient, where P4 did not realize that the patient might be developing a tension pneumothorax. (*see 8.3.2.15.*) Although it may be easy to judge a practitioner as less competent, one has to carefully consider the circumstances surrounding the issue. For the practitioner to identify the pneumothorax he has to be able to clearly auscultate the lung fields, however the noise in the moving ambulance might have made it very difficult to hear clearly (*see 8.3.2.14*).

8.3.1.10. Professional autonomy

Although P4 mentioned that another equally qualified practitioner might assist in the management of the patient *(see 8.3.1.8)*, the concept of professional autonomy was re-enforced: *"I think the paramedic can make the decision himself. I think having somebody else could take…this is only a thought…could potentially take a lot longer, but I think that, that I made the right decision to um…to ventilate…to intubate him.…I don't think you need anyone else."*

Whilst it may be good to have the sort of support P4 refers to, it may not be essential.

8.3.1.11. Concern about opinions of colleagues

Although P4 has a strong personality and is confident to make his own clinical decisions, he still shows concern about criticism by other practitioners: *"… but I was happy that this patient didn't need to be intubated…because he was maintaining his own airway…and that goes back to the earlier question…you can't give a list. According to the list, he should be intubated…..I actually think that I probably would have been criticized by other paramedics that I know…not necessarily good paramedics or educated paramedics. I think that I would have come under some criticism for that."*

The 'list' that P4 is referring to is a prescriptive protocol that indicates which patients should generally be intubated. He is alluding to the fact that practitioners should be able to think outside of a narrow protocol when making clinical decisions.

In the case of P3, the practitioner was reluctant to make clinical decisions because of intimidation by other paramedics (*see Ch. 7, Sec. 7.3.1.6*). In contrast, P4 was very confident in making the decision not to intubate, despite what other practitioners might say.

This participant seemed to structure the task environment quite well for this particular clinical case, as he seemed to be more confident and integrated (May and Dennis, 1995:307). This conclusion was reached based on his confidence during the interview when relating his experience with the third patient. This is probably due to his experience as a practitioner and academic, and presumably his personality having an influence.

8.3.2. CLINICAL CATEGORIES

Eighteen clinical categories were identified. These categories will be presented in a chronological order.

8.3.2.1. Predetermining the need for airway management

P4 seemed to have an early appreciation of the potential need for advanced airway management, based on the mechanism of injury that was visible: *"the car had quite a bit of damage to it. He was entrapped in the car…there was a lot of front-end damage and driver's side impact…..He did still have a gag reflex um…and was maintaining his airway, but he was in a fairly bad way…he wasn't going to be protecting his airway very long."*

Early cognitive processes influence later decision making. Lauri and Salantera (2002:93) describe this process of rapid information processing in the intuitive paradigm (*see Ch. 3, Sec. 3.3.3*), which in this case sets the stage for further decisions about the need for airway management. In essence, P4 had already made a conscious decision that this patient required airway protection, which led to other clinical decisions resulting in ultimate airway protection with RSI: *"So, what we did…we decided to RSI, but it was a quite a quick decision…"*.

8.3.2.2. Taking over clinical management from another practitioner

When taking over the responsibility for a critically injured patient from another practitioner in the pre-hospital setting, there is usually insufficient time to get a full clinical report about the patient. The serious condition of the patient may require the practitioner to work quickly to prevent further deterioration. This occurred in

P4's second clinical case. He was already familiar with the other practitioner, and was confident in his previous clinical management: *"We didn't do a great detailed assessment because I trusted the paramedic who already assessed her that she needed to be intubated."* By doing this the practitioner was assuming that the assessment and management of the patient by the first practitioner was correct. This can be dangerous in terms of litigation, should something go wrong, especially if the assessment was incorrect or clinical procedures have already been undertaken by the referring practitioner. The receiving practitioner becomes completely responsible for the patient and is answerable for any and all clinical management of the patient: *"An attempt had already been made to…had already attempted to do non-drug assisted intubation. It didn't work."*

<u>P4 is indicating that the referring practitioner had an unsuccessful intubation attempt where no drugs were used to facilitate the intubation attempt.</u>

<u>8.3.2.3. Making the decision to intubate</u>

With the first patient, the decision to intubate had been made early, but the deterioration rate of the patient dictated the pace of the decision making: *"..we had been planning to intubate while we were still extricating from the car, we had already made the decision to intubate….knew that we needed to intubate this guy…so um…based on my knowing that we needed to intubate him…it was a quite a quick decision cause we needed to now intubate him. So he wasn't…he was…because his consciousness was dropping, we tried to do it quite quickly."* Therefore, although CDM was rapid, P4's thought process indicates that his decision making ability was not impulsive. The decision was expedited because of the rapid deterioration of the patient.

For the third patient, P4 made a conscious decision not to intubate, based purely on the clinical presentation.: *"This patient…he had no blood in his airway, but he was…he was really largely unresponsive…and texts say 'GCS below eight…intubate the patient'. However, this patient had umm…was maintaining saturation. He was breathing on his own…we weren't having to ventilate for him. Umm…and the rest of his vital signs were stable…his heart rate and blood pressure were perfectly acceptable. So, in some cases it would have often been considered…well, intubate this patient. Umm…we were quite comfortable. When I say we…cause I'd got a student involved in the discussion…but I was happy that this patient didn't need to be intubated…because he was maintaining his own airway… …you can't give a list. According to the list, he should be intubated."*

This extract shows maturity and critical thinking outside of a guideline. Other paramedics may have intubated this patient merely because he was unresponsive. However, it made more sense to P4 to quickly transport the patient to a hospital where more definitive management could take place. It may be argued though that if the patient's anticipated clinical course was expected to deteriorate, then RSI might have been indicated immediately (Walls, 2004:2).

P4 essentially weighed up the risks and benefits. At the stage described, the patient was maintaining his airway, so P4 decided to get him to hospital where it would be safer to intubate if necessary. However, if the patient had stopped maintaining her airway, it may have been necessary to quickly intubate her. This may be the kind of patient described by P1 as the crash intubation scenario where the practitioner should wait until the patient crashes and then intubate (*see Ch. 5, Sec. 5.2.3.3*). Although there was no need to manually ventilate the patient, P4 still continued oxygenation via facemask. In the event of the crash intubation, the patient would then have been adequately pre-oxygenated and ready to be intubated.

8.3.2.4. The clinical condition of the patient

The general clinical condition of the patient extends far beyond airway problems. *"...he was unconscious…I can't tell you exactly what the GCS was…but he was…he had started off slightly responsive to pain and then he was really gone…he wasn't responding to anything…he was in a fairly bad way…His level of consciousness was actually decreasing." (Patient One).*

The patient report form indicated that this patient's level of consciousness had decreased to a Glasgow Coma Scale (GCS) of 4/15 at approximately five minutes prior to RSI. A GCS of 4/15 suggests a severe brain injury which is a serious threat, part of which was manifesting as an airway problem. The distance to an appropriate receiving hospital was approximately twenty minutes away from the scene, which in this case would have been too long a trip without airway protection,

P4 made a quick decision to protect this patient's airway as the risk of secondary brain injury and further airway compromise outweighed the benefit of waiting to get to hospital: *"…we decided to RSI, but it was a quite a quick decision cause we needed to now intubate him. So he wasn't…he was…because his consciousness was dropping, we tried to do it quite quickly. We only went…as he had lost* *consciousness, we decided we didn't need to um…um…induce him…or sedate him rather…that we just gave him er…succinylcholine."*

Clinical decision making is usually based on whatever information and clues are immediately available to the practitioner. Obtaining a clinical history to guide decisions is also an important factor. This is another major challenge in the prehospital environment, when the patient is unresponsive and there are no next of kin present to provide information: *"…on scene, there was a single vehicle…" "A single occupant…male…."*

In this situation it was therefore not possible to obtain either a medical history or any other verbal information on the current condition of the patient.

The absence of certain clinical information coupled with situational factors further complicates the decision to RSI based primarily on the clinical condition of the patient. This has been evident with the other three participants as well (*see Ch. 5, Sec. 5.3.2.2, Ch. 6, Sec. 6.3.2.2 and Ch. 7, Sec. 7.3.2.2*).

8.3.2.5. Evaluation of the patient's airway

P4 did not formally evaluate the airway for difficulty as described by Walls and Murphy (2004:74), and made an assumption based on limited information, that it would be an easy intubation. Walls and Murphy (2004: 73) highlight the importance of bag/mask ventilation in airway management in the event of orotracheal intubation failure and go on to warn that the airway manager must be confident that bag/mask ventilation is possible, or at the very least that a crichothyrotomy can rapidly be performed.: *"I was confident enough that I…that I…the airway, I didn't formally assess the airway but it….he didn't appear to look like…you know…I didn't go through any steps."*

Fortunately for P4, his decision not to formally assess the airway did not result in a failed intubation. This however, may not always be the case. This decision was informed by the participant's previous experience with airway management: *"He looked like a standard, easy airway. As I said, he was a young man, he wasn't overweight...um…he wasn't deformed...didn't have funny facial features that was noticeable. It all looked quite easy."*

This appears to be a case of assessing the airway via a sub-conscious manner. P4 seemed to know what a difficult airway is likely to be and in this case, there was nothing to alert him to a potential difficult intubation. Whilst this may work for most patients, it is dangerous practice to always make these kinds of assumptions without formally assessing for difficulty. In essence, one should always be prepared for a failed RSI.

8.3.2.6. Need for speed of intubation

In the case of a critically ill or injured patient who is maintaining an airway but is deteriorating, the practitioner must decide whether to wait until the patient crashes or undertake RSI or SOI. This decision *(see 8.3.2.3)* hinges on the haemodynamic stability of the patient (*see Ch. 5, Sec. 5.3.2.3*), that is, the degree of emergence of the airway weighed up against the length of preoxygenation time to make the intubation attempt safe.. Traditional paramedic training has not fostered this kind of decision making and seems to have created a sense of ‘urgency’ to get the endotracheal tube into the trachea no matter what the physiological consequences may be. This has been the researcher’s observation. Historically, paramedics were first trained to rapidly intubate during cardiac arrest management, whereas RSI requires intubation in slow time that is much slower than during active cardiopulmonary resuscitation.

Once the decision to intubate has been made, the speed at which the intubation must take place is determined by the patient’s condition (s*ee 8.3.2.4*). *“Yes, you want to get the tube in quickly, but you still…you’ve got enough time, well in that situation we would have had enough… “*

<u>8.3.2.7. Making the choice between RSI and Sedation-only-intubation (SOI)</u>

For the first patient, P4 was cognizant of the need to protect the patient’s airway, but there was no question in his mind that RSI was the preferred method: *“…based on my knowing that we needed to intubate him…there was no question that I should, that I should RSI because I needed to…it was…it’s safer than doing sedation-intubation.*

P4 has used the combination of morphine and midazolam previously, but realized that this wasn’t necessarily appropriate: *“I would have had to give him morphine and midazolam just to really attempt anaesthesia…with morphine and midazolam…to stop him gagging because that was the only…the only issue. There was no need to put him to sleep, he was already sleeping. Um…so it was just to facilitate intubation…”*

The practitioner has to be able to make decisions and also re-visit decisions constantly *(see Ch. 5, Sec. 5.3.2.5; Ch. 6, Sec. 6.3.2.4 and Ch. 7, Sec. 7.3.2.4)*. P4 made a conscious decision about using drugs to facilitate the intubation. He realized that there was no need for any sedation, based on the patient's clinical deterioration: *"…as he had lost consciousness, we decided we didn't need to um…um…induce him…or sedate him rather…that we just gave him er…succinylcholine." (Patient One)*

This patient's condition parallels a crash airway as described by Walls (2004b: 12), where the first step is to attempt oral intubation by direct laryngoscopy without pharmacological assistance. If oral intubation is unsuccessful then the attempt is repeated after administration of succinylcholine and successful bag-valve-mask ventilation.

The above decision by P4 was also guided by asking himself about the potential effects of the different drugs: *"…well, the other thing is err…the things you should consider are, what are the drugs going to do to the patient."*

P4 has a contrasting opinion to P1 (se*e Ch. 5, Sec. 5.3.2.5*) in terms of the difference in the decision making for RSI and SOI: *"I don't think that the decision making should really be um…any different than to sedating and intubating the patient."*

P4's rationale for the above conclusion is the extent to which paramedics are educated and trained. Whilst this argument may be valid, there is still the question of whether the thought processes of individual paramedics are structured enough to handle these major clinical decisions and the clinical consequences and secondary decisions that follow. P4 may also be basing this rationale on his own ability, which may not be generalizable:

"I think the national diplomat graduate…if they can make the choice to intubate somebody, I think they will be able to um…make the choice to RSI somebody. They obviously need to then be taught the drugs and stuff. I don't think that it is such a big step away from deciding to um…sedate and intubate somebody. Umm…yes it does stop the person breathing, but I think that the training that the diplomats get on the airway course and then on the clinical management courses later are just umm…prepare them for that."

Whilst P4 may be correct in sense that making the decision to intubate may be the same, deciding how and when the intubation takes place may differ. It is this kind of different decision making that is required for safe pre-hospital practice.

8.3.2.8. Inappropriate use of Morphine and Midazolam

Although P4 has used the morphine and midazolam combination in the past, he has come to the realization that it is an inappropriate combination for drug-assisted intubation. His CDM in the future will probably be better, knowing this, and having experienced the RSI process: *"there was no question that I should, that I should RSI because I needed to…it was…it's safer than doing sedation-intubation. I would have had to give him morphine and midazolam just to…really attempt anaesthesia…with morphine and midazolam…to stop him gagging because that was the only… the only issue..."*

8.3.2.9. Preparation of the patient for RSI

As discussed in 3.3 and 3.4, there are a lot of other clinical considerations to be taken into account prior to proceeding with RSI. In order to make structured decisions, the practitioner needs to follow an adaptable stepwise approach, as described by Wang et al. (2005:145). This participant supports such an approach: *"I think if you don't go through a stepwise, you're gonna forget things."*

Pre-oxygenation of the patient is a critical factor that may determine outcome of the patient, especially when there is a risk of failed intubation after complete muscle paralysis. P4 acknowledges the need for such a decision, indicating it is an early step: *"I think that preoxygenation should start at the beginning…"*

8.3.2.10. Preparing medication

Preparation of medications for the patient before, during and after RSI, should not be an afterthought, as this may cause time wastage. As discussed in 3.7, medication preparation should follow a stepwise approach in order to ensure a safe and efficient process. P4 realizes the need for this and is critical of his own practice: *"…If I'd followed it properly and done my preparation where it should be…I would have had my Vecuronium drawn up."*

8.3.2.11. Confirmation of successful intubation

With the introduction of RSI, the decision making benefit to practitioners has increased, as a consequence of being forced to think about previous standard intubation practice: *"I had um….my…I did check the tube with…placement using end tidal CO_2, which I think …you know and I had set up my umm…my alternative airway device so I had them ready in case of a failed airway, which I've actually never had before. I've never even considered having it before, until the RSI thing."*

Decisions to continue other aspects of clinical management rest on confirming and maintaining successful endotracheal intubation (se*e Ch. 3, Sec. 3.6.3*). This participant confirmed successful intubation and continued monitoring the patient with appropriate monitoring devices: *"We used, end tidal CO_2 monitoring and saturation. We kept the saturation up above 95 which was no problem and we kept the end tidal CO_2 below 35. We had no problems maintaining the…emm…end tidal CO_2 readings and the saturation readings."*

Once the practitioner is satisfied that the endotracheal is continuing to protect the airway, further decisions can be made regarding mechanical ventilation *(see Ch. 3, Sec. 3.6.5)* and post-intubation sedation and paralysis *(see Ch. 3, Sec.3.6.2)*.

8.3.2.12. Post-intubation management

Post-intubation mechanical ventilation is vital for improved outcomes for the patient, as consistent ventilation is the only means to maintain an acceptable $EtCO_2$ reading (Helm, Hauke and Lampl, 2002; Helm, Schuster, Hauke and Lampl, 2003:327).

The consideration of mechanical ventilation, on-going sedation and on-going paralysis presents the need for decision making regarding the correct drugs and doses, and appropriate ventilator settings: *"…en route, I wanted to err…give him further sedation with…or further paralysis with Vecuronium to keep him down, which in retrospect, probably wouldn't have actually been necessary with his condition….I know we got the ventilator on, I think we had managed to prepare that quite quickly, because I think we had properly prepared the students. "*

In this case, the availability of good assistance *(see 8.3.1.8)* allowed the quick preparation and use of the mechanical ventilator. It is also evident that planning *(see 8.3.1.5)* prompted good decision making.

On the second patient case that P4 had attended, mechanical ventilation was completely neglected. The decision making here was inappropriate in terms of post-intubation ventilation: *"…we RSI'd this patient, intubated easily umm…we did not however prepare our ventilator. We did not use the ventilator" "Bad habit!" " I just forgot about the ventilator…until we were…you know, until it was really too late, because we would have been at hospital."*

In light of the above quote, RSI decision making may require the practitioner to change established practice as well as develop new decision making skills.

8.3.2.13. Hospital reception of the patient

Since RSI is a new paramedic procedure, most doctors and hospital staff are not aware of this capability, which may result in either a positive or negative reaction on arrival at hospital (*see Ch. 5, Sec. 5.3.2.10*). This may possibly influence the decision to RSI, that is, if a practitioner knows that he will be transporting his patient to a hospital that is usually unhappy about the procedure, he may elect not to RSI his patient when it may actually be indicated: *"I was surprised on the first one…we had no grumbling about that at all. I did hear that there was some unhappiness later…but when I got there, the doctor's first reaction was yah okay, the scoline was right. He wasn't so keen on the vecuronium for that first patient."*

8.3.2.14. Challenges to clinical assessment of the patient

A thorough primary examination of the patient must take place, although the pre-hospital environment may make this quite challenging (s*ee 8.3.1.6 and Ch. 5, Sec. 5.3.1.5*): *"Having done an initial evaluation of the lungs and not having anything…you know having good air entry, it never actually occurred to me that he would be having a tension pneumothorax." "Um…he didn't really appear to have too many injuries…we were querying a head injury…and…you know externally…he wasn't all broken up and bleeding and all of that…he had a tension pneumothorax…okay. I hadn't picked this up on initial auscultation of the chest, and that's probably because initially um…he may have had a spontaneous pneumothorax…err…not a spontaneous, he may have had a simple pneumothorax…which...and in retrospect, from the damage he had in the* *vehicle, he had damage to his…his right side chest. It didn't occur to me, and then in the ambulance…err…I couldn't hear his chest as well…" (Patient One).*

With the first patient, P4 conducted an initial evaluation of the lungs and did not identify a pneumothorax. It clearly developed over time, as with the use of positive pressure ventilation by bag-valve-mask, the little air in the patient's interrupted pleural space may have accumulated, resulting in a tension pneumothorax: *"…we turned err…a simple pneumothorax into a tension by positive pressure ventilation."*

Without the aid of diagnostic aids, such as x-rays and arterial blood gases, it is extremely difficult to make thoroughly informed clinical decisions. What does need to happen in the prehospital environment is that the primary clinical decisions made must be guided by what is immediately life-threatening to the patient. This may possibly be either stopping bleeding, protecting the airway or supporting respiratory efforts by initial manual ventilation.

P4 reflects that he should have stopped the moving ambulance to reassess the patient's chest: *"…what I should have done is, periodically stopped the ambulance. Umm…listened to the chest again without the noise of a moving vehicle and have carried on. I think with those two in mind, the patient may have actually survived."*

The practicality of stopping a moving ambulance en route to a hospital is questionable, as the patient is headed towards definitive care. It may also be argued that the initial auscultation of the chest may have appeared to be normal, but the true lung sounds may have been masked by environmental noises on the scene. It must be noted that during a patient extrication, very noisy hydraulic pumps are used, making the environment very non-conducive to chest auscultation. The clinical decision making by P4 is once again being critically reflected on, highlighting that he is improving his own decision making.

8.3.2.15. Consequences of actions and interventions

When the RSI process is not undertaken in accordance with the recommended guidelines, the patient's condition may deteriorate. The deterioration of the patient is also confounded by the severity of the existing clinical condition. What makes the difference though, is professional and efficient decision making. The first patient that P4 managed using RSI, unfortunately died:

"He umm….died as we got him into hospital. Um…he went into PEA (cardiac arrest with pulseless electrical activity) *and then after attempted resus he died. He had a tension pneumothorax…okay. I hadn't picked this up on initial auscultation of the chest… he may have had a simple pneumothorax…which...and in retrospect, from the damage he had in the vehicle, he had damage to his…his right side chest. It didn't occur to me, and then in the ambulance…err…I couldn't hear his chest as well…and we were having a problem with his saturation decreasing if I kept his end tidal* CO_2 *at the right level. So if I increased his end tidal* CO_2*… I mean if I decreased…if I increased his saturation, his end tidal* CO_2 *would drop, so I was battling to try and balance the two…so I was aiming to keep the saturation high then. Having done an initial evaluation of the lungs and not having anything…you know*

having good air entry, it never actually occurred to me that he would be having a tension pneumothorax."

As noted in 8.3.2.14, it may not have been reasonable for P4 to detect the pneumothorax. There was a delay because of the entrapment *(see 8.3.1.6)* he had the whole scene to manage *(see 8.3.1.7)* and the patient deteriorated rapidly *(see 8.3.2.3)*. This case shows CDM in a context where multiple decisions are needing to be made in a very short time and with partial information only. On reflection one can say that he should have realized the likelihood of a pneumothorax given the specific damage to the car, but it is always easier with hindsight and time to think.

From the above excerpt, it seems that the practitioner was pre-occupied with performing RSI for the first time, this over-concentration on one clinical skill may have distracted him from managing the patient as a whole: : *"…I think yes. I think I was probably a little overwhelmed by the…you know. Even though it wasn't much…it wasn't any different of a…of a skill…in fact I didn't even intubate the patient…it was all the decisions…. Okay now I'm…the next step. I've done that, now I must go on to the Vecuronium…I must get the ventilator set up and so I was concentrating on those things actually….didn't, didn't move any further than that."*

8.3.2.16. Who is the RSI'ing clinician?

During the holistic clinical management of a patient in an emergency situation, the practitioner that is appropriately qualified makes the decision to RSI (*see Ch. 5, Sec. 5.3.2.11 and Ch. 6, Sec. 6.3.2.8*). It may not matter whether the same practitioner actually performs the intubation or even draws up the appropriate drugs: *"I don't know who the hands were, but I was certainly the mind there.…I could get…I had a third year student who had passed his OSCEs* (objective skills competency evaluation)*…he had been around…he could, he could um…could actually pass the tube physically. Um…otherwise if I wasn't working with a student who could do that, I would then be needing to pass the tube, and I must make sure that the drugs are, that the drugs get administered properly. If I'm passing the tube, I can also do the drugs but it's probably better to have somebody else…"*

The RSI'ing clinician is the person that makes the decision to RSI and actually oversees the entire process, either from a bird's eye view, or from a hands-on approach: *"Well, well my role is to…I must...okay, it's to make the decision to intubate the patient or not. Um…it's then to facilitate the intubation…., but I must make sure that the whole scene runs."*

8.3.2.17. Seriousness of the RSI process

P4 downplays the seriousness of the RSI process based on his own experience with sedation-only intubation: *"I think drug-assisted intubation is really much of a muchness. You're either doing drug-assisted intubation or you're not."*

Whilst RSI might not be so complicated in the mind of P4, newer less-experienced paramedics may disagree (s*ee Ch. 7, Sec. 7.3.2.4; 7.3.2.7 and 7.3.2.11*).

8.3.2.18. Reflection on the RSI process

P4 had a good reflective ability and was not afraid to disclose his mismanagement of the patient: *"... it never actually occurred to me that he would be having a tension pneumothorax….we turned err…a simple pneumothorax into a tension by positive pressure ventilation… "*

The ability of a practitioner to reflect on his mistakes is invaluable in that it enables him to become his own benchmark for better practice (*see Ch. 7, Sec. 7.3.2.11*): *"I think the only thing that I would do or in fact a big thing I would do differently is that um…I would have spent…even if I had spent another thirty seconds on the basics…the mechanism of injury of the patient…how it happened, and then en route to hospital when I couldn't hear the lungs properly, what I should have done is, periodically stopped the ambulance. Umm…listened to the chest again without the noise of a moving vehicle and have carried on. I think with those two in mind, the patient may have actually survived….Um…following the first one, I had…gone and re-educated myself. I just made sure I understood the whole process completely."*

8.4. Conclusion

A total of 29 categories were identified from the interview with the fourth participant. It is very clear that for P4 there were many factors that affected his clinical decision making surrounding RSI

The integration of the identified categories will be discussed in Chapter 9.

CHAPTER NINE

THEORETICAL INTEGRATION

9.1. Introduction

The purpose of this chapter is to answer the primary and secondary research questions posed in Chapter One. Firstly, the findings from all four case studies, which have been presented in Chapters Five to Eight, will be integrated into a set of categories, the core category will be identified and a discussion of the relationships between the categories will be presented. Finally, the development of the conceptual model will be described.

Formulation of the answers to the secondary questions will then follow.

9.2. Re-visiting the primary research question

What are the factors that influence the paramedic's clinical decision making surrounding rapid sequence intubation, when faced with a critically ill or injured patient that requires definitive airway management?

9.3. Explaining the categories

This section will provide a description of the categories that emerged from the case studies, together with an explanation of each category and their links to other categories. A conditional relationship guide and reflective coding matrix was applied to determine category relationships as described by Wilson Scott (2004).

9.3.1. Categories emerging from the case studies

In answer to the primary research question, 31 categories were identified as a result of the extensive analysis of the four case studies. The final categories were decided upon by identifying commonalities amongst the four case studies with the addition of unique categories from each case. Table 9-1 depicts the categories that emerged during the study. These categories will each be further explained below. For the purposes of this chapter, the categories will be listed and explained in a chronological pattern

Table 9-1: Clinical and non-clinical categories in alphabetical order

CLINICAL CATEGORIES	NON-CLINICAL CATEGORIES
1. Challenges to the clinical assessment of the patient	1. Assistance
2. Confirmation of successful intubation	2. Clinical governance of RSI
3. Consequences of actions and interventions	3. Confidence
4. Evaluation of the patient's airway	4. Concern about opinions of colleagues
5. Hospital reception of patient	5. Education and training
6. Inappropriate use of morphine and midazolam	6. General experience
7. Making the choice between RSI and SOI	7. Learning from past RSI experiences
8. Making the decision to intubate	8. Planning for RSI
9. Post-intubation management	9. Professional autonomy
10. Predetermining the need for airway management	10. Previous RSI experience
11. Preparation of the patient for RSI	11. The physical environment
12. Preparing medication	12. Scene management
13. Reflection on the RSI process	
14. Seriousness of the RSI process	
15. Taking over clinical management from another practitioner	
16. The clinical condition of the patient	
17. The need for speed of intubation	
18. The use of drugs	
19. Who is the RSIing clinician?	

9.3.1.1. Clinical categories explained

Nineteen clinical categories were identified overall from the four case studies. The order in which they are presented and explained accords with the time at which the category occurs in relation to the RSI process, i.e. in chronological order.

9.3.1.1.1. Pre-determining the need for airway management

This category is based on the practitioner being able to determine the need for protection of the airway of a critically ill or injured patient, by using the stimuli around him to guide that decision.

9.3.1.1.2. Taking over clinical management from another practitioner

This category represents the transfer of clinical management from one prehospital practitioner to another.

9.3.1.1.3. Making the decision to intubate

This category represents one of the key decisions in advanced airway management that is actually deciding whether or not to pass an endotracheal tube into the airway of a critically ill or injured patient.

9.3.1.1.4. The clinical condition of the patient

This category represents the decision making surrounding what the practitioner finds after examining the clinical presentation of the patient.

9.3.1.1.5. Evaluation of the patient's airway

This category represents the decision making involved when predicting the success of endotracheal intubation, by looking at the possibilities of a difficult intubation based on an evaluation of the airway of the critically ill or injured patient. This evaluation includes anatomical observations as well as specific injury patterns that might have caused anatomical disruption together with obstruction of the airway by blood or vomitus.

9.3.1.1.6. Challenges to the clinical assessment of the patient

This category represents the particular challenges and problems faced when trying to clinically assess the condition of a critically ill or inured patient in the prehospital environment e.g. noise, poor lighting and crowding of bystanders *(see 9.3.1.2.6)*.

9.3.1.1.7. The need for speed of intubation

This category represents the prioritization of clinical decisions once the decision has been made to intubate the patient *(see 9.3.1.1.3.)*.

9.3.1.1.8. Making the choice between RSI and SOI

This category represents the transition from old practice of sedation-intubation to the newer and better practice of rapid sequence intubation.

9.3.1.1.9. Use of drugs

This category is based on the decisions surrounding appropriate use of medications associated with RSI.

9.3.1.1.10. Inappropriate use of morphine and midazolam

This category represents the decision making associated with the common inappropriate use of medications.

9.3.1.1.11. Preparation of the patient for RSI

This category represents the decision making required for preparing the patient physiologically, in order to ensure a successful RSI.

9.3.1.1.12. Preparing medication

This category relates to the decision making required to have RSI medications adequately pre-prepared to ensure successful RSI e.g. having pre-filled syringes or proper cold storage of relevant medications.

9.3.1.1.13. Consequences of actions and interventions

This category represents the negative implications of not following the appropriate RSI process, which may result in either a failed intubation or other clinical consequences.

9.3.1.1.14. Confirmation of successful intubation

This category represents the decision making involved in ensuring that endotracheal intubation has been successful.

9.3.1.1.15. Post-intubation management

This category represents the decision making involved in ensuring that the patient is appropriately managed after successful intubation has been achieved. Part of this management includes mechanical ventilation and ongoing sedation and paralysis of the patient.

9.3.1.1.16. Hospital reception of the patient.

This category represents the decision making in terms of expectations of the receiving hospital. This includes procedures and medications that may or may not have been used on the patient, based on who is receiving the patient as well as a consideration of the proximity of the hospital from the scene.

9.3.1.1.17. Who is the RSIing clinician?

This category represents a fundamental question in the minds of prehospital practitioners as to who is ultimately responsible for the decision to RSI. Paramedics have historically relied on doctors who were responsible for major clinical decisions. This has however changed over the years and paramedic autonomy calls for sound, responsible clinical decision making.

9.3.1.1.18. Reflection on the RSI process

This category represents the facet of reflective practice which can have a direct effect on improving clinical decision making.

9.3.1.1.19. Seriousness of the RSI process

This category represents the differing mindsets regarding the serious consequences that may befall the patient, if the practitioner does not follow through with appropriate decisions about the RSI process.

9.3.1.2. Non-clinical categories explained

A total of twelve non-clinical categories were identified overall from all four case studies. They will be explained below in a chronological order. Chronology in this section represents the possible sequence of events or factors occurring, from before and after a particular clinical case has been undertaken.

9.3.1.2.1. General experience

This category represents the different levels of experience amongst the four participants and how this has impacted on their clinical decision making. Experience in this category refers to general operational experience as a clinical practitioner at an advanced life support level.

9.3.1.2.2. Previous RSI experience

This category represents the effect of previous experience specific to RSI, on clinical decision making.

9.3.1.2.3. Learning from past RSI experiences

This category represents the improvement in clinical decision making by constant reflection on past RSI experiences.

9.3.1.2.4. Education and training

This category represents the effect of paramedic education and training on clinical decision making. This has emerged as one of the fundamental aspects of preparing an individual for good clinical decision making.

9.3.1.2.5. Planning for RSI

This category represents the forward planning required to make RSI successful. This category includes pre-planning of equipment and general operational readiness for undertaking RSI.

9.3.1.2.6. The physical environment

The physical environment concerns adverse weather conditions, poor lighting, noise, crowding and possible hostile situations. This category sets the stage for prehospital clinical decision making and is certainly a major determinant of how paramedics make decisions. The environments that paramedics have to work in are nowhere near the clean, safe, well-lit and well resourced environment found in a hospital emergency unit.

9.3.1.2.7. Scene management

This category represents the additional responsibility of managing the scene of an emergency, for example a motor vehicle accident, whilst also attempting to make clinical decisions about the patient's /patients' medical management.

9.3.1.2.8. Assistance

This category represents a fundamental issue of the necessity of having the right kind of help required to undertake an RSI safely.

9.3.1.2.9. Confidence

This category emerged as being a key area affecting clinical decision making amongst the study participants. Confidence in undertaking RSI only represents one area of confidence and may not necessarily mean that the practitioner is generally confident in his decision making ability.

9.3.1.2.10. Professional autonomy

This category represents an area that directly affects decision making and includes the elements of professional accountability and responsible decision making.

9.3.1.2.11. Concern about opinions of colleagues

This category has emerged from two of the study participants and represents an issue that appears to be common amongst practitioners in the profession. It involves the concern of the practitioner about the views of his peers regarding his practice. It can range from perceived criticism of clinical practice to intimidation.

9.3.1.2.12. Clinical governance of RSI

This category represents the need for a quality intervention mechanism that may directly have an impact on clinical decision making. Clinical governance of prehospital RSI means that practitioners will be assessed for appropriateness of practice and this may therefore force practitioners to make careful sound clinical decisions *(see 9.3.1.2.10)*.

9.4. Comparing the four cases

9.4.1. Category commonalities and variations amongst all participants

Table 9-2 depicts the distribution of categories amongst the four case studies. A tick (√) represents the existence of the relevant category for the relevant participant on the table. The lightly shaded bands indicate that all four participants share the same category. Where only one or two ticks appear per category line, indicates an unusual difference with regards to the other participants.

P1, P2, P3 and P4 represents participant 1 to 4 respectively. The categories are displayed in alphabetical order.

Table 9-2: Distribution of categories across the four case studies

CATEGORIES IDENTIFIED		PARTICIPANTS			
CLINICAL CATEGORIES		**P1**	**P2**	**P3**	**P4**
1.	Challenges to the clinical assessment of the patient		√		√
2.	Confirmation of successful intubation		√	√	√
3.	Consequences of actions and interventions			√	√
4.	Evaluation of the patient's airway	√	√	√	√
5.	Hospital reception of patient	√		√	√
6.	Inappropriate use of Morphine and Midazolam	√	√	√	√
7.	Making the choice between RSI and Sedation-only-intubation (SOI)	√	√	√	√
8.	Making the decision to intubate	√	√	√	√
9.	Post-intubation management	√	√	√	√
10.	Predetermining the need for airway management				√
11.	Preparation of the patient for RSI	√		√	√
12.	Preparing medication		√		√
13.	Reflection on the RSI process			√	√
14.	Seriousness of the RSI process	√	√	√	√
15.	Taking over clinical management from another practitioner				√
16.	The clinical condition of the patient	√	√	√	√
17.	The need for speed of intubation	√			√
18.	Use of drugs	√			
19.	Who is the RSIing clinician?	√	√	√	√
NON-CLINICAL CATEGORIES					
1.	Assistance	√	√	√	√
2.	Clinical governance of RSI	√	√		
3.	Concern about the opinions of colleagues			√	√
4.	Confidence	√	√	√	√
5.	Education and training	√	√	√	√
6.	General experience		√	√	√
7.	Previous RSI experience	√			√
8.	Learning from past RSI experiences	√			√
9.	Planning for RSI	√	√	√	√
10.	Professional autonomy	√			√
11.	Scene management		√	√	√
12.	The physical environment	√	√	√	√

9.4.2. A comparison of the participants' background

An overview of the variance in the experience and education of the study participants may illuminate the results of this study. As depicted in Table 9-2, only P1 and P4 had previous RSI experience. There was although an important variance in general experience as depicted in Table 9-3 below.

Participant	General Background
P1	A registered paramedic who is currently a doctoral student developing clinical quality standards for emergency services. He has been extensively involved in paramedic education and training as well as also previously serving on the Professional Board for Emergency Care Practitioners Over the last nine years, P1 has spent a great deal of time and effort developing the South African programme for the BTEMC. He also made a significant contribution to the creation of professional autonomy for paramedic practitioners. P1's international experience in the clinical governance environment adds an additional dimension to his own clinical decision making ability. P1 has worked in an emergency medical service in Europe, as the service's clinical director which entailed being the clinical governance lead.
P2	This participant is a registered paramedic, and has completed the BTEMC program as well as also participating in an additional RSI workshop arranged by the researcher. P2 is currently involved in paramedic education and training and has many years of operational experience as an advanced life support practitioner. He also has extensive experience with endotracheal intubation.
P3	This participant is a registered paramedic, who has completed the BTEMC program as well as participating in an additional RSI workshop arranged by the researcher. After qualifying as a paramedic, the participant became involved in paramedic education and training and did not spend much time doing clinical advanced life support work. As a result of completing the BTEMC program immediately after obtaining the National Diploma, P3 had minimal clinical exposure between becoming a paramedic and then being authorized to perform RSI. P3 had limited clinical experience up to the point of actually undertaking this particular clinical case. Realizing that he was lacking clinical experience, he decided to relinquish his career as an educator. He is currently an operational advanced life support practitioner.
P4	This participant is a registered paramedic, and has completed the BTEMC program as well as participating in an additional RSI workshop arranged by the researcher. P4 has been involved in paramedic education and training for about four years and is currently an educator in the same discipline at a university in Europe. P4 is also a unique participant, because he has been involved specifically with advanced airway management training for a few years. P4 has accumulated a wealth of operational experience as he has been practicing as an advanced life support practitioner since 2001.

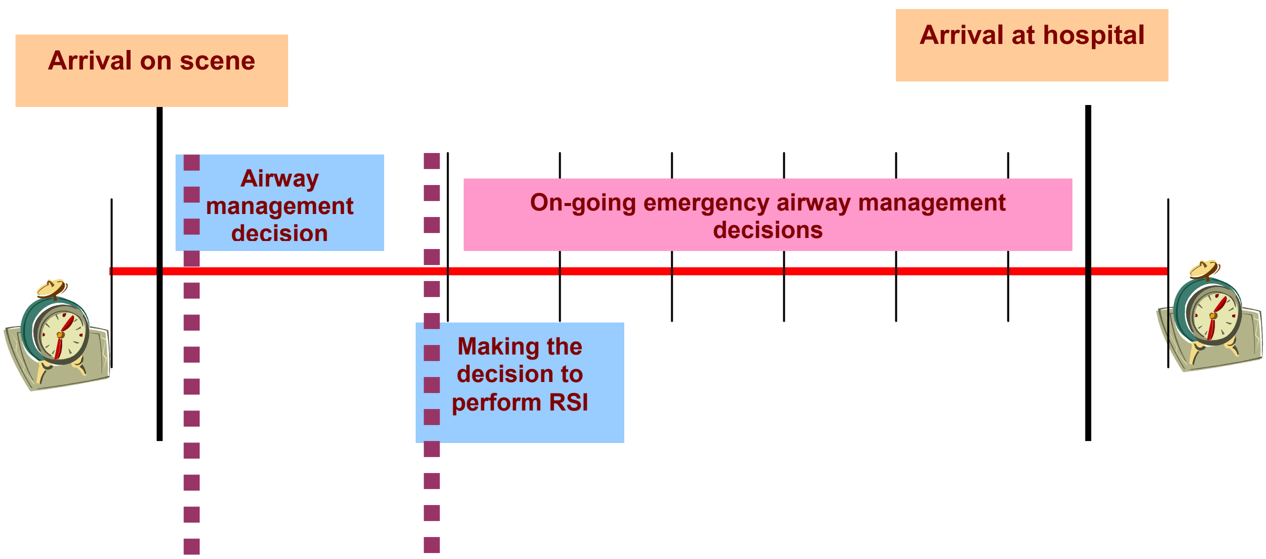
Table 9-3: A comparison of the study participants' experience and education

9.5. Explaining the core category

As analysis progressed, the core category became very clear, this being the "timing of decisions" along the decision making continuum *(see 9.3 and Ch. 4, Sec. 4.6.1)*. This was because it was found that the *timing of decisions* was the basis for effective clinical decision making surrounding RSI. If the right decision is not made at the right time, the consequences of the wrong decisions become very complicated as does the subsequent decision making. Timing of decisions is significantly influenced by many other factors and many decisions affect subsequent decisions.

Figure 9-1 is a graphic representation of the decision timeline, starting prior to arrival on scene and ending with the arrival of the patient at the hospital. Each short vertical bar represents a decision that must be made regarding management of the patient's airway.

Figure 9-1: The decision-timeline. A graphic representation of the core category - *Timing of decisions* -



9.5.1. Phase one of the core category: 'Timing of decisions' from the planning phase until arrival on the scene

The timing of decisions starts well before a patient case is dispatched. Decision making starts early in the planning stages and is influenced by previous RSI experience and general experience. The prescribed minimum equipment requirements for RSI also strongly influence the planning for RSI. The planning for RSI can thus stretch over weeks to months either following a previous RSI or starting to plan for the first one. On arrival at the scene, the immediate physical environment determines the way the emergency scene should be managed, which in turn is dependent on the type and availability of assistance. (See Figure 9.1.1 which depicts the first phase of the core category as explained above).

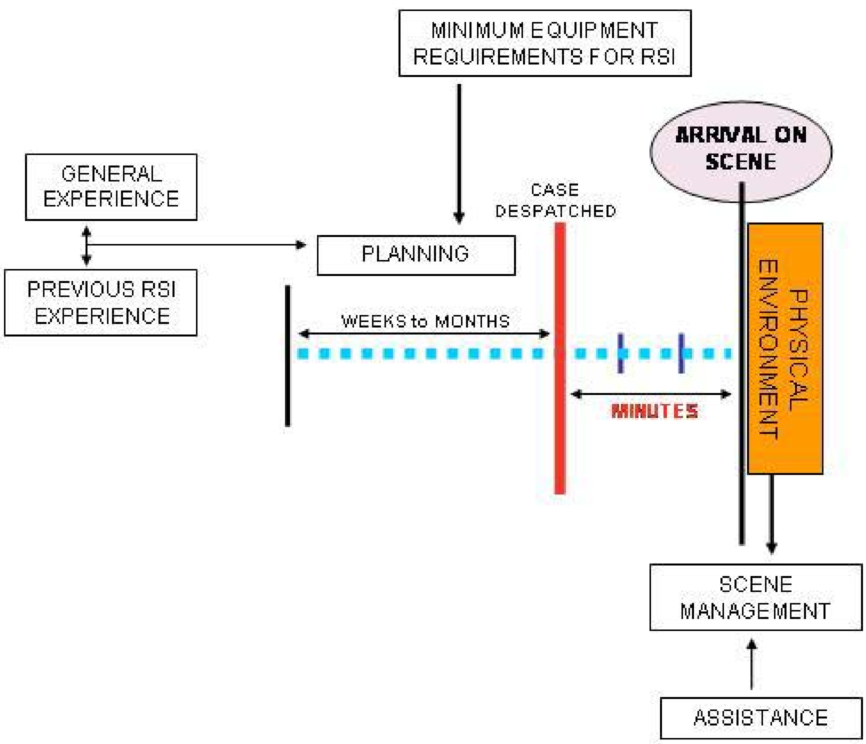


Figure 9.1.1: Phase one of the core category: 'Timing of decisions' from the planning phase until arrival on scene.

9.5.2. Phase two of the core category: 'Timing of decisions' from arrival on scene until successful intubation

After arrival on the emergency scene, the decision to intubate the critically ill or injured patient must be made within the first few minutes. This initial decision to intubate is guided primarily by general experience and then by pre-determining the severity of the clinical condition of the patient. The clinical condition of the patient on examination further informs the decision to intubate. The practitioner's education and training background as well as the level of confidence also influence the decision to intubate.

Whilst the decision to intubate is being considered, further decisions about the preparation of the patient in terms of pre-oxygenation, have to be made. Once these have been made, a further decision regarding whether or not to use RSI, comes into play. The decision to RSI is then also influenced by general experience and further by previous RSI experience and evaluation of the patient's airway. Deciding to RSI has to be influenced by the prescribed minimum RSI requirements, as the lack of any prescribed equipment may immediately negate the use of RSI. Another important factor that may influence the decision to RSI is the concern about the opinions of other colleagues, whether these are expressed at the scene or recounted later.

The decision to RSI may also be influenced by the type of receiving hospital, in terms of their preparedness for accepting a patient who has been paralyzed and mechanically ventilated.

All the factors influencing the decision to intubate and the decision to RSI occur simultaneously both physically and in the mind of the decision maker. See Figure 9.1.2 which depicts the second phase of the core category as explained above.

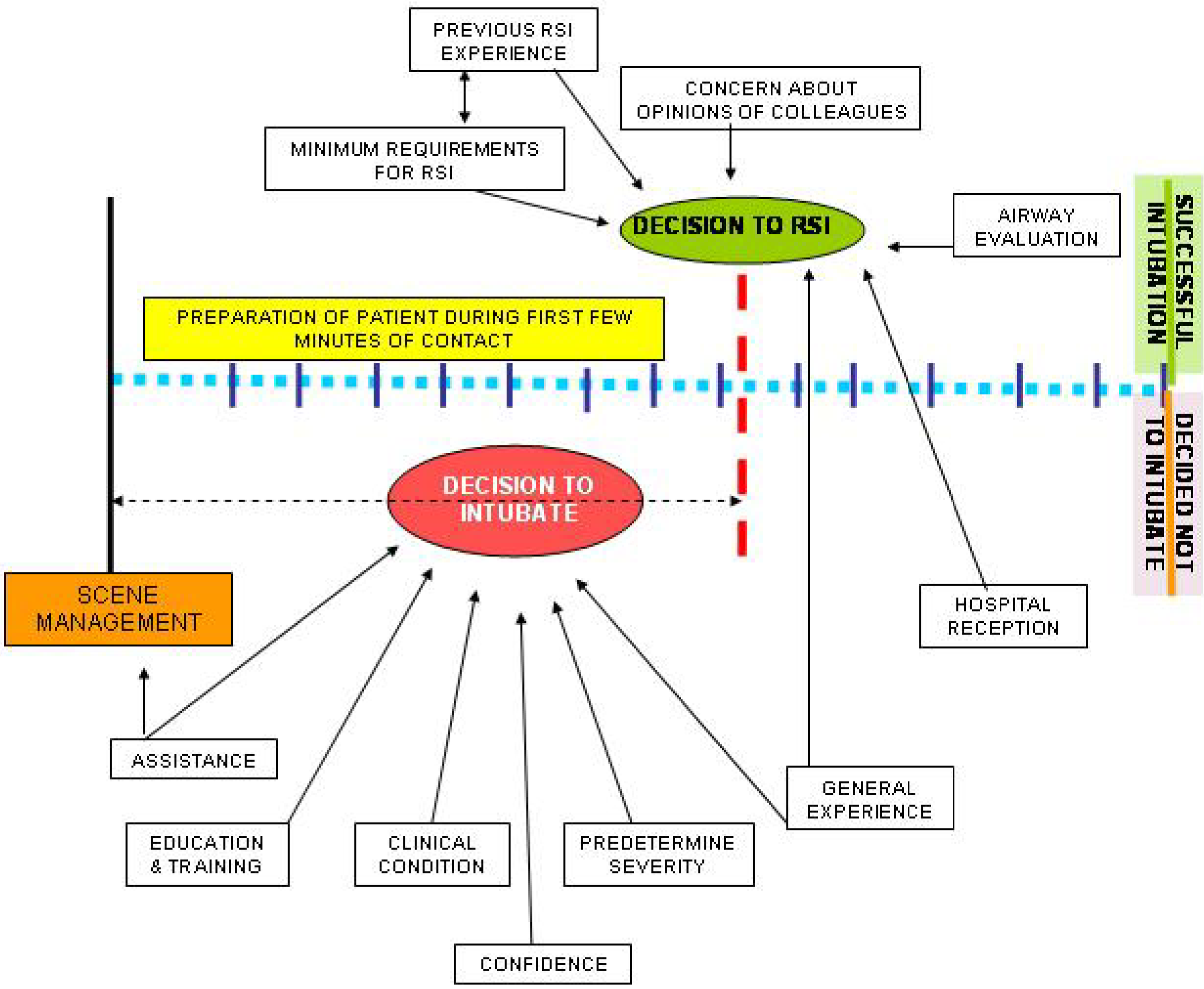


Figure 9.1.2: Phase two of the core category: 'Timing of decisions' from arrival on scene to successful intubation, or decision not to intubate.

9.5.3. Phase three of the core category: 'Timing of decisions' from successful intubation or decision not to intubate, to post-delivery of the patient at hospital

The timeline for decisions in the third phase may last minutes to hours; however the timing of decisions during this phase must not be downplayed, as there may be a sense of relief after successful intubation has occurred resulting in a decreased sense of urgency and importance with post-intubation management. The converse may also apply where the practitioner decides not to intubate the critically ill or injured patient. This could result from either a reluctance to intubate or from a clinical decision to transport the patient to a nearby hospital for more controlled airway management.

Post-intubation management includes the use of mechanical ventilation with on-going sedation and paralysis of the patient. One of the key minimum requirements for post-intubation management is a mechanical ventilator. Again, the preparedness of the receiving hospital may influence the use of the mechanical ventilator and on-going paralysis.

After delivering the patient to the hospital, many decisions are made to further prepare for the next RSI. In essence, reflection on the RSI case should lead to better planning for the next one. The timeline for decisions after delivery of the patient at hospital extends from the immediate few minutes after delivery at hospital to years after.

See Figure 9.1.3 which depicts the third phase of the core category as explained above.

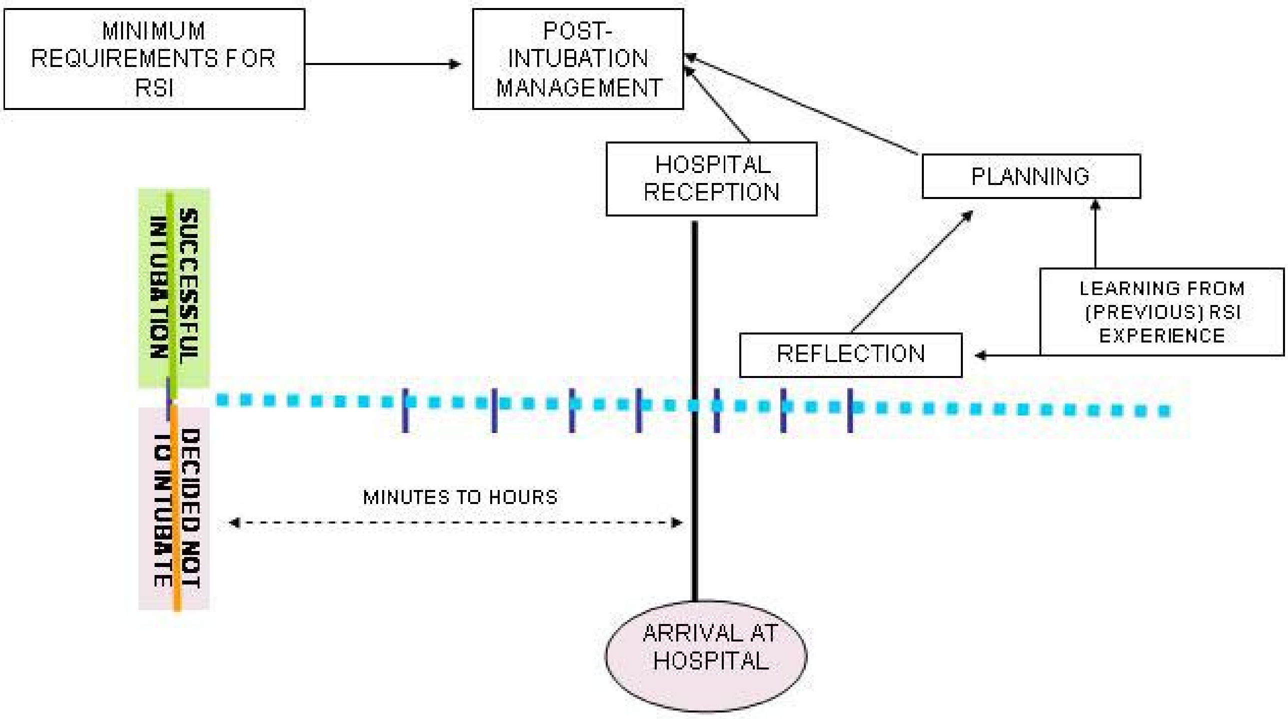


Fig. 9.1.3.: Phase three of the core category: ‘Timing of decisions’ from successful intubation or the decision not to intubate, to post-delivery of the patient at hospital

9.6. Relationships between categories explained

This section will explain the different categorical relationships that were found during the analysis using the technique explained in 9.3.

9.6.1. Explaining the relationship between significant influences and making the decision to intubate

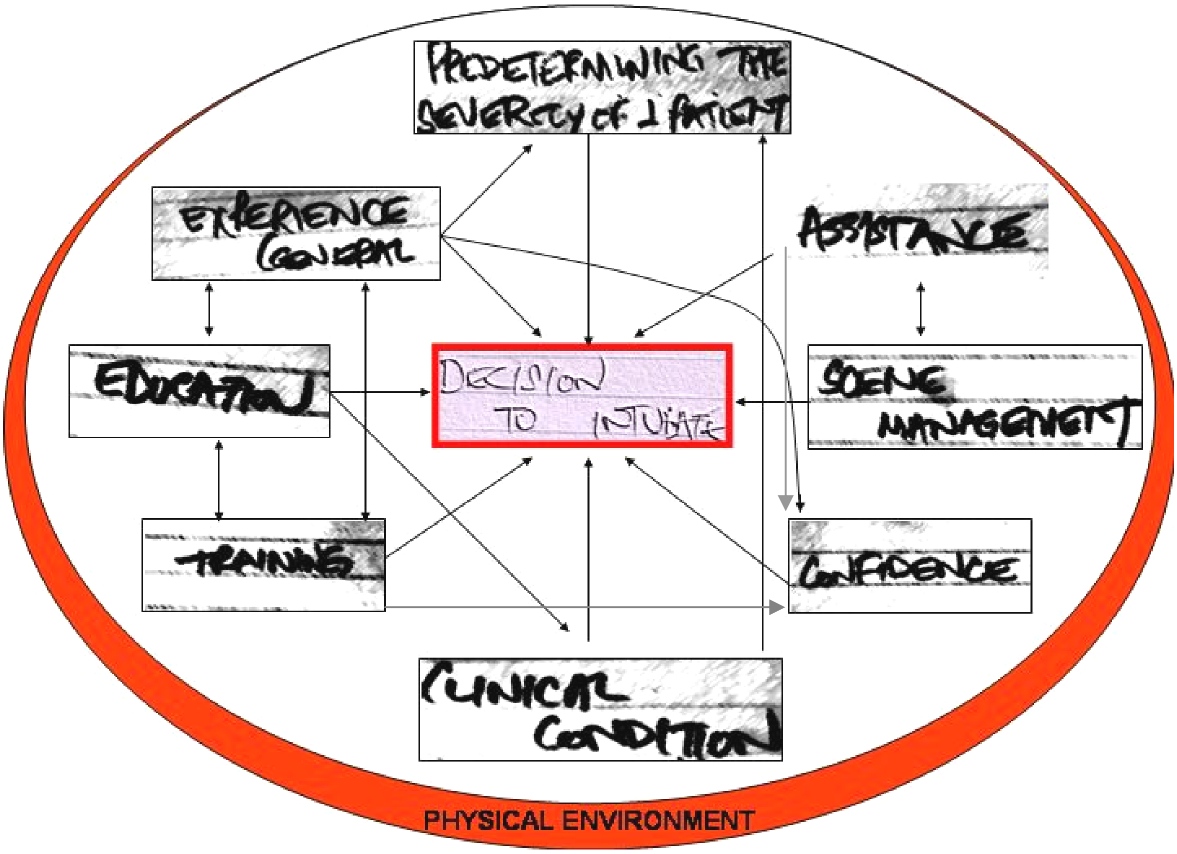


Figure 9-2: The relationship between significant influences and making the decision to intubate (This diagram was created using raw data that was collected and categorized using pieces of paper which were pasted onto a wall)

In Figure 9-2, the physical environment forms the context of making any pre-hospital decision, and therefore acts as the platform for making the decision to intubate. The nature of the physical environment can be quite varied as described by all participants (*see Ch. 5, Sec. 5.3.1.5, Ch. 6, Sec. 6.3.1.4, Ch. 7, Sec.8.3.1.4 and Ch. 8, Sec. 8.3.1.6*).

9.6.1.1. <u>The link between assistance and scene management</u>

The management of an emergency scene in itself requires additional human resources. The paramedic in his capacity as a clinician needs to focus on making clinical decisions for the patient. The need for assistance for both RSI and management of the scene may be a very important factor when making clinical decisions (*see Ch. 6, Sec. 6.3.1.6 and Ch. 8, Sec. 8.3.1.7/8*).

9.6.1.2. <u>The link between patient's clinical condition and making the decision to intubate</u>

The presenting clinical condition is the primary reason for deciding to intubate any patient. The more severe the condition is, the more likely the practitioner is to make the decision to intubate. (*see Ch. 5, Sec. 5.3.2.2, Ch. 6, Sec. 6.3.2.2., Ch. 7, Sec. 7.3.2.2. and Ch. 8, Sec. 8.3.2.4.*)

9.6.1.3. <u>The link between making the decision to intubate and predetermining the severity of the patient</u>

When a paramedic gets to the scene of an emergency, the presenting situation in terms of the physical environment often leads the paramedic to appreciate the degree of injury, based on the mechanism of injury (*see Ch. 8, Sec. 8.3.2.1*).

9.6.1.4. The link between general experience and confidence

The more operational experience a paramedic acquires the more confident he or she becomes. This confidence plays a very important role in making the decision to intubate. A lack of confidence may result in delayed decisions and possibly leading to patient compromise. (*see Ch. 5, Sec. 5.3.1.1, 5.3.1.7, Ch. 6, Sec. 6.3.1.7, Ch. 7, Sec. 7.3.1.7, Ch. 8, Sec. 8.3.1.9.*)

9.6.1.5. The link between general experience and making the decision to intubate

Experience may very well be an excellent teacher in the clinical environment. It was quite clear that the more experienced participants had less trouble making the decision to intubate. (*see Ch. 6, Sec. 6.3.1.1 and Ch. 8, Sec. 8.3.1.1.*)

A dynamic relationship exists between general experience, confidence, pre-determining patient severity, clinical condition and the decision to intubate (*see Fig. 9-3*). A proportional relationship between making decisions to intubate and general experience, is clearly evident that is, the more general experience the practitioner possesses, then the decision making to intubate seems to become better.

Another relationship also exists within this dynamic relationship, which is the need for constant comparison between pre-determining the severity of the patient's condition and the patient's actual clinical condition. The decision to intubate is based on this constant comparison and is guided by the clinical stability or deterioration of the patient

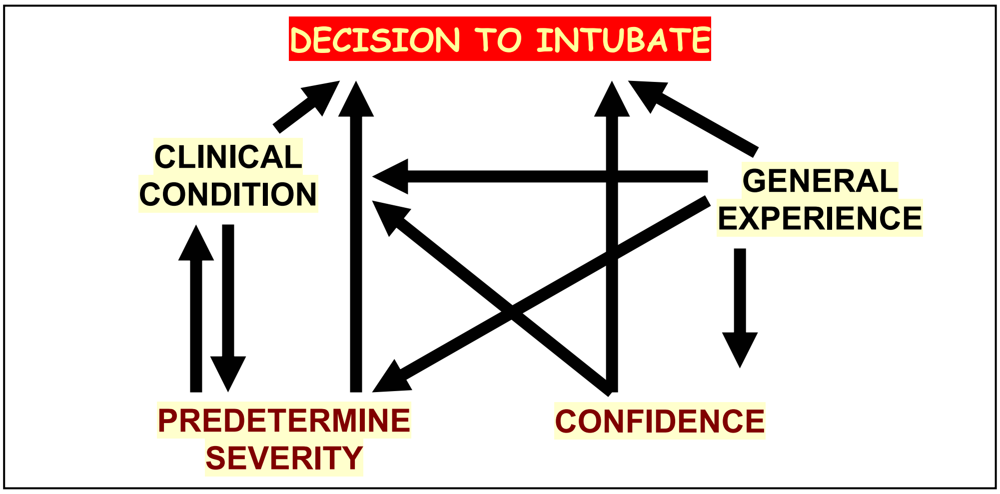


Figure 9-3: Depiction of the relationship that exists between general experience, confidence, predetermining severity, clinical condition and the decision to intubate

9.6.1.6. <u>The relationship between education and training</u>

Education is defined as activities aimed at developing the knowledge, moral values and understanding required in all the aspects of life rather than knowledge and skills related to a limited field of activity (Jerling, 1999:2). Training is defined as the systematic process of changing the behaviour and/or attitudes of people in a certain direction to increase goal achievement (Jerling, 1992:3).

Education in itself is therefore a comprehensive concept and may even include the concepts of training and development. In the pre-hospital emergency care profession, education seems to be defined as theoretical knowledge, whereas training seems to be skills development.

According to Christopher (2007:15), emergency medical care training in South Africa follows two streams, the first being the short course training undertaken at one of 57 colleges nationally or the three-year NDEMC program offered at four universities of technology nationally. These streams of education may eventually propel the practitioner into the arena of graduate training in the form of the BTEMC program. It is therefore vital that the route taken to eventually be allowed to practice pre-hospital RSI, must prepare the practitioner for future sound clinical decision making.

Christopher (2007:17) states that the PBECP is concerned that the current format of short course training is inadequate to meet the future health needs of the country and has proposed terminating short course training in favour of formal education.

Being a health professional implies a qualified health care provider who demonstrates professional autonomy, competence and accountability (Refshauge and Higgs, 1995:105). The profession of pre-hospital emergency care has emerged to professional status over many years of serious commitment, discarding a technical and directed role to achieve professional autonomy.

In the general health care profession, demand is increasing for quality care and accountability, from society, from within the health professions themselves, from health care authorities and from registration bodies (Refshauge and Higgs, 1995:105). Clinical decisions need to be made within complex, uncertain and subjective contexts. In addition to dealing with this complex clinical information, paramedics are expected to deal effectively with an increasing body of scientific knowledge. It is apparent then, that to meet the expectations of society and earn the right to act as autonomous health care providers, paramedics need to be skilled in making clinical decisions. The ability to make sound clinical judgements, especially in the context of pre-hospital care, could be described as the most important factor in effective pre-hospital clinical practice.

To improve clinical decision making, educational experiences must provide the opportunity for students to develop their awareness of the need to modify general clinical management approaches for individual patients, after all, patients do not read medical textbooks. Education, which really embodies skills training, therefore plays a significant role in developing practitioners that will make sound clinical judgements not only when undertaking RSI but whenever they are faced with critically ill or injured patients.

9.6.2. <u>Explaining the existing relationships surrounding the decision to RSI</u>

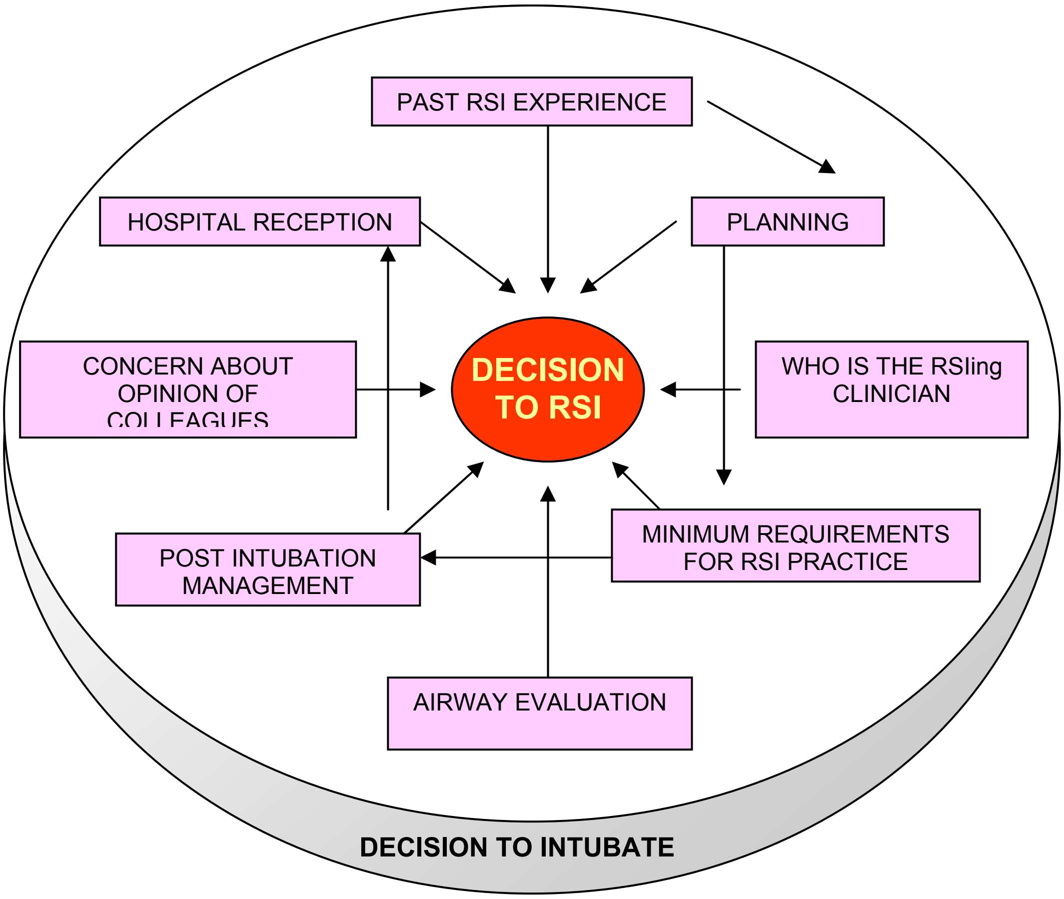


Figure 9-4: Factors affecting the decision to undertake RSI

After making the decision to intubate as previously described (see *Sec. 9.4*), the practitioner must then make the decision as to whether the patient should be intubated using RSI or not. The timing of the decision to intubate directly affects the timing of the decision to RSI or not. The factors affecting the decision to RSI will be discussed hereafter.

9.6.2.1. The link between past RSI experience and making the decision to RSI

Performing an RSI for the first time, as described by P1 and P4, can make the practitioner quite nervous and may result in clinical errors. However the experience gained from subsequent RSI cases may make future decisions to RSI somewhat less challenging provided there is reflection and further education and training so that the practitioner learns from mistakes or poor practice. Another aspect is just that the repetition of performing a process can make it more automatic as opposed to a series of consciously thought through steps *(see Ch. 5, Sec. 3.2 and Ch. 8, Sec. 3.3)*.

Another consideration is a bad RSI experience which could possibly have an adverse effect on the practitioner which might lead to increased fear of the procedure, decreased confidence and may even lead the practitioner to avoid doing it again.

9.6.2.2. The relationship between planning, past RSI experience and the decision to RSI

The practitioner may be able to plan better after the first RSI case as it may help to illuminate certain planning issues that can be rectified for subsequent RSI cases. It is the reflection upon the first case that brings to light these planning issues (*see Ch. 5, Sec. 3.2 and Ch. 7, Sec. 3.18*).

The decision to RSI is directly affected by proper planning of resources. These resources may include a difficult airway kit, a mechanical ventilator, suitable drug storage, adequate oxygen supply and appropriately trained assistance *(see Ch. 5, Sec. 3.4 and Ch. 6, Sec. 3.3*). Whilst this may be true, it may not always occur, as in the case of P4 (*see Ch. 8, Sec. 3.5*).

Figure 9-5: The relationship between RSI experience, planning and the decision to RSI

9.6.2.3. <u>The link between minimum equipment requirements, the decision to RSI and post-intubation management</u>

When deciding to undertake RSI, the practitioner must already be confident that all the necessary equipment and medications are available. These pre-requisite resources should be in place as a result of mandatory requirements for RSI, dictated by the PBECP (*see Sec. 9.1.4*) If these are not in place, then it would not only be illegal for the practitioner to undertake RSI which includes post-intubation management, but also dangerous in the sense that the patient will be put at risk.

9.6.2.4. The link between airway evaluation and the decision to RSI

As clearly highlighted by all participants, the evaluation of the patient's airway directly influences the decision to RSI (*see Ch. 5, Sec. 5.3.2.4, Ch. 6, Sec. 6.3.2.3, Ch. 7, Sec. 7.3.2.3 and Ch. 8, Sec. 8.3.2.5*). The possibility of a difficult intubation based on airway evaluation may lead the practitioner to exclude the use of a paralytic agent. Good practice of appropriate evaluation of the patient's airway should lead to this decision, however not all participants carried out an appropriate airway evaluation *(see Ch. 7, Sec. 7.3.2.3 and Ch. 8, Sec. 8.3.2.5)*

9.6.2.5. The relationship between post-intubation management, hospital reception and the decision to RSI

The fundamental aspects of post-intubation management are mechanical ventilation, on-going sedation and on-going paralysis. In the instance that the practitioner does not have access to a fully functional mechanical ventilator or an adequate oxygen supply that goes with it, the option of RSI may become less favourable. All patients should be mechanically ventilated post-intubation, whether they received RSI or not. This however is not current standard practice (*see Ch. 8, Sec. 8.3.2.12*). General paramedic practice involves intubation followed by bag-valve-mask ventilation until arrival at hospital. This has become the norm although clinical evidence is clear that inconsistent ventilation causes physiological derangements (*see Ch. 3, Sec. 3.3*).

Timing of the decision to mechanically ventilate the patient hinges on availability of the device, proximity to hospital (*see Ch. 6, Sec. 6.3.2.7*) and ventilator skill competence (*see Ch. 7, Sec. 7.3.2.9*). One of the participants although just completely forgot to use the ventilator *(see Ch. 8, Sec. 8.3.2.12).*

The practitioner may elect not to perform RSI if he is confident that the hospital would so in a more controlled environment (*see Ch. 5, Sec. 5.3.2.9*). The hospital that receives the patient is another factor that may deter the practitioner from performing RSI, either because of a previous bad experience with the hospital staff, or the fact the patient has to be continuously ventilated. The issue of continuous ventilation is one that is affected by the availability of mechanical ventilators in the intensive care units at the receiving hospital.

9.6.2.6. The link between the decision to RSI and 'Concern about opinions of colleagues?'

This has been an issue for years in a profession that seems to be egocentric and highly competitive. New paramedics seem to be intimidated by more experienced ones (*see Ch. 7, Sec. 7.3.1.6*). This issue may very well reduce the paramedic's confidence and lead to a decision not to RSI when it was actually indicated (*see Ch. 7, Sec. 7.3.2.4*). This in turn creates a serious problem of poor clinical decision making, which may be mitigated against by a period of internship as suggested in the discussion later (*see Sec. 9.12.1.2.4*).

9.6.2.7 <u>The link between the decision to RSI and 'Who is the RSIing clinician'</u>

It is clear from the data analysis that the RSIing clinician is actually the person that must make the decision to undertake RSI (s*ee Ch. 5, Sec. 5.3.2.11*). That person may not necessarily be the person to give the drugs or even intubate (s*ee Ch. 6, Sec. 6.3.2.8*), but should be the person that assumes responsibility for the decision making before, during and after the RSI takes place (s*ee Ch. 7, Sec. 7.3.2.10*). In the pre-hospital setting, the paramedic is rarely fortunate to have skilled assistance in the form of paramedic students or even other paramedics that may be on the same scene. In any event, after the decision to RSI has been made, the RSIing clinician must ensure that the duties delegated to the assistants are carried out safely and efficiently during the RSI process. The RSIing clinician is accountable for the decision to delegate and must therefore carefully assess whether the assistant is able to undertake the procedure safely.

9.6.3. The answer to the primary research question

A final conceptual model has been developed following extensive and comprehensive data analysis. The final model (Fig. 9-7) can be found at the end of this chapter.

9.7. Re-visiting the first of the secondary research questions

The question was:

Are paramedics correctly applying the guidelines approved by the Department of Emergency Medical Care and Rescue, to undertake the rapid sequence intubation process?

9.7.1. Formulating the answer to the first of the secondary questions

This question will be answered by reviewing comments made by the expert clinical review panel. The researcher will then provide expert clinical review. The question will be answered based on the format of the expert clinical review form.

The form is made up of two parts. The first part analyses whether the paramedic is undertaking RSI appropriately, whereas the second part analyses whether there were any adverse effects encountered as a result of RSI.

9.8. Re-visiting the clinical expert panel

The following experts were consulted:

9.8.1. A specialist anaesthetist at a Durban hospital who has a special interest in out-of-hospital RSI, and has been closely involved with development and training of the BTEMC qualified paramedics involved in the study.

9.8.2. An emergency care nurse consultant from a London hospital, who holds an MSc: Cardiology, is also a registered paramedic and is also very closely involved with the graduate paramedic training.

9.8.3. A registered paramedic who holds a BTEMC and is currently a PhD student. He has a keen interest in airway management and has been intensively involved with the development of paramedic training at the Durban University of Technology, and had started the process of paramedic RSI.

9.9. Analysis of the expert clinical review forms

From this point on the first, second and third reviewer will be referred to as R1, R2 and R3 respectively.

9.9.1. Was an appropriate patient or clinical condition chosen?

All reviewers agreed that P1, P2, P3 and P4 had correctly selected appropriate patients to RSI. R2 however agreed and disagreed with P3: "*Sux was used to rescue a failed sedation-only intubation – should have been RSI from the start!!!!!!!!*"

The researcher agrees that all participants chose an appropriate patient for RSI, although also shares the sentiments of R2. In the case of P3, although a correct patient was selected for RSI, the decision to RSI was not the primary one, but more of a decision following a failed sedation-only intubation.

9.9.2. Was preoxygenation undertaken?

All reviewers agreed that all participants adequately undertook pre-oxygenation of the patient. In the case of P3, the method of pre-oxygenation may have been inappropriate. R3 showed concern that: "*vital capacity breaths run the risk of gastric insufflation*", which was contradicted by R2: "*Used non-rebreathing bag prolonged oxygenation*".

The researcher agrees that all participants adequately pre-oxygenated their patients. The contradiction between R2 and R3 highlights the timing of decisions in terms of pre-oxygenation.

9.9.3. <u>Was the patient's heart rate, oxygen saturation and blood pressure recorded prior to RSI?</u>

All participants recorded the patient's vital signs on the prescribed form. All reviewers, including the researcher agreed that all participants followed the guidelines in this regard.

9.9.4. <u>Were the appropriate drugs selected?</u>

Three of the four participants correctly selected the appropriate drugs for RSI. One participant deviated from this, resulting in completely inappropriate use of drugs. R1, R2 and R3 concur on the fact that morphine and midazolam used as an induction agent was inappropriate. R1 argued that "*etomidate would have provided superior conditions*" and this was echoed by R2 who noted that it was "*less than ideal*" in an isolated head injury. R3 showed concern that drugs were not used for on-going sedation in the case of P4. R1 shared this concern: "*Vecuronium as sole agent post intubation – risk of awake paralysis offset by head injury.*"

The researcher agrees that P1, P2 and P4 selected the appropriate drugs, whereas P3's decision to use morphine and midazolam was completely inappropriate. The decision of P4 not to use drugs for on-going sedation was based on his appreciation of the patient's need for it, as revealed through the interview *(see Ch. 8, Sec. 8.3.2.12)*.

9.9.5. Were appropriate drug doses used?

R1 and R2 agreed that the dose of succinylcholine used by P1 may have been a bit high, although agreed that it was within the normal range. R3 was concerned that P1's use of "*200mg succinylcholine seems excessive.*"

With respect to P3, all reviewers agreed that the dose of succinylcholine was appropriate. R3 indicated that if morphine and midazolam was being used, then the dose used would "*carry a significant risk of inadequate suppression of the intubation response and awake paralysis (masked by head injury)*".

For P4, all reviewers agreed that the dose of succinylcholine was appropriate.

The researcher agrees with the expert panel, that all the participants selected an appropriate dose of succinylcholine that was within an acceptable range.

9.9.6. Was an appropriate method of ET-tube placement confirmation used?

All reviewers agreed that all participants appropriately confirmed placement of the endotracheal tube.

R1 did comment though that for P1 and P3 "*syringe aspiration* (is) *not required with intact circulation and CO2 detection*". In this case it is being suggested that the patient's clinical condition must be taken into consideration when deciding on methods of tube placement confirmation.

The reviewer was pleased to note that every effort was being made by all participants to ensure correct tube placement.

9.9.7. Were the ventilator settings appropriate?

This is a concern for the researcher, as the guidelines are very specific about the need to use a mechanical ventilator, to prevent derangements on the capnograph. However, only two of the four participants used the mechanical ventilator. R2 and R3 were also generally disappointed about the non-use of the mechanical ventilator.

9.9.8. Were there any adverse effects encountered as a result of RSI?

R1 and R2 agreed that all participants did not encounter any patient adverse effects as a result of RSI. R3, however, commented that there might have been some accidental hyperventilation with P2 and P4: "*Initial ETCO2 indicates hyperventilation*."

The researcher agrees with R1 and R2. This in effect means that none of participants encountered any patient adverse effects. With regards to R3's comment above, the researcher is convinced that the initial accidental hyperventilation was short-lived and was unlikely to contribute as an adverse event.

However, it is important to note that P3's data reporting was poor. This made it a bit challenging for the review panel and the researcher to accurately gauge the incidence of adverse events as a result of RSI.

9.9.9. General comments by the expert clinical panel

General comments on the clinical practice of RSI have been captured from each of the participants' patient reports. These are provided hereafter.

9.9.9.1. Comments from Reviewer 1:

Comments on P1: "*Well conducted case – minor differences from anaesthetic succinylcholine dosage and confirmation with no impact on patient outcome or quality of care.*" [First patient].

Comments on P2: "*Well conducted case. Tidal volume difficult to record with BVM. Hyperventilation unlikely with rate used*."

Comments on P3: "*Poorly documented case. Inappropriate drug selection. Uncertain of protocol for "on the road" training of students but the technique chosen is likely to have reduced rather than improved the confidence of the students and given them a false impression of the efficacy of muscle relaxation as opposed experience with intubation.*"

Comments on P4: "*Well conducted case. Good 'post-mortem'. Excellent learning experience for student.*" [First patient].

9.9.9.2. <u>Comments from Reviewer 2:</u>

Comments on P1: "*Classic isolated head injury. Dose of post-RSI Vecuronium may be a bit low*." [First patient].

Comments on P2: "*Patient was flown by a helicopter therefore ventilator not used. Does helicopter not have a ventilator? It would appear that the importance of continued use of a ventilator needs reinforcing*."

Comments on P3: "*A number of concerns exist with this case – why was sedation-only intubation attempted first this shows a serious lack of thought. No use of ventilator due to closeness of hospital either a) RSI not appropriate because close to ED or b) not aware of important role of ventilator. Considering the initial GCS was 8 why no Vecuronium or additional sedation used?"*

Comments on P4: "*This seemed to have gone well – couple of issues*

1) *Ventilator not used – continued to rely on BVM [bag-valve-mask] – education is required*
2) *Dose of Vecuronium low – should have been 6-8mg (4mg = 1 ampoule) but important is the lack of post-RSI sedation. Note the increase in BP on the last recording – this could be suggestive of patient distress."* [First patient].

9.9.9.3. Comments from Reviewer 3

Comments on P1: "*Rather high dose of sux although the data collection sheet does not provide for weight and it is therefore difficult to evaluate dose vs. weight*" [First patient].

Comments on P2: "*The patient should have been mechanically ventilated (although the responsibility for this was passed to an aeromedical crew). It is clear that as per existing evidence (and a prehospital reflection published by this department* [DEMCR] *that hand ventilation makes it very difficult to maintain stable $EtCO_2$ / $PaCO_2$. No post-intubation medications – perhaps even more important that these are provided prior to aeromedical evacuation*."

Comments on P3: "*Amazed by the use of midazolam / morphine induction combination. This in effect was not RSI – Rapid Sequence Induction. This was more a case of sedation-only attempts followed by a crash intubation following failed intubation. Emphasis on mechanical ventilation should be increased. No post-intubation medications! Even with a short drive to casualty* [hospital emergency unit] *the effects of sux at least would have been wearing off.*"

Comments on P4: "*Disappointing that mechanical ventilation not used. Also $EtCO_2$ should have been available immediately. No on-going sedation?*" [First patient].

9.9.10. General comments after researcher review

The researcher's role in implementing the practice of RSI allows a broader view of the cases being reviewed. The researcher had more available information about each participant's clinical cases after being able to interview them, which led to a different opinion to the experts in some instances. It is quite evident that three of the four cases were appropriately conducted in the initial stages. One of the cases requires some serious re-education and reflection and by the participant.

The dose of succinylcholine seems to be too convenient i.e. a one ampoule approach whereas it should be calculated based on the patient's weight.
There seems to be a general lack of use of post RSI sedation and paralysis

Post-intubation management seems to be an area that needs re-visiting in terms of emphasis during education and training.

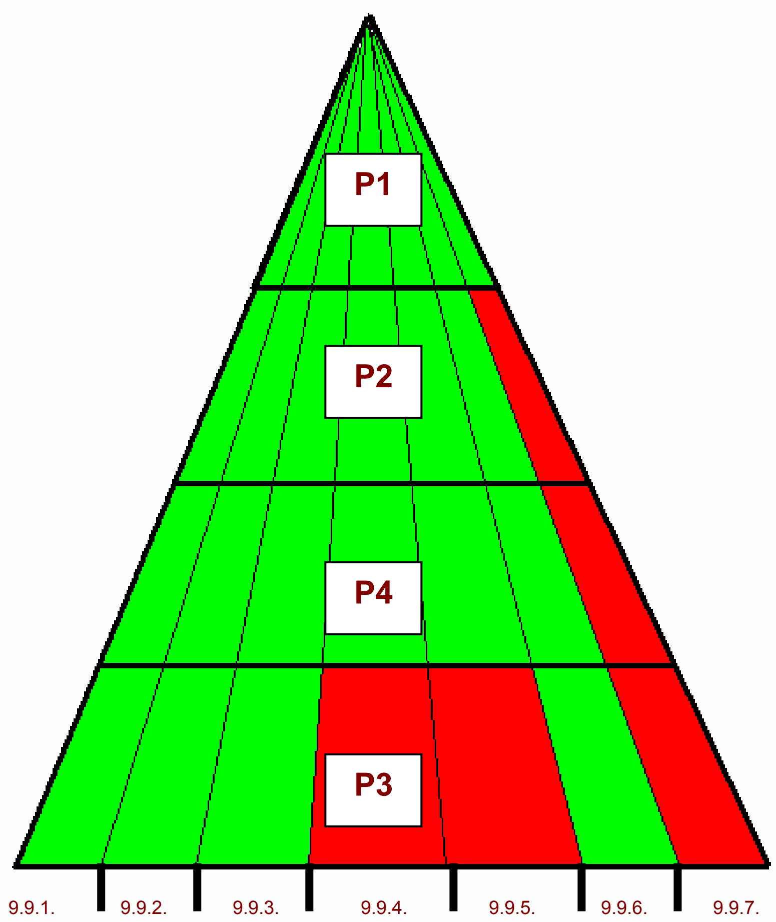
9.9.11. Skill competence versus practitioner confidence

Although three of the four participants seemed to be very confident about their decision making in relation to RSI, not all participants were completely competent in undertaking RSI according to the DEMCR recommendations. Figure 9-6 consists of a graphic representation of the participants' competence with respect to the seven key areas of competence which have been discussed above. It seems that P1 shows complete competence in all seven areas, whereas P3 seems to be lacking in three areas of competence.

Figure 9-6: Identification of RSI competence

KEY: Green shaded areas = Competent; Red shaded areas = Not yet competent

9.9.1.	=	Was an appropriate patient or clinical condition chosen?
9.9.2.	=	Was preoxygenation undertaken?
9.9.3.	=	Was the patient's heart rate, oxygen saturation and blood pressure recorded prior to RSI?
9.9.4.	=	Were the appropriate drugs selected?
9.9.5.	=	Were appropriate drug doses used?
9.9.6.	=	Was an appropriate method of ET-tube placement confirmation used?
9.9.7.	=	Were the ventilator settings appropriate?



Marteau, Wynne, Kaye and Evans (1990: 849) indicate that there is a "tendency to invoke competence after successful performance of a procedure but not question it after failure. Though this tendency may protect the practitioner's self-esteem, it may stand in the way of a realistic perception of competence."

Although levels of general personal confidence could not be measured, the researcher picked up on this during the participant interviews by the tone of their voices, level of active participation and comments made in the interview. It was clear to the researcher that P1, P2 and P4 were very confident about their ability to make clinical decisions *(see Ch. 5, Sec. 5.3.1.7, Ch. 6, Sec. 6.3.1.7 and Ch. 8, Sec. 8.3.1.9)*. This was probably because of their general clinical experience *(see 9.4.2)*, whereas it was evident that P3 wasn't very comfortable making major clinical decisions. In the case of P3, the general lack of experience might have contributed to this lack of confidence *(see Ch. 7, Sec. 7.3.1.7)*.

In Figure 9-6, it is very evident that even the confident participants (P2 and P4) showed a lack of competence in certain areas of RSI. Only P1 was completely competent in all areas, whereas P3 lacked competence in three different areas. P2 did however, during the interview realise that his post-intubation management was problematic which showed critical reflection on his practice *(see Ch. 6, Sec. 6.3.2.7)*. The general problem area seems to be post-intubation management, where more emphasis may need to be placed during teaching.

9.10. The answer to the first of the secondary questions

It is quite clear that for the most part, three of the paramedics were correctly applying the guidelines approved by the DEMCR, to undertake the RSI process. However, much remains to be done to improve practice, as the case reviews revealed gaps in the way paramedics apply the guidelines. A review of practitioner competence must be conducted to ensure safe practice of RSI.

9.11. Re-visiting the second secondary question

The questions was:

Is there a need for the rapid sequence intubation guideline set out by the Department of Emergency Medical Care and Rescue to be reviewed?

9.11.1. Formulating the answer to the second secondary question

This question will be answered by reviewing textual data from the interviews and by applying the researcher's expert opinion as the person responsible for implementing the RSI procedure.

9.11.1.1. Current guidelines

The current RSI guidelines developed by the researcher, takes the form of a written handbook that encompasses all aspects pertaining to advanced airway management *(see Ch. 2, Sec. 2.6)*. It is currently very comprehensive and includes both an algorithmic approach and an open-minded approach. All the necessary tools for making the appropriate clinical decision are found in the handbook.

According to P4, *"… the algorithmic thing is right because if you have that, then when the paw-paw hits the fan, you're not going to forget, you're gonna follow a step. Still, it doesn't take away the thought…it doesn't replace the decision to say, 'should I intubate him or shouldn't I'."*

9.11.1.2. The need for reviewing the guidelines

9.11.1.2.1. Participant perspective

The participants have indicated that the current guidelines are very useful, although a few adjustments need to be made.

P1: *"it's quite a complicated decision tree umm... I think algorithms are internationally are accepted as err...um... good ways to standardize umm… clinical interventions… but … not all patients will fit into that algorithm. So, I think they are useful but I think umm...clearly there has to be guidelines again because patients will fall inside and outside of those."*

P4: *"I think the advanced airway management guideline, from what I can remember…I think is just a little bit too much. I think they are good, but I think there needs to be a scaled down memory-jogger version."*

"I think I've had out my paper with the drugs on…you know, every time I do it. I think that putting out a little chart….like a little easy to follow algorithmic step that goes through it…is right."

9.11.1.2.2. Researcher perspective

Based on the current clinical practice gauged from the interviews, the researcher recommends that the current guidelines be simplified, with more basic decision trees to follow. The guidelines need to be further developed in the specific decision steps with regards to post-intubation management.

The researcher also realizes the need for a simplified pocket-size version of the guidelines for quick reference. There is a definite need for these guidelines, both as a guide to algorithmic decision making and to provide critical information to guide overall clinical decision making during advanced airway management.

9.11.2. The answer to the second secondary question

Yes, there is a need for the guidelines to be reviewed. The guidelines will be reviewed in the near future, by the researcher in consultation with external experts.

9.12. Re-visiting the third secondary question

The third secondary question was:

What measures can be put in place to improve or enhance clinical decision making surrounding rapid sequence intubation?

9.12.1. Formulating the answer to the third secondary question

After a comprehensive analysis of the data, the researcher was able to make specific recommendations as to what measures need to be put in place to improve or enhance clinical decision making surrounding RSI. A large part of the recommendations will be gleaned from participants' statements and recommendations. Specific measures are described hereafter.

9.12.1.1. Clinical governance of RSI

9.12.1.1.1. The need for clinical governance of RSI

There is an urgent need for a formalized clinical governance arrangement for the practice of RSI. The current arrangement through the DEMCR is temporary for the purposes of this study. A formalized arrangement should consist of active quality assurance programs to assess and maintain the quality of RSI performance and also have database tracking of all RSI interventions.

9.12.1.1.2. Clinical governance within individual pre-hospital care systems

Every emergency service, both private and provincial, should have individual governance systems in place. This should result in improved control of practice in the pre-hospital environment.

P1: *"I think also what's probably more important, is that individual prehospital care systems have to have a governance system in place to monitor to measure, to assure the quality of the clinical services that are being offered and that by and large does not exist in Africa."*

9.12.1.1.3. The role of the PBECP

The role of the PBECP needs to be clearly defined for pre-hospital practitioners, and the board needs to be more involved with respect to the oversight of the running of emergency services, especially where RSI is concerned.

P2: *"The board should be in charge of clinical governance. They're not doing it to the best of their ability at the moment…… ideally I would…you would want the board to be more involved with the management of the different services, to make sure that clinical governance is being conducted."*

P1: *"…need to be a professional board that's built for purpose which isn't at the moment. Through no fault of their own bar the fact that they, quite frankly, don't have the balls to make decisions. You know, they also* *don't have the experience to make decisions because they're not able to because they are squeezed by beaurocracy, so we do need to have a professional board at a regulatory level."*

9.12.1.2. <u>Education and training recommendations</u>

9.12.1.2.1. There needs to be more emphasis placed on scenario-based learning to highlight and test different situational difficulties and improve the clinical decision making process surrounding RSI.

P4: *"...there needs to be more on the whole post-intubation management. I think a lot of emphasis needs to be placed on considering an airway and scenario training…whether its paper-based scenarios or simulation manikin-based scenarios, I think there needs to be a lot more practice ones of those of when you would make the decision, and what your whole process will be…I think that maybe having more emphasis placed on formal airway evaluation, because I think if you don't go through a stepwise, you're gonna forget things."*

P1: *"I think they could be more practical err... scenario based teaching because at the end of the day, RSI is a skill. It's a practical skill umm... after the decision's been made…I think there could be more work done on the clinical decision making and the reason that I highlight that, is because I had opportunity to attend an RSI course run by the military and they spent a huge amount of time on testing the decision making by presenting scenarios.."*

9.12.1.2.2. There needs to be more strategies put in place to integrate theoretical knowledge with psychomotor skills.

P1: *"I think we've gone a long way here in terms of the theory component although I think we still need to do a bit more on the psychomotor integration of theory with practice..."*

9.12.1.2.3. Pre-hospital work integrated learning may be necessary for the less experienced paramedic wishing to undertake RSI.

Pre-hospital work integrated learning may be a key factor affecting the development of clinical experience of a new paramedic. This work integrated learning may need to take place during the teaching and learning phase of the BTEMC programme.

P3: *"…maybe if we went and RSI'd you know…like training on a real patient with you or whoever our trainer would have been…not in hospital you know….I think it would have been better. Because it's different…it's more different RSIing in the pre-hospital context than it is in theatre….It would have been much nicer if one of the trainers…would work with us on the road…I don't know, a couple of hours…show us how to RSI a real patient in the pre-hospital environment."*

9.12.1.2.4. There is a need for an internship program for the NDEMC program.

Graduates should probably spend at least six-months to a year as a supervised practitioner. This should certainly improve their decision making ability and allow for general experience generation. After at least a year, this graduate may then be ready to undertake the BTEMC program.

P3: *"I've practiced for three years under someone's supervision and now I suddenly have to go out and make my own decisions about what I'd do for the patient, how I manage the patient. It's just too scary you know."*

P4: *"I think that there should be some sort of internship. It would be difficult to put in, but I think that there needs to be something like that and even if it means that for six months or a year, all their cases get reviewed. Not just their RSI cases, all of their cases."*

9.12.1.3. Stakeholder involvement and updates

In order to improve professional relationships with medical personnel outside of the pre-hospital environment, systems need to be put in place to update doctors, nurses and other emergency care providers of the new paramedic-RSI procedure. This may enhance patient benefits by facilitating the maintenance of the continuum of care.

9.12.1.4. Prescription of minimum requirements for RSI practice

There is an urgent need for the PBECP to publish an official practice guideline for the new Emergency Care Practitioner register. This guideline should prescribe the minimum logistical requirements for undertaking RSI.

P1: *"...the professional board needs to put…a position statement on prehospital RSI or part of the existing protocol system then it very clearly defines the minimum requirements to do RSI.."*

9.12.1.5. Standard operating procedures

Currently there is an unwritten understanding that when a practitioner assumes responsibility from another practitioner or gives responsibility to another practitioner, there should be a full report given to the respective practitioner. This however does not always happen.

P4: *"We didn't do a great detailed assessment because I trusted the paramedic who already assessed her that she needed to be intubated."*

P2: *"the helicopter crew were basically…actually didn't take the responsibility away from me regarding ongoing paralysis…just that the hospital was a stone throw away from the scene."*

There should be a written standard operating procedure for these kinds of situations, stipulating the responsibilities of the respective practitioners, especially regarding levels of qualifications in terms of maintaining the standard of care.

9.12.2. The answer to the third secondary question

Many discussion points have emerged in response to the third secondary question. These have revealed the key areas that need to be addressed in terms of improving clinical decision making surrounding RSI. In summary, the following measures need to be put in place:

- Institute proper controlled clinical governance of RSI
- Improve education and training programs by:
  - emphasizing scenario-based learning
  - developing strategies to integrate theoretical knowledge with psychomotor skills
  - introducing pre-hospital work integrated learning for the less experienced paramedic wishing to undertake RSI
  - introducing an internship component for the NDEMC program
- Increase stakeholder involvement and hold regular updates on changes in professional practice
- Prescribe minimum requirements for RSI practice
- Develop standard operating procedures for transfer of responsibility of clinical management

9.13. Conclusion

The categories and the linkages between them have been integrated into a conceptual model. The core category of 'timing of decisions' underpins the relationships between the categories along the decision making continuum, from prior to arrival on the scene to post-delivery of the patient at hospital. The case study approach has proven to be of great value in developing the theoretical concepts that have contributed to the overall conceptual framework (*see Figure 9-7*).

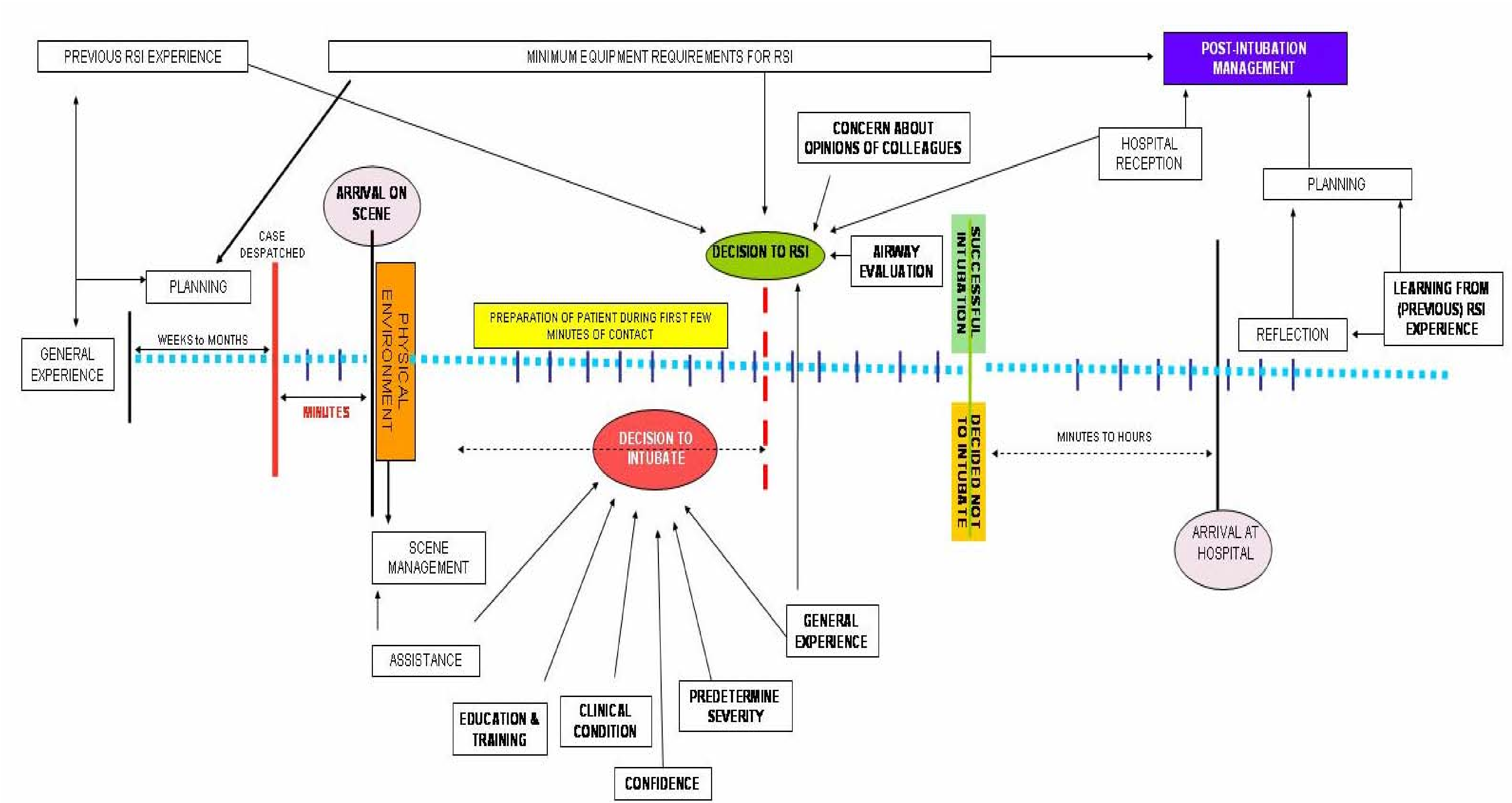


Figure 9-7: The conceptual framework for clinical decision making surrounding rapid sequence intubation of the critically ill or injured patient in the prehospital environment.

CHAPTER TEN

CONCLUSIONS AND RECOMMENDATIONS

10.1. Conclusions

It can be concluded from this study that emergency airway management of a critically ill or injured patient is a difficult task requiring successive execution of multiple critical decisions and tasks and that small errors at critical decision points may quickly magnify to result in airway compromise and patient death.

This study has produced a comprehensive model for clinical decision making surrounding RSI, as well as practical measures that can be implemented to improve paramedic practice.

The primary research question has most certainly highlighted the risk factors, associated with clinical decision making related to pre-hospital RSI. These identified factors have paved the way for the recommendations to the PBECP. The recommendations that follow aim to improve or enhance clinical decision making surrounding RSI in this setting and should eventually lead to patient benefits.

10.2. The findings

The initial analysis using open coding seemed confusing. However, as the simultaneous data gathering, analysis and search for relevant literature continued, categories that were logical and meaningful gradually emerged. After connecting these categories though the process of axial coding, a conceptual framework for understanding the clinical decisions surrounding RSI was developed. Similarly, although the core category was not initially evident, it became apparent during the axial coding process, which indicated that the timing of clinical decisions surrounding the RSI process related to all the factors and influences operating during the process as well as to the outcome for the patient.

10.3 A brief analysis of the research process for this study

10.3.1.Strengths of the study

The study was unique in that no other study of its kind has been identified within the pre-hospital emergency care arena. The study was much needed for reasons beyond just the implementation of rapid sequence intubation. It has highlighted key areas that are common to many parts of general paramedic practice. The methodology produced credible and trustworthy findings, as a result of key strategies, particularly the use of different methods to triangulate the data.

The key strength of this study was its ability to produce a comprehensive model as well as practical measures that can be implemented to improve practice. The PBECP requested a study that would inform safe practice of RSI and they now have useful findings. The fact that it should lead to action is a great strength, unlike many studies that are largely ignored by policy makers. Another strength is that I obtained such active participation by my colleagues and it is commendable that they were prepared to have their practice scrutinised in this manner.

I have kept a journal of events during the study, leading up to the development of the conceptual model. This journal is a vital tool for me to improve my own research abilities.

10.3.2. Limitations of the study

One limitation of the study was that all participants had an academic background. This is not the norm with general paramedic practice. This might have had an effect the results. Further studies on paramedic decision making, using a wider range of paramedic participants, are needed. The delay between the performance of the RSIs by Participant 4 and the interview may have resulted in the loss of some detail due to the challenge of memory recall. However, this is unlikely to be substantial as the details on the patient report form acted as an aid.

10.4. Recommendations

The outcome of this project has been a conceptual model indicating the factors that influence CDM surrounding RSI. This conceptual model now needs to be tested with further research in the emergency care environment, using paramedic participants. The findings from this study can be used to understand paramedic clinical decision making in a broader context. This may lead to the further development of clinical decision making theory which is relevant for paramedics.

Specific recommendations have already been made in Chapter 9 *(see Sec. 9.12.2)* in respect of the secondary questions. The recommendations that follow are general to the entire study.

10.4.1. First recommendation

The exposure of both paramedic students and new BTEMC graduates to clinical experience is mandatory. This has implications for both educators and EMS administrators. Clinical education needs to provide students with the opportunity to gain as much clinical experience as possible in undergraduate programmes. Whilst tertiary programs may be addressing this need, it is strongly recommended that new graduates undertake at least a year of paramedic internship. Employment of new graduates by EMS administrators needs to go beyond staffing requirements and be sensitive to the provision of clinical exposure that has the potential to enrich and develop beginning practitioners.

10.4.2. Second recommendation

It is recommended that new graduates from the NDEMC program not be allowed to start the BTEMC program until the relevant academic department is satisfied that the individual has received adequate clinical exposure as an ALS practitioner. Adequate clinical exposure should be nothing less than two years of full time operational experience.

10.4.3. Third recommendation

A formal clinical governance mechanism should be implemented by the PBECP and by EMS administrators with strong involvement from the PBECP in regional and local EMS systems.

10.4.4. Fourth recommendation

The PBECP needs to publish minimum national standards for the practice of RSI to ensure safe and consistent decision making.

10.4.5. Fifth recommendation

The PBECP needs to formulate formal standard operating procedures for the transfer of practitioner responsibility for patients. This must include inter-ALS practitioner transfer and transfer between the ALS practitioner and other health care professionals.

10.4.6. Sixth recommendation

With the introduction of pre-hospital RSI, we need to educate the rest of the medical fraternity to obtain co-operation and continuation of care of our patients. This needs to happen either through a publication or through a forum that targets the relevant professionals.

10.5. The research journey

For me as the researcher, this was truly a journey into the unknown. I perceived this as a challenge and decided to embark on a path that would eventually lead to a whole new world of understanding. This was because I already had a great interest in quantitative research, yet chose to explore the qualitative.

I am passionate about contributing to the body of knowledge of the emergency care profession, and even more passionate about improving clinical practice. Initially, I set out to bring about a rapid change in the EMS profession, but soon realized that this had to be done ‘one master’s project at a time’. As a result, this research project changed from a very large scale complicated study to a very focused more manageable one. The study nevertheless yielded remarkable truths about issues surrounding paramedic clinical decision-making.

There was a lot of frustration in the early stages of this study, as I had to face both personal and academic challenges. During the course of this study, I sustained the loss of a sibling and a parent, and was also faced with having to find a new supervisor for the project.

Together, these led me to consider abandoning the project but fortunately I did not. Conducting this study has been quite a difficult period for me and I have yet to experience a more challenging phenomenon.

From a personal point of view, I have watched myself grow from being somewhat wary about working within the interpretive paradigm, which was new for me, to realizing that the research problem determines the appropriate paradigm. I am now more confident in this aspect of research and feel ready to take on future challenges. Research has become my passion and I am looking forward to publishing some of my work.

Through many a personal crises and family tragedies, I have only my heavenly Father to thank for weathering the storms with me. I am truly blessed to be at this point, as I never would have thought I could get here.

The most important thing that I have learnt throughout this process was to completely trust in God!!

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ANNEXURE 0 : Interview procedure guide

Interview Procedure Guide

1. Thank you for taking the time to be interviewed for this study

2. Introduce myself and the purpose of the interview

3. Remind participant of confidentiality and anonymity of interview

4. Questions:

    a. So, you've have had the opportunity to RSI a patient. Tell me a little about your first experience

    b. Can you describe some of the particular challenges that you might have had during the management of your patient?

    c. Do you believe that you have been adequately prepared for undertaking RSI? Please elaborate.

    d. What would you say went well during the clinical management of your patient, specific to airway management?

    e. What is your feeling about paramedics having professional autonomy?

    f. In hindsight, is there anything that you would have done differently during the RSI process?

    g. Additional questions leading from comments from the participants.

5. Thank you once again for your time and availability. Go well!

ANNEXURE 1 : Sample patient report form

DEPARTMENT OF EMERGENCY MEDICAL CARE AND RESCUE

Pre-hospital Airway Management and Rapid Sequence Intubation Patient Data Collection Form

A DESPATCH DETAILS

EMS Service Name ________________
Case ref no. ________________
Time despatched _____h______
Time arrived on scene _____h______
Time mobile to hospital _____h______
Time arrived at hospital _____h______

B PATIENT DETAILS

Date (dd/mm/yy) : _____/______/_______

Race ☐ Black ☐ White ☐ Asian ☐ Coloured
Gender ☐ Male ☐ Female
Date of birth (dd/mm/yy): ______/_____/_____
Age (approx) ___________ yrs

C REASON FOR INTUBATION

CLINICAL INDICATION

- Apnoea or inadequate respirations ☐
- Airway reflex compromised ☐
- Ventilatory effort compromised ☐
- Injury/illness involving airway ☐
- Potential for compromised airway ☐
- Other (Specify) __________________ ☐

DIAGNOSTIC INDICATION

- Isolated severe head trauma ☐
- Near fatal asthma ☐
- Life-threatening arrhythmia ☐
- Polytrauma ☐
- Cardiac arrest ☐
- Other(Specify) __________________ ☐

D AIRWAY ASSESSMENT FOR DIFFICULT LARYNGOSCOPY

- Orofacial trauma ☐
- Secretions ☐
- Blood ☐
- Vomitus ☐
- Decreased neck mobility ☐
- Anatomical difficulty ☐
- Other (Specify)_________________ ☐

E VITAL SIGNS

	PRE-RSI		*RSI*	*POST RSI*	
	O / A	5min.	10min.	15min.	20min.
Time recorded					
Pulse rate					
Blood Pressure					
Respiratory rate					
Consciousness level					
Alert					
Verbal response					
Pain response					
Unresponsive					
G.C.S. (Head injury only)					
Eye response (__/4)					
Verbal response (__/5)					
Motor response (__/6)					
SaO2		%	%	%	%
ETCO2			mmHg	mmHg	mmHg

F PRE-OXYGENATION

Number of vital capacity breaths _______
Duration of 100% oxgen via facemask _______ min.

G PRE-TREATMENT

		Dose	Time
Atropine	☐	_____mg	___h___
Lidocaine	☐	_____mg	___h___
Other(Specify) _____________	☐	_____mg	___h___

H INDUCTION

		Dose	Time
Etomidate	☐	_____mg	___h___
Ketamine	☐	_____mg	___h___
Other (Specify) _____________	☐	_____mg	___h___

I PARALYSIS

		Dose	Time
Succinylcholine	☐	_____mg	___h___
Vecuronium	☐	_____mg	___h___
Rocuronium	☐	_____mg	___h___
Other (Specify) _____________	☐	_____mg	___h___

J ENDOTRACHEAL INTUBATION ATTEMPT

N.B. Direct laryngoscopy is regarded as an 'attempt'

1st attempt successful	☐ YES	☐ NO	
2nd attempt successful	☐ YES	☐ NO	☐ N/A
3rd attempt successful	☐ YES	☐ NO	☐ N/A
4th attempt successful	☐ YES	☐ NO	☐ N/A

DEPARTMENT OF EMERGENCY MEDICAL CARE AND RESCUE

Pre-hospital Airway Management and Rapid Sequence Intubation Patient Data Collection Form

K TUBE PLACEMENT CONFIRMATION METHOD

- Chest auscultation ☐
- Bulb aspiration ☐
- Syringe aspiration ☐
- Colorimetric ETCO2 ☐
- Waveform ETCO2 ☐
- Visualization of tube thru cords ☐
- Other (Specify) _______________ ☐

L FAILED INTUBATION (Alternate method of airway support)

- BVM ☐
- Surgical airway ☐
- Needle crichothyrotomy ☐
- Laryngeal tube ☐
- Combitube ☐
- Laryngeal Mask Airway ☐
- Not applicable ☐

M POST-INTUBATION MEDICATIONS

		Dose	Time
Midazolam	☐	____mg	___ h____
Morphine	☐	____mg	___ h____
Ketamine	☐	____mg	___ h____
Vecuronium	☐	____mg	___ h____
Rocuronium	☐	____mg	___ h____
Other(Specify) ___________	☐	____mg	___ h____

N MECHANICAL VENTILATION

- PEEP ☐
- Ventilation volume (ml/kg) ______ml/kg
- Ventilator rate (bpm) ______bpm
- Model of ventilator _________(eg. Oxylog 1000)
- Mode of ventilation
  - ☐ CMV
  - ☐ SIMV/IMV
  - ☐ CPAP
  - ☐ Other:___________

- BVM ventilation (in absence of ventlator) ☐
- Reason for non-mechanical ventilation
  - ☐ Unavailable
  - ☐ Ventilator malfunction
  - ☐ No oxygen supply
  - ☐ Prefer using BVM
  - ☐ Other: ___________

BVM ventilation performed by:

- ☐ BAA
- ☐ AEA
- ☐ Paramedic
- ☐ Doctor
- ☐ Other: ___________

O MONITORING AND OTHER TREATMENT

- ECG ☐
- IV Access ☐
- CPR (ECC) ☐
- Pulse oximetry ☐
- C-spine immobilization ☐
- Gum elastic bougie ☐
- Other (Specify) ☐ ____________

P CRITICAL COMPLICATIONS ENCOUNTERED

- Failed intubation effort ☐
- Trauma to patient from intubation effort ☐
- Adverse response to paralyzing agents ☐
- Oesophageal intubation-delayed detection ☐
- Oesophageal intubation-detected in hospital ☐
- Tube dislodged during transport/patient care ☐
- Other : ______________________________ ☐

Q COMMENTS

ANNEXURE 2 : Clinical checklist used by clinical expert panel

Patient report form/Paramedic participant number :

Expert Clinical Review of Paramedic Performed Rapid Sequence Intubation

PART 1: Did the Paramedic undertake RSI appropriately?			
INTERVENTION	**YES**	**NO**	**COMMENTS**
Appropriate patient/clinical condition?			
Preoxygenation?			
Pre RSI heart rate, SpO_2 & BP recorded?			
Appropriate drug selection?			
Appropriate drug dose?			
Appropriate method for confirmation of ET-tube placement?			
Appropriate ventilator settings used?			
PART 2: Were there any adverse effects encountered as a result of RSI?			
INTERVENTION	**YES**	**NO**	**COMMENTS**
Desaturations?			
Accidental hyperventilation?			
Accidental hypoventilation?			
Bradycardia?			
Hypotension?			

General comments:

ANNEXURE 3 : Durban University of Technology: Ethics approval

M E M O R A N D U M

TO : Mr R Naidoo
Head: Department : Emergency Medical Care and Rescue

FROM : Mr Vikesh Singh
Faculty Officer : Faculty of Health Sciences

DATE : 12 September 2006

MASTERS DEGREE IN TECHNOLOGY : EMERGENCY MEDICAL CARE
MR Y PILLAY - STUDENT NO: 19908439

The research proposal for the above student has been approved by the Faculty of Health Sciences Research Committee..

The Faculty of Health Sciences Research Committee requires that you please be reminded that it is your overall responsibility as Head of Department to monitor the progress of this student's research.

Enclosed please find attached:

(1) A copy of the approved budget.
(2) A copy of the approved DUT186

I have requested the finance department to transfer the above amounts into the relevant departmental accounts.

NOTE:- **This funding is not paid directly to the student but is controlled by the Head of Department. Any proposed changes to this funding allocation needs the approval of the supervisor, and the Faculty of Health Sciences Research Committee.**

Thank you

VIKESH SINGH
FACULTY OFFICER
FACULTY OF HEALTH SCIENCES

FACULTY OF HEALTH SCIENCES

DIT 186 – RESEARCH PROPOSAL

SECTION A

Student Number:. **19908439**

Surname:. **PILLAY** Title: **Mr.**

Full First Names:. .**YUGAN**

Postal Address:. .**52 Summerfield Road, Bayview, Chatsworth, 4092**

Telephone No:. **(031) 373 5269 (Work)** **(083) 6668545. .(Home)**

Date of Birth:. **02 April 1975**

Post matriculation (or equivalent) qualification/s attained (attach certified copy/ies)
N.Dip.: Emergency Medical Care
B.Tech.: Emergency Medical Care

Qualification for which topic is to be registered:
Master's Degree in Technology: Emergency Medical Care

Title of MINIDISSERTATION (in respect of Master's Degree in Technology)
"Clinical decision making by paramedics in emergency rapid sequence intubation"

Estimated direct total costs of research to Durban University of Technology: **R 10 000**

ANNEXURE 4 : Health Professions Council of SA: Research approval

HPCSA
Health Professions Council of South Africa

553 Vermeulen Street
Arcadia, Pretoria

PO Box 205
Pretoria, 0001

Tel: +27 (12) 338 9480
Fax: +27 (12) 328 4862
Email: altap@hpcsa.co.za
Website: www.hpcsa.co.za

PROFESSIONAL BOARD FOR EMERGENCY CARE PRACTITIONERS

Mr Y Pillay
Durban University of Technology
P.O. Box 1334
Durban
4000

Department: PROFESSIONAL BOARDS
Senior Manager: DR N T MOSIA
Manager: Mrs A Pieters
My Ref: 19/7/P
Date: 10 May 2007

Dear Sir

RESEARCH PROPOSAL: PROTOCOL FOR PRACTICE OF PRE-HOSPITAL RAPID SEQUENCE INTUBATION (RSI) AND THROMBOLYSIS

I wish to confirm that the Professional Board for Emergency Care Practitioners in October 2004 noted that the Executive Committee approved the research proposals by Durban Institute of Technology (now Durban University of Technology) on pre-hospital thrombolysis and RSI and that research participants be entered into a national registry to be administered by the Durban Institute of Technology (now Durban University of Technology)

Yours faithfully

MRS A PIETERS
PROFESSIONAL BOARD MANAGER

ANNEXURE 5 : Letter of information to participants

LETTER OF INFORMATION – PARAMEDIC PARTICIPANTS

Dear Participant

Welcome to my study and thank you for your interest. The study is titled, "***Clinical decision making by paramedics in emergency rapid sequence intubation*** "

Name of Supervisors:		Dr. Linda Grainger (grainger@telkomsa.net)
	:	Mr. Nicholas Castle (nicholas.castle@ntlworld.com)
Name of Student	:	Yugan Pillay (031-3735269 / 083 666 8545)
Name of Institution	:	Durban University of Technology Dept. of Emergency Medical Care & Rescue

Purpose of the study: The purpose of this study is to understand the factors influencing the clinical decision making process of RSI administered by South African advanced life support practitioners who have obtained the B.Tech.:Emergency Medical Care through the Durban University of Technology. This should assist the Professional Board for Emergency Care Practitioners with the implementation of RSI.

Procedure: You will be required to perform your usual duties as an operational paramedic, although you will be required to document all definitive airway management cases that are potential RSI candidates, on a purpose-designed patient report form. You will be required to attend one or more interviews with the researcher, on a one-on-one basis, in order to discuss your experience of rapid sequence intubation. These interviews will occur at a mutually acceptable time, and will not last more than an hour.

Risks: There are no risks involved as all information divulged will be kept confidential.

Benefits: There are no financial benefits from this study, however it may contribute to your own professional development.

All participant information is confidential and the results will be used for research purposes only. You have the right to be informed of any new findings that are made. You may ask questions of an independent source if you wish to (see supervisor contact details above). If you are not satisfied with any area of the study, please feel free to forward any concerns to my supervisor. Thank you once again for your interest and your decision to participate in this study.

Yours faithfully

Yugan Pillay (M.Tech. Emergency Medical Care – Final year student)

LETTER OF INFORMATION – CLINICAL EXPERTS

Dear Participant

Welcome to my study and thank you for your interest. The study is titled, "***Clinical decision making by paramedics in emergency rapid sequence intubation*** "

Name of Supervisors:		Dr. Linda Grainger (grainger@telkomsa.net)
	:	Mr. Nicholas Castle (nicholas.castle@ntlworld.com)
Name of Student	:	Yugan Pillay (031-3735269 / 083 666 8545)
Name of Institution	:	Durban University of Technology Dept. of Emergency Medical Care & Rescue

Purpose of the study: The purpose of this study is to understand the factors influencing the clinical decision making process of RSI administered by South African advanced life support practitioners who have obtained the B.Tech.:Emergency Medical Care through the Durban University of Technology. This should assist the Professional Board for Emergency Care Practitioners with the implementation of RSI.

Procedure: As an expert in the field of emergency airway management, you will be consulted to determine whether the participants are correctly applying the RSI protocol, and also to identify possible issues surrounding the use of RSI in particular situations. You will be required to complete a checklist for particular patients that have been treated with rapid sequence intubation by paramedics that have completed a B.Tech.: Emergency Medical Care. You will be required to attend one or more interviews with the researcher, on a one-on-one basis, in order to discuss your views of each rapid sequence intubation case that you will have done a checklist for. These interviews will occur at a mutually acceptable time, and will not last more than an hour.

Risks: There are no risks involved as all information divulged will be kept confidential.

Benefits: There are no financial benefits from this study, however it may contribute to your own professional development.

All participant information is confidential and the results will be used for research purposes only. You have the right to be informed of any new findings that are made. You may ask questions of an independent source if you wish to (see supervisor contact details above). If you are not satisfied with any area of the study, please feel free to forward any concerns to my supervisor. Thank you once again for your interest and your decision to participate in this study.

Yours faithfully

Yugan Pillay (M.Tech. Emergency Medical Care – Final year student)

Annexure 6:INFORMED CONSENT FORM – PARAMEDIC PARTICIPANT

Date : _______/______/_____

The title of the research project is "***Clinical decision making by paramedics in emergency rapid sequence intubation***"

Name of Supervisors	:	Dr. L. Grainger (grainger@telkomsa.net)
	:	Mr. Nicholas Castle (nicholas.castle@ntlworld.com)
Name of Research Student	:	Yugan Pillay (031-3735269 / 083 666 8545)
Name of Institution	:	Durban University of Technology
		Dept. of Emergency Medical Care & Rescue

The purpose of this study is to understand the factors influencing the clinical decision making process of RSI administered by South African advanced life support practitioners who have obtained the B.Tech.:Emergency Medical Care through the Durban University of Technology. This should assist the Professional Board for Emergency Care Practitioners with the implementation of RSI.

Please circle the appropriate answer

1. Have you read the participant information sheet? YES / NO
2. Have you had the opportunity to ask questions regarding this study? YES / NO
3. Have you received satisfactory answers to your questions? YES / NO
4. Have you had an opportunity to discuss this study? YES / NO
5. Have you received enough information about this study? YES / NO
6. Who have you spoken to?___________________________________
7. Do you understand the implications of your involvement in this study? YES / NO
8. Do you understand that you are free to withdraw from this study? YES / NO
    a) at any time?
    b) Without having to give a reason for withdrawing and
    c) Without affecting your future training
9. Do you agree to voluntarily participate in this study? YES / NO

PARTICIPANT NAME : __________________________________ (in block letters)

Signature : _________________________

WITNESS NAME : _____________________________(in block letters)

Signature : _________________________

RESEARCH STUDENT : Yugan Pillay Signature:_______________

If you have answered NO to any of the above questions, please do not hesitate to contact my supervisor/s who will be able to assist you.

ANNEXURE 7 : Advanced airway management guidelines

Advanced Airway Management Guidelines 2007

DURBAN UNIVERSITY of TECHNOLOGY

DEPARTMENT OF EMERGENCY MEDICAL CARE AND RESCUE

Baccalareus Technologiae:
Emergency Medical Care
(BTEMC1)

Module: Intensive Care
(EMCA421)

Faculty of Health Sciences

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AN OVERVIEW OF RAPID SEQUENCE INTUBATION

Maintaining control of a patient's airway is one of the most basic interventions that paramedics can undertake to decrease the risk of secondary brain injury and prevent deterioration into cardiac or respiratory arrest because of severe hypoxaemia. The patient with an intact gag reflex often cannot be safely intubated either nasally or orally, leaving the paramedic with limited options to gain control of the airway and ventilation.

Traditionally paramedics have relied on inappropriate medications to facilitate 'safe' intubation. The infamous '15 and 15 morphine and midazolam cocktail' has been repeatedly used by paramedics to allow the passage of an endotracheal tube, with the dose proportionate risk of hypotension, which contributes to the detriment of the patient. [1, 2]

Rapid Sequence Intubation (RSI) involves the rapid administration of a sedative/induction agent and a paralytic agent that extinguishes the patient's ability to breathe on their own. In the pre-hospital setting, critically ill or injured patients typically already have a reduced level of consciousness and the aim then is to ensure that they don't remember the intubation attempt (hence the sedation), but that we get good 'paralysed' conditions early with an effective dose of succinylcholine.

Once paralysis has occurred, the paramedic can successfully intubate and quickly attain control of the patient's airway, without the risk of causing hypotension and/or increasing intra-cranial pressure in the head-trauma victim.

The potential serious danger is that intubation or ventilation may become difficult or impossible and may require insertion of other intermediate airway devices or a surgical crichothyroidotomy to secure the airway.

THE DECISION TO INTUBATE

The decision to intubate should be based on three fundamental clinical assessments: [3]

1. Is there a failure of airway maintenance or protection?
2. Is there a failure of ventilation or oxygenation?
3. Is the clinical course expected to deteriorate?

The results of these three evaluations will lead to a correct decision to intubate or not to intubate in virtually all conceivable cases.

The benefit of obtaining airway control must be weighed against the risk of complications.

GENERAL INDICATIONS FOR RSI [3-7]

a) Respiratory failure
b) Loss of gag reflex or protective airway reflex
c) Glasgow Coma Scale of < 7/15
d) Severe head trauma
e) Combative patient (after ruling out reversible causes)
f) Spinal cord injury
g) Asthma or respiratory illness
h) Status epilepticus (not responding to other therapy)

GENERAL CONTRA-INDICATIONS FOR RSI [3-6]

ABSOLUTE

a) Known hypersensitivity to any drug used in RSI
b) Patient in whom crichothyroidotomy would be impossible
c) Patient in whom intubation would be impossible
d) Neck trauma or swelling that compromises the airway
e) Upper airway obstruction
f) Known or suspected epiglottitis
g) Known history of myasthenia gravis or other skeletal muscle myopathy

RELATIVE

a) Spontaneous breathing with adequate ventilation and airway maintenance.
b) Patient in whom crichothyroidotomy would be difficult
c) Patient in whom intubation would be difficult
d) Entrapped (vehicular or structural) patient with inadequate access to patient and airway.
e) Less than 180^o access to the patients head

COMPLICATIONS OF RSI [3-5]

a) Inability to secure the airway after administration of the paralytic agent
b) Arrhythmias:
   i. Tachycardia
   ii. Bradycardia
   iii. Asystole
c) Aspiration
d) Broncospasm
e) Inability to evaluate neurological status and seizures
f) Emesis
g) Prolonged apnoea
h) Histamine flush

EVALUATION AND RECOGNITION OF THE DIFFICULT AIRWAY

Whilst there may be some limitations with difficult airway prediction [8], a good knowledge of what contributes to laryngoscopy difficulty, coupled with an awareness of patient safety issues in emergency airway management is of crucial importance when deciding when RSI should be avoided.

Difficult laryngoscopy and intubation ordinarily implies that the operator has a poor view of the target i.e. the glottis. The object of identifying difficult laryngoscopy and intubation preemptively is to minimize to the greatest extent possible the likelihood of encountering a failed airway. To identify as many risks as possible to meet the demands of an emergency situation, the mnemonic LEMON [3] is a useful guide:

Look externally:[3, 9] If the airway looks difficult, it probably is.

- The external look specified here, is for external evidence of lower facial disruption that might make both intubation and mask ventilation difficult.
- Look out for small mandible, short neck, large tongue, large teeth and retracted jaw.

Evaluate 3-3-2:[3, 9, 10] First 3

(Adequacy of oral access)

- Ability to accommodate three of the patient's fingers between his/her incisors

Second 3

(Capacity of the mandibular space to accommodate the tongue on laryngoscopy)

- The thyromental distance is represented by the ability to accommodate three of the patient's fingers between the tip of the mentum and hyoid bone.
- More than or less than three fingers are both associated with greater degrees of difficulty in visualizing the larynx.

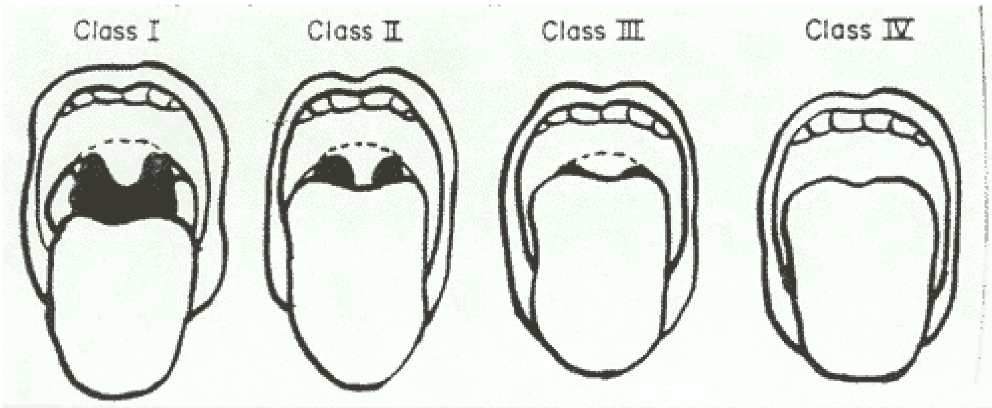
The final 2

(Identifies the location of the larynx in relation to the base of the tongue)

- Ability to fit two of the patient's fingers between his/her hyoid bone and the thyroid notch
- If significantly more than two fingers are accommodated, the larynx is distant from the base of the tongue, indicating that it may be difficult to visualize the glottis
- Fewer than two fingers may mean that the larynx is tucked up under the base of the tongue and may be difficult to expose (anterior larynx).

Mallampati Score:[3, 9, 10]
This score determines the degree to which the posterior oropharyngeal structures are visible and reflects the relationships among mouth opening, the size of the tongue and the size of the oral pharynx.

- In an emergency, a crude Mallampati measure is often all that can be acquired by looking into the supine, obtunded patient's mouth with a lighted laryngoscope blade to gain an appreciation of:
  - how much mouth opening is present
  - how likely the tongue and oral pharynx are to conspire to prevent successful laryngoscopy.



Obstruction: [3] Upper airway obstruction should always be considered as a marker for a difficult airway.
Look out for:
- Muffled voice (hot potato voice)
- Difficulty swallowing secretions (because of pain or obstruction)
- Stridor

Neck mobility: [3] The ability to position the head and neck is one the crucial factors necessary to the achievement of the optimal laryngoscopic view of the larynx.

<u>Some important definitions</u>

Difficult airway control: Airway control difficulty is defined as ventilation dificulty (using either facemask or extraglottic devices) and/or intubation difficulty with standard equipment (curved blade laryngoscope and simple endotracheal tube).[9]

Difficult mask ventilation: Occurs whenever the required tidal volume cannot be administered to the patient. Under this point of view, any mechanical factor limiting mask efficacy (both facemask, LMA, or other supraglottic device) should be considered as predictive factor of ventilation difficulty.

Bag-Valve-Mask-Reservoir Ventilation

The goal of effective oxygenation and ventilation is to deliver 16 to 24 breaths per minute (reduced tidal volume of 500ml) without exceeding the proximal and distal oesophageal sphincter opening pressures of approximately 25cmH_2O.[3] To be successful on both, a appropriate rhythm of bagging must be followed. The rhythm should be similar to "squeeze…release…release…squeeze…release…release)[3]. The goal is to deliver smaller tidal volumes with each breath at an increased rate to maintain an effective minute volum of 10 liters per minute. The application of Sellick's manoevre will minimize passage of air into the stomach.

When initial bag-valve-mask-reservoir ventilation fails to establish or maintain adequate oxygen saturation, better bag and mask techniques must be used. One should immediately employ a two-handed-two-person technique. The following should be considered:

1. Is the mask seal optimal?
2. Are all upper airway adjuncts being properly used?
3. Does the jaw-thrust manoevre need to be re-done to more effectively open the airway?
4. Does a more experienced person need to be recruited to help optimize bag and mask technique?

Difficult Bag-Valve-Mask-Reservoir Ventilation [3,7,10]

It must be remembered that good BVMR ventilation technique is critically important if it is to be a rescue manoevre when orotracheal intubation has failed. To ensure that this is achieved, the airway practitioner must be able to recognize potential difficulties that may be encountered. Some of the common evils of difficult BVMR ventilation include:

***M**ask Seal* : An adequate mask seal can be limited by:

- Bushy beards
- Crusted blood on the face
- Lower facial disruption

Consider using KY jelly or cling film under the mask to improve seal

***O**besity* : Body mass index > 26kg/m^2 = difficult ventilation

- Obese patients – increased resistance to airflow in the supraglottic airway due to redundant tissue.
- Women in third-trimester gestation - increased body mass and resistance to diaphrahmatic excursion by the gravid uterus

***A**ge* : Age > 55 years is associated with a higher risk of difficult BVMR ventilation

- possibly due to loss of muscle and tissue tone in the upper airway consistent with the ageing process.

***N**o teeth* : Mask seal may be difficult in the edentulous patient

- face tends to cave in

Consider leaving dentures in (if available) for BVMR ventilation or gauze swabs may be inserted in the cheeks to puff them out and improve seal.

***S**tiff* : Patients with 'stiff' lungs are resistant to ventilation and require high ventilation pressures

- Reactive airways disease with small and medium airway obstruction including asthma and COPD
- Pulmonary oedema and ARDS

Minimum equipment required to perform RSI

1. Standard advanced life support airway kit
2. End-tidal CO2 monitor (quantitative)
3. Mechanical ventilator
4. Surgical airway kit
5. Intermediate airway devices (at least one of the following):
    a. Laryngeal mask airway
    b. Laryngeal tube airway
    c. Oesophageal Tracheal Combitube
6. ECG monitor
7. Pulse oximeter (integrated or stand-alone)
8. Sphygmomanometer (manual or electronic)

Oxygenation and Ventilation

The literature clearly demonstrates that three things kill with RSI:

1. Failed intubation
    a. Never assume that an endotracheal tube can be easily passed, even if the paramedic is very experienced
    b. Always be prepared for the worst case scenario i.e. bail-out options must be well thought out and prepared
    c. When faced with a possible difficult airway, think carefully about the decision to use paralytic agents

2. Hypoxia
    a. Good pre-oxygenation is critically important to prevent desaturations during the RSI process, especially in the critically hypoxic patient
    b. The use of SpO2 is extremely important to identify and prevent further hypoxia

3. Hyperventilation
    a. The paramedic is directly responsible for the proper direction of mechanical ventilation i.e. the patient should be started on a mechanical ventilator (eg. Oxylog) as soon as possible and avoid prolonged use of the BVMR.
    b. Use of $EtCO_2$ is mandatory to ensure correct ventilation i.e. ideal range should be 34 – 38 mmHg (the aim is to keep the $EtCO_2$ > 29mmHg and < 40 mmHg for the entire pre-hospital period).
    c. Initial ventilator settings: **6 ml/kg @ 10bpm with FiO_2=1**
    d. Adjust ventilator in accordance with SpO_2 and EtCO2 but avoid exceeding: **10 ml/kg and 10bpm** respectively

INDUCTION AGENTS

ETOMIDATE (S5)

Class
General anaesthetics : Ultra-short-acting induction agent. It is a carboxylated imidazole-derived, non-barbiturate, non-narcotic, hypnotic agent

Mechanism of action:
Etomidate appears to have gamma-aminobutyric acid (GABA)–like effects. Unlike the barbiturates, etomidate reduces subcortical inhibition at the onset of hypnosis while inducing neocortical sleep. Etomidate attenuates underlying elevated ICP by decreasing cerebral blood flow and cerebral metabolic oxygen demand. Etomidate does not cause histamine release and is safe for use in patients with reactive airways disease.

Indications: Induction agent for RSI

Contraindications: Adrenal insufficiency

Induction: 0.3 mg/kg IVI (Max.)
Critical hypotension / polytrauma 0.2 mg/kg IVI

Beware overdosing in obese patients as increased drug doses have little impact on fat i.e. do not allow more than 100kg body weight when calculating weight-based dose.

Onset of Action: 30 seconds

Duration of Action: 5-10 minutes

Side Effects: Suppression of cortisol synthesis

Commentary:
Etomidate is well suited as an induction agent for RSI because its pharmacokinetic profile closely matches that of succinylcholine and it has minimal cardiovascular side effects. The transient suppression of cortisol synthesis is of no clinical significance with a single dose. Clinically significant adrenal dysfunction has only been seen with long-term use of etomidate. Etomidate has no analgesic effect.

KETAMINE (S5)

Class
General anaesthetics: Non-barbiturates

Mechanism of action:
Ketamine is a phencyclidine (PCP) derivative that provides significant analgesia, anaesthesia, and amnesia with minimal effect on respiratory drive. The amnestic effect is not as pronounced as seen with the benzodiazepines. Ketamine is though to interact with the N-methyl-D-aspartate (NDMA) receptors at the GABA-receptor complex, promoting neuroinhibition and subsequent anaesthesia. Action on opioid receptors accounts for its profound analgesic effect. Ketamine releases catecholamines, stimulates the sympathetic nervous system and therefore augments heart rate and blood pressure. Ketamine directly stimulates the CNS, increasing cerebral metabolism, cerebral metabolic oxygen demand and cerebral blood flow, thus potentially increasing ICP in patients with CNS injury. In addition to its catecholamine-releasing effect, ketamine directly relaxes bronchial smooth muscle, producing bronchodilation.

Indications	**:**	Induction agent for RSI Sedation and analgesia Ketamine also has useful bronchorelaxant and anticonvulsant activity
Contraindications	**:**	Head injury Hypertension Ischemic heart disease Aortic dissection
Induction	:	2 mg/kg slowly IVI (Adults) 1 – 2 mg/kg slowly IVI (Paeds)
Post-intubation Sedation	:	0.5 mg/kg IV bolus repeated at 15 minutes Small adult (50kg) **25mg** (Add ± 3mg Midazolam) Average adult (70kg) **35mg** (Add ± 4mg Midazolam) Large adult (100kg) **50mg** (Add ± 5mg Midazolam)
Onset of Action	**:**	1 -2 minutes
Duration of Action	**:**	5 - 15 minutes
Side Effects	**:**	Tachycardia, hypertension, Increased ICP, bronchodilation

Commentary:
Ketamine's effect on ICP makes it use limited in trauma patients. Its mild bronchodilatory effects make it a reasonable induction agent for the asthmatic patient. Ketamine however does cause increased bronchial secretions, which can be mitigated against by the administration of Atropine 0.02mg/kg (min. 0.1mg). The hallucinations that are well known to occur occasionally on emergence from ketamine are more common in the adult than in the child and can be eliminated by the concomitant or subsequent administration of a benzodiazepine, if required.

NEUROMUSCULAR BLOCKING AGENTS

SUCCINYLCHOLINE / SUXAMETHONIUM CHLORIDE (S4)

Class:
Depolarizing muscle relaxants.

Mechanism of action:
Succinylcholine (SCh) is chemically similar to acetylcholine. It stimulates all of the nicotinic and muscarinic cholinergic receptors of the sympathetic and parasympathetic nervous system, not just those at the neuromuscular junction. Muscle fasciculation is followed by rapid and complete depolarizing muscle relaxation of short duration, after which it gradually dissipates within 10 minutes. Succinylcholine is rapidly hydrolysed in the plasma and tissues by pseudocholinesterase and only 10% is excreted unchanged. Excessive dosage (>500mg) may cause a dual block which has features of a non-depolarising block.

Indications:
NMBA for RSI: Rapid and complete depolarizing muscle relaxation of short duration; used mainly for endotracheal intubation

Contraindications:
Muscular dystrophy
Myopathies
Denervation syndromes
Stroke
Spinal cord injury
Prolonged immobilization
Known hyperkalemia

Dose	:	Adults	1.5 - 2 mg/kg IVI
		Children	2 mg/kg IVI
		Infants	3 mg/kg IVI

Onset of Action : 45 seconds

Duration of Action : 5-10 minutes

Side Effects :
Fasciculations
Hyperkalemia
Bradycardia
Increased intra-cranial pressure
Increased intra-ocular pressure
Malignant hyperthermia

Commentary:
Succinylcholine's pharmacokinetics make it well suited for RSI. It does however have some potentially life-threatening side effects in certain patient populations so it should be used judiciously.

Rocuronium Bromide (S4)

Class:
Non-depolarizing (competitive) muscle relaxants: Aminosteroid compounds

Mechanism of action:
Competes with acetylcholine at the post-junctional cholinergic nicotinic receptors in the neuromuscular junction. Its action is reversible by anticholinesterase agents, which allow the concentration of acetylcholine to increase at these receptor sites and displace the 'blocker'.

Indications:
Maintenance of paralysis for mechanical ventilation *once ETI confirmed*
Alternative primary NMBA for RSI *(only if Succinylcholine is contraindicated)*

Contraindications:
None

Dose	:	Initial	0.6 mg/kg IVI
		Repeat	0.6 mg/kg as required after 30 minutes
Onset of Action	:	60 seconds	
Duration of Action	:	30-45 minutes	
Side Effects	:	None	

Commentary:
Rocuronium has the fastest onset of any of the non-depolarizing NMBAs and thus should be considered for primary paralysis ***only*** when a contraindication to succinylcholine exists.

VECURONIUM BROMIDE (S4)

Class:
Non-depolarizing (competitive) muscle relaxants: Aminosteroid compounds

Mechanism of action:
Competes with acetylcholine at the post-junctional cholinergic nicotinic receptors in the neuromuscular junction. Its action is reversible by anticholinesterase agents, which allow the concentration of acetylcholine to increase at these receptor sites and displace the 'blocker'.

Indications:
Maintenance of paralysis for mechanical ventilation <u>*once ETI confirmed*</u>
Primary NMBA for RSI *(only if Succinylcholine is contraindicated)*

Contraindications:
None

Dose:	Initial:	0.1 mg/kg IVI
	Repeat:	0.1 mg/kg IVI as required after 30 minutes

Onset of Action: 2-3 minutes

Duration of Action: 30-45 minutes

Side Effects: None

Commentary:
Vecuronium has a relatively slow onset of action. It can be used for primary paralysis <u>***only***</u> if there is a contraindication to succinylcholine. To hasten its onset one can administer "high dose vec" which is 0.3 mg/kg. This can reduce its onset of paralysis to 90 seconds.

RAPID SEQUENCE INTUBATION
MEDICATIONS GUIDELINE

Durban University of Technology
Department of Emergency Medical Care and Rescue

***NB.**: The concentration of drugs may differ with different manufacturers. Please use the table below as a guideline only for drug volumes. The dose (mg/kg) however will remain consistent irrespective of change in packaged volume.*

Mass (kg)	6-7	8-9	10-11	12-14	15-18	19-22	23-30	31-40	≥ 50	≤ 100
Age	6-7/12	8-9/12	1	2-3	4-5	6-7	8-10	11-13	Adult	Adult
VOLUME OF PREPARED SOLUTION OF DRUG										
INDUCTION										
Etomidate (0.3mg/kg) 2mg/ml	1ml	1.3ml	1.5ml	2ml	2.5ml	3ml	4ml	5.5ml	10ml	15ml
Ketamine (2mg/kg) 10mg/ml	1.2ml	1.6ml	2ml	2.4ml	3ml	3.8ml	4.6ml	6.2ml	10ml + 0.5mg Midazolam	20ml
PARALYSIS										
Suxamethonium (2mg/kg) 50mg/ml	0.3ml	0.4ml	0.5ml	0.5ml	0.6ml	0.8ml	1ml	1.4ml	2-3ml	4ml
Vecuronium ☠ (0.1 mg/kg) 1mg/ml	0.6ml	0.8ml	1ml	1.2ml	1.5ml	1.9ml	2.3ml	3.1ml	5ml	10ml
Rocuronium ☠ (0.6 mg/kg) 10mg/ml	0.3ml	0.4ml	0.6ml	0.7ml	0.9ml	1.2ml	1.3ml	1.8ml	3ml	6ml

POST - RSI CONTINUOUS SEDATION

	0.05mg/kg Midazolam and 0.01mg/kg Morphine administered over 1 hour.		
Midazolam and Morphine	**Large adult ± 100kg** 5mg Midazolam *AND* 1mg Morphine infused over one hour ***OR*** I.V. BOLUS 5mg Midazolam *AND* 5mg Morphine Repeat at 15-20 minute intervals	**Average adult ± 70kg** 3.5mg Midazolam AND 0.7 mg Morphine infused over one hour ***OR*** I.V. BOLUS 4mg Midazolam *AND* 4mg Morphine Repeat at 15-20 minute intervals	**Small adult ± 50kg** 2.5mg Midazolam *AND* 0.5mg Morphine infused over one hour ***OR*** I.V. BOLUS 3mg Midazolam *AND* 3mg Morphine Repeated at 15-20 minute intervals
	0.05mg/kg Midazolam and 2mg/kg Ketamine administered over 1 hour.		
Midazolam and Ketamine	**Large adult ± 100kg** 5mg Midazolam *AND* 200mg Ketamine infused over one hour ***OR*** I.V. BOLUS 5mg Midazolam *AND* 50mg Ketamine Repeat at 15-20 minute intervals	**Average adult ± 70kg** 3.5mg Midazolam AND 140mg Ketamine infused over one hour ***OR*** I.V. BOLUS 4mg Midazolam *AND* 35mg Ketamine Repeat at 15-20 minute intervals	**Small adult ± 50kg** 2.5mg Midazolam *AND* 100mg Ketamine infused over one hour ***OR*** I.V. BOLUS 3mg Midazolam *AND* 25mg Ketamine Repeat at 15-20 minute intervals

☠ Do not use these agents for primary RSI. Use only for post-RSI paralysis.

RAPID SEQUENCE INTUBATION IN THE ADULT PATIENT

- Universal precations (gloves, facemask and eyewear)?
- ETI indicated?
- Contraindications to RSI?
  - Inadequate access to patient?
  - Entrapped patient sitting upright?
  - Anticipated intubation difficulty or failure?
- Airway open and maintained?
- Adeqauate BLS respiratory support with cricoid pressure?

PREPARATION (Whilst Preoxygenating - See Box 2) 1

- Establish large-bore IV line (ACF ideal)
- Assemble equipment for ETI:
  - Suction unit an BVMR for IPPV
  - Appropriate size selection of ETTs (Female = 7 to 8mm; Male = 8 to 9 mm)
  - Introducing stylet and / or gum elastic bougie
  - An appropriately size laryngoscope handle and blade with a working bulb.
  - Adult Magill's forceps and a 20ml syringe
  - Trachea tape / ETT securing device and catheter mount (optional)
  - EDD an End-tidal CO2 monitor (quantitative)
  - Prepare induction, paralysis and ongoing sedation medications
  - Prepare cardiac arrest medications

PRE-OXYGENATION 2

- Oxygenate and/or ventilate patient with a BVMR(IPPV) / 100 and non-rebreather mask as appropriate
- 100% O_2 minimum for 3-5 minutes or minimum of 8-vital capacity breaths immediately prior to ETI attempt

PLAN FOR FAILED AIRWAY 3

- Prepare one of the following prior to ETI attempt:
  - Laryngeal Tube Airway and / or
  - Laryngeal Mask Airway and / or
  - Oesophageal Tracheal Combitube™ and / or
  - Surgical / needle crichothyroidotomy kit and / or Retrograde intubation kit

POSITIONING 4

- Position the patient's head and neck in the "sniffing the moring air" position, supine (excluding airways disease) with 180° access around the head.
- Manually immobilize the head and neck in the neutral position for suspected cervical-spine injury, also supine with 180° access around the head.

PRE-TREATMENT

You may *consider* the following 3 minutes prior to induction:

1. Lidocaine 1.5mg/kg IVI for patients with increased ICP or reactive airways disease.
2. Defasciculating dose of competitive NMBA for patients with risk of increased ICP i.e. 10% of paralyzing dose e.g. Vecuronium 0.01mg/kg OR Rocuronium 0.06mg/kg

PARALYSIS WITH INDUCTION 5

- Administer induction agent
  - Etomidate 0.3 mg/kg rapid IV push (head injury or cardiac patients) followed by a minimum of 100ml IV fluid ***OR***
  - Ketamine 2 mg/kg rapid IV push (respiratory failure incl. polytrauma excuding cardiac patients) followed by a min. of 100ml IV fluid
- Administer paralytic agent
  - Succinylcholine / Suxamethonium 1 - 2mg / kg rapid IV push followed by a minimum of 100ml IV fluid

PROTECTION 6

- Perform Sellick's Maneuver (cricoid pressure) when the patient loses consciousness (approximately 30-60 seconds)

PLACEMENT WITH PROOF 7

- Perform ETI approx. 30 seconds after Succinylcholine
- Inflate the tube cuff (up to 10ml)
- Assess ETT marking at teeth and secure ETT
- Rapidly confirm correct ETT position
- ***CLINICAL:*** Auscultation and chest rise / fall
  AND AT LEAST ONE OF THE FOLLOWING:
  - Oesophageal detector device
  - End-tidal CO_2 (qualitative or quantitative)

POST INTUBATION MANAGEMENT 8

- Maintenance infusion for sedation:
  - Midazolam 0.05 mg/kg mixed with Morphine Sulphate 0.01 mg/kg administered over one hour (head trauma or cardiac patients) ***OR***
  - Midazolam 0.05 mg/kg mixed with Ketamine 2 mg/kg administered over one hour (respiratory failure incl. polytrauma, excl. cardiac) ***AND***
  - Rocuronium 0.6 mg/kg slow IV bolus ***OR***
  - Vecuronium 0.1 mg/kg slow IV

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RAPID SEQUENCE INTUBATION IN THE PAEDIATRIC PATIENT

- Universal precations (gloves, facemask and eyewear)?
- ETI indicated?
- Contraindications to RSI?
    - Inadequate access to patient?
    - Entrapped patient sitting upright?
    - Anticipated intubation difficulty or failure?
- Airway open and maintained?
- Adeqauate BLS respiratory support with cricoid pressure?

PREPARATION (Whilst preoxygenating - See Box 2) 1

- Establish large-bore IV line (ACF ideal)
- Assemble equipment for ETI:
    - Suction unit an BVMR for IPPV
    - Appropriate size selection of ETTs (Using Broselow® Tape / age & weight calculation)
    - Introducing stylet and / or gum elastic bougie
    - An appropriately size laryngoscope handle and blade with a working bulb.
    - Paediatric Magill's forceps and a 20ml syringe
    - Trachea tape / ETT securing device and catheter mount (optional)
    - EDD an End-tidal CO2 monitor (quantitative)
    - Prepare induction, paralysis and ongoing sedation medications
    - Prepare cardiac arrest medications

PRE-OXYGENATION 2

- Oxygenate and/or ventilate patient with a BVMR(IPPV) / 100 and non-rebreather mask as appropriate
- 100% O_2 minimum for 3-5 minutes or minimum of 8-vital capacity breaths immediately prior to ETI attempt

PLAN FOR FAILED AIRWAY 3

- Prepare one of the following prior to ETI attempt:
    - Laryngeal Tube Airway and / or
    - Laryngeal Mask Airway and / or
    - Oesophageal Tracheal Combitube™ and / or
    - Surgical / needle crichothyroidotomy kit (C/I if < 7years old) and / or Retrograde intubation kit

POSITIONING 4

- Position the patient's head and neck in the "sniffing the moring air" position, supine (excluding airways disease) with 180^{o} access around the head.
- Manually immobilize the head and neck in the neutral position for suspected cervical-spine injury, also supine with 180^{o} access around the head.

PRE-TREATMENT

You may *consider* the following 3 minutes prior to induction:

1. Atropine Sulphate 0.02 mg / kg (max. 1mg) ***for paeds <10 years old only.***

1. Lidocaine 1.5mg/kg IVI for patients with increased ICP or reactive airways disease.

2. Defasciculating dose of competitive NMBA for patients with risk of increased ICP i.e. 10% of paralyzing dose e.g. Vecuronium 0.01mg/kg OR Rocuronium 0.06mg/kg

PARALYSIS WITH INDUCTION 5

- Administer induction agent
    - Etomidate 0.3 mg/kg rapid IV push (head injury or cardiac patients) followed by a minimum of 100ml IV fluid ***OR***
    - Ketamine 2 mg/kg rapid IV push (respiratory failure incl. polytrauma excuding cardiac patients) followed by a min. of 100ml IV fluid
- Administer paralytic agent
    - Succinylcholine 1 - 2mg / kg (3mg / kg in infants) rapid IV push followed by a minimum of 100ml IV fluid

PROTECTION 6

- Perform Sellick's Maneuver (cricoid pressure) when the patient loses consciousness (approximately 30-60 seconds)

PLACEMENT WITH PROOF 7

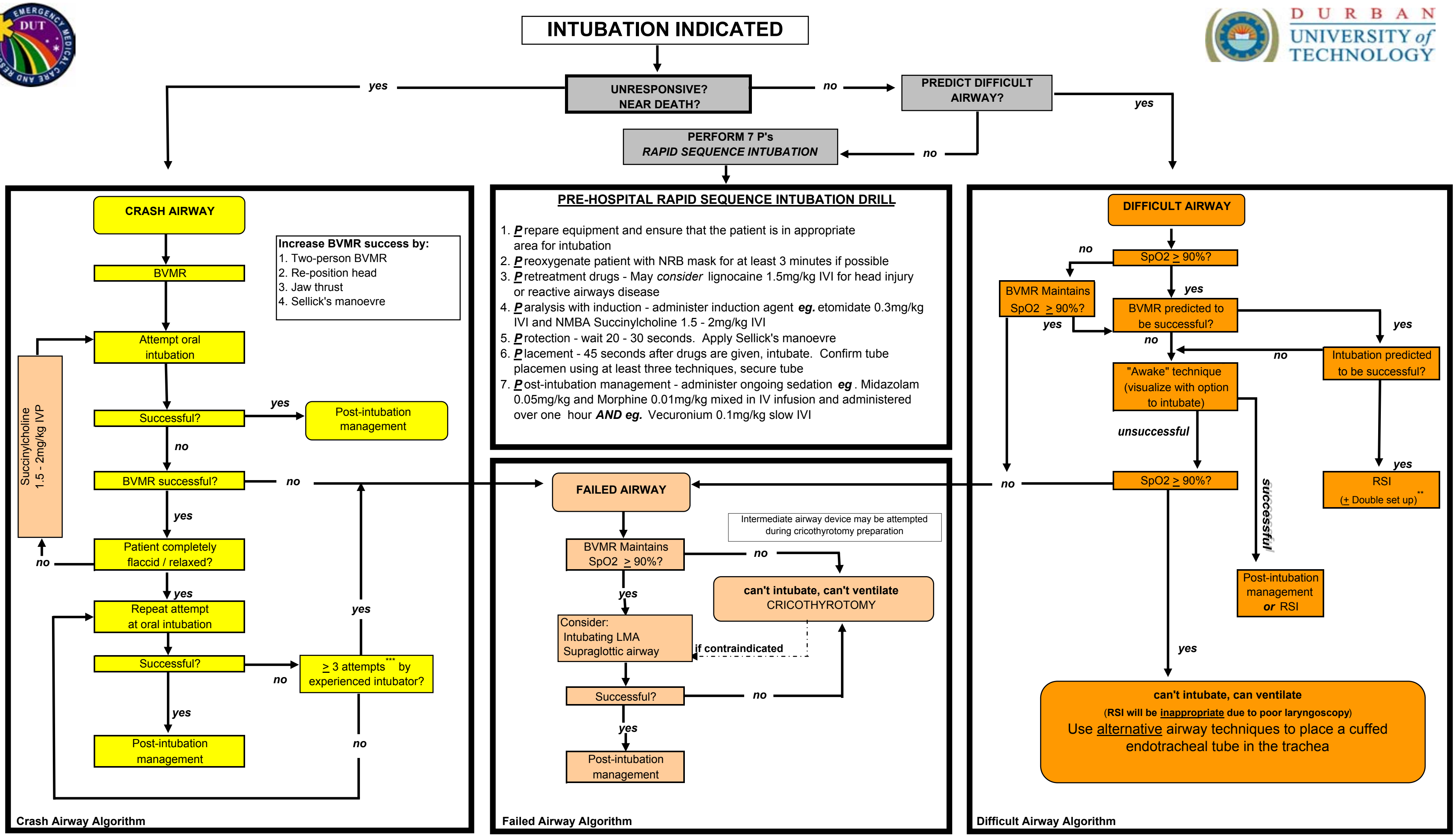
- Perform ETI approx. 30 seconds after Succinylcholine
- Inflate the tube cuff (up to 10ml)
- Assess ETT marking at teeth and secure ETT
- Rapidly confirm correct ETT position
- ***CLINICAL:*** Auscultation and chest rise / fall

AND AT LEAST ONE OF THE FOLLOWING:

- Oesophageal detector device
- End-tidal CO_2 (qualitative or quantitative)

POST INTUBATION MANAGEMENT 8

- Maintenance infusion for sedation:
    - Midazolam 0.05 mg/kg mixed with Morphine Sulphate 0.01 mg/kg administered over one hour (head trauma or cardiac patients) ***OR***
    - Midazolam 0.05 mg/kg mixed with Ketamine 2 mg/kg administered over one hour (respiratory failure incl. polytrauma, excl. cardiac) ***AND***
    - Rocuronium 0.6 mg/kg slow IV bolus ***OR***
    - Vecuronium 0.1 mg/kg slow IV



Note: In the absence of an identified crash or dificult airway, RSI is the method of choice for airway management
If BVMR ventilation is unlikely to succeed in the context of difficult intubation or if the chance of successful oral intubation is felt to be poor, then RSI is ***NOT*** recommended.

* "Awake" technique: This technique allows spontaneous respirations until such time as it has been ascertained that the trachea can be successfully intubated.
The word "awake" is a misnomer because the patient is sedated (asleep but not comatose: using low-dose midazolam) with liberal use
of topical anaesthesia (eg. Xylocaine® Spray) to permit laryngoscopy. If the glottis can be easily visualized and the difficult airway is static (chronic) then proceed with RSI. If the difficult airway is dynamic (acute) then it is the judgement of the parmedic whether to proceed directly with intubation during this awake laryngoscopy or to back out and perform RSI.

** Double set up : In some cases the RSI may be done under a double set up, in which the patient is evaluated and prepped for crichothyrotomy and the surgical instruments are open and ready before the RSI is initiated.

*** ≥ 3 attempts assumes that after each attempt, adjustments were made to improve laryngoscopy. Failure to make adjustments constitutes poor practice and not necessarily a failed airway.

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Pre-hospital Confirmation of Endotracheal Tube Placement

Confirm placement with Oesophageal Detector Device **BEFORE** ventilating the patient.

SUCCESSFUL

Ventilate patient and ensure $ETC0_2$ monitor is attached – assess equal breath sounds over both hemithoraces.

Ventilate patient at a rate between 8-10 breaths per minute to maintain $EtC0_2$ of 36-38mmHg

(Set ventilator at 6ml/kg at 10bpm and review in accordance with $EtC0_2$)

UNSUCCESSFUL

ODD indicates a failed intubation **see *Protocol A***

$ETC0_2$ indicates failed intubation **see *Protocol B***

Auscultation indicates failed intubation **see *Protocol C***

Protocol A

ODD can give a 'false negative' in pregnancy, obese patients and in hyper-inflated lungs e.g. asthma

If confident in placement and patient falls into one of the above sub-groups then apply $ETC0_2$ – colour change and air entry on auscultation = successful intubation

If not confident **THEN IMMEDIATELY REMOVE TUBE**

Protocol B

ETC02 is dependant on lung perfusion – this maybe poor during cardiac arrest.

If ODD indicates successful intubation and there is air entry = successful intubation

$ETC0_2$ colour change should improve with CPR

If not confident **THEN IMMEDIATELY REMOVE TUBE**

Protocol C

Chest auscultation is used to:

- Detect R-bronchus intubation
- Confirm with either ODD and/or ETC02

If not confident **THEN IMMEDIATELY REMOVE TUBE**

For confirmation of ET-tube placement, two out of three tests must indicate successful intubation

Failed intubation drill = if intubation is unsuccessful 30-seconds after the last breath was administered or $Sp0_2$ <90%

- Remove tube
- Immediately place LMA
- Ventilate 8-10 breaths per minute
- Consider 'can I do something different to achieve intubation' ; if **yes** consider 2nd attempt
  If **no** stay with LMA and move to hospital.

Special Clinical Circumstances : Raised Intracranial Pressure

1. Reflex ICP response to laryngoscopy
   Laryngoscopy may increase the ICP by a direct reflex mechanism not mediated by sympathetic stimulation of the blood pressure or heart rate. Although there have been no direct studies of lignocaine with respect to blunting the ICP response to laryngoscopy, it has been shown that administration of *Lignocaine (1.5 mg/kg IVI)* effectively blunts the ICP response to laryngeal stimulation and endotracheal suctioning. It is for this reason that lignocaine is recommended as a pre-treatment drug for these patients. In addition to this, intubation should be performed in the gentlest manner possible, limiting both the time and intensity of laryngoscopy.

2. Neuro-muscular Blocking Agents and ICP
   Succinylcholine (Sch) itself appears capable of causing an increase in ICP. Studies have shown that this increase is related to the presence of fasciculations in the patient, but is not the result of synchronized muscular activity leading to increased venous pressure. There appears to be a complex reflex mechanism originating in the muscle spindle and ultimately resulting in an elevation in ICP. It has been shown that the administration of a small defasciculating dose of a competitive NMBA, such as 0.01 mg/kg Vecuronium, effectively blunts the intracranial response to Sch.

3. Induction Agents and ICP
   Etomidate remains the agent of choice, as it does not adversely affect cerebral perfusion pressure, and is the most haemodynamically stable of all commonly used induction agents. It also has the ability to decrease the brain's basal oxygen metabolic rate and ICP in a manner analogous to sodium thiopental. Although sodium thiopental may be a good choice for patients with potential brain injury, it's potent venodilator and negative inotropic effects make it unsuitable for the haemodynamically unstable patient. Ketamine should be avoided, as it may elevate ICP further.

4. Mechanical Ventilation
   Mechanical ventilation in the patient with raised ICP should be based on two principles:
   - Optimal oxygenation
   - Avoidance of ventilation mechanics e.g. PEEP and high peak inspiratory pressure that would increase venous congestion in the brain

5. General considerations
   RSI is clearly the desired method for tracheal intubation in patients with suspected raised ICP. However, the use of neuromuscular blockade carries the responsibility of performing a detailed neurological evaluation of the patient before paralysis. The careful recording of this evaluation will be invaluable for ongoing evaluation of the patient in hospital. The following should be documented prior top paralysis:
   - Patient's ability to interact with the surroundings
   - Spontaneous motor movement
   - Response to deep pain
   - Response to voice
   - Localization
   - Pupillary reflexes
   - Other pertinent neurological details

Special Clinical Circumstances: Reactive Airways Disease

1. <u>Clinical challenge</u>
   These patients are usually fatigued and have reduced functional residual capacity, so it is therefore quite difficult to pre-oxygenate them optimally. Rapid desaturation must be anticipated. As most of these patients have been struggling to breathe against severe resistance, usually for hours, they have little if any residual physical reserve and mechanical ventilation will be required. In fact the indication for intubation will be mechanical ventilation, as the upper airway itself is almost invariably patent and protected.

2. <u>Technique</u>
   The single most important principle in managing the status asthmaticus patient who requires intubation is to take total control of the airway as expeditiously as possible. Pre-oxygenation should be achieved to the greatest extent possible. The RSI drugs chosen should be administered to the patient in their position of comfort, often sitting upright. Once the patient loses consciousness, perform Sellick's manoeuvre, place patient supine and intubate, preferably with an 8.0mm to 9.0mm endotracheal tube to decrease airway resistance.

3. <u>Drugs</u>
   If time permits, administer Lignocaine 1.5 mg/kg 3minutes prior to induction, to attenuate the reflexive bronchospasm in response to airway manipulation. Ketamine is the induction agent of choice, because it stimulates the release of catecholamines and also has a direct bronchial smooth muscle relaxing effect. Ketamine 2 mg/kg IVI is administered immediately before the administration of 1.5 – 2.0 mg/kg Succinylcholine IVI.

4. <u>Mechanical Ventilation</u>
   The initial goal of mechanical ventilation is to improve arterial oxygen tension to adequate levels without inflicting barotrauma on the lungs or increasing auto-PEEP.
   - Determine the patient's ideal body weight.
   - Set a tidal volume of 6 to 8 ml/kg with FiO_2 of 1.0.
   - Set a respiratory rate of 8 to 10 bpm.
   - Set I:E ratio of 1:4 to 1:5. Pressure control is preferred.
   - Measure and maintain the plateau pressure at less than $30cmH_20$.
   - Ensure continuous sedation with Midazolam and Ketamine and paralysis with Vecuronium or Rocuronium.
   - Continue in-line beta2-agonist therapy and additional pharmacologic adjunctive treatment.

Special Clinical Circumstances: Acute Pulmonary Oedema

1. Clinical challenge

   The patient with acute pulmonary oedema due to LV failure who requires intubation presents several challenges to the paramedic performing intubation:

   - Pre-oxygenation will provide little in the way of oxygen reserve, as these patients have reduced functional residual capacity. Oxyhaemoglobin desaturation will occur rapidly.
   - The patient may be unable to lie flat and is often struggling.
   - Foamy secretions may obscure visualization of the airway.
   - High airway resistance and low pulmonary compliance are likely to render IPPV with BVMR difficult or ineffective.
   - The patient who is hypertensive, is more likely to tolerate opioids and induction agents than a patient who is normotensive or hypotensive.
   - Intubation is likely to exacerbate any element of bronchospasm.

All the above points emphasize the fact that there is little margin for error in these patients and that intubation should be swift, atraumatic and successful on the first attempt. This argues strongly for the superior pharmacological and physical control, and success rates provided by RSI.

2. Technique

   - Pre-oxygenate with 100% oxygen and assist ventilations to try and maintain oxygen saturation if possible.
   - It may be best to administer drugs with the patient erect and then to place the patient supine for intubation.
   - Patients who are hypertensive have the capacity to respond aggressively to intubation and may require medications to attenuate this response e.g. Morphine Sulphate (which may have already been administered pre-intubation). The ideal drug would be Fentanyl 1.5 mcg/kg – 3mcg/kg depending on blood pressure.
   - Use the largest endotracheal tube possible to minimize resistance to ventilation.

3. Drugs

   - Consider pre-treatment with an opioid (Morphine 5mg IVI) only if patient is hypertensive and reduce dose by half if normotensive. Avoid pre-treatment altogether if patient is hypotensive.
   - Etomidate 0.3 mg/kg if hypertensive or normotensive; reduce to 0.2 mg/kg if hypotensive.
   - Post-intubation sedation with Midazolam and Morphine.

4. Mechanical ventilation

   - In the event that the lungs are very stiff and high airway pressures are compromising venous return and cardiac output, faster rates at lower tidal volumes may be required.
   - If there is significant bronchospasm, the rate may have to be decreased to extend the expiratory time and tidal volume increased, if possible, to maintain minute volume.
   - PEEP beginning with 5 cmH_2O may be introduced to enhance functional residual capacity and oxygenation if the cardiac output will tolerate it. Increase PEEP as needed and as tolerated.
   - Treat the pulmonary oedema aggressively according to its cause.

Special Clinical Circumstances: Cardiogenic Shock

1. Clinical Challenge

   The patient in cardiogenic shock is gravely ill with a high mortality rate. This fact serves to emphasize the attention to detail that is required in managing the intubation.
   - In the absence of pulmonary oedema, the FRC is probably intact and pre-oxygenation will be helpful.
   - There is no cardiac reserve, and any medications that reduce cardiovascular performance are relatively contra-indicated and induction agents in particular must be carefully selected. An amnestic agent like midazolam 1 to 2mg may be well tolerated. Etomidate and ketamine in very reduced doses are also reasonable although either may depress cardiac function.
   - Circulation times are prolonged, so drug effects are substantially delayed.

2. Technique and drugs

   As with the patient in pulmonary oedema, there is little margin for error in this patient and intubation should be swift, atraumatic and swift on the first attempt.
   - Depending on the patient's circulatory status, either no induction agent or a greatly reduced dose such as,
     - 1 to 2 mg Midazolam IVI *or* 0.5mg/kg Ketamine IVI *or* 0.1 mg/kg Etomidate IVI
     - Follow up with Succinylcholine 1.5 mg/kg IVI
   - Post intubation sedation should be carefully titrated with blood pressure, aiming to give smaller bolus doses of midazolam with longer intervals between repeat doses in conjunction with 0.1 mg/kg Vecuronium IVI to assist with mechanical ventilation.

3. Mechanical Ventilation

   Be cautious of impeding venous return and cardiac filling.

Special Clinical Circumstances: Severe Anaphylaxis

1. Clinical challenge
   - Orotracheal intubation may be difficult because of upper airway oedema.
   - A small diameter ET tube and a surgical airway kit should be readily available. Ventilation through needle crichothyrotomy or other supraglottic devices will be ineffective because of a combination of both upper airway obstruction and bronchospasm.
   - Intense bronchospasm will challenge the ability to ventilate the patient effectively.

2. Technique and drugs
   - Intense bronchospasm and hypotension will limit the effectiveness of pre-oxygenation and gas exchange in the pre-intubation period, therefore expeditious intubation is desirable.
   - Be prepared to perform a primary surgical airway especially if severe upper airway oedema and/or severe stridor is present
   - Maximize intubation success with RSI (if confident that you can intubate the patient) with early intubation.
   - Ketamine provides the best blood pressure support and is a bronchodilator.
   - Pre-treat with Lignocaine 1 mg/kg IVI, followed by Ketamine 2 mg/kg IVI and Succinylcholine 1.5 mg/kg
   - Treat the anaphylaxis aggressively with epinephrine, steroids and antihistamines.

3. Mechanical ventilation

   The substantial increase in airway resistance will mandate slower rates and moderate tidal volumes with permissive hypercapnia to achieve acceptable oxygenation, minimal barotraumas, and optimum cardiac output as for severe asthma.

Special Clinical Circumstances: Prolonged seizure activity

1. Clinical challenge
   - Although most self-limiting seizures do not require intubation, there are several indications for intubation in the prolonged seizure:
     - Hypoxaemia (SpO2 < 90%) secondary to hypoventilation and airway obstruction
     - Cessation of prolonged seizure refractory to anti-convulsants to prevent accumulating metabolic debt (acidosis, rhabdomyolysis)
     - Generalized status epilepticus
   - Extensive generalized motor activity will eventually cause hypoxia, significant acidosis, rhabdomyolysis, and hyperthermia.
   - Respiratory depression may result from high doses of combinations of anti-convulsants.

2. Technique and drugs
   - RSI is the method of choice in the seizing patient, as it ends all motor activity, allowing the body to correct the metabolic debt
   - Pre-oxygenation may be sub-optimal because of the unco-ordinated respiratory effort, therefore pulse oximetry is critical
   - Induction with Midazolam 0.3 mg/kg IVI is recommended for the actively seizing patient. This dose should be reduced to 0.1 to 0.2 mg/kg if the patient is haemodynamically compromised.
   - Etomidate can be considered if associated hypotension precludes the use of Midazolam.
   - After giving Succinylcholine 1.5 mg/kg IVI, it is more likely that the patient may desaturate below 90% before complete relaxation and therefore may require IPPV with the BVMR before attempts at intubation.
   - Prolonged paralysis with Vecuronium 0.1 mg/kg IVI repeated at 30 minute intervals.
   - The paralyzed patient may still be seizing, possibly causing neurological injury despite the lack of motor activity. This may require effective doses of long-acting anti-convulsants.
   - Use Midazolam 0.05 – 0.1 mg/kg/hr IV infusion for continuous sedation or bolus doses of Midazolam 3 – 5 mg every 15 minutes as necessary.

3. Mechanical ventilation

   Follow general mechanical ventilation protocol and adjust in accordance with $EtCO_2$ and SpO_2.

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