

# Pre-hospital intubation in trauma patients: Essential practice or overrated intervention?

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## ABSTRACT:

Despite the fact that pre-hospital intubation is a well established intervention worldwide, the way in which it is practiced is widely variable. The evidence base for the intervention is poor and most studies are sub-optimal. However there is increasing evidence that intubation, particularly without the assistance of drugs, does not improve outcome in trauma patients. We believe that the indications for pre-hospital intubation are the same as those in the emergency department. To achieve the intervention safely the same standards and expertise needs to be applied outside as inside hospital.

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## Introduction

Pre-hospital tracheal intubation has been performed on trauma patients in many emergency medical systems for many years. Since proper evaluation of the procedure was never carried out the technique was introduced and performed in many different forms in different systems. This situation continues today. For example, in Scandinavia drug assisted intubation is performed by anaesthetists (1), in the UK intubation is often performed by paramedics without the use of drugs (2) and in the US wide variation occurs between systems, with intubation carried out by most possible professional groups with, and without, drugs.

Despite the lack of well conducted studies many of us believe that drug assisted tracheal intubation is a core skill in effective pre-hospital trauma care. Looking at the papers published on the subject in the last few years it would be reasonable to question this statement. The reason that we persist in this view is that, like the majority of doctors practicing trauma care, we believe that hypoxaemia particularly in the context of head injury is associated with poor outcome (3) and we often see severely injured patients that are hypoxaemic but still have airway reflexes, making intubation without drugs difficult or impossible. In our system, intubation of trauma patients without drugs does not seem to be useful (2). We are concerned that this vulnerable period may be prolonged because we know that in our own (mostly paramedic led) system, and in many other systems, the majority of the first hour after injury is spent in the pre-hospital phase. This appears prolonged but many pre-hospital publications concentrate on scene times – the pre-hospital phase includes emergency call time, dispatch time, transport to scene, scene time, loading time, transport from scene time and unloading time. This is in

non-trapped patients - for trapped patients it often takes even longer. We cannot imagine that any ethics committee would give approval for a study where patients with head injuries were left hypoxaemic for this period of time in the emergency department unintubated, and compared with those who were provided with skilled intubation on arrival. Similarly we see no reason why our patients should be left unintubated in the pre-hospital phase provided that, when an RSI is performed, a standard of care similar to that achieved in the emergency department is pursued. Also, before deciding to perform the procedure that the potential risks and benefits are considered in every patient.

The last few years have produced no randomised controlled studies on pre-hospital intubation in adults but a number of other interesting studies which may well influence the future development of pre-hospital airway management have been published. (4,5,6). In the US and some other countries current practice is being questioned (7,8) Hopefully this will lead to improvements in clinical practice.

## Studies and their problems

In an editorial in the *Annals of Emergency Medicine* in 1997(9) it was stated that, despite major expenditure on pre-hospital care, the total evidence base for it was less than that of several minor illnesses including constipation and urticaria. Within this subject area the topic of pre-hospital airway care is no different. There is no shortage of studies but quality is variable and interpretation difficult. There are many variables in each study, which may independently influence outcome, and it is extremely difficult to extrapolate results from one system to another. Questions that need to be asked of each study include the following key issues:

- Were drugs used to intubate? If so which ones?
- Who performed the procedure? What is their background? How much training have they had? How many procedures do they usually perform? Does retraining occur?
- Was the procedure performed in a ground based or aeromedical system?
- What was the patient case mix?
- What were the indications for intubation in the system?
- What type / level of care was provided in the in-hospital phase of care?

Published success rates for the intubation of trauma patients without drugs vary from 49 – 71% (10-15) increase to around 90% with the addition of a benzodiazepine (16) and when neuromuscular blockade is introduced should increase to the high 90's (17-19). Therefore studies with different drug regimes are rarely comparable. There are few good studies comparing particular induction agents or muscle relaxants in pre-hospital care.

The operator performing the intubation may come from several professional groups. The doctor led model is more prevalent in European countries. The doctor may be from a number of different backgrounds – a fully trained anaesthesiology specialist performing anaesthesia and intubation on most working days, perhaps a trainee with one, two or five years experience, an emergency physician with limited anaesthesia training or even a general practitioner with rare exposure to the compromised airway. Clearly the techniques and success rates in such diverse 'physician led' systems are not necessarily comparable. Similarly the term 'paramedic' covers a wide spectrum of skills, training and experience. We have observed systems where paramedics are recruited at approximately degree level entry, have thousands of hours of theoretical teaching, extensive practical training and comprehensive examination and assessment before qualification. Post qualification they have practice audit, re-certification and specialist medical input into the services that they provide. At the other end of the spectrum there are systems which have paramedics who enter initial technician training with school leaver qualifications, have only a few months of specific paramedic training, limited clinical exposure and scanty re-certification and retraining structures. Either might satisfy the role that a particular emergency medical service has for its paramedics but levels of advanced airway care are unlikely to be the same in published papers from each system, despite the 'paramedic' label given to both. Nurses operate in some systems and often have a narrower spectrum of practice. Many are nurse anaesthetists or have a critical care background and practice at high skill levels. Despite this there are occasional published reports from nurse led systems with very high failed intubation rates even when muscle relaxants are used (20).

The differences seen between aeromedical providers and ground providers are not just due to the presence of an aircraft. The aeromedical providers tend to have higher

intubation rates in published studies of trauma patients: 18.5% (range 6 – 51%) compared to 4% (range 2 – 37%) in ground providers (21). This is likely to be due to patient case mix as well as the training, skills and experience of the providers. Expensive aeromedical resources are generally targeted at the more severely injured. Patient case mix varies tremendously between studies. In recently produced guidelines on tracheal intubation after traumatic injury published in the *Journal of Trauma* (21) only papers where more than 50% of patients had a trauma mechanism were taken into consideration. However even those studies had between 50 and 89% of patients with a trauma mechanism of injury. Injury severity also varies between study populations as does mechanism. A common variation is the proportion of penetrating trauma seen in a particular population.

The indication for intubation in trauma patients is a key variable in many studies. For example, some guidelines suggest that intubation is indicated where Glasgow Coma Score (GCS) is 8 or less (21) whereas in other guidelines it is suggested that combative patients with serious injuries (who may well have higher GCS scores than 8) may require intubation (22) Many intubations in our system fall into the latter category. Since initial GCS correlates to outcome in patients with head injury, outcome in patients intubated with GCS 8 or less may well not be comparable to those intubated in a system where intubation is indicated in some with a GCS above 8.

The standard of care provided after arrival in hospital may well influence outcome. Where patients receive different interventions in the pre hospital phase it is important that each group receive similar in-hospital management before outcomes are compared. This type of interpretation problem can also be seen where study populations are compared with historical controls i.e. where in-hospital management has changed between the admission of historical controls and the study population.

### Evidence

For non-drug assisted intubation the main study quoted in favour of the procedure is a retrospective review of patients with blunt injury and GCS of 8 or less (23). The mortality in patients who were intubated was 26% while in those who were not was 36.2%. Interpretation of this study is difficult because an unknown number of patients had attempted and failed intubation and were then included in the non-intubation group. These patients may have suffered the complications of the procedure without the possible benefits. Also a 'significant minority' of patients were transported by air by teams who had advanced skills (including drugs) and were not included in the outcome data. The percentage of patients who had a scene GCS of 3 and survived is much higher than expected. Most other studies which are quoted in support of pre-hospital intubation do not separate the possible contribution of intubation from other interventions. An example of this is an Australian study where the addition of physicians to an aeromedical crew led

to much higher intubation rates (51% vs.10%) and improved outcomes (24).

The only paper which is prospective and randomised on the subject was published in 2000 (25). It looked at 830 children who were treated with bag-valve-mask (BVM) ventilation followed by intubation (without drugs) or continued BVM ventilation. The patient case mix was diverse and only a minority were victims of trauma. Outcome was not significantly different in each group though in some sub groups mortality was worse in the intubation group. The complication rate was high for misplaced or displaced tracheal tubes. Whether this study has any relevance to adult trauma patients is unclear. In the same year a retrospective review of 496 trauma patients demonstrated that patients intubated by paramedics without drugs were much less likely to survive than those treated with BVM ventilation. Unfortunately the study had several flaws both in terms of design and case mix differences between groups (26).

In 2003 several more relevant papers were published. In February a prospective but unrandomized study of 191 patients with 'non-acutely lethal traumatic brain injury' was published (6). The patients in this study all had a head injury and a GCS of 8 or less. 36% had isolated head injuries. Patients either had intubation on scene or on arrival in hospital. Patients with failed field intubations, long extrications and lethal brain injuries were excluded. Mortality was higher in the pre-hospital intubation group (23% vs 12.4%) but it is difficult to determine if the patients in each group were strictly comparable. In March 2003 the results of the San Diego paramedic RSI trial were published (4). This study enrolled 209 patients with GCS 8 or below who could only be intubated with the assistance of drugs and compared them with 627 historical controls. Patients who could not be intubated, those without head injuries and deaths in the pre-hospital phase (or within 30 minutes of admission) were excluded. Mortality was significantly increased in the study (intubated) group (33% vs. 24.2%  $p<0.05$ ). The authors struggled to explain this increased mortality and suggested that inadvertent hyperventilation may have contributed to a poor outcome. The possibility of transient significant hypoxaemia during the RSI procedure was briefly mentioned but the magnitude of this problem was only revealed when a subgroup was examined in detail and published in December 2003 (5). Newly introduced monitoring equipment allowed one agency involved in the study to monitor oxygen saturation and pulse rate every eight seconds during RSI in 54 patients. 57% demonstrated significant desaturation and 19% bradycardia. This is surprising enough but the most worrying features of this study was that in the patients with these adverse events 84% had adequate oxygenation with basic airway manoeuvres and the same number had the RSI procedure described as 'easy' by the paramedic operators. Previous studies have revealed disturbing rates of failed or oesophageal intubation. This study alerts us to the possibility that many studies may have under

reported potentially damaging physiological derangements during advanced airway management (7).

## Conclusions

It is clear that there is no good current evidence that pre-hospital intubation improves outcome in trauma patients. However, this does not mean that benefit does not exist. Most studies have significant flaws and the most recent studies may explain why outcome is worse if the procedure is carried out in a sub-optimal manner.

Our indications for pre-hospital intubation are the same as those in the emergency department. However, even in a physician led service, this does not mean that every patient that meets these criteria should have an RSI. We encourage a rapid risk-benefit analysis before every RSI, taking patient, operator and resource issues into account. For example, if a small child can be oxygenated with basic airway skills we feel that the risks of RSI in our system usually outweigh the potential benefits (even if we know that RSI will be carried out shortly after arrival in hospital).

We have major doubts about the benefits of non-drug assisted intubation as currently carried out by paramedics in the UK. The introduction of paramedic RSI to areas which do not currently have it would seem, on the basis of current evidence, to be very questionable (7). To practice pre-hospital RSI operators need to have the skills to perform the procedure well and without preventable complications. They also need the back up of a robust system to support them in their training and practice (22).

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