Commentary: Current controversies in trauma airway management

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Airway management in trauma remains a topic which stimulates emotion and controversy. Much of the controversy is intimately linked with the related issues of territory, personnel, staffing and politics! For this commentary we focus specifically on the controversies in trauma airway management at the beginning of the 21st century.

The topics we wish to consider are
1. Who should be intubating trauma patients?
2. Where should these patients be intubated?
3. What training is required to do this?
4. Is the recommended technique of trauma intubation safe?

Who should be intubating trauma patients?

In an ideal world all medical and paramedical personnel responding to major trauma 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?’ Are we better off concentrating expertise in the hands of a small number of experts, at the expense of a slower response time, or diluting the experience more widely in the medical and paramedical community?

The answers to the above questions will vary widely around the world. It is important to distinguish between a well developed and properly staffed trauma centre, and a casualty department staffed by junior doctors who may have minimal experience in major trauma management. In some hospitals it may be the best solution to move badly injured directly to an operating theatre, if there is no good trauma resuscitation system in the emergency department. In addition, any patient who is bleeding significantly should be in an operating theatre or radiology suite, not an emergency department. It is also important to know how well developed prehospital systems are in that location, including availability and appropriate use of aeromedical services, whether paramedics are themselves trained to perform advanced procedures or rely on prehospital responses by doctors or advanced practice nurses, and indeed what experience and training the doctors and nurses have had – a junior or ‘non expert’ doctor is probably worse than useless in a dangerous prehospital environment.

The medical literature must be interpreted in this light. There is a significant publication bias, but senior doctors can have excellent results prehospital. Paramedics perform poorly in some series and well in others. When levels of training, experience and protocols are examined, however, the trauma systems in which these paramedics worked differed dramatically. The same applies to hospital emergency departments. The mere possession of a medical degree does not make a doctor an expert in airway management any more than a job in an ambulance service makes a paramedic an expert.

The only reports in the literature with a consistently good airway management, whether prehospital or in the emergency room, are those where well trained individu-
als used a sensible drug regime to allow the airway to be secured. It is well established that trauma patients who can be intubated without the use of drugs almost invariably die.6,7 A somewhat controversial corollary to that is that if a system does not train its staff to safely use drugs for intubation then it should probably not allow them to attempt to intubate trauma patients at all. Many emergency medical services teach intubation ‘cold’ for patients in cardiac arrest, but it is not rational to extrapolate that to trauma, especially when intubation attempts waste valuable time. Far more valuable are simple measures to maintain a clear airway, and prompt transport to hospital.

The use of anaesthetic drugs for intubation brings up an important semantic point. The abbreviation ‘RSI’ is used to stand for both ‘rapid sequence induction (of anaesthesia)’ and ‘rapid sequence intubation (of the trachea)’. The former phrase emphasizes the use of a balanced anaesthetic including neuromuscular blockade to provide amnesia, anaesthesia and ablation of airway reflexes whilst safely securing an airway. The latter phrase emphasizes above all else the placement of a tube in the trachea, and has been misused in many protocols such as ‘RSI after morphine and midazolam’ where pharmacologically there was unlikely to have been any useful effect from the drugs at the time laryngoscopy was attempted.8

To answer the first question, the only people who should be intubating trauma patients are those who are adequately trained and experienced in advanced airway management, including the appropriate use of drugs for intubation and appropriate training in the use of alternative airways for failed intubation, including at least one supraglottic (LMA, ILMA or Combitube) and one subglottic (cricothyrotomy) approach to the airway.9

Where should these patients be intubated?

It has been assumed that what was good for the hospital was good in the field, but prehospital intubation has never been formally validated. Most publications are merely observational, describing performance in a particular system, rather than a critical analysis a primary end point.

Local geography must be considered, as well as the expertise of the emergency medical service. As a general principle, nothing should be done prehospital that is likely to significantly delay the transport of the patient to ‘definitive care’. If the scene of the accident is within 20 minutes of a trauma hospital then it is very unlikely that there will be any benefit in taking the time to intubate a non apnoeic patient, rather than proceeding directly to hospital. In more remote locations the risk / benefit ratio changes and ten minutes spent safely securing an airway becomes more justifiable. In many systems advanced care providers (whether doctors, nurses or paramedics) and helicopters are intimately linked. It is important to remember that a helicopter is only a vehicle, however, and confers no time benefit at all over distances of less than 50km or 30 minutes driving time.10 If the choice comes down to ‘waiting for the helicopter with the doctor’ or ‘driving for twenty minutes to the hospital’ then almost always the latter is the more rational, though less glamorous, option. The benefit of helicopters and advanced crews is seen in more remote locations and in prolonged entrapment, and there is some evidence that in this context a specialist doctor team has better outcomes than even a well trained paramedic team.11

In the context of head trauma, the question then becomes ‘what is definitive care’? Fewer than 25% of head injury patients ever require cranial surgery,12 whereas more than 95% of secondary insults occur before admission to intensive care.12 It can therefore be argued that ‘definitive care’ is the provision of good neurointensive care, which begins with securing the airway and controlling ventilation prehospital if that is feasible. A major prospective randomised trial is about to start in Australia comparing outcomes from traumatic brain injury in a standard paramedic system with outcomes achieved by a helicopter based critical care physician / paramedic team (Garner A, personal communication). The technique used for the intubation is crucial.

Observational studies have suggested worse outcomes after prehospital intubation in head trauma13,14 but in every one of these studies the training, experience and technique of the paramedics can be criticised. The most recent of these from San Diego15 demonstrated the same problems. Inadequately trained paramedics attempted drug assisted intubations led to hypoxia, hypotension and aspiration on induction, hyperventilation after tube placement, and increased scene time.
So where should these patients be intubated? There is no evidence to support prehospital intubation when transport time to a trauma hospital is relatively short, and there is a large body of evidence that attempts at intubation delay transport and may cause harm if performed inexpertly. For longer prehospital times there may be a benefit to intubation, especially in neurotrauma, but this still needs validation in a formal trial. In inexperienced hands prehospital intubation can be extremely dangerous – attempts to introduce RSI into a prehospital programme just because it appears good in the emergency department are fraught with danger unless performed in the right (remote) demographic by appropriately trained and skilled personnel.

The same arguments apply in hospital. It is just as unacceptable for a junior emergency department doctor to attempt a drug assisted intubation unsupervised as it is for a junior paramedic. The most experienced doctor must be immediately available to assist with any trauma intubation as the patient’s reserves are diminished and problems occur quite unpredictably.

What training is required to intubate trauma patients?

No validated guidelines exist for training in airway management. The traditional approach is via an anaesthesia ‘apprenticeship’ but the appropriateness of this is being questioned. A specialist anaesthetist is estimated to perform at least 500 intubations annually, though the majority will be on ‘easy’ elective patients. Access to operating theatres however is difficult for non anaesthetic trainees, such as those from intensive care or emergency medicine programmes, and more so for nurses and paramedics. More importantly the practice of anaesthesia is changing, with newer less invasive operations and far fewer patients being intubated for their surgery. Particularly, the “classic” rapid sequence induction for Caesarean section is now infrequently performed as even emergency Caesareans are performed using regional blockade. As the overall incidence of difficult airways is extremely low in an elective surgical population it is reasonable to question whether six months or even twelve months of anaesthesia is time well spent for a trainee in emergency medicine or intensive care.

The alternative approach is with high fidelity simulators. In the context of a structured training programme it is possible to practice a wide variety of airway problems and solutions within a short time frame, \(^{16,17}\) Simulators allow practice in the management of airway ‘disasters’ and expose trainees to the range of adjunctive devices which can retrieve a ‘failed intubation’. It is likely that simulation will be increasingly important not just for training but also for recertification and it seems quite reasonable in the future that personnel involved in high risk procedures, such as trauma airway management, will have to undergo an annual reassessment of their skills on a simulator just as do personnel involved in aviation or the nuclear power industry. \(^{18}\)

Prehospital, too, the level of training is highly variable. In the San Diego RSI trial \(^{15}\) the only training in advanced airway management was with mannequins, whereas an excellent paramedic system in Bellingham County, Washington State, \(^{5}\) provides a training programme where paramedics get didactic teaching and practise on models then perform a minimum of 20 intubations in the operating theatre. This is followed by periods of in field supervision, ongoing case review and annual refreshers. To maintain currency the paramedic must perform at least one ‘live’ intubation per month for the first three years of practice then one every quarter subsequently.

Given the cost of this sort of training it is reasonable to question whether every paramedic should or could ever be trained to this level. It is estimated that 95% of paramedic intubations are for non-trauma indications, predominantly cardiac arrest. In one large prospective series, the Prehospital Airway Collaborative Evaluation (PACE-1)\(^{19}\) it was estimated that RSI was needed in only one case per 18 paramedics involved. Extrapolating their figures to the City of Pittsburgh EMS, Wang and colleagues\(^{5}\) estimate the need for only one RSI per paramedic per 10 years! It is clearly impractical to try to maintain skills if they are only likely to be needed once a decade on average.

A senior doctor in the trauma centre is expected to have significantly better skills than any paramedic. It therefore seems reasonable to the authors to insist on a minimum of 50 intubations under supervision before anyone is allowed to intubate an emergency patient, and at least one per month to maintain currency. If a trauma centre is not busy enough to maintain these numbers
for all senior doctors then an ongoing simulation programme is required in order to guarantee skills are maintained when they are needed.

**Is the recommended technique of trauma intubation safe?**

Practice has changed significantly in the last 30 years. Initial concerns about the risks of direct laryngoscopy in the context of cervical spine injury have proved unfounded, whilst the dangers of blind nasal intubation have been recognised. Better alternative airway devices have been developed, with the advent of firstly the laryngeal mask airway (LMA) in the mid 1980s and the Intubating LMA (ILMA) in the mid 1990s. Any guidelines written prior to about 1995 are likely to be invalid. Cricothyrotomy should now hardly ever be required (though still must be taught) and the Intubating LMA is probably the adjunct of choice in the context of initial failed intubation.

The ‘best’ technique for a routine trauma intubation is the technique the operator is used to, has practiced, and does well. The recommended rapid sequence induction for severe trauma includes preoxygenation, manual inline stabilisation of the cervical spine with removal of the anterior part of the cervical collar, cricoid pressure, induction drugs and a neuromuscular blocker, and direct laryngoscopy without extension of the atlanto-occipital joint. This technique has been used over 50,000 times at the Adams Shock Trauma Centre in Baltimore, with a cricothyrotomy rate of 0.1% and no new neurological injuries identified after the procedure [Dutton R, personal communication]. A subset of 393 of these patients with known cervical spine injuries have been described and there were no new neurological injuries after application of this technique.

**Conclusions**

We have highlighted a number of the current controversies in airway management in trauma. Trauma intubation needs to be done by “the right person, in the right place, with the right training”. Prehospital intubation is topical but has not been shown to improve outcomes and may cause significant harm in the hands of inexperienced operators. Anything which delays transfer to definitive care in severe trauma is inappropriate. In the right hands rapid sequence induction with manual in line stabilisation is a safe technique, and is the manoeuvre of choice to provide a definitive airway in a severely injured patient.

**References**

15. Davis DP, Hoyt DB, Ochs M, et al. The effect of paramedic rapid sequence intubation on outcome in patients with severe trau-


