Maxillofacial Injury—Not Always a Difficult Airway

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Abbreviations:
CT: computerized tomography
EMS: Emergency Medical Services
RSI: rapid sequence intubation

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Abstract

The optimal method for securing the airway in injured patients is controversial. Maxillofacial injury has been shown to be a marker for difficult airway management; however, a delay in intubation may result in deterioration of intubating conditions due to further airway bleeding and swelling. Decisions on the timing and method of airway management depend on multiple factors, including patient characteristics, the skill set of the clinicians, and logistical considerations. This report describes the case of a multi-agency response to a motor-vehicle collision in a rural area in Ireland. One young male patient had sustained significant maxillofacial injuries, multiple limb injuries, and had a decreased level of consciousness. Further airway compromise occurred following extrication. Difficult intubation was predicted; however, abnormal jaw mobility from bilateral mandibular fractures enabled easy laryngoscopy and intubation. Although preparation must be made for difficult airway management in the setting of maxillofacial injury, appropriately trained and experienced practitioners should not be deterred from performing early intubation when indicated.

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Introduction

Failure to protect the airway has been shown to be an error contributing to mortality in 16% of in-patient deaths from trauma in a Level I regional trauma center.[1] Patients with maxillofacial injury may present with airway compromise,[2] and management of this subset of trauma patients particularly can be challenging.

In the hospital setting, endotracheal intubation is considered standard practice for patients with potential or actual airway compromise. Prehospital airway management of these patients may take the form of basic maneuvers and adjuncts (positioning, jaw thrust, oropharyngeal airway, and nasopharyngeal airways), supraglottic devices, or endotracheal intubation. The percentage of trauma patients undergoing endotracheal intubation in ground-based Emergency Medical Service (EMS) varies from 2%-37%[3] and depends on the protocols of individual EMS systems.

Although effective airway management is a key component of prehospital care, the ideal approach to achieving this remains controversial.[4] Patients who are intubated without drugs following trauma have increased mortality when compared to patients undergoing basic airway management,[5] and prehospital rapid sequence intubation (RSI) has been associated with worse outcomes in traumatic brain injury.[6] In the United States, Cudnik et al showed that there was no statistical difference in survival of trauma patients who underwent prehospital intubation compared to patients who were not intubated.[7] An Australian study of paramedic provided prehospital RSI found a survival benefit in patients with isolated head trauma.[8] No published data exist on the benefit of prehospital RSI in patients with a combination of maxillofacial injury and compromised airway.

Despite the conflicting evidence base, prehospital RSI is considered standard of care in many jurisdictions, and several high-performing prehospital services have shown that prehospital RSI can be performed safely by well-trained doctor-paramedic teams.[9-13]

A decision on the optimal method of airway management should be made for each individual patient, and this decision may vary due to local factors of geography, transport time, transport modality (ground vs air), patient characteristics, and the availability of experienced emergency teams with the capability to perform prehospital RSI.[14]

Case Report

Written informed consent to write and publish this case report was obtained from Patient 2. Consent was not required from Patient 1 as his case was not discussed in detail.

A multi-agency response was dispatched to a motor-vehicle collision in rural County Tipperary, Ireland. A small car with two male occupants had been involved in a high-speed, frontal impact with a tree.

The initial response included an advanced paramedic in a rapid response vehicle, an Advanced Life Support ambulance, and a Basic Life Support ambulance. Fire and Rescue personnel and Police were also dispatched. At 2:52 AM, a critical care doctor was requested and arrived on scene at 3:21 AM.

Patient 1

Patient 1 was a 19-year-old male who was the unrestrained passenger and was ejected from the vehicle. He was alert and complaining of abdominal pain. On examination, he was tachycardic and hypotensive and had a soft but tender right upper quadrant. Ultrasound equipment was not available, so enhanced Focused Assessment with Sonography in Trauma was not performed.

He was packaged rapidly, and tranexamic acid (1 g) was administered for presumed intra-abdominal hemorrhage. He was transported from the scene in the care of an advanced paramedic. Blood products were not available, so intermittent boluses of crystalloid were administered en route to maintain a radial pulse.

Computerized tomography (CT) scans subsequently showed that he had sustained a liver laceration, which was managed conservatively and he made a complete recovery.

Patient 2

Patient 2 was also 19 years old and was the restrained driver of the vehicle. On arrival of EMS, he was trapped in the driver's seat, haemodynamically stable (heart rate 96; blood pressure 114/72), but with a reduced level of consciousness (Glasgow Coma Score 7; Eye response 1, Verbal response 2, and Motor response 4). He had obvious severe facial injuries with active airway hemorrhage, as well as multiple limb fractures. During his entrapment, his airway was maintained with a combination of an oropharyngeal airway, suction, and jaw thrust.

Due to the reduced level of consciousness and airway compromise, it was decided that a prehospital RSI would be performed immediately after extrication. Equipment (including failed intubation and surgical airway equipment) was set up and drugs were prepared using the RSI checklist (Appendix 1), as per standard operating procedure. Due to adverse weather conditions, it was decided to perform the procedure in the ambulance.

During the prolonged and difficult extrication from the vehicle, the patient was placed on a long spine board and had a cervical collar in situ. When he was positioned supine, the airway became compromised further despite basic adjuncts, and he required assisted ventilation with a bag-valve-mask to maintain oxygen saturation >94%. Facial swelling and mobile anatomical structures made mask seal difficult. Significant intra oral hemorrhage was noted from a tongue laceration and this required frequent suctioning.

Fentanyl 200 mcg, ketamine 100 mg, and rocuronium 100 mg were administered during the prehospital RSI. A Cormack and Lehane[15] Grade I view was achieved and the patient was intubated successfully with an 8.0 mm endotracheal tube on first pass. Apneic diffusion oxygenation was provided with nasal prongs, and there was no desaturation or hypotension. Correct tube placement was confirmed both clinically and with continuous capnography. After securing the endotracheal tube, intraoral bleeding was controlled easily with direct pressure on the tongue laceration.

Anesthesia was maintained with boluses of morphine and midazolam, and ongoing muscle relaxation was ensured with a further 50 mg of rocuronium. The patient was ventilated manually using a Mapleson C-circuit (Intersurgical; Berkshire, United Kingdom), and a target $EtCO_2$ range of 35 mmHG-45 mmHg was maintained. A single episode of hypotension during transport was responsive to a 250 ml bolus of crystalloid, and vacuum splints were applied to his limbs en route. Significantly increased facial swelling was noted on arrival at the receiving facility at 4:43 AM.

Subsequent CT imaging showed multiple facial fractures, including bilateral medial and lateral orbital wall fractures, bilateral medial and lateral pterygoid plate fractures, fractures to the lateral walls of the maxillary sinuses bilaterally, a fracture of the medial wall of the right maxillary sinus and bilateral mandibular fractures, as well as a comminuted nasal bone fracture.

He also sustained multiple fractures of all four limbs and focal intracerebral hemorrhages, which did not require neurosurgical intervention. Following extensive surgery and rehabilitation, the patient made a full recovery.

Discussion

Due to the injuries identified on assessment of Patient 2, the team anticipated difficulty in managing his airway. Bag-valve-mask ventilation[16] and endotracheal intubation has been reported to be more difficult in the presence of maxillofacial injury,[17-20] and trauma courses with an in-hospital[21] and a prehospital[22] focus list maxillofacial trauma as a marker for difficult airway management. This may be due to distorted or mobile maxillofacial anatomy resulting from the loss of bony integrity associated with bilateral maxillary or mandibular fractures.[23]

Airway swelling[24,25] and hemorrhage[26] can further obscure the view during laryngoscopy,[27] and a combination of these factors may lead to a delay in securing the airway. In patients with maxillofacial injuries, intubating conditions can deteriorate with the passage of time due to increased swelling, and intubation of these patients in the prehospital phase may be optimal.[28]

Multiple attempts at intubation are associated with an increased rate of complications,[29] and for this reason, many prehospital services advocate optimization of the first intubation attempt.[30] The strategies for maximizing first-pass success include optimizing patient positioning, removal of the cervical collar prior to laryngoscopy (with maintenance of manual in-line stabilization), ensuring that the patient is paralyzed pharmacologically and sedated adequately, ensuring the availability of multiple suction devices in the event of massive airway hemorrhage, external laryngeal manipulation and the routine use of a bougie, as well as performing a challenge-response checklist and team briefing prior to commencing the prehospital RSI. In the event of failed intubation, a backup plan (ie, supraglottic device and surgical airway technique) should be in place and discussed during the team brief. Following intubation, hemorrhage from the mid-face may be controlled by the use of McKesson props and balloon tamponade.[31]

In this case of maxillofacial trauma following a motor-vehicle collision, intra-oral hemorrhage and abnormal posterior movement of the tongue and fractured mandible resulted in airway compromise when the patient was placed supine on extrication from the vehicle. This same abnormal jaw mobility also facilitated laryngoscopy and led to an easier than anticipated intubation. This phenomenon may contribute to the finding that maxillofacial injury is not associated with difficult airway management in some series.[32]

Conclusion

It was considered that early definitive airway management was a key factor in a successful outcome for Patient 2. While the presence of maxillofacial trauma may, in some cases, make airway management more challenging, this should not deter appropriately trained and equipped providers from performing early prehospital RSI when indicated.

References

1. Gruen RL, Jurkovich GJ, McIntyre LK, Foy HM, Maier RV. Patterns of errors contributing to trauma mortality: lessons learned from 2,594 deaths. *Ann Surg*. 2006;244(3):371-380.
2. Tung TC, Tseng WS, Chen CT, Lai JP, Chen YR. Acute life-threatening injuries in facial fracture patients: a review of 1,025 patients. *J Trauma*. 2000;49(3):420-424.
3. Mayglothling J, Duane TM, Gibbs M, et al. Eastern Association for the Surgery of Trauma. Emergency tracheal intubation immediately following traumatic injury: an Eastern Association for the Surgery of Trauma practice management guideline. *J Trauma Acute Care Surg*. 2012;73(5 Suppl 4):S333-S340.
4. Boer C, Franschman G, Loer SA. Prehospital management of severe traumatic brain injury: concepts and ongoing controversies. *Curr Opin Anaesthesiol*. 2012;25(5):556-562.
5. Evans CC, Brison RJ, Howes D, Stiell IG, Pickett W. Prehospital non-drug assisted intubation for adult trauma patients with a Glasgow Coma Score less than 9. *Emerg Med J*. 2013;30(11):935-941.
6. Karamanos E, Talving P, Skiada D, et al. Is prehospital endotracheal intubation associated with improved outcomes in isolated severe head injury? A matched cohort analysis. *Prehosp Disaster Med*. 2014;29(1):32-36.
7. Cudnik MT, Newgard CD, Daya M, Jui J. The impact of rapid sequence intubation on trauma patient mortality in attempted prehospital intubation. *J Emerg Med*. 2010;38(2):175-181.
8. Bernard SA, Nguyen V, Cameron P, et al. Prehospital rapid sequence intubation improves functional outcome for patients with severe traumatic brain injury: a randomized controlled trial. *Ann Surg*. 2010;252(6):959-965.
9. McQueen C, Crombie N, Hulme J, et al. Prehospital anaesthesia performed by physician/critical care paramedic teams in a major trauma network in the UK: a 12 month review of practice. *Emerg Med J*. 2015;32(1):65-69.
10. von Vopelius-Feldt J, Benger JR. Prehospital anaesthesia by a physician and paramedic critical care team in Southwest England. *J Emerg Med*. 2013;20(6):382-386.
11. Kamiutsuri K, Okutani R, Kozawa S. Analysis of prehospital endotracheal intubation performed by emergency physicians: retrospective survey of a single emergency medical center in Japan. *J Anesth*. 2013;27(3):374-379.
12. Sollid SJ, Lossius HM, Søreide E. Pre-hospital intubation by anaesthesiologists in patients with severe trauma: an audit of a Norwegian helicopter emergency medical service. *Scand J Trauma Resusc Emerg Med*. 2010;18:30.
13. Crewdson K, Lockey DJ. An observational study of intubation success rates and rescue airway techniques among 7,256 pre-hospital physician intubations of trauma patients. *Scand J Trauma Resusc Emerg Med*. 2014;22(1):788.
14. Boer C, Franschman G, Loer SA. Prehospital management of severe traumatic brain injury: concepts and ongoing controversies. *Curr Opin Anaesthesiol*. 2012;25(5):556-562.
15. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. *Anaesthesia*. 1984;39:1105-1111.
16. Perry M, Morris C. Advanced Trauma Life Support (ATLS) and facial trauma: can one size fit all? Part 2: ATLS, maxillofacial injuries and airway management dilemmas. *Int J Oral Maxillofac Surg*. 2008;37(4):309-320.
17. Combes X, Jabre P, Jbeili C, et al. Prehospital standardization of medical airway management: incidence and risk factors of difficult airway. *Acad Emerg Med*. 2006; 13(8):828-834.
18. Slagt C, Zondervan A, Patka P, de Lange JJ. A retrospective evaluation performed of the intubations performed during five years of helicopter emergency medical service in Amsterdam. *Air Med J*. 2004;23(5):36-37.
19. Kellman RM, Losquadro WD. Comprehensive airway management of patients with maxillofacial trauma. *Craniomax- illofac Trauma Reconstr*. 2008;1:39-48.
20. Breckwoldt J, Klemstein S, Brunne B, Schnitzer L, Mochmann HC, Arntz HR. Difficult prehospital endotracheal intubation - predisposing factors in a physician based EMS. *Resuscitation*. 2011;82(12):1519-1524.
21. American College of Surgeons Committee on Trauma. *Advanced Trauma Life Support Program for Doctors*. 8th ed. Chicago, Illinois USA: American College of Surgeons; 2008.
22. National Association of Emergency Medical Technicians. *Prehospital Trauma Life Support*. 7th ed. Sudbury, Massachusetts USA: Jones & Bartlett; 2010.
23. Hutchison I, Lawlor M, Skinner D. ABC of Major Trauma. Major maxillofacial injuries. *BMJ*. 1990;301:595-599.
24. Morrissette MP, Chewning LC. Rapid airway compromise following traumatic laceration of the facial artery. *J Oral Maxillofac Surg*. 1990;48:989-990.
25. Ardekian L, Rosen D, Klein Y, Peled M, Michaelson M, Laufer D. Life-threatening complications and irreversible damage following maxillofacial trauma. *Injury*. 1998;29(4): 253-256.
26. Chase CR, Hebert JC, Farnham JE. Post-traumatic upper airway obstruction secondary to a lingual artery hematoma. *J Trauma*. 1987;27:953-954.
27. King HK. Airway managements of patients with maxillofacial trauma. *Acta Anaesthesiol Sin*. 1996;34(4):213-220.
28. Bredmose PP, Rock S, Lockey DJ. Prehospital tracheal intubation in severe facial trauma: a short window of opportunity. *Emerg Med J*. 2012;29(9):767-768.
29. Mort TC. Emergency tracheal intubation; complications associated with repeated larynogoscopic attempts. *Anesth Analg*. 2004;99:607-613.
30. Greater Sydney Area HEMS RSI Manual. Greater Sydney Area HEMS Web site. www.sydneyhems.com/. Accessed May 15, 2014.
31. Murphy AP, Doran HJ, O'Sullivan I, Sleeman D, Cusack SP. The McKesson prop–an essential tool for the emergency physician? *Emerg Med J*. 2010;27(2):156-158.
32. Cobas MA, De la Peña MA, Manning R, Candiotti K, Varon AJ. Prehospital intubations and mortality: a Level 1 trauma center perspective. *Anesth Analg*. 2009; 109(2):489-493.

Appendix 1. RSI Checklist.

RSI Check-List

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READ EVERY WORD AND WAIT FOR RESPONSE BEFORE MOVING TO NEXT LINE

What is indication for RSI ?	Response
PRE-OXYGENATE – Consider Nasal Prongs	**Check**
Oxygen cylinder more than 1/2 full or Wall source available	Check
Spare cylinder available under trolley	Check
Water's Circuit connected to Oxygen	Check
Face Mask, filter and End Tidal CO_2 Monitoring connected into circuit	Check
SUCTION working	**Check**
Hand-held back-up suction available	Check
BVM available	**Check**
Oropharyngeal & 2 nasopharygeal airways available	Check
LMA available if there is failure to intubate on 2nd attempt?	Check
Surgical airway kit available	Check
IV Running with access port connected	Check
2nd cannula in situ or IO available	Check
Drugs for Induction, what dose?	Response
Paralysing agent, what dose?	Response
What maintenance drugs are we using?	Response
Emergency drugs available?	Response
LARYNGOSCOPE working	**Check**
Back-up Laryngoscope working	Check
Bougie	Check
Tube size	Response
Alternate tube size	Response
Test tube cuffs	Check
Tube tie or tape	Check
Check Monitoring, what is the **O2 Saturation?**	Response
What is the **Blood Pressure?**	Response
What is the **Heart Rate?**	Response
Brief drug administrator	Briefing
Perform In-line immobiliser brief	Briefing
Perform Cricoid brief	Briefing
All listen for failed airway plan	Briefing
Optimise patient position	Ready
Check Complete	Proceed

Abbreviation: RSI, rapid sequence intubation.

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