PREHOSPITAL CARE

Critically injured patients, inaccessible airways, and laryngeal mask airways

J Hulme, G D Perkins

Emerg Med J 2005;**22**:742–744. doi: 10.1136/emj.2005.026443

Managing the airway of a critically injured trauma patient in the prehospital environment is challenging, especially when access to the patient's airway is limited as is often the case in vehicle entrapment incidents. This paper reports the use of the laryngeal mask airway as an adjunct to airway management when attempts using simple airway management techniques have failed to provide adequate oxygenation and ventilation and limited access to the patient precluded endotracheal intubation.

Airway management is a priority to achieve oxygenation and ventilation. Resuscitation reduces immediate deaths, multi-organ failure, and disability, accounting for the first and third peaks respectively in a trimodal distribution of death following trauma.[1] The "gold standard" method for airway control is a cuffed tube within the trachea.[2] However, prehospital resuscitation commonly takes place in conditions where environmental or personnel constraints make endotracheal intubation impossible.

Current ambulance service guidelines promote use of the laryngeal mask airway (LMA) following failed intubation during resuscitation or where limited access to the patient prohibits intubation.[2] Despite these recommendations, provision of LMAs across ambulance service trusts in the UK is not universal. We have reviewed LMA use in an urban prehospital care setting when endotracheal intubation was not possible.

CASE SERIES

Doctors responding through the West Midlands Central Accident Resuscitation Emergency (CARE) Team[3] retrospectively reported prehospital LMA use between 2003–04 on a standard proforma. These doctors have training in airway skills including endotracheal intubation, LMA insertion, and surgical airway techniques and attended approximately 150 incidents during the study period. During this time LMAs were not available to paramedics in the local ambulance service trust.

Table 1 describes the use of the LMA in 15 patients (trapped in motor vehicles (n = 12) or machinery (n = 2), or run over (n = 1)). In 11 cases, patient positioning precluded attempts at intubation. In four patients its use followed failed intubation attempts and in one patient it was used to prevent airway soiling from bleeding. In 14/15, oxygenation and ventilation were impaired before LMA insertion despite the use of airway positioning and simple adjuncts. In the other patient the LMA was used during general anaesthesia before limb amputation.

LMA insertion was performed without sedation, anaesthesia, or neuromuscular blockade in 8/15 cases.

There were three complications. In one case the LMA was coughed out as oxygenation improved. In a second case where the LMA was used in a prone patient, ventilation failed as the result of an excessive leak after extrication and turning supine. Rapid sequence induction (RSI) and endotracheal intubation was then performed. This patient had massive chest injuries and a ruptured diaphragm and presumably poor pulmonary compliance. In the final case, the LMA was used after a failed attempt at endotracheal intubation, but failed to adequately ventilate the patient. A definitive airway was then obtained by surgical techniques.

DISCUSSION

This series confirms the important role the LMA has in managing the prehospital airway. It facilitated management of critical airway problems in approximately 10% of patients treated by doctors in an urban prehospital care scheme. Although the use of the LMA is increasing in prehospital resuscitation from cardiac arrests[4] there are few published reports of its use in patients with traumatic injuries, where poor access to the patient may limit the opportunities for more traditional approaches to airway management such as endotracheal intubation.

The LMA has been available since 1988 as an alternative when an endotracheal tube (ETT) is not required. It is now used routinely in hospital practice and in some operations where traditionally the ETT was regarded as the gold standard. It plays an important role in managing the difficult airway—either as a planned alternative to, or to facilitate intubation or as a rescue device as part of the failed intubation drill. The trapped, critically injured patient with airway problems presents unique challenges to the prehospital care provider. Access constraints to patients' airways mean that airway management is often suboptimal despite the use of simple airway adjuncts such as the oropharyngeal or nasopharyngeal airway particularly when positive pressure ventilation is required. Problems with access to the airway often preclude RSI and intubation.

The LMA is inserted blindly into the oropharynx while maintaining manual in-line stabilisation. It is generally tolerated without neuromuscular blockade. Patients tolerating an oropharyngeal airway can often tolerate an LMA.[5] Spontaneous ventilation alone through an LMA may be adequate once the airway has been opened with it or may be supported by positive pressure ventilation. Manual ventilation through an LMA has been shown to be superior to bag valve mask ventilation. Success rates by paramedics even in ideal conditions are greater for the LMA (90%) than endotracheal tube (77%) and the airway is secured more rapidly with less cervical spine movement or sympathetic stimulation.[6] The complications of oesophageal or bronchial intubation do not occur.

Abbreviations: ETT, endotracheal tube; LMA, laryngeal mask airway; RSI, rapid sequence induction.

Table 1 Laryngeal mask airway use by immediate care doctors

Sex	Age	Scenario	Clinical condition	Indication for LMA	Anaesthesia/ muscle relaxants for insertion	Complications	Further management
M	20	Vehicle entrapment	Obstructed airway	Limited access	No	No	ETT after extrication
F	80	Vehicle entrapment	Respiratory arrest	Limited access Unable to ventilate with bag and mask	No	No	ETT after extrication
M	20	Vehicle entrapment	Respiratory arrest	Limited access Unable to ventilate with bag and mask	No	No	ETT in A&E
M	36	Vehicle entrapment	Respiratory arrest	Limited access Unable to ventilate with bag and mask	No	Failed 1st attempt, successful 2nd attempt	ETT in A&E
M	?	Vehicle entrapment	Obstructed airway	Limited access	No	No	ETT in A&E
M	55	Vehicle entrapment	Obstructed airway	Failed intubation	Yes	No	Tracheostomy in A&E
M	55	Vehicle entrapment	Obstructed airway	Limited access	No	No	ETT in A&E
M	32	Hit and run	Obstructed airway	Limited access	No	Coughed out LMA	ETT in A&E
M	50	Vehicle entrapment	Obstructed airway	Limited access	Yes	No	ETT in A&E
M	30	Vehicle entrapment	Obstructed airway	Limited access	No	Large leak when supine Required intubation	ETT after extrication
M	33	Vehicle entrapment	Obstructed airway	Limited access	Yes	No	ETT in A&E
M	50	Trapped in machinery	Anaesthesia for amputation	Difficult patient position	Yes	No	ETT in A+E
M	30	Vehicle entrapment	Obstructed airway	Failed intubation	Yes	No	ETT in A&E
M	55	Vehicle entrapment	Obstructed airway	Failed intubation	Yes	No	Tracheostomy in A&E
F	18	Vehicle entrapment	Obstructed airway	Failed intubation	Yes	Could not ventilate	Surgical airway at scene

ETT, endotracheal tube.

There are limitations. Prehospital LMA success rates are lower than those seen in the hospital cardiac arrest or elective surgical patient; probably because of the less controlled environment, the presence of intact airway reflexes, or maxillofacial injuries.[7] Tolerance can be facilitated with sedation, or paralysis if used after failed intubation. It may not protect against aspiration hence full stomachs are a contraindication to elective use. However, the incidence of aspiration with the LMA may be overstated and is less than when intubation is preceded by bag and mask use.[8] LMAs can reduce soiling from upper airway bleeding.[9] High airway pressures (>20 cm H_20) cannot be reliably generated when ventilating through the LMA which can lead to ineffective ventilation in patients with poor respiratory compliance due to injury, concurrent disease, or body habitus. The patient with ineffective LMA ventilation due to thoracic injuries was possible to ventilate after intubation by one of the authors (JH).

An alternative to the standard LMA is the ProSeal LMA. This has a separate channel in addition to the channel used for ventilation which allows escape of gastric contents and reduces stomach insufflation. It has a second cuff to improve the seal, is easy to insert, provides better ventilation if airway pressures are higher, and reduces risk of pulmonary aspiration.[10] It may be a superior device for prehospital patients.

In this series, the LMA was replaced following extrication in three cases despite working adequately in two. It is unclear when an LMA should be exchanged for an endotracheal tube. We suggest that if working well, exchange is performed in the emergency department where good lighting and positioning, easily accessible equipment, and experienced staff make intubation a more achievable ''gold standard''.

In conclusion, this case series reports the successful use of the LMA by UK immediate care doctors when attempts to manage the airway using simple adjuncts failed or access to perform RSI and intubation had been difficult or unsuccessful.

Most patients did not require anaesthesia or neuromuscular blockade for the LMA to be used successfully and insertion would have been possible by the ambulance crew already on scene. Successful use following failed intubation during RSI simulates use during cardiac arrest, when airway reflexes are absent, and re-enforces existing recommendations.

The frequency with which the LMA was used to manage critical airway problems supports the expansion of LMA use throughout ambulance service trusts. Immediate care doctors should be familiar with the LMA in these situations and as a successful device following sedation or anaesthesia, especially after failed intubation.

ACKNOWLEDGEMENTS

The authors thank doctors within the West Midlands CARE team for providing details of the clinical cases presented in this report: Keith Porter, Nick Sherwood, Matt Robbins, Jonathan Leach, Adrian Noon, Ken Deacon.

Authors' affiliations

J Hulme, University Hospital Birmingham NHS Trust, Selly Oak Hospital, Birmingham, UK

G D Perkins, Division of Medical Sciences, University of Birmingham, Birmingham, UK

Financial support: none.

Competing interests: none declared

Correspondence to: Dr Jonathan Hulme, 38 Earls Court Road, Birmingham B17 9AH, UK; jonhulme@doctors.org.uk

Accepted for pubication 26 July 2005

REFERENCES

1 **Baker CC**, Oppenheimer L, Stephens B, *et al*. Epidemiology of trauma deaths. *Am J Surg* 1980;**140**:144–50.
2 In: **Todd I**, ed. *Clinical practice guidelines for use in UK ambulance services*. London: IHCD (on behalf of the Ambulance Service Association and the Joint Royal Colleges Ambulance Liaison Committee), June, 2004.
3 **Porter KM**. Training doctors in prehospital care: the West Midlands (UK) approach. *Emerg Med J* 2004;**21**:509–10.
4 **Pattinson K**, Todd I, Thomas J, *et al*. A two year review of laryngeal mask use by the Warwickshire ambulance service [letter]. *Emerg Med J* 2004;**21**:397–8.
5 **Brimacombe J**. The advantages of the LMA over the tracheal tube or facemask: a meta-analysis. *Can J Anaesth* 1995;**42**:1017–23.
6 **Deakin CD**, Peters R, Tomlinson P, *et al*. Securing the prehospital airway: a comparison of laryngeal mask insertion and endotracheal intubation by UK paramedics. *Emerg Med J* 2005;**22**:64–7.
7 **Grantham H**, Phillips G, Gilligan JE. The laryngeal mask in pre-hospital emergency care. *Emerg Med* 1994;**28**:97–102.
8 **Stone BJ**, Chantler PJ, Baskett PJ. The incidence of regurgitation during cardiopulmonary resuscitation: a comparison between the bag valve mask and laryngeal mask airway. *Resuscitation* 1998;**38**:3–6.
9 **John RÉ**, Hill S, Hughes TJ. Airway protection by the laryngeal mask. A barrier to dye placed in the pharynx. *Anaesthesia* 1991;**46**: 366–7.
10 **Brain AIJ**, Verghese C, Strube PJ. The LMA 'ProSeal'—a laryngeal mask with an oesophageal vent. *Br J Anaesth* 2000;**84**:650–4.