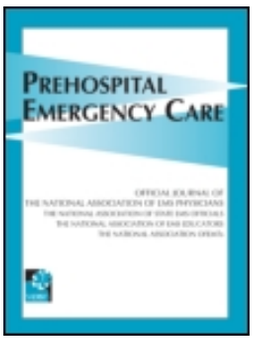

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Prehospital Airway Management with the Laryngeal Mask Airway in Polytraumatized Patients

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In Italy, as in most industrialized countries, trauma represents the first cause of death in populations aged less than 40 years, and the third overall cause of death in every age group, with an incidence of about 120 cases for every 100,000 inhabitants.[1] Traumatic events (road, industrial or domestic accidents, or assaults) inflict an enormous social cost due to the fact that they often affect patients in the most productive age groups. Furthermore, in many injured patients, disabling conditions remain permanent, aggravating the negative consequences on both a human level and a social level.

The distribution curve of trauma deaths appears to demonstrate a three-part pattern. The first peak concerns deaths happening within a few seconds or minutes of the traumatic event. The causes are such things as severe cranial and spinal injuries and lacerations of the great vessels—injuries that are life-threatening and usually quickly fatal in spite of the actual level of medical technology available. These are unavoidable deaths, and as a consequence an increase in survival under such circumstances can be achieved only through the adoption of preventive measures. The second peak of mortality incidence finds its place in the first hours after trauma. It concerns primarily hypoxia and hypovolemia deriving from injuries to the viscera and vessels that are potentially lethal but can often be managed through rapid treatment.[2,3] Finally, the third peak, chronologically located after some days and weeks from the trauma, concerns all deaths caused by multiorgan insufficiency, infections, and multiple functional inability.

Timely and appropriate management of the airway is of fundamental importance in the prevention of the second peak of mortality. It is likely that alternatives to the endotracheal tube, such as the laryngeal mask airway (LMA), can be extremely important when, for whatever reason, it is not possible to carry out laryngoscopy or proceed with a blind endotracheal intubation of the patient. This article reports six cases of difficult intubation in polytraumatized patients where laryngoscopy was unsuccessful. In each of these cases an LMA was rapidly inserted on scene by the anesthesiologist of Padua's SUEM 118 (*Servizio Urgenza Emergenza Medica*, Medical Urgency and Emergency Service).

Case 1

On March 17, 1999, a 70-year-old woman (weight 65 kg, height 165 cm) was run over by a heavy truck while she was in her car. A primary evaluation of the patient showed coma [Glasgow Coma Scale score (GCS) 7], facial trauma with edema, concussive cranial trauma, and stertorous breathing with a copious rhinopharyngeal hemorrhage. Central and peripheral pulses were present: blood pressure (BP) 90/60 mm Hg, heart rate (HR) 110 beats/min, and oxygen saturation (SaO_2) 88%.

The rigid KED (Kendrick extrication device) and cervical collar were applied. The airways were aspirated; then a laryngoscopy was carried out, after sedating the patient with diazepam 10 mg intravenous (IV) and fentanyl 100 μg IV. The laryngoscopy appeared immediately difficult (Cormack and Lehane grade 4). The physician made five unsuccessful attempts at oral intubation using a laryngoscope; subsequently, a size 4 standard LMA was inserted. It was inflated with 25 mL of air, and the patient was manually ventilated with a bag–valve and oxygen (8 L/min) until good levels of arterial saturation were obtained, as shown by the saturation meter.

A small pharyngeal probe in continuous aspiration kept the upper airways clear. During transportation in the ambulance, the hemodynamic conditions remained stable: BP 100/60 mm Hg; HR 100 beats/min, and SaO_2 95%.

The LMA was left in place until arrival at the emergency ward, where endoscopists had been alerted and were ready to proceed with the endotracheal intubation of the patient.

The patient was attended by an anesthesiologist through all diagnostic investigations. A computed tomography (CT) scan of the brain showed cerebral edema, no cervical spinal lesions, multiple small bruises, and bilateral fractures of the wall of the orbit and the cheekbones. The patient was then transported to intensive care, and released from the hospital after ten days, without neurological consequences.

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Case 2

A 20-year-old man ran off the road while driving his car, which capsized in a ditch. He showed concussive cranial trauma, GCS 4, an open fracture on the right upper limb, BP 100/65 mm Hg, HR 110 beats/min, and SaO_2 97%. Considering the patient's position and the dynamics of the accident, an injury to the spine was suspected (though not confirmed by the subsequent diagnostic investigations). A size 5 LMA was placed, and inflated with 30 mL of air. Adequate saturation and ventilation were provided for more than 20 minutes until the patient was extricated with a cervical collar, KED, and spinal board. After the patient was placed in the ambulance, two IV catheters were placed, fluid therapy was started, and the LMA was replaced with an orotracheal tube by means of laryngoscopy and manual in-line stabilization of the cervical spine.

Sixty days after the trauma, the patient was discharged from the hospital without neurologic sequelae.

Case 3

A 40-year-old man was involved in a road accident, with the car ending up in a ditch. The SUEM medical car arrived on scene before the Fire Brigade. The patient showed BP 110/70 mm Hg, HR 95 beats/min, SaO_2 92%, GCS 5, head–facial trauma, thoracic trauma, and a fractured left shoulder. It was impossible to open the driver's door and the patient could be reached only through the side window. Therefore, a number 5 LMA and an IV catheter were placed through the window, thus ensuring good oxygenation and ventilation until the arrival of the Fire Brigade. With their help it was possible to open the back door of the car and extricate the patient with a cervical collar, KED, and spinal board. In the ambulance, the LMA was replaced with an orotracheal tube. The CT and other radiological investigation carried out at the emergency ward confirmed the traumas: a frontal cerebral contusion, a Le Fort II fracture, and fractures of left ribs 4 through 6 and the left shoulder.

After 32 days the patient was discharged without neurological damage.

Case 4

A 35-year-old man, weight 70 kg, height 175 cm, was a restrained passenger involved in a rollover motor vehicle accident. After a head-on collision with a heavy vehicle, the patient was thrown out of his car and found in a ditch on the opposite side of the road at a distance of more than 10 meters. He showed: GCS 8, concussive cranial trauma, suspected medullar lesion, lower right limb compound fracture, fracture of the pelvis, bradypnea, suspected fractures of the ribcage, BP 70 mm Hg systolic, diastolic pressure undetected, and HR 130 beats/min.

The dynamics of the accident suggested a lesion of the cervical vertebrae with fair certainty (as later confirmed by a CT investigation). Intubation was very difficult: the patient's head was lying between a pole and the guard-rail. In order to avoid moving the head or neck, manual in-line stabilization of the neck was applied by a paramedic, and the physician, who was lying alongside the patient, positioned a number 4 LMA. A cervical collar was then applied and with log-roll technique, the patient was positioned on the spinal board.

After volume replacement and ventilation with oxygen, the arterial pressure reached 120/70 mm Hg with an HR of 80 beats/min and an SaO_2 of 96%.

Four days after surgery to stabilize the cervical vertebrae, the patient was transferred to the surgical ward without evidence of aspiration pneumonia or any neurologic damage.

Case 5

A 25-year-old man, weight 80 kg, height 180 cm, was involved in a head-on collision with another car. He was found in a ditch, lying on his side, the most seriously injured of the victims. When the SUEM medical car arrived, he was in a coma (GCS 6) and needed immediate intubation. The patient was trapped in his car and, waiting for the Fire Brigade to arrive and free him, the physician squeezed into the capsized car alongside the patient and positioned a number 5 LMA. After 25 minutes the patient was removed to the ambulance stretcher with a KED, cervical collar, spinal board, and peripheral IV catheter. Arterial saturation was good (97%), BP was stabilized at about 100/55 mm Hg, and the HR was 98 beats/min.

On arrival at the emergency ward, a CT brain investigation showed multiple cerebral contusions with significant edema. Fractures were identified in the following positions: 5th, 6th, and 7th right ribs, right clavicle, right humerus, and right femur. On arrival at the intensive care unit, the medical staff positioned an orotracheal tube. After eight days the patient was transferred to the ward, with stabilized fractures, and without neurological damage.

Case 6

A 44-year-old man fell from a 6-meter height while cleaning the windows of the office where he was employed as a cleaner. When the SUEM medical car arrived, his condition appeared very serious: concussive cranial trauma (GCS 7), abdominal trauma, open fracture to right femur, and a lesion to left femoral artery.

The patient lay with his head in a small space between a very heavy concrete flower pot and the wall of the building. A number 5 LMA was placed by standing in front of the patient. The patient was stabilized and the bleeding at the left femoral artery was controlled, IV lines were inserted in two large peripheral veins, and an adequate volume fill was carried out. After being immobilized with a cervical collar, spinal board, and head immobilizer, the patient was placed in the ambulance, where the femoral bleeding from the lower right limb was blocked with ropivacaine. Blood pressure

was stable at 110/90 mm Hg, with HR 115 beats/min and SaO_2 96%.

Twenty days later, the patient was transferred to the surgery ward, and was subsequently discharged without neurological sequelae after 34 days.

DISCUSSION

High incidences of unsuccessful attempts and complications have been reported when emergency tracheal intubation is performed outside the hospital on severely injured patients. The experience of the operator influences the number of attempts and the time needed to complete a successful intubation.[4]

In a recent study carried out at our center,[5] we found that 62.4% of in-hospital deaths due to polytrauma occurred within the first hour and 86.8% within the first 24 hours. This demonstrates the severity of the initial lesions. Tracheal intubation is the most reliable means to control airway patency definitively[6] and, when it is accompanied by an adequate assisted ventilation, it is probably one of the most useful interventions in patients with severe head trauma.

However, tracheal intubation is often made difficult or impossible by environmental factors (car accident victims are often blocked in their cars in a sitting, lateral, or prone position) and the traumatic pathology (such as cervical trauma or edema of the airway). The LMA can be inserted from the frontal or lateral position with respect to the patient when traditional laryngoscopy behind the patient's shoulders is difficult or impossible (restricted spaces, car's bodywork interfering with the reaching of the patient, an overturned car, etc.).[7,8] The introduction of new instruments offers further help in emergency aid maneuvers until the patient reaches the hospital.

At the university of Padua, thanks to the routine use of the LMA in our operating theaters, we have been able to appreciate the advantages and limitations of this device and, therefore, extend its favorable applications to our external emergency situations; in our area, anesthesiologists are used to carrying and using it in the field. This device, as well as other airway management devices such as endotracheal tubes, the Combitube, oro- and nasotracheal cannulae, and face masks, is present on board the 20 type A ambulances (mobile resuscitation units with trained volunteer personnel) and eight SUEM medical cars (with an anesthesiologist and nurse) in service in the province of Padua (2,141 km^2, about 830,000 inhabitants, or 388 inhabitants/km^2).

A patient with possible cervical spinal trauma or an "uncleared cervical spine" requiring endotracheal intubation represents a difficult situation with which prehospital personnel, emergency physicians, and anesthesiologists are often confronted. Management of the airways in cervical spine-injured patients remains controversial. However, patterns of safe methods of airway management have emerged in the last ten years. The methods in those situations are: direct oral intubation with cervical spinal immobilization, blind nasotracheal intubation, and retrograde intubation via the cricothyroid membrane—but these techniques are not without complications.

Although some researchers suggest that nasal intubation is the least disruptive to the cervical spine,[9,10] one study showed that 1.6% of patients with traumatic cervical spinal fracture develop a neurologic deficit after nasal intubation.[11] In our experience, the LMA seems to constitute a real advantage when compared with face mask ventilation. Further, it may represent a valid alternative until arrival at the emergency ward, where a more experienced anesthesiologist can be contacted, or until the arrival of an endoscopist.[12]

The main hindrance in the use of the LMA in emergency situations is the possibility of aspiration of gastric contents in the event of a regurgitation. Several prospective epidemiological studies have been conducted with regard to this. Brimacombe and Berry cite two cases every 10,000[13]; Lee and Brain[14] and Brain[15] report an incidence of two cases out of 8,500. Leach and Alexander found no cases of aspiration of gastric contents out of 7,000 analyzed cases,[16] as did Moylan and Luce (out of 2,500 cases),[17] Wainwright (out of 1,877 cases),[18] and the same Brimacombe and Berry in another study[19]; Haden et al. refer one case out of 3,500 patients.[20]

Although the LMA does not guarantee protection against gastric content reflux and aspiration, it is necessary to remember all prehospital patients must be assumed to have full stomachs, and the risk of aspiration is present also during the performing of the orotracheal intubation. All things considered, the incidence of aspiration with the LMA seems to be very low (0.6% in a polycentric study[21]) and much lower than likely during resuscitation maneuvers on patients with non-protected airways, using facial mask ventilation (FMV) or mouth-to-mouth ventilation. Regurgitation takes place much more frequently when the stomach has been insufflated by a previous mouth-to-mouth respiration or a bag–valve–mask (BVM) ventilation.[22,23] In prehospital situations, the initial ventilation is commonly carried out by BVM, before the positioning of another device that can ensure protection to the airways, and undoubtedly this fact increases the risk of regurgitation.[24] If such complication is attributed to the use of the LMA, then it is necessary to take into consideration whether the patient has been previously ventilated by a facial mask. Many studies have confirmed that when the LMA is used as a first device to manage the airways, the incidence of aspiration of gastric contents is lower than when its positioning is preceded by mask ventilation.[25–29]

Conclusions

Cases of difficult intubation are more frequent in emergency rather than in elective situations. In our system, the LMA is widely used in out-of-hospital emergency situations, in cases when intubation is difficult, such as with patients who are blocked in their cars or lying on their sides or prone. The LMA can provide a fast, secure, patent airway in many patients who cannot be intubated under emergency circumstances.

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