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CASE REPORT

Prehospital fiberoptic intubation☆,☆☆

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Summary We present a case of a patient with severe multiple trauma who was treated at the scene by a physician-staffed trauma life support team. Due to a complete tracheal transection, a ''cannot ventilate, cannot intubate''-situation occurred. The patient was then intubated using a fiberoptic bronchoscope in the prehospital setting. The current literature concerning fiberoptic intubation in emergencies is discussed.

Introduction

Airway management remains a crucial issue in prehospital emergency care and has been discussed consistently in the scientific literature, especially in recent years. Establishing an airway under prehospital emergency conditions is more difficult than in the standard hospital clinical situation, where expert help and alternative airway devices are usually abundantly available.[1] Various success rates and outcomes concerning rapid sequence induction and tracheal intubation in the prehospital setting have been reported, and the deleterious effects of unrecognised oesophageal and endobronchial out-of-hospital intubation have been highlighted recently.[2,3] We report a case where prehospital airway management proved to be extremely complicated and control of the airway was finally achieved using fiberoptic bronchoscopy.

Case report

The rescue helicopter was dispatched to a motor-vehicle accident and was the first physician-staffed vehicle to arrive on the scene. The crew found three patients injured after a severe crash between a truck and a passenger car, whose driver had to be extracted from the wreckage by fire-fighters and was treated by the helicopter crew.

At the first assessment, the 70-year-old male was unconscious with a Glasgow Coma Score of 3 and skin cyanosis. Although the patient was breathing spontaneously, bubbling and snoring indicated partial airway obstruction. The pulse rate of 120 per minute was palpable at the carotid arteries only. In addition to abrasions across the abdomen and signs of fracture of the left femur, physical examination revealed severe craniofacial trauma and bruises and marks across the chest wall. Subcutaneous emphysema and crepitation on the left side of the chest and around the neck indicated the presence of severe thoracic trauma.

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After immediate application of oxygen via an oxygen mask, the patient was monitored, three intravenous lines inserted and 500 ml of hydroxyethyl starch and two units of O negative packed red blood cells were transfused. To facilitate tracheal intubation, the emergency physician, a very experienced anaesthesiologist, gave 50 μg fentanyl, 10 mg etomidate and 60 mg succinylcholine. After thorough suctioning, direct laryngoscopy was performed, the glottis was clearly visible and wide open. Several attempts to advance both an 8.0 and a 7.0 mm inner diameter (i.d.) tube further into the trachea after glottic passage failed. Bag-valve mask ventilation with an oropharyngeal airway was ineffective. The emergency physician then decided to use a flexible fiberoptic bronchoscope, which is carried on the local mobile intensive care unit, for another intubation attempt. As the patient was tall and the glottic opening appeared large, the emergency physician estimated an 8.0 mm i.d. tube to be of adequate size; the tube was mounted on the bronchoscope in the usual manner. Bronchoscopy revealed a tracheal rupture with complete discontinuation of the lumen in the proximal part. The emergency physician managed to identify the distal stump, introduced the bronchoscope into it, and successfully placed the tube just above the carina (Figure 1). During the whole procedure, oxygen was constantly applied via the working channel of the bronchoscope. The patient was ventilated by volume-controlled ventilation with a tidal volume of 400 ml at a rate of 15 per minute, endexpiratory CO_2 ($etCO_2$) was 27 mmHg. A chest-tube thoracostomy was placed in the fourth left intercostal space, inflation and deflation of the left lung were clearly palpable during digital thoracocentesis. The patient was then transported to a level one trauma centre without further diagnostic or therapeutic interventions. During transportation, cyanosis improved, but no pulse oximetry could be obtained due to reduced peripheral perfusion.

Figure 1 Insertion of the endotracheal tube via bronchoscopy at the accident scene.

In the emergency department, monitor readings indicated a heart rate of 140 per minute and an $etCO_2$ of 25 mmHg. A peripheral pulse was still not palpable. Sonography displayed free intraabdominal fluid. In spite of immediate transfusion of packed red blood cells, fresh frozen plasma and hydroxyethylic starch, haemodynamics and the patient's cardiac function deteriorated rapidly with a subsequent cardiac arrest. Resuscitation attempts were unsuccessful and terminated after 10 min. The trachea was examined by a thoracic surgeon and the diagnosis of complete tracheal transection was confirmed. An autopsy was not performed, however.

Discussion

Most emergency medical systems carry a bag-valve-mask, oropharyngeal or nasopharyngeal airways for basic airway management and standard tracheal tubes. Supraglottic airways such as the laryngeal mask airway, the laryngeal tube, the intubating laryngeal mask airway, the oesophagotracheal combitube and other devices have been studied extensively in the last two decades and have also achieved an important role in current practice guidelines.[4,5] Therefore most emergency ambulances providing advanced life support are equipped with at least one supraglottic airway device, some also carry an emergency surgical airway access kit. Given that operators are trained and experienced in their use, these airway tools will enable adequate oxygenation in almost any emergency patient.

In the patient described above, any supraglottic airway attempt would have most likely failed because the trachea was discontinued below the larynx level. In addition to the oesphagotracheal combitube, the American Society of Anesthesiologists difficult airway algorithm[4] suggests a rigid bronchoscope and transtracheal jet-ventilation as possible options of non-invasive airway access in the emergency pathway. A rigid Bonfils endoscope has proven suitable both for routine intubation[6] and the management of the difficult airway.[7,8] Although it has even been used in the prehospital setting,[9] it should not be inserted in the trachea[10] due to its rigid nature and would therefore not have been suitable for inspection of the tracheal trauma presented in this case report. Similarly, transtracheal jet-ventilation by needle-cricothyroidotomy might not have provided adequate oxygenation in this particular case.

The true incidence of tracheal rupture is not known exactly due to a high prehospital mortality[11,12] and reports about the prehospital and intrahospital management are inconsistent. Sobiegalla et al.[13] describe the prehospital management of a similar trauma by a necklace incision and subsequent intubation of the tracheal stump which was palpated in the mediastinum. Naghibi et al.[14] report a case where oxygenation could only be maintained by bronchial catheters inserted via a thoracotomy.

Although fiberoptic bronchoscopy is a standard procedure for the management of the difficult airway, studies concerning its use in prehospital emergency airway management are limited.[15] In 1990, Hutton et al.[16] studied the feasibility of a flexible fiberoptic bronchoscope for correct tube placement verification and concluded it was a promising tool. A recent paper found a specificity of 93% and a sensitivity of 87% for the detection of correct tube placement when a fiberoptic bronchoscope was used alone, but both increased to 100% when misting and CO_2-detection were also taken into account.[17] Thierbach et al.[18,19] investigated the use of a fiberoptic bronchoscope in the prehospital setting in a physician-staffed emergency medical service in 1999. They describe a series of nine cases with a mean duration of 4.5 min for the total procedure of fiberoptic intubation, although they emphasise that the actual intubation process only took 28—60 s. Another case report describes prehospital fiberoptic intubation in a patient who had bilateral neck dissection and radiation.[20]

Fiberoptic intubation is a sophisticated and costly technique and requires the operator to have considerable experience and skill. If emergency physicians are not anaesthesiologists or do not receive extended airway management training, they will not be able to use this method in an emergency setting. However, analyses of constructed learning curves have shown that after 10 attempts of fiberoptic intubation, a 90% success rate within 2 min can be achieved, whereas 57 attempts for a 90% success rate in classical laryngoscopic intubation are needed.[21] In a case series of 60 fiberoptic intubations in an emergency department with operators previously untrained in the technique, Delaney and co-worker[22] reported a success rate of 87% and decreasing duration of the procedure after 9 or 10 attempts. A similar study with inexperienced operators revealed a 72% success rate.[23] The current rare use of fiberoptic intubation in the prehospital setting may be more likely due to cost and practice opportunity issues rather than to the difficulty of the technique itself, but anaesthesiologists or emergency physicians with extended anaesthesia training may have adequate experience with this method. Depending on the basic medical specialty of the emergency physicians, it may therefore make sense to establish fiberoptic intubation as an additional tool for airway management in complex situations like the patient described above, especially in larger centres where anaesthesiologists or emergency physicians with advanced airway management skill account for the main part of the staff. Controlled trials in that setting could determine the feasibility and safety of prehospital fiberoptic intubation, and methods of teaching it to previously inexperienced users for that purpose may also merit further research.

Conflict of interest

None.

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