Role of percutaneous tracheostomy in emergent difficult airway conditions: An update

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Abstract

Introduction

Percutaneous tracheostomy (PT) has replaced the surgical approach of airway establishment in many intensive care unit patients and is mainly indicated for elective use. However, the role in emergency conditions has yet to be adopted by standard guidelines. A patient with a craniovertebral junction anomaly developed severe respiratory insufficiency; however, this was successfully managed with PT. Many reports have highlighted the successful management of emergent difficult airway. Our case also demonstrates the feasibility of PT technique in patients who need emergency airway access. Therefore, in this article, we have reviewed the present role of PT in an emergency situation and illustrated it with the help of a short case report.

Conclusion

PT, though considered to be an elective option for airway management, may be used safely in emergency situation; however, it requires appropriate training and skills.

Introduction

Difficult airway comprises difficult bag mask ventilation (DMV) and difficult tracheal intubation (DTI). To secure airway in the difficult conditions is always the greatest challenges for the perioperative physicians.1 Many airway devices have been innovated to establish airway in the safest manner; however, the conditions of ‘No Ventilation, No Intubation (NINV)’ warrants additional methods to be adopted in these situations.2 The methods described in these conditions usually include cricothyroidotomy and surgical tracheostomy.2

The role of emergency percutaneous tracheostomy (PT) is not well established yet. It is mainly used for elective tracheal cannulation; however, some authors described the role of rapid PT technique in cases of mass casualty and other emergency situations; however, the use of this technique raises concerns about safety and spine stabilization.3 Many physicians advise against a PT in the emergency setting and recommend a cricothyroidotomy instead. Others resort to the percutaneous technique only after orotracheal intubation fails.4 Therefore, in this article, we have reviewed the present role of PT in emergency situations and illustrated it with the help of a short case report.

Exemplary Case

A middle-age victim of fall from height was presented to the emergency department with complains of pain in the neck and weakness in all four limbs for a few weeks. There was no history of any loss of consciousness, vomiting, ear or nose bleed or seizures. The neurologic examination revealed normal tone, normal deep tendon reflexes, no clonus and power was 4/5 in all limbs. The bladder, bowel and sensory functions were all intact. On imaging, he was diagnosed as a case of atlanto-axial dislocation due to pre-existing craniovertebral junction anomaly. Elective transoral odontoidectomy and posterior fixation was planned on the same day. On airway examination, the patient had a mouth opening of less than two fingers with restricted neck extension and also with a neck collar. In view of unstable cervical spine and difficult intubation, patient was intubated in the OR using awake fibreoptic bronchoscopy after proper topicalization. After the uneventful but prolonged (9 h) intraoperative course, the patient was shifted to the ICU. In the ICU, the patient was gradually weaned off the ventilator and the respiratory and haemodynamic parameters were continuously observed. On the third postoperative day, he was extubated after meeting all the extubation criteria; however, he immediately became restless and had short of breath and further developed respiratory arrest. Immediately, bag and mask ventilation with 100% oxygen was started by ambu-bag, and oral airway was also put to facilitate ventilation. However, the adequate ventilation was not achieved and intubation with direct laryngoscopy was not successful. LMA placement was also tried but in vain. Therefore, we decided to do emergency PT, and it was done using Ciaglia Blue Rhino (CBR) PT introducer set by Seldinger’s technique. After the confirmation of the tracheostomy tube in place, mechanical ventilation was ensured. Patient oxygen saturation improved, and after few days, the patient was decannulated and the rest of the course was uneventful.

Difficult Airway and Surgical Management

DMV is defined as the inability to maintain adequate bag mask ventilation, No Intubation (NINV)'

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ventilation for keeping SPO2 more than 92% and for adequate ventilation. The incidence varies from 2% to 8%6,7. On the other hand, DTI is defined as the difficulty in tracheal intubation after multiple intubation attempts by expert anaesthesiologist. The incidence of failure to intubate the trachea is 1 in 2,000 in the nonobstetric population and 1 in 300 in the obstetric population. The incidence may vary and can be high in certain groups of patients (cervical spine, laryngeal surgery and morbid obesity)8,9. Airway management is the most important consideration for periorperative physicians to provide adequate ventilation and oxygenation in certain subgroups of patients6–8,9. Difficult airway is a major concern in this regard and requires expertise as well as difficult airway carts. In conditions of NINV, limited options exist and the major consideration remains as prevention of hypoxic damage of brain by instituting rapid airway control.

An open/surgical tracheostomy is considered as the gold standard for establishing long-term airway access10–12. However, this procedure is time consuming and often difficult to perform in an emergency setting. Though this is the method to achieve airway in difficult situations, it still needs expertise and time; therefore it is generally not recommended for emergency cases12. The use of surgical tracheostomy often needs endotracheal intubation in situ and general anesthesia. In addition, the role of surgical tracheostomy in cases of NINV is questionable. On the other hand, a cricothyroidotomy can provide rapid airway access in an emergency, but adequate ventilation may be difficult to achieve, particularly in patients who have reduced compliance such as pulmonary oedema, morbid obesity and other associated chest injuries12–14. The other subgroup of patients in which hypercarbia may cause potential risks of herniation include severe head injury patients and patients with pre-existing raised ICP. Therefore, the utility of these adjuncts in difficult airways may not be considered as an absolute method to ensure adequate oxygenation and ventilation especially in real emergency settings.

Percutaneous Tracheostomy
PT is an accepted means of accessing the airway to provide mechanical ventilation but without visualizing the trachea. It is a bedside tracheostomy and was first described by Ciaglia and coworkers15. This technique has gained great popularity among many intensivists in the last 10 years and has established an alternative to standard surgical tracheostomy in many intensive care units where it can be performed quickly at the patient’s bedside. Initially, it was described as a blind technique; however, incorporation of fibre optic bronchoscope has assisted in visualizing the trachea as well as port/guide wire/tube. It consists of a Seldinger’s type needle and wire, over which a guide and then series of dilators are passed. There is one of the three following techniques that are commonly used for PT: guide wire dilating forceps (GWDF) tracheostomy, CBR tracheostomy and sequential dilation tracheostomy (classic Ciaglia). Though there is no consensus, the use of PT has been advocated in elective cases15. It is mainly used for patients who require prolonged ventilation and in whom a tracheostomy can facilitate clearing of secretions and assists in early weaning from the ventilator or who have obstruction of the upper airway. In certain circumstances, however, this technique has been contraindicated, including in patients aged less than 15 years, uncorrected bleeding diatheses, gross distortion of neck and in cases of inability to extend the neck because of spinal fusion etc16,17. However, with the increasing experience gained with it, the procedure has been performed successfully in several situations considered previously to be contraindications. Percutaneous dilatational tracheostomy has been reported in patients with morbid obesity, burn patients, spinal fusion, previous tracheostomies and paediatric patients12–17. PT is normally safe and efficacious; however, it can result into cannula dislodgment, airway obstruction, tracheal stenosis or other complications and therefore is not generally recommended for emergencies9. The false track and pneumothorax is also reported. In fact, the manufacturer of the Per-fit tracheostomy tube warns that its use is contraindicated for airway insufficiency requiring emergency access. Nevertheless, a few case reports have shown the efficacy of this approach for rapid tracheal access.

Review of Literature
In a retrospective study of 18 patients in which successful PT were done, interestingly in 10 patients, there were no airways near them18. In this study, no PT-related complications were noted18. In another retrospective study of 107 patients, PT did not worsen the ventilation parameters in nonhypoxic patients but found to improve ventilation in hypoxic patients19. Our case confirms that, under special circumstances, when application of standard management techniques for a difficult airway is not possible, a PT can be valuable in an emergency situation to establish airway access in the hands of those who are experienced and confident in performing the procedure. Similarly, in a case of difficult airway and circulatory collapse in burn patients, PT could be done within a minute and save the life of the patient; therefore, this signifies its importance to achieve a prompt and effective way to secure airway in emergent conditions18. Similarly, in emergent conditions in patients with severe head injury and neck injuries, PT could be rapidly done and placed in the tracheal tube within 5–6 min including the oxygen insufflation period19. In a study of emergency tracheotomies of
530 patients, CBR PT, in comparison with Fantoni tracheostomy, was found to be safe, cost-effective and a less time-consuming technique. It is the familiarity and experience of the intensivists with the technique of PT and availability of the other airway equipment at hand in relation to the patient airway, which indeed decides the superiority of the technique of airway acquisition in emergency situations. The experience of physicians is the most important factor for the successful and prompt PT in emergency situations. Our case report suggests that PT can be an alternative to manage airway in experienced hands in emergency situations. Some authors suggest that the training of PT should be incorporated in residency training as these can be useful and lifesaving manoeuvres if done with prior experience.

Discussion

Initial studies focused only on the elective uses of PT in patients who require prolonged ventilation. At present, there are many studies and reports, which have shown the effectiveness of PT in emergency conditions. In expert hands, the procedural time is usually very short (5 min or less) and with minimal complications. In addition, successful use of PT is also reported in various sites outside the ICU or emergency ward. In the literature, success rates in emergent conditions were found to be very high and resulted in good outcome in survivors. The other benefit is related to its cost-effectiveness. As we routinely learn, the advantage is that PT is a rapid and effective percutaneous tracheostomy and intubation technique. PT is also a safe procedure, usually very short (5 min or less) and resulted in good outcome in survivors.

References