Indian J Otolaryngol Head Neck Surg
https://doi.org/10.1007/s12070-020-01971-1

ORIGINAL ARTICLE

Fine Governance of Difficult Tracheostomy in Difficult Airway with Stridor and Respiratory Distress

Smita Soni[1] · Aneena Chacko[2] · V. K. Poorey[3]

Received: 13 June 2020 / Accepted: 13 July 2020

Abstract Difficult airway is a commonly encountered problem in the anesthesia practice, might needing otolaryngologist expert in creation of surgical airway. Supraglottic airways, surgical or needle cricothyrotomy, high frequency jet ventilation, cardiopulmonary bypass (Tunstall in Can J Anaesth 36:611–613, 1989) are initial rescue measures in such scenario. But in otolaryngology practice, patient presenting with stridor having difficult airway and difficult tracheostomy concurrently will definitely pose problems resulting in life-threatening consequences. We report cases in which difficult airway and difficult tracheostomy coexisted. (1) upper tracheal stenosis following strangulation and intubation (2) short neck with obesity (3) blunt trauma to neck with surgical emphysema (4) deep neck space infection (5) Paediatric tracheostomy in faucial diphtheria. Though difficult surgical tracheostomy in difficult airway is challenging, the anticipation of complications and planning can minimise the difficulty in the technique.

Keywords Difficult tracheostomy · Difficult airway

Deceased: V. K. Poorey

✉ Aneena Chacko
aneenachacko@ymail.com

Smita Soni
smitasoni2009@rediffmail.com

[1] Department of ENT & Head and Neck Surgery, Gandhi Medical College, Bhopal, India

[2] Department of ENT & Head and Neck Surgery, Amala Institute of Medical Sciences, Thrissur, India

[3] Gandhi Medical College and Associated Hospital, Bhopal, MP 462001, India

Introduction

A difficult airway is defined as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with face mask ventilation of the upper airway, difficulty with tracheal intubation, or both. A difficult tracheostomy is defined as the inability to insert the tracheostomy tube. Though practice guidelines of difficult airway, [1, 2] have given stress on can't ventilate and can't intubate situation which do not adequately address rescue from a situation and wherein one faces difficulty in securing an emergency surgical airway. In Otorhinolaryngology CVCI can arise in certain situations, added to the upper respiratory obstruction, presenting patient with respiratory distress and stridor with imminent respiratory failure. Then surgical tracheostomy becomes the immediate choice of creation of airway especially if cricothyrodotomy is not possible. Adding to this scenario, difficulties arising during tracheostomy tube insertion can be rapidly fatal since the airway may not be adequately controlled.

Emergency tracheostomy can be very difficult and have serious complications [3]. Delay in completion of tracheostomy in this situation results in death of the patient [4, 5]. The anaesthetist must be prepared to use invasive techniques to secure the airway via the cricothyroid membrane. Success depends on understanding the anatomy of the cricothyroid membrane and of the factors which determine efficacy of ventilation with different airway devices. These must be matched to the ventilation technique in order to provide a system which can deliver a large minute volume.

Published online: 21 July 2020

Case Scenario 1

A 20 year-old male presented to the accident and emergency department with three-week history of increasing stridor in Gandhi medical college, Bhopal. He had history of suicidal attempt 6 months back, following which was on ventilator support for 7 days. There was no history of dysphagia. There was no evidence of any weight loss in the recent past. Indirect laryngoscopy revealed upper tracheal stenosis with pin hole size lumen(Cotton-Myer:Grade3). Patient had stridor and respiratory distress with increasing pulse rate and hypoxemia. Decision for surgical tracheostomy under local anesthesia, avoiding intravenous sedation was taken in view of persisting stridor and impending airway obstruction. Patient was shifted to operation theater and gave 100% oxygen maintaining spontaneous breathing. After proper positioning and local anesthesia infiltration, tracheostomy procedure was started. Soft tissues were fibrosed, making the tissue planes unappreciable and the tracheal rings were also not able to appreciate. Trachea was brought into field with finger sweeping movement following the cricoid ring from above. Trachea was cord like, hardly the thickness of pencil with soft to firm consistency. Meanwhile, mask ventilation with spontaneous ventilation was becoming increasingly difficult. Trachea confirmed with air aspiration and small opening was made with 11 no blade. 5 mm Endotracheal tube was passed with difficulty. After 5minutes, 7.5 mm internal diameter (ID) tracheostomy tube inserted removing the ETT. CT done postoperatively revealed invisible lumen in the upper trachea and patient was referred to higher centre for further management. Throughout the event, patient maintained oxygen saturation levels above 90%. Retrograde intubation device and flexible fiber-optic intubation was not possible. Emergency cricothyrodotomy was not feasible since constriction was at the level of cricoid.

Case Scenario 2

Sixty-eight years old female presented to the emergency department with dysphagia, stridor of 2 weeks duration along with respiratory distress. She had excessive expectoration since 2 weeks. She was obese with short neck and had right sided pulmonary crepitation on auscultation. Indirect laryngoscopy showed oropharyngeal malignancy with supraglottic extension. Patient was taken for surgical tracheostomy in OT under local anaesthesia. Difficult tracheostomy was anticipated in view of short neck. But the tracheostomy was uneventful even though only small portion of cervical trachea was seen just above the suprasternal area and 7.5 mm ID tracheostomy tube insertion done.

Case Scenario 3

Seventeen years old male presented to the emergency department with history of sustained blunt trauma to neck in road traffic accident 8 h after injury. He was brought with stridor and increasing respiratory distress. On examination, surgical emphysema (Fig. 1), was present superiorly upto lower border of mandible and inferiorly upto upper chest along with localised bruising and tenderness. Endotracheal intubation was not tried inview of creation of false passage in case of laryngotracheal laceration. Tracheostomy was performed under local anaesthesia and the only difficulty was the depth of the plane of trachea due to increased skin tracheal distance due to surgical emphysema. He was conservatively managed with successful decannulation after 2 weeks.

Case Scenario 4

A 65 year old female presented with complaints of oral cavity and neck pain and difficulty in swallowing for 10 days. She reported with progressive swelling in the neck and inability to open her mouth for which she was conservatively treated in local hospital. An infected third molar had been extracted 2 weeks before the present illness. Her mouth opening was two fingerbreadth with limited neck flexion and extension. She was diagnosed to have Ludwig's angina and underwent incision and drainage. Meanwhile she also diagnosed to have diabetes mellitus. Irrespective of the antibiotic in accordance with culture sensitivity, the infection spreaded to deep neck spaces including bilateral parapharyngeal, paratracheal spaces which were also drained. She developed stridor and xray lateral view of neck showed oedematous epiglottis, with laryngeal lumen narrowing. Patient was taken for

Fig. 1 Surgical emphysema

trachestomy in view of safe airway and prevention against aspiration. She was positioned and local infiltration given. As dissection began, surgical planes were found to be fibrosed and leaky from the pus collection pockets on either sides of trachea. Trachea was also fibrosed and tethered to surrounding tissue. 7.5 mm ID tracheostomy tube inserted and connected to airway circuit. Following which retropharyngeal abscess was drained under surface anaesthesia with lignocaine spray with head low position.

Case Scenario 5

A 14 month old boy admitted in PICU with three-day history of fever and sore throat with progressive difficulty in swallowing and breathing. Clinically, the child was severely ill; with stridor and respiratory distress. On oropharyngeal examination, a whitish membrane covering the uvula, tonsils and posterior pharyngeal wall was noted. But he had no bull neck. A sample of the pseudomembrane and a tonsillar swab were collected and submitted to the bacteriology laboratory for routine microscopy and culture, as well as culture on selective media for Corynebacterium diphtheria (Fig. 2). An emergency tracheostomy was performed, and 3 mm (ID) ETT was inserted with adequate stabilisation as tracheostomy tube was unavailable and following which the child was transferred to the intensive care unit for further management.

Discussion

Rapid development of severe hypoxemia, particularly associated with bradycardia, is an indication for imminent intervention with an invasive technique. Rapid reoxygenation is now necessary, and this is best achieved with a combination of an invasive airway device and a ventilation technique which is capable of reliably delivering a large minute volume with an FiO2 of 1.0. Many cricothyroidotomy techniques have been criticised because they are not capable of providing effective ventilation [6]. Classical emergency surgical tracheostomy involves incision through skin and platysma, division of the isthmus of the thyroid gland, haemostasis, incision of tracheal cartilage, and insertion of a cuffed tracheostomy tube. Although tracheostomies are commonly performed in critically ill patients, the reported complication rates following insertion of tracheostomy vary widely, from as low as 2.1% to as high as 20% [7]. The rate of major or serious insertion complications like major bleeding, posterior tracheal wall injury, pneumothorax, and death is approximately 6% [8]. Pneumothorax and subcutaneous emphysema following tracheostomy has been reported to occur in 2 to 5% of cases [9]. In upper tracheal stenosis, the lower limit of tracheal narrowing cannot be made without imaging and evenif there is no anatomical stenosis, the functional stenosis due to collapse of trachea with Bernoulli's effect, have to be anticipated. Loss of Anatomical plane due to prior injury to soft tissue and trachea made the situation more worse in case 1.

Fig. 2 Corynebacterium diphtheria

Morbid obesity makes the tracheostomy insertions difficult because of their increased skin to tracheal distance. Short neck adds to the perplexity which is seen in case 2. To perform a surgical tracheostomy, the patient's shoulders are elevated and the head is extended unless contraindicated by cervical disease or injury. This position elevates the larynx and exposures more of the upper trachea. However, even in this position, our patient's neck was still too short. Muhammad and colleagues [10] compared MRI scans of patients with short, thick necks and those with normal necks. They reported that the more exaggerated the curvature of the spine, the further away the trachea is from the skin, and that the trachea follows the curvature of the spine, not the skin. CT scans depict that the trachea follows the course of the cervical and thoracic spine and not the direction of the skin contour, and that the curvature of the spine is quite pronounced resulting, the extrathoracic trachea lying deep in the root of neck. The size discrepancy and curvature mismatch between a standard-size tracheostomy tube and the increased distance between the skin and trachea makes the tracheostomy difficult. As most commercially available tracheostomy tubes are designed with normal limits of anatomic proportions in mind, these standard tubes are usually of inadequate length to suit obese patients and those with short, thick necks [11].

Surgical emphysema create the situation similar to the obesity with increased skin tracheal distance. But extracare to be taken not to exaggerate the injury already sustained in the larynx and trachea. In the morbidly obese population, the incidence of complications from tracheostomy has been reported to be approximately 25% with an estimated mortality of 2%, attributed mainly to the loss of airway accessibility [12]. Suction catheters, nasogastric tubes, endotracheal tube exchangers, guidewires, and Eschmann tracheal tube introducers have all been variously used in

the management of difficult tracheostomy tube insertion [13]. In morbidly obese patients, cervical lipectomy or "defatting" tracheostomy have been successfully employed to access the trachea prior to tracheostomy [14]. Adjustable length tracheostomy tubes, which can be adjusted according to the depth to which the tube is inserted, and extra length tubes with spiral wire reinforced flexible design, are now available for use in the morbidly obese patients [15].

Intubation carries the risk of retropharyngeal abscess rupture. In difficult cases tracheostomy under local anaesthesia is safe and reliable method to stabilize airway though the distortion of tissue planes and tracheal deviation due to abscess cavity can make the tracheostomy difficult. If abscess extended to central compartment it is best to avoid the tracheostomy as pus may trickle into stoma [16].

Paediatric tracheostomy itself is difficult as having different anatomy from the adult and especially, in the neonate. In diphtheria, intubation carries the risk of complete airway occlusion by dislodged membrane along with bleeding into tracheal lumen, though intubation was discovered by Eugene Bouchut in 1858 for bypassing the diphtheria pseudomembrane to the opened airway [17, 18]. It is unfortunate to do tracheostomy in vaccine preventable disease, but adequate treatment may lead to successful decannulation.

Conclusion

Surgical tracheostomy is the dictum for the maintainance of airway in life threatening situations with difficult airway. Difficult anatomy and the related complications need to be anticipated and appropriate measures to be taken in such emergency situations.

Funding No funding.

Compliance with Ethical Standards

Conflict of interest Smita Soni and Aneena Chacko declares that there is no conflict of interest.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

1. American Society of Anesthesiologists Task Force on Management of the Difficult Airway (2003) Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 98:1269–1277
2. Henderson JJ, Popat MT, Latto IP, Pearce AC (2004) Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia 59:675–694
3. Tunstall ME (1989) Failed intubation in the parturient. Can J Anaesth 36:611–613
4. Jason DR (1992) Fatal angioedema associated with captopril. J Forensic Sci 37:1418–1421
5. Safar P, Pennickx J (1967) Cricothyroid membrane puncture with special cannula. Anesthesiology 28:943–945
6. Biro P, Moe KS (1997) Emergency transtracheal jet ventilation in high grade airway obstruction. J Clin Anesth 9:604–607
7. Fikkers BG, Briede IS, Verwiel JM, Van Den Hoogen FJ (2002) Percutaneous tracheostomy with the blue rhino trade mark technique: presentation of 100 consecutive patients. Anaesthesia 57:1094–1097
8. Delaney A, Bagshaw SM, Nalos M (2006) Percutaneous dilatationaltracheostomy versus surgical tracheostomy in critically ill patients: a systematic review and meta-analysis. Crit Care 10:55–59
9. Glossop AJ, Meekings TC, Hutchison SP, Webber SJ (2011) Complications following tracheostomy insertion in critically ill patients—experience from a large teaching hospital. J Intensive Care Soc 12:301–306
10. Muhammad JK, Major E, Patton DW (2000) Evaluating the neck for percutaneous dilatational tracheostomy. J Craniomaxillofac Surg 28:336–342
11. Headley WB, Rodning CB (1993) Fabricated single lumen tracheal cannula for a morbidly obese patient. J Otolaryngol 22:438–441
12. ElSolh A, Jaafar W (2007) A comparative study of the complications of surgical tracheostomy in morbidly obese critically ill patients. Crit Care 11:R3
13. Hwang S, Jang J, Yoo J, Kwon H, Lee S, Lee J et al (2011) Difficult tracheostomy tube placement in an obese with a short neck: a case report. Korean J Anesthesiol 60:434–436
14. Clayman GL, Adams GL (1990) Permanent tracheostomy with cervical lipectomy. Laryngoscope 100:422–424
15. Lim PV, Raman R (2001) Adjustable length tracheostomy tube for the morbidly obese and thick neck patient: a prototype. Otolaryngol Head Neck Surg 124:56–57
16. Tubachi J, Hakeem A, Pradeep D, Nayak P (2012) Surgical management of parapharyngeal abscess. Int J Otorhinolaryngol Clin 4(3):122–124. https://doi.org/10.5005/jp-journals-10003-1097
17. Elizabeth Roberts MA CPC (2011) History of medicine: The strangling angel of children - Birth of endotracheal intubation
18. Waxham FE (1888) Intubation of the larynx. Truax, Chicago