International Journal of Otorhinolaryngology and Head and Neck Surgery
Tiwaskar S et al. Int J Otorhinolaryngol Head Neck Surg. 2024 Dec;10(6):765-769
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937

DOI: https://dx.doi.org/10.18203/issn.2454-5929.ijohns20243525

Case Report

Unnoticed breakage of airway exchange catheter during nasal endotracheal tube exchange

Shilpa Tiwaskar*, Kshama Shah, Rahul Ranade, Jyotsna Karande

Department of Anaesthesia, Bhaktivedanta Hospital and Research Institute, Thane, Maharashtra, India

Received: 27 August 2024
Revised: 11 November 2024
Accepted: 12 November 2024

***Correspondence:**
Dr. Shilpa Tiwaskar,
E-mail: drtiwaskar@gmail.com

ABSTRACT

During unanticipated difficult intubation, amidst the various attempts and techniques, the anaesthesiologist tries using various airway adjuvants to facilitate endotracheal intubation. After successful intubation, seldom do we check the integrity of adjuvants used. Our case report emphasizes on the need of checking integrity of airway adjuvants after their use in emergency situations. In addition, the report also highlights the fact that, adjuvants on the difficult airway cart must be checked daily for quality, friability, stickiness, any cracks, bends, damages, pliability, their mere presence on difficult airway cart is of little significance.

Keywords: Nasal intubation, Airway exchange catheter, Breakage, Rigid bronchoscopy, Retrieval

INTRODUCTION

Airway exchange catheters (AEC) are long, thin, hollow, semirigid catheters having open blunt distal end with side-holes. The centimetre markings on the length of catheter facilitate alignment with endotracheal tube. ACEs provide various important airway options, for anaesthesiologists and intensivists.[1] They are used for replacement of endotracheal tube (ETT) or tracheostomy tube, when one is already in place. For example, if ETT cuff is damaged or tracheostomy tube is blocked with thick secretions, then AEC is passed through *in situ* ETT/tracheostomy tube. The unwanted ETT/tracheostomy tube is removed, keeping AEC *in situ* and fresh ETT/tracheostomy tube is passed over AEC and AEC is then removed. AECs are used before extubating difficult airway. This use is documented in difficult airway society guidelines for the management of tracheal extubation 2011.[2] and guidelines for difficult extubation by all India difficult airway association 2016 guidelines.[3] Batuwitage et al describe use of AEC for staged extubation.[4] For example, if there was difficult intubation, or postoperative airway oedema or if patient is suspected to have tracheomalacia or vocal cord injury, then AEC is inserted through an *in situ* ETT before tracheal extubation and extubation is done safely over AEC, keeping AEC *in situ*.[4] If such patients don't maintain airway and require re-intubation, it can be quickly done over the AEC. AECs are provided with removable 15 mm rapi-fit connectors. These connectors permit oxygen delivery during an exchange procedure. AEC also serves as a conduit to administer oxygen manually, by insufflation, or by jet ventilation

Many types of AECs have been used; the common one is Cook's AEC. They are available in sizes 11, 14, and 19-French and have a length of 83 cm. The selection of the external diameter of the Cook's AEC is based on the internal diameter of the single-lumen endotracheal tube. 11 French is for endotracheal tubes with an inner diameter of 4 mm or larger, 14 French is for endotracheal tubes with an inner diameter of 5 mm or larger and 19 French is for endotracheal tubes with an inner diameter of 7 mm or larger.

AECs are associated with complications. Many of the complications result from overly deep placement of these catheters by users because; a length of 83 cm far exceeds

the length necessary for safe endotracheal tube exchange. Also, markings on AEC are till only 35 cm, which remain inside the ETT, while removing ETT over AEC, hence not easily noticeable, to check whether AEC is pushed more inside. Due to unnoticed deep placement, there could be mechanical injury to broncho-alveolar tree while inserting AEC, which can range from small tear to serious pneumothorax.[5] and there could breakage of AEC while removing it. Jet ventilation of more than 25 psi, through AEC, can cause barotrauma and result in pneumothorax, pneumomediastinum.[6,7]

Other complications of AEC are the AEC or ETT can be misplaced in the oesophagus, the AEC can accidentally dislodge when the ETT is removed, the exit of AEC can get misdirected, which can prevent the ETT from being withdrawn over the AEC. This can lead to loss of airway or the inability to withdraw either the AEC or ETT. The AEC can come out through murphy's eye of ETT and get folded on itself in trachea.

To reduce the risk of complications, physicians can, consider the insertion and maintenance depths of the AEC, check the expiration date and visually inspect the AEC before use, verify the position of the AEC before exchange, not to insert the AEC more than 24 cm from the lip, use coloured markers to highlight the safe insertion depth, use direct or video laryngoscopy to visualize the glottis during exchange and confirm the placement of the second ETT with auscultation, end-tidal carbon dioxide, or a portable chest X-ray.

AECs differ from bougies. Bougies are rigid, short, they are used to facilitate endotracheal intubation. They cannot be used for ETT exchange as they are short, J-tipped and rigid. Bougies aren't hollow, hence cannot be used to provide supplemental oxygen nor provide jet ventilation nor position can be confirmed by end-tidal carbon dioxide. Bougies don't have 15 mm rapi-fit connectors, hence cannot be connected to anaesthesia circuit.[8]

We report a case, where our AEC broke inside the tracheo-bronchial tree while exchanging nasal endotracheal tube and remained unnoticed for 2 days. Kumar et al has also reported a case of AEC breakage; while using it for endotracheal tube exchange but broken part of their AEC was found above vocal cords immediately.[9] In our case, the broken part was retrieved successfully with help of rigid bronchoscope on 3rd postoperative day.

CASE REPORT

A 34 year old, 80.3 kg, male patient was posted for bilateral tonsillectomy. There was no history of any comorbidities and all investigations were within normal limits. Examination of airway was normal and Mallampati classification was 2. Nasal endotracheal intubation with 7.5 mm portex ETT was planned.

Standard monitoring devices were attached on day of surgery. Normal vitals were recorded. Nasal xylometazoline hydrochloride drops were put. Premedication of injections, glycopyrrolate 0.2 mg, midazolam 2 mg, nalbuphine 10 mg and lidocaine 100 mg was given. Induction with propofol 100 mg and cisatracurium 10 mg was done. Conventional laryngoscopy revealed Cormack Lehane (CL) score 3, which on BURP (backward, upward, right and posterior) maneuver, improved to 2. Nasal ETT, 7.5 mm was passed through right nostril, over J tipped bougie and guided to glottic opening with help of Magill's forceps successfully, on 2nd attempt. It was fixed at 26 cm to nostril. On inflation of ETT pilot cuff, leak was detected.

We had 14 Fr, 83 cm, 3 mm internal diameter, cook's AEC. So, we decided to exchange the ETT using this. AEC was passed through ETT and ETT removed. Then, 2nd 7.5 mm ETT was smoothly passed over AEC and AEC was removed and handed over to anaesthesia assistant. The pilot cuff of 2nd ETT was inflated with 5 mls of air. Few minutes later, we heard an audible leak over ETT, but pilot cuff was still properly inflated. Leak continued, even with further inflation of the cuff and we decided to change over to oral 8 mm ETT, which was fixed at 20.5 mark, after which leak sound disappeared. Rest intraoperative period was uneventful. There was no airway oedema nor trauma.

After extubation, patient had slight cough, which settled with injection lidocaine 60 mg. He was observed for 1 hour in PACU (Post anaesthesia care unit), where he had good vitals, no cough nor restlessness nor breathlessness.

Course in ward-At night, patient started having slight cough, which gradually increased over the next day, (day 1) postoperative. Patient was given steam, steroids, antitussives and nebulization with Duolin and Budecort. On day 2, cough continued and by evening patient became breathless, we asked for x-ray chest and found retained piece of AEC on X-ray chest shown in Figure 1.

Figure 1: X-ray of chest showing retained piece of AEC.

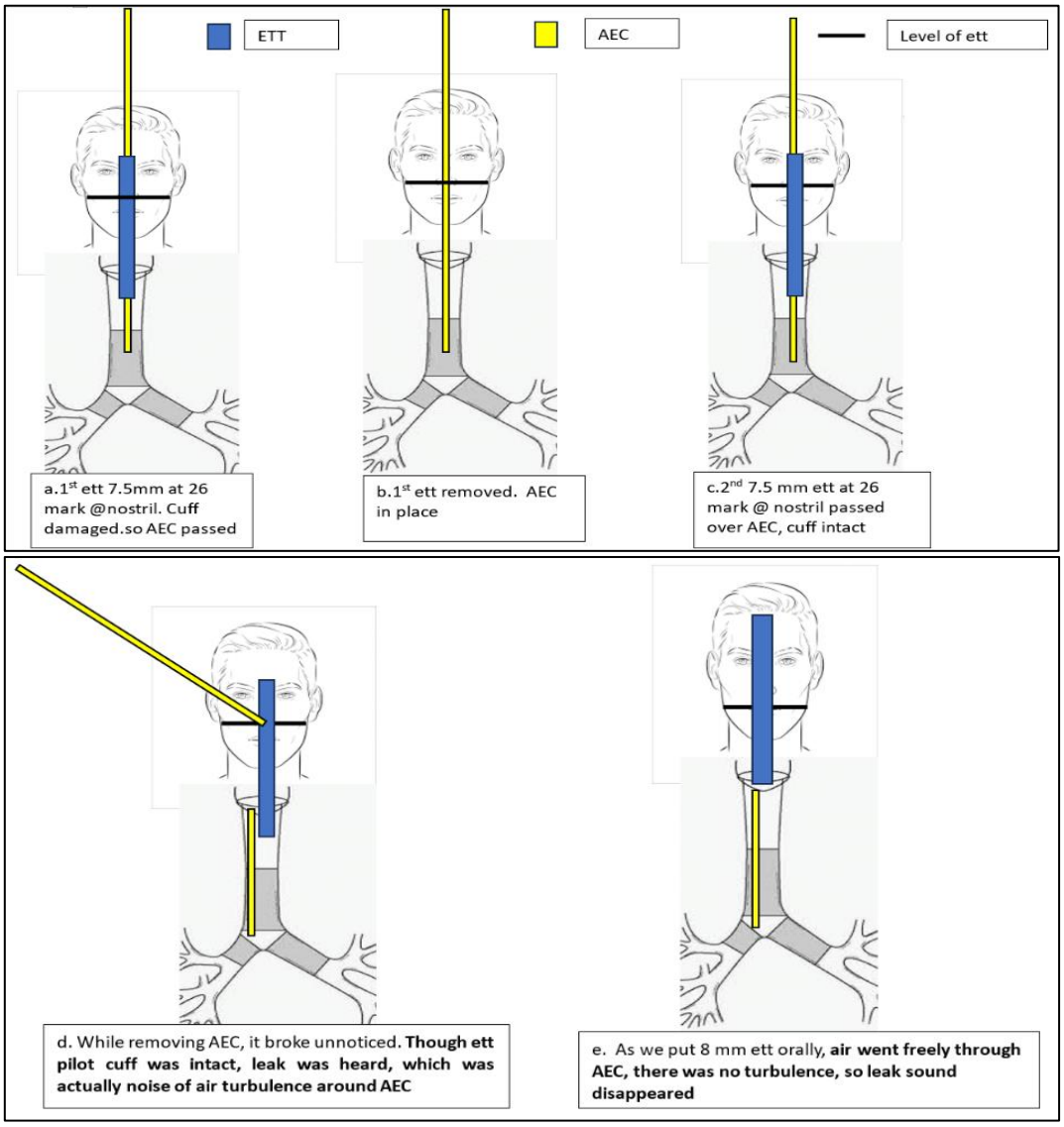

Figure 2 (a-e): Schematic presentation of events while exchanging endotracheal tube.

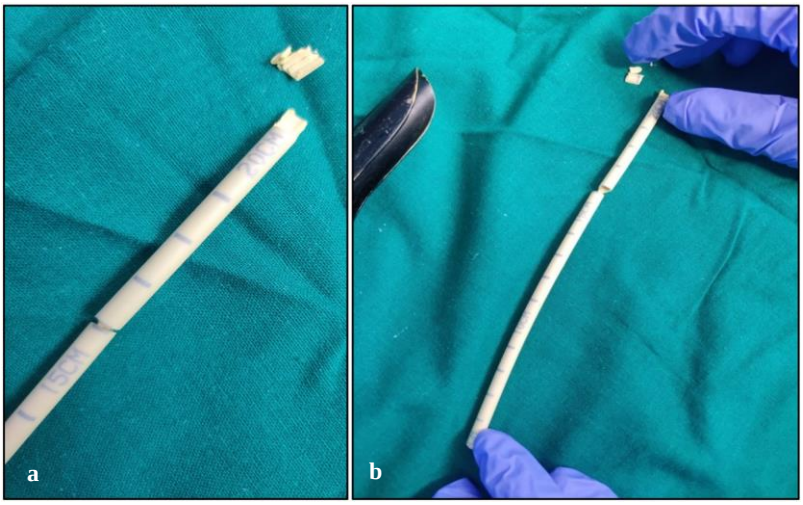

Figure 3 (a and b): A 20 cm section of an airway exchange catheter (AEC) was found inside the patient. The AEC was removed intact in one piece; however, it broke again when placed on a towel.

Our AEC was bought 10 years back and had become brittle. We postulate that following sequence of events may have occurred, which are schematically shown in Figure 2.

Patient was taken for bronchoscopy, on 3rd postoperative day. Premedication with injections atropine 0.3 mg, midazolam 2 mg, pentazocine 30 mg and ondansetron 4 mg was done. Induction was with propofol 100 mg and succinylcholine 50 mg and maintained on intermittent 5 mg succinylcholine. Rigid bronchoscopy was done by surgeon and on second attempt, the 20 cm piece of AEC was removed intact from the patient which broke into pieces while keeping on trolley (Figure 3).

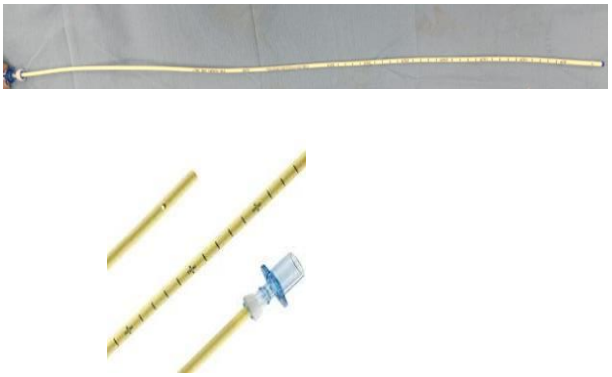

Figure 4: New AEC bought.

DISCUSSION

AECs are intended for emergency, urgent, and elective airway management. AEC can be used for endotracheal tube and tracheostomy tube exchange. They provide oxygen insufflation or jet ventilation. AECs can be used as a bridge to extubation for patients with difficult airways as recommended in 2012 guidelines, by the difficult airway society and 2016 guidelines by all India difficult airway association.[2,3]

AEC are in sizes 11,14, and 19 French and have a length of 83 cm. They have atraumatic blunt tip. Its lumen and distal side-ports are designed to deliver oxygen. It has centimetre markings to facilitate accurate alignment with endotracheal tubes, the markings start from 5 cm and are there only till 35 cm. It has removable Rapi-fit adaptors with leur lock to permit oxygen delivery during an exchange procedure. 11, 14 and 19 AEC sizes have internal diameter 2.3, 3.0 and 3.4 and they pass through ETT of sizes, 4, 5 and 7 respectively.

Inspite of noble intended use of AEC with good salient features, our 19 F AEC broke inside tracheobronchial tree. With review of literature, we found a similar case reported by Kumar et al where even their AEC broke unnoticed while exchanging ETT.[9] They eventually had to do fibreoptic intubation and during that time they found broken part of AEC just below vocal cords. In our case, the broken part of AEC remained unnoticed as it got pushed further in tracheobronchial tree. Since the broken part of AEC was not resting against the palpable trachea in the neck, no brui or turbulence could be heard. Hence ours is rarest of rear case where broken part of AEC remain unnoticed for 2 days in tracheobronchial tree.

In case of Swaro et al the AEC broke inside the ETT, before exchange and was visible through the ETT. They removed the entire assembly and later could intubate with direct laryngoscopy over a bougie.[10]

Shaikh et al reported alveolar injury and pneumothorax with AEC use, when they ventilated patient through AEC with oxygen and ambu ventilation.[11] De Almeida et al reported posterior laceration in the right main bronchus and pneumothorax when ETT exchange was done over AEC in intensive care unit (ICU).[12] Harris et al reported a case of endotracheal tube exchange with AECs complicated by pneumothorax, without evidence of tracheal or bronchial injury demonstrable via bronchoscopy.[13]

Nates et al reported 2 cases where while exchanging ETT over AEC, in ICU, the AEC went into the oesophagus through murphy's eye of ETT.[14] Foglia et al reported a case for mandibular fixation with postoperative jaw wires where a failed ETT exchange with an AEC resulted in a near loss of the airway.[15] The tip of the AEC had passed through the murphy eye of the ETT, and then in a retrograde manner had looped back on itself and kinked in the trachea. So, guiding the ETT over AEC or pulling back of the coiled AEC, both failed. They removed everything enblock, under glideoscope guidance.

McLean et al performed a single centre retrospective cohort study of 1177 patients to find out the incidence and associated factors for airway exchange failure and complications with the use of the Cook AEC.[16] Among 1177 cases, in 527 patients, AEC was used for exchange and in remaining cases for step-wise extubation. Failed intubation during attempted tube exchange was noted in 73/527 (13.8%).

In our case, the CL score on direct laryngoscopy was 3. There was difficulty in negotiating a nasal ETT. After 2nd attempt, when patient was intubated, the ETT cuff was found damaged. Jelly was applied over AEC and a smooth exchange of ETTs occurred. Probably while removing 1st ETT, AEC had got pushed a bit further inside and while removing AEC, it broke as it was brittle. But as AEC came out smooth, we never thought it could have been broken. AEC is not frequently used. So, the Anaesthesia technician who took it for washing didn't realize, as they are used to washing gum elastic bougie which are of much shorter length. Postoperatively the patient was comfortable and was observed for 1 hour in recovery area, hence it never occurred to us that part of AEC could have been still inside. We present this case to increase awareness and alertness even in emergency situations too, to prevent hazardous situations later.

CONCLUSION

We conclude that periodic check-up of all anaesthesia gadgets is required and it is important to check length and intactness of airway adjuvants before and after use. Though AEC can be used in emergency airway management, few seconds must spend to check its markings, brittleness before and after use.

To avoid such situations, inspection of difficult airway carts every day and checking for expiry date of adjuvants is must. With review of literature, we found so much reported complications with AEC. So, it's time to introspect whether a longer 60 cm gum-elastic bougie should suffice for tube exchange.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Airway Exchange. Airway Management. Cook. Cookmedical.com, 2021. Available at: https://airwaymanagement.cookmedical.com/airway-exchange/. Accessed on 25 September 2024.
2. Mitchell V, Dravid R, Patel A, Swampillai C, Higgs A. Difficult Airway Society Guidelines for the management of tracheal extubation. Anaesthesia. 2012 ;67(3):318-40.
3. Myatra S, Shah A, Kundra P, Patwa A, Ramkumar V, Divatia J, et al. All India Difficult Airway Association 2016 guidelines for the management of unanticipated difficult tracheal intubation in adults. Indian J Anaesth. 2016;60(12):885-98.
4. Batuwitage B, Charters P. Postoperative management of the difficult airway. BJA Education. 2017;17(7):235-41.
5. Rashid AM, Williams C, Noble J, Rashid OM, Kazuaki T, Anand RJ. Pneumothorax, an underappreciated complication with an airway exchange catheter. J Thoracic Dis. 2012;4(6):1.
6. Duggan LV, Kiely Law J, Murphy MP. Brief review: Supplementing oxygen through an airway exchange catheter: efficacy, complications, and recommendations. Canad J Anaesthesia. 2011;58(6):560-8.
7. Nunn C, Uffman J, Bhananker SM. Bilateral tension pneumothoraces following jet ventilation via an airway exchange catheter. J Anesthesia. 2007;21(1):76-9.
8. Cook T, Kristensen MS. Core Topics in Airway Management. Cambridge University Press. 2020.
9. Kumar P, Singhal S, Malhotra N, Yadav N. Broken Airway Exchange Catheter-A Rare and Serious Complication. Ann Int Med Dental Res. 2018;4(6):25-6.
10. Sriramka B, Swaro S, Samal R. Fragmentation of airway tube exchange catheter: A dangerous situation. Saudi J Anaesth 2023;17(3):440-1.
11. Shaikh N, Mahmood K, Wafa AA, Kokash O. Endotracheal tube exchange and pneumothorax: A case report. Case Rep Clin Med. 2013;2(2):183-5.
12. Almedia J, Hajjar LA, Fukushima JT, Nakamura RE, Albertini R, Regina F. Bronchial Injury and Pneumothorax after Reintubation using an Airway Exchange Catheter. Revista Brasileira De Anestesiologia. 2013;63(1):107- s12.
13. Harris K, Chalhoub M, Maroun R, Elsayegh D. Endotracheal tube exchangers: Should we look for safer alternatives? Heart Lung. 2012;41(1):67-9.
14. Nates JL, Berner DK. Mishapsw with Endotracheal Tube Exchangers In ICU: Two Case Reports and Review Of The Literature. Internet J Anesthesiol. 1999;5(1):10.
15. Foglia J, Guy J. An underappreciated risk of an airway exchange catheter. Can J Anesthesia. 2019;67(4):491-2.
16. McLean S, Lanam CR, Benedict W, Kirkpatrick N, Kheterpal S, Ramachandran SK. Airway Exchange Failure and Complications with the Use of the Cook Airway Exchange Catheter®. Anesthes Analgesia. 2013;117(6):1325-7.

Cite this article as: Tiwaskar S, Shah K, Ranade R, Karande J. Unnoticed breakage of airway exchange catheter during nasal endotracheal tube exchange. Int J Otorhinolaryngol Head Neck Surg 2024;10:765-9.