

FIXATION TAPE: A CAUSE OF FAILURE OF CUFF DEFLATION AND PILOT ASSEMBLY MALFUNCTION

Anaesthesiology

Dr. Ashish Yadav	Senior Resident, Department of Anaesthesiology and Critical Care, Pt. B. D. Sharma, PGIMS Rohtak, Haryana
Dr. Rupali Arora*	Junior Resident, Department of Anaesthesiology and Critical Care, Pt. B. D. Sharma, PGIMS Rohtak, Haryana *Corresponding Author
Dr. Kirti Kamal	Professor, Department of Anaesthesiology and Critical Care, Pt. B. D. Sharma, PGIMS Rohtak, Haryana
Dr. Monika Bhandari	Junior Resident, Department of Anaesthesiology and Critical Care, Pt. B. D. Sharma, PGIMS Rohtak, Haryana
Dr. Savita Saini	Professor, Department of Anaesthesiology and Critical Care, Pt. B. D. Sharma, PGIMS Rohtak, Haryana
Dr. Geeta Ahlawat	Professor, Department of Anaesthesiology and Critical Care, Pt. B. D. Sharma, PGIMS Rohtak, Haryana

ABSTRACT

Kinking of the inflation tube of the endotracheal tube can lead to inadequate inflation or failure of deflation of endotracheal tube cuff. We discuss a case of difficult extubation, due to inadequate deflation of the tracheal tube cuff, despite collapse of the pilot balloon, on its aspiration. This was caused by inadvertent kinking of the pilot balloon tubing due to inappropriate tape fixation of the endotracheal tube.

KEYWORDS

cuff, deflation, fixation, tape, endotracheal tube

INTRODUCTION

Pilot balloon assembly malfunctions are one of the common causes of difficult extubation. Difficulty in deflating the cuff due to kinking of the inflation tube can create problems at the time of extubation¹. There have been few instances where it is seen that there is failure of endotracheal tube cuff to deflate despite the pilot balloon completely collapsed after aspiration of air with a syringe. This often occurs due to kinking of inflation tube of pilot balloon by fixation tape. We report an unusual case of inability to deflate the ETT cuff during extubation due to fixation tape.

CASE REPORT

A 60 years old, 70 kg male was admitted to orthopedics ward with non-union of supracondylar fracture of right humerus following fall 3 months back. After proper pre-anesthetic checkup, patient was taken up for open reduction and internal fixation of the fracture under general anaesthesia. The patient was premedicated with intravenous midazolam 1mg. After preoxygenation, anesthesia was induced with intravenous fentanyl 100 mcg, thiopentone sodium 300 mg and vecuronium 6 mg. Endotracheal intubation was done using prechecked endotracheal tube size 8.0 mm cuffed polyvinyl chloride tube and the tube was fixed at 21 cm using thin strips of elastic adhesive bandage (Dynaplast). The inflation tube was not included in the fixation bandage. Anaesthesia was maintained with isoflurane, nitric oxide and oxygen. The intraoperative period was uneventful with stable hemodynamics throughout the procedure which lasted for 2 hours. On completion of surgery, the neuromuscular blockade was reversed with glycopyrrolate 0.6 mg and neostigmine 3.5 mg. At the time of extubation, the pilot balloon was deflated completely to remove the ETT. We encountered slight resistance at first attempt of ETT removal. Only after application of mild to moderate force, the ETT could be removed. After removal of the ETT, the cuff was found to be inflated even though the pilot balloon was completely deflated (Figure 1). We examined the inflation tube under the dynaplast and it was found that the inflation tube was kinked at its junction with the ETT because of tight dynaplast strapping over it. On removing the dynaplast, the pilot balloon got inflated by itself and both ETT cuff and pilot balloon could be inflated and deflated easily (Figure 2). On close examination, the pilot balloon assembly was found to be kinked just at the point of its origin from the tube due to its exclusion and resulting downfolding of the pilot balloon assembly (Figure 3).



Figure 1 Inflated cuff with the collapsed pilot balloon.



Figure 2 Pilot balloon again reinflated after removing the fixation tube

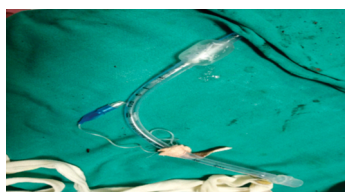


Figure 3 Kinking of the pilot balloon assembly beneath the fixation tape at its origin from tube

DISCUSSION

Extubation is defined as purposeful removal of the endotracheal tube and transition from an established airway to normal natural airway². Difficult extubation is very rarely encountered problem in anaesthesia practice³, but forceful extubation has been associated with fatality⁴. This has also been reported to cause vocal cord edema, dislocation of the arytenoid cartilage and laryngeal trauma⁵. Multiple mechanical factors have been identified consistent with forceful extubation such as failure to deflate the cuff caused by a damaged pilot tube, trauma to larynx, herniation of cuff, adhesion to tracheal wall, inadvertent fixation of endotracheal tube or pilot balloon tubing with orofacial soft

tissues during surgical interventions, entangling of pilot tube with the nasogastric tube and malfunctioning of the cuff assembly^{2,3}. Out of all the possible causes, cuff malfunction has been reported as the commonest cause³. Improper deflation of the tracheal cuff can result from kinking of the pilot tube distal to the pilot balloon (between balloon and point of attachment to the endotracheal tube) or severed pilot tube at the point of attachment with the endotracheal tube³.

In our case, kinking of the tube had taken place distal to the pilot balloon at its origin from the endotracheal tube. This kink prevented complete deflation of the endotracheal tube cuff despite an apparently deflated pilot balloon. The negative suction on the pilot balloon caused the walls of balloon to get apposed to each other without complete deflation of the cuff. Further examination of the endotracheal tube revealed that the inflation tube had kinked at its point of origin from the endotracheal tube. The pilot balloon assembly was exiting the tube at 22 cm and the depth of the endotracheal tube at the angle of the mouth was 21 cm. Since the inflation tube was excluded from the fixation tape, this downfolding resulted in complete occlusion of the inflation tube lumen which resulted in pilot balloon assembly malfunction and forceful extubation.

Therefore, it is recommended that pilot balloon assembly must be included in the fixation bandage especially in a scenario where the fixation point is near the point of origin of pilot assembly from the tube. Moreover, if such a problem is anticipated, gently removing fixation tape from the tube prior to the deflation to exclude any kinking at the origin of the pilot assembly can help to overcome such a situation. This will prevent a case of forceful extubation and airway trauma.

Although we had pulled the tube out by applying additional traction, many measures have been suggested in literature to overcome such a situation. Examination of the pilot tubing has been suggested as the initial measure to identify kinking of the tube⁶. Insertion of a needle with an attached syringe distal to the kinked portion had been advocated as the next corrective measure⁶. In another suggested method, tube can be pulled out until it is just visible at the vocal cords and deflation of the cuff afterwards by puncturing with a sharp object⁷. Moreover, alternate fixation methods other than the standard fixation tapes should be searched. Endotracheal tube holders such as Thomas endotracheal tube holder (Laerdal) are available but they are not routinely used⁸.

The causes of pilot balloon assembly malfunction are multiple. Hence, no particular recommendations can be made to manage such situations⁹. Therefore awareness, vigilance, early identification and analysis of the specific problem in each case individually can help us in choosing the best possible method to rectify that particular situation of difficult extubation.

REFERENCES

1. Baduni N, Pandey M, Sanwal MK. Malfunctioning pilot balloon assembly. *J Anaesthesiol Clin Pharmacol* 2013;29:131-2.
2. Karmarkar S, Varshney S. Tracheal extubation. *Continuing Education in Anaesthesia Critical Care and Pain* 2008;8:214-20.
3. Nakagawa H, Komatsu R, Hayashi K, et al. Fiberoptic evaluation of the difficult extubation. *Anesthesiology* 1995;82:785-6.
4. Dryden DE. Circulatory collapse after pneumonectomy (an unusual complication from the use of a catheter): case report. *Anesth Analg (Cleve)* 1977;56:451-2.
5. Hulme J, Agarwal S. Failure to deflate an endotracheal cuff. *Acta Anaesthesiol Scand* 2008;52:719.
6. Hartley M, Vaughan RS. Problems associated with tracheal extubation. *Br J Anaesth* 1993;71:561-8.
7. Guntupalli KK, Boucek CD. Cricothyroid puncture of an undeflatable endotracheal tube cuff. *Crit Care Med* 1984;12:924.
8. Murdoch E, Holdgate A. A comparison of tape-typing versus a tube-holding device for securing endotracheal tubes in adults. *Anaesth Intensive Care* 2007;35:730-5.
9. Nag DS, Samaddar DP. Inappropriate fixation of an endotracheal tube causing cuff malfunction resulting in difficult extubation. *Rev Bras Anestesiol* 2016;66:536-38.