CASE REPORT

Management of endotracheal tube air leak—A simple yet an effective manoeuver

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Abstract

The management and maintenance of an airway can prevent life threatening complications. The handling of airway, especially in difficult airway and trauma patients, requires extreme caution. We have demonstrated a simple technique in the management of emergency airway, who was getting hypoxic due to severed endotracheal tube (ETT) cuff inflation line. A 20 G intravenous cannula was used, the leak was stopped, and the ETT balloon was inflated. Hence, the leakage and eventually hypoxia settled. We were able to manage emergency airway with this peculiar technique. The use of 20 G intravenous cannula can help to inflate a damaged ETT cuff inflation line. This is an inexpensive and effective manoeuver.

Keywords: Airway management; Intubation; Intratracheal; Cervical Vertebrae.

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Introduction

The maintenance of an advanced airway is imperative in the management of patients who need mechanical ventilation. According to the National Audit Project (4th Edition), loss of airway in intensive care unit (ICU) can even lead to death.[1] Other complications include brain injury, emergency surgical airway, and prolonged ICU stay. We report an incidence, where the endotracheal tube (ETT) cuff inflation line was accidentally severed while the dressing was being readjusted. The resulting damage led to hypoxia of the patient with cervical spine surgery. Some novel methods for the temporary management of air leaks have been used previously. However, here a rather simple, safe, and effective technique to inflate the ETT cuff and prevent its deflation is being shown. It can help in prevention of morbidity and even mortality.

Case Report

A 45-year-old male presented at the emergency department of Aga Khan University Hospital, Karachi, after a road traffic accident in June 2021. The patient was managed as per the advanced trauma life support guidelines. The trauma workup was done. Radiology revealed anterolateral atlantoaxial dislocation, splenic laceration, right pelvis open book fracture, extraperitoneal bladder rupture, and fractures of the transverse processes of multiple lumbar vertebrae and right humerus. A multidisciplinary team was taken on-board. Cervical traction was applied, and cervical fixation was planned. The patient was intubated in the operating room with an endotracheal tube of size 8 mm (Medtronic). During intubation, in line stabilisation was done and a video laryngoscope was utilised for minimal cervical manipulation. The surgery lasted for seven hours. Postoperatively, he was shifted to the ICU intubated and kept on mechanical ventilation. For cardiovascular support, a Norepinephrine infusion at 0.08mics/kg/min was used. At 1:00am, the assigned staff was changing the dressing of his central venous catheter (right internal jugular) during which the endotracheal tube pilot inflation line was severed accidentally, as shown in Figure 1. Due to pilot line damage, the endotracheal cuff was deflated and there was a significant air leak. The tidal volume dropped which resulted in tachypnoea, tachycardia leading to drop in SpO_2 (oxygen saturation) and a rush call was generated. The FiO_2 (fraction of inspired oxygen) was increased to 100% and a Mapleson C circuit was opened for ventilation. Due to pilot line damage, the positive pressure ventilation was ineffective. Reintubation with a new endotracheal tube was planned. However, due to the background of cervical spine damage and minimal manipulation of the cervical spine, the anaesthesia team was called for the intubation, and a

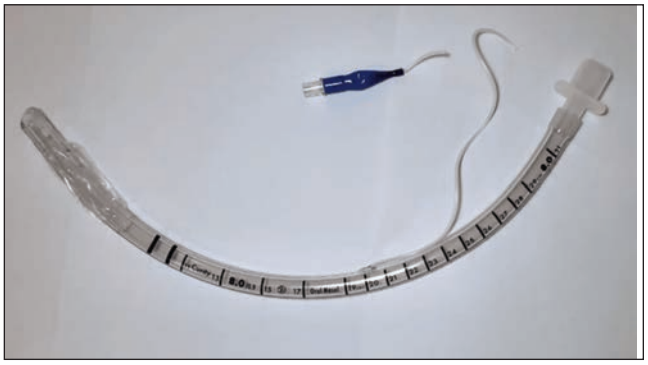

Figure-1: Severed inflation line.

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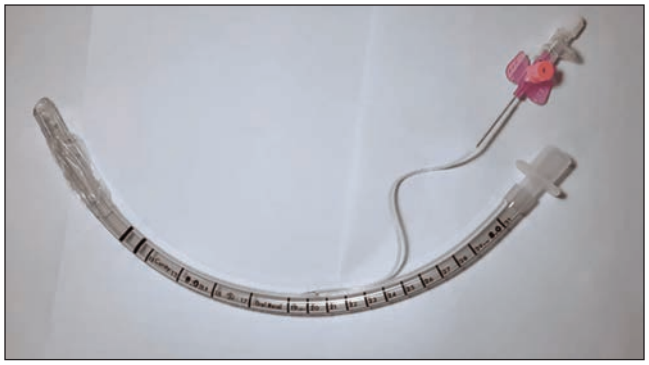

Figure-2: 20G cannula inserted in severed line.

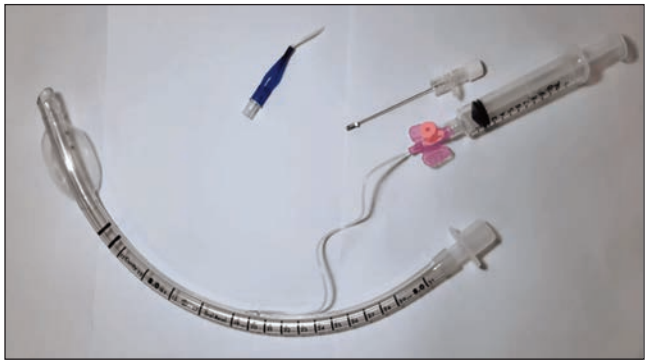

Figure-3: Cuff inflated with the help of cannula and 10 cc syringe.

request was made for the arrangement of a video laryngoscope. The anaesthesia team was on the way, but the patient was becoming hypoxic. To combat this, we used a 20 G IV cannula, inserted its needle in the pilot line of the damaged endotracheal tube, slid the catheter in the pilot line, the needle was withdrawn, and a 10cc syringe was attached to the cannula, as shown in Figure 2. With the 10CC syringe, the endotracheal tube cuff was inflated, and the plunger of the syringe was tapped to prevent backward flow of the plunger, as shown in Figure 3. Eventually, due to the absence of leak, the patient's tidal volume improved and the heart rate and SpO_2 also normalised. As the endotracheal tube was managed with this manoeuver, the management of the airway was no longer an emergency. Later, the endotracheal tube was changed electively under a controlled environment with the help of the anaesthesia team and video laryngoscope. Eventually, following a 20-day hospital stay, the patient was discharged home.

Discussion

The endotracheal reintubation can also be due to defects in the cuff, inflation valve, pilot balloon, and from the wall of ETT at the insertion point of the pilot line.[2] The leak in the ETT cuff causes difficult ventilation and the risk of aspiration of oropharyngeal secretion. Further, emergency intubation can also cause trauma to the repaired cervical spine. The pilot line was damage while dressing the central venous catheter. Keeping the pilot balloon and its tube in good condition requires proper handling and manipulation of the ETT particularly in patients with potential difficult airway, cervical spine fracture, airway trauma, patients on high FiO_2 and positive end-expiratory pressure.

To fix such a defect, in addition to the manoeuver utilised in this case, literature has mentioned other novel approaches. One of the approaches is via the use of an epidural connector. The cut end of the cuff inflation line is inserted into the epidural connector (Smiths Medical) which can also be connected to a three-way stopcock. Singh et al used an intravenous (IV) catheter connected to a Luer Lock valve adaptor. A modification of this technique with the addition of a triple stopcock valve in place of the pilot balloon has also been used.[3] Another approach by Sprung et al uses the inflation line of unused ETT and its connection to the severed inflation line of the patient's ETT via the use of a hypodermic needle.[4] In emergency, we used the technique used by Watson and Harris. They used a 22G IV soaked with alcohol to inflate the severed cuff inflation line.[3] P. Deb also used the same size of IV cannula for the damaged inflation line.[5] However, in the present case a 20 G IV cannula for size 8 mm ETT (Medtronic) was used. Bediako et al have made recommendations regarding the size of ETT and the estimated intravenous cannula size which can be used in such a scenario. For the size 7.5–8 mm ETT, IV cannula size 18–22 G can be used. Nonetheless, the over inflation of the ETT cuff is always a possibility in such a scenario. Thus, the use of a three-way stopcock with the intravenous cannula has been suggested.[6] The intracuff pressure can be monitored and kept at less than 27 mmHg.

Commercially another product BE 409 Pilot Tube Repair Kit (Instrumentation Industries Inc, Bethel Park, PA) has been introduced to manage the severed cuff line in an emergency situation. Epstein et al used an intravenous catheter as a stent and inserted the severed pilot balloon into it. Comparing the intact and the repaired ETT in eight-hour intervals, they observed no significant difference in pressure drop. Moreover, the air leak was not visible even with cuff inflation to 120 mmHg. They concluded that for a disrupted balloon assembly, this approach was an effective method in situations where ETT replacement may bear a risk to the patient.[4] Unlike Epstein, we did not replace the pilot cough. So, in a clinical scenario in which the replacement of ETT is not possible, the method opted by Epstein should be utilised. The integrity of repaired ETT has been checked via this manoeuver. However, the choice of method depends on personal preference and availability of the required equipment. In the present case, intravenous cannula was opted for because it is available in every health care facility. The use of IV cannula has been used and tested

as well.[4,6] A limitation of this method is the possibility of damage to the pilot line during insertion of the needle. Because of the emergency situation, the risk of such a hazard is substantially increased. Moreover, the risk of needle stick injury cannot be undermined.

In order to prevent such events, the most important factor is staff education and training to handle such a scenario. The staff should be educated regarding the safe use of scissors and sharps at the patient's bedside. The cuff inflation system should be positioned away from the dressing and can be marked with paper tape. Nonetheless, the feasibility of such a manoeuver has been mentioned in the anaesthesia; however, the data is lacking regarding its adoption in the intensive care unit and in patients with tracheostomy.

Conclusion

An emergency was encountered that was managed effectively at that time with the utilisation of a simple manoeuver. Although the technique used is not a permanent solution, it can help to manage the patient in emergency and buy some time until a definite airway is secured, preventing a life-threatening complication. It is recommended that the staff assigned to the management of patients with endotracheal tube/tracheostomy tube should be educated about this manoeuver.

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