

Transection of Flexometallic Tube in Intensive Care Unit: Literature Review with a Case Report

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Abstract

Flexometallic tubes are used to prevent kinking related airway and ventilation complications, but they are not free from complications such as dissection, deformation and transection. There are many reports of dissection and deformation but there is only one report of transection in Intensive Care Unit. We report a case of transection and uncomplicated retrieval of flexometallic tube due to biting during postoperative management of resection of suprasellar space occupying frontal lobe lesion.

Keywords: Reinforced Tube; Dissection; Deformation; Transection; Airway Complication

Introduction

The spiral embedded (flexometallic, armored, reinforced, metal spiral, wire reinforced) tube has a spirally wound reinforcing wire (metal or nylon) covered internally and externally by rubber, poly vinyl chloride (PVC), or silicone [1]. Because of inherent resistance to kinking these tubes are preferred in head and neck surgeries, neurosurgeries, surgeries performed in non-supine position. During the postoperative period, patient may need to be managed in intensive care unit (ICU) while waiting for stabilization followed by weaning and extubation. There are many complications related to the use of flexometallic tubes. In this paper, we report a case of complete transection of a flexometallic tube and its immediate management including retrieval in ICU with a review of previous reported instances in the literature.

Case Report

A 25 years old female of American Society of Anaesthesiologist physical status class II, presented with on and off headache for one year, difficulty in speech, weakness on the left leg for 1 month. Following clinical examination and investigation a left sided suprasellar space-occupying lesion was found and scheduled for left fronto-temporal craniotomy. On airway examination, the inter-incisor distance was 4 cm, with normal dentition and Mallampati class I. She had normal range of neck movements with thyromental and sternomental distance was 6.5 cm and 12 cm respectively. Surgery was performed under general anesthesia in right lateral position and intubation was done by using a new, 7.5 mm internal diameter cuffed flexometallic endotracheal tube (Flexicare, Mid Glamorgan, UK). The duration of the procedure was four and half hours and was uneventful. Postoperatively, she was transferred to the ICU for elective ventilation and planned for extubation after complete recovery from anesthesia.

In the postoperative period, she had an uneventful recovery. She was not under any sedation and cuff leak was present with adequate cough reflex. Due good breathing efforts and neurological recovery, the patient was planned for extubation with standby preparation for re-

intubation if needed. In the meantime, nursing staff noticed ventilator alarm and disappearance of capnometry graph with gurgling sound coming from the patient's mouth. Immediate examination revealed transected flexometallic tube with the distal part having migrated towards hypopharynx. However, the transected distal part remained connected to the proximal part with the strand of intact spiral wire, which prevented the further migration of the tube down the pharynx (Figure 1). Patient was extubated by retrieval of the distal segment using a Magill forceps following cuff deflation and oral suctioning. Post-extubation, she had a good recovery without airway obstruction though intubation and difficult airway trolleys were kept standby. Patient was transferred to the neurosurgery ward the following day and made a good neurological recovery.

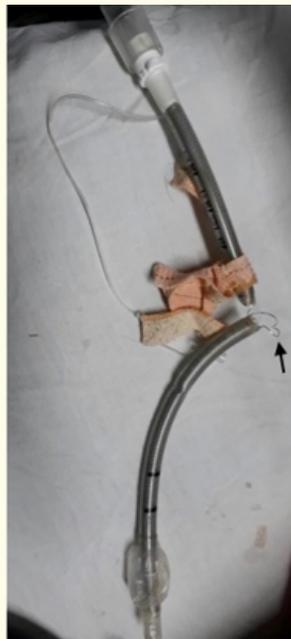


Figure 1: Transected tube with segments linked by metallic wire.

Discussion

Flexometallic or armored endotracheal tubes have been used to avoid kinking of the tube and consequent hypoxemia, hypercarbia, and their sequelae [2]. Although they are inherently resistant to kinking, but numerous complications have been reported in the past due to dissection, transection, permanent deformation, dynamic kinking and fire incidents due to melting (Table 1). Therefore, anesthesiologists should be aware of all possible complications, which may arise in various situations and need to be prepared to avoid and manage the consequences in best possible way. In past, reuse of the tube following multiple washing and Ethylene oxide sterilization had led to bubble formation, dissection and intraoperatively, partial to complete airway obstruction. Use of nitrous oxide as an anaesthetic agent compounds the situation by gradual accumulation of the gas between the already weakened and or separated two layers of the tube leading to dissection, high airway resistance, hypoventilation, hypercapnia and life-threatening intraoperative airway complications. Also, large intraluminal aneurysmal dilations may not allow the passage of Airway exchange catheter complicating reintubation attempt in the middle of the procedure. Single use flexometallic tubes have gradually reduced such incidences, but resource constraint situations may force multiple usages leading to various complications. There are numerous reports related to compression due to Boyale-Davis mouth gag [3], Dingman retractor [2] and other surgical equipments. Ladi and Aphale [4] had reported a case of complete transection of the tube

by Giglisaw, due to close proximity of surgical site to the endotracheal tube. Kinking caused by instruments can be permanent due to vertical pressure and change in the shape of the wires or can be temporary due to tangential pressure leading to dynamic kinking of the coils [2].

| Author | Complication | Procedure | Management |
|---------------------------|---|--|---|
| Kumar and Das [2] | Dynamic kinking due to Dingman retractor | Transoral odontoidectomy | Use of alternate blades of the retractor |
| Azim., et al. [9] | Post-operative deformation due to biting during reversal | Lumbar spine, prone position | Extubation and reintubation |
| Rao., et al. [10] | Intraoperative dissection of inner layer | CP angle tumor, lateral position | Extubation and reintubation |
| Jeon., et al. [11] | Intraoperative dissection of inner layer | Lumbar laminectomy | Continued the procedure with post procedure left lower lobe atelectasis |
| Chalkeidis., et al. [6] | Tube and cuff's inflation tube damage due to biting | Lumbar laminectomy | Continued procedure with anesthesiologist's finger preventing the leak |
| Balalkrihna., et al. [12] | Intraoperative deformation due to biting in lighter plane | Thyroid surgery | Extubation and reintubation |
| Ladi and Aphale [4] | Intraoperative complete transection | Partial maxillectomy | Unable to remove distal end, emergent tracheostomy |
| Rajkumar and Bajekal [13] | Intraoperative dissection at the junction of the pilot tube and the inner lumen | Meningioma excision, midthoracic, prone position | Extubation and reintubation |
| Shin., et al. [5] | Intraoperative fire and melting of tube, cautery origin | Intracranial bleed and surgical tracheostomy | Fire control and tracheostomy tube insertion |
| Mercanoglu., et al. [7] | Intraoperative dissection of inner layer (two cases) | Thyroidectomy | Stopped Nitrous oxide and tube change |
| Hosseinzadeh., et al. [3] | Boyale-Davis mouth gag induced spiral wire damage | Tonsillectomy | Reintubation using a videolaryngoscope |
| Karim Habib., et al. [7] | Transection due to patient bite during extubation | Thyroidectomy | Proceeded with extubation, uneventful |
| Yoon., et al. [8] | Transection due to biting in ICU | Post gluteal tumor removal, prone nursing | Removal by Micro-laryngoscopy |

Table 1: Various complications linked to flexometallic tube use from literature.

In a case of surgical tracheostomy following traumatic brain injury with flexometallic tube in situ, Shin., et al. [5] had reported a case of intraoperative fire hazard following melting of the tube due to heat from cautery. Patient biting on the tube may lead to complete deformation, increased airway resistance, leak due to tube and or cuff's inflation tube or transection. Spine surgeries with intraoperative motor evoked potential monitoring without the effect of neuromuscular blocking agents can lead to biting of the tube due to involuntary intensive contraction of masseter muscle leading to tube damage with or without a bite block in situ. Chalkeidis., et al. [6] had reported such an incident during lumbar spine surgery in prone position. Two cases of complete transection due to patient biting had been reported.

In one case, there was complete transection with easy retrieval of distal segment, which happened on the operating table during reversal from general anaesthesia [7]. In a second incident, tube was transected due to patient biting during post operative period in ICU, following a large gluteal histiocytoma resection and vascular pedicle skin flap repair requiring nursing in the prone position. The distal segment had migrated to right main bronchus requiring microlaryngoscopic removal in the operation suite without any further airway related complication [8]. In our case the transection due to patient biting did not lead to any further complication but it could have been prevented by postoperative replacement of the flexometallic with a PVC one, preoperative patient education, postoperative patient explanation and assurance during weaning. In general, patient biting of the tube can be prevented by using a bite block and mild sedation with a low dose dexmedetomidine infusion without causing respiratory depression and compromising neurological examination. Exchanging the flexometallic tube with a PVC endotracheal tube at the end of the procedure can avoid all the postoperative complications related to flexometallic tube [7]. In case of frontal lobe pathology with or without surgery, patient education and counseling may not help, due to the inherent neurological problems of loss of inhibition by affected frontal lobe. In patients requiring non-supine nursing in ICU with a flexometallic tube, adequate sedation and analgesia can prevent tube biting and related complications.

Conclusion

Even though, flexometallic tubes are normally resistant to the usual position-related kinking, other problems can complicate its usage. Introduction of single use tubes and decreased use of nitrous oxide have reduced the incidence of dissection related complications. Pre-anaesthetic and ongoing patient education, judicious use of sedation and bite blocker can prevent transection related to patient biting. Above all, awareness of possible complications related to the use of flexometallic tube during various surgical procedures and preparedness to handle them will help in prevention, early recognition and successful management of potentially fatal airway related events.

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