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Armoured Rescue: Flexometallic Endotracheal Tube Secures the Airway in Total Laryngectomy for Glottic Carcinoma with Cartilage Erosion

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Abstract
Advanced glottic carcinoma presents complex airway challenges during total laryngectomy, requiring a balance between maintaining ventilation and ensuring unobstructed surgical access. Airway devices such as the Oxford tube and flexometallic tube offer distinct advantages and limitations. We report the case of a 64-year-old hypothyroid female with moderately differentiated squamous cell carcinoma of the glottis and thyroid cartilage erosion. She underwent total laryngectomy, partial pharyngectomy, PMMC flap reconstruction, bilateral neck node sampling, and primary tracheoesophageal puncture (TEP) device insertion. A flexometallic tube was chosen for airway management through the pre-existing tracheostomy stoma, enabling repeated intraoperative repositioning without kinking and maintaining secure ventilation throughout surgery. Flexometallic tubes provide flexibility, kink resistance, and ease of repositioning in complex head-and-neck surgeries. However, documented risks include spiral dislodgement, cuff leaks undetectable by standard checks, dynamic obstruction, and accidental extubation due to elastic recoil, particularly in reused tubes. A detailed device inspection and vigilant intraoperative monitoring are essential. In selected cases of complex laryngectomy, a flexometallic tube—when meticulously inspected and correctly positioned-can function as an effective “armoured rescue” airway device.

INTRODUCTION

Carcinoma of the glottis with thyroid cartilage erosion (T4a, AJCC 8th Edition) mandates total laryngectomy due to local invasion and airway compromise[1]. Airway management in such patients is particularly challenging due to distorted anatomy from previous tracheostomy, inability to perform standard oral airway assessments, and the necessity for close surgical–anaesthetic coordination to maintain a clear operative field while ensuring ventilation[2,3].

The Oxford tube, with its wire-reinforced curvature and posteriorly directed breathing limb, offers excellent surgical field clearance but limited intraoperative flexibility[2,3]. The flexometallic (reinforced) endotracheal tube incorporates spiral metal reinforcement, conferring multi-plane flexibility, resistance to kinking, and minimal pressure on posterior airway structures[4,5]. These characteristics make it useful in complex head-and-neck surgeries where dynamic repositioning is required. However, case reports describe hazards such as dislodged reinforcing spirals causing sudden kinking[6], cuff leaks escaping routine detection[7], spiral unfurling causing intermittent obstruction[8], and elastic recoil resulting in accidental extubation[9]. These risks are compounded by tube reuse[9].

This report details a case where a flexometallic tube was deliberately chosen for its adaptability during a total laryngectomy with flap reconstruction, and discusses its comparative merits and potential pitfalls.

Case Presentation

Patient Profile: A 64-year-old female, known hypothyroid on thyroxine, otherwise healthy, was diagnosed with moderately differentiated squamous cell carcinoma of the glottis with thyroid cartilage erosion. She presented for definitive surgical management.

Preoperative Management: Airway examination was not assessable orally due to a prior tracheostomy. Contrast-enhanced CT of the neck revealed thyroid cartilage erosion with narrowing of the glottic lumen. Baseline laboratory investigations were within normal limits, and thyroid function was optimised with levothyroxine therapy. Multidisciplinary evaluation was obtained from pulmonary, cardiology, and anaesthesia teams. The surgical plan included total laryngectomy with partial pharyngectomy, PMMC flap reconstruction, bilateral neck node sampling with frozen section, and primary TEP device insertion.

Anaesthesia Management: A difficult airway cart, including a fibreoptic bronchoscope, alternative airway tubes, and an emergency surgical airway kit, was prepared. Two large-bore intravenous lines were established, and standard ASA monitoring was applied.

- **Induction:** Preoxygenation was performed via the tracheostomy. IV fentanyl 2 µg/kg, propofol 2 mg/kg, and vecuronium 0.1 mg/kg were administered. The existing tracheostomy tube was exchanged for a cuffed flexometallic tube inserted through the stoma, with position confirmed by auscultation and capnography.
- **Maintenance:** Anaesthesia was maintained with isoflurane in an oxygen–air mixture, supplemented with intermittent vecuronium and fentanyl boluses. The flexometallic tube allowed intraoperative repositioning without kinking, ensuring uninterrupted ventilation.
- **Intraoperative Course:** Estimated blood loss was approximately 400 mL, replaced with crystalloids. No episodes of desaturation or airway difficulty occurred.
- **Emergence:** Neuromuscular blockade was reversed with IV neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg. The flexometallic tube was replaced with a cuffed tracheostomy tube, and the patient was transferred to the ICU on room air.

Fig. 1: Immediate postoperative view of the patient following total laryngectomy, showing the Ryle's tube exiting the nostril for enteral feeding and the flexometallic tube secured via the tracheostoma.

Surgical Summary: Under general anaesthesia via the tracheostomy, the neck was extended, a Gluck–Sorenson incision made, and flaps raised. Bilateral nodal sampling was performed, followed by circumferential mobilisation of the larynx and resection with clear margins. The pharyngeal defect was reconstructed with a right PMMC flap, and a primary TEP device was inserted. The trachea was exteriorised and sutured to skin; haemostasis was secured; drains were placed; and closure was completed.

Postoperative Management: The patient was managed in the ICU for two days with humidified oxygen via stoma as needed, regular suctioning, and semi-erect positioning. Analgesia was provided with IV paracetamol and a fentanyl infusion. Broad-spectrum IV antibiotics, proton pump inhibitor, and IV fluids

were administered. After stable recovery, she was shifted to the ward, and drains were removed sequentially. Wound sites were inspected daily, and flap viability remained intact.

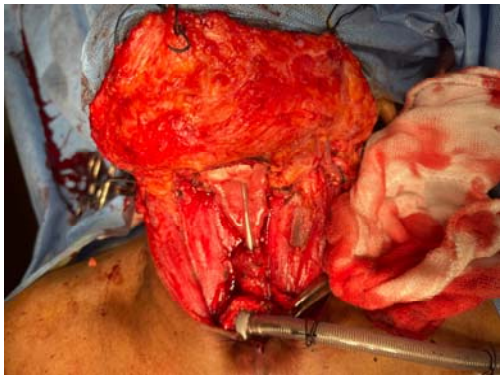

Fig. 2: Intraoperative image depicting the surgical field after laryngeal resection, with surrounding soft tissues retracted and the flexometallic tube positioned in the tracheostoma to ensure airway patency during the procedure.

Follow-up and Outcome: The patient was discharged in stable condition with instructions for stoma care, voice rehabilitation counselling, and wound management. Follow-up was arranged for suture removal, review of histopathology, and planning of adjuvant radiotherapy. At the two-week postoperative review, the stoma was healthy, the flap well-perfused, and the patient was adapting well to the TEP device.

RESULTS AND DISCUSSIONS

In this patient, the decision to use a flexometallic tube was guided by the anticipated need for intraoperative repositioning during flap reconstruction. While the Oxford tube excels in keeping the breathing circuit out of the surgical field, its rigidity can limit adaptability in cases requiring frequent airway adjustments[2,3]. The flexometallic tube's spiral reinforcement offers significant flexibility and kink resistance under surgical manipulation[4,5], with the added benefit of reduced pressure on posterior tracheal structures and ease of suctioning[10].

However, its use is not without hazards. Dislodged spirals can cause sudden tube kinking[6], cuff leaks may remain undetected until ventilation is compromised[7], spirals may unfurl during surgery causing dynamic obstruction[8], and elastic recoil can precipitate accidental extubation[9]. In nasotracheal fibreoptic intubation, flexometallic tubes are more prone to impingement compared to intubating laryngeal mask airway tubes, although this is usually resolved with rotation[11]. These complications are more frequent when tubes are reused[9].

To mitigate risks, every flexometallic tube should undergo rigorous pre-use inspection, including assessment of spiral integrity, cuff function, and lumen patency. Secure fixation and careful circuit management reduce the risk of migration or extubation. Limiting use to single-patient application avoids cumulative wear and structural failure. Throughout surgery, close monitoring of airway pressures and ventilation parameters facilitates early detection of problems.

In this case, meticulous preparation, intraoperative vigilance, and the inherent advantages of the flexometallic tube contributed to a complication-free airway course, validating its role as an "armoured rescue" in complex head-and-neck surgery.

CONCLUSION

The flexometallic endotracheal tube, when subjected to thorough inspection and used in accordance with single-use guidelines, offers valuable flexibility and kink resistance in total laryngectomy cases requiring frequent airway manipulation. While potential complications mandate caution, its judicious application can provide secure, adaptable airway control in challenging operative settings.

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Conflict of Interest: The authors declare no conflicts of interest related to this study.

Consent Declaration: Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

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