

## Obstruction of Reinforced Endotracheal Tubes: About Three Cases

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### Abstract

### Case Report

Reinforced endotracheal tubes are designed with a metal spiral to reduce the risk of kinking or compression. They are commonly used in head and neck surgeries, including neurosurgery. However, these tubes are not immune to obstruction. In this report, we present three cases of reinforced endotracheal tube obstruction in pediatric patients undergoing neurosurgical procedures. In the first case, obstruction was likely due to biting; in the third, to tube manipulation. In the second case, no clear cause was identified, suggesting the possibility of pre-existing tube deformities. These observations highlight the importance of thoroughly inspecting the endotracheal tube prior to use.

**Keywords:** Reinforced Endotracheal Tube, Anesthesia, Child, Deformation, Obstruction.

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## INTRODUCTION

Tracheal intubation is the insertion of a catheter into the trachea via the oral or nasal route. It is a routine procedure, generally rapid and simple, and is essential in both anesthesia and emergency settings to secure the airway and ensure effective ventilation and oxygenation.

Obstruction of the endotracheal tube is a serious complication that can quickly lead to adverse outcomes, especially if complete or if diagnosis is delayed.

We report three cases of reinforced endotracheal tube obstruction in pediatric patients managed in the Department of Pediatric Intensive Care and Anesthesia of Ibn Sina Hospital, Rabat. Our objective is to emphasize the need to consider tube deformity in cases of airway obstruction in patients intubated with reinforced tubes.

### Case 1

A 14-year-old patient was scheduled for surgery for hydrocephalus secondary to bacterial meningitis. Pre-

anesthetic evaluation revealed an ASA I status with no signs suggesting a difficult intubation.

Induction was achieved using propofol, fentanyl, and rocuronium. A size 7 reinforced oral endotracheal tube was inserted and fixed at 22 cm; a Guedel airway was placed. Intubation was uneventful, and the patient was positioned supine with the head turned to the left.

Two hours after ICU admission, airway pressure increased despite normal auscultation and oxygen saturation. Machine malfunction was ruled out. The patient showed signs of arousal but remained unconscious and apneic. Manual ventilation was slightly difficult, breath sounds were symmetrical, but tracheal suction was impossible. Reintubation was performed, and the original tube was found to have significant compression near the fixation site (Figure 1). Postoperative recovery was uneventful, and the patient was transferred to the neurosurgery department the next day.



**Figure 1: Compressed segment of the endotracheal tube**

### Case 2

A 15-year-old previously healthy patient was admitted for emergency surgery for a post-traumatic epidural hematoma. Pre-anesthetic evaluation found no signs of difficult intubation (ASA I).

Induction was performed with propofol, fentanyl, and rocuronium. A 6.5 mm reinforced orotracheal tube was placed and fixed at 21 cm; a Guedel airway was also inserted.

Although intubation was easy, the patient exhibited high peak inspiratory pressures ( $\sim 25$  cmH<sub>2</sub>O) throughout the procedure, with no desaturation or capnography abnormalities, despite deepened sedation and equipment checks. Manual ventilation was possible, but tracheal suction was not.

Due to the short duration of the surgery and absence of clinical deterioration, reintubation was not attempted. The patient awoke smoothly, and tube inspection revealed two major kinks (Figure 2). Postoperative recovery was uneventful.



**Figure 2: Kinks noted on the removed tube**

### Case 3

A 15-year-old with no significant medical history underwent surgery for a subdural hematoma. The patient was drowsy but had no motor deficits or features of difficult intubation.

Induction was achieved using propofol, fentanyl, and rocuronium. A size 7 reinforced orotracheal tube was inserted, fixed at 21 cm, along with a Guedel airway. Intubation was easy, and the patient was positioned supine.

After admission to ICU, extubation was considered once standard criteria were met. However, tracheal suction was only possible with very small-caliber catheters, which yielded no significant secretions.

Ventilatory pressures remained normal. The patient was extubated, and examination of the tube revealed two bends in the frontal plane (Figure 3). Postoperative course was uncomplicated.



**Figure 3: Tube showing deformations after extubation**

## DISCUSSION

Reinforced endotracheal tubes, due to their internal metal spiral, are designed to resist external compression and kinking. They are widely used during head and neck surgeries and neurosurgical interventions where manipulation or displacement of the airway may occur [1].

Despite their design, these tubes are not immune to obstruction. Mechanisms include external compression (e.g., biting), internal lumen deformation, and even manufacturing defects [2].

In **Case 1**, the compression near the fixation site and during emergence suggests a likely bite. This

highlights the importance of maintaining the Guedel airway throughout the procedure until extubation.

In **Case 2**, the tube showed high resistance from the beginning of the procedure, with the deformity far from the teeth, making a bite unlikely. A pre-existing defect is plausible, underlining the need for systematic pre-use inspection.

In **Case 3**, the tube showed two bends which likely resulted from head and neck manipulations, possibly exceeding the tube's flexibility limits.

In the event of suspected airway obstruction after intubation, a structured algorithm should be followed [3]:

- Deepen anesthesia

- Exclude ventilator or circuit malfunction by switching to manual ventilation
- Assess breath sounds and symmetry
- Deflate the cuff to rule out cuff-related obstruction
- Attempt suction through the tube If ventilation remains difficult or impossible, extubation and reintubation should not be delayed to avoid severe hypoxemia [4].

## CONCLUSION

Reinforced endotracheal tubes are useful during head and neck procedures, offering increased protection against kinking and compression. However, they are not exempt from complications such as obstruction due to biting, internal dissection, or mechanical compression.

A thorough inspection of the tube before use, the use of appropriate protective devices (e.g., Guedel airway), and adherence to an airway obstruction

algorithm are essential for patient safety in cases of unexplained respiratory resistance during mechanical ventilation.

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