

CASE REPORT

Intraoperative Endotracheal Tube Cuff Herniation During Prone Lumbar Spine Surgery: A Case Report

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ABSTRACT

Introduction: Endotracheal tube (ETT) cuff integrity is essential for effective ventilation, prevention of aspiration, and maintenance of airway pressures during general anaesthesia. Although ETT cuff-related complications are uncommon, cuff herniation or structural failure can result in significant air leaks, inadequate ventilation, and hypoventilation.

Case Report: A 54-year-old female (ASA physical status I) was scheduled for elective lumbar decompression at L4-L5 and L5-S1 levels under general anaesthesia. Preoperative evaluation revealed no significant comorbidities, normal airway assessment, and unremarkable laboratory investigations.

After standard monitoring was established, general anaesthesia was induced uneventfully. Tracheal intubation was performed using a standard-sized cuffed ETT, and correct placement was confirmed by bilateral chest auscultation, and appropriate airway pressures. The cuff was inflated to achieve an adequate seal, and the patient was mechanically ventilated with stable tidal volumes and normal peak airway pressures. The patient was then carefully positioned prone.

Soon after prone positioning, a progressive reduction in delivered tidal volumes accompanied by a significant ventilatory leak was observed. Peak airway pressures remained low, and capnography showed reduced end-tidal carbon dioxide values. Circuit disconnection, ventilator malfunction, and tube displacement were systematically excluded. Additional cuff inflation was attempted but failed to resolve the leak.

Given the persistent ventilatory compromise and restricted airway access in the prone position, the decision was made to return the patient to the supine position.

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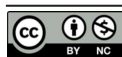
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Direct laryngoscopy revealed herniation of the ETT cuff proximal to the vocal cords. The tube was immediately replaced with a new cuffed ETT. Following re-intubation, normal tidal volumes, airway pressures, and capnography were restored. The patient was repositioned prone, and the remainder of the surgery proceeded uneventfully. Extubation was smooth, and the postoperative course was unremarkable.

Conclusion: Endotracheal tube cuff herniation, though uncommon, should be considered when sudden ventilatory leaks or reduced tidal volumes occur intraoperatively, particularly during prone-position spine surgeries. Early recognition, prompt airway reassessment, and immediate replacement of the ETT are crucial to ensure patient safety and prevent hypoxia-related complications.

KEYWORDS

- Endotracheal Tube • Cuff Herniation • Ventilatory Leak • Prone Position
- Lumbar Spine Surgery • Airway Complications

INTRODUCTION

Endotracheal tube (ETT) cuff integrity is essential for effective ventilation, prevention of aspiration, and maintenance of airway pressures during general anaesthesia. Although ETT cuff-related complications are uncommon, cuff herniation or structural failure can result in significant air leaks, inadequate ventilation, and hypoventilation.¹ These complications are particularly dangerous during prone-position spine surgeries, where access to the airway is limited and repositioning may be time-consuming. Prompt identification and management are crucial to prevent hypoxia and associated morbidity.² We report a rare case of intraoperative ETT cuff herniation occurring shortly after prone positioning during lumbar spine surgery.

CASE REPORT

A 54-year-old female (ASA physical status I) was scheduled for elective lumbar decompression at L4–L5 and L5–S1 levels under general anaesthesia. Preoperative evaluation revealed no significant comorbidities, normal airway assessment, and unremarkable laboratory investigations.

After standard monitoring was established, general anaesthesia was induced uneventfully. Tracheal intubation was performed using a standard-sized cuffed ETT, and correct placement was confirmed by bilateral chest auscultation, and appropriate airway pressures. The cuff was inflated to achieve an adequate seal, and the patient was mechanically ventilated with stable tidal volumes and

normal peak airway pressures. The patient was then carefully positioned prone.



Figure 1: Endotracheal tube cuff herniation

Soon after prone positioning, a progressive reduction in delivered tidal volumes accompanied by a significant ventilatory leak was observed. Peak airway pressures remained low, and capnography showed reduced end-tidal carbon dioxide values. Circuit disconnection, ventilator malfunction, and tube displacement were systematically excluded. Additional cuff inflation was attempted but failed to resolve the leak.

Given the persistent ventilatory compromise and restricted airway access in the prone position, the decision was made to return the patient to the supine position. Direct laryngoscopy revealed herniation of the ETT cuff proximal to the vocal cords. The tube was immediately replaced with a new cuffed ETT. Following re-intubation, normal tidal volumes, airway pressures, and capnography were restored. The patient was

repositioned prone, and the remainder of the surgery proceeded uneventfully. Extubation was smooth, and the postoperative course was unremarkable.

DISCUSSION

ETT cuff herniation is a rare but potentially serious cause of intraoperative ventilatory leak.³ It may result from manufacturing defects, over inflation, cuff material weakness, or mechanical stress during patient repositioning. In the prone position, gravitational forces and changes in tracheal orientation may exacerbate cuff distortion, leading to partial prolapse above the vocal cords and loss of seal.

The differential diagnosis of sudden intraoperative ventilatory leak includes circuit disconnection, ETT displacement, pilot balloon malfunction, cuff rupture, and ventilator malfunction. In prone surgeries, delayed recognition may result in hypoventilation, hypercapnia, and hypoxia. Additional cuff inflation may temporarily worsen the problem by increasing cuff herniation rather than restoring the seal.

This case highlights the importance of maintaining a high index of suspicion for cuff-related complications when unexplained ventilatory leaks occur, especially after position changes. Continuous monitoring of tidal volumes, airway pressures, and capnography is essential. When non-invasive corrective measures fail, prompt airway reassessment and ETT replacement remain the definitive management.

CONCLUSION

Endotracheal tube cuff herniation, though uncommon, should be considered when sudden ventilatory leaks or reduced tidal volumes occur intraoperatively, particularly during prone-position spine surgeries. Early recognition, prompt airway reassessment, and immediate replacement of the ETT are crucial to ensure patient safety and prevent hypoxia-related complications.³

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