

Airway Management in a Retropharyngeal Firearm Injury with Surgical Removal of Bullet Segments: A Case Report**Shweta Bharti Hembrom¹, Yashpal Singh², Sweta Dubey³, Logesh⁴**¹Senior Resident, Department of Anaesthesiology, IMS, BHU, Varanasi, Uttar Pradesh, India²Professor, Department of Anaesthesiology, IMS, BHU, Varanasi, Uttar Pradesh, India³Senior Resident, Department of Anaesthesiology, IMS, BHU, Varanasi, Uttar Pradesh, India⁴Junior Resident, Department of Anaesthesiology, IMS, BHU, Varanasi, Uttar Pradesh, India

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Abstract:**Background:** Firearm injuries involving the retropharyngeal space are rare and pose significant challenges in airway management due to their proximity to vital cervical structures. Accurate assessment and timely intervention are critical to prevent airway compromise and other complications.**Case Presentation:** We report a case of a 28-year-old male who sustained a penetrating firearm injury to the neck, with bullet fragments lodged in the retropharyngeal space. Imaging revealed multiple metallic fragments at the C3–C4 level with surrounding soft tissue edema but no vascular injury. The patient was managed with awake fiberoptic intubation for airway control, followed by surgical removal of the bullet segments once the airway edema subsided. Perioperative airway management included steroid therapy and nebulization to reduce swelling. The patient was successfully extubated the next day using an airway exchange catheter without requiring tracheostomy. Postoperative recovery was uneventful, and follow-up showed no residual airway compromise or infection.**Conclusion:** This case highlights the importance of meticulous airway assessment and multidisciplinary coordination in penetrating neck injuries. Awake fiberoptic intubation with planned surgical removal of bullet fragments ensured safe management without the need for tracheostomy. Early use of steroids and nebulization facilitated resolution of airway edema, supporting conservative yet definitive treatment in such complex airway trauma scenarios.**Keywords:** Firearm Injury, Retropharyngeal Space, Airway Management, Bullet Removal.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Penetrating injuries of the neck, although less common than blunt trauma, remain among the most challenging emergencies due to the presence of numerous vital structures in a compact anatomical space. The cervical region houses major vascular channels, the aerodigestive tract, and important neural elements, making even a small injury potentially life-threatening. Firearm trauma adds to this complexity, as bullets may ricochet or fragment, causing unpredictable tissue damage and retention of metallic pieces in deep cervical spaces. The retropharyngeal space, which extends from the skull base to the mediastinum, is an unusual site for bullet fragments but carries profound clinical importance due to its potential to compromise the airway and serve as a route for infection spread. Such cases are rare and sparsely reported in literature, yet they present a diagnostic and therapeutic challenge in trauma care.

The retropharyngeal space is bounded anteriorly by the buccopharyngeal fascia and posteriorly by the alar fascia, creating a potential pathway for pathology to track down into the thoracic cavity. Lodgement of bullet fragments in this space may initially be silent, but the risks of progressive airway obstruction, infection, abscess formation, and even descending mediastinitis are high. Additionally, metallic fragments may provoke local inflammation, fibrosis, or migrate toward vital structures such as the carotid sheath or cervical spine. These pathophysiological concerns highlight the necessity of early identification and careful monitoring. Conventional radiographs can reveal the presence of metallic foreign bodies, but contrast-enhanced CT is considered the imaging modality of choice to delineate fragment location, assess tissue damage, and rule out vascular involvement. CT angiography is particularly useful in excluding arterial injury, which may otherwise remain occult.

The most immediate priority in such cases, however, is airway management. Distorted anatomy, soft tissue edema, and the risk of sudden obstruction make securing the airway extremely difficult. Traditional laryngoscopy may worsen trauma, and endotracheal intubation can be hazardous if visualization is poor. Awake fiberoptic intubation offers a safer alternative by allowing controlled placement of the tube while maintaining spontaneous respiration. In certain cases, especially with gross distortion or bleeding, surgical airway procedures such as tracheostomy or cricothyrotomy may be lifesaving. The choice of technique depends on patient stability, availability of equipment, and expertise of the team. Once the airway is secured, management decisions can be tailored to the patient's clinical course, weighing the risks of surgical exploration against conservative observation.

The case from IMS BHU, Varanasi, underscores the unique challenges posed by firearm injuries with bullet fragments in the retropharyngeal space. Airway compromise was the most pressing issue, requiring timely intervention with fiberoptic intubation and tracheostomy. Conservative management was chosen for retained fragments due to the high surgical risk, reflecting the delicate balance between intervention and watchful waiting in such rare presentations. This report not only adds to the limited global literature on retropharyngeal firearm injuries but also emphasizes the importance of a multidisciplinary approach involving trauma surgeons, anesthesiologists, radiologists, and otolaryngologists. By sharing clinical and radiological perspectives on this rare case, we aim to provide insights into effective decision-making strategies that can improve survival and reduce complications in similar future scenarios.

Case Presentation: A 28-year-old male sustained a penetrating firearm injury to the neck during an interpersonal conflict and was brought to the emergency department of IMS BHU. On arrival, he was conscious, oriented, and hemodynamically stable, but complained of respiratory distress, inspiratory stridor, dysphagia, and painful swallowing. Mild subcutaneous emphysema was noted around the neck.

Imaging Findings: A lateral neck X-ray and contrast-enhanced CT scan revealed multiple metallic bullet fragments lodged in the retropharyngeal space at the level of C3–C4, with associated soft tissue edema and airway narrowing. Importantly, there was no evidence of vascular or bony injury.

Airway Management: Given the anticipated difficulty due to soft tissue swelling and distorted airway anatomy, an awake fiberoptic nasal intubation was performed. Visualization confirmed

retropharyngeal bulging that significantly narrowed the glottic view. Intubation was achieved safely while maintaining spontaneous ventilation, ensuring controlled airway access.

Surgical Management: After stabilizing the airway and confirming fragment localization, the patient was taken for surgical exploration and removal of the bullet segments from the retropharyngeal space. The procedure was completed without complications or vascular injury.

Postoperative Course: The patient was managed postoperatively with steroids and nebulization therapy to reduce airway edema. Continuous airway monitoring was maintained. Once the swelling subsided, the patient was successfully extubated the next day using an airway exchange catheter, ensuring a controlled and safe transition to spontaneous breathing.

Outcome: The postoperative recovery was uneventful. The patient showed progressive improvement in swallowing and respiration, with no signs of airway obstruction or infection during follow-up.

Discussion

Penetrating neck injuries caused by firearms are complex due to the compact anatomy and the presence of multiple vital structures, including the airway, great vessels, and cervical spine. The trajectory of a bullet in this region can be unpredictable, often leading to deep tissue lodgement and fragmentation. The retropharyngeal space is an unusual but clinically significant site for such injury, as it lies in close proximity to the airway and provides a potential pathway for infection spread into the mediastinum.

In our case, the presence of bullet fragments in the retropharyngeal space presented a major airway management challenge. The patient arrived with respiratory distress, stridor, and dysphagia—symptoms indicating progressive airway compromise. Imaging with contrast-enhanced CT was crucial for accurate localization of the fragments and for assessing associated soft tissue edema while ruling out vascular involvement. CT angiography remains the modality of choice in such scenarios, as it provides detailed visualization of possible arterial injury, which may not always be clinically apparent.

The airway was managed using awake fiberoptic intubation, which is considered the gold standard for difficult airways with distorted anatomy. This approach allows continuous visualization of the airway while maintaining spontaneous ventilation, thereby minimizing the risk of complete obstruction during the procedure. Once the airway was secured, the patient was stabilized for surgery.

Unlike previously reported cases where tracheostomy was often required for prolonged airway protection, our patient did not require tracheostomy. Following surgical removal of the bullet segments and after subsidence of airway

edema with the help of steroid therapy and nebulization, the patient was extubated the next day using an airway exchange catheter. This technique ensured safe extubation with the option of rapid reintubation if airway compromise recurred.

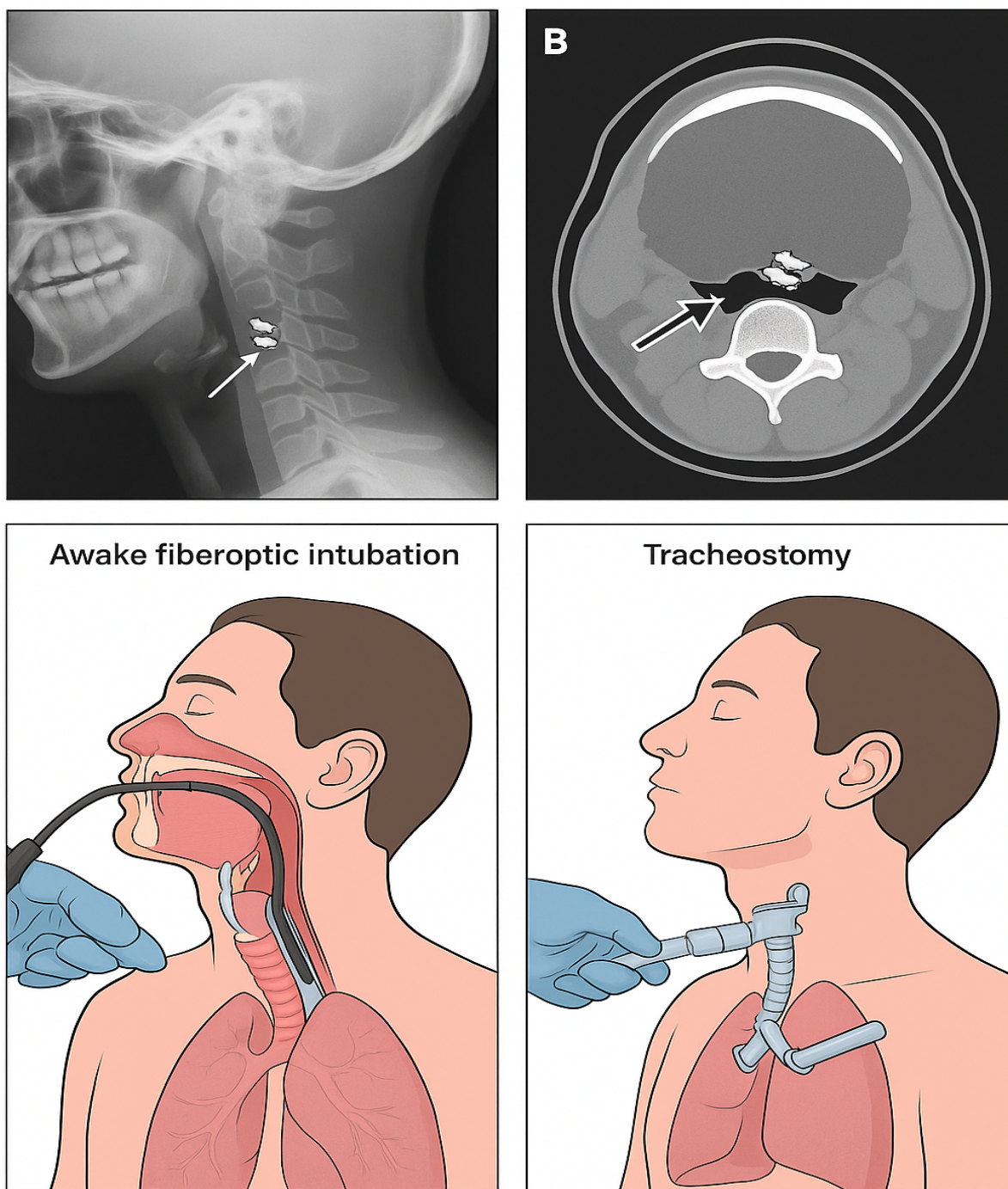


Figure 1:

- (A) Lateral neck radiograph showing metallic bullet fragments (arrow) lodged in the retropharyngeal space at the C3–C4 level.**
- (B) Contrast-enhanced axial CT scan of the neck depicting hyperdense bullet fragments in the retropharyngeal region with surrounding soft tissue swelling.**
- (C) Schematic illustration of awake fiberoptic intubation used for securing the airway.**
- (D) Schematic representation of tracheostomy performed as a definitive airway management step.**

The decision to proceed with surgical removal was based on the accessibility of the bullet fragments and the absence of vascular injury. In select cases, deeply lodged fragments may be managed conservatively; however, retained metallic bodies can serve as foci for infection, fibrosis, or migration. Therefore, surgical removal is justified when feasible and safe, as it eliminates potential sources of chronic complications.

Postoperative management focused on controlling airway edema, preventing infection, and monitoring for any signs of airway obstruction. Early use of steroids and humidified nebulization played a vital role in reducing inflammation and facilitating extubation. The patient's smooth recovery and absence of postoperative complications highlight the effectiveness of this combined medical and surgical approach.

Overall, this case reinforces several important principles: early recognition of airway compromise, meticulous planning of airway management, and coordination among anesthesiologists, otolaryngologists, and trauma surgeons are critical to achieving favorable outcomes. The successful management of this patient without tracheostomy demonstrates that with proper planning, modern airway techniques, and timely surgical intervention, even complex retropharyngeal firearm injuries can be managed safely and effectively.

Conclusion

Firearm injuries involving the retropharyngeal space are uncommon but carry a high risk of airway obstruction and infection. In this case, early airway control using awake fiberoptic intubation allowed safe surgical removal of bullet segments once edema subsided. The use of steroids and nebulization contributed to airway recovery, enabling extubation the following day through an airway exchange catheter without tracheostomy. This experience underscores the value of careful airway planning, imaging-guided decision-making, and multidisciplinary management to achieve favorable outcomes in complex cervical firearm injuries.

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