

Penetrating Right Main Bronchus Injury From an Impaled Knife: A Case Report of Successful Surgical Management in a Resource-Limited Setting

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Abstract

Penetrating tracheobronchial injuries (TBIs) are highly lethal emergencies that pose a critical challenge in low-resource settings due to the lack of advanced imaging. We report the case of a male patient with a knife impaled in the right posterior thorax who presented with dyspnea, hemoptysis, and subcutaneous emphysema. Due to the clinical suspicion of an airway injury and the inability to perform a computed tomography (CT) scan, the patient was immediately transferred to the operating room guided by basic radiographs; via a right thoracotomy, the sharp object was safely extracted, and primary repair of a right main bronchus transection was successfully achieved. This case demonstrates that a high index of clinical suspicion and prompt surgical exploration bypass the need for complex preoperative studies, ensuring lung preservation and an excellent postoperative outcome.

Categories: General Surgery, Trauma, Cardiac/Thoracic/Vascular Surgery

Keywords: impaled knife wound, low-resource setting, open surgery, penetrating injury, penetrating thoracic trauma, right main bronchus, tracheobronchial injury

Introduction

Tracheobronchial injuries (TBIs) are rare but potentially catastrophic events, accounting for only 0.5% to 2% of all trauma cases [1]. Despite their low incidence, they are associated with a significant mortality rate. It is estimated that up to 80% of patients with airway injuries die at the scene or prior to reaching the hospital due to tension pneumothorax or asphyxiation [1].

While blunt trauma is a frequent cause of TBI, penetrating injuries (such as those from stab wounds or gunshots) are highly prevalent in low and middle-income countries and are often immediately lethal [2]. The clinical presentation of TBI is notoriously non-specific, frequently manifesting as dyspnea, hemoptysis, hoarseness, and subcutaneous emphysema [3].

The gold standard for diagnosing TBI is fiberoptic bronchoscopy, often complemented by computed tomography (CT) angiography with three-dimensional reconstructions to assess the exact topography of the lesion [3]. However, in resource-limited settings, access to advanced imaging, hybrid operating rooms, or extracorporeal membrane oxygenation (ECMO) is frequently constrained or absent. Consequently, clinicians must rely heavily on clinical suspicion and basic radiography to guide immediate life-saving surgical interventions [4]. This case report discusses the successful surgical management of a penetrating right main bronchus injury caused by an impaled knife in a low-resource hospital setting, emphasizing the importance of clinical diagnosis and prompt operative repair.

Case Presentation

A 35-year-old male patient presented to the emergency department with a 30-minute history of a penetrating trauma caused by an impaled knife in the right posterior thorax, sustained during a physical altercation. The patient complained of respiratory distress, hemoptysis, and dysphonia. Upon physical examination, his vital signs were as follows: blood pressure, 130/70 mmHg; heart rate, 104 beats per minute (reference range: 60-100 beats per minute); respiratory rate, 28 breaths per minute (reference range: 12-20 breaths per minute); oxygen saturation, 93% (reference value: 95-100% at sea level). Clinical examination revealed extensive subcutaneous emphysema in the cervical region, and the sharp object (knife) remained impaled in the described anatomical area (Figure 1).

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FIGURE 1: Knife impaled in the right posterior thorax

Due to the unavailability of a CT scanner at the facility, anteroposterior and lateral cervical and chest X-rays were obtained (Figures 2-5).

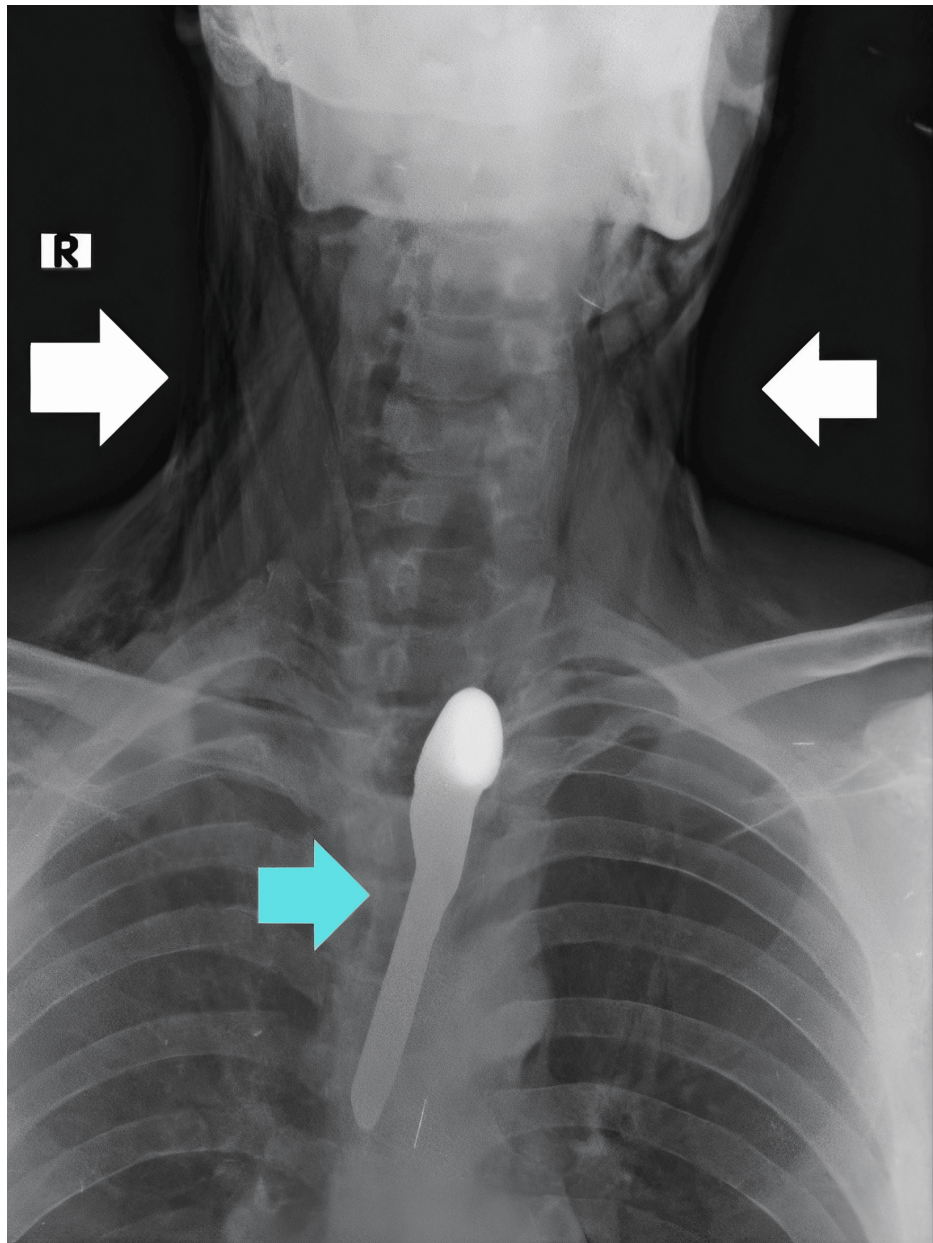


FIGURE 2: Anteroposterior cervical radiograph

Demonstrates subcutaneous emphysema in the cervical region (white arrows) and the impaled knife in the thorax (blue arrow).

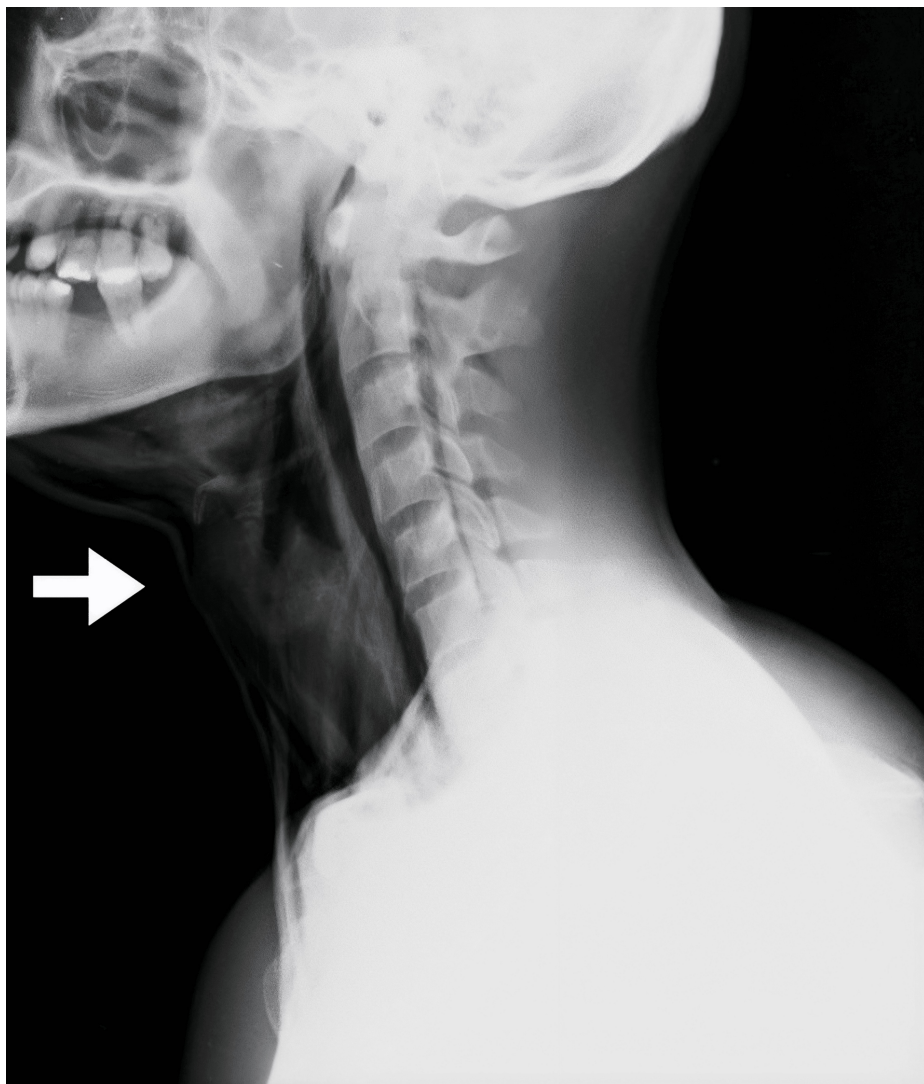


FIGURE 3: Lateral cervical radiograph

Demonstrates subcutaneous emphysema in the cervical region (white arrow).

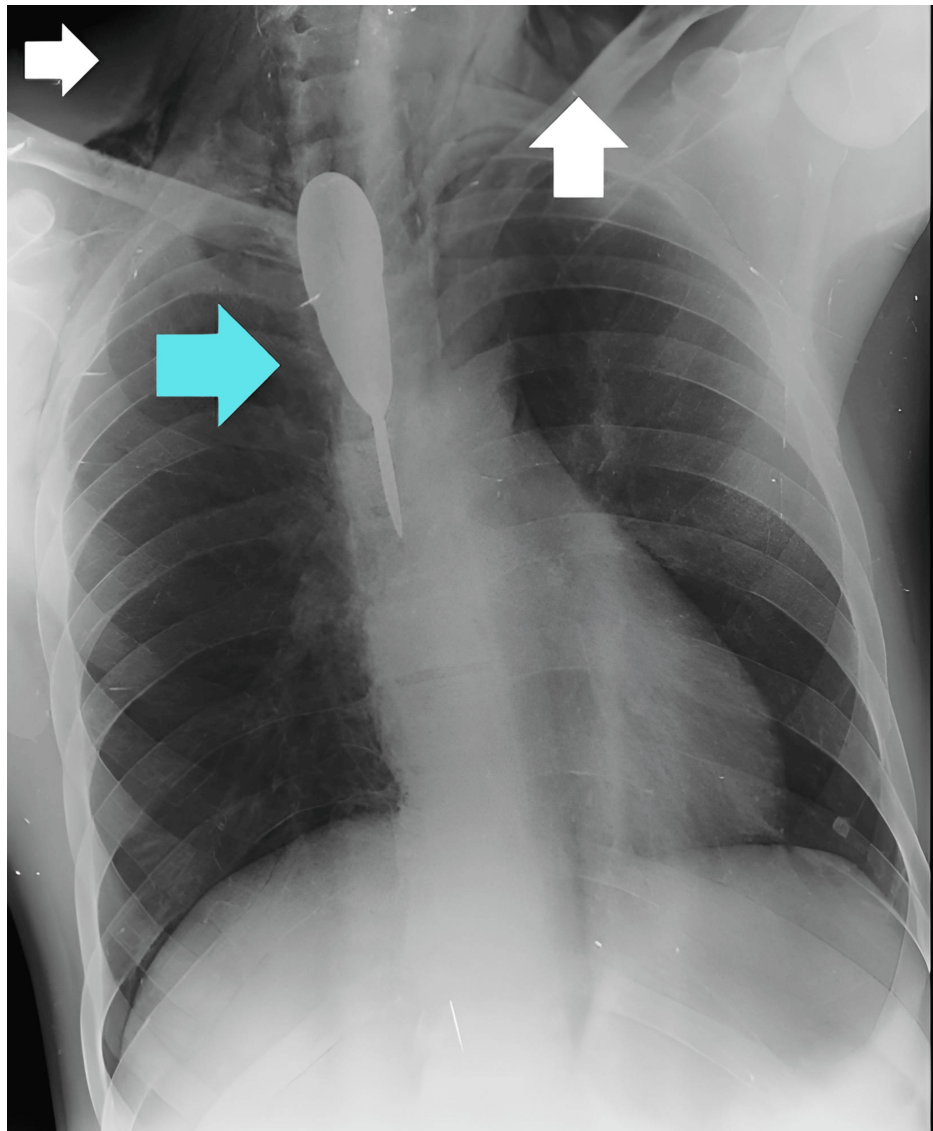


FIGURE 4: Posteroanterior chest radiograph

Demonstrates subcutaneous emphysema (white arrows) and the impaled knife in the thorax.

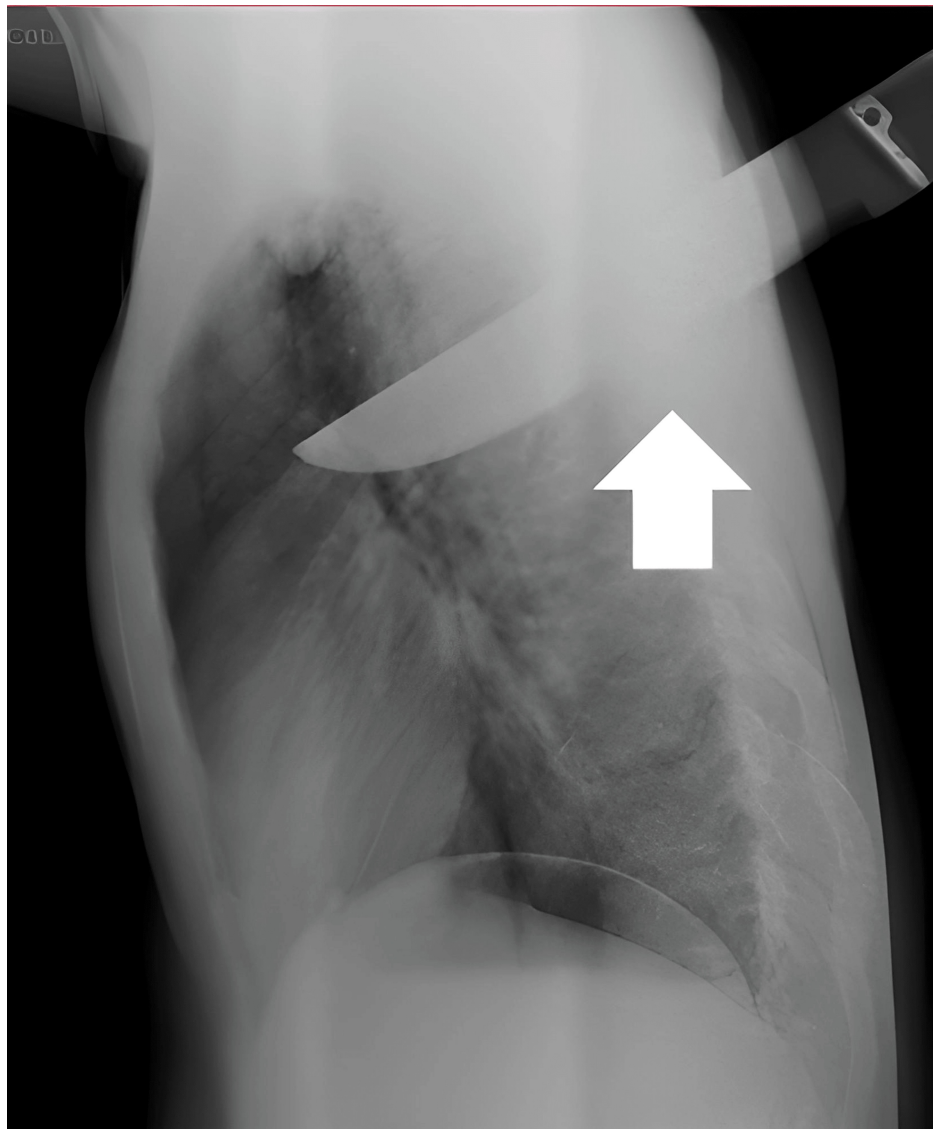


FIGURE 5: Lateral chest radiograph

Demonstrating the impaled knife in the thorax (white arrow).

These radiographs confirmed cervical subcutaneous emphysema and demonstrated the sharp foreign body with an apparent trajectory toward the mediastinum. Based on the clinical presentation, which included both hard and soft signs of airway injury, and due to the impossibility of performing a preoperative bronchoscopy, the patient was immediately transferred to the operating room.

A right anterolateral thoracotomy was performed, revealing a hemothorax of approximately 100 mL. Removal of the knife was performed under direct vision. To evaluate the suspected airway injury, a water-seal leak test was conducted by instilling sterile saline solution into the thoracic cavity while the anesthesiologist delivered manual positive-pressure ventilation. Upon ventilation, distinct bubbling was observed in the region of the main bronchus (Figure 6).

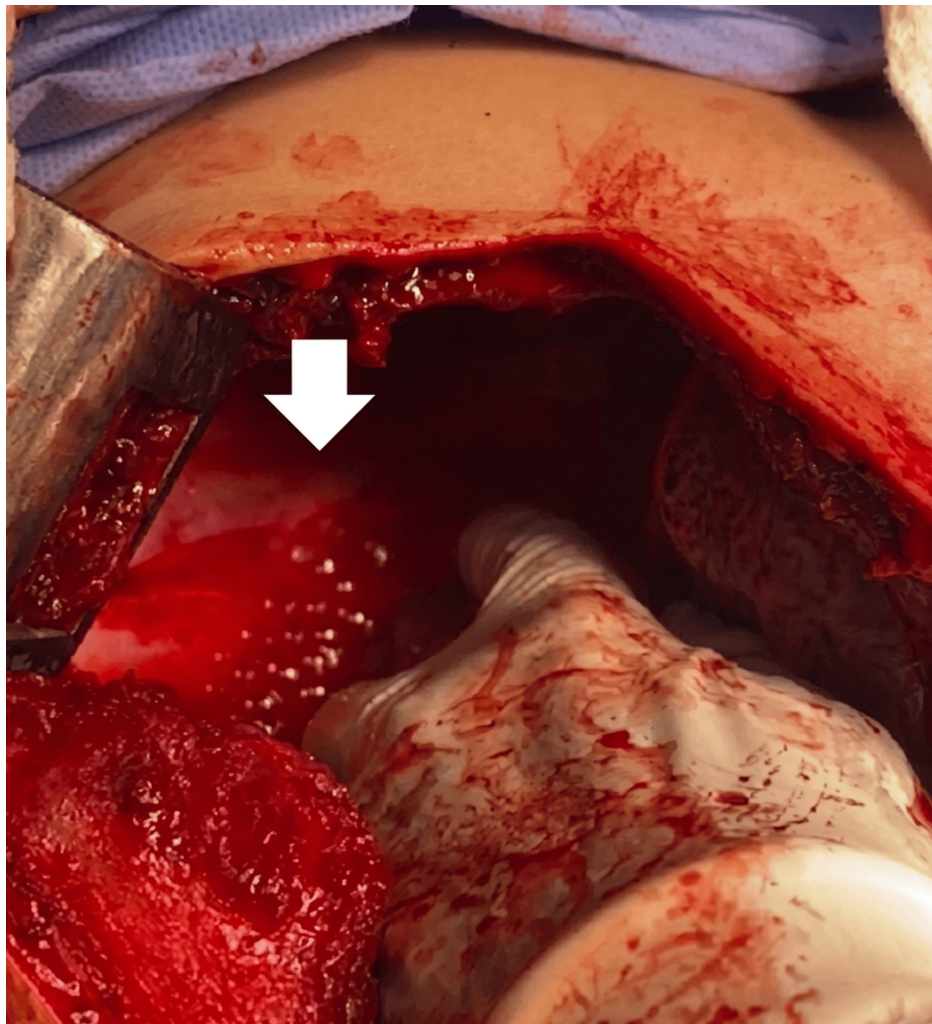


FIGURE 6: Positive air leak test performed in the right pleural cavity

Shows air bubbling through the sterile saline solution (white arrow).

Subsequent surgical dissection of the hilum revealed a complete transection of the right main bronchus (Figure 7).

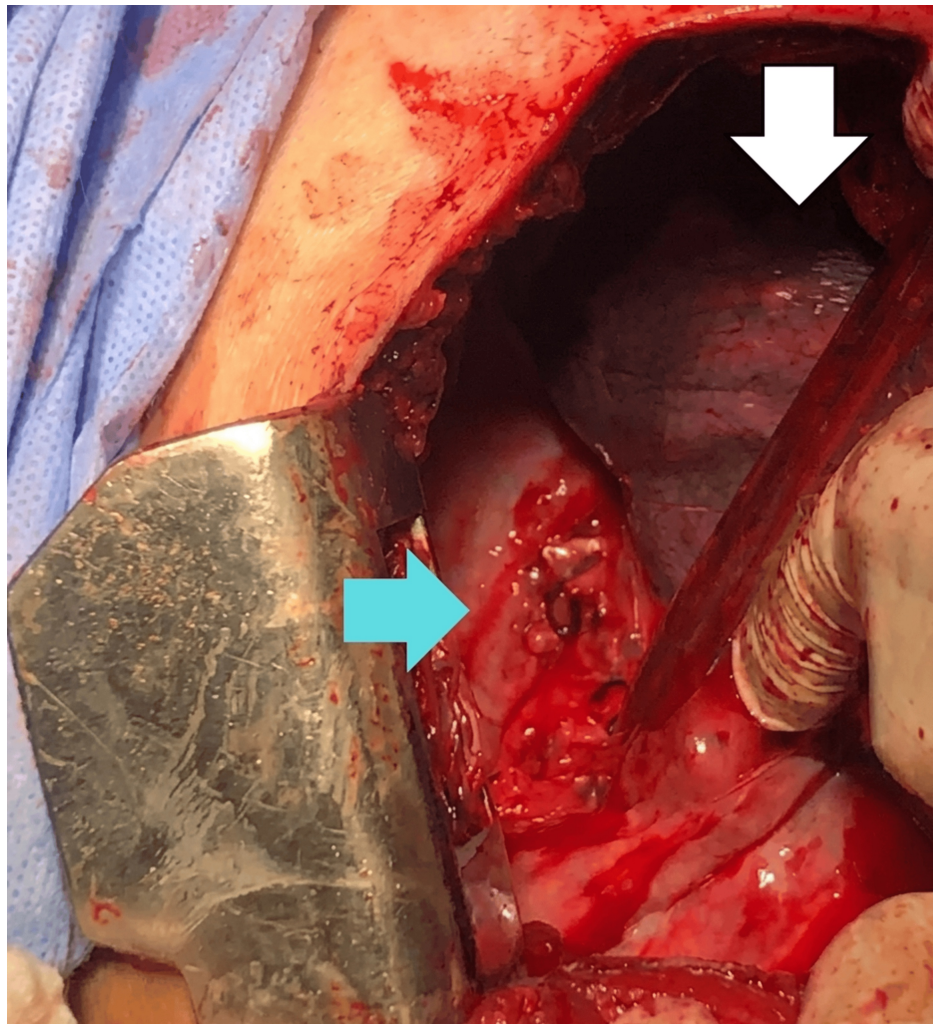


FIGURE 7: Adjacent pulmonary parenchyma (white arrow) and right main bronchus injury (blue arrow)

Primary repair (bronchorrhaphy) of the right main bronchus was successfully executed using Prolene sutures. A repeat leak test was performed and yielded negative results. Two chest tubes were placed in the thoracic cavity, and the thoracotomy closure was performed in layers.

The patient was transferred to the intensive care unit (ICU), where he remained for three days with a favorable clinical course. He was then transferred to the general inpatient ward for two additional days, after which he was safely discharged from the hospital.

Outpatient follow-up evaluations conducted at five, 15, and 30 days post-discharge demonstrated excellent clinical recovery and an completely uneventful evolution.

Discussion

Penetrating injuries to the tracheobronchial tree demand an exceptionally high index of clinical suspicion. The classic triad of a history of chest trauma, dyspnea, and soft tissue or mediastinal emphysema should immediately alert the clinician to the possibility of a major airway injury [4]. Furthermore, dysphonia and hemoptysis, as seen in this patient, are strong clinical indicators of tracheobronchial involvement [3].

In modern trauma centers, CT scans and early bronchoscopy dictate the therapeutic algorithm [4]. However, in low-resource settings, or in cases involving retained metallic objects that preclude CT imaging, clinicians must depend on basic chest radiography. Findings such as the "fallen lung" sign, persistent pneumothorax despite tube thoracostomy, and massive subcutaneous emphysema are critical radiographic clues [5]. In this case, the inability to perform advanced imaging did not deter the necessary immediate surgical intervention, demonstrating that clinical judgment remains paramount.

Surgical management is the definitive treatment for severe penetrating TBIs [6]. A right thoracotomy is the standard and most effective surgical approach for injuries located in the lower third of the trachea, the carina, and the right mainstem bronchus [7]. The principles of airway repair in the trauma setting include frugal debridement of devitalized tissue to prevent strictures, preservation of healthy mucosa, and direct end-to-end anastomosis or primary closure utilizing absorbable sutures [6]. In this patient, primary repair without the need for anatomical lung resection prevented unnecessary parenchymal loss, which is a primary goal in TBI surgery.

Postoperative care must include surveillance for potential complications such as anastomotic dehiscence, stricture formation, or impaired bronchial clearance due to localized denervation [4]. The use of intraoperative or early postoperative fiberoptic bronchoscopy is a critical quality-control step to confirm the integrity of the repair before the patient leaves the operating theater [8–11].

Conclusions

Penetrating right main bronchus injuries are rare, high-acuity emergencies that carry a significant risk of mortality. In resource-limited hospitals, the unavailability of advanced imaging modalities should not impede the delivery of life-saving care. The prompt recognition of clinical signs, specifically respiratory distress, hemoptysis, and subcutaneous emphysema, combined with immediate surgical exploration via a right thoracotomy, allows for safe extraction of impaled objects and effective primary repair of the airway. Adherence to fundamental surgical principles ensures lung preservation and excellent postoperative outcomes.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Andrés David De León Murillo, Luis Eduardo Garcia Peñaloza

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Supervision: Andrés David De León Murillo, Luis Eduardo Garcia Peñaloza

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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