CASE REPORT

DOI: 10.5336/caserep.2025-110816

Intrathoracic Complications and Difficult Treatment Journey Resulting from Gunshot Wound 40 Years Ago

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ABSTRACT A patient who underwent parenchymal repair with a thoracotomy due to a close-range shotgun wound to the left anterior chest wall 40 years ago was recommended for surgery due to suspicious lesions showing a mass and abscess-like formation in the lung when he presented with a cough complaint. During the surgery, sponge material from the previous procedure was identified, and primary parenchymal repair was performed. Later, resistant empyema and bronchopleural fistula were observed. Therefore, a destroyed lung developed, and a left pneumonectomy was required. In this article, we aimed to describe our case in which a small perioperative carelessness led to vital organ loss and a long and difficult treatment process, and the successful treatment process.

Keywords: Bronchopleural fistula; destroyed lung; empyema; retained foreign body; gossypiboma

Thoracic traumas account for 10-15% of all traumatic injuries, with approximately 30% of these being penetrating in nature. Penetrating thoracic injuries can lead to significant morbidity and mortality due to both acute and delayed complications. These injuries may result in cardiopulmonary damage and often require surgical intervention. They can also lead to pleural and parenchymal alterations, including complications such as parenchymal destruction, empyema, and bronchopleural fistula (BPF).

BPF is an abnormal communication between the lung parenchyma and the pleural space, typically result from surgery, trauma, infection, or radiotherapy.[1] Although post-traumatic BPF is relatively rare, delayed complications arising from remote injuries have been reported.[2] A retained surgical sponge, known as gossypiboma, may also lead to late-onset BPF due to a foreign body reaction and its mass-like appearance.[3] Retained foreign bodies may cause direct parenchymal injury and contribute indirectly to empyema and fistula formation through infection and biofilm development. Additionally, ballistic foreign bodies such as shotgun pellets can act as chronic foci of intrathoracic infection when retained.

This report presents a unique case of delayed-onset BPF, chronic empyema, and destroyed lung resulting from a retained surgical sponge and shotgun wadding material following penetrating thoracic trauma that occurred 40 years prior. The case highlights diagnostic challenges, surgical decision-making, and the role of adjunctive therapies such as intrapleural irrigation in managing persistent post-pneumonectomy infections.

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Peer review under responsibility of Turkiye Klinikleri Journal of Case Reports.

Received: 25 Apr 2025 ***Accepted:*** 17 Aug 2025 ***Available online:*** 23 Sep 2025

CASE REPORT

A 63-year-old male with a history of hypertension and diabetes mellitus presented to a healthcare facility abroad in August 2024 with a persistent cough. Forty years earlier, he had sustained a close-range shotgun injury to the left anterior chest wall and had undergone a left thoracotomy with pulmonary parenchymal repair. Thoracic computed tomography (CT) revealed suspicious lesions, and a left re-thoracotomy was performed in September 2024 due to concerns for malignancy or abscess (Figure 1). Notably, neither positron emission tomography-CT nor fiberoptic bronchoscopy had been performed preoperatively.

Intraoperatively, a retained surgical sponge was identified within the lingular segment, and shotgun wadding material was found in the lower lobe. Both foreign bodies were removed, and primary parenchymal repair was performed (Figure 2). The patient was transferred to the ward with apical and basal thoracic drains in place. A postoperative chest X-ray demonstrated left lung re-expansion and a normally positioned left hemidiaphragm.

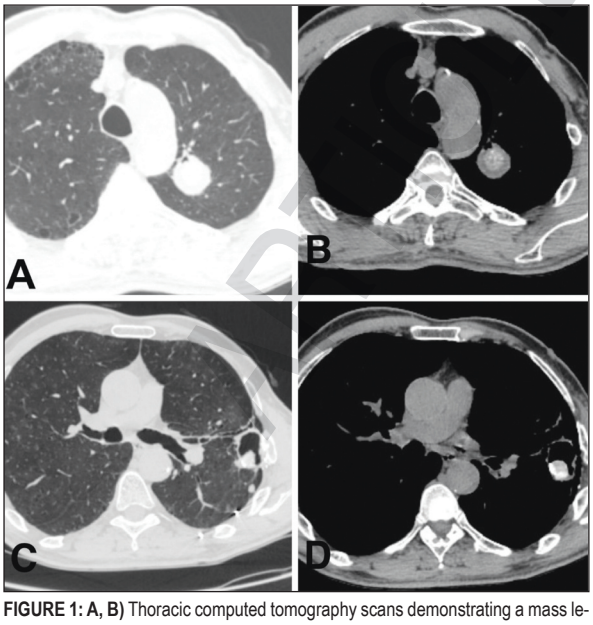

FIGURE 1: A, B) Thoracic computed tomography scans demonstrating a mass lesion in the apicoposterior segment of the left upper lobe, shown in both parenchymal and mediastinal windows; **C, D)** Thoracic computed tomography scans revealing a cavitary lesion in the lingular segment of the left upper lobe, visualized through parenchymal and mediastinal windows

FIGURE 2: Intraoperatively discovered retained sponge material excised during reoperation

However, during follow-up, the patient developed a massive air leak, elevation of the left hemidiaphragm, and complete collapse of the left lung. Pleural fluid cultures grew *Pseudomonas aeruginosa*. On postoperative day 10, due to the persistent air leak, the original drains were replaced with two 32F Pezzer catheters: one placed in the second intercostal space at the midclavicular line and the other through the former basal drain site. As his clinical condition deteriorated, the patient and his family elected to transfer care to our institution.

Upon admission, the patient was in moderate-to-poor condition, requiring oxygen supplementation and intensive care unit monitoring. His room air oxygen saturation was 80%. CT imaging revealed total collapse of the left lung, multiple consolidation areas in the right lung, intraperitoneal misplacement of the basal Pezzer drain, and scattered shotgun pellets within the left thoracic cavity and lung parenchyma. Persistent *P. aeruginosa* growth prompted initiation of targeted broad-spectrum antibiotic therapy. Flexible bronchoscopy identified multiple BPFs in the lingular, apicoposterior, and basal segments of the left lung. Due to the size and number of fistulas, bronchoscopic closure was not feasible.

Following nutritional support and continued antibiotic therapy, including total parenteral nutrition due to oral intolerance, the intraperitoneal drain was repositioned into the thoracic cavity with a 15F catheter. Twice-daily pleural irrigation with 500 mL of normal saline mixed with 5 mL of 0.1% sodium

hypochlorite (Dakin's solution) was initiated. After 15 days, inflammatory markers improved significantly, and the patient became clinically stable and suitable for surgery.

Given the extensive adhesions from prior surgeries and chronic infection, thoracotomy was chosen over video-assisted thoracoscopic surgery. During reoperation, the left lung was partially mobilized; however, due to diffuse necrosis and fibrosis, the lung remained non-expansile despite bilateral ventilation. Therefore, an intrapericardial left pneumonectomy was performed. A new 36F basal drain was placed, and the apical drain was removed. Pathological examination of the resected specimen revealed three distinct BPFs, each up to 3 cm in diameter (Figure 3). Postoperatively, the patient's oxygen saturation improved to 97% on room air. Serial chest radiographs of the patient are presented in Figure 4.

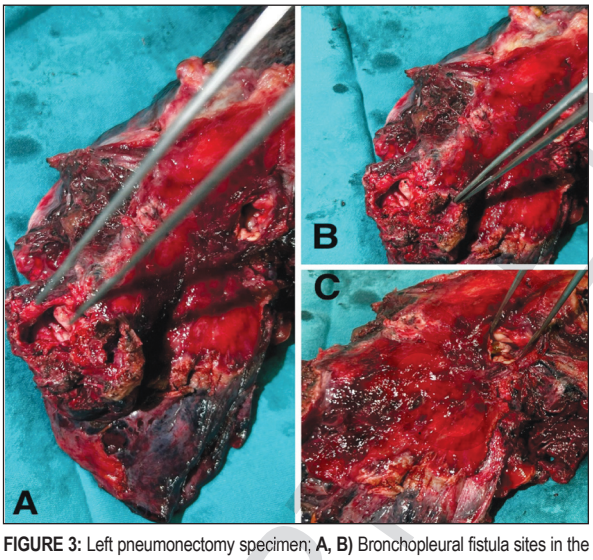

FIGURE 3: Left pneumonectomy specimen; **A, B)** Bronchopleural fistula sites in the lingular segment of the left upper lobe (indicated by the tip of the forceps); **C)** Bronchopleural fistula site in the left lower lobe (indicated by the tip of the forceps)

Pleural irrigation was continued, and serial cultures, summarized in Table 1, were used to guide therapy. On postoperative days 33-34, thoracostomy was terminated following 2 consecutive sterile cultures, resolution of purulent drainage, and normalization of inflammatory markers (C-reactive protein ≤10 mg/L, procalcitonin ≤0.5 ng/mL, white blood count=9,000/μL).

Ten days after drain removal, pleural cultures again grew *P. aeruginosa*, though in lower colony counts. Given the patient's stable condition, normal inflammatory markers, and absence of clinical signs of infection, this was considered chronic colonization rather than active infection. No further surgical intervention was required.

At one-month follow-up, the patient's inflammatory markers remained normal, there was no evidence of fistula on bronchoscopy, and no wound drainage was observed. By the 3rd month, he had returned to his baseline functional status and resumed daily activities.

Written informed consent was obtained from the patient.

DISCUSSION

The coexistence of BPF and empyema presents a challenging clinical scenario, significantly increasing the complexity of lung resection and carrying a high risk of morbidity and mortality. Successful management in such cases requires a comprehensive approach, including infection control, fistula closure, and rehabilitation of the pleural space. In our case,

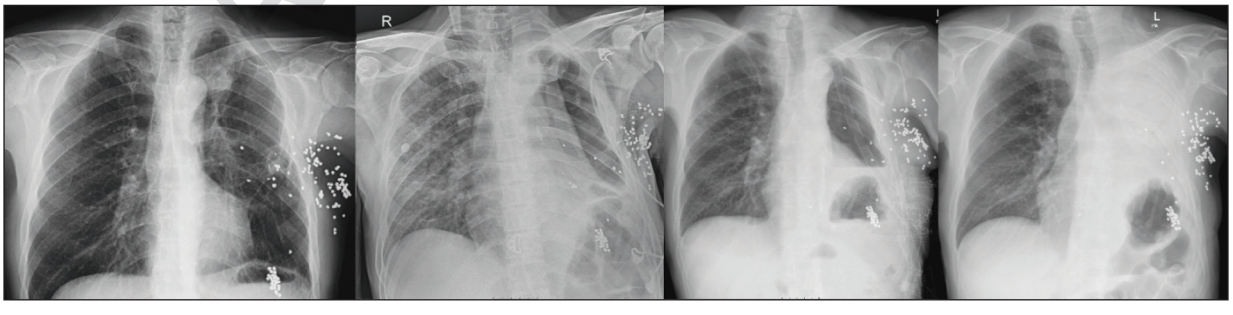

FIGURE 4: The patient's serial chest radiographs (from left to right) include: the preoperative radiograph before initial surgery; the image obtained before pneumonectomy demonstrating pneumonia in the right lung; the immediate postoperative image after pneumonectomy; and the radiograph taken at the 3-month follow-up visit

TABLE 1

Postoperative day	Culture result	Antibiogram	Intrapleural treatment	Duration
Day 1	No growth	-	-	-
Days 2-3	*P. aeruginosa*	Sensitive to ciprofloxacin and ceftazidime	400 mg ciprofloxacin+5 cc 0.1% NaClO (Dakin's solution) in 500 cc saline	13 days, once daily
Day 15	*P. aeruginosa*	Resistant to ciprofloxacin, sensitive to high-dose ceftazidime	2,000 mg ceftazidime+20 cc chlorhexidine+5 cc 0.1% NaClO in 250 cc saline	10 days, once daily
Day 25	*P. aeruginosa* *K. pneumoniae*	*P. aeruginosa*: resistant *K. pneumoniae*: sensitive to trimethoprim/sulfamethoxazole	1,200 mg sulfamethoxazole+240 mg trimethoprim+500 mg rifamycin+ 10 cc chlorhexidine in 100 cc saline	7 days, once daily
Days 33-34	No growth	-	None	-
Day 44	*P. aeruginosa*	Resistant	None	-

the presence of concurrent empyema and contralateral pneumonia necessitated postponement of surgery until after 2 weeks of intensive medical optimization.

Although gossypibomas are more commonly encountered following abdominal surgery, they may also occur in the thoracic cavity, where they represent a rare but serious cause of delayed complications.[4] Intrathoracic gossypibomas are usually symptomatic, but asymptomatic cases discovered decades later have also been reported.[5,6] These foreign bodies can mimic a wide range of conditions, including hematomas, bronchiectasis, malignancies, aspergillomas, hydatid cysts, and empyema.[7-13] In our patient, both a retained surgical sponge and shotgun wadding material were identified 40 years after thoracotomy for gunshot trauma, ultimately contributing to the development of BPF, chronic empyema, and parenchymal destruction.

The classic triad of BPF -lung collapse, empyema, and pneumothorax- was evident in our case.[14] A persistently elevated diaphragm and progressive left lung collapse were likely exacerbated by an unrecognized misplaced basal thoracostomy, which had been inadvertently inserted into the abdominal cavity. The subsequent ineffective pleural drainage and ongoing air leak facilitated the transition to chronic empyema and destroyed lung.

BPFs are often accompanied by infection, frequently involving multidrug-resistant organisms such as *P. aeruginosa*, which pose a substantial therapeutic challenge.[15] Particularly in post-pneumonectomy empyema, the absence of lung parenchyma makes it difficult for systemic antibiotics to achieve effective concentrations in the pleural space. This necessitates the use of adjunctive treatments such as intrapleural irrigation with antibiotic-containing solutions. In our case, persistent *P. aeruginosa* growth was attributed to retained shotgun pellets and biofilm formation on the pleural surfaces. The patient was treated with intrapleural irrigation using antiseptic agents including povidone-iodine (10%), Dakin's solution, and chlorhexidine. Following treatment, the patient's acute-phase reactants normalized and his clinical condition improved.

Dakin's solution, consisting of 0.1% sodium hypochlorite (NaOCl) in sterile water, is an antiseptic and disinfectant commonly used for infected wounds, abscess drainage, and irrigation of infected intrapleural spaces.[16,17] At high concentrations, it is cytotoxic and can cause mucosal and ocular irritation. However, due to limited efficacy and the lack of a clearly established standard irrigation protocol, we incorporated various antibiotics, antiseptics, and disinfectants into the irrigation solution. Chlorhexidine, which exerts its antimicrobial activity by binding to microbial cell membranes and has broad-spectrum efficacy against gram-positive and gram-negative bacteria, fungi, and some viruses, was added for its bactericidal effects.[18] While its routine uses include preoperative skin disinfection and wound care, there are limited reports of its applica-

tion in pleural cavity irrigation.[19,20] The currently recommended volume for surgical hand scrubbing is 3 mL for 60 seconds; in our case, 20 mL was used based on pleural surface area. Additionally, rifamycin, which is effective against gram-positive organisms and certain gram-negative pathogens, was added to the irrigation solution as an antibiotic.

Gustafson et al. reported observing green-colored biofilm within the pleural cavity of a patient with BPF and empyema secondary to tuberculosis. They successfully treated the infection with a 21-day course of pleural irrigation using dornase alfa and amikacin, leading to patient discharge.[21]

In our patient, repeat pleural fluid culture revealed low-colony *P. aeruginosa* growth. However, given the patient's favorable clinical status, low inflammatory markers, and absence of systemic signs of infection, this was considered chronic colonization. The presence of foreign material promotes biofilm formation, which in turn fosters antibiotic resistance. Literature reports indicate that this process can occur in the presence of retained sponges, metallic objects, or chest drains.[22] In our case, both the retained foreign materials and shotgun pellets contributed to the development of biofilm.

In conclusion, chronic empyema and abscess formation secondary to retained foreign bodies, including gossypibomas and ballistic materials, require a high index of suspicion, even decades after the initial injury. When conventional medical and bronchoscopic therapies fail, pleural irrigation with antiseptic and antibiotic agents should be considered as a component of multimodal infection control. In cases of destroyed lung and multiple BPFs, surgical resection -despite its inherent risks- may be necessary to achieve definitive resolution.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Emrah Karcı, Fatma Mutlu;* ***Design:*** *Emrah Karcı, Fatma Mutlu;* ***Control/Supervision:*** *Volkan Karaçam, Aydın Şanlı;* ***Data Collection and/or Processing:*** *Emrah Karcı, Fatma Mutlu;* ***Analysis and/or Interpretation:*** *Emrah Karcı, Fatma Mutlu;* ***Literature Review:*** *Emrah Karcı, Fatma Mutlu, Volkan Karaçam, Aydın Şanlı;* ***Writing the Article:*** *Emrah Karcı, Fatma Mutlu, Volkan Karaçam, Aydın Şanlı;* ***Critical Review:*** *Emrah Karcı, Fatma Mutlu, Volkan Karaçam, Aydın Şanlı;* ***References and Fundings:*** *Emrah Karcı, Fatma Mutlu, Volkan Karaçam, Aydın Şanlı;* ***Materials:*** *Emrah Karcı, Fatma Mutlu, Volkan Karaçam, Aydın Şanlı.*

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