Case Report

A tale of two effusions diagnosing and managing pleural and pericardial empyema

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ABSTRACT

A male in his early 50s with no comorbidities presented with a weeklong history of left-sided chest pain, breathlessness, and cough with yellow–green expectoration. Over 4 months, he reported a 5 kg weight loss and decreased appetite. Investigations revealed mild anemia, electrolyte imbalances, elevated erythrocyte sedimentation rate, and alkaline phosphatase. An electrocardiogram showed low-voltage complexes, and an echocardiogram detected pericardial effusion. A chest X-ray showed bilateral pleural effusion. Ultrasound-guided thoracentesis indicated pleural and pericardial empyema. Sputum tests identified *Proteus mirabilis* and pericardial fluid grew *Escherichia coli*. After the therapeutic intervention, the patient initially improved but later worsened, requiring mechanical ventilation, and inotrope support. On the 5th day of admission, he suffered a cardiac arrest and expired despite resuscitative efforts.

Key words: Cardiology, Empyema, Infectious diseases, Interventional cardiology, Pericardial disease, Respiratory medicine

Empyema, the accumulation of pus within the pleural or pericardial space, is a severe clinical condition often resulting from bacterial infections [1]. While pleural empyema is relatively more common and has been extensively documented, its concurrent presentation with pericardial empyema is rare and poses significant diagnostic and therapeutic challenges [2]. The etiological agents, clinical manifestations, and management strategies for both conditions can vary, making it imperative for clinicians to adopt a comprehensive and multidisciplinary approach. This case offers a unique opportunity to delve into the complexities of managing a patient with both pleural and pericardial empyema. Furthermore, it underscores the importance of early detection, prompt intervention, and the potential complications that can arise, even in patients without prior comorbidities. Through this case, we aim to enhance the understanding of dual empyema presentation and contribute to the existing literature on its management and outcomes.

CASE REPORT

A male patient in his early 50's, alcoholic, who was nil comorbid presented with complaints of left-sided chest pain radiating to the shoulder and jaw along with breathlessness, and cough with expectoration for 1 month. He also gives a history of significant weight loss and loss of appetite. Chest pain was insidious in onset and gradual in progression, each episode of the chest pain lasting for 5–10 min, radiating to the shoulder and jaw with no aggravating and relieving factors. The cough was insidious in onset, occurred in bouts and was associated with mucopurulent expectoration which was yellow to greenish in color, non-blood stained, foul smelling, and copious in amount. Breathlessness was also insidious in onset, started as breathlessness on exertion (Modified Medical Research Council [MMRC] grade 0) and gradually progressed to breathlessness on minimal activity (MMRC grade 3). He reports a loss of 5 kg weight over the past 4 months along with decreased appetite for the same duration.

On general examination, he was conscious, moderately built, and nourished with a body mass index of 24.6. He had pallor but no icterus, cyanosis, edema, clubbing, and lymphadenopathy. Vitals showed a pulse rate of 128/min, respiratory rate of 26/min, blood pressure of 90/60 mmHg, and pulse oximeter saturation of 98% on room air. Routine investigations revealed mild anemia (Hb 9 g/dL), elevated total counts with a neutrophilic predominance (total counts 16,200 cells/cu.mm, neutrophils 95.4%), hyponatremia (sodium 129 mmol/L), elevated erythrocyte sedimentation rate (90 mm/h), and elevated alkaline phosphatase (551 IU/L).

A 12-lead electrocardiogram was taken which showed low-voltage complexes (Fig. 1). Echocardiogram (ECHO) on admission

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showed moderate-to-large pericardial effusion, normal LV systolic function, and mild PAH. Initial chest X-ray showed features of bilateral pleural effusion, left more than right with characteristic "money bag" appearance of heart depicting pericardial effusion (Fig. 2a)

Ultrasound-guided diagnostic thoracentesis was performed which showed features suggestive of exudative pleural effusion with normal adenosine deaminase. Pleural fluid cytology revealed features suggestive of empyema. The pleural fluid culture showed no growth. A sputum sample was sent for acid-fast bacilli (AFB), Gram stain, and culture and sensitivity, of which AFB and Gram stain turned out to be negative. Sputum culture and sensitivity showed growth of *Proteus mirabilis* (Fig. 3a). After obtaining a cardiology opinion, under aseptic precautions, both diagnostic and therapeutic pericardiocentesis were performed and fluid was sent for analysis. Pericardial fluid cytology also showed features of empyema. Pericardial fluid was exudative with extremely high lactate dehydrogenase (70033 U/L). Pericardial fluid AFB was negative. Pericardial fluid culture and sensitivity showed growth of *Escherichia coli*. (Fig. 3b)

The patient was started on sensitive antibiotics and other supportive management. Cardiology reviewed the patient and performed therapeutic pericardiocentesis using a pericardial pigtail following which 380 mL of greenish purulent fluid was removed (Fig. 4). Another 100 mL was aspirated on the following day. The patient improved symptomatically and radiologically (Fig. 2b).

Over the following days of his hospital stay, the patient developed renal dysfunction and a nephrology opinion was taken for the same and advised conservative management. The patient's condition gradually deteriorated, warranting mechanical ventilation and inotrope support. On the 5th day of admission, the patient developed sudden cardiac arrest and could not be revived despite best resuscitative efforts as per advanced cardiac life support protocol and declared expired.

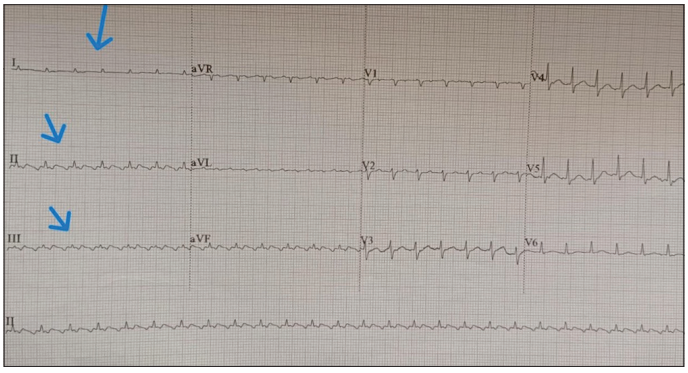


Figure 1: Electrocardiogram taken at admission which shows low-voltage complexes, suggestive of pericardial effusion. (Low voltage is indicated by a QRS voltage of <5 mm in the limb leads and <10 mm in the chest leads) (blue arrows)

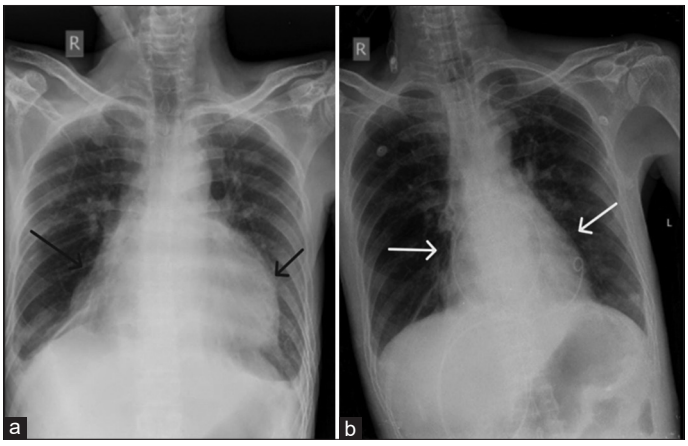


Figure 2: (a) Initial chest X-ray (CXR) showing blunting of bilateral costophrenic angles (left > right), suggestive of pleural effusion and "money bag" appearance of the heart suggesting pericardial effusion (black arrows). Repeat CXR post-pigtail showing resolution of the pericardial effusion (white arrows)

DISCUSSION

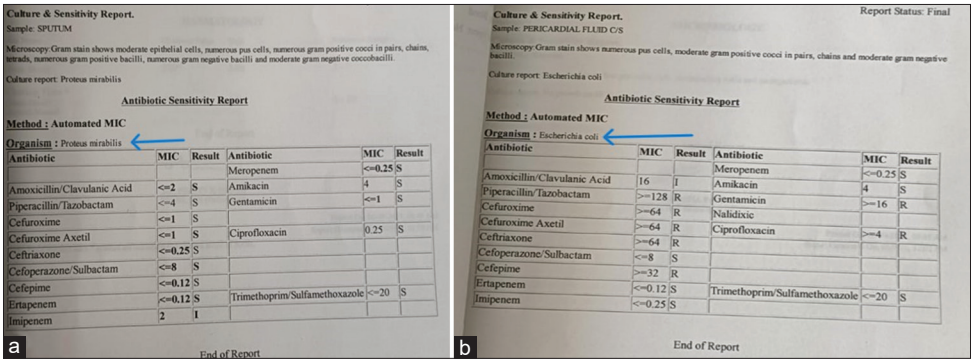
Empyema, in a clinical context, refers to the accumulation of purulent material within a body cavity. In the thoracic domain, this can manifest within the pleural or pericardial spaces, often secondary to bacterial infections [1].

Pleural empyema is characterized by the presence of pus in the pleural space, typically as a sequela of pneumonia. However, hematogenous spread from an extrapulmonary focus can also be a causative factor [3]. A notable case involved a patient undergoing continuous ambulatory peritoneal dialysis who developed pleural empyema. This was further complicated by concomitant pericardial empyema, culminating in cardiac tamponade [3]. The etiological agent identified from the pleural fluid culture was methicillin-sensitive *Staphylococcus aureus*, underscoring the imperative of microbiological identification for targeted antimicrobial therapy.

Pericardial empyema denotes the presence of purulent material within the pericardial sac. This condition can precipitate cardiac tamponade, a critical clinical scenario where cardiac function is compromised due to the external compression exerted by the accumulated fluid. A particularly intriguing case involved a male patient in his early 80s diagnosed with primary pericardial mesothelioma, which was obscured by concurrent pleural empyema [4]. The diagnostic conundrum was exacerbated by the manifestation of heart failure, pericardial effusion, and pericarditis. Conventional imaging modalities, including echocardiography and computed tomography (CT), were suboptimal in delineating the pathology, necessitating surgical exploration for definitive diagnosis [4].

E. coli is a Gram-negative bacterium predominantly found in the gastrointestinal tract. Its presence in the pericardial fluid is indicative of purulent pericarditis, a severe condition that can lead to cardiac tamponade and hemodynamic instability. The source of *E. coli* in the pericardium can be multifactorial. Direct extension from an adjacent infection, such as pleural empyema, is a common route [5].

A study conducted by Wu *et al*. highlighted the increasing resistance of *E. coli* strains, emphasizing the challenges in clinical treatment. The study found that multidrug-resistant *E. coli* has become a significant clinical concern, necessitating



Culture & Sensitivity Report.
Sample: SPUTUM
Microscopy Gram stain shows moderate epithelial cells, numerous pus cells, numerous gram positive cocci in pairs, chains, tetrads, numerous gram positive bacilli, numerous gram negative bacilli and moderate gram negative coccobacilli.
Culture report: Proteus mirabilis
Antibiotic Sensitivity Report
Method : Automated MIC
Organism : Proteus mirabilis

Antibiotic	MIC	Result	Antibiotic	MIC	Result
			Meropenem	<=0.25	S
Amoxicillin/Clavulanic Acid	<=2	S	Amikacin	4	S
Piperacillin/Tazobactam	<=4	S	Gentamicin	<=1	S
Cefuroxime	<=1	S			
Cefuroxime Axetil	<=1	S	Ciprofloxacin	0.25	S
Ceftriaxone	<=0.25	S			
Cefoperazone/Sulbactam	<=8	S			
Cefepime	<=0.12	S			
Ertapenem	<=0.12	S	Trimethoprim/Sulfamethoxazole	<=20	S
Imipenem	2	I			

End of Report

a

Culture & Sensitivity Report. Report Status: Final
Sample: PERICARDIAL FLUID C/S
Microscopy Gram stain shows numerous pus cells, moderate gram positive cocci in pairs, chains and moderate gram negative bacilli.
Culture report: Escherichia coli
Antibiotic Sensitivity Report
Method : Automated MIC
Organism : Escherichia coli

Antibiotic	MIC	Result	Antibiotic	MIC	Result
			Meropenem	<=0.25	S
Amoxicillin/Clavulanic Acid	16	I	Amikacin	4	S
Piperacillin/Tazobactam	>=128	R	Gentamicin	>=16	R
Cefuroxime	>=64	R	Nalidixic		
Cefuroxime Axetil	>=64	R	Ciprofloxacin	>=4	R
Ceftriaxone	>=64	R			
Cefoperazone/Sulbactam	<=8	S			
Cefepime	>=32	R			
Ertapenem	<=0.12	S	Trimethoprim/Sulfamethoxazole	<=20	S
Imipenem	<=0.25	S			

End of Report

b

Figure 3: (a) Sputum report showing growth of *Proteus mirabilis* and its sensitivity pattern. (blue arrow); (b) Pericardial fluid report showing growth of *Escherichia coli* and its sensitivity pattern. (blue arrow)

Figure 4: Greenish yellow foul-smelling pericardial fluid which was aspirated after the initial insertion of the pericardial pigtail. (orange arrow)

vigilant monitoring of *E. coli* resistance, especially in vulnerable populations [6]. Another illustrative case emphasized the rare occurrence of pericarditis and pleural empyema secondary to the transdiaphragmatic extension of a pyogenic liver abscess [2]. The clinical trajectory was marked by rapid progression, underscoring the urgency of early diagnostic and therapeutic interventions. One case reported by Gala *et al*. talks about an elderly male with alcohol use disorder who presented with dysphagia, fever, fatigue, and back pain. He was diagnosed with septic shock, acute mediastinitis, and suspected pericardial empyema. An ECHO confirmed cardiac tamponade, leading to emergency pericardiocentesis which drained 750 mL of purulent fluid. A subsequent CT scan revealed a mediastinal abscess and a loculated pericardial effusion. Surgical intervention included right thoracotomy, pleural decortication, and pericardial window formation. Blood and pericardial fluid cultures identified multiple bacteria. An upper endoscopy detected esophageal squamous cell carcinoma. Post-6-week IV antibiotics, the patient was discharged with a yearlong oral antibiotic regimen and oncology follow-up [7]. This was very similar to our case where pericardial empyema had not occurred due to usual causes. Yang *et al*. documented a case involving a 54-year-old woman with diabetes who had been managing her condition with oral hypoglycemic agents for 2 years. She was admitted with symptoms of dyspnea and orthopnea. On admission, she was found to have a significant pericardial effusion and moderate bilateral pleural effusion. Diagnostic procedures, including pericardiocentesis and thoracocentesis, revealed the growth of *Salmonella typhimurium* in both cultures. Despite initiating antibiotic treatment, her pleural effusion persisted. Following multiple thoracentesis and drainage procedures, she was discharged after 51 days, having fully recovered. This case, highlighting the rare co-occurrence of pericarditis and empyema due to Salmonella infection, contributes to the limited reports of such cases in existing medical literature [8]. Furst *et al*. reported on a 19-year-old male who had severe malignant pleural and pericardial effusions, leading to tamponade physiology and indications of congestive heart failure. The patient underwent an emergency subxiphoid pericardial window procedure. However, the surgical pericardial drainage led to an unexpected cardiovascular collapse, unresponsive to pressors, and intravenous fluids. A median sternotomy, performed under the suspicion of pericardial perforation, showed the heart was intact. Normal arterial pressure was reestablished following the pleural effusion drainage. This case suggests prioritizing pleural effusion drainage in patients with concurrent tamponading pericardial and pleural effusions. The report also delves into the pathophysiology and associated literature of low cardiac output states caused by these effusions [9].

The coexistence of Proteus in sputum and *E. coli* in pericardial fluid necessitates a holistic approach to patient management. Empirical antibiotic therapy should be initiated promptly, targeting both organisms, followed by adjustments based on culture and sensitivity results. In addition, the underlying source of these infections should be identified and addressed.

CONCLUSION

This case report brings forward the rare occurrence of a “dual empyema” or the coexistence of a pleural and pericardial empyema in the same patient at the same point in time. Concurrent pleural and pericardial empyema, although rare, require heightened clinical awareness. Early detection and intervention are vital in suspected empyema cases to improve outcomes. Comprehensive microbiological investigations are crucial for tailored antibiotic therapy. A multidisciplinary approach ensures comprehensive

care in complex cases. Continuous monitoring is essential, as patients with empyema can rapidly develop complications.

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