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INDWELLING PLEURAL CATHETER IN RECURRENT PLEURAL EFFUSION DUE TO CONGESTIVE HEART FAILURE: A CASE REPORT

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Abstract: Indwelling Pleural Catheter in Recurrent Pleural Effusion Due to Congestive Heart Failure: A Case Report. Pleural effusion commonly appears in congestive heart failure (CHF), caused by raised pulmonary capillary pressure and impaired lymphatic drainage, often resulting in respiratory distress and reduced quality of life. This case report presents the use of an indwelling pleural catheter (IPC) for recurrent pleural effusion in CHF unresponsive to standard therapy. A 42-year-old man with acute decompensated CHF and bilateral pleural effusions presented with worsened dyspnea. Initial thoracentesis and diuretic therapy failed to resolve the effusion, leading to IPC placement for ongoing drainage. IPC insertion resulted in marked symptom improvement, effective fluid management, and shorter hospital stay. The patient was able to continue outpatient care and experienced no major complications. This case demonstrates that IPCs can provide safe and effective symptom control in CHF-related pleural effusions when conventional treatment is inadequate. Individualized strategies, including the use of IPC, may enhance quality of life and reduce hospitalizations in patients with effusions caused by heart failure.
Keywords: CHF, IPC, Recurrent Pleural Effusion

Abstrak: *Indwelling Pleural Catheter* Pada Efusi Pleura Berulang Akibat Gagal Jantung Kongestif: Laporan Kasus. Efusi pleura sering terjadi pada kasus gagal jantung kongestif (*congestive heart failure*/CHF), yang disebabkan oleh peningkatan tekanan kapiler paru dan gangguan drainase limfatik. Kondisi ini sering menyebabkan sesak napas dan menurunkan kualitas hidup. Laporan kasus ini mendeskripsikan penggunaan kateter pleura menetap (*indwelling pleural catheter*/IPC) pada kasus efusi pleura pada CHF yang muncul berulang walaupun sudah mendapatkan terapi standar. Seorang pria usia 42 tahun dengan CHF disertai dengan efusi pleura bilateral datang dengan keluhan sesak napas yang memberat. Tindakan torakosintesis awal dan terapi diuretik gagal mengatasi efusi pleura, sehingga dilakukan pemasangan IPC untuk drainase berulang. Pemasangan IPC menunjukkan perbaikan gejala yang signifikan dan lama rawat inap yang lebih singkat. Pasien diperbolehkan rawat jalan dan tidak mengalami terdapat komplikasi pasca rawat. Kasus ini menunjukkan bahwa IPC dapat memberikan hasil terapi yang baik dan kontrol gejala yang efektif pada efusi pleura terkait CHF ketika terapi konvensional tidak menunjukkan perbaikan yang spesifik. Strategi terapi individual, termasuk penggunaan IPC, dapat meningkatkan kualitas hidup dan mengurangi lama rawat inap pada pasien dengan efusi pleura yang muncul akibat gagal jantung.
Kata Kunci: Efusi pleura berulang, gagal jantung kongestif, IPC.

INTRODUCTION

Pleural effusion is the abnormal accumulation of fluid within a cavity between the pleural layers that surround the lungs (Krisna, 2024). Excess fluid can accumulate through several kinds of processes, such as an increase in pulmonary capillary pressure and increased pulmonary capillary

permeability. Inadequate absorption is caused by decreased intrapleural pressure, decreased plasma oncotic pressure, and obstruction of pleural lymphatic drainage (D'Agostino, 2023).

Retention of fluid in the pleural space may constrict the lungs, limiting their capacity to expand during inspiration and causing shortness of breath, cough, and chest pain (Yao, 2020). Pleural effusion can result from certain diseases and is typically classified as transudate or exudate. Separating exudate and transudate fluids is important for understanding the primary cause and developing an effective diagnostic strategy (Ferreiro, 2024). Pleural effusions can be caused by several conditions, including heart failure and pneumonia, as well as thoracic malignancies and systemic inflammation associated with autoimmune diseases (Elkins, 2025).

Pleural effusion is often diagnosed using a combination of clinical examination, imaging, and medical procedures, such as thoracentesis. Treatment of pleural effusion varies depending on its cause and severity. Draining the pleural fluid is essential to relieve the symptoms, but in some cases, dealing with complications such as infection or recurrence becomes the next problem (Krisna, 2024).

Recurrent fluid accumulation necessitates repeated drainage procedures to alleviate symptom burden (Rajendran, 2022). Indwelling pleural catheters (IPCs) have emerged as an effective treatment option for refractory pleural effusions (Aboudara, 2019). Pleural effusion related to congestive heart failure (CHF) that requires IPC placement is rarely reported in the literature. This case report aims to describe such a condition where pleural effusion due to CHF persisted despite optimized medical therapy. IPCs provide continuous drainage, improving symptoms and reducing the need for repeated thoracentesis, thereby reducing hospital stays.

CASE PRESENTATION

A 42-year-old male patient arrived at the respiratory outpatient clinic with a chief complaint of recurrent dyspnea, which started 3 months before coming to the hospital and worsened within 1 week. The complaints were followed by leg swelling and exertional dyspnea within 2 weeks, as well as cough without sputum. The patient was reported to use more than 3 pillows during night time sleep and frequently waken up due to shortness of breath. He previously had no symptoms or treatment related to metabolic comorbidities such as diabetes mellitus, hypertension, and systemic diseases related to his condition. The patient is a smoker and worked as a carpenter and furniture craftsman.

The patient's clinical condition was conscious, with vital signs indicating a slightly low blood pressure of 100/60, heart rate of 108 beats per minute, a respiratory rate of 28 times per minute without accessory respiratory muscle involvement, and peripheral oxygen saturation of 95% in the room air. The physical examination showed an increasing pressure in the jugular vein 5+3 cmH_2O. A thoracic examination revealed symmetrical lung expansion, Sonor percussion in the upper region and dullness percussion in the basal region, especially on the posterior side, soft-crackles in the lower part of both sides of the chest, and no wheezing. The heartbeat was regular, with slightly muffled heart sounds. The patient was then transferred to the emergency department for further management.

Peripheral blood examination results showed no abnormalities; Cardiac marker testing could not be performed due to the unavailability of the necessary laboratory facilities. The chest X-ray revealed bronchovascular cranialization on both lung fields, bilateral pleural effusions, and signs of cardiac enlargement (Figure 1). Echocardiography showed poor echo window due to massive pleural effusion (also confirmed using thoracic ultrasound with fluid estimation nearly 2000 ml, figure 2); left ventricular

systolic function and ejection fraction was 58%, right ventricular contractility was decreased with mild tricuspidal valve regurgitation, estimated right atrial pressure (eRAP) was 15, and found minimal pericardial effusion. Needle thoracocentesis was performed to the patient to evacuate the pleural fluid. Pleural fluid analysis showed a seroxanthochrome color with characteristics of transudate. *Mycobacterium tuberculosis* was not detected from the pleural fluid examination and from the sputum rapid molecular examination. The patient's working diagnosis was bilateral pleural effusion due to acute decompensated heart failure.

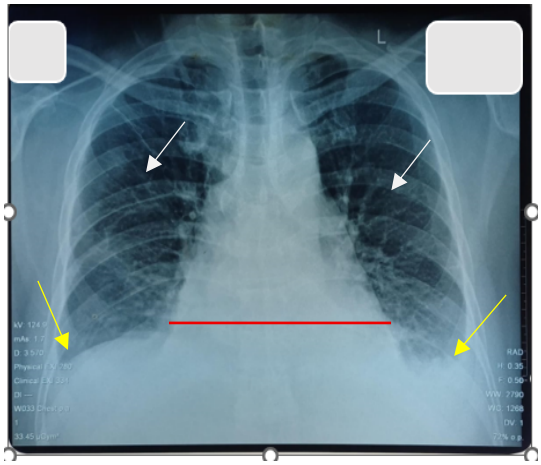

Figure 1. Patient's Chest X-ray Showed bronchovascular cranialization (white arrow), bilateral Pleural Effusion (yellow arrow) with Significant Enlargement in The Cardiac Shape (red line).

The patient had received supplemental oxygenation via a 3-liter nasal cannula. After finishing the thoracocentesis procedure in both the right and left chest, the patient's clinical sign was better, peripheral oxygen saturation improved to 97%, respiratory rate 22 times per minute, and blood pressure slightly increased to 110/70 mmHg. The patient then continued to inward hospitalization and was treated using diuretics to remove the excess fluid and a venodilator drug to reduce ventricular filling pressures and improve hemodynamics.

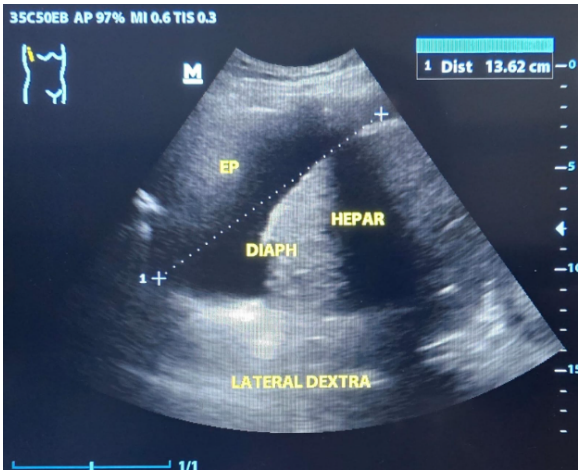

Figure 2. Fluid Accumulation estimated at more than 2000 ml in the Pleural Space Confirmed with Lung Ultrasound (EP: pleural effusion).

Clinical improvements were monitored every 6 hours during the first 24 hours of admission and every 8 hours thereafter. Despite initial treatment, pleural fluid persisted after three days, leading to the insertion of indwelling pleural catheters in both the right and left chest to facilitate daily drainage and reduce hospital stay. The total length of stay was 7 days. The decision to remove the IPCs was made after symptom improvement and thoracic ultrasound showed no further pleural fluid accumulation. The patient was advised to have regular follow-up visits at the cardiology and pulmonology clinics for ongoing monitoring.

DISCUSSION

The 42-year-old male patient presented with recurrent dyspnea worsening over weeks, accompanied by leg swelling and orthopnea, classical signs suggestive of heart failure. Physical examination showed elevated jugular venous pressure, bilateral basal dullness on percussion, and crackles, consistent with pulmonary congestion and pleural effusions (Pirrota, 2021).8 The patient's smoking and occupational exposures pose additional long-term pulmonary risks; however, the acute presentation is dominated by cardiac dysfunction.

Chest X-ray findings of bilateral pleural effusions, cardiomegaly, and bronchovascular cranialization are typical imaging features in congestive heart failure (CHF). Echocardiography further confirmed cardiac involvement with decreased right ventricular function, mild tricuspid regurgitation, and elevated right atrial pressure, while preserved left ventricular ejection fraction suggested possible right-sided or biventricular failure contributing to symptoms. Lack of cardiac biomarker testing due to limited resources is a limitation, yet clinical sign, imaging, and pleural fluid findings adequately support the working diagnosis of bilateral pleural effusions secondary to acute decompensated heart failure.

Congestive heart failure (CHF) is the most common cause of recurrent pleural effusion, followed by pulmonary infection (Wijayaratne, 2024). CHF is a leading global cause of pleural effusion, responsible for a significant proportion of cases across regions. Its prevalence is particularly high in hospitalized patients with acute or advanced heart failure (Korczyński, 2020).

The Global Prevalence of pleural effusion caused by CHF in the United States is estimated at around 1.5 million new pleural effusion cases, with CHF responsible for 36.3% to 37.4% of the total. CHF cases are also higher in the developed countries with the prevalence of pleural effusion is approximately 320 cases per 100.000 people. Pleural effusion causing an increase in hospitalization of acute decompensated CHF patients (Wakaki, 2021).

Pleural fluid analysis showing transudative characteristics fits with fluid accumulation due to raised hydrostatic pressures in CHF rather than infectious or malignant causes. Negative tuberculosis testing further excluded infectious etiologies.

Pleural effusion in congestive heart failure (CHF) arises from impaired fluid balance due to elevated cardiac filling pressures and altered hemodynamics. Elevated Hydrostatic Pressure manifests as increased left ventricular end-diastolic pressure (LVEDP) that raises pulmonary capillary hydrostatic pressure and forces fluid into the lung interstitium (Malek, 2023). Fluid translocation occurs when excess interstitial fluid crosses the visceral pleura into the pleural space, overriding lymphatic drainage capability (Shams, 2025).

Lymphatic Drainage Insufficiency as a pathogenesis cannot be avoided. Elevated central venous pressure causes reduced lymphatic flow, which restricts pleural fluid reabsorption via parietal pleural lymphatics. Persistent vascular congestion and fluid retention lead to increased fluid accumulation in the pleural space (Malek, 2023).

Chloride dynamics and electrolyte imbalance can also be underlying causes

of pleural fluid in CHF. Analysis of the pleural effusion in CHF patients is known to consist of higher chloride (Cl^-) concentrations than serum, possibly due to altered electrolyte transport in interstitial spaces. The condition of elevated Cl^- may enhance fluid retention in the pleural space, though this mechanism is less established than traditional Starling forces (Kataoka, 2021).

Initial patient intervention with therapeutic thoracentesis improved respiratory status by reducing pleural fluid volume and improving lung expansion. Subsequent diuretic therapy aids in mobilizing systemic and pulmonary congestion by reducing fluid overload, while venodilators help decrease preload and improve cardiac hemodynamics.

The decision to insert bilateral indwelling pleural catheters (IPCs) in this patient was driven by persistent pleural effusions despite initial medical treatment. Medical therapies, including diuretics and venodilators, primarily address systemic fluid overload and cardiac function but may be insufficient to promptly resolve large or recurrent effusions, especially when pleural fluid continues accumulating (Ajmani, 2023).

IPCs allow continuous, controlled drainage of pleural fluid, leading to improved symptoms and reduced hospital stay compared to repeated thoracentesis. Compared to pleurodesis, which induces inflammation to obliterate the pleural space, is effective mainly in malignant or exudative effusions but less favored in congestive heart failure (CHF)-related transudative effusions due to lower efficacy and higher procedural morbidity (Matta, 2023). The systemic nature of CHF and transudative pleural characteristics also explain why medical therapy alone may not rapidly resolve effusions, necessitating additional interventions. Pleurodesis might be a suitable option in recurrent effusions persist after optimization of medical therapy (Ajmani, 2023).

Pleural effusions in CHF are initially treated with thoracentesis and diuretic drugs, but in several conditions, like in this case, fluid will be produced repeatedly despite appropriate treatment. Recurrent pleural effusions causing dyspnea or reduced exercise tolerance despite optimal diuretic therapy and guideline-directed CHF management (Nicholson, 2023). Large effusion volumes (>1,000–2,000 mL) with persistent symptoms after therapeutic thoracentesis needed a specific treatment with an indwelling pleural catheter (Thøgersen, 2025).

Indwelling pleural catheters (IPCs) are effective in reducing symptoms in patients with CHF-related refractory pleural effusions, particularly when medical therapy (e.g., diuretics) fails. Indwelling pleural catheters are soft silicone tubes that aid individuals in relieving shortness of breath caused by recurring pleural effusions. This small catheter are easy to handle and do not interfere with a person's regular activities, therefore, it is commonly used in outpatient care (Sidhu, 2023). IPC placement significantly reduces dyspnea symptoms in CHF patients with recurrent pleural effusions. In one study, more than 80% of patients reported improved symptoms following IPC use, making it a reliable option for symptomatic relief. Functional improvement was also reported in the study of a case series of CHF patients with New York Heart Association (NYHA) Class IV symptoms that improved to Class II after IPC placement. This device also provides prolonged symptom control and improves patient comfort, indicated for those with end-stage CHF or poor candidates for invasive procedures like pleurodesis or thoracoscopy (Pothechin, 2015). IPCs are generally safe, with low complication rates. A study reported that no significant renal dysfunction was observed after IPC placement in CHF patients regarding concerns about renal failure due to continuous repeated drainage. The patient must be concerned for some complications, including infections, catheter blockage, or loculated effusions, but these are

somehow manageable if detected early (Chalhoub, 2018).

Blockage of indwelling pleural catheters (IPCs) in congestive heart failure (CHF)-related pleural effusions is rare, and this can be attributed mainly to the nature of the pleural fluid. Pleural effusions in CHF are typically transudative, meaning the fluid is clear, low in protein and cellular content, and less viscous compared to exudative effusions caused by infection or malignancy. This low viscosity and low cellular debris reduce the likelihood of catheter blockage (Chalhoub, 2018).

Studies report catheter blockage rates under 5% in general IPC use, with blockage more common in malignant or infected pleural effusions where the fluid is thicker, contains more cells, fibrin, or necrotic material that can occlude the catheter lumen. In contrast, CHF effusions involve more serous, less complex fluid, making blockage less frequent. Furthermore, the regular drainage enabled by IPCs helps prevent clot or debris accumulation (Nicholson, 2023).

CONCLUSION

Indwelling Pleural Catheter is highly effective in reducing symptoms like dyspnea and improving quality of life in CHF patients with refractory pleural effusions. They are particularly beneficial for patients who cannot tolerate invasive procedures or have recurrent effusions despite optimized medical therapy. Prospective studies comparing IPCs directly to other treatments in CHF are needed to establish definitive guidelines.

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