

Pleuroperitoneal Leak: A Rare Complication of Peritoneal Dialysis

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Established Facts

- Pleuroperitoneal leak is a rare complication of peritoneal dialysis (PD): it occurs in less than 2% of PD patients and typically manifests as a unilateral right-sided pleural effusion.
- Diagnosis relies on biochemical tests rather than imaging alone: elevated pleural fluid glucose compared to serum glucose (>50 mg/dL difference) is highly indicative. Contrast-enhanced CT scans may not always detect leaks (positive in only 33% of cases).
- Pathophysiology is multifactorial: proposed mechanisms include congenital diaphragmatic defects, increased peritoneal pressure, and impaired lymphatic drainage.
- Conventional management often includes cessation of PD: transitioning to hemodialysis is a common approach, with or without pleurodesis. Some cases resolve spontaneously with temporary PD cessation.
- Risk factors are not well-defined: some studies suggest female gender, polycystic kidney disease, and early onset of the leak (<30 days after catheter placement) might be associated with higher recurrence rates.

Novel Insights

- Limited sensitivity of imaging in diagnosing pleuroperitoneal leak: unlike previous reports emphasizing imaging techniques, this case highlights that contrast-enhanced CT scanning did not identify the pleuroperitoneal communication.
- The case reinforces the importance of biochemical analysis, particularly pleural fluid glucose concentration, as a key diagnostic tool.
- Use of video-assisted thoracoscopic surgery-guided talc pleurodesis as a preferred treatment: the successful use of VATS *with talc pleurodesis* allowed the patient to resume peritoneal dialysis (PD), avoiding permanent transition to hemodialysis.
- Patient preference as a key consideration in treatment decisions: despite recurrence after an initial trial of PD resumption, the decision to perform VATS was largely influenced by the patient's strong preference to continue PD. This underscores the role of patient-centered care in choosing between hemodialysis transition and advanced interventions to sustain PD.
- Challenges in risk stratification and prognosis: the case highlights the ongoing challenge of identifying predictors of pleuroperitoneal leaks as traditional risk factors (such as polycystic kidney disease or early vs. late leaks) remain inconsistent. More data are needed to refine risk assessment and guide personalized treatment strategies.

Keywords

Pleuroperitoneal leak · Peritoneal dialysis · Pleural effusion · Case report

Abstract

Introduction: Pleuroperitoneal leakage is a rare but dramatic cause of pleural effusion; it can lead to the cessation of peritoneal dialysis. It typically manifests as respiratory distress and reduced drainage volumes. **Case Presentation:** In this article, we report a case of pleuroperitoneal leak in a patient undergoing continuous ambulatory peritoneal dialysis who presented to the emergency with shortness of breath, lower limb edema, and weight gain. The diagnosis was established through pleural puncture, revealing that the pleural fluid is transudative with elevated glucose level which is pathognomonic for this condition, “sweet hydrothorax.” Furthermore, the composition of this fluid was almost identical to the peritoneal dialysis effluent. The management of this case involved temporarily discontinuing peritoneal dialysis and performing pleurodesis. The evolution was favorable, and peritoneal dialysis was resumed 2 weeks later. **Conclusion:** Patients on peritoneal dialysis who present with significant pleural effusion, especially if it is unilateral, should prompt clinicians to consider the possibility of a pleuroperitoneal leak.

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Introduction

Hydrothorax in a patient undergoing peritoneal dialysis (PD) presents a diagnostic challenge as determining the etiology can be difficult due to the wide range of potential differential diagnoses [1]. Pleural effusions occur in up to 80% of the dialysis population, with common causes including hypervolemia, parapneumonic effusions, and uremic pleuritis [1, 2]. However, pleuroperitoneal leaks are a rare complication of PD, with an incidence of less than 2% [3].

Diagnosis of a pleuroperitoneal leak relies on a combination of biochemical tests and imaging techniques as no gold standard diagnostic test exists [1]. This condition typically manifests as a right-sided hydrothorax in 88% of cases, often occurring within the first 2–4 weeks of initiating PD [3]. Delays in diagnosis can worsen pleural effusions, particularly when fluid overload is misdiagnosed, leading to increased use of high osmolar peritoneal dialyzate in an attempt to improve ultrafiltration (UF).

Accurate diagnosis and timely intervention are essential to prevent the need for cessation of PD. In this

report, we present a case of pleuroperitoneal leak in a PD patient, detailing the diagnostic approach used to identify and manage this uncommon complication.

Case Report

A 68-year-old male with a history of end-stage renal disease secondary to diabetes, on continuous ambulatory peritoneal dialysis (CAPD) for 6 months, presented to the emergency department with shortness of breath, lower limb edema, and weight gain. He also reported having low drain volumes with the PD (500 mL).

On clinical examination, the patient was dyspneic, desaturated in room air at 85% SpO₂. On pleuropulmonary examination, there was auscultatory silence on the right, with dullness on percussion, and crepitus on the left. Edemas of the lower limbs appeared, reaching the thighs, white, soft, and symmetrical.

His CAPD regimen consisted of three 2-L exchanges per day (isoosmolar – isoosmolar-intermediate osmolarity). Chest X-ray showed a large unilateral right pleural effusion (shown in Fig. 1a). Chest X-ray 6 months prior to the presentation was normal.

Thoracentesis revealed 2 L of clear transudative fluid and culture was negative. Pleural fluid glucose was 5.7 g/L with simultaneous blood glucose of 1.3 g/L. The protein level was 9 g/L, LDH <90 UI/L, Na = 135 mmol/L, K = 4 mmol/L, urea = 0.80 g/L → the same composition as the PD effluent (Table 1).

Thoraco-abdominal CT scan with injection of gas-trographine into the peritoneal dialyzate fluid revealed a large hydrothorax, peritoneal contrast enhancement without passage to the thoracic stage. To explain the negative UF, a cytobacteriological examination and a peritoneal balancing test were done. The culture was negative, and the peritoneum was moderately hyper-permeable which does not explain the negative UF.

The patient was temporarily switched to hemodialysis. The evolution was marked by pleurisy regression. After resumption of PD, the patient again experienced shortness of breath. A chest X-ray again diagnosed a large hydrothorax. We diagnosed a pleuroperitoneal leak and switched him to hemodialysis for 3 weeks.

Since the patient preferred treatment with PD, he underwent video-assisted thoracoscopic surgery (VATS) with talc pleurodesis (shown in Fig. 2). He restarted PD shortly afterward (2 weeks later) with a smaller volume of exchanges (1.5 L) without any further right-sided pleural effusion (shown in Fig. 1b). The patient was satisfied with his care management.

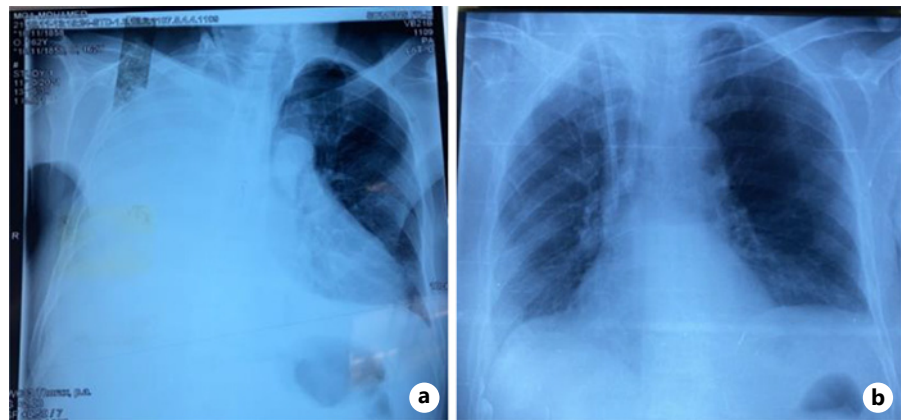


Fig. 1. Chest X-ray on presentation (a) and after pleurodesis and restarting PD (b).

Discussion

Unfortunately, in our case, the pleuroperitoneal shunt was not visible on the CT scan, and the diagnosis primarily relied on biochemical tests and the patient’s clinical progression. Tang et al. [4] found that contrast leakage into the pleural cavity was observed in only 33% of patients with pleuroperitoneal leaks.

The first case of hydrothorax complicating CAPD was documented by Edwards and Unger in 1967. Since then, multiple studies have reported on this complication, with one of the largest studies estimating an incidence of 1.6% [5]. A key diagnostic marker for pleuroperitoneal leaks is an elevated glucose concentration in the pleural fluid. In a study by Chow et al. [6], they assessed seven cases of hydrothorax due to pleuroperitoneal communication, comparing the biochemical profiles of pleural fluid, serum, and PD effluent to control cases with transudative pleural effusions. They found that cases with pleuroperitoneal communication had significantly higher pleural fluid glucose levels (243 ± 29 vs. 149 ± 21 mg/dL, $p = 0.017$) and a larger pleural fluid-to-serum glucose gradient (106 ± 18 vs. 32 ± 7 mg/dL, $p = 0.001$). Based on these findings, a glucose gradient exceeding 50 mg/dL had 100% sensitivity and specificity in confirming the diagnosis of pleuroperitoneal communication.

Several imaging techniques can be used to diagnose pleuroperitoneal leaks, including the following:

1. Intraperitoneal infusion of contrast material followed by plain abdominal radiography or CT scan.
2. Peritoneal scintigraphy using a radioisotope, such as technetium-labeled or macroaggregated albumin.
3. Magnetic resonance imaging, which has shown potential as a diagnostic tool according to Prischl et al. [7].

However, radiological methods generally suffer from relatively low sensitivity [1]. Various mechanisms have been

Table 1. Biochemical results

	Pleural fluid	PD effluent	Plasma
LDH	<90 UI/L	<90 UI/L	295 UI/L
Glucose	5.7 g/L	6 g/L	1.3 g/L
Protein	8 g/L	7.8 g/L	55 g/L
Na	135 mmol/L	135 mmol/L	132 mmol/L
K	4 mmol/L	4 mmol/L	4.1 mmol/L
Urea	0.80 g/L	0.80 g/L	1.88 g/L

proposed to explain hydrothorax in PD, including compromised lymphatic drainage, congenital diaphragmatic defects, and pleuroperitoneal pressure gradient variations.

The hypothesis of impaired lymphatic drainage was supported by findings of diaphragmatic lymphatic swelling during surgical exploration following peritoneal fluid instillation [8]. Meanwhile, congenital anatomical defects were suggested based on surgical and autopsy findings of fluid-filled diaphragmatic blebs, overlaying tendinous diaphragm discontinuities attributed to collagen fiber loss [9].

Traditional management of pleuroperitoneal leaks has often involved discontinuing PD and transitioning to hemodialysis, with or without chemical pleurodesis, to allow spontaneous closure of the defect. However, the success rate for this approach is around 50% [10]. Alternatively, some clinicians have adopted a modified approach using lower dialyzate volumes in a semi-upright position [11]. In our case, we opted for video-assisted thoracoscopic surgery (VATS) pleurodesis, which has been reported by others to be a successful alternative. VATS has shown higher success rates either through the instillation of a pleurodesis agent [4] or direct suturing of diaphragmatic defects [12].

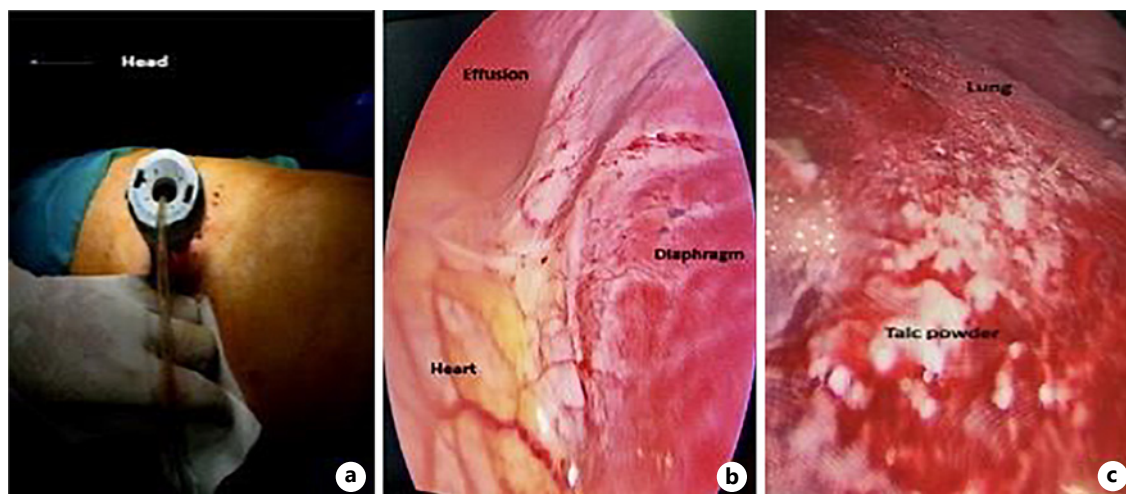


Fig. 2. a–c Video-assisted thoracoscopic pleurodesis.

In recent years, VATS has become the preferred treatment method for pleuroperitoneal leaks, especially in adult patients, by closing diaphragmatic defects [13–18]. Inspired by Huang et al. [19], who successfully treated hepatic-origin hydrothorax with mesh diaphragm coverage, Attila Nemeth and his team suggested that VATS-guided implantation of a polypropylene mesh – rather than polyethylene terephthalate mesh – on the diaphragm might promote permanent closure of the pleuroperitoneal leak. In their series of cases, with a median follow-up of 1.9 years, no patients experienced a recurrence of the leak. This technique was further supported in a literature review by Ferruh Artunç [20].

The prognostic factors for pleuroperitoneal leaks are not well-established, making precise risk stratification and treatment selection challenging. It has been suggested that treatment outcomes and recurrence rates may differ between early leaks (within 30 days of catheter insertion) and late leaks [21].

In a review of 104 patients, Chow et al. [22] found that treatment failure was more common in female patients, those with polycystic kidney disease (likely due to higher intraperitoneal pressure), and patients with early leaks. However, none of these risk factors reached statistical significance when compared.

Conclusion

Hydrothorax related to CCPD is a rare occurrence. Swift identification and timely therapeutic intervention are crucial to prevent life-threatening consequences. The

CARE Checklist has been attached in the online supplementary material (for all online suppl. material, see <https://doi.org/10.1159/000545281>).

Statement of Ethics

Ethical approval is not required for this case report in accordance with national guidelines. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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Author Contributions

Dr. Maria Lafrid and Dr. Narjiss Labioui: text redaction. Dr. Mohamed Hallak and Dr. Hajar Laasli: bibliographic research. Pr. Abdelali Bahadi and Pr. Driss El Kabbaj: correction. Dr. Mohammed Massine El Hammoumi and Pr. El Hassane Kabiri: figure of video-assisted thoracoscopic pleurodesis.

Data Availability Statement

The datasets used and/or analyzed during the current case report are available from the corresponding author on reasonable request.

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