# Recurrent hydrothorax associated with peritoneal dialysis: challenges in the diagnosis of pleuroperitoneal leak

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## ABSTRACT

**Background:** Peritoneal dialysis can be associated with various mechanical complications. Among them, pleuroperitoneal leak leading to recurrent hydrothorax is a lesser known entity. The condition can lead to life-threatening complications like respiratory distress, cardiac failure, arrhythmias, and infections. Various imaging modalities like computerized tomography, magnetic resonance imaging, and nuclear scans have been used to establish the diagnosis of pleuroperitoneal leak.

**Case Presentation:** An elderly gentleman with multiple co-morbidities on peritoneal dialysis presented with recurrent hydrothorax. After ruling out cardiac, infective, and neoplastic etiologies as causes for hydrothorax, the diagnosis of pleuroperitoneal leak was established using computerized tomography peritoneography. Despite temporarily interrupting peritoneal dialysis, our patient developed recurrent hydrothorax, thus requiring to be transferred to hemodialysis.

**Conclusion:** A high index of clinical suspicion and choice of the imaging modality will help in the timely diagnosis of pleuroperitoneal leak and appropriate therapeutic intervention.

**Keywords:** Pleuroperitoneal leak, hydrothorax, peritoneal dialysis, CT peritoneography.

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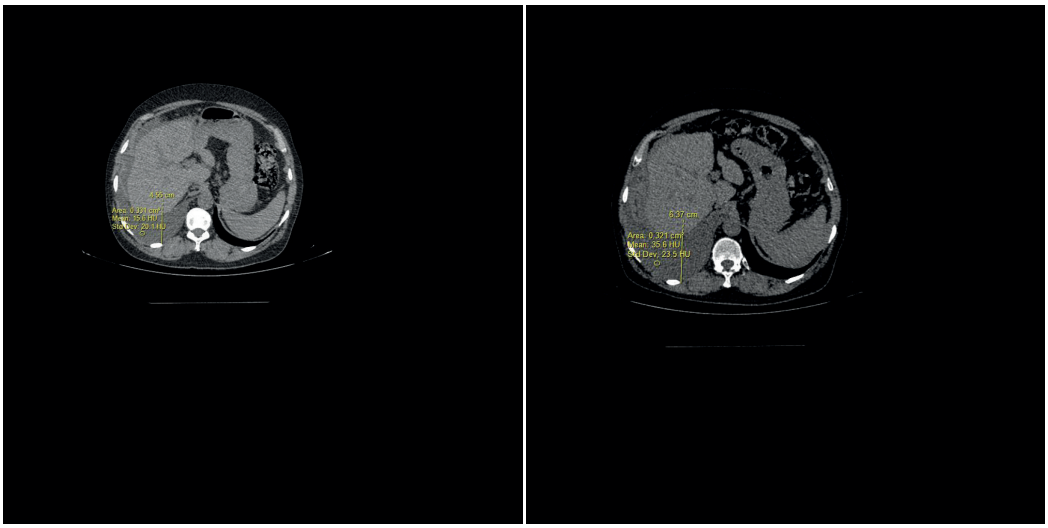
## Background

The first case of peritoneal dialysis (PD)-related hydrothorax was published in 1967 by Edward and Unger [1]. The reported prevalence of PD-related hydrothorax varies from 1.6% to 6% [2,3]. Although an uncommon complication of PD, it has serious consequences resulting in temporary or permanent discontinuation of PD. There is no single effective, non-invasive method for the accurate diagnosis of pleuroperitoneal leak. Few case reports have demonstrated pleuroperitoneal leak by modalities like magnetic resonance imaging peritoneography [4], computerized tomography (CT) peritoneography [5], and radionuclide imaging [6]. We report a case of PD-related hydrothorax posing dilemmas in diagnosis and therapy.

## Case Presentation

A 65-year-old gentleman with coronary artery disease and End-stage renal disease due to hypertensive nephrosclerosis was initiated on PD. He was also Hepatitis B serology-positive with preserved liver functions and no detectable viral load, hence not on antiviral therapy. There were no prior surgeries or trauma. He underwent laparoscopic PD catheter insertion and was on Continuous Ambulatory Peritoneal Dialysis (2.5% dextrose, 3 exchanges/day of 4-hour dwell each with ultrafiltration of 800-1,200 ml/day). After 8 months of PD, he presented with sudden onset breathlessness associated with a notable decrease in ultrafiltration volume. On examination, he was afebrile and normotensive but tachypneic at rest. An urgent chest X-ray revealed moderate right-sided pleural effusion. Blood test showed hemoglobin 9 g%, total count 6.1 cell/mm, serum creatinine 10.8 mg/dl, and mildly reduced serum albumin (2.9 g/dl). 12-lead Electrocardiogram and 2-dimension echocardiography were normal. Pleural fluid analysis showed transudative picture (glucose = 181 mg/dl, protein = 0.7 g/dl, Lactate dehydrogenase = 37 U/l, Adenosine deaminase = 1.7 U/l) with no evidence of bacteria or tubercular infection. After ruling out cardiac, infective, and neoplastic causes, the possibility of pleuroperitoneal fistula was considered. To confirm the same, CT peritoneography was performed. At baseline, CT chest and abdomen showed right-sided pleural fluid of 690 cc volume and CT value of 16-Hounsfield unit (HU), as shown in Figure 1A. This was followed by instillation of 1 l of dialysate fluid mixed with 100 ml of ionic contrast. Repeat CT was done after 4 hours showed an interval increase in the pleural fluid volume (838 cc) and CT value (23-HU), as shown in Figure 1B. The study demonstrated the presence of a pleuroperitoneal



(A) (B)

***Figure 1.*** *(A) CT peritoneography demonstrating hydrothorax at D12 level: 0 hour image with intra-pleural width 4.5 cm and CT value 15-HU. (B) CT Peritoneography demonstrating hydrothorax at D12 level: 4-hr delayed image showing an increase in intra-pleural width to 6.3 cm and CT value 35-HU.*

leak. However, it was noted that the PD catheter tip had migrated to the right iliac fossa. Subsequently, the PD catheter was exchanged to rule out possible omental wrapping. During this time, PD was stopped temporarily and the patient was transferred to hemodialysis. With the interruption of PD, his breathlessness subsided and repeat chest X-ray showed resolution of the hydrothorax. After 4 weeks, PD was re-initiated. However, after a few sessions of PD, he presented with similar symptoms of breathlessness with reduced ultrafiltrate and recurrence of right pleural effusion, thus confirming the diagnosis of pleuroperitoneal leak. The chest X-ray images depicting initial hydrothorax was followed by resolution and recurrence, as shown in Figure 2.

## Discussion

Pleuroperitoneal leak constitutes less than 5% of the PD-related mechanical complications. Various mechanisms like congenital diaphragmatic defects, pleuroperitoneal pressure gradients, lymph drainage disorders, and acquired anatomic defects have been proposed for the development of hydrothorax [7-9]. Symptoms usually occur after a few days of starting PD [10]. However, in our case, the symptoms developed after a period of 8 months of being on PD. Pleural effusion commonly develops on the right side and patients present with sudden onset dyspnea, decrease in ultrafiltration volume or pleuritic chest pain. Dyspnea can be easily mistaken for congestive heart failure, pulmonary infection, hypoalbuminemia, fluid overload, or inadequate dialysis. However, new onset dyspnea with a dramatic decrease in ultrafiltration volume is a clinical pointer to consider pleuroperitoneal leak.

Choosing an appropriate diagnostic modality to establish the presence of a pleuroperitoneal leak remains a challenge. The reported sensitivity of radionuclide scans

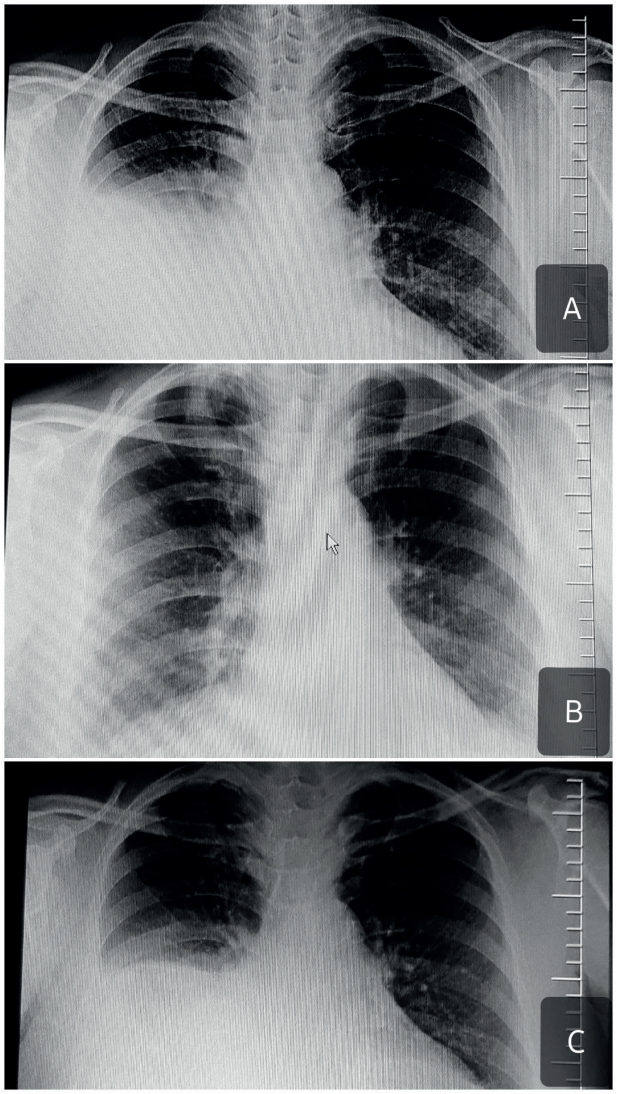



***Figure 2.*** *Chest X-rays: (A) The initial X-ray showing right-sided hydrothorax. (B) Repeat chest X-ray showing resolution of hydrothorax after interrupting PD. (C) Later X-ray showing recurrence of the hydrothorax after reinstituting PD.*

such as Tc-99m Diethylene Triamine Pentaacidic Acid (DTPA) is between 40% and 50% [11,12] and contrast CT peritoneography is 33% [13]. CT peritoneography not only diagnoses pleuroperitoneal communication, but can also locate the site of leak. In the presence of underlying cardiac and liver dysfunction, as in our case, diagnosing a pleuroperitoneal leak was challenging. We chose CT peritoneography as it has the advantage of locating the position of the PD catheter. Although the exact site of leak could not be established, CT peritoneography confirmed the presence of pleuroperitoneal leak.

Pleuroperitoneal leak can be managed conservatively by interrupting PD for 4-6 weeks. Most of the time, the leak seals and the hydrothorax resolves, allowing resumption of PD. Different management strategies like pleurodesis or video-assisted thoracoscopic repair or thoracotomy may be required when conservative treatment fails. Nearly 60% of patients with pleural defects resume maintenance PD after either conservative or interventional treatment [14]. In our patient, the pleural effusion recurred despite temporarily interrupting PD and repositioning of the PD catheter. We could not perform a pleurodesis and the patient requested to switch over to hemodialysis. Although PD was the most appropriate mode of renal replacement therapy in our patient, PD was deferred and he was continued on maintenance hemodialysis.

## Conclusion

Mechanical complications associated with peritoneal dialysis need timely interventions for maintaining adequacy of dialysis. Pleuroperitoneal leak being a lesser known entity needs a high index of clinical suspicion. The case highlights the challenges faced in terms of diagnosis of the pleuroperitoneal leak, given the unusual presentations like late onset of symptoms and associated cardiac or hepatic dysfunction. Also, the choice of an imaging modality in resource-limited settings and optimizing therapeutic interventions need to be individualized to the patient and healthcare facility.

## Acknowledgment

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### What is new?

Pleuroperitoneal fistula in patients on peritoneal dialysis is a rare, but is a previously reported entity. It commonly presents with recurrent hydrothorax. Our case report highlights the diagnostic challenges and choice of appropriate therapy in limited resource settings.

### List of Abbreviations

| | |
|---|---|
| CT | Computerized Tomography |
| HU | Hounsfield unit |

### Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this article.

### Funding

None.

### Consent for publication

Written consent was obtained from the patient.

### Ethical approval

The study was approved by the Institutional Ethics Committee, St John's Medical College Hospital, Bangalore, on 8-10-2020. The study reference number is 264/2020.

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## Summary of the case

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|---|---|---|
| 1 | **Patient (gender, age)** | Male, 65-year-old |
| 2 | **Final diagnosis** | Pleuroperitoneal fistula |
| 3 | **Symptoms** | Recurrent hydrothorax |
| 4 | **Medications** | Diuretics, antihypertensives |
| 5 | **Clinical procedure** | CT peritoneography to demonstrate pleuroperitoneal leak causing recurrent hydrothorax. |
| 6 | **Specialty** | Nephrology |