Nephropleural Fistula after Percutaneous Nephrolithotomy: Diagnosis and Management

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ABSTRACT

Nephropleural fistula is a rare abnormal connection between the renal collecting system and pleural cavity. It may occur secondarily to a percutaneous renal intervention, renal abscess, trauma, urinary obstruction, or renal malignancy. Percutaneous intervention is the most common cause of nephropleural fistula. Herein, we describe a case of nephropleural fistula occurring after percutaneous nephrolithotomy to raise clinicoradiologic awareness of this rare entity and complication.

CASE REPORT

BACKGROUND

Nephropleural fistula (NPF) is a rare abnormal connection between the renal collecting system and pleural cavity. It may occur secondarily to a percutaneous renal intervention, renal abscess, trauma, urinary obstruction, or renal malignancy. Percutaneous intervention is the most common cause of nephropleural fistula. Herein, we describe a case of nephropleural fistula occurring after percutaneous nephrolithotomy to raise clinicoradiologic awareness of this rare entity and complication.

INTRODUCTION

Nephropleural fistula (NPF) is an abnormal connection between the renal collecting system and the pleural space. This condition can occur due to percutaneous renal intervention, renal inflammatory conditions (such as renal abscess or xanthogranulomatous pyelonephritis), trauma, urinary obstruction, or renal malignancy.

Although NPF is a rare entity, it may arise as a complication of percutaneous renal procedures like percutaneous nephrolithotomy (PCNL)—with an incidence of 0.87%. In this context, we present a case of NPF after PCNL treatment for a staghorn calculus. Clinicians may overlook this condition due to its rarity, but it can lead to empyema, urinoma, or clinical deterioration. It is essential to consider this rare diagnosis as a potential cause of flank pain or pleural effusion after percutaneous renal procedures.

CASE PRESENTATION

A 40-year-old woman with a history of a right renal staghorn calculus (Figure A), which was previously treated with standard percutaneous nephrolithotomy (PCNL) using a 30Fr (10 mm) nephrostomy dilation balloon catheter and a rigid nephroscope (Figure B), visited our emergency department. She complained of persistent right pleuritic pain, mild shortness of breath, and flank pain after removing her urinary stent.

Chest radiographs **(**Figures C,D**)** revealed the presence of a pleural effusion at the right posterior costophrenic angle and in the major fissure posterosuperiorly. Subsequent contrast-enhanced chest, abdominal, and pelvic CT **(**Figure E**)** showed a right-sided posterosuperior renal cortical defect from which a fistula extended superiorly to a rim-enhancing pleural effusion—diagnostic of a nephropleural fistula.

The patient underwent a retrograde pyelogram a day after presentation, which showed no contrast extravasation or communication with the pleural space. A 6Fr (2 mm) 24 cm double-J ureteral stent was then placed. Urine culture was positive for Pseudomonas aeruginosa and Vancomycin-resistant Enterococcus faecium, and the patient was treated with ciprofloxacin, amoxicillin-potassium clavulanate, and linezolid. A thoracentesis was not performed as the pleural effusion was considered insufficient for intervention.

A one-month follow-up CT urogram revealed a small persistent nephropleural tract but no contrast within the tract or pleural space.

At the last clinical follow-up, the patient remained afebrile, had discontinued antibiotics, and experienced improving pain with deep inspiration.

DISCUSSION

Nephropleural fistula is a rare condition and defined as an abnormal connection between the renal pelvic system and pleural cavity. NPF is more commonly caused by percutaneous renal interventions followed by chronic infection, including xanthogranulomatous pyelonephritis or tuberculosis **(**Table 1**)**. The incidence of NPF following PCNL is approximately 0.87% [1]. This complication usually occurs when there is damage to the pleura during percutaneous interventions [1]. Supracostal access to an upper renal pole is more likely to result in a nephropleural fistula because it increases the likelihood of violating the parietal pleura [1]. The risk may be higher during a left-sided procedure because the left kidney is usually situated more cranially [1]. However, some reports suggest that a right-sided procedure increases the risk as the sonographic window is narrower on the right [2]. Our patient had underwent PCNL with supercostal access of the right upper renal pole, which likely increased the risk of NPF development.

The preferred diagnostic method for NPF is CT urography [2]. This test can reveal the presence of a fistulous tract that connects the renal collecting system to the pleura. Other radiological features that may be observed include the presence of foci of perinephric gas, pleural effusion, and evidence of a prior intercostal approach for nephrostomy access [2]. If a percutaneous nephrostomy tube is already in place, the diagnosis can be aided by directly injecting contrast through the PCN tube and visualizing the fistulous pleural communication. Alternatively, a renal scan using technetium-99m labeled mercaptoacetylglycerine (MAG-3) can also be performed to reveal the fistula [3]. Pleural fluid analysis can also support the diagnosis, with a fluid-to-serum creatinine ratio greater than 1 suggesting urinothorax [3].

The management of nephropleural fistula is mainly conservative [1,3]. The clinical course is usually not severe due to the sterility of urine [2]. Decompression of the collecting system with a urinary catheter may promote fistula closure [1,3]. Intervention with thoracostomy or repetitive thoracentesis can also help [4]. Rarely, in a severe case of NPF resulting in pleural empyema and pyonephrosis, pleural decortication and nephrectomy may be required [5].

In summary, it is important to consider NPF as a cause of pleural effusion in patients who have had percutaneous interventions such as percutaneous nephrostomy or -lithotomy. The preferred diagnostic method for NPF is CT urography, and conservative treatment is usually sufficient.

TEACHING POINT

It is important to consider NPF as a cause of pleural effusion in patients who have had percutaneous interventions such as percutaneous nephrostomy or -lithotomy. The preferred diagnostic method for NPF is CT urography, and conservative treatment is usually sufficient.

QUESTIONS

Question 1: Nephropleural fistula is most commonly caused by:
A. Trauma
B. Percutaneous interventions
C. Infection
D. Tumor
E. Congenital abnormality
Answer: Percutaneous interventions

Question 2: The incidence of NPF after percutaneous intervention is:
A. Less than 1%
B. Greater than 1%
C. 10%
D. 25%
E. 50%
Answer: Less than 1%

Question 3: The preferred diagnostic test for NPF is:
A. Ultrasound
B. MRI
C. Radiographs
D. CT urography
E. Nuclear medicine renal scan
Answer: CT urography

Question 4:. Which access approach may increase the risk of NPF:
A. Anterior
B. Lateral
C. Posterior
D. Supracostal
E. Infracostal
Answer: Supracostal

Question 5:. Management of NPF is mainly:
A. Pleural decortication

B. Repetitive thoracenteses
C. Thoracotomy
D. Nephrectomy
E. Conservative
Answer: Conservative.

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FIGURES

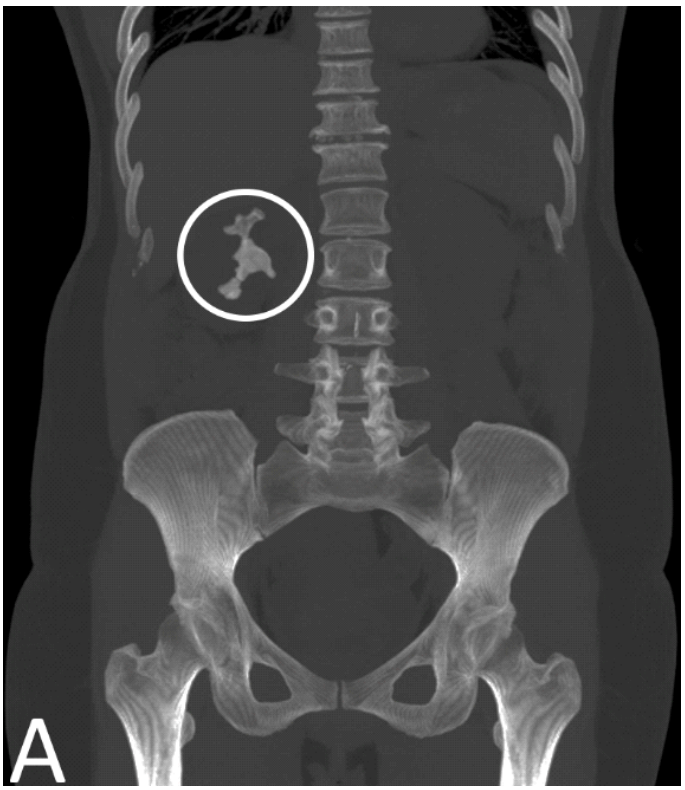


Figure A: Coronal non-contrast CT MIP in bone window demonstrates original staghorn calculus (encircled in white) within the right renal collecting system.

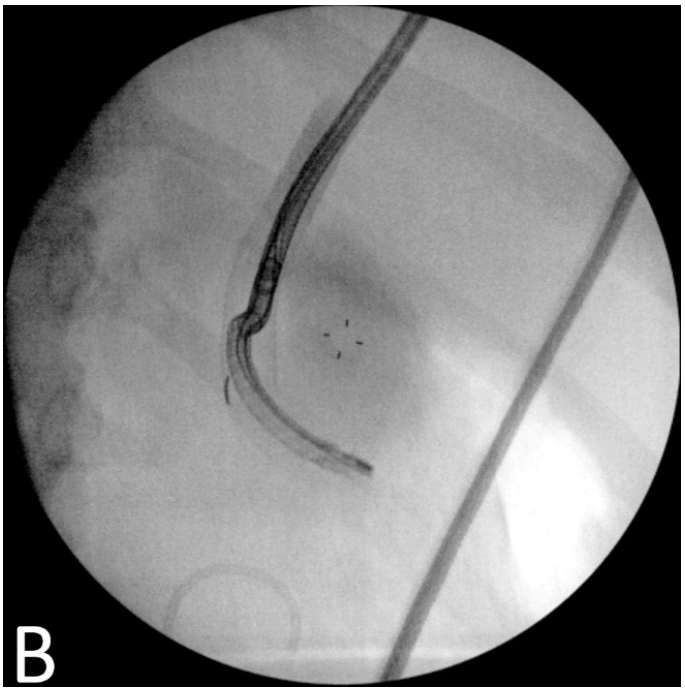
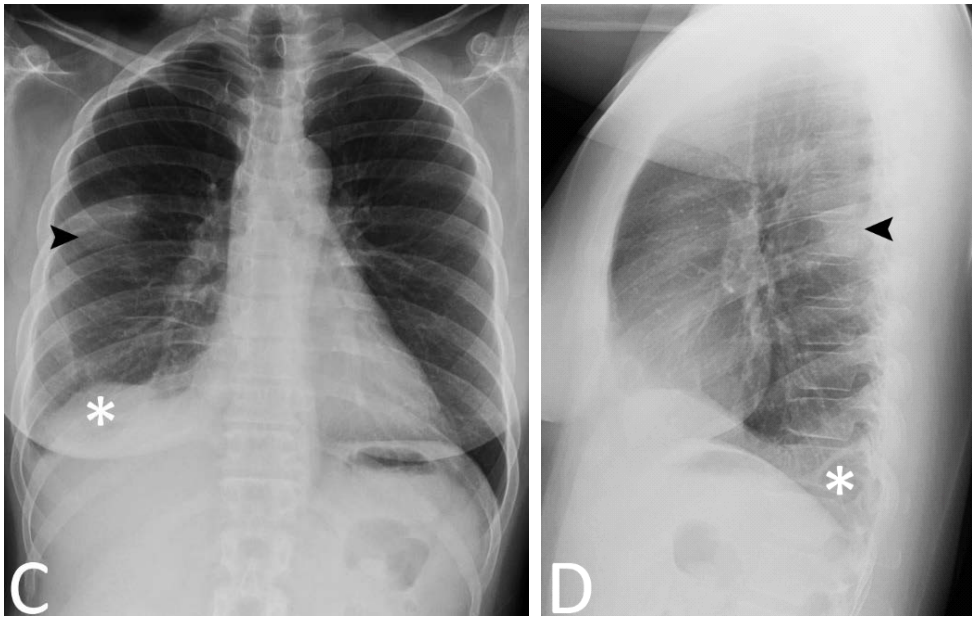


Figure B: Intraoperative fluoroscopic examination demonstrates percutaneous nephrolithotomy. Note the superior to inferior orientation of the nephroscope and its projection over the lower ribs compatible with a supracostal approach, which may predispose to nephropleural fistula.



Figurex C,D: Frontal and lateral chest radiographs at the time of presentation to our institution demonstrate a lentiform density (asterisks) at the right posterior costophrenic angle creating the so-called spine sign on the lateral view (6). There is also a small amount of pleural fluid in the major fissure posterosuperiorly (arrowheads).

Figure E: Sagittal CT postcontrast image demonstrates a fistula (arrow) arising from a cortical defect from the posterosuperior aspect of the right kidney and extending superiorly to communicate with the small pleural collection (asterisk) at the posterior costophrenic angle—diagnostic of a nephropleural fistula. Also note the small curvilinear soft tissue edema and scarring (wavy arrow) within the posterior subcutaneous fat consistent with a tract related to the prior nephroscopic access site.

Table 1: Review of the causes of nephropleural fistula.

Reference number	Number of patients	Etiology
1, 5, 7-15	15	Percutaneous nephrolithotomy or Percutaneous nephrostomy
4, 16-20	6	Infection, including chronic granulomatous diseases (e.g., Xanthogranulomatous pyelonephritis and tuberculosis)
21	1	Trauma

KEYWORDS

Nephropleural fistula; • Percutaneous nephrolithotomy; CT