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Nephro-Pleural Fistula and Massive Empyema: An Unusual Thoracic Manifestation of Xanthogranulomatous Pyelonephritis

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Abstract | **Case Report**

Xanthogranulomatous pyelonephritis (XGP) is a rare, chronic destructive granulomatous infection of the renal parenchyma, typically associated with long-term urinary tract obstruction. While local extra-renal extension is common, transdiaphragmatic spread leading to a nephro-pleural fistula is an extremely rare and life-threatening complication. We report the case of a 48-year-old male with a history of pulmonary tuberculosis who presented with acute respiratory distress and a 'white-out' of the left hemithorax. Contrast-enhanced CT revealed the pathognomonic 'bear paw sign' in the left kidney, a staghorn calculus, and a direct fistulous communication through the diaphragm into the pleural space. Management required a staged approach: urgent percutaneous drainage of the renal and pleural collections followed by a delayed total nephrectomy. This case underscores the role of the radiologist in identifying the subtle signs of fistulous tracking in the setting of chronic renal sepsis.

Keywords: Xanthogranulomatous pyelonephritis, Nephro-pleural fistula, Bear paw sign, Staghorn calculus, Diaphragmatic extension, Computed tomography.

INTRODUCTION

Xanthogranulomatous pyelonephritis (XGP) is a distinct clinicopathological entity representing a chronic, suppurative infection that results in the replacement of renal tissue by granulomatous tissue containing lipid-laden macrophages (xanthoma cells). It is often referred to as the 'great imitator' due to its ability to mimic renal cell carcinoma or tuberculosis [1]. While the inflammatory process frequently breaches the renal capsule to involve the perirenal fat, extension into the thoracic cavity is a rare event. Such extension typically occurs via the posterior pararenal space or through diaphragmatic apertures. Early radiological recognition is paramount, as the clinical presentation often points toward a primary pulmonary pathology, potentially delaying the diagnosis of the underlying renal source [2].

CASE PRESENTATION

A 48-year-old male presented to our emergency department with a 10-day history of productive cough, worsening dyspnea, and left-sided pleuritic chest pain that radiated toward the left flank. His medical history was significant for pulmonary tuberculosis treated in 1998. On initial assessment, he was febrile (38.5°C) and tachycardic. Physical examination revealed absent breath sounds and stony dullness to percussion over the left hemithorax. Laboratory workup showed a profound inflammatory response with a white blood cell count of 22,340/mm³ and a CRP of 431 mg/L. Renal function remained surprisingly preserved (Creatinine 1.1 mg/dL).

An initial chest radiograph demonstrated a complete 'white-out' of the left hemithorax with a contralateral mediastinal shift (Figure 1). Given the patient's history, a pleural complication of tuberculosis was initially considered. However, a contrast-enhanced CT of the thorax and abdomen was performed to further characterize the effusion. The CT revealed a massively enlarged left kidney with the classic 'bear paw sign' multiple fluid-attenuation collections replacing the renal parenchyma (Figures 2 and 3). A large staghorn calculus was noted within the renal pelvis (Figure 2). Crucially, the CT demonstrated a focal solution of continuity in the left diaphragmatic dome, with inflammatory tracking from the perirenal space directly into the pleural cavity, confirming a nephro-pleural fistula (Figure 4).

The patient was stabilized with broad-spectrum intravenous antibiotics. We performed urgent guided

percutaneous drainage of the renal collections and placed a large-bore chest tube to manage the compressive empyema. Once the sepsis was controlled and the patient's respiratory status improved, he underwent a formal left nephrectomy. The surgical specimen (Figure 5) showed a distorted, enlarged kidney with extensive xanthomatous changes. Histopathology confirmed the diagnosis of XGP. The patient's postoperative course was uneventful, and he was discharged in stable condition.

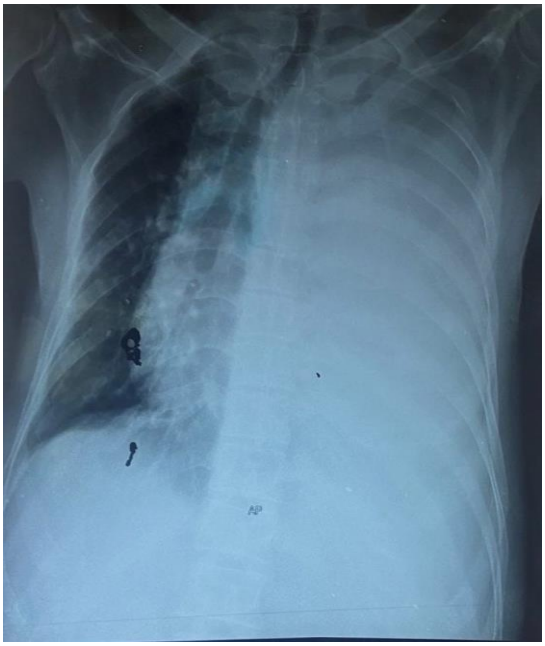

Figure 1: a large opacity of the left hemithorax with a contralateral mediastinal shift

Figure 2: Axial CT showing an enlarged left kidney with the classic 'bear paw sign' multiple fluid-attenuation collections replacing the renal parenchyma

Figure 3: Coronal CT section showing a large staghorn calculus in the renal pelvis and the characteristic 'bear paw' distribution of dilated calyces

Figure 4: a coronal CT section showing a focal solution of continuity in the left diaphragmatic dome, with inflammatory tracking from the perirenal space directly into the pleural cavity, confirming a nephro-pleural fistula

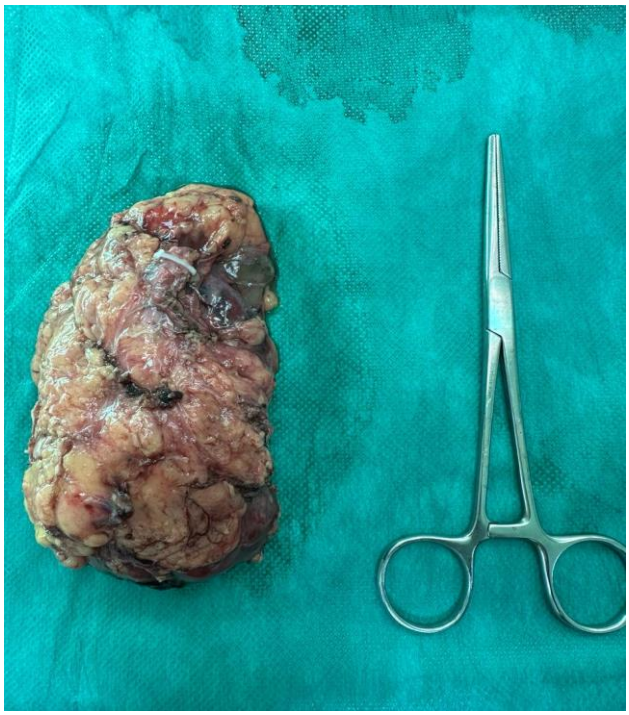

Figure 5: Gross nephrectomy specimen showing the enlarged, irregular renal architecture and xanthomatous changes

DISCUSSION

The diagnosis of XGP is primarily radiological. The triad of a non-functioning enlarged kidney, a staghorn calculus, and multiple rounded hypodense areas (the 'bear paw sign') is highly suggestive [3]. In our case, the diagnostic challenge was the overwhelming thoracic presentation. Nephro-pleural fistulae are rare because Gerota's fascia usually acts as an effective barrier. However, chronic, untreated infection can lead to the erosion of the fascia and subsequent transdiaphragmatic spread [4].

Radiologists must carefully scrutinize the diaphragmatic interface in any case of XGP associated with an ipsilateral pleural effusion. The presence of fat stranding in the posterior pararenal space tracking superiorly should raise suspicion of a fistula [5]. Management is necessarily aggressive, requiring both thoracic and urological intervention. As demonstrated in this case, percutaneous drainage serves as a vital bridge to definitive surgery, allowing for the stabilization of the patient before a technically demanding nephrectomy.

CONCLUSION

XGP complicated by a nephro-pleural fistula is a rare but high-stakes diagnosis. This case highlights the necessity of including the upper abdomen in the imaging workup of unexplained massive empyema. A multidisciplinary approach involving radiologists, urologists, and thoracic surgeons is essential for a successful outcome.

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