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(CASE REPORT)

Aggressive Squamous Cell Carcinoma Arising in Chronic Xanthogranulomatous Pyelonephritis: CT Imaging of a Rare Case with Hepatic Metastases

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Abstract

Xanthogranulomatous pyelonephritis (XGP) is a rare, severe form of chronic renal infection associated with long-standing urinary tract obstruction, most commonly due to staghorn calculi. Although considered a benign inflammatory condition, it may rarely be associated with or evolve into squamous cell carcinoma (SCC) of the renal pelvis, an aggressive malignancy with poor prognosis.

We report the case of a 55-year-old male with a history of urolithiasis who initially presented with left flank pain. Computed tomography (CT) demonstrated findings consistent with XGP in a non-functioning left kidney. Despite nephrostomy drainage and indication for nephrectomy, the patient was lost to follow-up. One year later, he returned with fever, purulent nephrostomy discharge, anorexia, and weight loss, with marked inflammatory syndrome. Follow-up CT revealed an infiltrative renal mass with heterogeneous enhancement and necrosis, extending beyond the kidney, associated with ureteral involvement, lymphadenopathy, and multiple hepatic lesions. Biopsy of a liver lesion confirmed metastatic squamous cell carcinoma. The patient was managed with urinary diversion and systemic chemotherapy.

This case highlights the potential for malignant transformation of untreated XGP into aggressive renal SCC. The presence of infiltrative masses, heterogeneous enhancement, and extrarenal extension on imaging should raise suspicion for malignancy. Early surgical management and close follow-up are essential to prevent disease progression and improve outcomes.

Keywords: Xanthogranulomatous Pyelonephritis; Renal Squamous Cell Carcinoma; Chronic Pyelonephritis; Staghorn Calculus

1. Introduction

Xanthogranulomatous pyelonephritis (XGP) is a rare, severe form of chronic renal infection, characterized by destruction of the renal parenchyma and replacement with granulomatous tissue containing lipid-laden macrophages (1, 2). It is frequently associated with long-standing obstruction and staghorn calculi (1).

Radiologically, XGP may mimic renal neoplasms due to aggressive local inflammation, with CT findings including renal enlargement, parenchymal thinning, and the characteristic “bear paw” appearance (2).

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Although XGP is benign, rare cases of coexisting renal squamous cell carcinoma (SCC) have been reported (3). Chronic irritation from calculi and infection can induce squamous metaplasia, which may progress to malignancy (4). Renal SCC is uncommon, accounting for <1% of renal tumors, and is usually diagnosed at an advanced stage (4, 5).

We report a rare case of untreated XGP evolving into an aggressive renal SCC with hepatic metastases, illustrating radiological progression and emphasizing the importance of timely surgical management.

2. Case presentation

A 55-year-old male with a history of prior renal surgery (pyelotomy performed in 1993 for presumed urolithiasis, without available documentation) initially presented three years prior to the current admission with left flank pain.

Contrast-enhanced computed tomography (CT) of the abdomen and pelvis demonstrated a markedly enlarged left kidney (bipolar diameter: 16.5 cm) with lobulated contours and diffuse parenchymal thinning. There was severe calyceal dilatation with a multiloculated appearance, producing a characteristic “bear paw” configuration. A large staghorn calculus occupying the renal pelvis, along with multiple calyceal calculi of similar density, was identified.

The renal parenchyma showed markedly reduced enhancement, with absence of contrast excretion on delayed phases, consistent with a non-functioning kidney. Associated findings included mild upstream dilatation of the left ureter (maximum diameter 8 mm) with circumferential wall thickening and enhancement. There was extensive inflammatory stranding of the perirenal, peripyelic, and periureteral fat, associated with thickening of the adjacent retroperitoneal fascia. These imaging features were highly suggestive of diffuse xanthogranulomatous pyelonephritis (Figure 1).

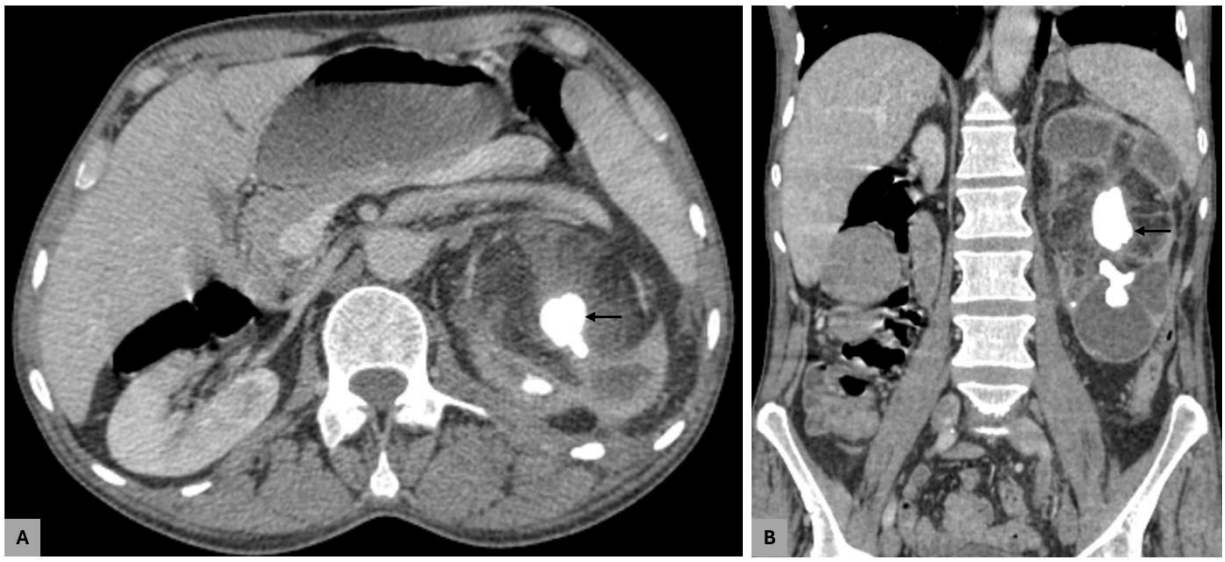

Figure 1 Contrast-enhanced computed tomography of the abdomen at initial presentation demonstrating an enlarged left kidney with marked calyceal dilation and a central staghorn calculus occupying the renal pelvis (black arrow). Coronal reconstruction (B) shows diffuse parenchymal thinning with a multiloculated “bear paw” appearance, associated with perirenal fat stranding.

The patient underwent percutaneous nephrostomy drainage and received conservative management. A left nephrectomy was indicated; however, the patient was lost to follow-up and did not undergo surgery, remaining with the nephrostomy tube in situ.

One year later, the patient presented with fever, left flank pain, purulent discharge from the nephrostomy site, as well as general deterioration with anorexia and unintentional weight loss. Laboratory investigations revealed a marked inflammatory syndrome, with leukocytosis and a C-reactive protein level of 552 mg/L.

Follow-up contrast-enhanced CT demonstrated a large, ill-defined infiltrative soft-tissue mass centered on the lower pole of the left kidney, replacing the previously described parenchyma. The lesion exhibited heterogeneous enhancement with multiple central areas of low attenuation consistent with necrosis. There was frank transgression of

the renal capsule, with contiguous extension into the perirenal and posterior pararenal spaces, and infiltration of the adjacent psoas muscle (Figure 2).

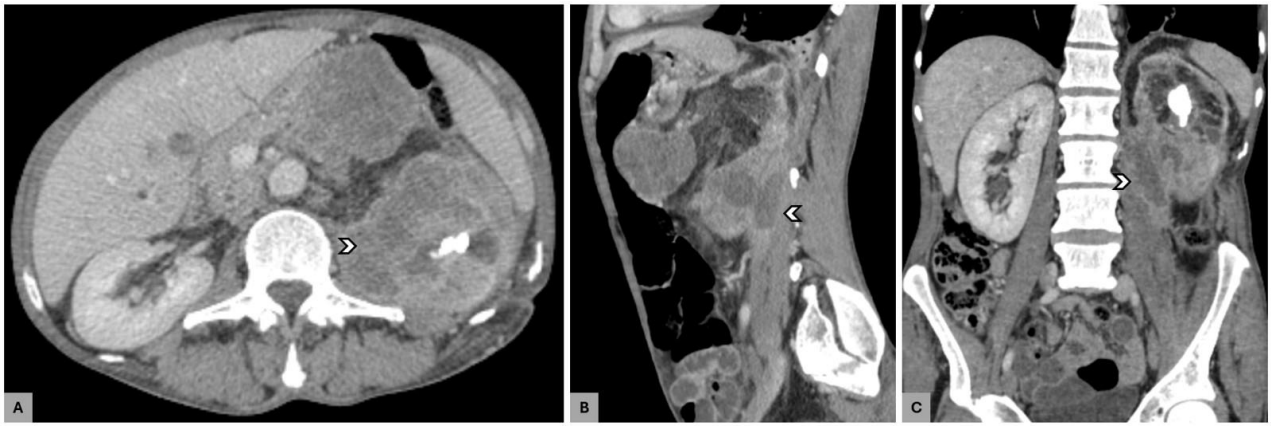

Figure 2 Follow-up contrast-enhanced computed tomography performed one year later showing an ill-defined infiltrative mass in the lower pole of the left kidney with heterogenous enhancement and central necrosis (white arrow head). The lesion extends beyond the renal capsule into the perirenal and posterior pararenal spaces, with involvement of the psoas muscle.

Residual intrarenal calculi persisted within the dilated calyceal system, the largest measuring 23 × 18 mm. The left ureter was markedly dilated (up to 16 mm) and demonstrated irregular, asymmetric wall thickening with heterogeneous enhancement. Two focal segments of luminal narrowing were identified at the lumbar and pelvic levels, associated with marked periureteral fat stranding.

Multiple enlarged lymph nodes were present in the left renal hilum and along the latero-aortic chain. The liver was enlarged and contained multiple, variably sized hypodense lesions involving several hepatic segments, consistent with secondary metastatic deposits (Figure 3).

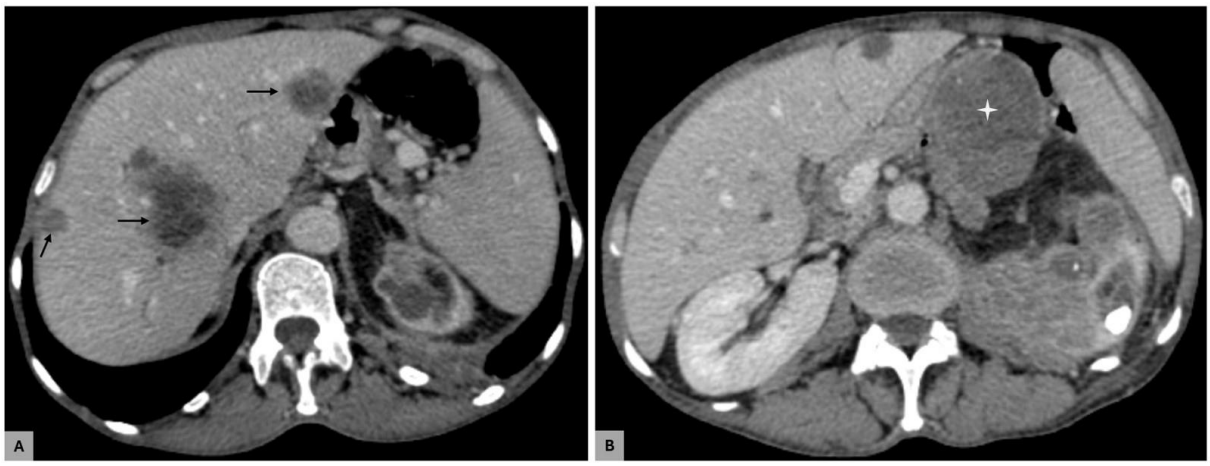

Figure 3 Axial contrast-enhanced computed tomography images demonstrating multiple hypodense lesions within liver consistent with metastatic deposits (black arrows), associated with enlarged lymph nodes suggestive of metastatic lymphadenopathy (white asterixis).

An ultrasound-guided biopsy of a hepatic lesion was performed, and histopathological examination revealed a squamous cell carcinoma, consistent with metastatic dissemination from a renal primary in the context of chronic inflammatory disease.

Following diagnosis, the nephrostomy tube was removed and replaced with a double-J ureteral stent for urinary diversion. The patient was subsequently referred for oncological management and has recently been initiated on systemic chemotherapy combining cisplatin and gemcitabine.

3. Discussion

Xanthogranulomatous pyelonephritis (XGP) is an uncommon, chronic inflammatory disorder of the kidney in which normal renal tissue is progressively replaced by granulomatous tissue containing lipid-laden macrophages. It typically develops in the setting of long-standing urinary tract obstruction, most often due to staghorn calculi, and recurrent bacterial infections, commonly involving Proteus or Escherichia coli (1, 2). Persistent inflammation and chronic urothelial irritation may induce squamous metaplasia, which in rare instances can evolve into squamous cell carcinoma (SCC) of the renal pelvis (3, 4).

Renal SCC is a rare malignancy, accounting for less than 1% of all renal tumors, and is usually diagnosed at an advanced stage due to nonspecific clinical manifestations such as flank pain, hematuria, fever, anorexia, and weight loss (4, 5). Only a limited number of cases describing the coexistence of XGP and SCC have been reported in the literature, most of which were diagnosed postoperatively. Cases demonstrating radiologic progression from XGP to metastatic SCC remain exceptionally rare (3, 6, 7).

Imaging plays a central role in both diagnosis and follow-up. Computed tomography (CT) is the modality of choice, as it allows detailed evaluation of the renal parenchyma, collecting system, ureter, and surrounding structures (2). Typical CT findings of diffuse XGP include renal enlargement with lobulated contours, dilated calyces separated by inflammatory tissue producing the “bear paw” appearance, hypoattenuating areas corresponding to xanthomatous infiltration, perirenal fat stranding, and associated calculi, frequently staghorn in configuration (2, 6).

In the present case, sequential CT imaging clearly demonstrated the evolution of disease. The initial examination showed features consistent with XGP, including an enlarged kidney with calyceal dilatation, parenchymal thinning, a large staghorn calculus, and inflammatory changes in the perirenal fat. On follow-up imaging, an ill-defined infiltrative mass developed in the lower pole, characterized by heterogeneous enhancement and central necrosis. The lesion extended beyond the renal capsule into the posterior pararenal space, infiltrated the psoas muscle, and tracked along the nephrostomy tract to the subcutaneous tissues. Additional findings included irregular ureteral wall thickening with focal luminal narrowing, regional lymphadenopathy, and multiple hypodense hepatic lesions, later confirmed as metastatic deposits on biopsy.

These findings highlight the diagnostic challenge in differentiating advanced inflammatory disease from malignant transformation. Particular attention should be paid to the development of new infiltrative soft-tissue components, heterogeneous enhancement patterns, necrotic areas, and extension beyond the renal capsule, as these features should raise suspicion for malignancy rather than simple inflammatory progression. Differential diagnoses may include renal cell carcinoma, urothelial carcinoma, or severe complicated pyelonephritis; however, the association with long-standing calculous disease and aggressive infiltrative features should prompt consideration of SCC.

This case illustrates several important clinical implications. First, untreated or inadequately managed XGP may, although rarely, predispose to the development of SCC. Second, imaging alone may not reliably distinguish between inflammatory and neoplastic processes, particularly when both coexist, necessitating a high index of suspicion in cases of atypical evolution or systemic deterioration. Third, early surgical management, typically by nephrectomy, remains essential in XGP to control infection and potentially prevent malignant transformation.

The prognosis of renal SCC remains poor, largely due to delayed diagnosis and the frequent presence of locally advanced or metastatic disease at presentation. Systemic chemotherapy, including regimens based on cisplatin and gemcitabine, may be considered in advanced cases (4, 5).

The present case is particularly noteworthy due to the availability of sequential imaging, illustrating the progression from typical XGP to an aggressive metastatic carcinoma in the absence of definitive surgical management. It underscores the importance of close follow-up in patients who defer surgery, as prolonged obstruction and chronic inflammation may increase the risk of malignant transformation. Early recognition of suspicious imaging features, combined with timely histopathological confirmation, is crucial for appropriate management and improved patient outcomes.

4. Conclusion

Xanthogranulomatous pyelonephritis is a severe chronic inflammatory condition that may rarely undergo malignant transformation into squamous cell carcinoma, particularly in the setting of long-standing obstruction and infection.

This case highlights the importance of recognizing suspicious imaging features such as infiltrative masses, heterogeneous enhancement, and extrarenal extension, which should raise concern for malignancy.

Early surgical management and close follow-up are essential to prevent disease progression and improve patient outcomes.

Compliance with ethical standards

Disclosure of conflict of interest

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

Statement of informed consent

Written informed consent was obtained from the patient for participation in this case report and for publication of any accompanying images.

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