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Radio-Diagnosis

CT IMAGING IN EMPHYSEMATOUS PYELONEPHRITIS: KEY FINDINGS AND CLINICAL IMPLICATIONS

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ABSTRACT Emphysematous pyelonephritis (EPN) can be defined as an acute necrotizing infection of the renal parenchyma and surrounding tissues. Diabetes mellitus is the most important risk factor, presenting in >90% of the cases. Escherichia coli (E.Coli) is the most common organism cultured from urine and blood specimens. The symptoms of EPN infection are usually nonspecific, but the clinical trial of fever, flank pain, and nausea are the most common presentations. Clinical diagnosis of the condition closely mirrors acute pyelonephritis, which requires accurate evaluation through imaging, particularly computed tomography (CT) scans.

KEYWORDS : Emphysematous pyelonephritis, Escherichia coli, Diabetes mellitus, Huang-Tseng classification computed tomography, Nephrectomy.

INTRODUCTION

Emphysematous pyelonephritis (EPN) is an acute necrotizing infection of the renal parenchyma and surrounding tissues[1]. Gas can be present in the renal parenchyma or collecting system or in the perinephric fat. Diabetes mellitus is the most important risk factor, presenting in >90% of patients[2]. Around 95% of the cases with EPN have underlying uncontrolled diabetes mellitus[3]. Escherichia coli is the mostly commonly isolated pathogen (49%–67%), followed by Klebsiella (20%–24%), Proteus (5% 18%), Enterococcus (14%), and Pseudomonas[4] (5%)

Left kidney is more frequently involved than right[5]. The symptoms of EPN infection can be nonspecific, but the clinical trial of fever, flank pain, and nausea represent the most common presentations. Patients may also present with renal colic or hematuria. Clinical diagnosis of the condition closely mirrors acute pyelonephritis, which requires accurate evaluation through imaging, particularly computed tomography (CT) scans[6].

MATERIALS AND METHODS

This study included 10 patients with fever, flank pain and raised serum creatinine levels who underwent computed tomographic imaging at GSL medical college and general hospital, Rajahmundry within 3 months. Clinical symptoms in majority of the test subjects were abdominal pain and distension, weight loss. In all these cases, thin sections of plain abdomen and pelvis were acquired. In view of elevated serum creatinine levels, contrast study could not be done.

The severity of EPN was graded as per the Huang classification. We have applied the reported prognostic factors to our patients to find out whether these factors correlated with failure of conservative treatment.

RESULTS

EPN was common in females. In our study comprising of 10 patients, around 7 of them had a history of recurrent UTI. Around 6 patients, had uncontrolled diabetes mellitus. Around 4 of them were hypertensive. 6 cases were class I. 2 cases were class II and 1 case each were class III and IV.

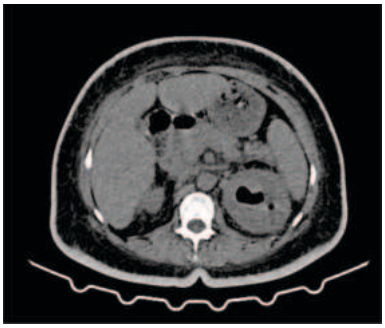
1A

1B

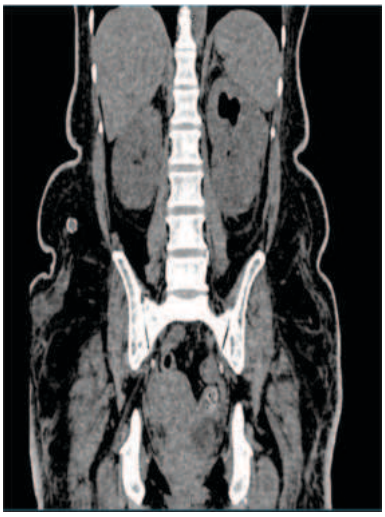
1C

Figure 1: A 57 year old female came to radiology department with complaints of fever, right flank pain since 5 days. She was a known diabetic; not on regular medication.

NCCT Abdomen A) axial, B) coronal, C) sagittal images show gas in the right kidney in parenchyma only (without intraparenchymal extension)-F/S/O Class 2 Emphysematous pyelonephritis of right kidney.



2A



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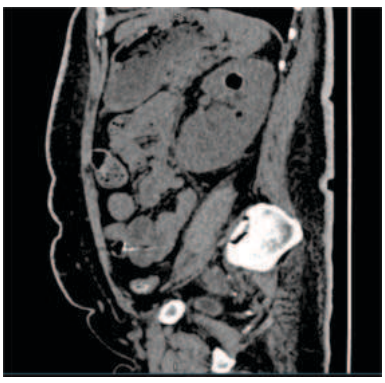

2C

Figure 2: A 42 yr female presented with complaints of fever, left flank pain and nausea since 3 days. She was a known diabetic; not on regular medication.

NCCT Abdomen A) axial, B) coronal & C) sagittal images show gas in the left kidney in collecting system only - F/S/O Class 1 Emphysematous pyelonephritis of left kidney.

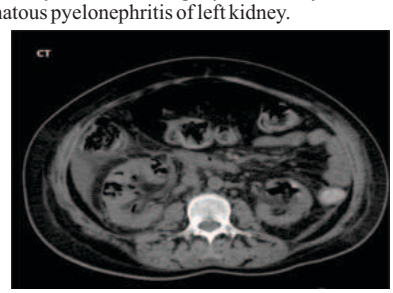

Figure 3: A 75yr female presented with complaints of fever and bilateral flank pain since 5 days. She was a known case of CKD.

NCCT Abdomen axial image shows relatively small size left kidney with bilateral perinephric fat stranding and thickening of right anterior and lateral conal fascial thickening noted -F/S/O Class 4 Emphysematous pyelonephritis.

DISCUSSION

Emphysematous pyelonephritis (EPN) is an acute necrotizing infection of the renal parenchyma and surrounding tissues. Gas can be present in the renal parenchyma or collecting system or in the perinephric fat. EPN is usually more prevalent in older patients and in females (4:1), because of higher rates of urinary tract infections[7]. Risk factors associated with adverse outcome include advanced age, altered mentation, acute renal failure, thrombocytopenia, hypoalbuminemia, severe proteinuria, polymicrobial infections, and shock.

Uncontrolled diabetes can cause bacterial propagation and disease progression due to high tissue glucose levels, impaired oxygen supply to the kidneys, and microvascular disease. Gas accumulation observed is a consequence of microbial fermentation of glucose and lactate, producing gases such as carbon dioxide, hydrogen, and nitrogen. Urinary tract obstructions can cause reduction in renal blood flow and tissue perfusion, exacerbating the infection.

In 2000, Huang and Tseng reported classification system based on CT findings, which is currently widely used in clinical assessments. In this study, we have used this classification system.

Huang and Tseng[8] focused primarily on the gas distribution: In Class 1, the gas is present only in the renal collecting system; in Class 2, the gas is present in the renal parenchyma, without extension to the extrarenal area; in Class 3A, gas or abscess are present in the perinephric space; in Class 3B, gas or abscess are present in the pararenal space; and in Class 4 bilateral involvement can be observed.

An increase in the gas distribution reflects an increase in the infection area, which is associated with an increase in the mortality rate, with Class 4 having the worst outcomes.

Table 1. Grading system described by Huang and Tseng (2)	
Class I	Gas in the collecting system only
Class II	Parenchymal gas only
Class IIIA	Extension of gas into perinephric space
Class IIIB	Extension of gas into pararenal space
Class IV	EPN in a solitary kidney or bilateral disease

EPN: Emphysematous pyelonephritis

Source: Emphysematous Pyelonephritis: A Twelve-year Review in A Regional Centre[9].

Huang and Tseng have proposed a management approach for EPN based on clinico-radiological classification as follows:
Classes I and II EPN: Medical management alone or combined with percutaneous drainage can yield favorable outcomes.

Classes IIIA and IIIB EPN: These are further divided into 2 categories, as listed below.

- In patients with fewer than 2 risk factors: Medical management plus percutaneous drainage.
- In patients with more than 2 risk factors: Medical management plus percutaneous drainage less successful compared to class III A requiring nephrectomy.

Class IV EPN: The initial step remains medical management plus percutaneous drainage.

In any class of EPN, renal preservation with medical management and percutaneous drainage should be done. Nephrectomy should only be considered if these approaches prove to be unsuccessful[10].

CONCLUSION

EPN is a life-threatening condition associated with septic complications that require immediate attention. Class II is the most common type of EPN and class IV is the most severe associated with high mortality. The initial use of broad-spectrum antibiotics such as Third-or fourth-generation cephalosporins and carbapenems are

recommended. Nephrectomy should be reserved as the last resort for those who fail to respond to conservative therapy.

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