

Emphysematous pyelonephritis: three-year experience of managing 16 cases in a tertiary care hospital of Bangladesh

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ABSTRACT

Background: Emphysematous pyelonephritis (EPN) is an uncommon, acute and severe necrotizing infection affecting the renal parenchyma, collecting system and surrounding tissues. This study was planned to describe the demographic, clinical, laboratory and imaging characteristics and in-hospital outcomes of patients with EPN.

Methods: This retrospective study was done at BIRDEM General Hospital, Dhaka, Bangladesh between 2021 and 2023. Patients' clinical, laboratory and imaging characteristics and in-hospital outcomes were recorded in case record forms at the time of discharge or death, if were any.

Results: Total patients were 16 with female predominance (10, 62.5%). Mean age of patients was 57.1 (range 29 - 67) years. Risk factors for EPN were diabetes mellitus (16, 100%) and renal stones (3, 18.8%). Fever (16, 100%), loin pain (11, 68.8%), vomiting (10, 62.5%) and dysuria (10, 62.5%) were common presenting features. All (16, 100%) patients had leukocytosis and uncontrolled blood glucose (HbA1c >7%). Complications included acute kidney injury (AKI) (7, 43.8%), hyponatremia (5, 31.3%) and bacteremia (3, 18.8%). *Escherichia coli* (11, 68.8%) was the most common urinary isolate. Most patients (11, 68.8%) had class 2 EPN, 3 (18.8%) had class 3B and 1 (6.3%) had class 3A disease. One (6.3%) patient had class 4 EPN with emphysematous cystitis. Along with medical management, four (25%) patients required surgery (open drainage in 3, open drainage with double J stenting in 1). None required nephrectomy. Mean hospital stay was 8 (range 6 - 11) days and there was no death.

Conclusion: EPN occurred predominantly among female diabetic patients with poor glycemic status, who presented with fever, loin pain, vomiting and dysuria. Two-fifths of patients had AKI and one-fourth required surgery. None required nephrectomy and there was no mortality.

Key words: emphysematous pyelonephritis, outcome, risk factor, presentation, radiological classification.

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INTRODUCTION

Emphysematous pyelonephritis (EPN) is an acute and severe form of necrotizing infection affecting the renal parenchyma, collecting system and surrounding tissues with feature of gas accumulation. Risk factors for EPN include diabetes mellitus (DM), obstructive uropathy, vesico-ureteric reflux and immunosuppression, although patients without DM are not exempted.^{1,2} Patients may present with fever, loin pain, vomiting, altered consciousness and shock.¹⁻³

Different imaging modalities can identify gas but computed tomography (CT) scan is the most reliable for establishing the diagnosis of EPN and classification: class 1, gas in the collecting system only; class 2, gas in the renal parenchyma without extension to the extra renal space; class 3A, extension of gas or abscess to the perinephric space; class 3B, extension of gas or abscess to the pararenal space; class 4, bilateral EPN or a solitary kidney with EPN.³

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As EPN is an uncommon diagnosis, patients are managed differently in different centers. Overall treatment includes resuscitation, intravenous antibiotics, glycemic control in diabetics, release of obstructions and nephrectomy.¹⁻³ Outcomes depend on clinical status during presentation, radiological class and quality of care given.² This study aimed to describe the demographic, clinical, laboratory and imaging characteristics and in-hospital outcomes of patients with EPN.

METHODS

This retrospective study was carried out at BIRDEM General Hospital, Dhaka, Bangladesh from 2021 to 2023. The participants were evaluated by nephrologists and urologists after undergoing a CT scan to determine whether urologic intervention was needed. Data were collected during discharge or after death, if were any and contained selected socio-demographic, clinical, laboratory and imaging characteristics and in-hospital treatment outcomes. Patients having a fistula between the genitourinary tract and gut and if they had undergone a recent genitourinary procedure were excluded. The study protocol was approved by the Ethical Review Committee of Bangladesh Diabetic Somiti (BADAS). Statistical Package for Social Scientists (SPSS version 20) was used to analyze the data.

RESULTS

Total patients were 16 including 10 females. Mean age was 57.1 years. Risk factors for EPN were DM (16, 100%) and renal stones (3, 18.8%). Base-line characteristics are shown in Table I.

Table I. Base-line characteristics of patients with emphysematous pyelonephritis (N = 16)

Base-line characteristics	Number (percentage)	Range
Male/Female (number)	6/10	-
Age (years)	57.1 ± 11.3	29 – 67
Comorbidity		
Hypertension	7 (43.8)	-
Chronic kidney disease	4 (25)	-
Risk factors for emphysematous pyelonephritis		
Diabetes mellitus	16 (100)	-
Renal stone	3 (18.8)	-

Fever, loin pain, vomiting and dysuria were common (Table II). Complications included acute kidney injury (AKI), hyponatremia and bacteremia (Table III).

Table II. Clinical features of patients with emphysematous pyelonephritis (N = 16)

Clinical features	Frequency	Percentage
Fever	16	100
Loin pain	11	68.8
Dysuria	10	62.5
Increased frequency of micturition	6	37.5
Vomiting	10	62.5
Altered sensorium	-	-
Shock	-	-

Neutrophilic leukocytosis was common and all patients had uncontrolled blood glucose (Table III). *Escherichia coli* (11, 68.8%) was the most common urinary isolate. Most patients (11, 68.8%) had class 2 EPN followed by class 3B and class 3A. One patient had class 4 EPN with emphysematous cystitis (Figures 1 and 2). Besides medical management, four (20%) patients required surgery (open drainage in 3, open drainage with DJ

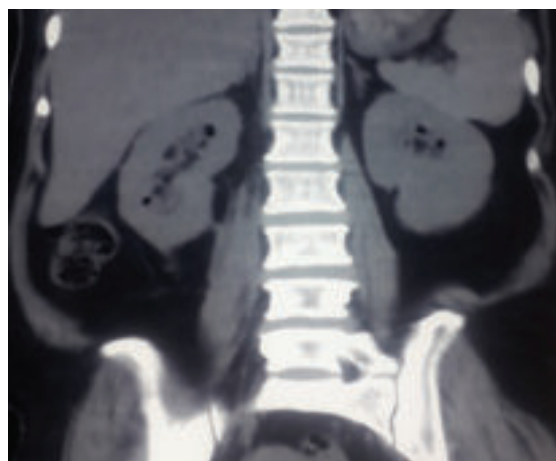


Figure 1. Computed tomography scan (coronal section) showing bilateral emphysematous pyelonephritis



Figure 2. Computed tomography scan axial film showing emphysematous cystitis

Table III. Laboratory, radiological and microbiological features and treatment and outcome of patients with emphysematous pyelonephritis (N = 16)

Features	Mean \pm SD (Range)	Frequency (Percentage)
Total white cell count/cmm	19200 \pm 4130 (14300 - 29100)	-
Platelet count	16100 \pm 39000 (110000 - 254000)	-
Erythrocyte sedimentation rate	68 - 111 mm in 1 st hour	-
C-reactive protein (mg/L)	26 - 196	-
Procalcitonin (available in 11 patients)	0.4 - 36 ng/ml	-
Random blood glucose (mmol/L)	13.6 \pm 4.2 (11.3 - 18.7)	-
HbA1c (%)	8.5 \pm 2.1 (7.8 - 11.3)	-
CT class of EPN³		
Class 1		None
Class 2		11 (68.8)
Class 3A	-	1 (6.3)
Class 3B	-	3 (18.8)
Class 4	-	1 (6.3)
Urinary isolates		
<i>E coli</i>	-	11 (68.8)
<i>K pneumoniae</i>	-	3 (18.8)
<i>Enterococcus</i>	-	1 (6.3)
Complications		
Bacteraemia	-	3 (18.8)
Acute kidney injury	-	7 (43.8)
Hyponatraemia	-	5 (31.3)
Surgical intervention		
Open drainage	-	3 (18.8)
Open drainage wit DJ stenting	-	1 (6.3)
Nephrectomy	-	None
Outcome		
Complete recovery	-	13 (81.25)
Residual renal dysfunction	-	3 (18.8)
Death	-	None

stenting in 1). None required nephrectomy and there was no death. Hospital stay was 8 (range 6 – 11) days. Radiological characteristics, infective organisms, treatment and outcome are shown in Table III.

DISCUSSION

Kelly and MacCallum were the first to report a case of gas-forming renal infection (pneumaturia) in 1989.⁴ Various terms, for example, 'pneumonephritis' and 'renal emphysema' were used to describe this disease and 'emphysematous pyelonephritis' was coined in 1962.⁵

Gas formation in EPN is due to glucose fermentation by enteric bacteria.³ The pathogenesis may include infection by gas-forming organisms, tissue ischemia, anaerobic environments and immune deficiency.³ Obstruction of urinary flow stones, tumors or papillary necrosis predispose to EPN.^{1-3,6}

Like pyelonephritis and cystitis, EPN predominantly occurs in females. Any kidney can be involved and bilateral involvement is the least common.^{1-3,7} There are reports of exceptional cases with bilateral renal

involvement (class 4) and concomitant emphysematous cystitis.^{8,9} One patient in our series had class 4 disease with emphysematous cystitis. Misgar et al. found one-third of their EPN patients had class 4 disease.⁷

Patients with EPN present with fever, renal-angle pain or tenderness and vomiting.¹⁻³ In severe cases, they have features of altered consciousness and shock.^{1,3} The clinical presentation of fever, loin pain and vomiting in our series is comparable with other published series.^{1-3,7,10-12} Asymptomatic cases are rarely reported.¹³

Neutrophilic leukocytosis, high ESR, high CRP and poor glycemic status are consistent features in EPN.^{1-3,10-12} *E. coli* is the most commonly isolated organism in most series.¹⁻³ Over two-thirds of our patients had AKI, while in other studies, up to 75% of EPN cases were complicated by AKI.^{14,15} Our patients stayed in hospital for 6 – 11 days and most of them received antibiotics for 4 weeks, which was consistent with another report.¹⁴ In our series open drainage was required in 3 patients and 1 needed open drainage with DJ stenting.

Mortality in EPN has reduced largely in last few decades. Poor prognostic features include altered conscious level and shock during admission, hematuria, proteinuria, hypoalbuminemia, thrombocytopenia, uremia and the requirement for hemodialysis, polymicrobial infection, bacteremia and extension of infection to perinephric areas.^{3,15} Our series had no mortality. Irfaan et al. reported a series of 20 EPN patients, of whom nearly half had altered sensorium and a quarter had shock, without any mortality.¹ Factors contributing to the improved outcomes in EPN are availability of CT scan facilities, early detection and less advanced radiological classes of EPN, aggressive resuscitative measures, rapid glycemic control using intravenous insulin, early administration of effective, broad-spectrum intravenous antibiotics, interventional radiology, minimally invasive intervention techniques and a multidisciplinary team approach.²

In conclusion, EPN occurred predominantly in females and all patients were diabetic. Fever, loin pain, vomiting and dysuria were common. Two-thirds of patients had AKI and a forth required surgical intervention, without nephrectomy. There were no deaths.

Authors' contribution: AL, TS, MAR planned the study. MAR, SAM collected data. AL drafted manuscript. All authors read and approved final version for publication.

Conflicts of interest: Nothing to declare.

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