

Emphysematous Pyelonephritis: Experience of Managing 15 Consecutive Cases in a Tertiary Care Hospital of Bangladesh

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Abstract

Background: Emphysematous Pyelonephritis (EPN) is a rare but potentially life threatening necrotizing renal parenchymal infection, specially in diabetic population, characterized by the production of intra parenchymal gas. We aimed to describe the demographic profile, clinical details, investigations, management strategies and inpatient outcome of EPN cases managed at our hospital.

Methods: This was an observational study where we analyzed medical records of diabetic patients admitted with a diagnosis of EPN from April 2010 to April 2013 in Nephrology unit of BIRDEM General Hospital.

Results: Total number of patients were 15. There were 12 female and 3 male patients. The mean age was 50 (range 40-60) years. All the patients had diabetes mellitus (DM) with average duration of (11.57±5.1) years and with poor glycemic control (HbA1c 9.1-15.7%). Fever (86.6%) and pain in abdomen (86.6%) were the two commonest presenting complaints. Renal angle tenderness was the commonest sign. Only 6.6% cases were presented with shock. All patients (100%) had leucocytosis and raised CRP with 3 (20%) having thrombocytopenia. Sixty percent patients had acute kidney injury (AKI). *Escheria coli* (73.33%) was the commonest bacteria isolated from urine. Bacteremia was found in 23% cases, 2 having growth of *Escheria coli* and one had growth of *Pseudomonas*. Imaging studies diagnosed EPN (60% by USG and 80% by CT scan including reconfirming the USG reports). Fourteen cases had unilateral and one had bilateral involvement. On the risk factor stratification 3 patients had simultaneous presence of 2 or more risk factors (altered sensorium -3 patients, thrombocytopenia-3 patients, AKI- 9 patients, shock- 1 patient). All cases were treated conservatively. 20% required drainage of the abscess. Overall survival rate was 93.33%.

Conclusions: DM poor glycemic status is the commonest risk factor for developing EPN and *Escheria coli* is the commonest infective agent. CT scan is the investigation of choice. Conservative approach has become the focus of treatment modality with timely diagnosis of the disease.

Keyword: Emphysematous pyelonephritis, risk factor, management.

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Introduction

Emphysematous pyelonephritis (EPN) is defined as an acute, severe necrotizing infection of the renal parenchyma and its surrounding tissue, which results

in gas formation in the renal parenchyma, collecting system or perinephric tissue.¹ It was first reported in 1898 by Kelly and MacCallum and the term “emphysematous pyelonephritis” was coined by Schultz and Klorfeinin 1962 to describe this serious infection.^{2,3}

Till mid 1980s, the standard treatment was nephrectomy of the affected kidney.⁴ Although it is most commonly seen in diabetic patients, EPN has also been reported in patients with ureteral obstruction and immunocompromised conditions.⁵⁻⁸ It mostly affects female and the illness is commonly caused by enteric gram-negative bacilli, such as *Escherichia coli* and *Enterobacter*, *Klebsiella* and *Proteus spp.* *E. coli* is the most common organism associated with the disease. *Streptococcus spp.* and *Candida spp.* have also been implicated.⁹⁻¹²

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Since it carries a grave prognosis, early suspicion and treatment of this entity is of paramount importance. The situation has improved dramatically in the last two decades with earlier computed tomography (CT) scan based diagnosis and advances in multi-disciplinary intensive care of sepsis and multi-organ dysfunction syndrome. Management alternatives now range from invasive surgery to more conservative approaches. The options include medical treatment alone, percutaneous drainage plus medical treatment and percutaneous drainage and medical treatment plus emergency nephrectomy. EPN is a life-threatening infection with a mortality rate as high as 80% in earlier studies.^{13,14} Over the past two decades, improved management has resulted in a decreased mortality rate of 21%-25%.¹⁵ We present our experiences of managing 15 cases of EPN, managed conservatively at a tertiary care hospital in Bangladesh.

Methods

We analyzed the medical records of 15 diabetic cases of EPN admitted and treated in BIRDEM General Hospital between April 2010 to April 2013. Data were analyzed for the following: demographic characteristics, clinical picture, laboratory profile, treatment (conservative and surgical management), duration of hospital stay and outcome.

The baseline characteristics included age, sex and presence of diabetes mellitus (DM) with duration and status of glucose control, previous history of pyelonephritis and presence of renal stone with or without obstructed uropathy.

The clinical feature included symptom at presentation, physical finding like mental status, haemodynamic status, palpable renal mass or tenderness in abdomen.

The laboratory variables were total leukocyte count, platelet count, serum creatinine, serum electrolyte, glycated haemoglobin (HbA1c), results of urine and blood culture. Radiological data included ultrasonography (USG) CT scan of abdomen.

Treatment included medical management (MM) alone, MM with drainage of renal or extra renal lesion and nephrectomy. Patient consent was taken after proper counselling.

Patients with known fistula between the gastrointestinal and urinary tracts and patient with a recent history of penetrating injury or needle injury to their kidneys were excluded from this study.

Definitions

I. Emphysematous pyelonephritis (EPN)

- Presence of gas in collecting system/renal parenchyma/peri-renal/para-renal space as evident on USG or CT scan of KUB region with any of the following:
- Features of UTI like fever, dysuria, flank pain or any other non specific symptom
- Pyuria \pm (positive urine culture/leucocytosis/raised C-reactive protein (CRP)/pneumaturia

II. Class of disease

Class of disease was defined on the basis of CT scan as described by Huang and Tseng [9]

- Class 1: Gas in collecting system only
- Class 2: Parenchymal gas only
- Class 3A: Extension of gas into perinephric space
- Class 3B: Extension of gas into pararenal space
- Class 4: EPN in solitary kidney or bilateral disease

III. Thrombocytopenia

Thrombocytopenia was defined as platelet count less than 1 50 000/mm³.

IV. Hyponatremia

Serum Na level <130 mmol/L.

V. Acute renal failure

Acute renal function impairment was defined as absolute increase in serum creatinine of ≥ 0.3 mg/dl from the baseline or first serum level at the time of admission (≥ 1.5 mg/dl) if previous record is not available or comparing it with the reduced level at the time of discharge.

VI. Shock

Shock was defined as systolic pressure ≤ 90 mm Hg at admission.

VII. Risk factors

Altered mental status, shock at presentation, thrombocytopenia, acute kidney injury (AKI).

VIII. Outcome

Outcome was classified by survivors and non-survivors. Survivors were declared improved on the basis of resolution of fever, reduction of raised serum creatinine level and normalization or improvement of total leucocyte count and platelet count.

All patients were treated by multi-disciplinary team comprising Nephrologist, Urologist, Endocrinologist and Intensivist. All patients required fluid resuscitation and insulin for glycemic control. Empirical antibiotics with third generation cephalosporin or carbanem were started in all patients and subsequent changes were made as required based on urine culture sensitivity results. Surgery was done depending on extension of the local disease. Surgical approach involved only open drainage of abscess.

Statistical analysis

All available data were noted into a specially designed questionnaire and were analyzed using Statistical Package for Social Sciences (SPSS) version 20 computer software. Results were expressed as median or mean±standard deviation for continuous data/variables and as frequencies with percentages for categorical data/variables.

Results

A total fifteen cases of EPN were diagnosed during the study period (12 females and 3 males), female: male being 4:1. Ninety three percent of patients were in age group of 40 to 60 years. All cases were known to have diabetes mellitus (DM), six cases had chronic kidney disease (CKD) (46.15%), eight had history of pyelonephritis (61.53%) including one EPN. The mean±standard deviation of duration with of DM was 11.57±5.1 (range 2-20) years with poor glycemic control, average HbA1C with standard deviation was 11.92±1.84 (range 9.1-15.7)%. None had obstructed uropathy.

Fever and diffuse pain in abdomen were the the two most common complaint and were present in 13/15 (86.6%) of cases. These were followed by dysuria in 9/

15 (60%) and altered sensorium in 3/15 (20%). Tenderness in the loin was the commonest sign elicited 8/15 (53.3%), whereas ballotable kidney was found in 3/15 (20%) cases and shock was present in only one patient (6.6%).

All patients had leucocytosis and three patients (20%) had thrombocytopenia. AKI was seen in 10/15 (67%) cases. Among them three (3/10) had AKI on chronic kidney disease (CKD) and five (5/10) had pure AKI at admission and two patients developed AKI during admission. Hyponatremia was present in 8/15 (53.33%) patients. Microbiologically *Escherichia coli* was the commonest organism cultured from urine and blood. Blood culture could not be performed in two cases as they were transferred from other department and already was on antibiotic. (Table I).

Ultrasonogram (USG) of abdomen was done in all cases. 9/15 (60%) was diagnosed as EPN by USG whereas CT scan of kidney, urinary bladder (KUB) region could be performed in twelve cases and diagnosed EPN. Right sided kidney was involved in eight cases (53.33%), left was in six cases (40%), bilateral involvement was detected in one (6.6%). According to Huang and Tseng classification patients were classified depending on CT scan finding (Figure 1).

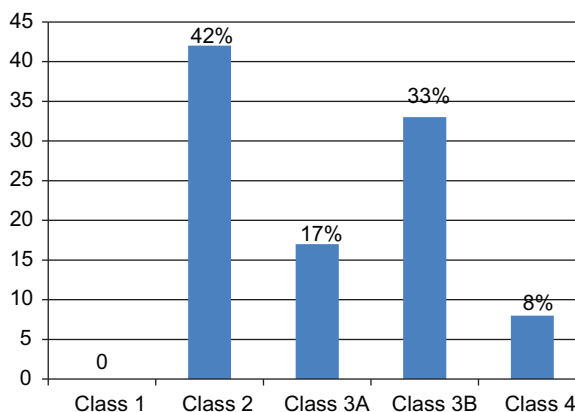


Figure 1 Classification of EPN cases according to Huang and Tseng

C/S		E.Coli	Pseudomonas	Mixed bacterial species	No growth
Urine	No(%)	11(73.33)	01(6.6)	01(6.6)	02 (13.33)
Blood	No(%)	02(15.38)	01(7.69)	00	10(76.92)

Most of our patients were treated conservatively. They were either put on injectable cephalosporine or carbapenam group empirically. Later on antibiotic was adjusted according to culture sensitivity report. Carbapenam was sensitive in all cases. Twelve cases were treated with antibiotic alone (80%) and three (20%) required additional surgical intervention i.e drainage of the abscess. (Figure 2) Among risk factors (altered sensorium 20%, thrombocytopenia 20%, shock at presentation 7%, AKI 67%) ≥ 2 factors were present in 27% cases and ≤ 2 risk factors were present in 73% cases. Open drainage was mostly done in patients having less than 2 risk factors.

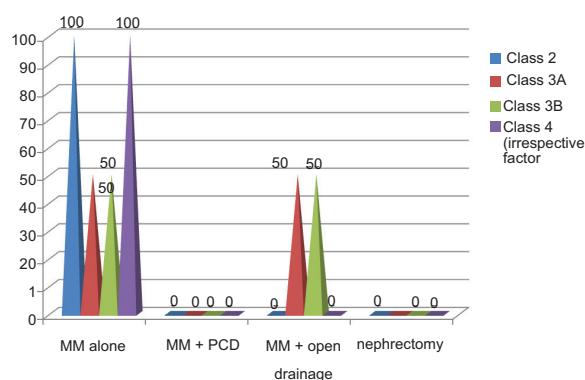


Figure 2 Management according to CT scan classification (MM=Medical management, PCD=Per cutaneous drainage)

The overall survival rate in our series was 93.33% (14/15) and survival rate of patients having ≥ 2 risk factors was 75%. No patient required nephrectomy. The patient who did not survive was in Class IV and was advised for nephrectomy. This patient was the only one who presented with shock, highest level of leucocyte count and hyponatremia with growth of pseudomonas in both blood and urine cultures. She was one of the two cases of our series with maximum age and longest duration of DM.

All survived patients were discharged after improvement both clinically and biochemically. Average stay at hospital was 20.2 ± 6.78 (38-7) days. All cases with pure AKI regained normal renal function. None of the patients needed any form of dialysis.

Discussion

EPN is much more common in females, with various studies reporting the female to male ratio ranging from

3:1 to 43:3.^{16,17} In our study too, majority of the patients were female. The increased occurrence in women is presumably because of their increased susceptibility to urinary tract infection.¹⁸ EPN is common in patients with DM, with up to 90% of them being diabetic.¹⁷ Occasionally, patients without DM but with obstruction of the corresponding reno ureteral unit may also develop EPN;¹⁶ however, we didn't get any case with obstructed uropathy and all our patients were diabetic.

Huang and Tseng have postulated that 4 factors are involved in the pathogenesis of EPN, which were gas forming bacteria, high tissue glucose level, impaired tissue perfusion, and a defective immune response.⁹ Hyperglycemia with impaired blood supply to the kidneys from vasculopathy are prevalent in diabetic patients- facilitates the process of anerobic metabolism.¹⁹ Furthermore leucocyte dysfunction seen in diabetic patients may contribute to the pathogenesis of EPN. All patients of our series had long standing DM with poor glycemic control supports this pathogenesis.

Patients with EPN usually present with nonspecific signs and symptoms such as fever, pain in flanks, abdomen, changes in mental status and even shock²⁰ as in our case, where fever with abdominal pain was the commonest finding.

EPN is mainly caused by *Escherichia coli* which is reported over 90% of cases as in our series and the rest attributed to other microbes such as *Proteus mirabilis*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Bacteroid fragilis*, *Aerobacter aerogenes*, *Candida albicans* and *Cryptococcus neoformans*. *E. coli* and *K. pneumoniae* infection in patients with DM and/or urinary obstruction are two etiologic factors in the development of EPN.²¹

As there are no sign or symptom pathognomonic of EPN, imaging is essential to diagnose EPN.²² The sensitivity and specificity of ultrasonography (USG) in EPN is low.²³ We could diagnose all cases with CT scan who could avail it but not with USG. According to Huang and Tseng 33.33% of the patients belonged to class 1 and 2 while 66.66% were in class 3 or 4 but majority of the patients of our series belonged to class 3 and class 2.⁹

Despite the morbidity and mortality associated with EPN, there is still controversy regarding its proper management. Shokier et al. and Ahlering et al. proposed

immediate nephrectomy following resuscitation of the patient.^{17,19} Huang and Tseng proposed the management protocol based on the radiological classification and presence of risk factors.⁹ They managed class 1 and 2 EPN with antibiotics along with percutaneous drainage or relief of obstruction while those with class 3 or 4 EPN were given a trial of conservative management, and nephrectomy was done in patients who had more than 2 risk factors for poor prognosis or in patients in whom conservative management failed. We managed almost all cases medically irrespective of number of risk factors and our survival rate was 93.33%.

Our study is limited by its design and small size, which limit the strength of statistical inference drawn from it.

Conclusion

DM is the commonest risk factor in developing EPN with poor glycemic status and *Escheria coli* is the commonest infective agent. CT scan is the investigation of choice. Conservative approach has become the focus of treatment modality with timely diagnosis of the disease.

Conflict of interest: Nothing to declare.

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