Double J stenting: A rewarding option in the management of emphysematous pyelonephritis

Debiprasad Das, Dilip Kumar Pal

Department of Urology, Institute of Post Graduate Medical Education and Research, Kolkata, West Bengal, India

INTRODUCTION

Emphysematous pyelonephritis (EPN) is an acute necrotizing inflammation of renal parenchyma and peri-nephric tissue characterized by gas formation. In this study, we evaluated the outcome of EPN cases by medical management with or without renal decompression.

MATERIALS AND METHODS

We collected the cases from admissions in our Department of Urology and referred from other departments such as...

Access this article online

Website:
www.urologyannals.com

DOI:
10.4103/0974-7796.184881

How to cite this article: Das D, Pal DK. Double J stenting: A rewarding option in the management of emphysematous pyelonephritis. Urol Ann 2016;8:261-4.

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Address for correspondence:
Prof. Dilip Kumar Pal, Department of Urology, Postgraduate Institute of Medical Education and Research, 244, AJC Bose Road, Kolkata - 700 020, West Bengal, India. E-mail: drdkpal@yahoo.co.in

Received: 13.10.2015, Accepted: 10.01.2016

How to cite this article:

Das D, Pal DK. Double J stenting: A rewarding option in the management of emphysematous pyelonephritis. Urol Ann 2016;8:261-4.
Nephrology or Internal Medicine. This is an observational prospective study conducted in the Department of Urology from August 2013 to August 2015.

For this study, only those cases were included who have radiological evidences of gases in renal parenchyma or in pelvicalyceal system [Figure 1], urinary bladder or in peri-nephric space.

Clinical profile, laboratory reports, microbiological study, and radiological study of all the patients were analyzed. All cases were managed aggressively by broad spectrum antibiotics (started empirically), glycemic control (target blood sugar is below 200 mg/dl), fluid and electrolyte management, and hemodialysis, if required. JJ stenting [Figure 2] and PCN decided by the response of conservative measures and stage of the disease as mentioned by Huang and Tseng,[5] but that was not delayed beyond 48 h. All cases are followed up for 2 months.

RESULTS

A total of 15 cases of EPN were included over 2-year period. Eleven were female and 4 were male patients [Table 1]. Age of the patients vary from 40 to 70 years (mean age is 55.66 years). Twelve patients were known diabetics (80%), and among diabetics, 3 had chronic kidney disease also. One patient was known stone disease which was stented and later on improved clinically by undergoing open ureterolithotomy. All 15 cases [Table 2] were having fever at presentation (100%) and 10 patients had loin pain (66%). Ten patients had tender renal angle (66%) and 6 had palpable renal lump (40%). One patient was in shock and altered sensorium at the time of presentation. Among 15 cases, 11 had left-sided disease (74%) and 4 (26%) had right-sided disease. According to computed tomography (CT) features, all patients were classified according to Huang and Tseng classification.[5] Three patients were in Class IIIB, 2 were in Class IIIA, 7 cases were in Class II, and 3 patients belonged to Class I. On blood examination, all patients have raised total leukocyte counts (18,000–25,000), two patients had thrombocytopenia (<40,000), and three patients had deranged renal function tests. On urine analysis, *Escherichia coli* isolated in eight patients (54%), *Klebsiella* in two patients, and *Pseudomonas* in one patient. Four cases had sterile urine. All patients are managed initially by aggressive medical therapy including broad spectrum antibiotic, glycemic control, fluid, and electrolyte management. Ten patients had undergone drainage procedures, among which 7 (46.6%) by JJ stenting and 4 (26.6%) by PCN. Rest 4 patients improved by only medical managements. All cases recovered well and discharged. The patients were followed up for 2 months. During the follow-up, all patients recovered well with respect to symptom improvement and renal function.

DISCUSSION

EPN is an acute necrotizing infection of the renal parenchyma or urinary system caused by gas-forming organisms such as *E. coli* and *Klebsiella*.[5] The first case of EPN was reported by Kelly and MacCullem in 1898.[6] The term of “EPN” was coined by Schultz and Klorfein in 1962.[7] EPN is commonly seen in diabetics and immunocompromised patients, with other risk factors such as intravenous drug users, neurogenic bladder, alcoholics, malnutrition cases, and in patients having some anatomical abnormalities in the urinary tract. However, diabetes is the single most predisposing factor. Nowadays, HIV infection is also emerging as a risk factor.[8]

The most common causative organism is *E. coli*. The other organisms are *Klebsiella*, proteus, coagulate negative

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**Figure 1**: Computed tomography scan showing left side Grade 3 emphysematous pyelonephritis

**Figure 2**: Cystoscopy showing pus coming out through the DJ stent
Staphylococcus aureus, and some anaerobes such as Clostridium septicum.\(^{(9)}\)

Pathogenesis is not still clear, but it is proposed that high tissue level of glucose with impaired blood supply facilitates the process of anaerobic metabolism of glucose and lactate by the microorganisms, leading to the production of gases such as carbon dioxide, nitrogen, hydrogen, oxygen, and methane. Thus, the factors involved in pathogenesis include high level of glucose within the tissues, the presence of gas-forming micro-organisms, impaired vascular supply, reduced host immunity, and the presence of an obstruction within the urinary tract.

Clinical presentation of EPN is similar to pyelonephritis such as fever, dysuria, nausea/vomiting, and flank pain. Fever is present in more than 80% of cases of EPN. On examination, loin tenderness is the common finding. Some cases may have palpable crepts in loin due to peri-nephric gas collection.

Laboratory findings include leukocytosis, azotemia, and hyperglycemia. Urine-analysis show pyuria and hematuria.

For diagnosis of the case, radiological evidence of gas is needed. Plain X-ray kidney ureter bladder may reveal mottled gas in renal area or crescent-like gas pattern in case of peri-nephric gas collection. Ultrasonography reveals strong focal echoes in the renal area. Interpretation of X-ray and ultrasonography for gas is difficult in obese patients and in the presence of bowel gases. CT scan or magnetic resonance imaging are the best modalities of choice for diagnosis.

Staging of EPN is done radiologically based on the extent of gas in the renal parenchyma and surrounding tissues. It might be useful for decision making and prognostication. Langston and Pfister suggested a classification on the basis of CT scans.\(^{(10)}\) which was later modified by Michaeli et al.\(^{(11)}\) They classified EPN into three classes:

- Class I: Gas in renal parenchyma or peri-nephric tissue
- Class II: Gas in the kidney and its surroundings
- Class III: Extension of gas through fascia or bilateral disease.

Wan et al.\(^{(1)}\) classified the gas collection as Type I or Type II, on the basis of CT scans.

- Type I: Renal necrosis with the presence of gas, but no fluid
- Type II: Parenchymal gas associated with fluid in renal parenchyma, peri-nephric space, or collecting system.

Mortality was 69% in patients with Type I EPN and only 18% in patients with Type II EPN. Similar mortality rates for Type I and Type II EPN were observed by Chen et al. Huang and Tseng\(^{(5)}\) also used CT to classify patients with EPN as follows:

| Table 1: Patient profile, management and outcome |
| Age (years)/sex | Co-morbidity | Huang grade | Urine CS | Antibiotics used/duration | Procedure | Outcome |
|-----------------|--------------|-------------|----------|---------------------------|-----------|---------|
| 46/female       | DM           | 2           | E. coli  | Pipzo/10 days              | DJ stenting| Recovered |
| 60/female       | DM           | 1           | E. coli  | Do                         | Medical management| Do |
| 52/male         | DM           | 3A          | E. coli  | Do                         | PCN       | Do |
| 70/female       | DM/CKD       | 2           | Sterile  | Do                         | DJ stenting| Do |
| 48/male         | No           | 1           | Sterile  | Do                         | Medical management| Do |
| 56/female       | DM/CKD       | 3B          | E. coli  | Do                         | PCN       | Do |
| 65/female       | No           | 3A          | Klebsiella| Do                         | DJ stenting| Do |
| 54/female       | DM           | 2           | E. coli  | Do                         | DJ stenting| Do |
| 76/male         | DM           | 2           | Pseudomonas| Do                         | DJ stenting| Do |
| 57/female       | DM           | 3B          | E. coli  | Do                         | PCN       | Do |
| 61/female       | DM/CKD       | 2           | E. coli  | Do                         | DJ stenting| Do |
| 58/female       | No           | 1           | Klebsiella| Do                         | Medical management| Do |
| 47/female       | DM/upper ureteric calculus | 2 | E. coli | Do | DJ stenting followed by open ureterolithotomy later-on | Do |
| 40/female       | DM           | 3A          | Sterile  | Do                         | Medical management| Do |
| 45/female       | DM           | 2           | Sterile  | Do                         | DJ stenting| Do |

DM: Diabetes mellitus, CKD: Chronic kidney disease, PCN: Percutaneous nephrostomy, E. coli: Escherichia coli, CS: Culture and sensitivity

| Table 2: Clinical features at presentation |
| Clinical features | n (%) |
|-------------------|-------|
| Sex               |       |
| Male              | 4 (26.7) |
| Female            | 11 (73.3) |
| Clinical presentation |     |
| Fever             | 15 (100) |
| Flank pain        | 10 (66.7) |
| Vague abdominal   |       |
| Discomfort        | 4 (26.7) |
| Nausea and vomiting | 8 (53.3) |
| Luts              | 3 (20.0) |
| Signs             |       |
| Renal angle       |       |
| Tenderness        | 10 (66.7) |
| Abdominal lump    | 6 (40.0) |
| Hypotension       | 1 (6.7) |
| Altered sensorium | 1 (6.7) |

Urology Annals | Jul - Sep 2016 | Vol 8 | Issue 3
• Class I: Gas in collecting system only
• Class II: Parenchymal gas only
• Class IIIA: Extension of gas into peri-nephric space
• Class IIIB: Extension of gas into paranephral space
• Class IV: EPN in solitary kidney, or bilateral disease.

The classification by Huang and Tseng\(^5\) is superior due to the better prognostic value and is also helpful in selecting a management protocol. In their study, Class I and II patients, all survived following treatment with percutaneous procedures and medical therapy. While in patients belonging to Class III or IV, those with fewer than two risk factors (i.e., thrombocytopenia, acute renal function impairment, disturbance of consciousness, and shock) had an 85% survival rate with percutaneous drainage and medical therapy, whereas patients of Class III or IV EPN and two or more risk factors had a 92% failure rate with percutaneous drainage and medical therapy.

Diagnosis of EPN is done by high clinical suspicion in cases of acute pyelonephritis and confirmed by radiological evidence of gas in renal parenchyma or collecting system or peri-nephric space.

Management includes medical management and drainage procedures. Medical management includes early use of broad-spectrum antibiotics empirically. Once the culture report is available, the antibiotics can be changed accordingly to glycemic control with insulin, correction of fluid and electrolyte imbalance, hemodialysis (if required). Drainage procedures are PCN and JJ stenting. There are several reports showing better outcome by conservative management.\(^{\text{12,13}}\)

The presence of bilateral disease, uncontrolled diabetes, thrombocytopenia, hypotension, altered sensorium, and impaired renal function are predictors of poor outcome and carry poor prognosis.

In our study, aggressive medical management was started and drainage procedure, if required, was done within 48 h. We prefer JJ stenting as the choice of drainage procedures as it can be done endoscopically and also less morbidity for the patients.

None of the patients in our series had >2 risk factors, thus necessity of emergent nephrectomy was not there. There was no Class IV EPN in our series.

CONCLUSION

Medical management and drainage procedure are sufficient for the management of EPN cases. Currently, the role of nephrectomy in EPN is minimal. Among the drainage procedure, JJ stenting in our study showed a good outcome. PCN was done in selected cases. As JJ stenting can be done under local anesthesia and has less morbidity for the patient without the need for of extra care, it was preferred over PCN. All patients in our study recovered well with medical management and drainage procedures. A combined team approach by a nephrologist, urologist, endocrinologist, and radiologist may be adopted for better outcome of this condition.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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