



THE ROLE OF MINIMALLY INVASIVE APPROACHES IN MANAGEMENT OF EMPHYSEMATOUS PYELONEPHRITIS

Urology

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ABSTRACT

Introduction & Objective: The Emphysematous pyelonephritis (EPN) is a serious life threatening, necrotising infection which can affect renal parenchyma, collecting system and nearby tissue with presence of gas within the renal system. Complication of acute sepsis results in a poor prognosis. This disease creates a urologic emergency. It needs special attention because of its life-threatening potential. Our objective is to study the role of minimally invasive approaches in the management of EPN in terms of earlier reduction of inflammatory markers, shorter convalescence period and shorter hospital stay. **Methods:** A prospective study conducted between minimally invasive approaches & conservative management as a treatment modality of patients with CT scan diagnosis of EPN was done with 15 patients in each group fulfilling the inclusion & exclusion criteria. Patients presenting to department of urology or referred to department of urology with EPN were evaluated with detailed clinical history, physical examination, Complete blood count, Renal Function Test (RFT), Urine Routine & Culture, Convalescence period, Duration of hospital stay. The data collected was compiled and analysed with SPSS software. **Result:** A total 30 patients with 15 in each group were evaluated. EPN is more common in females. Most common co morbid condition associated with is Diabetes Mellitus. In the minimally invasive approach group there is significant reduction of tenderness, fever, total leucocyte count, earlier than the conservative management arm. There is also reduced length of hospital stay. **Conclusion:** Medical management and minimally invasive drainage procedures are sufficient for the management of EPN cases. The outcome and results after Minimally Invasive therapies are better than those with medical therapy in cases of Emphysematous Pyelonephritis.

KEYWORDS

Emphysematous Pyelonephritis, DJ Stent, Percutaneous Drainage

INTRODUCTION

Emphysematous pyelonephritis was first coined by Schultz and Klorfein [1] and is applied when gas is formed and collected only in or around the kidney.[2] Necrotizing lesions in infected tissue in diabetic patients or those with an obstructive urinary tract, infection by Gas-forming bacteria which uses glucose as a substrate is EPN. Complication of acute sepsis results in a poor prognosis. This disease creates a urologic emergency.[3] Mortality with Emphysematous pyelonephritis vary from 7 to 75%.[4,5] It needs special attention because of its life-threatening potential.

Though it has generally been regarded as a rare infection, with the more extensive use of ultrasonography and computed tomography in the evaluation of patients with features of sepsis or complicated urinary tract infection (UTI), more cases of Emphysematous pyelonephritis (EPN) are being recognized. Huang et al believed that EPN is not rare and should be considered an important clinical entity.[6]

Earlier days, emphysematous pyelonephritis was managed by nephrectomy or open surgical drainage and appropriate antibiotics.[6] Fluoroscopic guided percutaneous drainage for the treatment of emphysematous pyelonephritis was first described by Hudson et al.[7] With the advent of image guided drainage procedures and endoscopic drainage procedures - PCD, endoscopic stenting and medical therapy consisting of intravenous antibiotics and glycemic control measures are often applied. This is a disease that most commonly affects diabetics- a systemic disease with proven hazardous effect over the other uninvolved kidney in the long run. Moreover, emphysematous pyelonephritis can be a bilateral problem in 10% and can affect solitary kidneys. Renal conservation becomes more preferable in more instances.

OBJECTIVE

To study the role of minimally invasive approaches in the management of EPN in terms of -

- Improvement in Serum Creatinine
- Earlier reduction of inflammatory markers
- Shorter convalescence period
- Less requirement of further procedure

MATERIALS AND METHODS

It is a prospective observational study of 1 year duration. Study

population being the patients admitted with CT scan proven Emphysematous Pyelonephritis in Department of Urology and Referred to Department of Urology, Govt. Medical College, Thiruvananthapuram.

Patients with clinical features suggestive of acute pyelonephritis without gas in the renal parenchyma, presence of history of recent endoscopic or open interventions in the urinary tract and recent history of catheterization are excluded from the study.

Patients who fulfilled the inclusion criteria were thoroughly counselled about the merits, drawbacks and possible complications of each method. The patients will be divided into 2 groups namely -

- Group 1 – patients treated by minimally invasive methods
- Group 2 – patients treated by Medical management – Antibiotics, glycemic control & symptomatic management

Patients were followed up during hospital stay and evaluated for various outcome parameters. We always took further necessary steps if the patient condition is deteriorating.

History and Clinical examination, X ray- KUB & USG- KUB, CT Scan – KUB, Blood Glucose level, Routine Blood, RFT (pre and post treatment), Convalescence Period and Further Procedures needed or not for treatment are recorded.

In minimally invasive therapy group we have performed -

- PCD along with DJ stenting in 4 (27%) of patients.
- Only DJ stenting in 11 (73%) patients.

RESULTS

We analysed the outcomes of 30 patients presenting with EPN during the period February, 2022 to February 2023 after they had been allocated to two treatment arms -

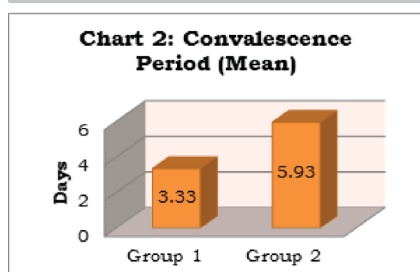
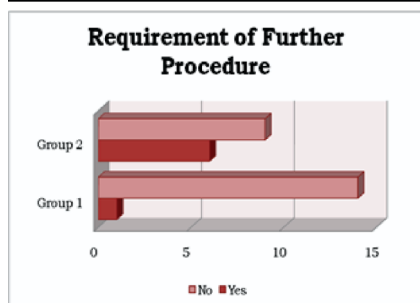
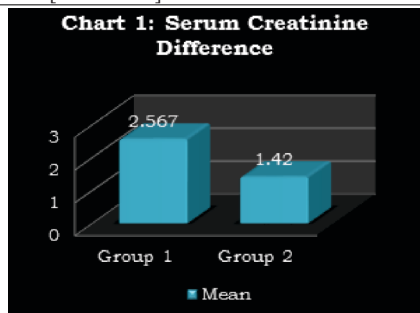
- Group 1 - Minimally Invasive Group – 15 cases
- Group 2 – Conservative Group – 15 cases

Table 1: Demographic & Clinical Factors

Variables	Group 1 (n=15)	Group 2 (n=15)	P- Value
Age (years)*	58.33 ± 7.12	53.73 ± 6.42	0.0736
Sex	Male=2; Female=13	Male=4; Female=11	0.6513
Laterality	Rt.=5; Lt.=9; B/L=1	Rt.=5; Lt.=8; B/L=2	0.8815
Diabetic Status	Yes=12; No=3	Yes=9; No=6	0.2320

Hemoglobin %*	10.740 ± 0.529	10.593 ± 0.809	0.5643
Urinary organisms	E. coli= 11; Klebsiella= 2; Proteus= 2	E. coli= 11; Klebsiella= 1; Proteus= 3	0.8635
CT Scan Grading	I=0; II=6; IIIA=5; IIIB= 4	I=3; II=7; IIIA=4; IIIB= 1	
Serum Creatinine (mg./dL)*			
Pre treatment	3.693 ± 1.668	3.520 ± 1.965	
Post treatment	1.127 ± 0.171	2.100 ± 0.146	
Difference	2.567 ± 1.538	1.420 ± 1.043	0.0239
Convalescence Period (days)*	3.33 ± 0.98	5.93 ± 3.53	0.0104
Need for further procedure	Yes=1; No=14	Yes=6; No=9	0.0309

*Expressed as [Mean ± SD]



DISCUSSION

Gas-producing infections account for a very small percentage of all bacterial infections of the urinary tract but they are important to recognize because of their life-threatening potential. The spectrum and differential diagnosis of gas producing infections include emphysematous pyelonephritis (EPN), emphysematous pyelitis, and emphysematous cystitis. These distinct clinical entities vary in clinical course, management, and prognosis.[8]

EPN is a rare but life-threatening acute suppurative infection of the kidney, characterized by production of gas within the renal parenchyma, collecting system, or perinephric tissues. One of the first case series of EPN was reported in 1898 by Kelly and Mac Callum, who described a number of patients suffering from gas in the urinary tract discovered either after the urinary bladder became distended with gas, or after direct observation of air bubbles emanating from the ureters during cystoscopic examination. These cases were described as 'pneumaturia', and were found to be caused by gas-forming bacterial infections of the kidney.[9]

In its most severe forms, EPN can lead to septic shock and multiple

organ failure, with a mortality rate of up to 30% in several case series. It occurs predominantly in diabetic patients (70–90%) and in patients with urinary tract obstruction, and much more commonly affects females than males by a 5–6:1 ratio. Less than 10% of cases involve both kidneys.[10-13]

While a few small series have reported that EPN was 6 times more common in females than in males [14-16], our study also shows female preponderance (80% female vs. 20% male). This is in agreement with the fact that urinary tract infections are more frequent in females. EPN usually presents in the fourth and fifth decades of life [11, 17, 18], but as seen in our series, it is most commonly seen in 6th decade of life.

In EPN, left kidney is more frequently involved than the right. A recent meta-analysis has reported that 52% of patients had left-sided, 37.7% right-sided, and 10.2% bilateral EPN.[19] Huang *et al.* have reported that 67, 25, and 8% of the 48 patients with EPN had left sided, right sided, and bilateral disease, respectively.[15] In our series, the left kidney was involved in 56.7% patients and the right kidney was involved in 33.3% patients. In the literature, bilateral EPN is reported to occur in up to 10% of patients.[20] In our series, also 10% of patients had bilateral EPN.

Analysis of causative pathogens revealed that *E. coli* was isolated in 22 of our 30 EPN cases (i.e. 70.33%), which was in agreement with previous reports which showed that this pathogen was responsible for nearly 70% of the reported cases [11,17].

The factors believed to underlie the pathogenesis of EPN include gas-forming bacteria, high tissue glucose concentrations, impaired tissue perfusion, and defective immune response which occurs in DM[21]. The high tissue glucose level acts as a substrate for the microorganisms such as *Enterobacteriaceae* to produce hydrogen (H₂) and carbon dioxide (CO₂) by mixed acid fermentation of glucose. In a study by Huang *et al.*, five of the six gas samples contained H₂ and all the gas samples contained CO₂. [15] 70% of our patients had DM.

Ahlering *et al*[22], Pontin *et al*[10] and Shokeir *et al*[13] had concluded that vigorous resuscitation and appropriate medical treatment should be attempted, but immediate nephrectomy should not be delayed for successful management of EPN. However, successful treatment of EPN using percutaneous catheter drainage (PCD) and antibiotic treatment has also been reported[23-25].

The derangement of renal parameters was the most commonly noted laboratory finding. The trend of serum creatinine rise/fall was studied and was taken as a variable to be included in our study. The trend was found to be statistically significant and was similar to the results of Wie *et al.*[26]

Shorter convalescence period was reported in minimally invasive management group in our study as seen in previous study by Shaikh *et al.*[27]

Limitations of the study:

Being a tertiary care referral hospital, many such patients were admitted in a critical stage, necessitating an early intervention. If the number of patients in each group was higher, interpretation of the data would have had much more relevance.

CONCLUSION

Our study demonstrates that Minimally Invasive Procedures provide more significant improvement in various parameters like Serum Creatinine, Earlier normalisation of blood parameters, earlier convalescence period when compared to medical therapy in patients with CT scan diagnosed Emphysematous Pyelonephritis.

Thus, the outcome and results after Minimally Invasive therapies are better than those with medical therapy in cases of Emphysematous Pyelonephritis.

Conflict Of Interest

None

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