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A CASE SERIES ON EMPHYSEMATOUS PYELONEPHRITIS FROM WESTERN INDIA

Urology

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ABSTRACT

Emphysematous Pyelonephritis (EPN) is an uncommon infection characterized by gas in the renal system and parenchyma and surrounding tissues. It is rapidly progressive, life-threatening infection requiring appropriate therapy to save the infected kidney. It has low incidence but high mortality (15-20%). The goal is to report our case series on emphysematous pyelonephritis and review literature about this entity to improve its management. Our case series presents 17 patients admitted in our institute from 2022-24 between the age of 40-90 years with a clinical, laboratory, microbiological and radiological diagnosis of EPN. At our institute early goal directed therapy with antibiotics + emergency drainage of the system & collections along with diabetes control, supportive treatment and monitoring is followed. We use an antibiotic regimen of Inj Meropenam + Inj Linezolid (renal adjustment if needed) with urologic interventions like ureteral stenting or percutaneous nephrostomy and drainage of perinephric or affected parenchymal gas with pigtail (when required) in an attempt to avoid nephrectomy and save the kidney. Nephrectomy was done for advanced disease and if the above management was not feasible. EPN was diagnosed in 76.5% patients with uncontrolled diabetes and 70.6% patients were women. The commonest presentations were fever (53%), flank pain (35.3%), oliguria (29.4%) and generalised weakness (47%). Most common organism was E.coli (53%). EPN was graded according to Huang Tseng classification with Grade>=2 in 41.1% patients. Presence of calculus as the cause was found in 35.3%. Creatinine was raised in 76.4% with dialysis needed preoperatively in 53% patients. Nephrectomy was needed in 2 patients (11.7 %). Early goal directed therapy for sepsis coupled with interventional urologic procedures is a valuable alternative to emergent nephrectomy, except in cases where a fulminant infection may be present despite conservative line of management.

KEYWORDS

emphysematous pyelonephritis, minimally invasive management, new classification, diabetes

INTRODUCTION

Emphysematous Pyelonephritis (EPN) is a rare clinical condition characterized by the presence of gas in the renal system, most often to the parenchyma, but also extending to surrounding perinephric tissues. It is caused by gas forming organisms, most commonly Escherichia coli (E. coli), in addition to Klebsiella, Clostridium, Candida, Aspergillus, Cryptococcus an Amoeba[1].

Shultz and Klorfien originally described the clinical entity in 1962, although there is evidence that the medical field has knowledge of this in the late 1800[2]. Although the clinical presentation of EPN is similar to uncomplicated pyelonephritis, it is a much more aggressive disease with high morbidity and mortality with estimates as high as 90%[3]. Huang and Tseng have described a large case series involving 48 patients with EPN which showed that with different modalities the overall mortality was 18.8%[2].

The pathogenesis of this disease is thought to involve many different predisposing factors including high tissue glucose concentrations, presence of gas forming organisms, impaired vascular supply, impaired immune system and ureteral obstruction[4].

The aim of this case series is to add to current literature by providing information regarding our experience in diagnosing and managing EPN at our institution

Case Series Description And Methods

My prospective case series presents 17 patients, between the ages of 40-90 years, admitted at my institute; MGM medical college and hospital, a tertiary care hospital in the outskirts of Mumbai, from 2022-24 with a clinical, laboratory, microbiological and radiological diagnosis of EPN.

Patients were selected based on the CT findings suggestive of EPN and fulfilling study criteria.

The CT guided patient selection was based on the Huang Tseng classification[2], which was as follows:

Grade 1 – gas in the pelvi-calyceal system,
Grade 2 - gas involving parenchyma,
Grade 3 A/B - gas in peri/ paranephric space,
Grade 4- bilateral gas or gas in solitary kidney.

At our institute early goal directed therapy with antibiotics + emergency drainage of the system & collections along with diabetes control, supportive treatment and monitoring is followed. We use an antibiotic regimen of Inj Meropenam + Inj Linezolid (renal adjustment if needed) with urologic interventions like ureteral stenting or percutaneous nephrostomy and drainage of perinephric or affected parenchymal gas with pigtail (when required) in an attempt to avoid nephrectomy and save the kidney. Nephrectomy was done for advanced disease and if the above management was not feasible.

Type of urological intervention for grade >=2 was decided based on our institutional grading system which relied on amount of gas and the cortical integrity on CT

As per Kutikov et al[5], the R.E.N.A.L score – (L) lines are drawn when the parenchyma is disturbed by renal vessels or PCS in the coronal plane. Similarly, gas involving regions -
<1/3rd - above or below the lines
1/3rd – 2/3rd – if it crosses the lines
>2/3rd - if it crosses both lines.

If <1/3 or 1/3rd to 2/3 rd involvement and cortical integrity is intact - minimally invasive with ureteral stenting (PCN if required for collections).

If >2/3rd involvement was present, then nephrectomy was planned.

Special Points –

1. Multiple small gas pockets were present in different poles, a trial of antibiotics and stenting was done, in cases of nonresolution, targeted PCN insertion was done.
2. Parenchymal gas between two lines was treated as <1/3rd unlike R.E.N.A.L score.

RESULTS

Table No. 1 : Post operative fall in creatinine with p value comparison

CT grade >=2 (Huang Tseng)	Post op creatinine drop (AFTER 2 WEEKS) - Mean +/- SD
41.1% [7]	2.813 +/- 3.533
CT grade	Post op creatinine drop (AFTER 2 WEEKS)

	Mean +/- SD
<1/3rd [3]	2.31 +/- 3.088
1/3rd to 2/3rd [2]	1.5 +/- 1.93
>2/3rd [2]	4.82 +/- 6.33
Parameter	P value (drop in creat with our grading vs huang tseng)
<1/3rd vs overall	0.8369
1/3rd-2/3rd vs overall	0.64
>2/3rd vs overall	0.56

Table No. 2 : Parameters

Parameter	EPN %
Diabetes mellitus	76.5%
Female	70.6%
Fever	53%
Flank pain	35.3%
Oliguria	29.4%
Generalised weakness	47%
E.Coli	53%
EPN grade >=2	41.1%
Calculus as cause	35.3%
Raised Creat >2.5	64.7%
Dialysis needed preop	53%
Nephrectomy	11.7%

Table No. 3 : P-value For Symptoms

Parameter	Hospital Stay (Mean +/- SD)	P value
Age<60	10.5 +/- 2.99	0.6621
Age>=60	9.86 +/- 2.794	
Male	9.4 +/- 1.816	0.45
Female	10.58 +/- 3.175	
Diabetics	11.307 +/- 2.175	0.0017
Non diabetics	6.75 +/- 1.708	
Grade <2	10 +/- 2.981	0.6973
Grade>=2	10.57 +/- 2.819	
E.Coli	10.89 +/- 2.759	0.329
Non e.coli	9.5 +/- 2.928	
Preop Creat < 2.5	11.16 +/- 1.835	0.337

EPN was diagnosed in 76.5% patients with uncontrolled diabetes and 70.6% patients were women. The commonest presentations were fever (53%), flank pain (35.3%), oliguria (29.4%) and generalised weakness (47%). Most common organism was E.coli (53%). EPN was graded according to Huang Tseng classification with Grade>=2 in 41.1% patients. Presence of calculus as the cause was found in 35.3%. Creatinine was raised in 64.7% with dialysis needed preoperatively in 53% patients. Nephrectomy was needed in 2 patients (11.7%).

In this study operative intervention was undertaken for patients with grade >=2, which were 7 patients. Out of which 3 had less than 1/3rd involvement, 2 had between 1/3rd to 2/3rd involvement and 2 had >2/3rd involvement.

Post operative creatinine drop after 2 weeks was used as a measure of treatment. In patients with <1/3rd involvement, the post operative creatinine drop after 2 weeks was 2.31+/- 3.088 (mean +/- SD), while those with 1/3rd to2/3rd involvement had 1.5+/- 1.93 and those with >2/3rd involvement had a drop of 4.82+/- 6.33.

The average creatinine drop 2 weeks post op of all patients with >=2 grade to 2.813+/- 3.533. The P values of <1/3rd vs overall was 0.8369, 1/3rd – 2/3rd vs overall was 0.64 and >2/3rd vs overall was 0.56 which was not significant

The hospital stay of patients below 60 years of age (10.5+/- 2.99) was actually more than those above 60 years of age (9.86 +/- 2.794); with a P value of 0.6621. Females had a longer hospital stay (10.58 +/- 3.175) as compared to males (9.4+/-1.816) with a P value of 0.45. The most significant factor according to this study in relation to hospital stay was seen in diabetic patients as compared to non diabetics, with a hospital stay of 11.307 +/- 2.175 in diabetics as compared to 6.75+/- 1.708 with a P value of 0.0017. The hospital stay of grade <2 as compared to >=2 was surprisingly similar with grade <2 having a hospital stay of 10+/- 2.981 days as compared to 10.57+/- 2.819 in grade >=2; with a P value of 0.6973. Patients with E.coli vs non E.coli infection had similar hospital stay of 1089+/-2.759 and 9.5 +/- 2.928, with a P value of 0.329. Pre op creatinine had minimal effect on hospital stay with pre op creatinine <2.5 having hospital stay of 11.16+/-1.835 days while those with pre op creatinine >2.5 had a hospital stay of 9.73+/- 3.228 with a p value of 0.337.

DISCUSSION

Initially, the only accepted management option was radical nephrectomy, with mortality rates being as high as 80 %; however, therapeutic strategies are currently diverse depending on the severity of the presentation, and mortality in general has decreased to 21 %[6].

The recent trend in management is along the lines of conservative treatment or a minimally invasive one, probably due to advent of newer highly effective antibiotics, better imaging and early diagnosis, superior supportive care and a set of prognostic factors available to base our treatment on[7].

Table No. 4 - Discussion

Parameter	Other study	My study
Post op fall in creatinine or recover in kidney function	AR el nahas et al – recovery of clearance >5% on Tc MAG3 scan[8]	Post op fall in creatinine more with <1/3rd vs 1/3rd - 2/3rd Involvement of parenchymal gas i.e. 2.31 vs 1.5, but not significant
	Khaira et al- mean creat 1.86 +/- 0.45[9]	
Parameter	Other study	My study
Female at risk	Micaheli and Perlberg- 2:1[10] Pontin et al - 3.:1 [11] Shokier et al - 43:3 [12] Alaparthi et al – 50% [13]	70.6%
Diabetes mellitus	Pontin et al – 90% [11] Alaparthi et al – 91.6% [13] Eswarappa et al - 98% [14] Aboumarzouk et al – 85% [15]	76.5%
Obstruction due to calculi	Alaparthi et al – 41.6% [13] Eswarappa et al - 7.84 [14]	35.3%
E.coli	Alaparthi et al – 83.4% [13] Eswarappa et al -37.2%[14]	53%
Creat > 2.5	Alaparti et al - 66.6% [13]	64.7%
PCN for emphysematous PN survival rates	Hudson et al – 90% [16]	94.11%
Mortality rates	Somani et al [6]–medical with 1. PCN 13.5% vs 2. Nephrectomy – 25% Aboumarzouk et al – odd ratio of 3.13 for PCN vs nephrectomy [15]	5.8%

Early intervention by placement of intraureteric stenting with or without percutaneous nephrostomy drainage could account for the lower mortality rate in our study[12]

A systematic review of 10 retrospective studies showed mortality associated with medical management plus percutaneous drainage (13.5%) was significantly lower than medical management plus emergency nephrectomy (25%)[6].

CONCLUSIONS

In conclusion, we must know that EPN, although rare, is a life threatening disease commonly seen in diabetic females. CT is essential for diagnosis.

In our study, we tried to use a new method of grading EPN according to the volume of parenchymal gas in each pole, the cortical integrity of the kidney and planned our minimally invasive procedures accordingly.

The fall in creatinine was more in <1/3rd than 1/3rd -2/3rd Hospital stay increased significantly among diabetics and was increased in females, with grade >=2 and E.coli as the organism but was not statistically significant Factors not in our favour was the sample size

Conflict Of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper

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