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Feasibility and safety of laparoscopic nephrectomy in emphysematous pyelonephritic kidneys

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ABSTRACT

Background: Emphysematous pyelonephritis (EPN) is a serious suppurative infection of renal and extrarenal tissues. Most of them end up in nephrectomy, either in an emergency setting or delayed, which is increasingly favored. Laparoscopic nephrectomy is difficult in the post-EPN state due to dense adhesion around the kidney. **Aims and Objectives:** In this study, we want to check the feasibility of laparoscopic nephrectomy in EPN kidneys. To the best of our knowledge, our series is the single largest series as of today with 10 cases of laparoscopic nephrectomies in EPN kidneys. **Materials and Methods:** All patients of EPN who underwent laparoscopic nephrectomy at Institute of Kidney Diseases and Research Centre, Ahmedabad, between December 2017 and October 2019 were taken as study subjects and retrospectively reviewed. Patients in whom conservative management was successful were excluded from the study. All patients were diverted initially, either ultrasound/computed tomography-guided percutaneous nephrostomy (PCN) insertion or double J stenting, with or without PCN along with antibiotics and supportive therapy. Delayed transperitoneal laparoscopic nephrectomies were performed for poorly functioning EPN kidneys in follow-up renal scans. **Results:** A total of 10 patients underwent nephrectomy in this period. The male-to-female ratio was 3:7. As per Huang and Tseng's EPN classification, one patient had Class 2, four patients had Class 3a, and five patients had Class 3b EPN disease. Mean operative time was 192 min and mean blood loss was 206 ml. Two cases had intraoperative complications managed laparoscopically. No conversion to open nephrectomy or mortality was seen. The drain was placed for a mean period of 3.1 days. The mean hospital stay was 4.8 days. **Conclusion:** Laparoscopy is safe and feasible for nephrectomy in EPN kidneys. Experience with laparoscopy and operating on pyelonephritis cases is important to reduce complications and extend the advantages of laparoscopy in these groups of patients. An increase in class does not increase the degree of difficulty during laparoscopy.

Key words: Emphysematous pyelonephritis; Laparoscopy; Nephrectomy

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INTRODUCTION

Emphysematous pyelonephritis (EPN) is an acute, severe, necrotizing, bacterial infection of the renal parenchyma and surrounding tissues, with gas in the renal parenchyma, collecting system or perinephric tissue.[1] It is potentially life threatening and early recognition and treatment are the keys to reducing mortality. EPN has higher mortality than emphysematous pyelitis, which is gas in the collecting system only[2] and has a good prognosis with medical management. Previously, most EPN cases were subjected to emergency nephrectomy. However, in recent years, there is a body of literature suggesting a change in the management of EPN cases, which includes stabilization

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of the patient with antibiotics, hemodynamic management, and diversion in the form of percutaneous nephrostomy (PCN), double J (DJ) stent, and percutaneous drain (PCD).[3-5] The decision of nephrectomy or salvaging the renal unit is usually taken during re-evaluation after 2–3 weeks. This change of management is preferred as it decreased the mortality and morbidity rates as compared to emergency nephrectomy.[4,5] Once the decision of nephrectomy is taken, these cases were subjected to an open surgical approach of nephrectomy in most of the centers due to the assumption of dense perirenal adhesion after EPN. Laparoscopic surgical approach for nephrectomy is the standard of care for benign disease of kidney, transplant donor nephrectomies, and low stage cancers. Only few case reports have been published for laparoscopic nephrectomy in EPN kidney. In this article, we are sharing our experiences of performing laparoscopic nephrectomy in post-EPN patients and assessing its safety and feasibility in EPN kidneys. To the best of our knowledge, this study represents the first large case series of 10 cases of EPN kidney, successfully treated by laparoscopic nephrectomy.

Aims and objectives

The aim of our study was to assess the feasibility of laparoscopic nephrectomy in emphysematous pyelonephritis kidney. To determine this, we analyzed the success rate of laparoscopic nephrectomy without converting it to open nephrectomy. We also checked the complications reported during the para operative period.

MATERIALS AND METHODS

All patients of EPN who underwent laparoscopic nephrectomy at Institute of Kidney Disease and Research Centre, Ahmedabad, India, between December 2017 and October 2019 were taken as study subjects and retrospectively reviewed. Ethical committee approval was obtained for this study. Patients in whom conservative management was successful and not subjected to nephrectomy were excluded from the study. Patients with single kidneys with EPN were also excluded from the study. All EPN patients were stabilized with necessary resuscitative measures, given IV broad-spectrum antibiotics and supportive care. All patients were initially diverted in the form of either ultrasound/computed tomography (CT)-guided PCN insertion or DJ stenting, with or without PCD placement. The renal nuclear scan was performed on all EPN patients after 3 weeks intervals to access the renal function status of the EPN kidney. Laparoscopic nephrectomies were performed in all EPN kidneys with less than 15% function, after obtaining informed consent.

Technique of laparoscopic nephrectomy: Pneumoperitoneum was established by the Veress needle technique and ports were placed in the configuration like any other nephrectomy, additional ports were placed as and when required. Cold scissors were used for bowel mobilization using sharp and blunt dissection. Perihilar lymphatics were divided by scissors and monopolar cautery and vessels were controlled by Weck and Hem-o-lok clips and divided. The kidney was mobilized all around with monopolar cautery, especially at the site of percutaneous tubes. Kidneys were bagged and a thorough wash with saline and amikacin was given in all cases. A wide bore drain was placed into the renal fossa and kidneys were removed by the technique of morcellation through the camera port site by slightly extending the incision.

RESULTS

As per our hospital records, 10 patients of EPN underwent laparoscopic nephrectomy between December 2017 and October 2019. The clinical profile of all patients is illustrated in Table 1. The male versus female ratio was 3:7. The mean age was 50.5 years. Eight patients were diabetic while seven had renal stone disease. Five patients had both renal stones disease and diabetes. One patient had a recent history of endoscopic instrumentation (Table 1). Based on Huang and Tseng's CT scan-based classification (Class 1 gas in pcs, Class 2 gas in the parenchyma, Class 3a gas in perinephric space, Class 3b perinephric collections, and Class 4 gas in both kidneys or solitary kidney), one patient was of Class 2, four belong to Class 3a, and five belong to Class 3b EPN (Figures 1 and 2). Three patients, one of 3a and two of 3b, were in the high-risk class (Huang and Tseng risk stratification) with thrombocytopenia, and acute kidney failure, and one patient was reported in shock.

All 10 patients were managed by diversion procedure initially through DJ stenting in four patients and ultrasound/CT-guided PCN tube insertion in the rest of six patients. Additional PCD was placed in six patients for whom there was perinephric collection.

The poor functioning status of the EPN kidney was assessed by renal scan in all 10 patients and patients were subjected to transperitoneal laparoscopic nephrectomy under general anesthesia. No patient was planned for open nephrectomy nor any laparoscopic nephrectomy was converted to an open procedure intraoperatively.

All patients were successfully nephrectomized laparoscopically. The mean operative time was 192 min. The mean blood loss was 206 ml. There were two

Table 1: Demographic details and intraoperative details

S. No.	Age	Sex	Stone	Diabetes	Class	Operative time in min	Blood loss in ml	Intraoperative injury	Drain removed in days	Hospital stay
1	52	M	Yes	Yes	3A	210	200	No	3	5
2	56	F	No	Yes	2	190	180	Vascular	4	6
3	39	M	Yes	No	3B	180	160	No	2	5
4	47	M	Yes	Yes	3B	200	180	No	3	4
5	37	F	Yes	No	3A	150	400	No	3	5
6	49	F	No	Yes	3A	225	220	Serosal tear	5	6
7	51	F	Yes	Yes	3B	195	150	No	3	4
8	59	F	No	Yes	3B	220	200	No	2	4
9	54	F	Yes	Yes	3A	170	140	No	4	5
10	61	F	Yes	Yes	3B	180	230	No	2	4
Mean	50.5					192	206		3.1	4.8

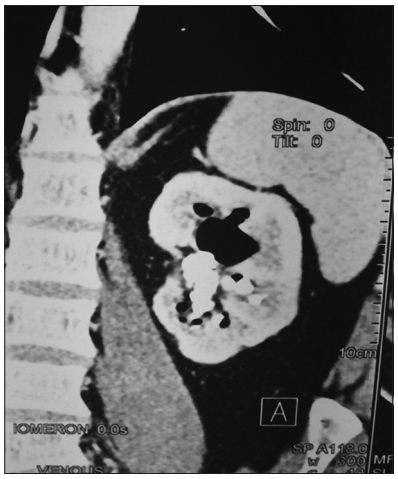

Figure 1: Computed tomography scan picture of a left kidney showing stone in renal pelvis and gas in the pelvicalyceal system extending into the parenchyma

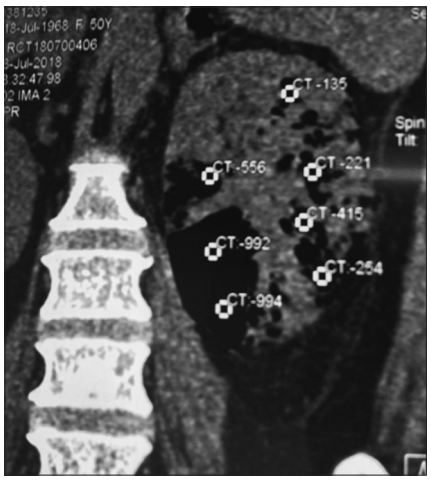

Figure 2: Computed tomography scan showing gas in the pelvicalyceal system and parenchyma with perinephric collection

injuries reported during laparoscopic surgery. First was a small injury to the left renal artery, which was managed laparoscopically with a hem-o-lok clip, that patient required blood transfusion postoperatively. Another had serosal injury of ascending colon, where Vicryl sutures were taken laparoscopically. The drain was placed in all cases, mean duration for drain removal was 3.1 days. All patients were given broad-spectrum antibiotics perioperatively. The mean period for discharge was 4.8 days. No further complications were reported in subsequent follow-ups.

DISCUSSION

Pneumaturia secondary to a gas-forming renal infection was first described by Kelly and MacCallum[1] in 1898 but the term EPN was coined by Schultz and Korfein in 1962.[2] EPN is an acute, severe, necrotizing, bacterial infection of the renal parenchyma and surrounding tissues, with gas in the renal parenchyma, collecting system, or perinephric tissue, EPN most often occurs in persons with diabetes mellitus, especially women. Its presentation is similar to that of acute pyelonephritis, but EPN often has a fulminating course and can be fatal if not recognized and treated promptly.

Although historically, EPN has had very high mortality with mortality rates up to 78% before the 1970s, this has been lower in more recent studies, improving to approximately 40–50%.[5,6] The best survival rates were Kapoor et al.,[7] in 2010 who reported a survival rate of 87% with kidneys salvaged at 67%.

In a recent meta-analysis, Desai et al., reported a 26% mortality rate in patients who had upfront emergency nephrectomy in EPN.[8] In yesteryears, emergency nephrectomy used to be the choice of treatment. Percutaneous nephrostomy for EPN was initially described in 1986 by Hudson.[9] Since then, percutaneous nephrostomy and antibiotics have been suggested to be the initial therapy of choice for EPN. This technique has demonstrated variable success rates. Somani et al., reported that early nephrectomy has been associated with increased mortality in comparison to medical management and PCN, 25% (16/64) to 13.5% (16/118), respectively.[5] In some

cases, a PCN had completely drained the collection but the delayed nephrectomies were performed for non-functioning kidneys or staghorn calculi.[6,10] Even though nephrectomy may be required in many patients of EPN, an emergency nephrectomy is rarely performed, and delayed nephrectomies are increasingly used in elective settings after the optimization of the patient. Huang and Tseng et al., suggested immediate nephrectomy in high-risk Class 3a/3b. High risk was defined as having ≥2 risk factors (thrombocytopenia, acute renal failure, disturbance of consciousness, or shock). This classification system also suggested nephrectomy where initial management (PCN and antibiotics) had failed.[4] In our series, even though we had three patients in the high-risk group, all of them responded nicely to our initial conservative management, hereby they all underwent delayed nephrectomy. The indication for delayed nephrectomy in our series was poorly functioning kidneys (<15%) on renal scan after 3 weeks. There was no mortality seen in our series.

Nephrectomy even in the delayed setting is performed by open means in many centers. However, there were some recent case reports where laparoscopy was used for performing nephrectomy. The first laparoscopic nephrectomy for EPN was reported by Bauman in 2005.[10] Demirtas et al., reported a case where an abscess was drained by retroperitoneoscopic technique in EPN and ultimately salvaged the kidney.[11] The length of stay in laparoscopic nephrectomy for EPN has been reported as shorter than both open nephrectomy and treatment with PCN and antibiotics.[12] The median stay after nephrectomy in our series was 4.8 days. We did not find any correlation between the degrees of difficulty as the class increases based on the CT scan.

IKDRC, Ahmedabad, is the biggest urology center in West India, where laparoscopic urological surgeries are performed on daily basis, all donor nephrectomies, simple nephrectomies, and most the radical nephrectomies were regularly conducted by laparoscopic approach. Due to good experience and a high volume of laparoscopic surgeries, urologists are now performing nephrectomy even in EPN kidneys by laparoscopic approach. They can easily manage most of the complications laparoscopically without converting to an open surgical approach. In the present series, we have recorded only two complications while performing laparoscopic nephrectomy, which were managed easily in the laparoscopic approach, without converting to an open surgical approach.

To the best of our knowledge, our series is the single largest series as of today with 10 cases of laparoscopic nephrectomies in EPN kidneys from a single center.

Limitations of the study

The limitation of our study was retrospective design and the small number of patients because of emphysematous pyelonephritis being an uncommon disease.

CONCLUSION

Laparoscopy is safe and feasible approach for nephrectomy in EPN kidneys. Experience with laparoscopy and experience in operating pyelonephritic cases are very important to reduce complications and extend the benefits of laparoscopy in EPN patients.

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