

Laparoscopic nephrectomy for emphysematous pyelonephritis

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Emphysematous pyelonephritis is a serious suppurative infection of the renal and extrarenal tissues. Controversies exist surrounding the appropriate management of this life-threatening condition with advocates for both medical management alone and percutaneous drainage combined with nephrectomy.

The laparoscopic approach for nephrectomy is quickly becoming the standard of care for benign disease of the

kidney and low-stage renal cancers. We report a case of a 60-year-old diabetic male undergoing successful laparoscopic nephrectomy for right emphysematous pyelonephritis, and our procedural technique. To our knowledge, this is the first report of laparoscopic nephrectomy in the setting of emphysematous pyelonephritis.

Carefully selected patients with emphysematous pyelonephritis may benefit from the advantages of laparoscopic nephrectomy in centers with sufficient laparoscopic experience.

Key Words: emphysematous pyelonephritis, laparoscopy

Introduction

Emphysematous pyelonephritis is a life-threatening suppurative infection of the renal parenchyma and extra-renal tissues by gas forming uropathogens. The majority of patients are diabetics, and present in acute

sepsis. Herein, we present a case of a 60-year-old diabetic male undergoing successful transperitoneal laparoscopic nephrectomy for right emphysematous pyelonephritis, with discharge on post-operative day 4. We discuss our operative technique, and review this uncommon condition while considering current management controversies.

Case and technique

A 60-year-old type II diabetic male was admitted in February 2005 with a 4-day history of vomiting, flank pain, hematuria, urinary frequency and fever of

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Figure 1. Along the right flank multiple curvilinear lucencies are noted consistent with gas collection in the retroperitoneal space. The right psoas margin is obscured.

38.0°C. Pertinent laboratory values demonstrated Na⁺ of 127 mmol/L, and an initial blood glucose of 51.6 mmol/L. Creatinine was elevated at 176 µmol/L, urea elevated at 16.3 mmol/L. The patient had a mild leukocytosis of 11.4 with normal levels of hemoglobin and platelets.

A plain chest x-ray demonstrated mild elevation of the right hemidiaphragm with right lower lobe atelectasis. A plain abdominal film demonstrated multiple curvilinear lucencies in the right flank with an obscured right psoas margin, Figure 1. Renal ultrasound (U/S) demonstrated shadowing

hyperechoic foci within the right renal fossa consistent with air, and a normal left kidney, Figure 2.

The patient was admitted to the internal medicine service with a diagnosis of pyelonephritis. With fluid repletion and IV antibiotics, the patient defervesced after 24 hours with normalization of renal function and electrolyte status. Apart from persistent tachycardia at 110 beats-per-minute, and a leukocytosis increasing to 17.7 on post-admission day 6, the patient was stable with good general appearance. A CT scan of the abdomen and pelvis with IV contrast was obtained the following day which demonstrated findings consistent with right



Figure 2. The right kidney cannot be visualized well: it is obscured by shadowing hyperechoic foci within the right renal fossa consistent with air.

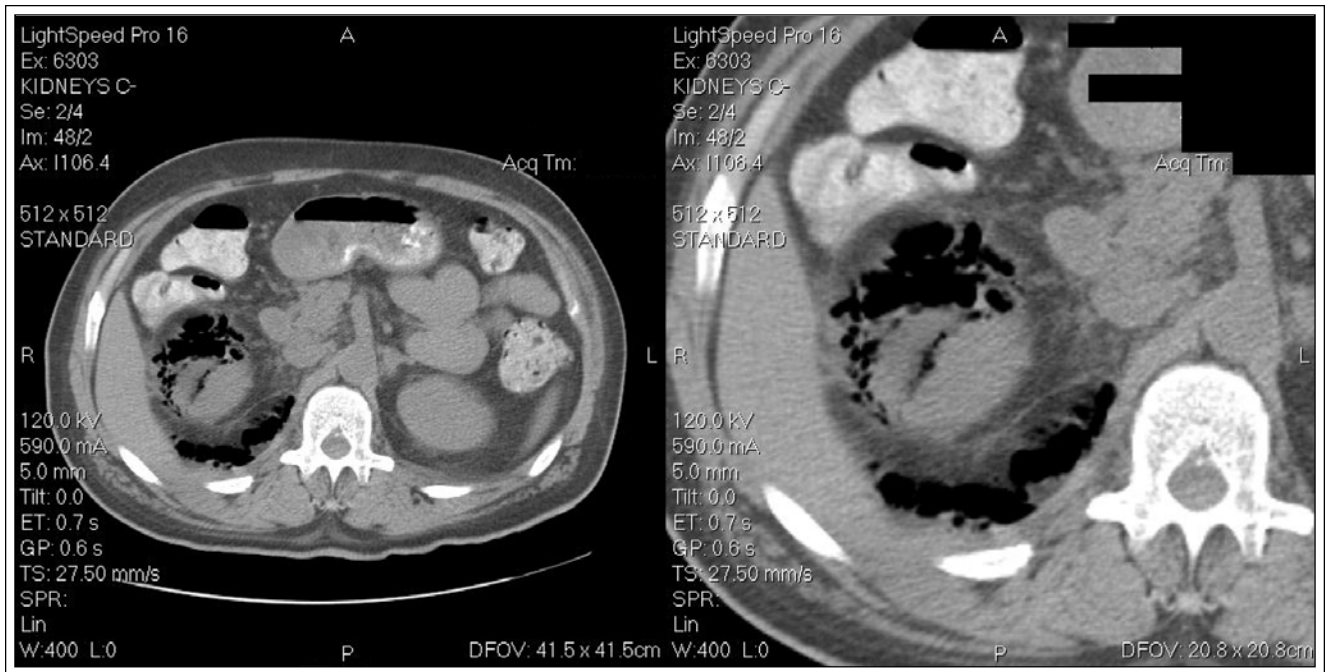


Figure 3. Enlargement of the right kidney with loculated gas of the anterior right kidney. Note extension of collection into right psoas muscle.

emphysematous pyelonephritis, Figure 3. A urology consultation was obtained at this time and urgent operative intervention was strongly considered. However, we elected for conservative management as the patient remained clinically and hemodynamically stable.

The patient was observed on IV antibiotics and remained afebrile, but with persistent mild right flank and abdominal pain. An unenhanced CT scan was obtained on post-admission day 10, which demonstrated persistence of emphysematous pyelonephritis, with no significant deterioration. A lasix renogram was obtained which demonstrated no function of the right kidney and normal lasix response of the left.

The patient was taken to the OR undergoing a right transperitoneal laparoscopic nephrectomy via placement of two 10 mm ports and two 5 mm ports. Pertinent intra-operative findings included an enlarged right kidney with fibrotic adherence to the second part of the duodenum and ascending colon. Tissue planes were difficult to discern, and despite meticulous dissection a small serosal tear of the ascending colon was created. This was repaired primarily by intracorporeal suturing. The hilar artery and vein were then separately controlled with an Endo-GIA stapler (® Ethicon). A perinephric abscess cavity was entered during dissection and purulence

was suctioned with minimal spillage into the abdominal cavity. The nephrectomy was completed successfully with retrieval of the specimen in an Endo-Catch bag (® Autosuture) via fascial extension of the inferior port. Figure 4 shows the operative specimen bisected on the back bench. A drain was not placed given the clean appearance of the operative site after copious irrigation. Surgical operative time was 150 minutes and total operative time (including anesthetic



Figure 4. The operative specimen - emphysematous pyelonephritis.

induction and set-up) was 210 minutes.

Post-operatively, the patient was placed on ampicillin, gentamycin and metronidazole and tight glucose control. The patient remained intermittently febrile with a low-grade sinus tachycardia that resolved on postoperative day 3. The patient was discharged on postoperative day 4 in stable condition, with a creatinine of 133, on oral ciprofloxacin 400 mg BID po for 3 weeks. Final pathology showed features consistent with xanthogranulomatous pyelonephritis. He was seen in follow-up 4 weeks later with creatinine of 110, feeling well, and returned to work the following week.

Discussion

Emphysematous pyelonephritis is an uncommon and life-threatening suppurative infection of the renal parenchyma and perirenal tissues. This condition usually occurs in females (75%)¹ and diabetics (85%-100%),² as a complication of urinary tract infection. A minority of cases are associated with urinary tract obstruction from calculi or papillary necrosis.¹ All reported cases have been in adults. High tissue glucose levels and impaired immunity allow for continued infection by gas-forming uropathogens, most commonly *E. coli*, *Proteus* spp. and *Klebsiella* spp.³

The clinical presentation typically includes fever, vomiting, pyuria and flank pain in the setting of uncontrolled hyperglycemia.^{3,4} Patients may present with renal insufficiency, an altered level of consciousness and frank sepsis.

Renal U/S typically demonstrates strong focal echoes suggestive of intraparenchymal gas which however, can be confused with bowel gas. Consequently, abdominal radiographs can be helpful in this setting as they detect renal emphysema in 33%-85% of cases.^{5,6}

Emphysematous pyelonephritis can be classified into two types based on computed tomography (CT) appearance: "classic" pyelonephritis (type I) is associated with parenchymal destruction, streaky or mottled gas and little or no fluid. Type II, which may carry a better prognosis, is associated with renal or perirenal fluid collections associated with bubbly or loculated gas.^{2,7,8}

Management of emphysematous pyelonephritis includes aggressive control of blood glucose, volume resuscitation, relief of urinary obstruction if present, and parenteral antibiotics.⁹ Bilateral renal function should be determined because up to 45% of affected kidneys are non-functioning,² and 5%-10% of cases have been bilateral.^{1,10} Beyond supportive measures however, definitive therapy remains more controversial.

High mortality (40%-75%) and urgent nephrectomy are advocated in the early literature.¹⁰⁻¹³ Other reports have demonstrated the use of medical therapy alone,^{12,14-18} percutaneous drainage,^{12,13,19} or open drainage²⁰ in the successful management of emphysematous pyelonephritis. One recent review¹³ found insufficient evidence to recommend either percutaneous drainage or open nephrectomy, and suggested that they be combined in a staged procedure if necessary. Advocates of percutaneous drainage cite the possibility of preserving renal function,¹⁹ and the high risk of surgical intervention in the unstable patient.^{4,21} However, open nephrectomy remains the standard of care for a actively infected non-functioning kidney.⁹ To our knowledge, there are no reports of transperitoneal laparoscopic nephrectomy in the setting of emphysematous pyelonephritis.

In this case our patient presented with a "type II" emphysematous pyelonephritis in relatively stable condition, without the presentation of florid sepsis. Although percutaneous drainage was a consideration, the patient had a non-functioning kidney on the affected side which necessitated nephrectomy. We elected to attempt laparoscopic nephrectomy as the patient was hemodynamically and clinically stable. Laparoscopic nephrectomy was also chosen in light of our center's extensive laparoscopic experience. A retroperitoneal approach was considered, and may have been preferable since potential spillage of infected fluid/pus would remain extraperitoneal. However the operative surgeon's experience (AK) was mainly in transperitoneal laparoscopy, and because of the challenging nature of this operation, prior surgical experience was paramount and a trans-abdominal approach chosen. Likewise, a hand-assisted approach may have been reasonable, and this choice depends on the operative surgeon's prior laparoscopic experience. No drain was left in place as the wound was copiously irrigated and looked clean upon completion and it was felt a drain was not necessary – however leaving a drain through a port site would have been reasonable. Intra-operative findings as described earlier warrant caution in performing laparoscopic nephrectomy in this setting, even by experienced laparoscopists.

Conclusion

To our knowledge, we report the first case of laparoscopic nephrectomy in the setting of emphysematous pyelonephritis, with our technique for performing this procedure. Based on our experience we recommend: a) the laparoscopic

approach only be considered in selected clinically stable patients b) additional operative time to allow for careful dissection c) low-threshold for conversion to open nephrectomy d) copious suction/irrigation for all purulent drainage, and e) perioperative antibiotic coverage and bowel preparation.

The management of this life-threatening condition remains controversial: the literature demonstrates a shift toward medical and percutaneous management of emphysematous pyelonephritis, although open nephrectomy remains the standard of care particularly in the setting of an infected non-functioning kidney. In addition, the benefits of laparoscopic nephrectomy may be relevant to specially selected patients with emphysematous pyelonephritis in the setting of adequate surgical experience. □

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