DOI: 10.4081/aiua.2016.4.255

ORIGINAL PAPER

Laparoscopic heminephrectomy for benign and malignant diseases of the horseshoe kidney

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Summary ***Objectives: In the current study, we present our pure laparoscopic heminephrectomy experience in 13 patients with horseshoe kidney (HK).***
Material and Methods: A total of 13 patients with HK underwent pure laparoscopic heminephrectomy (Transperitoneal= 7, Retroperitoneal = 6) due to benign and malign renal conditions (non-functional hydronephrotic and/or infected kidney = 12, kidney mass = 1).
Results: The mean age of the patients was 45.8 years. The mean operating time was 140 minutes, and estimated blood loss was 131 ml. The mean hospital stay was 2.3 days. Division of istmus was performed with stapler in 5 patients, ultrasonic scalpel in 3, 15 mm Hem-o-lok clip in 3, 10 mm LigaSure vessel seal system in one and endoscopic suture by 0 polyglactin in one patient without bleeding. Twelve patients underwent pure laparoscopic heminephrectomy due to non-functional hydronephrotic and or infected kidney. One patient underwent transperitoneal laparoscopic right heminephrectomy due to kidney mass. According to modifies Clavien classification, Grade I complication (wound infection) occurred in one patient (7.7%) who underwent heminephrectomy due to non-functional kidney.
Conclusions: Laparoscopic heminephrectomy seems to be technically feasible and safe for benign and malignant diseases in patients with HK.

KEY WORDS: Heminephrectomy; Horseshoe kidney; Laparoscopy.

Submitted 24 February 2016; Accepted 6 March 2016

INTRODUCTION

Horseshoe kidney (HK) is one of the most common congenital kidney fusion anomalies. Its incidence in the population is estimated at 1 in 400. It could be associated with other urologic problems such as kidney stone, vesicoureteral reflux and ureteropelvic junction obstruction. The anomaly presents specific challenges for laparoscopic surgery owing to its position, vascular anomalies, and the presence of an isthmus of kidney parenchyma connecting the two sides (1). In the international literature, few publications have reported the laparoscopic surgery for benign and malignant conditions associated with HK.

In the current study, we aimed to present our pure laparoscopic heminephrectomy experience in 13 patients with HK.

MATERIAL AND METHODS

Between December 2011 and March 2014, a total of 13 patients with HK (3 female, 10 male) underwent pure laparoscopic heminephrectomy (transperitoneal = 7, retroperitoneal = 6) due to benign and malignant renal conditions (nonfunctional hydronephrotic and/or infected kidney = 12, kidney mass = 1) at 5 different medical centers. The data were retrospectively collected with using patients' medical records. Diagnostic radiological examinations such as computerized abdominal tomography or magnetic resonance imaging were performed before the surgeries. Non-functional kidney was confirmed by 99Tc-MAG3 renal scintigraphy in the patients. The surgical approach (transperitoneal or retroperitoneal) was selected upon the surgeon's surgical experience.

After written informed consent was obtained from all the patients, all patients underwent pure laparoscopic heminephrectomy (right = 5, left = 8) via transperitoneal or retroperitoneal approach as previously described (2-4). Under general anaesthesia, the patient was placed 45 degree lateral position. After CO_2 insufflation, standard transperitoneal laparoscopic procedures with a 3-trocar technique for left side and 4-trocar technique for right side was performed. In retroperitoneal approach, 3 or 4-trocar were placed. In all the operations, the ureter is identified medial to the psoas muscle and dissected cephalad to identify the renal isthmus. Then the isthmus is dissected and divided with using 45 or 60 mm Endo-GIA® stapler (*Covidien Healthcare, MA, US*), Harmonic® scalpel (*Ethicon, UK*), 15 mm Hem-o-lok® (*Weck-Teleflex, US*) clip, 10 mm LigaSure® (*Covidien Healtcare, MA, US*) vessel sealing system, or endoscopic suturization with using 0 polyglactin suture. At the end of the procedures, a Jackson-Pratt drain was placed in all the patients. Surgical procedures were performed by 5 different skilled laparoscopic surgeons.

No conflict of interest declared.

Results

The mean age of the patients was 45.8 ± 4.6 (range; 28 to 77) years. Seven patients presented initially with a history of moderate to severe degree intermittent flank pain, 2 patients presented with febrile urinary tract infection, 1 patient had abdominal pain, 1 patient had gross hematuria. The remaining of them did not describe any complaint.

The mean operating time was 140 ± 1.8 (100-180) minutes, and estimated blood loss was 131 ± 12.6 (30-320) ml. The mean hospital stay was 2.3 ± 1.4 (1-5) days. Division of isthmus was performed with 45 or 60 mm Endo-GIA® stapler (*Covidien Healthcare, MA, US*) in 5, Harmonic® scalpel (*Ethicon, UK*) in 3, 15 mm Hem-o-lok® (*Weck-Teleflex, US*) clip in 3, 10 mm LigaSure® (*Covidien Healtcare, MA, US*) vessel sealing system in 1 and endoscopic suturization by 0 polyglactin suture in 1 patients.

Twelve patients underwent pure laparoscopic heminephrectomy due to nonfunctional hydronephrotic and or infected kidney (right = 5, left = 7). The etiologic factors were urolithiasis (n = 7) and ureteropelvic junction obstruction (n = 5), respectively. Histopathological examination of the specimens revealed xanthogranulomatous pyelonephritis in 1, chronic pyelonephritis in 7 and chronic inflammation in 4 patients. One patient (a 58-year old man) was referred to us for evaluation of gross hematuria. Computerized tomography demonstrated a right renal mass (40 x 21 x 18 mm in diameter) with hypodense and calcified areas. The patient underwent transperitoneal laparoscopic right heminephrectomy. Histopathological examination of the surgical specimen showed a grade 1, pT1a, clear cell carcinoma and negative surgical margin.

According to modifies Clavien classification, Grade I complication (wound infection) occurred in one patient (7.7%) who underwent heminephrectomy due to nonfunctional kidney. The infection was successfully treated by parenteral third generation cephalosporin treatment.

Discussion

HKs represent the most common type of renal fusion anomaly. In this anomaly, two separate kidneys lie vertically on either side of the midline and are connected at their respective lower poles by a parenchymatous or fibrous isthmus that crosses the midplane of the body. The isthmus generally consists of parenchymatous tissue with its own blood supply (5). The isthmus mostly lies anterior to the aorta and vena cava but very rarely may pass between the inferior vena cava and the aorta or even behind both major vessels (6).

Generally, 33% of all patients with HK are asymptomatic, and the anomaly gets noticed incidentally on radiologic examination. The most common associated findings in HK are ureteropelvic junction obstruction which occurs in 35% of the patients. Kidney stones develop in 20% to 60% of patients and may be related with obstruction and recurrent urinary tract infections. Renal cell carcinoma, the most common, accounts for 45% of all tumors in patients with HK (6). In our cases, urolithiasis (54%) was the most common etiologic factor whereas the others were ureteropelvic junction obstruction (38.5%) and renal cell carcinoma (7.5%), respectively.

Laparoscopic approaching to HK is an evolving method, with technical challenges arising from the aberrant location and vasculature of these kidneys. Depending on the surgeon's experience, different approaches such as transperitoenal, retroperitoneal and hand-assisted are used (3, 4, 6-27). Yohannes and associates suggested that while the retroperitoneal approach may provide better exposure of the renal hilum in benign diseases, inadvertent entry into the peritoneum may be difficult to avoid given the intimate relation between the anterior aspects of the kidneys and the posterior peritoneum (11). Sausville and coworkers claimed that transperitoneal approach is successful and reasonable with minimal morbidity in a HK affected by xanthogranulomatous pyelonephritis (24).

Transperitoneal approach has been advocated for laparoscopic radical heminephrectomy and partial nephrectomy for malignant diseases in patients with HK (14, 15, 18-21, 27). Conversely, *Lee et al.* suggested retroperitoneal approach for laparoscopic partial nephrectomy in a HK for posterior and posterolateral lesions (26). In the current study, 7 (nonfunctional hydronephrotic and/or infected kidney = 6, kidney mass = 1) and 6 (nonfunctional kidney and/or infected kidney = 6) patients underwent transperitoneal and retroperitoneal laparoscopic heminephrectomy, respectively. Khan et al. reviewed all the cases of laparoscopic heminephrectomy for HK done until 2010 [6]. A transperitoneal approach was used in the majority of cases (59%). Hand-assisted and retroperitoneal approaches were used in 22.5% and 18.5% of cases, respectively. In our cases, we preferred either transperitoneal (n = 7) or retroperitoneal (n = 6) approach for the patients with regard to surgeon's decision.

Diagnostic radiographic imaging is important in the preoperative planning of heminephrectomy for HKs. In the international literature, computerized abdominal tomography and magnetic resonance imaging were used for better delineation of the anatomy (6, 28). Some authors suggested that routine preoperative arteriography is essential to identify all vessels, especially in patients with renal cancer (3, 6). The arterial supply of the HK was investigated by Janetschek et al. in 6 postmortem cases (29). They showed accessory arteries originating from the great vessels entering the hilum and aberrant vessels entering directly into the poles of the kidneys and the isthmus. These authors claimed that this vascular pattern of the HK can guide the surgeon during laparoscopic nephrectomy. In the current study, we did not perform arteriography in our patients to avoid unnecessary radiation exposure and possible renal failure risk due to dye loading. We believe that careful dissection of aberrant vessels, isthmus and renal hilum allows to the surgeon to identify all anatomical structures.

Methods for dividing the renal isthmus have been handled included staplers, bipolar coagulation, microwave coagulation ultrasonic scalpel, cold shears followed by argon beam fulguration, and parenchymal suture (6, 11). In the international literature, stapler is the most common device used (6). Success with heminephrectomy in HKs depends on achieving vascular control. At this stage, it is critical to see for a direct blood supply to the isthmus. Whatever technique is used, it is important not to enter the renal collecting system of the controlateral kid-

ney and to get adequate hemostasis. In the present study, division of isthmus was performed with stapler in 5 patients, ultrasonic scalpel in 3, Hem-o-lok® clip in 3, vessel sealing system in 1 and endoscopic suture with 0 polyglactin in one patient without bleeding. In our series, no major complications were encountered during division of isthmus.

Conclusions

In conclusion, we believe that laparoscopic heminephrectomy in HK seems to be technically feasible, safe and reliable for benign and malignant diseases in a HK.

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