Laparoscopic Renal Oncological Surgery in the Presence of Abdominal Aortic and Vena Caval Pathology: 8-Year Experience

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Purpose: To our knowledge the outcomes of laparoscopic renal oncological surgery in patients with major aortic and/or inferior vena caval pathology are unknown. We present our experience spanning an 8-year period.

Materials and Methods: From March 1998 to October 2006, 1,826 laparoscopic renal procedures were performed for tumor. Of these patients 66 (3.6%) had major abdominal aortic or vena caval pathology concomitantly. Demographics, specific entities of the vascular disease, and intraoperative and postoperative data were reviewed.

Results: A total of 66 patients had a history of abdominal aortic disease (54), vena caval disease (9) or both (3). Of the patients 85% had 3 or greater comorbidities, 88% had an American Society of Anesthesiologists score of 3 or greater and 88% were on chronic anticoagulation therapy. A total of 27 patients (41%) had undergone prior surgical treatment for vascular pathology. Laparoscopic renal surgery, which was transperitoneal in 25 cases and retroperitoneal in 41, included radical nephrectomy in 20, partial nephrectomy in 17 and cryoablation in 29. Open conversion was performed in 3 patients (5%). There were 3 intraoperative (5%) and 9 postoperative (14%) complications. One patient died of pulmonary sepsis. There was no statistically significant difference in perioperative outcomes between the aortic and vena caval disease groups. The retroperitoneal approach was associated with less blood loss and shorter operative time ($p = 0.0003$ and 0.004, respectively).

Conclusions: Laparoscopic surgery for renal tumor in the presence of aortic or vena caval disease is safe and feasible. Considerable prior laparoscopic experience is necessary when treating these patients at high risk.

Key Words: laparoscopy, renal, aorta, vena cava, tumor, renal cell carcinoma

The gold standard treatment for organ confined RCC is surgery. In the last 4 decades the surgical management of RCC has evolved with increasing acceptance of minimally invasive techniques. Parallel to the increase in the aging population the diagnosis of a renal mass in patients older than 70 years with multiple comorbidities has also increased.[1] Laparoscopic options for organ confined RCC include LRN, LPN and energy based probe ablative procedures, such as LCA. Selection of the particular laparoscopic approach depends on individual patient and tumor circumstances.

Abdominal aortic and vena caval pathology correlates with aging and systemic diseases, such as hypertension and atherosclerosis. The population of patients with aortic and/or vena caval disease increases parallel to increasing life expectancy.[2] As one would expect, renal tumor and concomitant aortic/vena caval disease are not infrequently found in the elderly population. Intra-abdominal malignancies are found in up to 4% of patients at aortic reconstructive surgery.[3] Hafez et al reported synchronous management of renal neoplasm and abdominal aortic aneurysm, and concluded that managing renal tumor and abdominal aortic aneurysmal pathology is challenging and should be performed with extreme care.[4]

Patients with untreated severe aortic/vena caval disease may be at higher surgical risk. Additionally, prior surgical intervention on the aorta and vena cava may increase the difficulty of subsequent surgery due to intra-abdominal scarring. Laparoscopic renal surgery has generally been associated with more rapid recovery and less morbidity. However, to our knowledge the impact of preexisting aortic/vena caval disease/surgery on subsequent laparoscopic renal procedures has not been addressed to date. We report our experience with patients with aortic and/or vena caval disease who underwent laparoscopic surgery for renal tumor.

MATERIALS AND METHODS

From March 1998 to October 2006, 1,826 laparoscopic procedures (LRN, LPN and LCA) were performed for suspected renal tumor at our institution. Of these patients 66, including 20 with LRN, 17 with LPN and 29 with LCA, who had aortic and/or vena caval disease were retrospectively identified from a prospectively maintained institutional review board approved computerized database. All patients underwent computerized spiral tomography before surgery. Cardiology clearance, including noninvasive cardiac stress testing, was administered to all patients preoperatively. No patient underwent simultaneous vascular and laparoscopic renal surgery.

Data on demographics, renal tumor characteristics, aortic and/or vena caval disease, prior management of vascular

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TABLE 1. *Demographics of patients with renal mass and concomitant aortic/vena caval disease*

No. pts (men/women)	66	(606)
No. rt/lt side	32/34	
Median age (IQR)	70	(65, 74)
Median kg/m^2 body mass index (IQR)	27.9	(24.4, 29.8)
American Society of Anesthesiologists score:		
Median (IQR)	3	(2, 4)
No. 1 (%)	0	
No. 2 (%)	8	(12)
No. 3 (%)	48	(73)
No. 4 (%)	10	(15)
Comorbidities:		
Median (IQR)	3	(3, 4)
1	1	(2)
2	9	(14)
3	29	(44)
4	22	(33)
5	5	(8)
Median cm tumor size (IQR)	3.3	(2.5, 4.2)
No. aortic disease:	57	
AAA	49	
DAA	4	
Aortic transection	3	
Aortic occlusion	1	
No. vena caval disease	12	
No. vena caval filter	12	

disease and other associated comorbidities, and surgical treatment were obtained from our database and patient charts. The intraoperative and postoperative parameters analyzed included type of laparoscopic renal procedure, ORT, EBL, perioperative complications, hospital stay and postoperative renal function assessment.

Surgical management for renal tumor, including the type of procedure and method of approach, were based on tumor size, location, overall renal function, technical feasibility of laparoscopic renal surgery and associated medical comorbidities. Our respective surgical indications for and techniques of LRN, LPN and LCA were described previously.[5-7] However, minor individualized modifications were applied according to the major vascular pathology.

Postoperative followup consisted of serum creatinine measurement at 1 month and abdominal computerized tomography or magnetic resonance imaging at 6 months and yearly thereafter in patients with pathologically confirmed renal cancer. Followup was obtained by contacting the patient, family and/or referring physician.

Descriptive statistics are presented with the median and IQR. Statistical analyses were based on the influence of the procedure type (LRN vs LPN vs LRC), the type of approach (transperitoneal vs retroperitoneal), the type of vascular disease (aortic vs vena caval) and whether the specific disease type had been previously treated (treated vs nontreated). Each variable was analyzed to determine risk factors for EBL, ORT, intraoperative complications, the conversion rate, postoperative complications and hospital stay. Multivariable linear regression models were used to model the data. To satisfy the distributional assumptions associated with a linear model EBL, ORT and hospital stay were transformed using log transformation. To test the statistical significance of each covariate incorporated into the model separate type III F tests were performed and p values were adjusted using the Bonferroni-Holm multiple comparison procedure. Statistical significance was assessed at the 0.05 significance level.

RESULTS

Table 1 lists demographic data. Median tumor size was 3.3 cm (IQR 2.5, 4.2). Renal tumors were treated with LRN in 20 patients, LPN in 17 and LCA in 29. Overall the transperitoneal approach was used in 25 patients and the retroperitoneal approach was used in 41. In addition to aortic/vena caval pathology, all patients had 1 or greater preexisting comorbidities, while 56 (85%) had 3 or greater comorbidities at surgery. Significant comorbidities included hypertension in all patients (100%), diabetes mellitus in 44 (67%), cardiovascular disease in 39 (59%), cerebrovascular disease in 7 (11%), chronic renal disease in 10 (15%), other cancer in 6 (9%) and other comorbidities in 23 (35%). A total of 58 patients (88%) were on anticoagulation therapy at diagnosis of the renal mass and anticoagulants were temporarily stopped as least 7 days before surgery. Anticoagulants were continued again 7 days postoperatively if no complications occurred.

Vascular disease included aortic pathology in 54 patients, vena caval disease in 9 and both in 3. Aortic pathology included AAA in 47 cases, DAA in 3, aortic transection in 3 and aortic occlusion in 1. Vena caval pathology included vena cava filter placement due to deep vein thrombosis/pulmonary embolism in 9 patients. Two of the 3 patients with combined aortic and vena caval disease had AAA and a vena caval filter, and 1 had descending aortic dissection and vena caval filter placement. Prior vascular intervention was

TABLE 2. *Summary statistics according to major vessel disease type*

	Aorta		Vena Cava		p Value
No. pts	54		9		
Median cm computerized tomography size (IQR)	3.5	(2.5, 4.2)	3.1	(2.3, 3.6)	0.26
No. procedure (%):					
LCA	23	(43)	5	(56)	—
LPN	15	(28)	4	(44)	
LRN	16	(30)	0		
No. approach (%):					
Retroperitoneal	34	(63%)	5	(56%)	—
Transperitoneal (IQR)	20	(37%)	4	(44%)	
Median cc EBL	150	(100, 250)	100	(100, 200)	0.85
Median mins ORT (IQR)	180	(158, 235)	168	(148, 203)	0.18
No. intraop complications (%)	2	(4)	0		—
No. open conversion (%)	3	(6)	0		—
No. postop complications (%)	7	(13)	2	(22)	—
Median hrs hospital stay (IQR)	72.0	(37.0, 116.0)	84.0	(60.8, 96.0)	0.66
Median mg/dl preop–postop serum creatinine difference (IQR)	0.1	(0.0, 0.4)	0.2	(0.1, 0.6)	0.11