

Oncology: Adrenal/Renal/Upper Tract/Bladder

PROSPECTIVE, RANDOMIZED COMPARISON OF TRANSPERITONEAL VERSUS RETROPERITONEAL LAPAROSCOPIC ADRENALECTOMY

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ABSTRACT

Purpose: We report a prospective, randomized comparison of transperitoneal laparoscopic adrenalectomy (TLA) vs retroperitoneal laparoscopic adrenalectomy (RLA) for adrenal lesions with long-term followup.

Materials and Methods: Between December 1997 and November 1999, 57 consecutive eligible patients with surgical adrenal disease were prospectively randomized to undergo TLA (25) or RLA (32). Study exclusion criteria were patient age greater than 80 years, body mass index greater than 40, bilateral adrenalectomy and significant prior abdominal surgery in the quadrant of interest. Mean followup was 5.96 years in the 2 groups.

Results: The groups were matched in regard to patient age ($p = 0.84$), body mass index ($p = 0.43$), American Society of Anesthesiologists class ($p = 0.81$) and laterality ($p = 0.12$). Median adrenal mass size was 2.7 cm (range 1 to 9) in the TLA group and 2.6 cm (range 0.5 to 6) in the RLA group ($p = 0.83$). TLA was comparable to RLA in terms of operative time (130 vs 126.5 minutes, $p = 0.64$), estimated blood loss ($p = 0.92$), specimen weight ($p = 0.81$), analgesic requirements ($p = 0.25$), hospital stay ($p = 0.56$) and the complication rate ($p = 0.58$). One case per group was electively converted to open surgery. Pathology data on the intact extracted specimens were similar between the groups. Averaged convalescence was 4.7 weeks in the TLA group and 2.3 weeks in the RLA group ($p = 0.02$). During a mean followup of 6 years 2 patients in the TLA group had a late complication (port site hernia). Mortality occurred in 5 patients, including 1 with TLA and 4 with RLA, during the 6-year followup.

Conclusions: For most benign adrenal lesions requiring surgery laparoscopic adrenalectomy can be performed safely and effectively by the transperitoneal or the retroperitoneal approach.

KEY WORDS: adrenal glands, adrenalectomy, laparoscopy, retroperitoneal space

Since laparoscopic adrenalectomy was first described in 1992 by Gagner et al,¹ it has become the standard of care for many patients with benign adrenal disease requiring surgery. Evidence from multiple centers is testimony to the feasibility, comparable efficacy and decreased morbidity of laparoscopic adrenalectomy compared with the open approach.^{2,3}

Laparoscopic adrenalectomy can be performed transperitoneally or retroperitoneally. The transperitoneal approach has the benefit of a wider working space and readily identifiable anatomical landmarks. The retroperitoneal approach has been thought to be associated with earlier recovery of bowel function, possibly leading to a shorter hospital stay and earlier recovery.

Most studies comparing the 2 approaches for laparoscopic adrenalectomy have been retrospective.^{2–4} To date only 1 small, prospective, randomized comparison of transperito-

neal laparoscopic adrenalectomy (TLA) vs retroperitoneal laparoscopic adrenalectomy (RLA) has been published.⁵ We report our prospective, randomized, single institution comparison of transperitoneal vs retroperitoneal laparoscopic adrenalectomy in 57 consecutive patients with intermediate term followup.

MATERIALS AND METHODS

Between December 1997 and November 1999, 57 consecutive patients were prospectively randomized to undergo transperitoneal (group 1, 25 patients) or retroperitoneal (group 2, 32 patients) laparoscopic adrenalectomy. Study exclusion criteria were patient age greater than 80 years, body mass index (BMI) greater than 40, bilateral adrenalectomy and significant prior abdominal surgery in the quadrant of interest. Patients were prospectively randomized by a computer generated program. All patients provided consent for either approach. The primary surgeon (ISG) was informed about the preselected laparoscopic approach for each individual patient in the operating suite immediately prior to positioning the patient for surgery.

Laparoscopic techniques for the lateral retroperitoneal⁶ and transperitoneal^{7,8} approaches for adrenalectomy have

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Study received Institutional Review Board approval.

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been previously described. Intraoperative data were documented by the primary surgeon in the operating room immediately at the end of the procedure using a statistically validated data sheet. All data were prospectively maintained in a computerized database with Institutional Review Board approval.

Information analyzed included patient demographics, preoperative adrenal characteristics, intraoperative and postoperative outcomes, and pathological adrenal features. Convalescence was defined as the period needed for complete recovery from the physical aftereffects of surgery. Current followup was obtained by telephone contact with individual patients or their families.

Summary statistics are presented as the median and quartiles, that is the 25th (Q1) and 75th (Q3) percentiles, when the Wilcoxon rank sum test was used. Statistics were performed with SPSS software (SPSS, Chicago, Illinois) using the Wilcoxon rank sum test for continuous variables and the chi-square or Fisher exact test for categorical variables with $p < 0.05$ considered statistically significant.

RESULTS

Baseline demographics were comparable in groups 1 and 2 with respect to patient age (57 vs 57.5 years, $p = 0.841$), BMI (29.1 vs 30.4, $p = 0.426$), American Society of Anesthesiologists class (3 vs 3, $p = 0.811$), laterality (right side 48% vs 28.1%, $p = 0.123$) and adrenal tumor size (2.7 vs 2.6 cm, $p = 0.825$) (table 1). Laparoscopic adrenalectomy was successfully performed in 55 patients with 1 elective open conversion per group because of failure to progress. TLA was comparable to RLA in terms of total operative time (130 vs 126.5 minutes, $p = 0.640$), estimated blood loss (50 vs 50 ml, $p = 0.922$) and specimen weight (24 vs 29 grams, $p = 0.809$) (table 2). The open conversion in group 1 was in a patient with a 9 cm right adrenocortical carcinoma with dense peritumor adhesions and in group 2 open conversion was done in a patient with a 6 cm right pheochromocytoma because of unclear tissue planes.

The 2 approaches were similar in regard to time to oral intake resumption ($p = 0.86$), time to ambulation ($p = 0.86$), analgesic (Toradol®) requirements ($p = 0.25$), hospital stay ($p = 0.56$) and convalescence ($p = 0.86$) (table 2). Postoperative complications occurred in 2 patients (8%) undergoing transperitoneal laparoscopy and in 1 (3.2%) undergoing the retroperitoneal approach ($p = 0.576$). Average convalescence was 4.7 weeks in the transperitoneal group and 2.3 weeks in the retroperitoneal group ($p = 0.02$).

Pathological data on the intact extracted specimens were similar in the 2 groups (table 3). Two patients, including 1 with adrenocortical carcinoma and 1 with leiomyosarcoma, died 2 and 31 months after surgery, respectively.

Mean followup was 5.9 years in the retroperitoneal and transperitoneal groups. During this time late complications occurred in 2 patients in the transperitoneal group, who had port site hernia. Mortality due to various unrelated causes occurred in 5 patients, including 1 in the transperitoneal and 4 in the retroperitoneal group, during the 6-year followup.

DISCUSSION

Minimal access surgery has inherent appeal for a small, deeply seated target organ such as the adrenal gland, which would otherwise necessitate a large abdominal skin incision for open surgical access. Reports from multiple institutions worldwide confirm the technical feasibility, safety and efficacy of the laparoscopic approach.^{7,8} Additionally, the decreased morbidity, more rapid recovery and superior cosmesis of laparoscopic adrenalectomy vs traditional open surgery are well established. This has resulted in laparoscopic adrenalectomy becoming the treatment of choice for the majority of benign adrenal lesions requiring surgery.

There are 4 laparoscopic approaches to the adrenal gland, namely transperitoneal (conventional laparoscopic or needle-scope⁹), lateral retroperitoneal,⁶ posterior retroperitoneal and transthoracic transdiaphragmatic.¹⁰ The transperitoneal route is often preferred by many surgeons because of its wider working space and familiar anatomy. However, retroperitoneal laparoscopic adrenalectomy has gained in popularity because it provides direct access to the adrenal gland, and avoids bowel handling and the potential for injury to the intra-abdominal viscera.

This prospective, randomized study was designed to objectively assess whether the transperitoneal vs the lateral retroperitoneal approach for laparoscopic adrenalectomy translated into any practical clinical differences in patient outcomes. To this end specific factors that were known to increase the difficulty of either approach, such as morbid obesity and prior surgery in the area of interest, were excluded from study. Additionally, patient demographics and baseline characteristics were comparable.

Our study showed no significant differences in operative time, estimated blood loss, specimen weight or complication rates between the 2 groups. These data confirm that, the constraints of a limited working space notwithstanding, the retroperitoneal approach is technically efficient because it takes advantage of naturally existing anatomical planes. After initial balloon dilation of the retroperitoneum laparoscopic examination through the transparent balloon confirms proper creation of the working space. Anatomical landmarks, such as the psoas muscle posterior, Gerota's fascia anterior and the diaphragm superior, facilitate operator orientation in the retroperitoneum. Our analysis of 404 retroperitoneal laparoscopic renal and adrenal surgeries demonstrated a low

TABLE 1. Demographic and preoperative data

	Group 1		Group 2		p Value
No. pts	25		32		Not assessed
Median age (Q1, Q3)	57.0 (50, 64.5)		57.5 (46, 66)		0.841
No. men (%)	13 (52)		13 (40.6)		0.392
No. rt side (%)	12 (48)		9 (28.1)		0.123
Median BMI (Q1, Q3)	29.1 (25.4, 31.4)		30.4 (25.5, 33.2)		0.426
Median American Society of Anesthesiologists class (Q1, Q3)	3 (3, 3)		3 (3, 3)		0.811
Adrenal mass:					
Median cm computerized tomography size (Q1, Q3)*	2.7 (1.6, 4.2)		2.6 (1.7, 4.9)		0.825
No. pts	19		24		
No. preop diagnosis (%):					0.143
Aldosteronoma	10 (40)		10 (31.2)		
Adrenal mass not otherwise specified	5 (20)		15 (46.8)		
Pheochromocytoma	7 (28)		2 (6.2)		
Cushing's syndrome	2 (8)		3 (9.3)		
Metastasis	1 (4)		1 (3.1)		
Adrenal Ca	0		1 (3.1)		

* Incomplete data set since some patients did not have a discrete mass on computerized tomography.

TABLE 2. *Intraoperative data*

	Group 1	Group 2	p Value
No. pts	25	32	
Intraop data:			
Median mins operative time (Q1, Q3)	130 (111, 187)	126.5 (90, 180)	0.640
Median ml estimated blood loss (Q1, Q3)	50 (25, 100)	50 (25, 100)	0.922
Median gm specimen wt (Q1, Q3)	24 (13, 43)	29 (11.8, 48.5)	0.809
No. open conversion (%)	1 (4)	1 (3.1)	0.859
Postop data:			
Median mg analgesic Toradol® requirement (Q1, Q3)	60 (30, 60)	42.5 (11.25, 60)	0.246
Median days to oral intake (Q1, Q3)	1 (1, 1)	1 (1, 1)	0.860
Median days to ambulation (Q1, Q3)	1 (1, 1)	1 (1, 1)	0.860
Median days hospital stay (Q1, Q3)	1 (1, 2)	1 (1, 1)	0.560
No. no postop complications (%)	23 (92)	31 (96.8)	0.576
No. urinary retention (%)	0	1 (3.2)	
No. fever (%)	1 (4)	0	
No. hematoma (%)	1 (4)	0	
Median convalescence (wks)	4.7	2.3	0.02

TABLE 3. *Pathological data*

	Group 1	Group 2	p Value
No. pts	25	32	
No. pathological findings (%):			
Adenoma	11 (44)	14 (43.8)	0.525
Hyperplasia	5 (20)	5 (15.6)	
Pheochromocytoma	6 (24)	3 (9.4)	
Metastatic adenoca	1 (4)	3 (9.4)	
Adrenocortical Ca	2 (8)	1 (3.1)	
Aldosteronoma	0	2 (6.3)	
Clear cell Ca	0	1 (3.1)	
Ganglioneuroma	0	1 (3.1)	
Leiomyosarcoma	0	1 (3.1)	
Other	0	1 (3.1)	
Mean followup (yrs)	5.96	5.96	Not significant
No. deaths	1	4	Not significant
No. recurrence	0	1	Not applicable

incidence of intraoperative vascular (1.7%) and bowel (0.25%) complications.¹¹ Seven of the 8 cases with vascular injury were managed laparoscopically or through the created extraction incision. Thus, we believe that retroperitoneal laparoscopy is a reliable and safe approach with adequate working space, reliable anatomical landmarks and operator orientation.

Groups 1 and 2 were similar in terms of analgesia requirements, resumption of ambulation and oral intake, and duration of hospitalization. Thus, contrary to our belief and that of others, the transperitoneal approach was not associated with a higher incidence of paralytic ileus or longer hospital stay. However, convalescence was significantly more rapid in patients undergoing the retroperitoneal approach (2 to 3 vs 4.7 weeks, $p = 0.02$). Also, we did not note any increased incidence of flank neuralgia syndromes in the retroperitoneal group during the intermediate or long-term followup. Pathological characteristics and the weight of the intact extracted specimen were comparable in groups 1 and 2.

In our study 4 patients undergoing RLA and 3 undergoing TLA had tumors 5 cm or greater. At our institution Hobart et al compared laparoscopic adrenalectomy for large volume (5 cm or greater) adrenal tumors.¹² They concluded that the feasibility of the laparoscopic approach was not impacted by adrenal mass size. The presence of local invasion and compromised peri-adrenal tissue planes were more important concerns regarding the technical feasibility of laparoscopic adrenalectomy.

Certain technical aspects of the retroperitoneal approach require emphasis. During right adrenalectomy the first step is usually identification of the right renal artery. Dissection is then performed along the lateral surface of the inferior vena cava to expeditiously control the main adrenal vein, which in our experience drains from the superomedial aspect

of the right gland. During left adrenalectomy the left main adrenal vein is visualized to be horizontally oriented and it is identified early along the cephalad aspect of and anterior to the vertically oriented left renal artery. The left main adrenal vein courses obliquely toward the left renal vein from the inferomedial aspect of the gland. Adrenal specimen mobilization requires constant anatomical orientation and it should be performed cautiously outside of the peri-adrenal fat. Occasionally with larger specimens entrapment may be more difficult in the somewhat smaller retroperitoneal space. We believe that the retroperitoneal approach can be applied with equivalent efficacy to the right or left adrenal gland.

Although cost data were not collected for this specific study, at our institution a recent cost analysis of 3 approaches for laparoscopic adrenalectomy (transperitoneal, lateral retroperitoneal and posterior retroperitoneal) showed no significant cost differences.¹³ The study indicated that operating costs should not be a factor in selecting the laparoscopic approach in an individual.

Although our study demonstrates the comparable safety and efficacy of either approach, some particular clinical situations should be kept in mind. In our hands patients with prior intra-abdominal surgery in the area of interest are preferentially approached retroperitoneoscopically. In morbidly obese patients the abdominal pannus fat tends to fall away from the operative site when the patient is in the full 90-degree flank position. Thus, we believe that in the obese patient retroperitoneal adrenalectomy may be somewhat technically simpler than the transperitoneal approach. Conversely the transperitoneal approach may be advantageous in patients with prior retroperitoneal renal surgery and in patients with larger (greater than 10 cm) adrenal masses. Moinzadeh and Gill reported on 31 patients who had undergone a total of 32 laparoscopic adrenalectomies for malignancy.¹⁴ The laparoscopic approach was retroperitoneal in 15 patients, transperitoneal in 13 and transthoracic in 2. Mean adrenal tumor size on preoperative computerized tomography was 5 cm (range 1.8 to 10). This study demonstrated that with adequate experience laparoscopic adrenalectomy by the transperitoneal or retroperitoneal approach can achieve good results for select, small, organ confined malignant tumors of the adrenal gland. Finally, it is important to note that the current prospective series reported comes from a surgeon who has extensive experience and facility with retroperitoneal laparoscopic adrenal and renal surgery.

CONCLUSIONS

Laparoscopic adrenalectomy can be performed safely and effectively by the transperitoneal or the retroperitoneal approach. Operative parameters, perioperative morbidity and pathological characteristics of the intact extracted specimen

were similar with the 2 approaches. In the end the choice of laparoscopic approach for adrenalectomy should depend on the personal experience and preference of the laparoscopic surgeon. Familiarity and expertise with the transperitoneal and retroperitoneal techniques will allow the laparoscopic surgeon to select the optimal approach for an individual patient.

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EDITORIAL COMMENT

Prospective, randomized studies comparing the transperitoneal vs the retroperitoneal approach for laparoscopic surgery are difficult to perform and, therefore, they are rarely found in the literature. However, it is important information such as presented in this report that helps formulate clinical laparoscopic surgery practice. These authors provide a comprehensive and well designed study comparing these 2 approaches for laparoscopic adrenalectomy. The results of their study are reinforced by the large number of patients, the prospective randomized format and the long-term followup. All operative parameters, including operative time, were similar for the 2 approaches. However, it must be recognized that the retroperitoneal approach has been demonstrated to be technically efficient in this study in the hands of an expert surgeon extensively experienced and facile with the retroperitoneal approach. It is of interest that, while perioperative morbidity, including the analgesia requirement, was similar for the transperitoneal and retroperitoneal approaches, convalescence was significantly more rapid in the retroperitoneal group than in the transperitoneal laparoscopic adrenalectomy group.

There is no question that laparoscopy has become the surgical technique of choice for adrenalectomy. The choice of transperitoneal vs retroperitoneal rests entirely on surgeon preference and the determined indication of the surgical procedure for each individual patient.

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