

Oncology: Adrenal/Renal/Upper Tract/Bladder

LAPAROSCOPIC PARTIAL VERSUS TOTAL ADRENALECTOMY FOR ALDOSTERONE PRODUCING ADENOMA

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ABSTRACT

Purpose: Laparoscopic surgery has become a standard method for adrenal treatment. Primary hyperaldosteronism is known to be frequently characterized by multiple adrenal lesions. The indication of laparoscopic partial or total adrenalectomy in patients with aldosterone producing adenoma (APA) remains controversial. We performed the 2 procedures and compared the outcomes of these 2 operations retrospectively.

Materials and Methods: A total of 92 patients with primary hyperaldosteronism were laparoscopically treated at our institution from 1995 to 2004. A total of 29 patients underwent partial adrenalectomy or enucleation, while unilateral total adrenalectomy was performed in 63. A single pathologist examined the number and histopathological characteristics of APAs. Postoperative median followup was 60.3 and 29.3 months, respectively.

Results: Laparoscopic adrenalectomies were successfully performed in each group, although the partial type had fewer ports and shorter operative time. All 63 patients with total adrenalectomy showed recovery from hypertension, suppressed plasma renin activity and high plasma aldosterone. Two of 29 patients with partial adrenalectomy or enucleation still experienced hypertension with high plasma aldosterone. Of the 63 extirpated specimens 17 adrenals (27.0%) demonstrated multiple space occupying lesions along with the main APA.

Conclusions: Primary hyperaldosteronism is highly associated with multiple adrenal space occupying lesions. The risk-to-benefit ratio must be carefully weighed against the potential advantage of partial adrenalectomy. We chose total laparoscopic adrenalectomy in patients with unilateral APA and primary hyperaldosteronism.

KEY WORDS: laparoscopy, adrenal glands, adrenalectomy, hyperaldosteronism, adenoma

Laparoscopic surgery has become a standard option for hormone hypersecreting adrenal tumors.¹ Primary hyperaldosteronism is the most common functional adrenal disease that leads to hypertension, and several cardiovascular and/or cerebrovascular events.² Primary hyperaldosteronism is classified into aldosterone producing adenoma (APA), unilateral adrenal hyperplasia and idiopathic hyperaldosteronism (IHA), etc.^{2,3} Of these categories more than 80% of primary hyperaldosteronism cases consist of APA. The surgical management of APA has long been discussed, although which procedure is appropriate between total adrenalectomy and partial resection (enucleation) remains controversial. Nakada et al reported that enucleation of APA showed good results with no remission of recurrent hyperaldosteronism and they concluded that it is preferable to total adrenalectomy.⁴ Jeschke et al performed laparoscopic partial adrenalectomy in 13 patients with APA and reported that it is a minimally invasive procedure with a low complication rate along with unremarkable postoperative blood pressure and aldosterone levels.⁵ However, in terms of surgical procedure

and therapeutic outcome to our knowledge no study has been done to compare unilateral total removal with partial adrenalectomy in the age of laparoscopic surgery. We have reported that laparoscopic total adrenalectomy was safely performed in 53 patients with APA.⁶ In this study we accumulated a number of patients and further analyzed the most appropriate surgical procedure for APA. We compared the clinical outcomes of laparoscopic total vs partial adrenalectomy in patients with APA.

PATIENTS AND METHODS

A total of 92 patients with a confirmed diagnosis of primary hyperaldosteronism underwent laparoscopic surgery at our institution from 1995 to 2004. All patients had clinical manifestations of hormone hypersecretion and underwent hormonal examinations and computerized tomography (CT) preoperatively. We examined 1.25 mm sliced adrenal images by multidetector row helical CT using a Hi-Speed Advantage Qx-I®. On this diagnostic imaging some patients had adenomas in the bilateral adrenals and in several we could not detect apparent space occupying lesions (SOLs) in the adrenals. We performed adrenal vein sampling (AVS) in such patients to detect the site responsible for secreting excessive aldosterone. According to high resolution CT and AVS we

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distinguished APAs from unilateral adrenal hyperplasia or IHA. Almost 13% of patients undergoing AVS were diagnosed with IHA (data not shown). Five of 92 patients were found to have bilateral adenomas, that is bilateral APA in 3, APA and Cushing's syndrome in 1, and APA and nonfunctioning adenoma in 1. Table 1 shows patient profiles. Adenoma size was measured by CT.

A total of 29 patients, including 5 with bilateral disease, underwent laparoscopic partial adrenalectomy (30 adrenals). The criteria for partial adrenalectomy were 1) unilateral single adenoma associated with plenty of normal adrenal tissue (21 cases) or 2) bilateral disease (5 cases). According to these preoperative investigations the final operative indication for partial resection was determined by each surgeon. Three patients underwent conversion to partial adrenalectomy because of intraoperative conditions. We performed laparoscopic unilateral total adrenalectomy in 63 patients (63 adrenals). We chose a retroperitoneal approach for partial adrenalectomy in 23 adrenals and a transperitoneal approach in 6. Tumor resection was performed with laparoscopic ultrasonic scissors (Harmonic Scalpel®). The resection line was 5 mm from the tumor. Fibrin glue was not used in any patients. The indication of the retroperitoneal or transperitoneal approach was chiefly made according to surgeon preference in partial or total adrenalectomy. A retroperitoneal approach was also used in 42 of 63 patients with total adrenalectomy.

A single pathologist examined the histopathology of the extirpated specimens, including the number of adenomas. Differences in patient characteristics, ports, intraoperative blood loss and operative time between the 2 groups were calculated by the unpaired t test using the StatView® program. Statistical significance was considered at $p < 0.05$.

RESULTS

No statistical differences were observed in patient sex, age or adenoma size (table 1). All laparoscopic operations were performed successfully. No open conversion was experienced in the operations, although 1 patient received blood transfusion after total adrenalectomy and another required laparoscopic removal of a migrated drain tube on the day after partial adrenalectomy. Table 2 lists surgical outcomes in the laparoscopic partial and total adrenalectomy groups. Significant differences in the number of ports were detected between the 2 groups ($p < 0.05$). The partial adrenalectomy group had statistically shorter operative time than the group with total adrenalectomy ($p < 0.01$). A lower amount of intraoperative blood loss was observed in the partial adrenalectomy group but this did not attain statistical significance.

All 63 patients showed improvement in hypertension, suppressed plasma renin activity and high plasma aldosterone (PAC) (approximately 12 mEq/ml) after unilateral total adrenalectomy. However, 2 of 29 patients with partial adrenalectomy remained hypertensive and showed high PAC after surgery. Figures 1 and 2 show the characteristics of these patients, respectively.

A total of 63 extirpated specimens were pathologically in-

	Adrenalectomy	
	Partial	Total
No. pts	29	63
No. men/women	15/14	31/32
Median age (range)	49.3 (30–68)	50.2 (29–75)
Mean mm main adenoma diameter (range)	15.5 (6–24)	16.0 (3–40)
Median mos postop followup (range)	60.3 (19.4–116)	29.3 (1.5–121)

TABLE 2. Partial vs total adrenalectomy for APA

	Partial	Total	p Value
No. pts	29	63	
No. lt/rt side	12/17	37/25	
Transperitoneal/retroperitoneal	6/23	21/42	
Mean No. ports (range)	3.2 (2–5)	4.0 (3–7)	<0.05
Mean ml intraop blood loss (max)	30.1 (67)	57.3 (330)	Not significant
Mean mins operative time (range)	115 (57–245)	199 (72–300)	<0.01
No. blood transfusion	0	1	
No. multiple adenomas (%)	2 (6.9)	17 (27.0)	

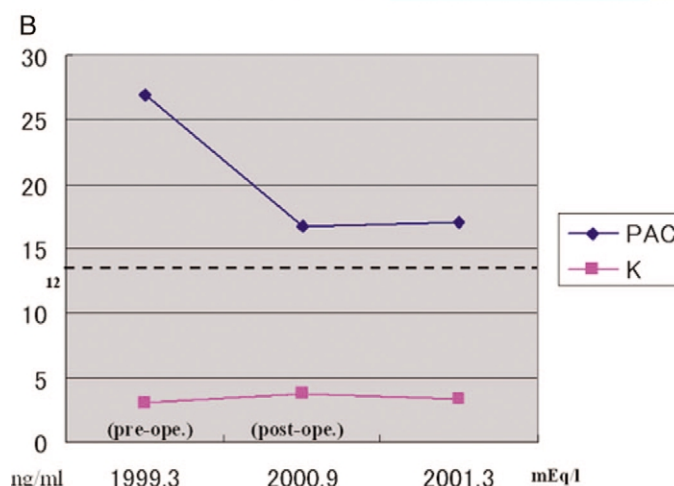
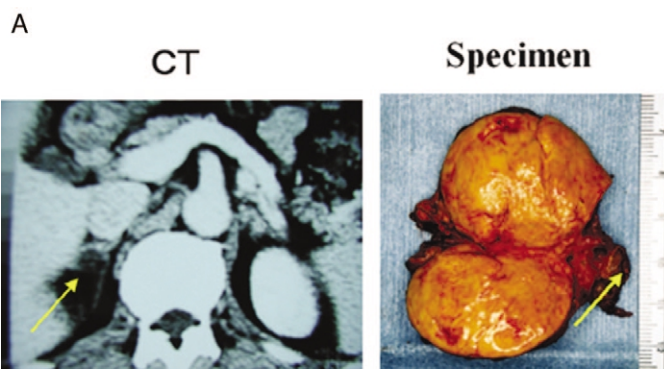


FIG. 1. Patient who underwent laparoscopic partial adrenalectomy and in whom clinical symptoms failed to improve. A, CT demonstrates single SOL (arrow). Macroscopic appearance shows typical yellowish single APA. Extirpated specimen reveals that normal adrenal tissue was dissected with ultrasonic scissors (arrow). *y.o.*, year old. B, neither PAC nor potassium was normalized after laparoscopic partial adrenalectomy. Patient remained hypertensive and required antihypertensive drugs. *pre-ope.*, preoperatively. *post-ope.*, postoperatively.

vestigated and 17 adrenals (27.0%) were associated with multiple SOLs (adenoma/nodules). Pathological findings revealed that the first, largest SOL was APA, although the remaining lesions demonstrated that macroscopic and microscopic findings were not identical with those of the first, largest SOL. Figure 3 shows a typical case of multiple SOLs with primary hyperaldosteronism.

DISCUSSION

This report represents a comparative, nonrandomized study of surgical outcomes in 2 groups of patients with APA who underwent laparoscopic partial and total adrenalectomy. To date it has been established that surgical removal of

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