

Surgical Outcomes of Laparoscopic Adrenalectomy: A 10-Year Single-Center Experience in the Philippines

Dinno Francis A. Mendiola, MD and Jose Vicente T. Prodigalidad, MD, FPUA

Department of Urology, National Kidney and Transplant Institute

Introduction and Objectives: Laparoscopic adrenalectomy is the standard treatment for adrenal tumors. Described here is the authors' 10-year experience with laparoscopic adrenalectomy in a single center.

Methods: A retrospective chart review was done on all patients who underwent laparoscopic adrenalectomy from January 2006 to January 2016 at the National Kidney and Transplant Institute. The authors determined the patient demographics (age and gender), tumor characteristics (size, functionality and laterality) and surgical outcomes (operative time, estimated blood loss, conversion to open and complications according to the Clavien-Dindo classification).

Results: A total of 90 patients underwent laparoscopic adrenalectomy. The female to male ratio was 1.4:1. Most tumors were left-sided [48/90 (53%)], with a mean size of 3.0 ± 0.75 cm. The operative time was 145 ± 35 minutes. The mean estimated blood loss was 50 ± 100 cc. The length of hospital stay was 3.0 ± 1 days. Forty six percent (42/90) of the adrenals were functioning: Hyperaldosteronism (26), Pheochromocytoma (14), and Cushing's syndrome (2). Ninety eight percent (88/90) were benign. There were 2 (2.2%) conversions to open. There were 8 complications (8.89%) (all Dindo-Clavien Class II), all of which were managed conservatively. There was no mortality.

Conclusion: The authors' experience with laparoscopic adrenalectomy shows that it is safe and effective for adrenal tumors.

Keywords: Laparoscopy, adrenalectomy, complications

Introduction

Laparoscopic adrenalectomy is recognized as the standard treatment for adrenal tumors.^{1,2} The potential benefits of laparoscopic adrenalectomy include less operative blood loss, reduced narcotic requirement for pain relief, a shorter hospital stay and more rapid recovery.³

Laparoscopic adrenalectomy was first performed by Go, et al. on a patient with aldosterone-producing adenoma in 1992. A patient with pheochromocytoma was then treated with laparoscopic adrenalectomy by Suzuki, et al. in 1993.^{4,5} Initially, the procedure was only indicated for small benign tumors. However, many recent studies have shown that larger, or even metastatic,

adrenal tumors are no longer contraindications for laparoscopic adrenalectomy.^{6,7} Moreover, the feasibility and efficacy of bilateral or partial adrenalectomy have also been reported.^{8,9}

The National Kidney and Transplant Institute (NKTi) performs a high number of laparoscopic adrenalectomies in the Philippines. The data can help determine how safe and effective laparoscopic adrenalectomy is and how we par in this procedure with institutions outside the Philippines.

The aim of the study was to determine the surgical outcome of patients who underwent laparoscopic adrenalectomy in NKTi for the past 10 years.

Patients and Methods

The study was a retrospective chart review. All patients who underwent laparoscopic adrenalectomy in NKTi from January 1, 2006 to January 1, 2016 were included. Data of the included patients were collected from the medical records: age, sex, duration of surgery, estimated blood loss, conversion to open surgery, length of hospital stay, tumor size, tumor histology, approach of laparoscopy (retroperitoneal or transperitoneal), readmission, post-operative complications (surgical site infection, ileus, myocardial infarction, pneumonia, hematoma). Statistics in the study were reported in frequency and/or percentage.

Primary endpoints of the study included indication for surgery, conversion to open, duration of surgery, length of hospital stay, post-operative complications. Secondary endpoints of the study included: age, sex, tumor size, tumor location, tumor laterality and tumor histology.

The list of patients was retrieved by review of the operative reports enlisted in the operative database of the Department of Urology and Medical Records from January 1, 2006 to January 1, 2016. The Review Board of the Research Ethics Committee approved the study. Permission was sought from the Department of Urology and Medical Records of the Hospital. Charts were reviewed in private, and data were collected with

confidentiality. Funding was done on the personal account of the principal author.

Personal information (e.g. name, age and sex) of patients gathered in this research was limited to the principal investigator and the research assistant/s involved. Personal information was placed in a Microsoft Excel file while on going data gathering. The file was accessible to the principal investigator and the research assistants involved. Anonymity of patients was protected by the assigning of codes. Patients were de-identified using number codes and only frequency and percentages of data would appear in the results. Once the relevant clinical and laboratory data were gathered, personal information was removed. All gathered information was used for research purposes only and the identity of the patients remained anonymous aside from the primary investigators and research assistants.

Transperitoneal Technique

The patient was put under general anesthesia. A nasogastric tube and a Foley catheter were inserted. The patient was then placed with a pillow in lateral decubitus position opposite to the site of the adrenal lesion. A Hasson trocar for open laparoscopy was inserted in between the mid-clavicular line and xiphoid line. The pneumoperitoneum was instituted at 12 mmHg and a 30° optic view was used for exploration of the abdominal cavity. A 12mm trocar allowed insertion of clip applier and a 5mm trocar was placed in subcostal position, respectively at the anterior and posterior axillary line depending on the actual location of the adrenal gland on inspection. Left laparoscopic adrenalectomy required three trocars while right laparoscopic adrenalectomy required another 5mm trocar to retract the right liver lobe (Figure 1). The maneuvers of dissection were conducted by ultrasonic scalpel with a 5.5mm shaft (Harmonic Aces Ethicon) or with laparoscopic scissors connected to electrocautery.

For laparoscopic left adrenalectomy, the dissection started by dividing the splenocolic ligament, then the colonic angle was mobilized, the distal pancreas and the spleen were mobilized medially. Dissection of the adrenal gland from the

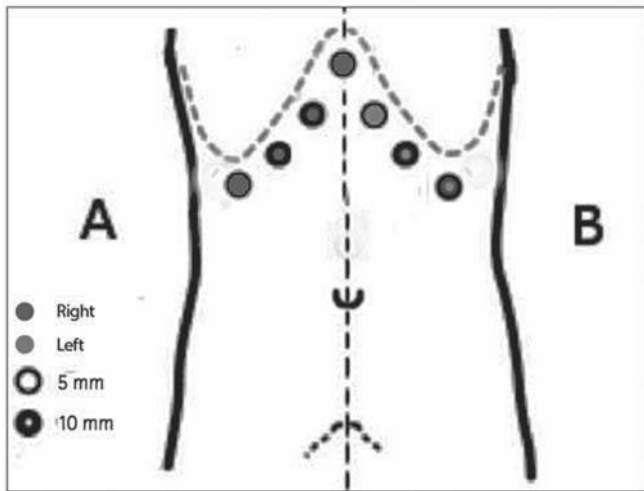


Figure 1. A: Laparoscopic adrenalectomy Right, (4 ports). B: Laparoscopic adrenalectomy left (3 ports)

superior pole of the kidney and the left crus of the diaphragm was carried out. The diaphragmatic vein and the renal vein were used as landmarks to identify the left adrenal vein. The adrenal vein was clipped with titanium clips, twice on the patient side and twice on the specimen side and then divided. For laparoscopic right adrenalectomy, the hepatic triangular ligament and the dorsal peritoneal sheets were divided, the liver was then mobilized, elevated and retracted medially so as to expose the adrenal gland. A window was created within the triangle formed by the right renal vein, the inferior vena cava and the superior pole of the right kidney. Care was taken not to injure the right polar renal arteries, which might appear in this location. The tissue in this area was dissected superiorly towards the liver with harmonic scalpel as they might contain some small blood vessels. Once the right adrenal vein was identified, it was ligated similar to the left adrenal vein. Then the adrenal gland was dissected from the superior pole of the kidney and from the right crus of the diaphragm. The adrenal gland was retrieved in an endobag through the main camera port. Whenever indicated, a drain was placed in the adrenal space.

The nasogastric tube was removed at the end of the procedure and the Foley catheter was removed the next morning. The retroperitoneal approach is rarely performed in NKTU and is not described in this study.

Results

A total of 90 patients underwent laparoscopic adrenalectomy in NKTU from January 1, 2006 to January 1, 2016. Of the 90 patients, 38 were male and 52 were female (Table 1). The mean age was 45 years old with a range of 15-74. Forty eight patients underwent laparoscopic adrenalectomy on the left and 42 on the right. Diagnosis was made either through ultrasound or computed tomography scan. Most patients were referred for functional adrenal tumors. All patients with incidental findings of an adrenal tumor were tested for functionality. Forty two of the 90 tumors were functioning: 26 Hyperaldosteronism, 14 Pheochromocytoma, and 2 Cushings syndrome. Of the 48 non-functioning tumors, 38 were ≥ 4 cm while the remaining 10 tumors had increasing tumor size. The mean tumor size was 3.0 cm with a size range of 1.0 to 10.0cm. Of the 90 specimens, 88 were benign and 2 were malignant. Of the 2 malignant cases, one was a case of adrenal cortical carcinoma measuring 10cm while the other one was a rare case of malignant peripheral nerve sheath tumor. All laparoscopic approaches were done transperitoneally. There were 2 retroperitoneal procedures done in the institution but were excluded from this study. Simultaneous laparoscopic procedures were done in 2 patients: one was laparoscopic cholecystectomy with laparoscopic adrenalectomy on the right while the other one was laparoscopic donor nephrectomy on the left with laparoscopic adrenalectomy on the same side.

The median operative time from skin incision to skin closure was 145 minutes (Table 2). The shortest operative time was 52 minutes while the longest was 290 minutes. The median estimated blood loss was 50 cc with a range of 30cc to 4500cc. The average length of hospital stay was 3.0 days with a range of 2 to 6 days.

There were 2 conversions from laparoscopy to open (2.2% conversion rate) (Table 3). One case was converted due to failure to progress in the operation. The patient was a 48-year-old female who underwent open adrenalectomy in another institution for hyperaldosteronism secondary to a functioning adrenal nodule on the right adrenal. Post-operatively, the specimen showed a normal

Table 1. Patient profile and post-operative diagnoses of patients who underwent laparoscopic adrenalectomy in National Kidney and Transplant Institute

Sex (frequency, %)	
Male	37 (41.3%)
Female	53 (58.7%)
Mean Age (year, range)	
Male	47.7 (15-74)
Female	42.4 (17-74)
Laterality (frequency, %)	
Left	48 (53.3%)
Right	42 (45.7%)
Post Operative Diagnosis	(frequency, %)
Hyperaldosteronism	26 (28.3%)
Pheochromocytoma	14 (16.3%)
Cushing's	2 (2.17%)
Non Functioning Adenoma	25 (29.3%)
Adrenal Cyst	5 (5.43%)
Myelolipoma	2 (2.17%)
Schwannoma	2 (2.17%)
Adrenal Cortical Carcinoma	1 (1.09%)
Malignant Peripheral Nerve Sheath Tumor	1 (1.09%)
Others	2 (2.17%)
Tumor Size (mean cm, range)	3.8 (1.0-10.0)

Table 2. Operative data

	Median	Range
Estimated Blood Loss (mL)	50	30-4500
Operative Time (min)	145	52-290
Length of Hospital Stay	3.0	2 to 6

adrenal gland. The patient had persistent hypokalemia and repeat CT scan showed another adrenal nodule on the right upper abdomen. When the patient underwent right laparoscopic adrenalectomy at NKTi, the adrenal nodule could not be identified hence the procedure was converted to an open one. The surgeon was eventually able to identify the adrenal nodule posterior to the liver and removed it. Post-operatively, the patient's symptoms from hyperaldosteronism resolved. The other case involved a 55-year old patient which was converted to an open procedure because of heavy bleeding from an inferior vena cava tear. The procedure was converted to open to control the bleeding. The estimated blood loss was 4.5 liters and the patient underwent transfusion with 6 units of packed RBC and was sent home 3 days post-op. The tumor was 10cm and histopathologic report revealed adrenal cortical carcinoma.

Discussion

A surgeon's experience is important in a safe laparoscopic adrenalectomy. In the early part of a surgeon's learning curve, it is more prudent to have a mentor to guide and assist the conduct of surgery. Adrenal tumors that are large or in post-operative-abdomens may be too difficult to remove laparoscopically even in the hands of an experienced surgeon. A decision to start via open adrenalectomy may be the better choice especially when patient's safety is compromised.

Table 3. Summary details of patients requiring open conversion

Age	Year	Indication	Approach	Side	Details
48	2008	Conn's Syndrome	Transperitoneal	Right	s/p open adrenalectomy from another institution but still with symptoms of hyperaldosteronism, Intra-operatively right adrenal could not be identified, failure to progress
55	2008	tumor 10cm	Transperitoneal	Right	Heavy bleeding from an inferior vena cava tear, 4500cc blood loss, transfused 6 u packed RBC, histopathologic report showed adrenal cortical carcinoma

Post-operative complications noted were 1 surgical site infection, 1 case of ileus and 5 patients had post-operative fever (Table 4). Only 1 readmission was noted where a 100cc subcapsular hematoma was noted and was managed conservatively. All complications were managed conservatively with medication (Claven-Dindo Class II classification). There were no re-operation or mortality noted.

Table 4. Post-operative complications

Complication	Number of Patients (%)
Grade II (Dindo-Clavien Classification)	
Surgical Site Infection	1 (1.11%)
Ileus	1 (1.11%)
Intraabdominal Hematoma	1 (1.11%)
Fever	5 (5.56%)
Re-operation	None
Re-admission	1 (1.11%)
Mortality	None

Review of the 10-year experiences on laparoscopic adrenalectomy done in developed countries showed that the mean operative time, conversion rate and length of hospital stay are comparable with the results of the present study (Table 5). The study shows that laparoscopic adrenalectomy done in a developing country such as the Philippines is safe and effective and has comparable results with other Western countries.

Table 5. Comparison of outcomes of laparoscopic adrenalectomy in other countries

	This Study	Pguliese Et Al	Al-Otaibi	Ali Et Al	Sommerey Et Al
Number of patients	92	68	34	134	215
Duration of Study	2006-2016	1998-2008	1999-2010	2000-2010	2000-2010
Country	Philippines	Italy	Saudi Arabia	United Kingdom	Germany
Mean Operative Time (min)	145	134 ± 90	150 (median)	137 ± 54.75	(median)
Conversion Rate (number, %)	2 (2.2)	3 (4.4)	1 (2.9)	5 (3.7)	9 (4.2)
Length of Hospital Stay (mean, days)	3.0	4 ± 2.4	2.5 ± 1.5	4	5 (median)
Mortality (number, %)	0	0	-	0	2 (0.9)

Conclusion

Laparoscopic adrenalectomy is the first line treatment for benign adrenal masses. The present review confirms that the procedure is safe and effective with minimal complications and low conversion rate. Laparoscopic adrenalectomy can be performed in developing countries like the Philippines with results acceptable compared to other published data from developed countries.

References

1. Janetschek G, Altarac S, Finkenstedt G, Gasser R, Bartsch G. Technique and results of laparoscopic adrenalectomy. *Eur Urol* 1996; 30: 475-9.
2. Vargas HI, Kavoussi LR, Bartlett DL, Wabner JR, Venzon DJ, Fraker DL, et al. Laparoscopic adrenalectomy: a new standard of care. *Urology* 1997; 49: 673-8.
3. Gagner M, Pomp A, Heniford BT, Pharand D, Lacroix A. Laparoscopic adrenalectomy: lessons learned from 100 consecutive procedures. *Ann Surg* 1997; 226: 238-46.
4. Go H, Takeda M, Takahashi H, Imai T, Tsutsui T, Mizusawa T, et al. Laparoscopic adrenalectomy for primary aldosteronism: a new operative method. *J Laparoendosc Surg* 1993; 3: 455-9.
5. Suzuki K, Kageyama S, Ushiyama T, Kawabe K, Tajima A, Aso Y, et al. Laparoscopic adrenalectomy: clinical experience of 12 cases. *J Urol* 1993; 150: 1099-2.
6. Gagner M, Lacroix A, Bolte E. Laparoscopic adrenalectomy in Cushing's syndrome and pheochromocytoma. *N Eng J Med* 1992; 327: 1033.

7. Hobart MG, Gill IS, Schweizer D, Sung GT, Bravo EL. Laparoscopic adrenalectomy for large-volume (≥ 5 cm) adrenal masses. *J Endourol* 2000; 14: 149-54.
8. Miccoli P, Materazzi G, Mussi A, Lucchi M, Massi M, Berti P. A reappraisal of the indications for laparoscopic treatment of adrenal metastases. *J Laparoendosc Adv Surg Tech A* 2004; 14: 139-45.
9. Lanzi R, Montorsi F, Losa M, Centemero A, Manzoni MF, Guazzoni G, et al. Laparoscopic bilateral adrenalectomy for persistent Cushing's disease after transsphenoidal surgery. *Surgery* 1998; 123: 144-50.
10. Pugliese R, Boniardi M, Sansonna F, et al. Outcomes of laparoscopic adrenalectomy. Clinical experience with 68 patients. *Surg Oncol* 2008;17(1): 49-57.
11. Al-Otaibi K. Laparoscopic adrenalectomy: 10 years experience. *Urol Ann* 2012; 4(2): 94-7.
12. Ali J, Liau S, Gunning K, et al. Laparoscopic adrenalectomy: auditing the 10 year experience of a single centre. *Surgeon* 2012;10(5): 267-72.
13. Sommerey S, Foroghi Y, Chiapponi C, et al. Laparoscopic adrenalectomy--10-year experience at a teaching hospital. *Langenbecks Arch Surg* 2015; 400(3): 341-7.
14. Al-Sobhi S, Peschel R, Bartsch G, et al. Partial laparoscopic adrenalectomy for aldosterone-producing adenoma: short-and long-term results. *J Endourol* 2000; 14:497.
15. Simforoosh N, Majidpour H, Basiri A, et al. Laparoscopic adrenalectomy: 10-year experience, 67 Procedures. *Urol J* 2008; 5(1): 50-4.
16. Szydelko T, Lewandowski J, Panek W, et al. Laparoscopic adrenalectomy - ten-year experience. *Cent Eur J Urol* 2012; 65(2): 71-4.
17. Wittayapiroch J, Jenwitheesuk K, Puchai S, et al. Laparoscopic adrenalectomy: 6 years experience in Srinagarind Hospital. *J Med Assoc Thai*; 98 Suppl 7:S174-8.