A Laparoscopic Versus Open Adrenalectomy in Ramathibodi Hospital

Naris Chotirosnramit MD*,
Theerapol Angkoolpakdeekul MD*, Youwanush Kongdan MD*,
Ronnarat Suvikapakornkul MD*, Surasak Leelaudomlipi MD*

** Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok*

Objective: *To compare the results of laparoscopic adrenalectomy with those of open adrenalectomy in Ramathibodi Hospital.*
Material and Method: *Medical charts of 41 laparoscopic and 39 open adrenalectomy patients were reviewed. Baseline characteristics and outcomes of treatment were compared between these two patient groups, using univariable statistical tests and multivariable statistical procedures.*
Results: *There were significant baseline differences between the two groups in terms of gender, body mass index, ASA class, and preoperative diagnosis. The outcomes operative time, estimated blood loss and length of hospital stay were also significantly different. After adjusting for the effects of baseline differences, laparoscopic adrenalectomy was associated with a significant reduction of length of hospital stay by 40%.*
Conclusion: *Laparoscopic adrenalectomy is a safe and effective procedure and should help hasten postoperative recovery and may save the costs of hospitalization.*

Keywords: *Laparoscopic adrenalectomy, Hospital stay*

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There has been increasingly widespread use of minimally invasive surgery since laparoscopic cholecystectomy was first introduced in 1987[1]. Snow et al[2] performed the first successful transabdominal laparoscopic adrenalectomy in a patient with hematoma of the right adrenal gland in 1991. Garner et al[3] popularized the lateral transabdominal approach for laparoscopic adrenalectomy in 1992. Later, in 1995, Marcan et al[4] described a technique for laparoscopic adrenalectomy via the posterior, retroperitoneal approach. Since these initial reports, several studies have demonstrated the safety and advantages of laparoscopic adrenalectomy, so that it has become the procedure of choice for the surgical management of many adrenal neoplasms[5-7]. Recent studies have demonstrated significant benefits for patients who have undergone laparoscopic adrenalectomy, in terms of reduced operative morbidity, shorter hospital stay and earlier return to normal activity when compared with open adrenalectomy[8-10].

The aim of the present study was to retrospectively compare the results of laparoscopic adrenalectomy with those of open adrenalectomy in Ramathibodi Hospital.

Correspondence to : Angkoolpakdeekul T, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University Bangkok 10400, Thailand.

Material and Method

Patients who underwent laparoscopic adrenalectomy at the Department Surgery, Faculty of Medicine, Ramathibodi Hospital, from January 2001 to November 2006, were compared retrospectively with a group of patients who underwent open adrenalectomy from January 1996 to November 2006 at the same institution. The laparoscopic operation was performed using a lateral transabdominal approach. After induction of general anesthesia, a nasogastric tube and Foley's catheter and was routinely inserted. Patients were placed in the lateral decubitus position with the side of the lesion elevated 45 degrees to open the costo-pelvic space. The opened technique was used to insert the

first trocar at the anterior axillary line. Intraabdominal pressure was maintained at 15 mmHg. The abdominal cavity was explored using a 30-degree laparoscope.

Left adrenalectomy was performed using two further 10 mm and 5 mm trocars at the posterior axillary line and mid axillary line, respectively. The splenic flexor of the colon was mobilized by sectioning the linorenal and splenocolic ligaments so that the spleen and the tail of the pancreas could fall medially without the need for a retractor. After dissecting the adrenal gland from the surrounding fatty tissue, the left adrenal vein was identified and ligated using clips.

Right adrenalectomy was performed with three further 10 mm trocars placed below the costal margin, one just beneath the costal margin in the mid clavicular line, and one in the subxiphoid area (for liver retraction). The procedure was begun with a complete section of the triangular ligament of the liver to allow adequate mobilization of the liver in order to achieve a good exposure of the operative field, avoiding laceration of Glisson's capsule. The retroperitoneum was opened, the inferior vena cava was identified and the right adrenal vein was exposed on its lateral side and divided between multiple clips.

In open adrenalectomy, the adrenal gland was approached transperitoneally on either side using a subcostal incision. The adrenal gland was exposed and removed in the conventional manner.

The records of all available cases (41 patients in the laparoscopic adrenalectomy group and 39 patients in the open adrenalectomy group) were reviewed. Relevant information including age, gender, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, previous abdominal surgery, preoperative diagnosis, duration of operation (operative time), postoperative complications, duration of ICU stay, estimated blood loss and length of hospital stay were retrieved. Data were contrasted between groups using the Chi squared test, Fishers's exact test, unpaired T test or Mann-Whitney U test as appropriate. The length of hospital stay was log-transformed and used as the outcome in a multiple linear regression analysis to identify significant factors associated with longer hospital stay. P-values less than 0.05 were considered significant. STATA version 7 (Stata Corp, College Station, TX, USA) was used for all statistical analyses.

Results

Seventy-six patients were included in the present study; 41 patients having undergone laparoscopic adrenalectomy and 39 patients open adrenalectomy. There were some significant differences in the baseline characteristics between the two groups (gender, BMI, and ASA class) (Table 1).

The preoperative diagnoses for both groups are listed in Table 2. The most common diagnosis in the laparoscopic group was primary hyperaldosteronism (Conn's syndrome) in 32 patients (78%). There were no pheochromocytoma patients in the laparoscopic group. All patients with pheochromocytoma underwent open adrenalectomy. The most common diagnosis in the open group was also Conn's syndrome, but with a smaller percentage of patients (15 patients or 38% of all opened procedures).

There were no significant differences between the two groups in terms of tumor size, tumor weight and side of the operation (Table 3). However, the

Table 1. Baseline characteristics of each study group

Baseline characteristic	Laparoscopic group (n = 41)	Open group (n = 39)	p-value
Age (years)			
Mean(SD)	48.7 (11.0)	45.1 (15.5)	0.212
Gender (M:F)			
Number (%)	18:23 (44:56)	6:33 (15:85)	0.005
Body Mass Index			
Mean (SD)	25.7 (5.1)	23.0 (3.7)	0.007
ASA class: number (%)			
1	0	3 (8)	0.002
2	21 (51)	29 (74)	
3	18 (44)	6 (15)	
4	2 (5)	1 (3)	

median operative time in the laparoscopic group was significantly longer than that in the open group (135 minutes versus 75 minutes, $p < 0.001$). Patients who underwent laparoscopic adrenalectomy had significantly less blood loss than those in the open group (50 mL versus 150 mL, $p < 0.001$). Three patients in the laparoscopic group converted to the open technique. One of these patients had extensive adhesions from previous cholecystectomy. Another had severe adhesions due to marked inflammation of the adrenal gland from tuberculosis. The third patient was converted because of massive bleeding from an accidental tear of the IVC.

There were no significant differences between the two groups in terms of postoperative complications, duration of ICU stay and amount of blood transfused. The hospital stay was significantly shorter in the laparoscopic group (6 days versus 13 days, $p < 0.001$; Table 4). Two perioperative complications occurred in the laparoscopic group. One patient had torn renal vein and IVC (and was converted to the open technique). Another had a moderate amount of subcutaneous emphysema at the chest wall and upper arm, which resolved with conservative treatment. In the open adrenalectomy group two perioperative complications occurred as well. The first patient had postoperative pancreatitis, the second underwent splenectomy due to accidental tear of the spleen and later acquired postoperative pneumonia. There was no operative mortality.

Although the hospital stay was significantly shorter in the laparoscopic group, this could be due to the confounding effects of unbalanced baseline and operative factors. In order to adjust for these confounding effects, a multiple linear regression analysis was done for the logarithm of hospital stay (log transformed to "Normalize" the distribution of the variable), with operative technique as well as the potential confounders detailed in Tables 1 and 3 as covariates. Significant factors associated with longer hospital

Table 2. Indications for operation

Preoperative diagnosis	Laparoscopic group Number (%); n = 41	Open group Number (%); n = 39
Conn's syndrome	32 (78)	15 (38)
Cushing's syndrome	4 (10)	7 (18)
Pheochromocytoma	0	9 (23)
Incidentaloma	5 (12)	8 (21)

Table 3. Operative data

	Laparoscopic group (n = 41)	Open group (n = 39)	p-value
Maximum tumor diameter (cm)			
Mean (SD)	5.1 (1.5)	5.7 (2.9)	0.223
Tumor weight (gm)			
Median (range)	9 (2.4-53.0)	10 (3.1-292.1)	0.118
Previous abdominal surgery			
Number (%)	9 (22)	3 (8)	0.074
Side (right : left)			
Number (%)	15:26 (37:63)	14:25 (36:64)	0.949
Operative time (minutes)			
Median (range)	135 (60 to 315)	75 (50 to 240)	<0.001
Estimated blood loss (mL)			
Median (range)	50 (10 to 3000)	150 (50 to 2500)	<0.001
Conversion to open procedure			
Number (%)	3 (7)	NA	NA

Table 4. Postoperative data

	Laparoscopic group (n = 41)	Open group (n = 39)	p-value
Duration of ICU stay (days)			
Median (range)	0 (0 to 2)	0 (0 to 16)	0.113
Length of hospital stay (days)			
Median (range)	6 (4 to 12)	10 (4 to 59)	<0.001
Blood replacement (units)			
Median (range)	0 (0 to 5)	0 (0 to 5)	0.161
Mean (SD)	0.22 (0.85)	0.64 (1.5)	

Table 5. Significant pre and operative factors related to hospital stay (each regression factor multiplies the hospital stay)

Factor	Multiplication factor (95% CI)	p-value
Conn's and Cushing's syndrome vs. pheochromocytoma and incidentaloma	1.49 (1.23 to 1.81)	<0.001
Laparoscopy		
(Yes vs. open)	0.63 (0.52 to 0.76)	<0.001
ASA class		
(Per one higher class)	1.20 (1.05 to 1.38)	0.010
Hypertension		
(Yes)	1.43 (1.13 to 1.81)	0.003
Estimated blood loss		
(Per log cc increase)	1.14 (1.07 to 1.22)	<0.001

stay according to the multiple regression analysis are presented in Table 5 (note that the regression coefficients are in exponential form in the table). After adjusting for the confounding effects of preoperative diagnosis, ASA class, presence of hypertension with blood loss, and laparoscopy were still significantly associated with a shorter hospital stay, reducing the duration of hospital stays by 37%.

Discussion

Until the end of the 1970s, the majority of surgeons used the anterior (transabdominal) approach to perform open adrenalectomy[5]. This open technique has a number of advantages, including wide exposure of the operative field, easy exploration of the entire abdomen and contralateral adrenal region, and easy control of the main adrenal vein. The disadvantages are the complications associated with any extensive open procedure and a long incision, e.g., surgical site infection, incisional hernia and the need for bowel manipulation, which increases the risk of visceral injury, ileus and postoperative adhesions.

Laparoscopic procedures introduced two decades ago have eliminated some, or attenuated the effects, of these complications. Laparoscopic adrenalectomy can reduce the need for parenteral pain medication, accelerate the resumption of a normal diet, significantly reduce postoperative hospitalization and allow patients to return to their normal daily activities earlier. Laparoscopic procedures can also avoid the muscular trauma typical of laparotomy, yield better cosmetic results, cause less severe postoperative pain as well as facilitate adequate ventilation, and thus, are likely to reduce pulmonary sequelae[6-12].

The present retrospective comparative study confirmed the previous findings of others that patients undergoing laparoscopic adrenalectomy require a significantly shorter duration of hospital stay following operation when compared with those undergoing open adrenalectomy[9-12]. Patients undergoing laparoscopic adrenalectomy also had less blood loss than those having the open operation, but the need for blood transfusion did not differ between the two groups.

The prolonged operative time recorded for patients who underwent laparoscopic adrenalectomy when compared with those who had an open operation was in keeping with the experience of others[13], as the laparoscopic procedure is technically demanding. Hopefully, the operating times for laparoscopic adrenalectomy will shorten as experience with the operation continues to grow.

Among the absolute contraindications documented for laparoscopic adrenalectomy is extensive tumor infiltration of adjacent organs, which requires en bloc resection. Laparoscopic removal of symptomatic pheochromocytomas during pregnancy is also discouraged. Relative contraindications are morbid obesity (which may require excessive intra-abdominal insufflating pressure), previous surgery with postoperative scarring and presence of a large pheochromocytoma. In the latter case, laparoscopic adrenalectomy is contraindicated due to the manipulation of the mass with consequent catecholamine surge, which may be more pronounced with the laparoscopic approach[14]. In the present series, all patients who had pheochromocytoma underwent open adrenalectomy.

Previous abdominal surgery has been considered by some to be a relative contraindication to using the laparoscopic approach because of intra-abdominal adhesions[15]. However, in the present series, 9 patients (22%) had a history of previous abdominal surgery. Only 1 patient required conversion to open adrenalectomy because of intraabdominal adhesions from a previous cholecystectomy.

In the present study the confounding effects of unbalanced baseline characteristics on the relationship between treatment and outcome were adjusted for in a multiple linear regression analysis. The results of the adjusted analysis confirmed that the shorter duration of hospital stay in the laparoscopic group was statistically significant. Laparoscopic adrenalectomy may reduce the length of hospital stay by as much as 40% compared with the open procedure.

Conclusion

The result of the present study confirmed that most adrenal lesions can be safely resected via a laparoscopic approach, with a low morbidity rate, no mortality and a potential saving of hospital resources.

References

1. Bonjer HJ, Lange JF, Kazemier G, de Herder WW, Steyerberg EW, Bruining HA. Comparison of three techniques for adrenalectomy. Br J Surg 1997; 84: 679-82.
2. Snow LL. Endoscopic general surgery: an update. Laser Highlights 1991; 2: 1-3.
3. Gagner M, Lacroix A, Bolte E. Laparoscopic adrenalectomy in Cushing's syndrome and pheochromocytoma. N Engl J Med 1992; 327: 1033.
4. Mercan S, Seven R, Ozarmagan S, Tezelman S. Endoscopic retroperitoneal adrenalectomy. Surgery 1995; 118: 1071-5.
5. Linos DA, Stylopoulos N, Boukis M, Souvatzoglou A, Raptis S, Papadimitriou J. Anterior, posterior, or laparoscopic approach for the management of adrenal diseases? Am J Surg 1997; 173: 120-5.
6. Staren ED, Prinz RA. Adrenalectomy in the era of laparoscopy. Surgery 1996; 120: 706-9.
7. Horgan S, Sinanan M, Helton WS, Pellegrini CA. Use of laparoscopic techniques improves outcome from adrenalectomy. Am J Surg 1997; 173: 371-4.
8. Jacobs JK, Goldstein RE, Geer RJ. Laparoscopic adrenalectomy. A new standard of care. Ann Surg 1997; 225: 495-501.
9. MacGillivray DC, Shichman SJ, Ferrer FA, Malchoff CD. A comparison of open vs laparoscopic adrenalectomy. Surg Endosc 1996; 10: 987-90.
10. Schell SR, Talamini MA, Udelsman R. Laparoscopic adrenalectomy for nonmalignant disease: improved safety, morbidity, and cost-effectiveness. Surg Endosc 1999; 13: 30-4.
11. Shichman SJ, Herndon CD, Sosa RE, Whalen GF, MacGillivray DC, Malchoff CD, et al. Lateral transperitoneal laparoscopic adrenalectomy. World J Urol 1999; 17: 48-53.
12. Toniato A, Bernante P, Rosse GP, Piotto A, Pelizzo MR. Laparoscopic versus open adrenalectomy: outcome in 35 consecutive patients. Int J Surg Investig 2000; 1: 503-7.
13. Acosta E, Pantoja JP, Gamino R, Rull JA, Herrera MF. Laparoscopic versus open adrenalectomy in Cushing's syndrome and disease. Surgery 1999; 126: 1111-6.
14. Zacharias M, Haese A, Jurczok A, Stolzenburg JU, Fornara P. Transperitoneal laparoscopic adrenalectomy: outline of the preoperative management, surgical approach, and outcome. Eur Urol 2006; 49: 448-59.
15. Bonjer HJ, Sorm V, Berends FJ, Kazemier G, Steyerberg EW, de Herder WW, et al. Endoscopic retroperitoneal adrenalectomy: lessons learned from 111 consecutive cases. Ann Surg 2000; 232: 796-803.

การศึกษาเปรียบเทียบแบบย้อนหลังระหว่างการผ่าตัดต่อมหมวกไตผ่านกล้องและการผ่าตัดแบบเปิดหน้าท้อง ในโรงพยาบาลรามาธิบดี

นริศ โชติโรศนรมิท, ธีรพล อังกูลภักดี, เยาวนุช คงด่าน, รณรัฐ สุวิกะประกรณ์กุล, สุรศักดิ์ ลีลาอุดมลิปี

วัตถุประสงค์: *เพื่อศึกษาผลการรักษาเปรียบเทียบแบบย้อนหลังในการผ่าตัดต่อมหมวกไตแบบผ่านกล้องและแบบเปิดหน้าท้อง ในโรงพยาบาลรามาธิบดี*

วัสดุและวิธีการ: *ทำการศึกษาเก็บข้อมูลจากเวชระเบียนที่รวบรวมได้จากผู้ป่วยซึ่งได้รับการผ่าตัดต่อมหมวกไตผ่านกล้อง 41 ราย ในระหว่างปี พ.ศ. 2544 - พ.ศ. 2549 และที่รวบรวมได้จากการผ่าตัดแบบเปิดหน้าท้อง 39 ราย ที่ผ่าตัดในระหว่างปี พ.ศ. 2539 - พ.ศ. 2549 โดยนำผลลักษณะพื้นฐานของผู้ป่วยทั้งหมดและผลการรักษาผ่าตัดทั้ง 2 วิธี มาเปรียบเทียบกันโดยใช้สถิติแบบ univariable statistical test และ multivariable statistical test*

ผลการศึกษา: *พบว่ามีความแตกต่างอย่างมีนัยสำคัญในทางสถิติในข้อมูลพื้นฐานของ เพศ ดัชนีมวลกาย ASA class และชนิดโรคของต่อมหมวกไต ในผู้ป่วยทั้งสองกลุ่ม ส่วนผลของการผ่าตัดที่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ คือ เวลาในการทำผ่าตัด, ค่าประเมินของการเสียเลือดระหว่างการผ่าตัด และระยะเวลาในการนอนโรงพยาบาล หลังจากใช้สถิติปรับค่าความแตกต่างพื้นฐานของผู้ป่วยทั้ง 2 กลุ่มแล้ว พบว่า ผู้ป่วยที่ได้รับการผ่าตัดต่อมหมวกไตผ่านกล้อง ทำให้ผู้ป่วยลดระยะเวลาในการนอนในโรงพยาบาลได้ถึงร้อยละ 40*

สรุป: *การผ่าตัดต่อมหมวกไตผ่านกล้อง เป็นการผ่าตัดที่ปลอดภัยและมีประสิทธิภาพ ช่วยลดระยะในการนอนในโรงพยาบาล ตลอดจนลดระยะเวลาฟื้นตัวหลังผ่าตัดของผู้ป่วยและอาจจะช่วยลดค่าใช้จ่ายของโรงพยาบาลได้*