Transperitoneal laparoscopic adrenalectomy: five years' experience with 35 patients

Altuğ Tuncel¹, Melih Balcı¹, Ersin Köseoğlu¹, Yılmaz Aslan¹, Özer Güzel¹, Tanju Keten¹, Dilek Berker², Serdar Güler², Ali Atan¹

ABSTRACT

Objective: To present our laparoscopic surgery experience in the treatment of adrenal masses.

Material and methods: Between January 2008 and February 2013, a total of 35 patients (24 females, 11 males) underwent transperitoneal laparoscopic adrenalectomy to treat an adrenal mass. The patients underwent hormonal evaluation, chemical shift magnetic resonance imaging, or abdominal computed tomography. Twenty-seven patients (77.1%) had a hormone-active adrenal mass.

Results: Eighteen right, 16 left, and one bilateral transperitoneal laparoscopic adrenalectomies were performed. The mean age and body mass index of the patients were 47.4 years and 26.6 kg/m², respectively. The mean adrenal mass size, operation time, estimated blood loss, and hospitalization duration were 41.9 mm, 94.7 min, 30 cc, and 2.4 days, respectively. No minor or major complications were observed perioperatively or postoperatively. In one patient (2.8%), the laparoscopic approach was converted to open surgery due to severe bradycardia resulting from chronic obstructive pulmonary disease. Histopathological examinations revealed adrenocortical hyperplasia in 23 (66%) patients, benign pheochromocytoma in 8 (22.8%) patients, and periadrenal paraganglioma, adrenocortical carcinoma, myeloid metaplasia, and myelolipoma in one (2.8%) patient for each entity.

Conclusion: Transperitoneal laparoscopic adrenalectomy is a safe and efficient minimally invasive treatment option with a low morbidity rate in the surgical treatment of adrenal masses.

Key words: Adrenal gland; laparoscopy; mass; treatment.

¹Third Department of Urology, Ministry of Health, Ankara Numune Research and Training Hospital, Ankara, Turkey

²Department of Endocrinology and Metabolism, Ministry of Health, Ankara Numune Research and Training Hospital, Ankara, Turkey

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Correspondence:
Altuğ Tuncel
Third Department of Urology,
Ministry of Health, Ankara
Numune Research and Training
Hospital, 06120 Ankara, Turkey
Phone: +90 555 331 33 93
E-mail: tuncelaltug@yahoo.com

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Introduction

Nowadays due to frequent use of radiological diagnostic methods, adrenal masses have been detected at an increasing rate. In international literature, incidence of detection of these masses changes between 4, and 6 percent.^[1] Laparoscopic adrenalectomy was firstly performed by Gagner et al.^[2] in 1992, and since it has become the preferred minimally invasive therapy in many centers with increasing popularity in the surgical treatment of adrenal masses. This surgical modality has advantages as lesser amount of perioperative bleeding, shorter hospital stay, early return to normal daily activities, improved cosmetic appearance, and provision of better field of vision for the surgeon.^[3] In international literature, for laparoscopic resection of adrenal masses, lateral, anterior, and transperitoneal approaches have been described. The most frequently used

laparoscopic method is lateral transabdominal approach.^[4,5]

In this study, we evaluated outcomes of the patients who had undergone transperitoneal laparoscopic adrenalectomy with the indication of an adrenal mass.

Material and methods

In this study, the data of the patients who had undergone transperitoneal laparoscopic adrenalectomy between January 2008, and February 2013 with the indication of adrenal mass were evaluated retrospectively. All patients were referred to our clinic from Clinics of Endocrinology, and Metabolism. Detailed medical history of the patients was inquired, and their physical examination was performed before surgery. Besides, routine biochemical analyses, whole blood counts,

serum cholesterol, aldosterone, dehydroepiandrosterone levels were determined, and free cortisol, vanillylmandelic acid, and metanephrine values were measured in 24 hour-urine samples. For the radiological diagnosis of adrenal mass, in 26 patients, chemical shift magnetic resonance imaging, and in 9 patients computed-tomography of the abdomen were performed. Antihypertensives, and other drugs used by the patients were recorded. One or more than one clinical complaints including lumbar pain, hypertension, tachycardia, tremor, sweating, headache, and flushing has been accepted as a positive sign for the presence of pheochromocytoma. Evaluation of the adrenal mass as for hormone-active status, and preoperative preparation of hormone-active tumors were performed in the Clinics of Endocrinology, and Metabolism of our hospital. In 27 (77.1%) patients adrenal mass was hormone-active. During preoperative period, alpha blocker, and beta blocker (on 3. day of 2 mg oral doxazosin therapy, 2 mg oral metoprolol was added and continued for 15 days) combination therapy was applied for hormone-active adrenal masses. Besides, all patients received daily doses of 2500 mL NaCl IV fluid replacement starting 15 days before the operation. In patients with initial diagnosis of Cushing's disease, before the operation Cushing protocol was started, and continued for 4 days postoperatively. The patient who had undergone bilateral transperitoneal laparoscopic adrenalectomy received Addison protocol, and maintained for 4 days postoperatively. To prevent intraoperative development of potential malignant hypertension, in all operations non-selective alpha blocker phentolamine mesylate was kept at hand. Written consent forms were obtained from all patients, preoperatively.

Postoperative follow up of the residual functional adrenal gland, and of the patients in whom a hormone-active adrenal mass was detected preoperatively, was performed in Clinics of Endocrinology, and Metabolism of our hospital. During these follow-ups, preoperatively higher serum, and urine metabolite values were detected to be within normal levels which was accepted as normalization of hormonal hyperactivity. In patients who clinically thought to have Cushing's disease, oral prednisolone treatment was started during the postoperative period at daily doses of 5-7.5 mg. These patients were monitored at 3 month-intervals, and based on their actual cortisol levels, treatment was discontinued at an appropriate time, and then they were followed up at yearly intervals. Oral prednisolone therapy at daily doses of 7.5 mg was started for patients who had undergone bilateral transperitoneal adrenalectomy, and maintained for their lifetime with 6-month controls. Patients without any preoperative hormone-active adrenal mass were included in the yearly follow-up protocol for the monitorization of the functional reserve of the residual adrenal gland.

Surgical technique

Under general anesthesia, the patients was laid in the 30° modified flank position with the ipsilateral adrenal gland on top. The table was flexed with the table break pressing against the kidney cushion protecting the umbilical region of the patient. Axillary region was supported with a roll of drapes to protect brachial plexus from exposure to excess pressure. Besides, to protect the upper arm from exposure to pressure a sponge pillow was placed under it, and fixated with a plaster. Priorly, a Veress needle (LapraSurge®, France) was inserted into the abdominal cavity from the intersection point between anterior clavicular line and a virtual horizontal line passing through umbilicus, and CO₂ insufflation was applied to construct a pneumoperitoneum at an air pressure of 12 mmHg. Over a blunt tip obturator advanced through the access tract of the Veress needle, a 12mm-trocar (Versaport®, Covidien Health Care, USA) was inserted into the abdominal cavity. Then under direct vision, nearly 2 cm inferior to the intersection point between the midclavicular line, and 12. rib, a 12 mm- working trocar (Versaport®, Covidien Health Care, USA) was placed. Finally, cranial to the umbilicus, another 12 mm- working trocar (Versaport®, Covidien Health Care, USA) was inserted over a blunt tip obturator through intersection point between the midclavicular line, and a virtual horizontal line passing through crista iliaca anterior superior. In cases with right transperitoneal laparoscopic adrenalectomy, under direct vision over a blunt tip obturator a 10 mm-trocar (Versaport®, Covidien Health Care, USA) was inserted through a point on the midclavicular line 2 cm inferolateral to the xyphoid with the intention of placing a 10- mm-fan retractor (Endoretract®, Covidien Health Care, USA) to be used if retraction of the liver was needed.^[6] In all operations 30° lens (Hopkins®, Karl Storz, Germany) was used for visualization of intraabdominal structures.

Following intraabdominal access, the operation was continued so as to maintain pneumoperitoneum pressure at 14 mm Hg. In transperitoneal left laparoscopic adrenalectomy technique, priorly with sharp dissection retroperitoneal space was entered from Todd's line. Then descending colon was dissected distally beginning from splenic flexura, and medialized. Afterwards, splenocolonic, and splenorenal ligaments were transected using 5 mm-monopolar scissors (Endo Shears®, Covidien Health Care, USA) or 5 mm- LigaSure® (Covidien Health Care, USA). To facilitate access into suprarenal fossa, incision was extended up to spleen, and spleen was freed completely. Following these procedures, suprarenal fossa was entered, and priorly left adrenal vein which drained into the left renal vein located inferomedial to the adrenal gland was released from its attachments completely with the aid of 5 mm-laparoscopic Hazel Nut F17 (Autosuture®, Covidien Health Care, USA), and then transected using 5 mm- LigaSure® (Covidien Health Care, USA). After structural identification of the adrenal gland, it was

liberated firstly from its posterior aspect, and then from its renal attachments using blunt, and sharp dissections. The specimen harvested was taken out on the operating bench, placed in a 10 mm-specimen bag (Endocatch, Covidien Health Care, USA).^[6]

In transperitoneal laparoscopic right adrenalectomy, through Toldt line retroperitoneal space was entered to identify right colon, and duodenum. These structures were medialized using blunt, and sharp dissections. Anatomy of vena cava inferior (VCI) was exposed. Then peritoneal layer covering upper pole of the kidney anterior to the liver was separated with sharp dissection, and triangular ligament was approached. This ligament was cut using 5 mm LigaSure® (Covidien Health Care, USA). In case of need, the liver was retracted using 10 mm fan retractor (Endoretract®, Covidien Health Care, USA). Firstly, right adrenal vein which drains directly into VCI was exposed, and identified posterolateral to VCI. In one case a large ligation clip (Hem-o-Lock, Weck-Teleflex, USA), and in other cases 5 mm- LigaSure® (Covidien Health Care, USA) were used to transect the right adrenal vein. After identification of the adrenal gland, it was freed from its posterior aspect, then from its renal attachments using blunt, and sharp dissection. Then harvested specimen was placed in a 10 mm-specimen bag (Endocatch, Covidien Health Care, USA) taken on the bench.^[6] At the end of the operation, in all patients, a Jackson- Pratt drain was inserted through the surgical wound incision. All operations were performed by a single surgeon (A.T.)

Statistical analysis

Descriptive data of the patients were evaluated using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL USA) for Windows Version 13.0. All numerical data were expressed as mean±standard deviation.

Results

Thirty-five patients had undergone transperitoneal laparoscopic adrenalectomy (right, 18; left, 16; bilateral, 1). Mean age of the patients was 47.4±1.7 (28-65) years. Patient population consisted of 24 (68.6%) female, and 11 (32.4%) male patients. Sixteen patients (11 females, and 5 males) had clinically initial diagnosis of Cushing's disease. Demographic characteristics, and perioperative findings are summarized in Tables 1, and 2, respectively. None of the patients required blood transfusion. Besides, in none of the patients, intraoperative, and/or early, and late-term postoperative minor or major complications developed. In only one patient (2.8%) who had undergone transperitoneal laparoscopic right adrenalectomy, the authors switched to open surgery because of development of intraoperative bradycardia on the background of severe chronic obstructive pulmonary disease, and operation was terminated without any complication.

Histopathological examination of the surgically excised specimens revealed adrenocortical hyperplasia (n=23; 66%), benign pheochromocytoma (n=8; 22.8%), periadrenal paraganglioma (n=1; 2.8%), adrenocortical carcinoma (n=1; 2.8%), myelolipoma (n=1; 2.8%), and myeloid metaplasia (n=1; 2.8%).

In all patients with preoperatively detected adrenal hormone-active masses, hormonal activity returned to normal during postoperative follow-up period.

Discussion

During the last 20 years, together with increased experience in laparoscopic surgery laparoscopic adrenalectomy has become globally preferred method in the surgical treatment of adrenal masses. When international literature was analyzed, comparisons between laparoscopic, and open adrenalectomy in terms of oncological efficacy, peri-, and postoperative parameters, and development of complications appears to be in the foreground. In the year 1998, Winfield et al.^[7], compared outcomes of transperitoneal laparoscopic (n=21), and open adrenalectomies (n=17) they performed for benign adrenal masses less than 6 cm in diameter.^[8] The authors reported that postoperative level of pain was lower with shorter hospital stay, and earlier return to daily activities. In their case-controlled study, Imai et al.^[8] compared the outcomes of transperitoneal laparoscopic (n=40), and open (n=40) adrenalectomies performed for cases with hormone-active adrenal masses. According to outcomes of this study, when compared with the open surgery group lesser amount of blood loss, (40 vs. 172 mL), 2.5 times lower requirement for analgesic use, and shorter hospital stay (12 vs. 18 days) were detected in the laparoscopic group. The authors reported that in the surgical treatment of active adrenal masses of <6 cm in diameter, laparoscopy was safe, and effective method with lower postoperative level of pain, and shorter hospital stay. In another study, the outcomes of patients with benign, and malignant adrenal masses who had undergone laparoscopic (n=31) or

Table 1. Demographic characteristics of the patients

	Mean±SD (range)
Mean body mass index (kg/m ²)	26.6±0.7 (18.1-35.5)
Mean diameter of the mass (mm)	41.9±2.1 (25-80)
Number of hormone-active masses	27

Table 2. Preoperative findings

	Mean±SD (range)
Mean operative time (mins)	94.7±4.6 (50-180)
Mean amount of blood loss (mL)	30±1.7 (0-60)
Mean hospital stay (days)	2.4±0.8 (1-3)

open (n=21) surgery were compared.^[9] In this study the authors indicated that in 2 cases in the laparoscopic surgery group, they switched to open surgery. They also detected lesser amount of blood loss (71 vs. 124 mL), lower requirement for meperidine for postoperative pain (45 vs. 120 g), and shorter hospital stay (4 vs. 8 days) when compared with the open surgery. When these literature data are evaluated, comparable effectiveness between laparoscopic, and open surgery is evident. In the light of the abovementioned data, laparoscopic surgery has been performed in our clinic since the year 2008.

Laparoscopic adrenalectomy can be also applied in the surgical treatment of adrenocortical carcinoma as for oncological effectiveness. Brix et al.^[4] performed open (n=117) or laparoscopic adrenalectomy with the indication of adrenocortical carcinoma measuring ≤ 10 cm in diameter. Based on the results of a multivariate analysis, they detected similarities between both surgical methods as for mortality rates, and survival without development of metastasis ($p=0.92$, and $p=0.69$, respectively). The authors reported that in cases of localized adrenocortical carcinoma measuring ≤ 10 cm, laparoscopic method was equivalent to open surgery regarding oncological effectiveness. Porpiglia et al.^[10] evaluated the outcomes of laparoscopic (n=18), and open surgery (n=25) they performed for stage I/II adrenocortical carcinomas, and during 30 months of follow-up recurrence rates were 64, and 50% in the laparoscopic, and open surgery groups without any intergroup difference as for recurrence-free survival. Lombardi et al.^[9] applied open (n=126), and laparoscopic (n=30) surgery with the indication of stage I/II adrenocortical carcinoma, and they couldn't find any difference between both groups as for local recurrence, distant metastases, and 5-year-survival rates. The authors of this article have concluded that if oncological principles were to be complied with, then surgical method would not effect oncological outcomes. In our series, we detected adrenocortical carcinoma in only one case among patients in whom we performed transperitoneal laparoscopic adrenalectomy. This was a 59-year-old female patient whose contrast-enhanced abdominal computed-tomography demonstrated a 4.5 cm mass in the right adrenal gland which displayed a post-contrast pattern. Postoperative histopathological examination of the surgical specimen did not reveal surgical margin positivity. The patient was consulted to Medical Oncology Clinics of our hospital, and adjuvant chemotherapy was not considered for this patient. Any recurrence was not detected during 4-year-follow-up period.

Even though laparoscopic adrenalectomy is accepted as a minimally invasive surgery, there is a risk of development of intraoperative complications. The most frequently seen perioperative complications are related to vascular, intestinal, hepatic, renal, and diaphragmatic injuries.^[11] Vascular complications rank on top of these complications which are especially more often

seen in cases with right adrenalectomy with incidence rates ranging between 0.7, and 5.4 percent.^[11-15] Eichhorn-Wharry et al.^[16], (2012) compared complication rates in cases who had undergone laparoscopic (n=1980) or open (n=592) surgeries based on Clavien classification. Based on the results of this study, respective Clavien class 4 or 5 complication rates were detected as 1.8, and 7.6 percent ($p<0.001$). As evaluation of our outcomes revealed, in only one patient we switched from laparoscopic to open surgery because of development of bradycardia on the background of chronic obstructive pulmonary disease, and then the operation was terminated without emergence of any complication. However in our other patients any minor or major peri-, and postoperative minor, and major complications were not detected. Since evaluation of our series has not revealed development of complication in any one of our study population, transperitoneal laparoscopic adrenalectomy is a safe surgical method to be performed in the treatment of cases with adrenal masses.

Review of the urology literature in the data base of the Turkish Medical Index has revealed three published studies about laparoscopic adrenalectomy. In a study published by Karataş et al.^[17] in 2009, experience with transperitoneal laparoscopic adrenalectomy in 5 cases (right=3; left=2) with adrenal masses less than 6 cm in diameter were presented. In this study mean operative time, and amount of blood loss were reported as 115 minutes, and 90 mL, respectively. Based on histopathological examination results, pheochromocytoma (n=3; 60%), adrenal hematoma (n=1; 20%), and metastasis of renal cell carcinoma to adrenal gland (n=1; 20%) were detected. The authors of this study reported discharge of all patients on the postoperative 1.days without any complication. Yavaşcağlu et al.^[18] published their experience in transperitoneal laparoscopic adrenalectomy in the year 2009 which is the largest series in the urology literature up to now. In this study, 33 cases with a mean age of 49 years had undergone laparoscopic adrenalectomy (right, n=15, left, n=17, and bilateral, n=1). Average size of the adrenal mass, operative time, amount of blood loss were reported as 35.9 mm, 150 minutes, 47 mL, and 3.2 days, respectively. In one case perioperative pancreas injury was reported which was managed with conservative approach, and the patient was discharged without any further problem. Based on histopathological results, adrenocortical adenoma (69.7%), pheochromocytoma (15%), adrenocortical hyperplasia (6%), adrenocortical carcinoma (3.1%), metastatic carcinoma (3.1%), and oncocytoma (3.1%) were detected. The authors indicated that transperitoneal laparoscopic adrenalectomy is a safe method with lower morbidity rates in the surgical management of adrenal masses. In their article published in 2012, Penbegül et al.^[19] reported that they had performed transperitoneal laparoscopic adrenalectomy (right, n=5; left, n=5) on 10 patients with an average age of 42 years. According to the outcomes of their study, average size of the

adrenal mass, operative time, hospital stay, and amount of blood loss were 7.1 cm, 136 minutes, 0 mL, and 2.3 days, respectively. The authors indicated that they had switched to open surgery in one case because of technical inadequacy without development of any early or late-term complication in none of their cases. Based on histopathological examination results, cases of adrenal adenoma (n=6; 60%), pheochromocytoma (n=2; 20%), myelolipoma (n=1, 10%), and lymphangioma (n=1; 10%) were detected. The authors of the cited article, indicated that transperitoneal laparoscopic adrenalectomy is a minimally invasive effective surgical alternative in the management of adrenal masses with lower morbidity. Our outcomes revealed that average operative time (94.7 mins), estimated amount of blood loss (30 mL), and hospital stay (2.4 days) were in compliance with national , and international urological data. As indicated in the international literature, histopathological examination of adrenal masses most frequently (60-65%) revealed the presence of benign adrenal masses.^[20-22] Similarly, adrenocortical hyperplasia was detected in 66% of our cases.

In conclusion, nowadays, frequent use of radiological diagnostic methods has increased incidence of adrenal masses. In the surgical treatment of these masses, transperitoneal laparoscopic adrenalectomy is a minimally invasive method which can be used safely as an alternative to open surgery.

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

Peer-review: Externally peer-reviewed.

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