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Laparoscopic Adrenalectomy: A Single-Center's Experience

Laparoskopik Adrenalektomi: Tek Merkez Deneyim

Murat Güner, Cengiz Aydın

Sağlık Bilimleri Üniversitesi Izmir Tepecik Egitim ve Araştırma Hastanesi Genel Cerrahi Kliniği, Izmir, Turkey

Abstract

Laparoscopic adrenalectomy (LA) has become the "gold standard" for treating most adrenal lesions. The purpose of this study was to evaluate the results of 98 consecutive laparoscopic adrenalectomies performed over 15 years at a single center. Ninety-eight patients who underwent laparoscopic adrenalectomy between 2006 and 2021 at the Izmir Tepecik Training and Research Hospital were included in this retrospective study. Previous abdominal surgery, American Society of Anesthesiologists (ASA) score, tumor size and location, surgical procedures, and postoperative results with histologic diagnosis and complications were analyzed from patient archives. The mean age of the patients was 53.38 ±13.55 years. The mean size of the adrenal lesions was 59.1 (range, 23 to 130) mm. Nineteen (19.4%) patients required conversion to open adrenalectomy. The rate of conversion was found to be significantly higher in patients with intraoperative complications (p<0.001) and lesions larger than 8 cm (p=0.032). The mean length of hospital stay was 6.3 (range, 2-32) days. Laparoscopic adrenalectomy is the standard treatment for adrenal lesions. Tumor location, histopathologic type, and the age of the patients should not be considered a contraindication for laparoscopic adrenalectomy. Intraoperative complications and lesions larger than 8 cm are seen as the most important reason for conversion to open adrenalectomy.

Keywords: Laparoscopic adrenalectomy; Laparoscopic surgery; Adrenalectomy; Endocrine surgery

Özet

Laparoskopik adrenalektomi (LA) adrenal lezyonunların tedavisinde "altın standart" tedavi yöntemi haline gelmiştir. Bu çalışmanın amacı tek merkezde 15 yıllık sürede uygulanan 98 laparoskopik adrenalektomi sonuçlarını değerlendirmektir. Bu retrospektif çalışmaya 2006-2021 yılları arasında İzmir Tepecik Eğitim ve Araştırma Hastanesi'nde laparoskopik adrenalektomi uygulanan doksan sekiz hasta dahil edildi. Hastaların tümör boyutu ve lokalizasyonu, ASA skoru, daha önce geçirilmiş abdominal cerrahi varlığı, uygulanan cerrahi işlem, histopatolojik tanı ve intraoperatif komplikasyon sonuçları hasta arşivlerinden analiz edildi. Hastaların yaş ortalaması 53.38 ±13.55 idi. Adrenal lezyonların ortalama boyutu 59.1mm (23-130 mm) idi. On dokuz (% 19.4) hastada açık adrenalektomiye dönüldü. İntraoperatif komplikasyon gerçekleşen (p<0.001) ve 8 cm'den büyük lezyonu (p=0.032) olan hastalarda açık cerrahiye dönüş oranı anlamlı olarak yüksek bulundu. Ortalama hastanede kalış süresi 6.3 gün (2-32 gün) olarak bulundu. Laparoskopik adrenalektomi adrenal lezyonlar için altın standart tedavi yöntemidir. Tümör lokasyonu, yaş veya histopatolojik tip laparoskopik adrenalektomi için kontrendikasyon değildir. İntraoperatif komplikasyon ve 8 cmden büyük lezyonlar açık adrenalektomiye dönüşün en önemli nedenleridir.

Anahtar Kelimeler: Laparoskopik adrenalektomi; Laparoskopik cerrahi; Adrenalektomi; Endokrin cerrahi

Correspondence:
Murat GÜNER
Sağlık Bilimleri Üniversitesi Izmir Tepecik Egitim ve Araştırma Hastanesi Genel Cerrahi Kliniği, Izmir, Turkey
e-mail: mgunerus@yahoo.com

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1. Introduction

Laparoscopic adrenalectomy was first described by Gagner et al. in 1992. Since then, it has become the gold standard treatment method for adrenal lesions (1). Two techniques have been described for laparoscopic adrenalectomy, transperitoneal adrenalectomy, and retroperitoneal adrenalectomy. Also, some studies are indicating that robotic technologies can be used safely in addition to these surgical procedures (2). Laparoscopic adrenalectomy (LA) is preferred to open adrenalectomy (OA) surgery because of less blood loss, lower complication rates, less postoperative pain, shorter hospital stay, and better cosmetic results (3). Open surgery is indicated in the case of radiologic evidence of tumor invasion into the periadrenal tissue, local recurrent tumor of a previously resected adrenal mass, and patients with severe cardiopulmonary disease (4). Although there is no definite contraindication, studies are recommending open adrenalectomy in malignant lesions because of the potential of incomplete resection, tumor spillage, and capsular disruption that can cause local tumor recurrence and metastasis (5). Size is an important variable in predicting malignancy. Although it is reported in the literature that lesions larger than 6 cm are suitable for open surgery due to their malignant potential, studies are reporting that giant lesions can be successfully resected with laparoscopic adrenalectomy (6-7).

2. Materials and Methods

A total of 98 laparoscopic adrenalectomies performed between 2006 and 2021 were evaluated retrospectively.

Preoperative

All patients, tumor size and location, previous abdominal surgery, American Society of Anesthesiologists (ASA) score, surgical procedures, and postoperative results with histologic diagnosis, length of hospital stay, and complications were evaluated retrospectively. All patients underwent preoperative imaging studies [computed tomography (CT) or magnetic resonance imaging (MRI)] to study the morphologic characteristics and size of the lesions. Before surgery, all patients underwent a complete preoperative endocrine evaluation to determine the hormonal activity of the adrenal tumor. In patients with suspected pheochromocytoma, patients were preoperatively treated with alpha-blockers (doxazosin 20 mg/day) (additional beta-blockers in case of co-existing tachycardia) and intravenous volume expansion with colloids and crystalloids. Preoperative steroid treatment was administered to patients with Cushing's disease and serum potassium levels were checked and corrected in patients with Conn's syndrome, preoperatively.

Patients selection

ASA score ≤ III, age less than 82 years, and functioning benign adrenal tumors were the main surgical inclusion criteria. Patients with suspected local invasive malignant adrenal neoplasm were recommended open surgery and excluded from the study.

Surgery

For all patients, the lateral transabdominal approach was used with the patient in the lateral decubitus position. We used a Veress needle to induce pneumoperitoneum. We used four trocars for both right and left-side adrenalectomies. In all patients, the lesion was excised through en bloc resection, and there was no capsular disruption during dissection. At the end of the procedure, surgical specimens were positioned in an endo-bag and removed through the operative trocar.

Postoperative management

In all patients, normal diet and mobilization started on the first postoperative day. Abdominal drainage was performed on all patients and drainage was removed on the first or second postoperative day. Postoperative complications were recorded.

Statistical analysis

Statistical analyses were performed using the SPSS software ver. 22.0 (IBM, Armonk, NY, USA). According to the distribution of variables, a Chi-square (χ^2) or Fisher exact

test was used to compare differences in discrete or categorical variables, respectively). Continuous variables were compared using the Student's t-test because of a lack of normal data distribution, continuous variables were assessed using the Mann–Whitney U test, and the significance of the difference in terms of median levels was investigated using the Kruskal–Wallis test. A p-value < 0.05 was considered statistically significant.

3. Results

After obtaining approval from the local ethics committee, the study was conducted at Izmir University of Health Sciences Tepecik Training and Research Hospital General Surgery Clinic between January 2006 and December 2021. A total of 98 patients who underwent laparoscopic adrenalectomy were included in the study. The patients' age, sex, previous abdominal surgery, ASA score, lesion size and location, lesion histopathologic type, surgical procedures, morbidity, and mortality were evaluated. There were 65 women (66.3%) and 33 men (33.7%). The mean age was [mean+standard deviation (SD)] 53.38±13.55 years. The mean lesion size was 59.1 ± 16.71 mm. The mean surgical time was 141.04±24.78 min. The mean length of hospital stay was 6.4 (range, 2-32) days. There were 19 (19.4%) cases of conversion to open surgery. Three patients died during the 30-day perioperative period. The demographic characteristics of patients who were recruited in the study are summarized in Table 1.

Table 1. The demographic characteristics of the patients

Age (Mean+SD) years	53.38 ±13.55
Sex (M/F)	33/65
Operation site*	
Right n (%)	39 (39.8%)
Left n (%)	59 (60.2%)
Operation time (min)	144.85±24.78 min
Tumor size (Mean+SD) mm	59.1 ± 16.71
Tumor diameter >8 cm n (%)	19 (19.4%)
ASA Score	
ASA1 n (%)	57 (58.2%)
ASA2 n (%)	24 (24.5%)
ASA3 n (%)	11 (11.3%)
First Radiologic imaging	
CT n (%)	68 (69.3%)
MRI n (%)	30 (30.6%)
Previous abdominal surgery n (%)	9 (9.2%)
Conversion to open surgery n (%)	19 (19.4%)
Complications n (%)	11 (11.3%)
Hospital stay (day) (Min-Max)	6.36 (2-32)
Mortality n (%)	3 (3.1%)

Pathologic reports are reviewed and shown in Table 2. Forty-two (42.9%) patients had cortical adenoma, 20 (20.4%) had pheochromocytoma, and nine (9.2%) patients had metastasis. The most common primary tumor causing metastasis was lung cancer in six patients, renal cell cancer in two, and colon cancer in one patient, respectively.

Table 2. Histologic type of adrenal lesions

Histological type	Patients (%)
Adenoma	42 (42.9)
Hyperplasia	5 (5.1)
Pheochromocytoma	20 (20.4)
Myelolipoma	8 (8.2)
Hamartoma	1 (1.0)
Cyst	9 (9.2)
Carcinoma	3 (3.1)
Hemangioma	1 (1.0)
Metastasis	9 (9.2)

Nineteen of 98 patients' surgery bean as LA and was converted to OA, nine due to bleeding, five for tenacious adhesions, and five for insufficient exposure. Bleeding was the most common cause of converting to OA. There was no statistical difference between the sexes regarding the rate of conversion from LA to OA (p=0.449). No statistical difference was found between right and left-sided masses in terms of the rate of conversion from LA to OA (p=0.311). There was no statistical difference between the histopathologic subtypes and the rate of conversion to OA (p=0.210), but conversion to OA was reversed in one patient with carcinoma.

When the rates of conversion to OA with previous abdominal surgery were evaluated, no statistical difference was found (p=0.821). There was no statistical difference between the ASA score and the rate of conversion to OA (p=0.178). Intraoperative complications were found to be an important factor in conversion to OA (p<0.001). There was no statistical difference in the rate of conversion to OA between patients diagnosed using preoperative CT or MRI (p=0.651).

Patients converted to OA and patients who completed LA were aged a mean of 60.26±13.80 years and 51.72±13.04 years, respectively. The mean age was found to be significantly higher in the patients who were converted to OA (p=0.013).

The median tumor size was found as 50 (min: 23, max: 130) mm in the LA group and 70 (min: 32, max: 125) mm in the converted OA group. There was no statistical difference between the two groups according to tumor size (p=0.317). Conversion to OA was needed in seven of 19 patients with adrenal lesions larger than 8 cm. When the lesions larger than 8 cm and lesions smaller than 8 cm were compared according to conversion rates, a significant difference was found (p=0.032).

The mean length of hospital stay was 5 (min: 2, max: 32) days in patients whose surgeries were completed laparoscopically and 7 (min: 4, max: 28) days in patients who were converted to open surgery. The length of hospital stay was found to be significantly longer in patients who were converted to OA (p<0.001).

Five of the patients with intraoperative complications were male and six were female. There was no statistical difference between the intraoperative complication and sex (p=0.350). No statistical difference was found between intraoperative complication and localization or histopathologic subtype (p=0.353 and p=0.90, respectively).

When previous abdominal surgery and intraoperative complications were evaluated, no significant difference was found (p=0.260). When intraoperative complications were evaluated according to the ASA score, ASA1 (n=0), ASA2 (n=10), ASA3 (n=1) were found, respectively (p=0.056). Although no statistically significant difference was found, the rate of patients with complications in the ASA2 risk group was found as 17.8%. The median tumor size of the patients with intraoperative complications was found as 55 (min: 39, max: 120) mm (p=0.411).

There was no significant difference between tumor size and histopathologic findings (p=0.139). Due to bleeding, splenectomy was required in three patients and nephrectomy in three patients. Serious vena cava injuries occurred in two patients, which were repaired intraoperatively. However, postoperative bleeding recurred in these patients and they were reoperated; both patients died during the follow-up period. One patient who needed a nephrectomy because of bleeding died of pulmonary thromboembolism. Six patients had postoperative complications. The 30-day morbidity rate was 6.1%; pulmonary infection in two patients, wound infection in two patients, and bleeding in two patients

4. Discussion

The adrenal glands are in a hard-to-reach area due to their location, thus large incisions are needed in open surgical procedures, but we can reach this area more easily with laparoscopic surgery. There are studies indicating that adrenal lesions larger than 8 cm are not suitable for laparoscopic surgery (8-9). However, it has been reported in the literature that adrenal lesions with a size of 18 cm can also be removed laparoscopically (10).

In our study, the median tumor size was found as 50 (min: 23, max: 130) mm in the LA group and 70 (min: 32, max: 125) mm in the converted OA group. However, conversion to OA was needed in seven of 19 patients with adrenal lesions larger than 8 cm. When the lesions larger than 8 cm and lesions smaller than 8 cm were compared according to the conversion rate, a significant difference was found (p=0.032).

Size is not a contraindication for laparoscopic adrenalectomy, but there are studies in the literature that accept 6 cm or 8 cm as the limit (11,12). LA in large lesions is more difficult than in smaller lesions and it is associated with significantly longer surgical time, increased intraoperative blood loss, and higher conversions rates. Patients with lesions larger than 8 cm should be evaluated more carefully and the possibility of conversion to open surgery should be kept in mind.

LA is currently the gold standard for the treatment of adrenal tumors (4,5). Conversion from LA to OA during surgery may be necessary to prevent complications. In a study, BMI ≥30 kg/m^2, tumors of >5 cm in diameter, and histologic type were significantly associated with conversion to open surgery (13). In our study, 19 of 98 (19.4%) patients whose surgery began as LA was converted to OA: nine for bleeding, five for tenacious adhesions, and five for insufficient exposure. Intraoperative complications were found an important factor in conversion to OA (p<0.001). Bleeding was the most common cause of converting to OA. No statistically significant results were found between conversion rates and sex, lesion side, or histopathologic type of lesion. In our hospital, resident training is given and laparoscopic adrenalectomy is performed by different surgical teams, and these surgeons are not of equal surgical experience. Bleeding is seen as the most important cause of conversion to open surgery, and in our opinion, surgical experience is one of the most important reasons for conversion to OA.

In our study, when the histopathologic types were examined, the most common lesion was adenoma 42.9%, followed by pheochromocytoma 20.4%, and metastasis 9.2% (Table 2). The most common cause of adrenal metastases is the lung, followed by renal malignancies and others (14). In our study, the most common primary tumor causing metastasis was lung cancer (n=6, renal cell cancer (n=2), and colon cancer (n=1), respectively. There are studies reporting that adrenalectomy improves outcomes in selected patients with metastatic disease (15,16). Open surgery is recommended in the presence of metastases in many studies (17,18). In our study, nine patients with metastases underwent laparoscopic adrenalectomy, and conversion to OA was needed in four of nine patients.

Age is an independent risk factor for postoperative complications or mortality, but in selected patients, major surgical procedures can be performed safely and comparable results can be achieved in the young population (19,20). According to age, patients who were converted to OA and patients who completed LA were found to be aged 60.26±13.80 years and 51.72±13.04 years, respectively. The mean age was found to be significantly higher in the patients who were converted to OA (p=0.013). Weinandt et al. stated that laparoscopic adrenalectomy could be safely performed in patients aged over 75 years of age without a significant increase in postoperative morbidity (21). Minimally invasive surgery for all age groups seems to be the best option; although the mean age of the patients who were converted to open surgery was found to be higher in our study, we do not think that age alone is a contraindication for laparoscopic surgery.

Adrenal lesions are found in approximately 4-6% of routine abdominal imaging examinations for other indications, often as incidental asymptomatic adrenal lesions (22). CT is the most commonly used technique for adrenal lesions and MRI is the second-line modality for the investigation of adrenal lesions (23). In our study, CT was used as first-line imaging in 68 (69.3%) patients and MRI was used as first-line imaging in 30 (30.6%) patients. There was no statistical difference in the rate of conversion to OA or intraoperative complications between patients

whose disease was diagnosed preoperatively using CT or MRI (p=0.651).

Although studies are reporting the length of hospital stay as 2-4 days (24,25), some authors have reported a longer length of hospital stay (4-7 days) (26,27). Hermosa et al. found a significant difference between a prolonged hospital stay and tumor size larger than 9 cm, day of operation, estimated blood loss ≥60 mL, and drainage (28). In our study, the mean length of hospital stay was 5 (min: 2, max: 32) days in patients whose surgery was completed laparoscopically and 7 (min: 4, max: 28) days in patients who were converted to open surgery. The length of hospital stay was found to be significantly longer in the patients who were converted to OA (p<0.001).

There is a risk of complications in every patient who undergoes surgery. Although complication rates decrease with surgical experience, complications can be seen due to reasons such as malignancy, anatomic variations, adhesions, and insufficient exposure. The most common complications during laparoscopic adrenalectomy are vascular injuries, intestinal injuries, liver and spleen injuries, pleural injuries, and pancreas injuries (29). In our study five of the patients with intraoperative complications were male and six were female. There was no statistical difference between the intraoperative complications and sex, localization, histopathologic subtype, or previous abdominal surgery (p=0.350, p=0.353, p=0.90, and p=0.260, respectively). Due to bleeding, splenectomy was required in three patients and nephrectomy in three patients. Serious vena cava injury occurred in two patients and the vena cava was repaired intraoperatively. However, postoperative bleeding recurred in both patients and they were reoperated but died in the follow-up period. One patient who needed a nephrectomy because of bleeding died of massive pulmonary thromboembolism.

This study is a retrospective study and has some limitations. The surgical procedures were performed by different surgeons, and each surgeon's experience with laparoscopic adrenalectomy is not equal. Therefore, we cannot evaluate the number of cases required for the learning curve. Postoperative initiation of oral feeding, use of drains, and time to discharge differ between surgeons and affect the length of stay in the hospital.

5. Conclusion

Minimally invasive surgery is increasingly used in all surgical procedures. LA is a safe procedure for suitable patients with acceptable complications and low conversion rates. Intraoperative complications and lesions larger than 8 cm are seen as the most important reasons for conversion to open surgery.

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Ethics

Ethics Committee Approval: This study was approved by the Ethics Committee of the Republic of Turkey Ministry of Health University of Health Sciences Tepecik Training and Research Hospital. (Number: 2021/01-26, Date: 25.01.2021).

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