



# Laparoscopic adrenalectomy single-center experience, does size matter?

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## ABSTRACT

**Introduction:** Today, with the increase in the use of computerized tomography and magnetic resonance imaging in clinical practice, the frequency of detection of adrenal mass has gradually increased. When a mass is detected incidentally in the adrenal gland, it should be investigated whether it is functional and has a malignant potential. In this study, patients treated in our clinic for adrenal mass were reviewed.

**Materials and Methods:** Patients who underwent laparoscopic adrenalectomy in the General Surgery Clinic of Haseki Training and Research Hospital between January 2018 and July 2023 were retrospectively reviewed. The recorded data consist of demographic information, surgery performed, duration of surgery, biochemical and hormonal laboratory values, radiological findings, surgery indication, terminal pathology results, hospital stay, complications, and mortality and morbidity data. The patients were divided into two groups according to tumor size and compared in terms of surgical results.

**Results:** Forty-five patients, 10 male and 35 female, were included in the study. When the group with tumor size smaller than 6 cm and the group with a tumor size of 6 cm or larger were compared, a significant difference was found in terms of operation time ( $p < 0.002$ ). There was no difference in complication rates.

**Conclusion:** In the management of an adrenal mass, hormonal evaluation of the tumor and its size determine the surgical approach decision. A multidisciplinary approach is required in cases with suspected malignancy and in cases where the tumor is functional. Currently, the gold standard in the surgical treatment of adrenal masses is the laparoscopic approach.

**Keywords:** Adrenal incidentaloma, Adrenal mass, Laparoscopic adrenalectomy

## Introduction

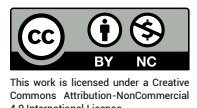
In general, adrenal tumors can be categorized into five groups: adrenal adenomas and nodular hyperplasia; other benign lesions (myelolipomas, cysts, hematomas, and others); adrenocortical carcinomas (ACC); other malignant tumors (metastases, sarcomas, and lymphomas); and pheochromocytomas.<sup>[1]</sup> Most adrenal incidentalomas

are benign and non-functional; up to 20–30% of such lesions are characterized by autonomous cortisol secretion (ACS) with hormonal overproduction. When an adrenal mass is incidentally detected, it should be investigated whether the mass is functional and has malignant potential. Plasma or urine levels of metanephrine, cortisol, ACTH, aldosterone, renin, and potassium should be mon-



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itored, and a dexamethasone suppression test should be conducted. The surgical approach in the management of adrenal incidentalomas is determined by the tumor's hormonal function and size.<sup>[2]</sup>

Tumor size is associated with the risk of malignancy. Tumors larger than 6 cm carry a risk of malignancy exceeding 25%. Tumors with a size of 4 cm or smaller constitute <2% of malignancies, whereas those ranging from 4 to 6 cm are malign in approximately 6% of cases. In any patient with a newly discovered adrenal mass, determining whether the mass is malignant and hormonally active is equally important to guide the best treatment. Malignancy is diagnosed in 5% to 8% of patients with adrenal tumors. The prevalence of malignancy varies between 1.2% and 12% in different series.<sup>[3]</sup>

Advancements in radiological imaging techniques and the widespread use of diagnostic laboratory tests have led to an increase in the detection of adrenal masses. The prevalence of adrenal incidentalomas has reached 5% with modern imaging methods, and it is expected to catch up with the rate seen in post-mortem studies (2.7–8.7%) in future.<sup>[4]</sup>

Laparoscopic adrenalectomy, owing to both the demonstration of its superiority over conventional surgery and the ease of its implementation gained through experiences in many centers, has become the preferred surgical technique, particularly for benign adrenal masses.

In this study, we aimed to present the data of laparoscopic adrenalectomy cases performed in our clinic and investigate the effect of tumor diameter on early outcomes.

## Materials and Methods

This study commenced after obtaining approval from the Haseki Research and Training Hospital Clinical Research Ethics Committee (Protocol number: 146–2023).

Patients who underwent laparoscopic adrenalectomy for adrenal mass in the General Surgery Clinic of Haseki Research and Training Hospital between January 2018 and July 2023 were retrospectively reviewed. The recorded data consist of demographic information, surgery performed, duration of surgery, biochemical and hormonal laboratory values, radiological findings, indication for surgery, terminal pathological results, length of hospital stay, development of complications, and mortality and morbidity data.

The patients were divided into 2 groups based on histopathological tumor size. Tumors with a diameter smaller than 6 cm were defined as Group 1, whereas tumors with a diameter of 6 cm or larger were defined as Group 2. These two groups were compared in terms of age, gender, lesion side, surgery duration, length of hospital stay, and complication rates.

IBM SPSS 20.0 for Windows program was used for statistical analysis. Descriptive statistics were calculated as numbers and percentages for categorical variables, and mean, standard deviation, and median minimum and maximum for numerical variables. Since the normal distribution could not be achieved in the comparison of the numerical data of the two groups, it was evaluated with the Mann–Whitney U test. The ratios between the two groups were compared with the Chi-square test. Statistical alpha significance level was accepted as  $p < 0.05$ .

## Results

In this study, 45 patients who underwent laparoscopic adrenalectomy in the General Surgery Clinic of Haseki Research and Training Hospital between January 2018 and July 2023 were retrospectively analyzed. 35 of them were female (77.8%) and 10 (22.2%) were male.

The age of the patients, the diameter of the mass detected on imaging and final pathology, the duration of surgery, and length of hospital stay are shown in Table 1.

The most common pathological diagnosis was adrenocortical adenoma ( $n=30$ ), whereas 3 pheochromocytomas and 1 adrenocortical cancer were seen. Three out of 6 cases operated for pheochromocytoma in the clinic were reported as adenomas in terminal pathology. The other

**Table 1. Demographic data and clinical features of tumor**

	Mean±SD	Median (min-max)
Age	51.49±11.83	53 (18–71)
Tumor diameter (imaging) (mm)	46.47±23.65	42 (11–124)
Tumor diameter (pathology) (mm)	51.11±29.44	45 (10–140)
Duration of surgery (minute)	118.38±40.122	120 (23–95)
Length of hospital stay (day)	3.27±1.61	3 (2–8)

three cases were reported as pheochromocytomas, of which 2 were evaluated as exhibiting aggressive behavior. Final pathology results are shown in Table 2.

Aggressively behaving pheochromocytoma cases and the case with adrenocortical cancer had tumor diameters larger than 6 cm. In our series, malignancy was not detected in tumors smaller than 6 cm.

In terms of complications, surgical site infection was detected in 1 patient (2.2%), adrenal insufficiency was found in 4 patients (8.9%), and no pathology was detected in the other 40 patients (88.9%). Out of the 4 cases that developed adrenal insufficiency, only 1 had undergone surgery

due to a non-functional adrenal mass. Temporary adrenal insufficiency was observed in all cases (Table 3).

There were nonfunctional masses in 68.9% (n=31) and functional masses in 31.1% (n=14) of the cases. Indications for surgery are shown in Table 4.

When the tumors smaller than 6 cm were defined as Group 1 and those with a tumor diameter of 6 cm or larger as Group 2, the operative times were significantly different between the two groups (Table 5). There was no difference between these two groups in terms of side (right and left), gender, complication, and functional status.

**Table 2. Pathological results**

	Number	Percentage	Valid percentage	Cumulative percent
Adenoma	30	66.7	66.7	66.7
Myelolipoma	6	13.3	13.3	80
Ganglioneuroma	1	2.2	2.2	82.2
Adrenocortical cancer	1	2.2	2.2	84.4
Leiomyoma	1	2.2	2.2	86.7
Pheochromocytoma	3	6.7	6.7	93.3
Other	2	4.4	4.4	97.8
Lymphangioma	1	2.2	2.2	100
Total	45	100	100	

**Table 3. Complications**

	Number	Percentage	Valid percent	Cumulative percentage
None	40	88.9	88.9	88.9
Surgical site infection	1	2.8	2.2	91.1
Adrenal insufficiency	4	8.9	8.9	100
Total	45	100	100	

**Table 4. Indications for surgery**

	Number	Percentage	Valid percent	Cumulative percent
Conn's syndrome	4	8.9	8.9	8.9
Cushing's syndrome	4	8.9	8.9	17.8
Pheochromocytoma	6	13.3	13.3	31.1
>6 cm	9	20.0	20.0	51.1
4–6 cm radiological suspect	14	31.1	31.1	82.2
<4 cm non-adenomatous, suspect	2	4.4	4.4	86.7
Collision tumor	6	13.3	13.3	100
Total	45	100	100	

**Table 5. Duration of procedure and length of stay in different sizes**

	Group 1	Group 2	p
Age	52.18±9.36	49.77±16.80	NS
Duration of procedure	107.9±37.07	146.15±34.29	0.002
Length of stay	3.16±1.54	3.54±1.80	NS

## Discussion

In recent years, with the increasing use of advanced imaging techniques such as computed tomography and magnetic resonance imaging in clinical practice, the incidence of incidentally detected adrenal masses has risen. Consequently, the evaluation and management of adrenal tumors have become significant areas of clinical interest. In this study, we aimed to present the outcomes of laparoscopic adrenalectomy based on a single-center experience, assess the relationship between tumor size and terminal pathology, and investigate whether this size presents any challenges for laparoscopic surgery applicability.

The diversity of adrenal tumors necessitates a comprehensive classification system. Adrenal adenomas, nodular hyperplasia, other benign lesions, ACC, malignant tumors, and pheochromocytomas constitute this spectrum. A significant portion of adrenal incidentalomas is benign and non-functional; however, a subset of these may exhibit hormonal activities such as ACS. In the literature, this ratio is reported to be around 20–30%,<sup>[5]</sup> whereas in our study, it was found to be 8.9%. The functional mass ratio in our series was 31.1%. While malignancy rates around 25% are reported for tumors exceeding 6 cm in the literature,<sup>[6]</sup> the rate for tumors between 4 and 6 cm is reported to be approximately 6%. However, in our study, malignancy rate was 23% for lesions above 6 cm, yet all tumors smaller than 6 cm were benign. These findings corroborate the crucial role of tumor size in determining malignancy.

Laparoscopic adrenalectomy was first reported by Gagner et al.<sup>[7]</sup> and has emerged as the gold standard in the surgical management of adrenal masses.<sup>[8]</sup> This study confirms the preference for the minimal invasive technique of laparoscopic approach, particularly for benign adrenal lesions. The popularity of laparoscopic adrenalectomy is due not only to its proven superiority over conventional

surgery, but also to its widespread practice in medical centers due to the accumulation of experience.<sup>[9]</sup> Our study indicates that tumor size affects surgical technique only in terms of operation duration, and it supports the safe application of laparoscopic surgery for larger masses with comparable complication rates.

## Conclusion

This study reinforces laparoscopic adrenalectomy as a reliable surgical approach for the management of adrenal tumors. Transabdominal laparoscopic adrenalectomy is a surgical technique that can be safely applied even for larger masses with low complication rates, considering the possibility of malignancy in tumors exceeding 6 cm.<sup>[10-12]</sup> However, the strict adherence to oncological surgical principles should not be overlooked.<sup>[13]</sup> The retrospective design of this study and the relatively limited number of cases are indeed its limitations.

## Disclosures

**Ethics Committee Approval:** This study commenced after obtaining approval from the Haseki Research and Training Hospital Clinical Research Ethics Committee (Protocol number: 146–2023).

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

**Authorship Contributions:** Concept – G.Ç., H.Ü.G.; Design – G.Ç., H.Ü.G.; Supervision – G.Ç.; Materials – G.Ç.; Data collection and/or processing – G.Ç., H.Ü.G.; Analysis and/or interpretation – G.Ç.; Literature search – H.Ü.G.; Writing – H.Ü.G.; Critical review – G.Ç., H.Ü.G.

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