

## Lateral Transperitoneal Laparoscopic Adrenalectomy: A Single Center Experience

### *Lateral Transperitoneal Laparoskopik Adrenalektomi: Tek Merkez Deneyimi*

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#### ABSTRACT

**Objective:** Laparoscopic adrenalectomy is the gold standard surgical technique for benign adrenal tumors. On the other hand, most surgeons still prefer to perform open surgery for adrenal tumors. This may be related with the surgeons opinions that laparoscopic adrenalectomy is an advanced laparoscopic surgery and has a high learning curve. In this article we present the results of our initial transperitoneal laparoscopic adrenalectomy cases.

**Methods:** Lateral transperitoneal laparoscopic adrenalectomy cases that were performed between 2013 and 2015, were retrospectively analyzed. Patients demographics, pathological types, operation time, blood loss, hospitalization time and complications were evaluated and compared with the literature.

**Results:** A total of 21 patients were analyzed. Twelve (57.1%) patients had right and 9(42.9%) patients had left laparoscopic adrenalectomy. Mean operation time was 130.2±39.1 min, mean blood loss was 197.6±72.4 ml and mean hospitalization time was 3.09±1.57 days. Pathology reports of adrenal tumors were pheochromocytoma at 4 patients, myeloma at 1 patient and adenoma at 16 patients. Patients with tumor size > 5 cm had significantly higher blood loss, operation time and hospitalization time compared to tumors < 5 cm. (p<0.05)

**Conclusion:** Laparoscopic adrenalectomy is a safe and feasible technique. Transperitoneal approach would be more suitable technique for initial cases. Surgeons must consider the tumor size and possible pathology of adrenal tumor to decide the surgical technique.

**Key words:** Adrenal Tumor, adrenalectomy, laparoscopy, transperitoneal, surgical results

#### ÖZET

**Amaç:** Laparoskopik adrenalektomi, benign adrenal kitlelerin tedavisinde altın standart yöntem olarak kabul edilmektedir. Ancak birçok cerrah, benign adrenal kitle tedavisinde açık cerrahiyi tercih etmektedir. Bu tercihin nedeni, cerrahların laparoskopik adrenal cerrahinin ileri düzey laparoskopik cerrahi olduğunu ve öğrenme eğrisinin yüksek olduğunu düşünmeleri olabilir. Bu çalışmada, transperitoneal laparoskopik adrenalektomi cerrahisi sonuçlarımızı bildirmeyi amaçladık.

**Yöntemler:** 2013 ile 2015 tarihleri arasında Namık Kemal Üniversitesi Tıp Fakültesi Hastanesin Üroloji Anabilim Dalında yapılmış olan laparoskopik adrenalektomi vakalarının verileri retrospektif olarak değerlendirildi. Hastaların demografik özellikleri, adrenal kitle patolojileri, kanama miktarı, hastanede kalış süreleri ve komplikasyonlar değerlendirildi.

**Bulgular:** Toplam 21 hastanın verileri değerlendirildi. Bu hastaların 12'sine (%57,1) sağ adrenalektomi yapılırken, 9'una (%42,9) sol adrenalektomi uygulandı. Hastaların ortalama operasyon süresi 130,2±39, dk, ortalama kanama miktarı 197,6±72,4 ml ve ortalama hastanede kalış süresi 3,09±1,57 gün olarak tespit edildi. Patolojik değerlendirmede hastaların 4'ünde feokromasitoma, birinde miyeloma ve 16'sında adenoma olduğu tespit edildi. Boyut olarak 5 cm'den büyük kitlelerde kanama miktarı, operasyon süresi ve hastanede kalış süresi, 5 cm'den daha küçük kitlelere göre belirgin anlamda yüksek tespit edildi (p<0,05).

**Sonuç:** Laparoskopik adrenalektomi, benign adrenal kitlelerin tedavisinde kolay ve güvenilir bir cerrahi tekniktir. Başlangıç vakalarında transperitoneal yaklaşım çok daha uygun bir yöntemdir. Cerrahi tekniğin seçilmesinde cerrahlar, tümör boyutunu, tümörün yerini ve olası patolojii değerlendirerek karar vermelidirler.

**Anahtar kelimeler:** Adrenal tümör; adrenalektomi, laparoskopi; transperitoneal; cerrahi sonuçlar.

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## INTRODUCTION

Adrenal tumor prevalence and adrenal surgery rates increased as the radiologic techniques evolved in the last 3 decades. Beside the development of diagnostic techniques, advent of new technologies on surgical techniques had contributed to the introduction of minimally invasive surgery for adrenal tumors. Laparoscopic adrenalectomy was first defined by Gagner et al, in 1992 [1]. Compared to open technique, laparoscopic adrenalectomy significantly decreased postoperative analgesic use and hospitalization time [2,3]. Due to its low morbidity and high success rates, laparoscopic adrenalectomy became a gold standard technique for benign adrenal masses. On the other hand, there are still some debates about its efficiency for malign adrenal tumors [4].

Laparoscopic adrenalectomy could be performed by anterior transperitoneal, lateral transperitoneal and posterior retroperitoneal approaches. Each approaches has both advantages and disadvantages. There is no consensus on the indications and choice of approach. Transperitoneal approach is the most frequently preferred technique for urologists. It enables them to have a wide operative field, a large visibility and urologists are more familiar with the anatomical landmarks in transperitoneal approach [5-7]. These advantages make this technique more favorable at initial cases of laparoscopic adrenalectomy. In this article we presented the results of our initial transperitoneal laparoscopic adrenalectomy cases.

## METHODS

We retrospectively evaluated the clinical documents of 21 laparoscopic adrenalectomy cases that were performed between May 2013 and October 2015. Ten patients were referred by endocrinologists and 11 patients were diagnosed incidentally in our outpatient clinic. Preoperative metabolic analysis was performed to all patients by an endocrinologist. The analyses included plasma and 24 hours urine metanephrine and normetanephrine levels, plasma cortisol level, plasma ACTH level. Plasma aldosterone and plasma renin levels were evaluated according to indication.

Plasma and 24 hours urine metanephrine and normetanephrine levels were evaluated to diag-

nose pheochromocytoma. Plasma cortisol level was measured for Cushing Syndrome and all patients underwent 1 mg dexamethasone suppression test. A plasma cortisol level of 1.8 microgram/dl was accepted as the cut-off point level for preceding evaluation with 2 mg. Dexamethasone suppression test. Patients with plasma cortisol level higher than 1.8 microgram/dL and plasma ACTH level lower than 10 microgram/dl after 2 mg Dexamethasone suppression test were diagnosed as subclinical Cushing Syndrome. Patients with hypertension were also evaluated with plasma aldosterone and plasma renin levels after the cessation of antihypertensive drugs. Plasma aldosterone to plasma renin ratio over than 30 was supposed to have primary hyperaldosteronism and saline infusion test was performed to these patients. Plasma aldosterone level less than 5 ng/dl after saline infusion test was diagnosed as primary hyperaldosteronism.

Urinary ultrasonography and abdominopelvic computerized tomography was performed for preoperative radiological evaluation. Positron emission tomography was done to patients with any doubt of adrenal malignancy and the patients with the risk of malignancy were operated with open technique. For the preoperative preparation of patients with pheochromocytoma, alpha-blocker and beta-blockers were used and the surgical team was ready to deal with possible hypertension crisis during the surgery. All patients received 40 mg methylprednisolone intravenously for 3 days postoperatively and oral cortisol treatment afterwards.

## Surgical technique

All patients were given informed consent before the surgery. Laparoscopic adrenalectomy was performed in lateral decubitus position under general anesthesia. We used 3 ports for left and 4 ports for right adrenalectomy. Pneumoperitoneum was performed subcostally with a Veres needle at midclavicular line. The first 10-mm. port was placed on pararectal area at umbilicus level. Second 10-mm. port was placed subcostally at midclavicular level and a third, 5 mm. port was placed subcostally at posterior axillary line. We used an extra 5 mm. port for right adrenalectomy, which was inserted in pararectal area, cranial to the first port, for liver retraction.

The first step of right adrenalectomy was medialization of colon and duodenum and dissection of liver for cephalad retraction. In order to provide better retraction, triangular ligament of liver was resected. After the mobilization of surrounding organs, renal hilum was dissected to identify renal vein and vena cava. Once these vascular structures were identified, dissection was preceded cranially at the border of vena cava to identify right adrenal vein. The adrenal vein was clipped with 5 mm metal clips and cut. As the dissection continued superiorly, small branches of the inferior phrenic vessels were encountered and cauterized with bipolar instruments. Further dissection was performed to identify right adrenal artery. As the artery was defined, it was clipped with 5-mm locking polymer clips and divided. After the medial dissection of adrenal tissue, lateral dissection was performed and the specimen was removed with EndoBag.

The first step of left adrenalectomy was the incision of white line of Todt from the splenic flexure to sigmoid junction to mobilize the left colon medially. After this step, splenocolic and splenorenal ligaments were divided and the spleen was retracted away from the left adrenal. Renal hilum was dissected to identify left renal vein and left adrenal vein. As the adrenal vein was identified, it was clipped with 5 mm metal clips and cut. The dissection was carried cranially on the medial border of left adrenal gland with the caution to pancreatic tail. Left adrenal artery was identified and clipped with 5-mm locking polymer clips and cut. Dissection was continued to free the superolateral border of adrenal. During this dissection left phrenic vein was identified and divided. As the left adrenal was freed away from surrounding tissue, the specimen was removed with EndoBag.

### Statistical Analysis

All data were analyzed with the Statistical Package for the Social Sciences for Windows software (Version 17.0 SPSS, Chicago, IL). Data were presented as mean and standard deviation or percentage. Data in independent groups were analyzed for normalcy with Kolmogorov–Smirnov test and further evaluated with independent t-test or Mann–Whitney U test.

### RESULTS

There were 6 (28.6%) male and 15 (71.4%) female patients and the mean age of the patients was 51,8 (22-70) years. Twelve (57.1%) patients had right laparoscopic adrenalectomy and 9 (42.9%) patients had left laparoscopic adrenalectomy. We did not perform any bilateral laparoscopic adrenalectomy. The mean size of the adrenal masses was  $5.82 \pm 1.46$  cm. Preoperative diagnoses of adrenal masses were pheochromocytoma in 4 patients, Cushing Syndrome in 6 patients and non-functioning adenoma in 11 patients. All of the surgeries were performed in lateral transperitoneal approach. We had to convert laparoscopy to open technique in one patient because of massive bleeding who had 7 cm pheochromocytoma. Excluding this case, the mean operation time was  $130.2 \pm 39.1$  min. and the mean blood loss was  $197,6 \pm 72.4$  ml. There was no other intraoperative complication like organ injury. We observed postoperative fever at two patients, which was spontaneously resolved with conservative management. The mean hospitalization time was  $3.09 \pm 1.57$  days. Pathology reports of adrenal tumors were pheochromocytoma at 4 patients, myeloma at 1 patient and adenoma at 16 patients.

**Table 1.** The mean blood loss, operation time and hospitalization time of adrenalectomies according to gender, operation side and tumor size

	Gender		Operation Side		Tumor size	
	Female	Male	Right	Left	<5 cm	>5cm
Mean Blood Loss (ml)	148.0±68.6	136.6±22.3	288.3±56.5	76.6±45.2	70.0±49.5	276.1±54.3
	p=0.587		p=0.009		p=0.022	
Operation Time (min)	145.0±36.9	93.3±12.6	128.3±44.3	132.7±33.2	126.2±23.7	132.6±46.9
	p=0.014		p=0.347		p=0.013	
Hospitalization Time (day)	3.13±1.64	3.00±1.54	3.66±1.87	2.33±0.50	2.75±0.46	3.30±1.97
	p=0.577		p=0.002		p=0.002	

The mean blood loss and the mean hospitalization time did not differ between the genders whereas operation time was significantly lower in male patients ( $p=0.014$ ). Operation side was related with the mean blood loss and hospitalization time. The mean blood loss was significantly higher in right laparoscopic adrenalectomy and the hospitalization time for those patients was also significantly longer. Tumor size was another variable that effects the operation results. The mean blood loss, mean operation time and the mean hospitalization time were significantly higher in patients who had  $>5$  cm. adrenal tumor (Table 1).

## DISCUSSION

Adrenalectomy has always been a challenging surgery because of the anatomic location of adrenal and related structures. The surgery had been performed by open technique for several years and open surgery was proposed as gold standard for adrenalectomy. In 1992, Gagner et al showed that adrenalectomy could successfully be performed by laparoscopy [1]. Although several studies demonstrated its safety and efficacy, surgeons had some concerns about this surgical technique and most of them preferred open technique for the treatment of adrenal tumors [8]. Compared to open technique, laparoscopic adrenalectomy had been shown to be more advantageous and it became more popular in the last decade [9]. With this revolution, laparoscopy replaced open adrenalectomy and now it is defined as gold standard for benign adrenal tumors.

Laparoscopic adrenalectomy is a safe and effective technique for the removal of benign adrenal tumors [2]. This technique have significant advantages like; shorter hospitalization time, less blood lost and less postoperative pain. On the other hand, its efficacy for malign adrenal tumors is still under debate because of the oncological principals [8]. Most of the studies concluded that laparoscopic adrenalectomy was contraindicated in malignant adrenal tumors unless there was an isolated metastasis [11,12]. The size of the adrenal tumor is another factor for determination of surgical technique. Konstantinos et al reported that complication rates of laparoscopic adrenalectomy significantly increased at tumors bigger than 8 cm [13]. Although we had limited number of patient in our clinical practice,

we also observed more bleeding, longer operation time and longer hospitalization time in patients with an adrenal tumor bigger than 5 cm. Surgeons must consider the adrenal tumor size and their experience to decide the best surgical technique for their patients.

Laparoscopic adrenalectomy can be performed transperitoneally or retroperitoneally. Lateral transperitoneal approach is the most preferred technique. It provides a wide surgical vision and more flexibility. Beside this, surgeons are familiar to anatomical appearance and surgical landmarks in lateral transperitoneal laparoscopy [5]. On the other hand, lateral transperitoneal approach had some disadvantages. It is a challenging procedure for bilateral adrenalectomies and there is a need for patient re-positioning. For these patients, retroperitoneal approach is more suitable. It can provide direct access to adrenals and there is no need for re-positioning [14]. Retroperitoneal adrenalectomy needs more advanced laparoscopic skills and experience because of the limited surgical field. As we present our initial experiences in laparoscopic adrenalectomy, all patients were operated by transperitoneal technique, which we were familiar from laparoscopic renal surgeries.

The surgical outcomes of transperitoneal adrenalectomy were reported in some studies. In a review article, Chai et al documented the results of 466 transabdominal laparoscopic adrenalectomies. They reported that the mean operation time was between 77.5 and 157 min, mean blood loss was between 35 and 123 ml. and the mean hospitalization time was between 2 and 6.7 days [9]. In our series, the mean operation time was 128 min, mean blood loss was 190 ml and the mean hospitalization time was 3.09 days. These results were consistent with the literature except the blood loss. The mean blood loss in our series was 190 ml, which was higher than the literature. As these surgeries were our initial cases, we believe that 190 ml blood loss is an acceptable volume. Adrenal tumor size was an important variable for our surgical results. The mean blood loss was 70.0 ml in adrenal tumors smaller than 5 cm, whereas it was 276 ml in adrenal tumors greater than 5 cm. We observed significantly less bleeding in patients with an adrenal tumor less than 5 cm The mean operation time and hospitalization time was also less in adrenal masses less than 5 cm, but the

difference was not statistically significant. Adrenal mass size is an important variable for the initial cases. A tumor size greater than 5 cm. may increase preoperative blood loss during the initial cases.

Laparoscopic adrenalectomy is a safe surgery. Most of the complications were minor and there were very limited number of life threatening complications in literature. Complication rates in laparoscopic adrenalectomy ranges between 2.9% to 15.5% [15]. Bilateral adrenalectomy, presence of pheochromocytoma as etiology, previous abdominal surgery, high body mass index and tumor size (>8 cm.) was shown to be risk factors for complications [13,16,17]. Bleeding was the most predominant complication and constituted 40% of all complications, but the transfusion rate related to laparoscopic adrenalectomy was 10% [15,18]. Major vascular injuries might occur during vena cava and adrenal vein dissection. So the surgeons must be cautious during the dissection of these vascular units. Major vascular injury is the major reason for conversion of laparoscopy to open surgery.[19] In the review article of Chai et al, total conversion rate was reported as 2.3% [9]. We converted 1 (4.7%) case to open surgery because of massive bleeding. This was the only major complication of our initial series. The patient had 7.5 cm adrenal tumor with pheochromocytoma. The surgery was completed successfully without any other complication. Diaphragm injury, pulmonary embolism, port site incisional hernia, postoperative ileus, pneumonia and even death were also reported during laparoscopic adrenalectomy [9]. We did not see any of these complications in our limited number of cases. Pathology of adrenal tumor was also reported as an important risk factor for complication [13,16,17]. Presence of pheochromocytoma increased the rates of bleeding. The mean blood loss was 190ml in pheochromocytoma cases whereas it was 115 ml in non-functioning adrenal adenomas. This might be related both with the systemic effects of pheochromocytoma and local tissue properties. We had very limited number of patients with pheochromocytoma so we could not make a clear conclusion about this subject.

The learning curve of laparoscopic adrenalectomy is an important issue for the surgeons. Goitein et al reported that the mean operation time and complication rates decreased significantly after 30 cas-

es. So they concluded that 30 cases of laparoscopic adrenalectomy is important for learning curve [20]. Pembegül et al reported that mean operation time and hospitalization time of transabdominal adrenalectomy was consistent with the literature in their first 10 cases [6]. Our initial surgical results and complication rates were also acceptable and consistent with the literature. We believe that the surgeon's familiarity to laparoscopic renal surgery might be an important factor to overcome the learning curve of laparoscopic adrenalectomy and transperitoneal approach would be more suitable for initial cases.

With the evolution of radiological techniques, the prevalence of adrenal tumors increased significantly. For this reason, surgeons have to deal with more adrenal surgeries. Laparoscopic adrenalectomy is a safe and feasible technique compared to open surgery. Transperitoneal approach would be more suitable technique for initial cases. Surgeons must consider the tumor size and possible pathology of adrenal tumor to decide the surgical technique. Having experience on laparoscopic renal surgery and familiarity to adrenal anatomy might decrease the learning curve of laparoscopic adrenalectomy.

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All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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