



# Comparison of Complications Following Laparoscopic Radical and Simple Nephrectomy Using the Clavien-dindo Clasification

## Laparoskopik Radikal ve Basit Nefrektomi Sonrası Oluşan Komplikasyonların Claven-dindo Sınıflamasına Göre Karşılaştırılması

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### Abstract

**Aim:** In this article, we aimed to compare the complications occurring after laparoscopic radical (LRN) and simple nephrectomy (LSN).

**Methods:** After obtaining local ethics committee approval, we analyzed the records of a total of 98 patients, who underwent transperitoneal laparoscopic nephrectomy. LSN and LRN were performed in 64 and 34 patients, respectively. The Clavien-Dindo classification was used for evaluating complications. Pneumoperitoneum was created using a Veress needle. Intraabdominal carbon dioxide pressure was 18 mmHg while three 10 mm trocars were inserted and then one 5 mm trocar was inserted if needed.

**Results:** The mean age of the LSN and LRN patients was 38.8±18.43 and 55.7±14.75 years, respectively. Five patients who underwent LSN developed postoperative minor complications (fever in one patient, nausea and vomiting in four patient). In addition, one patient who underwent LSN died postoperatively (vascular injury). Minor complications (fever in two patients, nausea and vomiting two, and ileus in one patient) developed postoperatively in five of 34 patients in LRN group.

**Conclusion:** The rate of complication after LRN was found to be statistically significantly higher than that after LSN.

**Keywords:** Simple nephrectomy, radical nephrectomy, complication

### Öz

**Amaç:** Bu yazımızda laparoskopik radikal ve basit nefrektomi sonrası oluşan komplikasyonları karşılatırmayı amaçladık

**Yöntemler:** Yerel etik onamı alındıktan sonra kliniğimizi transperitoneal laparoskopik nefrektomi yapılan ve 64'ü basit 34'ü radikal olmak üzere toplam 98 hastanın dosyaları retrospektif olarak incelendi. Komplikasyonlar için Clavien-Dindo sınıflaması kullanıldı. Hastaların tümüne standart bir şekilde Veres iğnesi ile batına giriş yapıp, karbondioksit basıncı 18 mmHg olacak şekilde pnömoperitoneum oluşturuldu. İntraabdominal karbondioksit basıncı 18 mmHg iken 3 adet 10'luk trokar ve daha sonra ihtiyaç olması halinde bir adet 5'lik trokar girildi. Cerrahi esnasında laparoskopik makas ve ligasure ile çalışıldı.

**Bulgular:** Laparoskopik basit nefrektomi yapılan hastaların yaş ortalaması 38,8±18,43 ve laparoskopik radikal nefrektomi yapılan hastaların yaş ortalaması 55,76±14,75 idi. Laparoskopik basit nefrektomilerde, Laparoskopik basit nefrektomi yapılan hastaların yaş ortalaması 38,8±18,43 ve laparoskopik radikal nefrektomi yapılan hastaların yaş ortalaması 55,76±14,75 idi. Laparoskopik basit nefrektomilerde, ortalama operasyon süresi 119,55±43,58. Radikal nefrektomilerde ise 152,94±40,23 idi. LBN yapılan hastaların beşinde postop minör komplikasyon (bir hastada ateş, dört hastada bulantı, kusma) gelişti. Ayrıca LBN yapılan bir hastamız postop exitus oldu. Radikal nefrektomi yapılan beş hastada minör komplikasyon (iki hastada ateş, hastada bulantı kusma, bir hastada ileus) gelişti.

**Sonuç:** Laparoskopik radikal nefrektomi sonrası oluşan komplikasyon, laparoskopik basit nefrektomi sonrası oluşan komplikasyon oranına göre istatistiksel olarak anlamlı olacak şekilde yüksek bulunmuştur.

**Anahtar Sözcükler:** Basit nefrektomi, radikal nefrektomi, komplikasyon

## Introduction

In the past 30 years, urological surgery has taken a serious turn towards minimally invasive techniques. As a result, laparoscopic nephrectomy has become an alternative to open surgery nowadays. Successful application of the first laparoscopic nephrectomy by Clayman (1) in an adult patient has been the turning point for laparoscopic nephrectomy. Later, the application of the first partial nephrectomy by Winfield (2) and the introduction of laparoscopic retroperitoneal nephrectomy by Gaur (3) extended the application area of laparoscopy in kidney surgery (4). The introduction of laparoscopic nephrectomy in benign renal pathologies in many centers and successful results have led to the application of this method in malignant renal tumors (5). In some centers today, laparoscopic nephrectomy is performed as a routine procedure for pediatric and geriatric age groups, dialysis patients, and even for renal transplantation (4,6). Harryman et al. (7) reported quality of life benefits of laparoscopic over open nephrectomy in the early postoperative period despite more comorbidities associated with laparoscopic surgery. In this study, we aimed to compare the complications associated with laparoscopic radical nephrectomy (LRN) and that with laparoscopic simple nephrectomy (LSN) using the Clavien-dindo classification.

## Methods

### Study design

After obtaining ethic committee approval from Van Yüzüncü Yıl University (Number: 16.02.2018/23, files of 98 patients, who underwent laparoscopic nephrectomy (64-transperitoneal LSN and 34-transperitoneal LRN) in our clinic between March 2012 and February 2018, were investigated retrospectively. Complications after laparoscopic radical and simple nephrectomy were evaluated using the Clavien-dindo classification (appendix).

Informed consent form was obtained from all patients.

### Surgical technique

Pneumoperitoneum was created using a Veress needle. Intraabdominal carbon dioxide pressure was 18 mmHg while three 10 mm trocars were inserted and then one 5 mm trocar was inserted if needed. After trocar insertion, the intraabdominal pressure was reduced to 13 mmHg. Both ultrasonic energy source (Harmonic Scalper-Ethicon®) and thermal energy source (Ligasure- Covidien®) were used during the dissection. We did not use Endo-GIA stapler for vascular control of the renal pedicle. A metal clip or ligature was used for minor (less than 7 mm) vascular structures while Hem-o-lok clip (Teleflex®) was used to close vital (greater than 7 mm) vascular structures. Bleeding control was performed with low intraabdominal

pressure (7-8 mmHg). Excised kidney tissue was removed from the skin using an endobag. No morcellation was done to disintegrate the tissues during organ extraction. A 16 or 18 Fr Nelaton catheter was inserted into the kidney lodge for postoperative draining and the procedure was completed.

### Statistical Analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) 22 (Inc, Chicago, Illinois, USA). In statistical analysis, frequency distributions, descriptive statistics were applied. Normal distribution fitness was analyzed by the Kolmogorov-Smirnov test. When numerical values did not satisfy parametric test conditions, the Mann-Whitney U test was used. The relationship between numerical values was analyzed by the Spearman correlation test. A p value of less than 0.05 was considered significant.

### Results

Demographic characteristics and operative data of patients are shown in Table 1. Sixty-four patients underwent LSN and 34 patients LRN. The mean age of the patients who underwent LSN and LRN was  $38.8 \pm 18.43$  and  $55.76 \pm 14.75$  years, respectively. In LSN patients, the mean duration of the procedure was  $119.55 \pm 43.58$  minutes and the mean length of hospital stay was  $4.22 \pm 3.25$  days. In LRN patients, the mean duration of the procedure was  $152.94 \pm 40.23$  minutes and the mean length of hospital stay was  $5.53 \pm 2.60$  days. LSN was performed in 41 patients with left non-functional kidney and 23 with right nonfunctioning kidney. LRN was performed in 24 patients with left renal masses and in 10 patients with right renal masses. Conversion from laparoscopic to open surgery was done in four patients (11.7%) in LRN group and five patients (7.81%) in LSN group. Four of these patients were found to be in the first year after laparoscopy. Five

**Table 1. Demographic data and operating findings**

	Simple nephrectomy (64)	Radical nephrectomy (n=34)
Sex (female/male)	35/29	16/18
Age (years)	$38.8 \pm 18.43$	$55.76 \pm 14.75$
Operation side (left/right)	41/23	24/10
Operation time (mean $\pm$ SD) (min)	$119.55 \pm 43.58$	$152.94 \pm 40.25$
Blood transfusion (n)	5	3
Organ injury (n)	1	0
Conversion to open surgery (n)	5	4
Hospitalization (mean $\pm$ SD) (day)	$4.22 \pm 3.25$	$5.53 \pm 2.60$

SD: Standard deviation

of patients who underwent LSN were given an average of  $2.3 \pm 0.6$  units of blood.

Complications after LRN and LSN according to the Clavien-dindo classification are shown in Table 2. Five patients with LSN had postoperative minor complications (fever in one patient, nausea and vomiting in four patients). In addition, one LSN patient died postoperatively (vascular injury). A total of LRN three patients received an average of  $3.2 \pm 1.3$  units of blood. Minor complications (fever in two patients, nausea and vomiting, and ileus in one patient) developed postoperatively in five of 34 patients in LRN group. No intraoperative complication developed in LRN group.

Clavien-dindo classification	Laparoscopic simple nephrectomy	Laparoscopic radical nephrectomy	p
Grade 1	5 (7.8%)	5 (14.7%)	p<0.05
Grade 2	5 (7.8%)	3 (8.82%)	-
Grade 3	0	0	-
Grade 4	0	0	-
Grade 5	1 (1.56%)	0	p<0.05
Total complication	11 (17.18%)	8 (23.52%)	p<0.05

## Discussion

Today, minimally-invasive surgery has become a standard procedure for surgical treatment of urological diseases. One of the minimally invasive surgeries is laparoscopic surgery (8-10). Compared to open surgery, it is a more comfortable surgical method. Laparoscopic nephrectomy provides less intraoperative bleeding, less postoperative pain, shorter hospital-stay, and better cosmetic results than open nephrectomy (11-13).

In general, laparoscopic surgery appears to be more advantageous when compared with open surgery (11,12). Therefore, open surgery is replaced by laparoscopic surgery. However, technical difficulties and long learning process for novices are the disadvantages of laparoscopy (14). Laparoscopy has begun to push standards forward not only in kidney surgery but also in the surgical treatment of other urologic cancers (i.e., prostate, bladder, ureter). In many studies, the overall oncologic outcomes and complication rate have been shown to be similar between laparoscopic and open surgery, however, laparoscopic surgery has been shown to be associated with reduced perioperative and postoperative morbidity (15).

Laparoscopic radical nephrectomy and LSN are routinely and safely performed in many clinics. We have been doing laparoscopic surgery in our clinic since 2012.

The first preferred surgical procedure for nephrectomy (LRN and LSN) is laparoscopic surgery for surgical team having sufficient experience in laparoscopic surgery; the first choice in kidney surgery should be laparoscopic surgery according to the the EAU guidelines (16). In our clinic, laparoscopic transperitoneal nephrectomy was performed in a total of 98 patients, 64 of which were simple and 34 were radical in the last 6 years. Although laparoscopic nephrectomy has advantages over open nephrectomy, complications may also be seen after laparoscopic nephrectomy. Occurrence of complications in laparoscopic surgery may be unavoidable as it is in all other surgical procedures.

The important thing is gaining necessary and sufficient training and experience, and to apply the right techniques to reduce the complication rate the least. In cases with complications, the most important factor in reducing patient morbidity and resolving the problem is early recognition of the complication (17).

Complication rates are also related to the experience of the surgeon. In a survey performed by Peter, it was found that the overall complication rate was 5.4% in more than 5,400 laparoscopic cases. The complication rate for clinicians with fewer than 20 cases was 8.3%. However, the complication rate reported by practitioners with a total experience exceeding 100 cases was 2.8% (18). In their work analyzing the complications in patients undergoing laparoscopic nephrectomy in a 4-year period, Kanno et al. (19) found that the rate of operative complications in the last year of the study was statistically significantly lower than in the first year (3.6% and 25.0%, respectively).

In our study, we observed that complications associated with both LRN and LSN occurred in the first year when we started laparoscopic surgery. For example, in the LSN group, a total of five patients underwent open surgery, four of whom were in the first year of experience of laparoscopic surgery. Thus, complications of laparoscopic surgery are directly related to the experience of the surgeon, as stated in the literature.

When we look at the literature, prediction of complications following laparoscopic nephrectomy is now made according to more objective evaluations. Today, the most recent and objective classification after laparoscopic nephrectomy is the Clavien-dindo classification (20). Thus, in this study we evaluated complications associated with LSN and LRN using the Clavien-dindo classification.

Good results of laparoscopic radical nephrectomy are being reported from many centers, and there is information on the reliability and low complication rates comparable to those of open surgery (21). XU et al. (22) reported that the overall complication rate was 19.31% in 88 patients who underwent LRN. Gill et al. (17) found an

overall complication rate of 18.4% in patients undergoing LSN due to benign conditions. On the other hand, in their study, Balci et al. (20) found a complication rate of 6.3% in 208 cases of transperitoneal laparoscopic nephrectomy according to the Clavien-dindo classification. They reported that grade 1 complications developed in 1.4% of patients, grade 2 in 4.3% and grade 3 in 0.5%. In general, the reported incidence of complications associated with laparoscopic nephrectomy varies between 0% and 33% in the literature (23,24).

In our study, the overall complication rate in the LSN group was 17.18%. According to the Clavie-dindo classification, 7.8% had grade one complications, 7.8% - grade 2 and 1.56% - grade 5. In the LRN group, the overall complication rate was 23.52%. According to the Clavien-dindo classification, 14.7% of these complications were grade 1 and 8.82% of them were grade 2. The main reason for higher complication rate for LRN is directly related to the fact that the operative time of LRN is longer than that of LSN.

Most of these complications are due to longer carbon dioxide insufflation depending on the length of the operation. A second cause is due to the size of the renal mass. As the size of the renal mass increases, the complications associated with laparoscopic nephrectomy also increase.

In their retrospective analysis of 505 laparoscopic transperitoneal nephrectomies, Kanno et al. (19) reported that complications developed in 10% of 80 patients (n=29) who underwent LSN and 13.7% of 212 patients who underwent LRN. In LRN group, intra-operative and postoperative complications were observed in nine and 20 patients, respectively (25). Complications in this study were not classified according to the Clavien-dindo classification. Major complications were included in the study but minor complications were not mentioned, thus complication rate seems low.

Kim et al. (25) reported a complication rate of 18.8% and a rate of conversion from laparoscopic to open surgery of 1.7% in 58 patients who underwent transperitoneal LSN.

Since Kim et al. (25) evaluated the complications according to the Clavien-dindo classification and both major and minor complications were included in their study, the complication rates seem more objective and correct. In our study, the rate of complications and rate of conversion from laparoscopic to open surgery in the LSN group was 17.18% and 7.8%, respectively. These rates in the LRN group were 23.52% and 11.7%, respectively.

Most of our cases of conversion from laparoscopic to open surgery were in the first year which we started to practice laparoscopic surgery. Another reason was

that most of our cases developed adhesions around the kidney secondary to chronic infection. These adhesions caused both prolonged duration of surgery and increased complication rate. Our rate of complication after laparoscopic nephrectomy seems to be consistent with the literature. Gill et al. (17) found that the most frequent intraoperative and postoperative complications were vascular injury (1.6%) and ileus (13.5%). In our study, vascular injury in the intraoperative period and nausea and vomiting in the postoperative period were the most frequent complications associated with both LRN and LSN.

The most common postoperative complication in our clinic is nausea and vomiting due to late activation of the gastrointestinal system. Although this complication was more common in our first cases, the rate of complications and operative time decreased with increasing laparoscopic surgical experience over time. However, the complication rates in both LRN and LSN groups were similar to those reported in the literature. In our study, when we compared the complications of LRN with the complications of LSN, the complications of LRN were found to be statistically significantly higher than LSN ( $p < 0.05$ ).

### Study Limitations

The limited number of patients and lack of follow-up for long-term complications are the limitations of our study.

### Conclusion

As a result, laparoscopy is used widely and safely in urological surgery as in other surgical branches. Although the rate of complication associated with LRN is higher than with LSN, it can be said that transperitoneal laparoscopic surgery is a safe and feasible method for both simple and radical nephrectomies.

### Authorship Contributions

Surgical and Medical Practices: R.E., K.T., M.G. Concept: R.E. Design: R.E., R.A. Data Collection or Processing: R.E., R.A., K.T. Analysis or Interpretation: M.G. Literature Search: R.E. Writing: R.E.

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