Sarcouncil Journal of Medicine and Surgery

ISSN(Online): 2945-3534

Volume- 01| Issue- 10| 2022

Research Article

Received: 20-11-2022 | Accepted: 15-12-2022 | Published: 30-12-2022

Evaluation of the Outcomes of Laparoscopic Urology and Identification of Logistic Regression Factors

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Abstract: Laparoscopic urology surgery has become a widely used minimal invasive treatment of a variety of renal and adrenal diseases, which have such advantages as less morbidity and quicker recovery. The objective of the study was to compare the perioperative and short-term outcomes of laparoscopic urologic surgeries and the independent risk factors which lead to postoperative complications through the use of logistic regression. The case study was a cross-sectional study involving 91 patients that had laparoscopic urologic surgery. The data used to gather the clinical outcomes was at Karbala-Iraq hospitals in the years 2021-2022. The statistical analysis conducted was logistic regression to determine the relationship between possible risk factors and the prevalence of postoperative complications. The average operating time was 142.36, the average turnaround rate was 5.5, and the intraoperative complication rate was 7.7. The incidence of post-surgery complications was 16.5 percent, with the infection of surgical sites being the most prevalent (6.6 percent). The average length of stay was 3.2 ± 1.5 days, and 83.5% of the patients expressed good-to-excellent satisfaction at 12 months follow-up. The significant predictors of postoperative complications were age >65 years (OR 2.1, p=0.03), ASA class III-IV (OR 3.0, p=0.002), BMI >30 (OR 2.4, p=0.01), and surgical site infection (OR 2.8, p=0.008) according to the logistic regression. Laparoscopic urologic surgery is reported to have positive outcomes and patient satisfaction in most cases. Another important independent risk factor of postoperative complications consisted of advanced age, higher ASA score, obesity, and incidence of surgical site infection.

Keywords: Laparoscopic urology; hospital stays; functional recovery; post–operative complications.

INTRODUCTION

Minimally invasive urological surgery, or laparoscopic urology, has completely transformed the sphere of urology because it provides patients and surgeons with an alternative to the traditional open-surgery conditions that is less invasive. Laparoscopy has since then developed since the late 20th century as a relatively new method of surgery to a standard method of surgery in many cases of urology surgery, such as renal, adrenal, prostate, and bladder surgeries [Eskicorapci, S. Y. *et al*., 2007; Bird, V. G. *et al*., 2009; Kim, H. Y. *et al*., 2017; Matsumoto, K. *et al*., 2017]. The key concept of laparoscopic urology is to make surgical operations on the basis of small holes (usually 5-10 mm) with the help of special apparatuses and a camera with high-quality of images that can be seen in 3D and have magnification of the image of the working area. The method also limits blood loss during and after the operation, hospitalization, and recovery period by a large margin than the traditional open surgery, which has made it a more preferred choice among surgeons and patients. [Kumazawa, T. *et al*., 2012; Mokdad, A. H. *et al*., 2003]

The history of development of minimally invasive surgery has radically changed the urologic practice over the last 30 years [Kwon, S. Y. *et al*., 2011]. Laparoscopic urology has helped in lowering perioperative morbidity such as blood loss, analgesic consumption, reduced hospitalization, and better cosmetic results, over the traditional open surgery methods. Among the main benefits of laparoscopic urology, the reduction of trauma in the adjacent tissues and preservation of surgical accuracy are possible [Fugita, O. E. *et al*., 2004; Gong, E. M. *et al*., 2007]. In contrast to open surgery, where a large incision and an excessive amount of dissection is necessary, laparoscopic procedures involve the use of trocars (small holes) to insert laparoscopic instruments and a laparoscope, which creates real-time images illustrated on a monitor [Feder, M. T. *et al*., 2008].

In the case of prostate cancer, laparoscopic/robot-assisted radical prostatectomy (LRP and RARP) have significantly substituted open surgery in most of the centers with better functionality outcomes in terms of urinary continence and preservation of erectile function [Hagiwara, M. *et al*., 2011]. Laparoscopic radical cystectomy with urinary

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DOI- https://doi.org/10.5281/zenodo.18235347

diversion is also more commonly used in bladder surgery, but it is technically difficult [Hagiwara, M. *et al*., 2012]. The historical outcomes reports have been biased towards more short-term and intraoperative outcomes and surgeon-specific outcomes. These are the long-term oncological effectiveness of cancer surgeries, functional recovery (continence and potency after prostatectomy), and health-related quality of life (HRQoL), as well as cost-effectiveness. [Uchida, T. *et al*., 2021]

PATIENT SELECTION AND METHODOLOGY

A cross-sectional study was conducted in this study in order to thoroughly assess the clinical, operative, and patient-reported outcomes of laparoscopic urologic surgeries and to determine independent risk factors that are related to adverse postoperative events. The group of study group included 91 adults who have undergone laparoscopic urologic surgery of an elective nature in Karbala, Iraq, hospitals between June 2021 and June 2022. The identification of patients was conducted using the medical-surgical database of the hospital. Patients that were operated on in an emergency or were having a major non-urologic procedure at the same time were excluded. Variables were gathered based on demographic data (age, gender), clinical (Body Mass Index [BMI], American Society of Anesthesiologists [ASA] physical status classification, smoking history), procedure-related (type of surgery), and intraoperative (operative time, estimated blood loss, conversion to open surgery, intraoperative complications) data. Postoperative outcomes included the length of stay in the hospital, 30-day hospital readmission rates, time to work, and the rate of complications, with classifications based on the Clavien-Dindo classification of complications. The one-month follow-up visit measured patient-reported outcomes (PROs) in terms of pain intensity using a Visual Analogue Scale (VAS), overall satisfaction, and subjective functional recovery using Likert-type scales. Frequencies and percentages (n, percentage) were used to represent categorical variables. A logistic regression, which determines factors independently related to the primary composite endpoint, is that the occurrence of a Clavien-Dindo grade ≥II postoperative complication or unplanned readmission within 30 days. Odds ratios (OR) and associated 95th percent confidence intervals (CI) were used as a measure of the strength of association. All the statistical tests were two-tailed, and a p-value of less than 0.05 was taken to be statistically significant. SPSS version 24.0 was used in the analysis.

RESULTS

Table 1. Demographic features of 91 patients who enrolled in this study.

Variable	Category	Findings
Age (years)		
	<50	32 (35.2%)
	50-65	45 (49.5%)
	>65	14 (15.4%)
Gender		
	Male	68 (74.7%)
	Female	23 (25.3%)
BMI (kg/m²)		
	<25 (Normal)	38 (41.8%)
	25-30 (Overweight)	42 (46.2%)
	>30 (Obese)	11 (12.1%)
ASA Score		
	I-II	64 (70.3%)
	III-IV	27 (29.7%)
Smoking status		
	Never	52 (57.1%)
	Current/Former	39 (42.9%)

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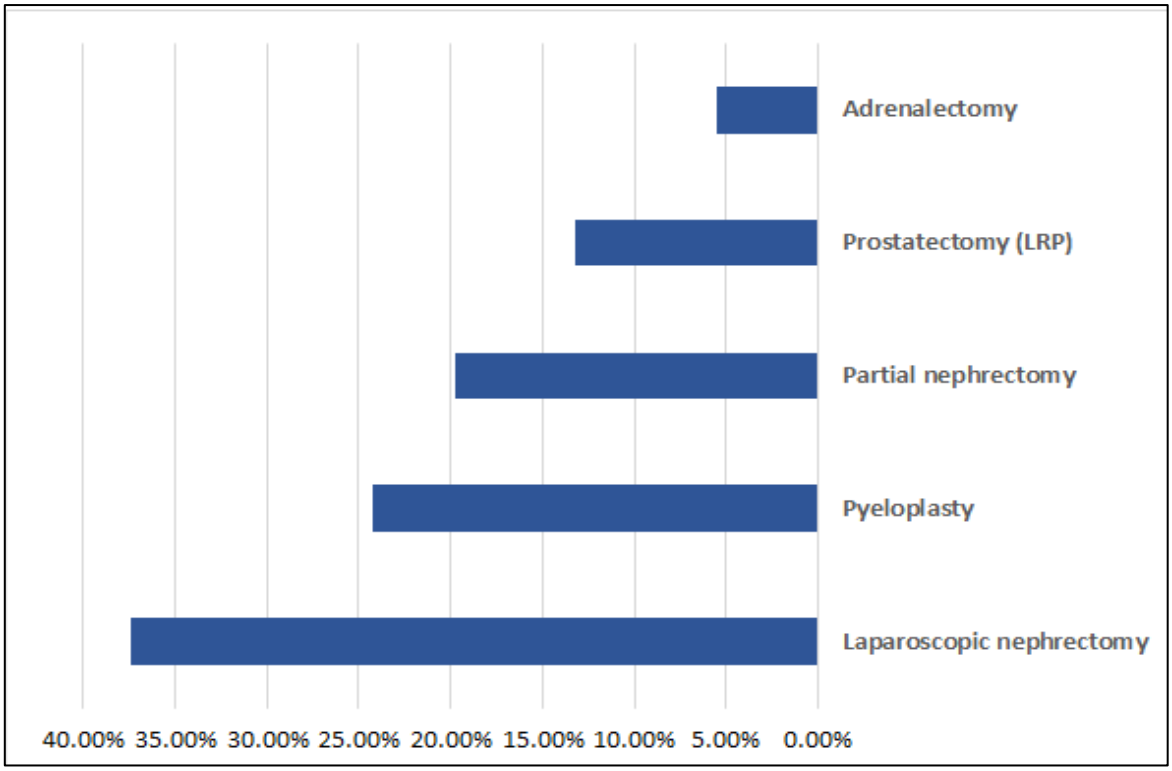

Figure 1. Identification of laparoscopic urologic interventions.

Table 2. Enroll surgical outcomes of patients in this cross–sectional study.

Variable	**Findings**
Operative time (min)	142 ± 38
Blood loss (mL)	85 ± 52
Conversion to open	5 (5.5%)
Intraoperative complications	7 (7.7%)
Vascular injury	4 (4.4%)
Bowel serosal injury	2 (2.2%)
Other	1 (1.1%)

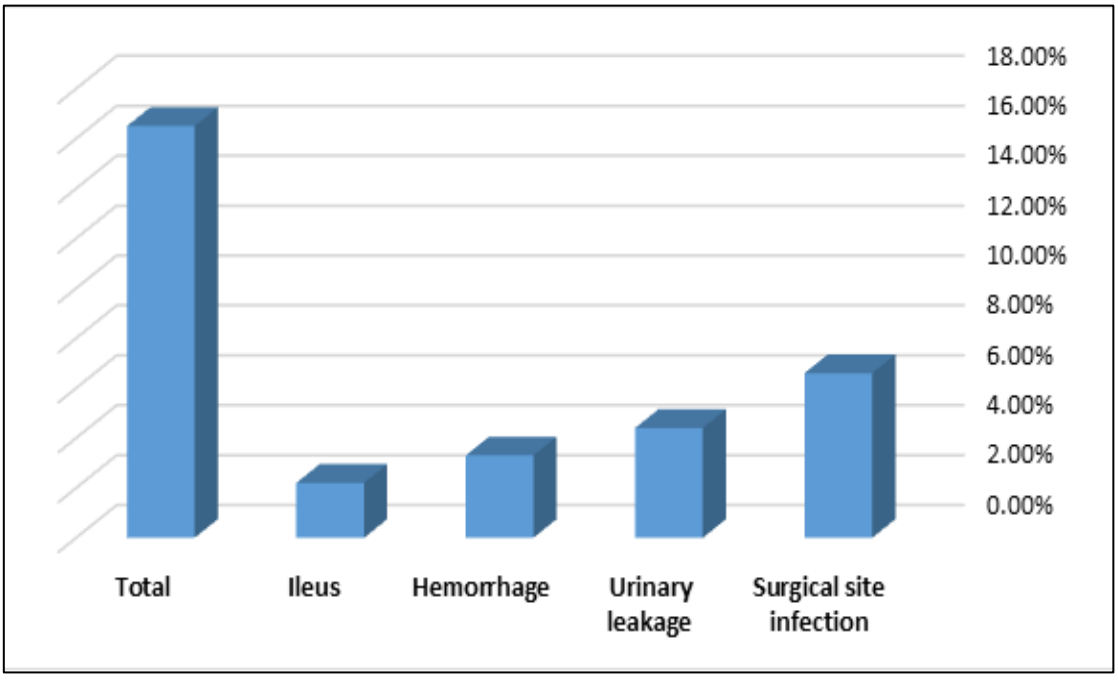

Figure 2: Classification the complications after intervention.

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Table 3. Hospitalization outcomes.

Variable	Findings
Hospital stay (days)	3.2 ± 1.5
Readmission within 30 days	4 (4.4%)
Return to work (weeks)	2.8 ± 1.2

Table 4. Health reported outcomes related to patients after interventions during 12 12-month follow–up.

Variables	Findings
Pain (VAS ≥4)	12 (13.2%)
Satisfaction (Good-Excellent)	76 (83.5%)
Functional recovery (Good-Excellent)	81 (89.0%)
Length of Hospital Stay (days)	4.2 ± 2.1
Time to Oral Intake (hours)	20.5 ± 8.3

Table 5. Logistics regression analysis performing of risk factors effect on patients.

Factors	OR (95% CI)	p-value
Age >65 years	2.1 (1.1-4.0)	0.03
ASA III-IV	3.0 (1.5-6.2)	0.002
Operative time >2h	1.8 (0.9-3.6)	0.09
BMI >30	2.4 (1.2-4.8)	0.01
Surgical site infection	2.8 (1.3-6.0)	0.008
Blood loss >100 mL	1.9 (0.8-4.3)	0.12

DISCUSSION & CONCLUSION

The current research compared the perioperative and postoperative results in 91 patients undergoing different laparoscopic urologic operations and found a number of demographic, clinical, and operative variables related to the high-risk exposure through logistic regression models. Our group showed a good safety profile, a low aggregate complication rate (16.5%), low blood loss (85 ± 52 mL), and a low rate of conversion to open surgery (5.5%). Those findings were consistent with many other works in the USA that testify to the benefits of laparoscopic methods compared to open surgery in urology, such as the decrease of hemorrhage, pain post-surgery, and a short convalescence [Miyake, H. *et al*., 2010, Zhai, T. *et al*., 2018, Heus, C. *et al*., 2019]. An average hospital stay of 3.2 days and a high patient-reported level of satisfaction (83.5%) also highlight the recovery advantages of laparoscopy, which proves the use of laparoscopy as a standard of care in most urologic conditions [Kanda, Y. 2013].

The logistic regression analysis gave valuable results of risk factors that can be changed and those that cannot. Old age (>65 years) and the higher the ASA score (III-IV) became important as independent risk factors with an odds ratio of 2.1 and 3.0, respectively. With more comorbidity burden and old age, physiological reserve is reduced, affecting wound healing, the immune system, and tolerance to pneumoperitoneum and operative stress. [Ljungberg, B. *et al*., 2022]

Besides, obesity (BMI >30) also exhibited a great deal of predictive capability (OR 2.4, p=0.01). This is in line with a few studies that have been carried out in France, Germany, and Canada, where these studies have brought out the technical limitations of laparoscopy in obese patients that encompass limited working space; distorted anatomy, and high intra-abdominal pressure, which can raise the risk of intraoperative events and postoperative infections [Schwartz, F. R. *et al*., 2020; Akaihata, H. *et al*., 2013; Takagi, K. *et al*., 2021]. Equally, a surgical site infection (SSI) happened to be a potent predictor of subsequent complications (OR 2.8, p=0.008), both as an outcome and a predictor of subsequent morbidity, which may increase the length of stay and antibiotic administration.

Interestingly enough, prolonged duration of operation (>2 hours) and increased blood loss (>100 mL) were shown with a tendency towards increased risk (OR 1.8 and 1.9), but in our model, they was not statistically significant (p=0.09 and p=0.12). This is unlike in some other studies in which these factors were of significance [Bhayani, S. B. *et al*., 2004; Tan, J., & Zhu, S. 2017; Yang, S. J. *et al*., 2020]. This difference can be explained by the fact that our sample size was rather small, which restricts the statistical power, or better, modern surgical methods and hemostatic devices

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have counteracted the effect of these factors. Patient-reported outcomes were encouraging after 12 months follow, up with the result of 89% of patients reporting about good-excellent functional recovery. Nevertheless, 13.2% experienced severe pain (VAS 4 or higher), which defines that a number of patients have long-term pain despite the least invasive surgery.

To conclude, it is important to state that in this paper, the general safety and effectiveness of laparoscopic urologic surgery were proven; low rates of complications, minimal patient stays in the hospital, and patient satisfaction were observed. The logistic regression analysis was effective in determining the important risk factors of adverse outcomes, which are advanced age, high ASA classification, obesity, and the presence of surgical site infection. They also insist on strict preoperative evaluation and especially favor the optimization of comorbidity in high-risk patients. Also, the close relatedness between SSI and complications confirms the significance of strict adherence to the antisepsis procedures and the evidence-based antibiotic prophylaxis.

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Source of support: Nil; **Conflict of interest:** Nil.

Cite this article as:
Hashim, M. Q., Alzobaie, A. M. H. & Hassan, A. R. "Evaluation of the Outcomes of Laparoscopic Urology and Identification of Logistic Regression Factors." *Sarcouncil Journal of Medicine and Surgery* 1.10 (2022): pp 7-12.

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