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COMPARISON OF PERIOPERATIVE FACTORS BETWEEN LAPAROSCOPIC AND OPEN NEPHRECTOMY

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Abstract

Objectives: *To compare between operating time, blood loss, post operative pain score, wound infection, hospital stay and return to normal daily life activities in patients undergoing laparoscopic vs open nephrectomies*

Study Design: *Quasi Experimental Interventional Study Design*

Place and Duration of Study: *Armed Forces Institute of Urology, Rawalpindi from June 2024-February 2025*

Methodology: *A total of 206 patients with benign and malignant renal diseases were selected through convenience sampling and randomly divided into two groups. Cases of Group-A (laparoscopic nephrectomy) whereas cases in Group-B (open nephrectomy). Intra operative time, intra operative blood loss, post operative pain score using VAS after 48 hours of surgery, post operative wound infection on day 7, hospital stay and return to normal daily life activities were compared between the two study groups.*

Results: *Time of surgery in Group-A was less compared to Group-B (open nephrectomy) with a statistical significance of p=0.003. Blood loss had a statistical significance of p=0.00 in Group-A (laparoscopic nephrectomy) compared to Group-B (open nephrectomy). Post operative pain was better tolerated in Group-A (laparoscopic nephrectomy) (p=0.00) at 48 hours after surgery, wound infection on day 7 was less in Group-A (laparoscopic nephrectomy) (p=0.00), hospital stay was less and patients were discharged earlier compared to Group-B (open nephrectomy) (p=0.00).*

Conclusion: *Group A Laparoscopic nephrectomy provides superior outcomes compared to traditional Group B open nephrectomy in terms of peri operative factors.*

INTRODUCTION

A renal mass or tumor is an abnormal growth in the kidney. Some renal masses are benign and some are malignant. Renal cancer is the 11th leading cause of cancer death in the US and is on 8th on the list of 10 most common types of cancers. Laparoscopic simple nephrectomy is indicated in the management of most benign renal conditions in which permanent loss of renal function has occurred. Some indications include chronic pyelonephritis, obstructive or reflux nephropathy, renal tuberculosis, multi cystic

dysplastic kidney, renovascular hypertension, acquired renal cystic disease in dialysis patients, nephrosclerosis, symptomatic patients with autosomal dominant polycystic kidney disease and post kidney transplantation hypertension. [1] Over 90% of adult kidney cancers are renal cell carcinoma (RCC), a disease which presents as several subtypes characterized by different histologies, molecular alterations, and clinical outcomes. [2] Kidney cancers account for 2% to 3% of all malignant tumors, with an incidence of 5.8/100000. [3] Approximately 75,000 cases will be detected in 2021, and over 13,000 people will die from renal cell carcinoma. [4] Partial Nephrectomy is preferred surgical procedure for renal masses and renal masses. [5,6] In 1968, Roson et al first reported the use of open radical nephrectomy (ORN) for the treatment of renal cancer, which was to release the kidney outside the perirenal fascia. [7] In 1991, Clayman et al first reported successful laparoscopic nephrectomy by intraperitoneal route. Subsequently, Guar invented a simple and practical balloon dilator to establish a retroperitoneal space technique, which enabled retroperitoneal laparoscopic renal surgery. [8] Although laparoscopic PN (LPN) is an enormous technical challenge and has a steep learning curve, it is obviously becoming a feasible alternative to open PN (OPN) with less blood loss, fewer complications, and comparable oncologic and functional outcomes.[9,10]

The rationale for conducting this study stems from the increasing adoption of laparoscopic nephrectomy as a minimally invasive alternative to open nephrectomy for the management of both benign and malignant renal conditions. While laparoscopic nephrectomy is believed to offer several advantages, such as reduced blood loss, shorter hospital stays, and quicker recovery times, there remains a need for robust comparative data regarding the perioperative factors between these two surgical approaches. Despite numerous studies on laparoscopic nephrectomy, there is still a lack of comprehensive evidence comparing laparoscopic and open nephrectomy in terms of specific perioperative outcomes, such as operating time, blood loss, pain scores, wound infections, hospital stay, and recovery time.

This study aims to bridge this gap by systematically evaluating and comparing these key perioperative factors between the two surgical techniques. By understanding these differences, the study will contribute valuable insights that can guide clinical decision-making, improve patient care, and inform best practices in the surgical management of renal diseases. Furthermore, the findings may help in identifying the most optimal approach for various patient populations, based on their specific clinical needs and conditions, and may lead to more personalized treatment strategies in the future.

Material and Methodology:

A Quasi Experimental study was conducted 206 patients and the data was collected from Armed Forces Institute of Urology Rawalpindi, Pakistan. This study was carried out over a period of 2 years between 2024-2025. The sample size was calculated using WHO sample size calculator using Confidence interval 95%, margin of error 5% and reported prevalence of renal diseases in Pakistan as 12.5%, the sample size came out to be 169, we increase it to 206 for generalizability of results. [10] A total of 103 patients were operated using laparoscopic approach where as a counterpart 103 patients undergoing open nephrectomy were included for comparison.

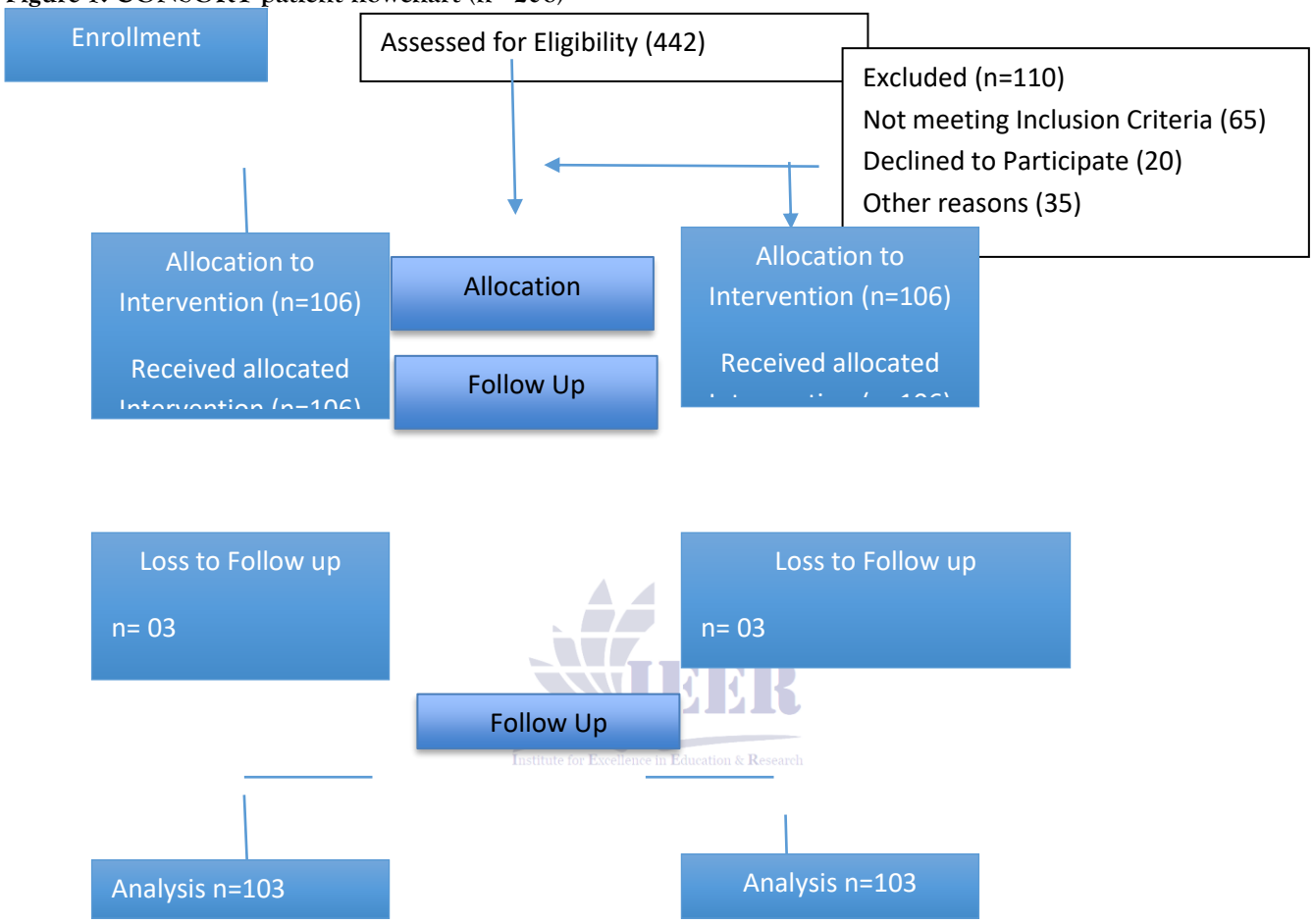
Inclusion criteria: Patients aged over 18 years with benign renal diseases or renal tumors with a stage up to T3a, as classified by the TNM staging system. T3 stage refers to tumors that have grown into surrounding tissues or structures, but have not yet metastasized to distant organs. Specifically, T3a tumors may invade the renal vein or surrounding fat, but still remain confined to the Gerota's fascia. This criterion ensures that patients included in the study have tumors that are suitable for nephrectomy procedures, either laparoscopic or open, while also providing insight into outcomes for those with locally advanced, non-metastatic tumors.

Exclusion Criteria: Pregnant females, bleeding diathesis, positive hepatitis status, metastatic lymphadenopathy, renal vein and IVC thrombus.

Permission from hospital ethical committee (URO-TRG-1/IRB/2024/09) was obtained. After explaining the procedure and associated complications in detail, a written informed consent was taken from every patient included in the study. Group-A received

laparoscopic nephrectomy, which involved a minimally invasive technique using small incisions and a camera-guided approach. Group-B received open nephrectomy, which involved a traditional open surgical approach through a larger abdominal incision to remove the kidney.

Figure-1: CONSORT patient flowchart (n =206)



Sampling technique employed was non probability technique convenience sampling. The study included a total of 206 patients divided into two equal groups of 103 by lottery method. In Group-A patients (laparoscopic nephrectomy) and Group-B patients (open nephrectomy). Different surgical techniques were employed for both group participants, open approaches included flank approach whereas laparoscopy included transperitoneal approach. Comparison was drawn between these two study groups in terms of intra operative time recorded in the theatre, intra operative blood loss, post operative pain score, post operative wound infection, hospital stay and return to normal daily life activities. Intra operative time was estimated in minutes. Blood loss was estimated in milliliters (mL) using blood collected in the drainage system and weighing soaked swabs and sponges. Post operative pain score was analyzed using Visual Analog Pain scale after the first 48 hours and was graded as Mild (1-3), moderate 4-6) and severe (7-10), all patients received the same analgesic combination and dosage. Wound infection was analyzed using Southhampton Classification system and was graded as 0 (normal), I (mild erythema), II (erythema and other signs of inflammation), III (clear or serosanguinous discharge), IV (purulent discharge). Hospital stay was divided into three groups and the data was analyzed at 3 days, 7 days and more than 7 days. Return to normal daily life activities was analyzed using QoL and PRS questionnaires. Patients

were followed up for up to 4 weeks, those patients who resumed their usual daily life activities and returned to work were placed in one group, those did not were placed in a separate group. Data for each patient was recorded on a follow up Performa. All data was analyzed on SPSS 26. Both groups were compared for qualitative values by applying Chi-Square test. $p< 0.05$ was considered statistically significant.

Results:

A total of 206 patients in the study, 103 patients in Group-A and 103 patients in Group-B were statistically analyzed. None of the subjects dropped out or were lost at any point in the study.

Table I: Gender Distribution of Respondents (n=206)

Gender Distribution	Male n (%)	Female n (%)	p value
Group-A	63 (61.16%)	40(38.83%)	0.06
Group-B	60 (58.25%)	43(41.7%)	0.05

The selection of 103, Group-A for Laparoscopic Nephrectomies patients recruited for laparoscopic surgery was not based on age, gender or demographic differences. The only factors included were those mentioned in the inclusion criterion. 32 (31.06%) laparoscopic simple nephrectomies, 54 (52.42%) laparoscopic radical nephrectomies, 12 (11.6%) HAL nephrectomies and 5 (4.8%) cases were converted from lap to open due to various reasons.

Table II: Types of Nephrectomies (n=206)

Types of Nephrectomies	**Group-A (Laparascopic Nephrectomies)**	**Group-B (Open Nephrectomies)**
laparoscopic simple nephrectomies	32 (31.06%)	52 (50.48%)
laparoscopic radical nephrectomies	54 (52.42%)	51(49.51%)
HAL nephrectomies	12 (11.6%)	
lap to open Nephrectomies	5 (4.8%)	

In comparison Group-B 52 (50.48%) patients underwent open simple nephrectomies and 51 (49.51%) patients underwent open radical nephrectomies. 41% patients included in the study had benign renal diseases where as 59% patients had malignant renal disease.

While analyzing the table, in Group-A the operative time was found to be less in laparoscopic group compared to open group (p=0.003). Blood loss was less in Group-A compared to Group-B (p<0.00). Post operative pain score calculated for the first 48 hours inpatient hospital stay was calculated using visual analog pain score system which revealed better pain tolerance in laparoscopic group compared to open group (p=0.00). Of 103 patients who had undergone laparoscopic nephrectomy only 6 showed post operative wound infection at day 7 at port sites (p=0.001). Longer hospital stay in open group was associated with prolonged paralytic ileus, wound infection and longer drain placement. Therefore, Group-A showed better outcome compared to Group-B (p=0.000). Return to normal daily life activities was deduced using the PRS questionnaire. Laparoscopic group showed return to normal activities within 4 weeks compared to open group where most patients showed slower recovery due to wound infections or post op scar site pain (p=0.003)

Table III: Intraoperative time, Open Nephrectomy vs Laparoscopic Nephrectomy (n=206)

Variables	Group-A Laparoscopic Nephrectomies (n=103)	Group-B Open Nephrectomies (n=103)	P value
Mean Time	2.01± 0.96	2.456± 1.6553	0.003
Intraoperative Blood Loss	175.01± 25.14	250.02± 20.1	0.05
Postoperative Pain Score (severity)	11	17	0.0000
Post Op Wound Infections	6	39	0.001
Return to Normal Activities (4 Weeks)	69	79	0.003

Discussion:

Present study had found greater superiority of Laparoscopic compared to open nephrectomy. This study to our knowledge is the first prospective study held in Pakistan which compares perioperative factors between open and laparoscopic nephrectomies in patient with nonfunctioning kidneys or renal tumors. Remarkable differences were seen between patients in terms of operative time between the two study groups. To add less blood loss, shorter hospital stays, better wound healing, lesser post operative pain and early return to normal daily life activities were also observed. [11, 12]

The results of present study are in accordance to a study carried out by Nadeem Iqbal et al. where both studies found greater superiority, for laparoscopic procedure, present study had greater superiority as we did comparison of outcomes between open vs Laparoscopic technique. [13,14] Increasingly, laparoscopy is achieving mainstream status in urologic surgery. Advanced ablative and sophisticated reconstructive procedures are being done using minimally invasive techniques. [15] Recently, Laparo-endoscopic single-site donor nephrectomy was performed safely even in patients with duplicated inferior vena cava. [16] Present study found that, 69 (66.96%) of the patients in Laparoscopic group were return to full activity in 4 days, the results are in accordance in multiple study, where patients return to full activity within 3-4 days, in Laparoscopic as compared to open nephrectomy 8-10 days. [17, 18]

As malignant and benign renal diseases cause a concern with patients and can lead to anxiety, pain, disability and absence from work. Any surgical technique employed for the management of these diseases should consist of lesser peri operative complications and early return to normal daily life activities and early return to work. Laparoscopic nephrectomy seems like an ideal surgical procedure for both benign and malignant renal diseases as it fulfils most of the peri operative criterion we discussed. Laparoscopy has been employed in the West with promising results with different RCTs showing favorable outcomes. This study to our knowledge is the first prospective study held in Pakistan which compares perioperative factors between open and laparoscopic nephrectomies in patient with nonfunctioning kidneys or renal tumors. Remarkable differences were seen between patients in terms of operative time between the two study groups. To add less blood loss, shorter hospital stays, better wound healing, lesser post operative pain and early return to normal daily life activities were also observed. [19, 20]

Not many factors influenced our findings in regards to patients, as there was no selection bias on the basis of age, gender or other demographic differences. Since laparoscopic nephrectomy is not a common practice among urologists in Pakistan therefore few patients showed anxiety when the option for laparoscopic approach was put forth to them. The previous study demonstrated that laparoscopic radical nephrectomy has an acceptably low complication rate and compares favorably to open radical nephrectomy. The low rate of complications combined with the advantages of laparoscopic surgery favor a laparoscopic approach for the majority of patients with stage T1 and T2 tumors. [21] The previous study reported that postoperative acute pain scores were not different after laparoscopic or open nephrectomy and patients undergoing laparoscopic or open nephrectomy were at equal risk of developing CPSP. Pain control should be carefully planned in order to reduce early postoperative pain and also potentially

prevent CPSP. [22, 23] This was comparable to our study that suggested decreased post operative pain at 48 hours in the laparoscopic group compared to open group. In both group similar regimen for pain control was administered for the first 48 hours. The previous literature suggested that there was a statistically significant difference between hand assisted radical nephrectomy and open radical nephrectomy in operative duration, length of hospital stay, total narcotic requirement, pain scores at 1 week and 1 month after surgery, and the time to resume routine and full activity, with all variables (except operative duration) lower. There were no significant differences between the groups in pain at 1–3 days, estimated blood loss or overall satisfaction. Compared with open radical nephrectomy, hand assisted radical nephrectomy is associated with lower narcotic requirement, pain scores, a shorter hospital stay and earlier resumption of routine and full activities. However, several obstacles remain, including increased operative duration and the increased equipment costs. However, in cases selected in our study demonstrated lesser operative time in laparoscopic group compared to open group. However, cost of equipment and laparoscopic procedure cost remains a challenge even in our set-up. [24] The average length of hospital stay in this study was 4.1± 1.2 days. This was marginally lower than the research that Balcı et al. shared. The previous study found that the group undergoing laparoscopic radical nephrectomy had a 19.31% complication rate. Compared to the laparoscopic radical nephrectomy group, they observed that the open nephrectomy group experienced higher Grade II complications and a longer postoperative hospital stay. [25]

Limitations of Study:

Small sample size, single centered study, no control group, were the major limitations

Conclusion:

To conclude laparoscopic nephrectomy provides superior outcomes compared to traditional open nephrectomy in terms of peri operative and post operative factors. Therefore, we hope that surgeons in Pakistan will use laparoscopy in different urological centers' in Pakistan for the benefit of patients. As the world is progressing forward in the employment of robotics in surgery, our hope is to help the surgeons in our country to fill this gap in the development of skills in the years to come.

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Authors Contribution:

Author	Contribution
TMQ	1. Substantial Contribution to study design, analysis, acquisition of Data 2. Manuscript Writing 3. Has given Final Approval of the version to be published
SR	1. Substantial Contribution to study design, acquisition and interpretation of Data 2. Critical Review and Manuscript Writing 3. Has given Final Approval of the version to be published
AJA	1. Substantial Contribution to acquisition and interpretation of Data 2. Manuscript Writing 3. Has given Final Approval of the version to be published
AH	1. Contributed to Data Collection and Analysis 2. Critically reviewed the article 3. Has given Final Approval of the version to be published
SAF	1. Substantial Contribution to study design and Data Analysis 2. Manuscript Writing and Critical review of the article 3. Has given Final Approval of the version to be published
GA	1. Contributed to study concept and Data collection 2. Critical review of the manuscript 3. Has given Final Approval of the version to be published

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