

# The Influence of Surgical Volume on Outcomes in Radical Cystectomy: A Population-Based Analysis

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## ABSTRACT

**Objective:** The purpose of this research was to look at the effect of surgical volume on postoperative outcomes in patients receiving radical cystectomy for bladder cancer in a population-based cohort of 113 patients.

**Study Design:** A prospective analysis design study

**Place and Duration of Study:** This study was conducted at the Department of Urology IKD, Peshawar between August 2021 to August 2023.

**Methods:** Radical cystectomy was performed on 113 patients between August 2021 and August 2023. Data on demographics, comorbidities, surgery volume, and outcomes was collected. Based on operations conducted by each surgical practitioner, surgical volume was low, midrange, or high. Postoperative complications, hospital stay, and 30-day mortality were key outcomes.

**Results:** The study consisted 113 patients: 23 low volume, 34 middle volume, and 56 high volume. All participants had a mean age of  $65.2 \pm 7.1$  years. The majority of patients (52.17%) were female. 82.61% had radical cystectomy, 17.39% partial. The majority of procedures were open (100%). Most patients reported infection (5.31%), followed by hemorrhage (3.54%) and serious problems (7.08%). Surgical volume did not significantly affect complications or LOS >7 days (adjusted OR 0.75, 95% CI 0.53-1.06,  $p=0.105$ ). These data imply that surgical volume may affect significant complications but not overall complications, LOS, or mortality.

**Conclusion:** Our study revealed a link between surgical treatment volume and significant side effects in cystectomy patients.

**Key Words:** Radical Cystectomy, Surgical Volume, Bladder Cancer, Population-Based Analysis, Postoperative

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## INTRODUCTION

Bladder cancer is a major worldwide health issue, and radical cystectomy is a crucial aspect of its treatment<sup>[1]</sup>. The results of radical cystectomy, a highly intricate surgical technique, may be affected by several variables, such as the number of surgeries conducted by the surgical care providers<sup>[2,3]</sup>. Extensive study has been conducted on the correlation between the number of surgeries performed and the results after surgery.

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Evidence indicates that a greater number of surgeries may be linked to better patient outcomes<sup>[4]</sup>. This study, based on a population, seeks to add to the current knowledge by investigating how the number of surgeries performed affects the outcomes after radical cystectomy in a group of 113 patients.

Bladder cancer poses a significant challenge to healthcare systems globally, requiring efficient solutions to improve surgical treatment and better patient outcomes<sup>[5,6]</sup>. The concept of surgical volume, which refers to the quantity of operations carried out by a surgical care provider, has been identified as a possible factor influencing the quality of different surgical interventions<sup>[7]</sup>. Previous research has shown a positive association between increased surgical volumes and enhanced outcomes in operations such as coronary artery bypass grafting and pancreatotomy<sup>[8]</sup>. However, the influence of the number of surgeries performed on the results of radical cystectomy in the setting of bladder cancer is still a subject that needs further research.

This study used a population-based methodology, using a heterogeneous sample of 113 individuals who had radical cystectomy within a certain era and healthcare system. The aim is to evaluate whether there is a

correlation between the number of cystectomy surgeries conducted by surgical care providers and differences in postoperative complications, duration of hospitalization, and mortality within 30 days. Our objective is to analyze surgery volume and classify it as low, the middle, or high in order to uncover any discernible trends that may be used to shape healthcare policy and clinical decision-making.

Gaining insight into the correlation between the number of surgeries performed and the resulting results in radical cystectomy is essential for maximizing patient care and efficiently allocating resources. The results of this investigation might have significant ramifications for healthcare professionals, governments, and patients, highlighting the potential advantages of centralizing cystectomy services. The ultimate objective is to provide significant insights that may improve the quality of treatment for persons who are having radical cystectomy for bladder cancer.

## METHODS

The study included a total of 113 patients. Data about demographic factors, coexisting medical conditions, and clinical attributes were gathered. Patient identifiers were anonymized to guarantee confidentiality. The surgical volume was classified according to the quantity of radical cystectomy operations conducted by each surgical professional. Centers were categorized as low, middle, or high volume based on specified criteria identified by the distribution of cases in the dataset. The primary variables assessed were surgical complications, duration of hospitalization, and mortality within 30 days. The postoperative complications were classified based on predefined criteria and their severity was assessed.

**Statistical Analysis:** Patient demographics and clinical features were summarized using descriptive statistics. The correlation between the number of surgeries performed and the resulting results was evaluated using suitable statistical procedures, such as chi-square for categorical variables and analysis of variance (ANOVA) for continuous data. A multivariate analysis was performed to account for any confounding factors.

**Ethical Considerations:** The work complied with ethical criteria and obtained permission by the IKD, Peshawar Review Board, and Ethics Committee. Strict adherence to patient confidentiality was ensured, and data were managed in compliance with applicable privacy legislation.

## RESULTS

The study had 113 patients in total, distributed as follows: 23 in the low volume group, 34 in the intermediate volume group, and 56 in the high volume group. The average age of all participants was  $65.2 \pm 7.1$  years. Females constituted the majority of patients, at 52.17% of the overall patient population. Regarding

comorbidities, hypertension was the prevailing disease, reported by 26.09% of patients. Among the patients, 21.74% reported having diabetes, making it the second most common comorbidity. Upon comparing the three volume groups, no substantial disparities were seen in terms of age or gender distribution. However, there were discrepancies in the occurrence of comorbidities, as a greater percentage of patients in the low volume category disclosed hypertension and diabetes in comparison to the intermediate and high volume categories. The research sample exhibited diversity in age, gender, and comorbidities, making it a representative sample for the study (Table-1).

The surgical characteristics of study participants are shown in Table 2. 17.39% of the 113 individuals had partial cystectomy, whereas 82.61% had radical cystectomy. The majority of procedures were open (100%). All subjects had a mean operational time of 240 minutes and a standard variation of 30 minutes. Cystectomy type and surgical method did not vary across the three volume groups. The high volume group had a mean operating time of 200 minutes, compared to 220 minutes in the intermediate volume group and 240 minutes in the low volume group. These surgical features reveal what was done on study participants and may affect their results.

The study participants' postoperative complications are shown in Table 3. Out of 113 patients, 29.20% had post-surgery complications. Most individuals reported infection (5.31%), followed by hemorrhage (3.54%) and serious problems (7.08%). Complication rates were similar among the three volume groups. The low volume group (13.04%) had more serious problems than the intermediate (8.82%) and high volume (3.57%) groups. These data imply that all volume groups have postoperative difficulties, although low volume centers may have a greater risk of significant complications.

Table 4 shows the study participants' LOS and mortality rates. All individuals' mean LOS was 6.5 days, with a 2.0-day standard deviation. The mean LOS was similar among the three volume groups. However, low volume (7.0 days) had a tendency towards longer LOS than intermediate (6.5 days) and high volume (6.0 days). A larger percentage of low volume participants (34.78%) experienced a LOS of more than 7 days than intermediate (11.76%) and high volume (7.14%) groups. The 30-day mortality rate was 3.54% for all individuals, with the low volume group (8.70%) having a greater risk than the intermediate (2.94%) and high volume (1.79%) groups. These data show that low-volume centers may have longer hospital stays and greater fatality rates than intermediate and high-volume centers.

Table 5 shows multivariate surgery volume and outcome statistics. After controlling for possible confounding variables, surgical volume did not predict

any complication (OR 0.75, 95% CI 0.53-1.06, p=0.105) or LOS >7 days (OR 1.32, 95% CI 0.88-1.97, p=0.186). However, surgical volume was associated with severe complications (adjusted OR 0.61, 95% CI 0.37-1.00, p=0.048), with intermediate and high volume centers having lower chances than low volume centers.

Surgical volume did not affect 30-day mortality (adjusted OR 0.92, 95% CI 0.47-1.78, p=0.796). These data imply that surgery volume may affect significant complications but not overall complications, LOS, or mortality.

**Table No. 1: Demographic Characteristics of Study Participants**

Demographic Factor	Total (n=113)	Low Volume (n=23)	Intermediate Volume (n=34)	High Volume (n=56)
Age (years)	Mean (SD)	65.2±7.1	64.8±6.5	66.4±7.8
Gender	Female	12 (52.17%)	19 (55.88%)	26 (46.43%)
	Male	11 (47.83%)	15 (44.12%)	30 (54.56%)
Comorbidities	Hypertension	6 (26.09%)	10 (29.41%)	11 (19.64%)
	Diabetes	5 (21.74%)	7 (20.59%)	6 (10.71%)

**Table No. 2: Surgical Characteristics**

Surgical Variable	Total (n=113)	Low Volume (n=23)	Intermediate Volume (n=34)	High Volume (n=56)
Type of Cystectomy	Radical	19 (82.61%)	27 (79.41%)	51 (91.07%)
	Partial	4 (17.39%)	7 (21.59%)	5 (8.93%)
Surgical Approach	Open	23 (100%)	34 (100%)	56 (100%)
Operative Time (min)	Mean (SD)	240 (30)	220 (25)	200 (20)

**Table No. 3: Distribution of Postoperative Complications**

Complication Type	Total (n=113)	Low Volume (n=23)	Intermediate Volume (n=34)	High Volume (n=56)
Any Complication	33 (29.20%)	9 (39.13%)	12 (35.29%)	12 (21.43%)
Major Complication	8 (7.08%)	3 (13.04%)	3 (8.82%)	2 (3.57%)
Infection	6 (5.31%)	2 (8.70%)	1 (2.94%)	3 (5.36%)
Hemorrhage	4 (3.54%)	2 (8.70%)	1 (2.94%)	1 (1.79%)

**Table No. 4: Length of Hospital Stay (LOS) and Mortality Rate.**

LOS Variable	Total (n=113)	Low Volume (n=23)	Intermediate Volume (n=34)	High Volume (n=56)
Mean LOS (days)	6.5 (2.0)	7.0 (1.5)	6.5 (1.8)	6.0 (2.2)
LOS >7 days	16 (14.16%)	8 (34.78%)	4 (11.76%)	4 (7.14%)
30-Day Mortality	4 (3.54%)	2 (8.70%)	1 (2.94%)	1 (1.79%)

**Table No. 5: Multivariate Analysis of Surgical Volume and Outcomes**

Outcome Measure	Adjusted Odds Ratio (95% CI)	P-value
Any Complication	0.75 (0.53-1.06)	0.105
Major Complication	0.61 (0.37-1.00)	0.048
LOS >7 days	1.32 (0.88-1.97)	0.186
30-Day Mortality	0.92 (0.47-1.78)	0.796

**DISCUSSION**

The findings of this study indicate that the number of surgeries performed may influence the probability of significant complications in individuals receiving cystectomy. This finding aligns with other research that has similarly shown a substantial correlation between the number of surgeries performed and the results after different surgical procedures<sup>[9]</sup>. In a research conducted by Finlayson EV et al.<sup>[10]</sup> in 2003, it was shown that there is a correlation between a larger number of

surgeries performed and a decreased occurrence of postoperative complications and mortality in patients having major cancer surgery. Similarly, a research conducted by Hanchate AD et al.<sup>[11]</sup> in 2010 discovered that performing a larger number of surgeries was linked to reduced occurrences of postoperative complications and death in patients following coronary artery bypass graft surgery.

Our study revealed that the total complication rate was 29.20%, with significant problems seen in 7.08% of patients. These results align with the findings of a research conducted in 2010, which indicated that patients who had cystectomy experienced an overall complication rate of 30.5% and a serious complication rate of 8.3%<sup>[12]</sup>. In addition, our research revealed a 30-day mortality rate of 3.54%, which is slightly lower than the 5.1% reported by Wolters M, et al (2017)<sup>[13]</sup>. The resemblance in complexity and fatality rates suggests our research sample accurately reflects the whole patient population receiving cystectomy.

Our analysis revealed a noteworthy correlation between surgical volume and major complications, indicating that intermediate and high volume centers had a lower risk of major problems compared to low volume centers. The earlier result aligns with the findings of a research conducted by Konety et al.<sup>[14]</sup> in 2007. This study likewise observed a noteworthy correlation between the number of surgeries performed and the occurrence of serious problems in patients having cystectomy. However, our research did not discover a substantial correlation between the number of surgeries performed and the occurrence of complications, length of hospital stay, or mortality rates. This contrasts with the results reported by Konety et al. (2005). The observed disagreement might be attributed to variations in the research's design and sample size. Our study, with a lower sample size, may have lacked sufficient statistical power to identify significant relationships.<sup>15</sup>

**Study Limitation:** Our study has various limitations that should be addressed when interpreting outcomes. First, our prospective research may have biased participant selection and data collection. Second, our investigation was done at one center, which may restrict its applicability. Finally, our small sample size may have prevented us from finding substantial relationships between surgery volume and outcomes. Despite these limitations, this analysis sheds light on how surgical volume affects cystectomy outcomes.

## CONCLUSION

The results of our research revealed a significant correlation between the number of surgeries performed and the occurrence of severe complications in individuals having cystectomy. These findings align with other research and emphasize the significance of surgical volume in affecting postoperative results. Healthcare organizations should contemplate the consolidation of certain surgical procedures in high-volume centers to enhance patient outcomes. Additional study is required to have a deeper understanding of the processes behind this correlation and to pinpoint measures for enhancing outcomes in centers with low patient volumes.

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