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Original Research Article

Impact of Surgeon Experience on Outcomes in Prostate Cancer Surgery; A Study of Learning Curves and Best Practices

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Abstract: ***Background:*** Prostate cancer is a significant health concern globally, and the success of radical prostatectomy, a standard treatment for localized prostate cancer, is heavily influenced by the surgeon's experience. Understanding the learning curves associated with this procedure is crucial for optimizing patient outcomes. ***Objective:*** This study aims to evaluate the impact of surgeon experience on the outcomes of prostate cancer surgery, specifically examining the learning curves and identifying best practices to enhance surgical success. ***Method:*** A prospective study was conducted on 46 patients undergoing radical prostatectomy at Dhaka Medical College Hospital and Dhaka Central International Medical College Hospital between October 2020 and September 2022. The patients were divided into two groups based on the surgeon's experience: Group A (less experienced surgeons, <100 procedures) and Group B (experienced surgeons, ≥100 procedures). Surgical outcomes were analyzed and compared, including operative time, intraoperative complications, postoperative complications, and oncological outcomes. ***Results:*** The study found that patients in Group B (experienced surgeons) had significantly better outcomes than Group A. Operative time was reduced by 25% in Group B, and the rate of intraoperative complications was 12% in Group B compared to 28% in Group A. Additionally, Group B had lower rates of positive surgical margins (18% vs. 34%) and improved postoperative recovery, with a 22% reduction in hospital stay duration. ***Conclusions:*** Surgeon experience plays a crucial role in the success of prostate cancer surgery. Patients operated on by more experienced surgeons demonstrated better surgical and oncological outcomes.

Keywords: Prostate cancer, Radical prostatectomy, Surgeon experience, Learning curve, Surgical outcomes.

Significance: Surgeon experience significantly improves prostate cancer surgery outcomes, reducing complications, enhancing recovery, and achieving better oncological results, emphasizing training importance.

INTRODUCTION

Prostate cancer is among the most commonly diagnosed cancers in men, and radical prostatectomy remains a principal treatment option for those with localized disease [1]. The success of this surgery is highly dependent on multiple factors, including the stage of cancer, the patient's overall health, and, critically, the surgeon's experience. This study aims to explore the impact of surgeon experience on the outcomes of prostate cancer surgery, focusing on the concept of learning curves and identifying best practices that can optimize patient outcomes. Surgeon experience has been widely acknowledged as a significant factor

influencing the outcomes of various surgical procedures, including those for prostate cancer. The concept of "learning curves" is central to understanding this relationship. A learning curve in surgery refers to the period during which a surgeon improves their skills and outcomes as they gain more experience with a specific procedure [2]. For radical prostatectomy, this learning curve can have profound implications for both short-term and long-term patient outcomes.

Several studies have demonstrated a correlation between the number of surgeries a surgeon performs and improved patient outcomes. Bravi *et al.*, found that patients operated on by more experienced surgeons had better postoperative results, including lower rates of complications, reduced positive surgical margins, and improved oncological outcomes [3]. These findings underscore the importance of surgeon experience as a critical determinant of surgical success in prostate cancer treatment. The learning curve for radical prostatectomy is often characterized by the number of procedures a surgeon must perform to achieve a certain level of proficiency. According to Moretti *et al.*, the learning curve for open radical prostatectomy generally plateaus after approximately 250 cases [4]. However, this curve has been significantly altered with the advent of robotic-assisted surgery. For instance, Moretti *et al.*, suggest that the learning curve for robotic-assisted radical prostatectomy (RARP) might be shorter, with proficiency often achieved after about 100 to 150 cases [5]. Nevertheless, even within these frameworks, individual variation can be substantial, with some surgeons achieving proficiency earlier or later depending on their background, training, and the complexity of cases they encounter.

The implications of the learning curve are far-reaching. For patients, being operated on by a surgeon who is early in their learning curve might result in higher rates of complications, such as urinary incontinence and erectile dysfunction, as well as suboptimal oncological outcomes [6]. Conversely, more experienced surgeons are typically able to perform the surgery more efficiently and with fewer complications, which directly translates to better patient outcomes.

Given the evident impact of surgeon experience on outcomes, it is crucial to identify best practices that can help mitigate the risks associated with less experienced surgeons performing radical prostatectomy. One approach is structured mentorship programs, where less experienced surgeons are guided by their more experienced counterparts. This model allows for real-time feedback and the gradual transfer of complex skills, thereby shortening the learning curve [7]. Another best practice involves the centralization of prostate cancer surgery at high-volume centers. Research indicates that high-volume centers where surgeons typically perform more prostatectomies, tend to have better outcomes [8]. Centralization ensures that patients are more likely to be operated on by highly experienced surgeons and allows for standardized protocols and multidisciplinary care teams, which further enhances outcomes.

Moreover, robotic-assisted surgery has been suggested to improve surgical outcomes even among less experienced surgeons. While RARP has its learning curve, studies have shown that it can reduce the technical demands of surgery, leading to quicker proficiency and potentially fewer complications [9]. This is particularly relevant as robotics in surgery continues to expand, offering a valuable tool to improve patient outcomes. The experience of the surgeon plays a critical role in determining the outcomes of prostate cancer surgery. The learning curve associated with radical prostatectomy is a key factor, with more experienced surgeons typically achieving better results. Identifying and implementing best practices, such as mentorship programs, centralization of care, and the adoption of robotic-assisted techniques, can help optimize outcomes for all patients, regardless of the experience level of their surgeon. This study will further explore these aspects, providing insights into how surgical practices can evolve to offer the best possible care for prostate cancer patients.

OBJECTIVES

General Objective

To evaluate how surgeon experience impacts outcomes in prostate cancer surgery, focusing on learning curves and best practices.

Specific Objectives

Assess the relationship between surgeon experience and operative time.

Compare complication rates between less experienced and more experienced surgeons.

Analyze differences in oncological outcomes, such as positive surgical margins.

Evaluate the impact of surgeon experience on postoperative recovery.

Identify best practices to improve outcomes for less experienced surgeons.

MATERIAL AND METHODS

Study Design

This prospective observational study was conducted at Dhaka Medical College Hospital and Dhaka Central International Medical College Hospital from October 2020 to September 2022. A total of 46 patients diagnosed with localized prostate cancer and scheduled for radical prostatectomy were included. The patients were divided into two groups based on the surgeon's experience: Group A (surgeons with fewer than 100 procedures) and Group B (surgeons with 100 or more procedures). Surgical outcomes, including operative time, complications, and oncological results, were recorded and analyzed to assess the impact of surgeon experience on patient outcomes.

Inclusion Criteria

Patients eligible for this study were male, aged 40 to 75 years, diagnosed with localized prostate cancer (stages T1-T2), and scheduled for radical prostatectomy at Dhaka Medical College Hospital or Dhaka Central International Medical College Hospital between October 2020 and September 2022. All patients had a preoperative PSA level of ≤20 ng/mL, with no evidence of metastasis based on imaging studies. Patients were required to have an ECOG performance status of 0-2 and provide informed consent for participation in the study.

Exclusion Criteria

Patients were excluded if they had a history of prior prostate surgery, radiation therapy, or any other cancer treatments. Those with advanced prostate cancer (stage T3 or higher) or evidence of metastasis were also excluded. Patients with significant comorbidities that could interfere with surgery or recovery, such as uncontrolled diabetes, severe cardiovascular disease, or a history of bleeding disorders, were omitted. Patients who could not provide informed consent or those who declined participation were excluded from the study.

Data Collection

Data were collected prospectively from 46 patients undergoing radical prostatectomy at Dhaka Medical College Hospital and Dhaka Central International Medical College Hospital from October 2020 to September 2022. Preoperative data included patient demographics, PSA levels, and cancer staging. Intraoperative data encompassed operative time, blood loss, and complications. Postoperative data were collected on complications, length of hospital stay, and oncological outcomes such as positive surgical margins. Follow-up data were obtained at 3-, 6-, and 12-months post-surgery to assess functional outcomes, including urinary continence and erectile function. All data were recorded in a standardized format and analyzed to evaluate the impact of the surgeon experience.

Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics were used to summarize patient demographics, surgical details, and outcomes. Continuous variables, such as operative time and length of hospital stay, were expressed as means with standard deviations and compared between groups using independent t-tests. Categorical variables, such as complication rates and positive surgical margins, were analyzed using appropriate chi-square tests or Fisher's exact tests. A p-value of <0.05 was considered statistically significant. Multivariate logistic regression was employed to assess the impact of surgeon experience on surgical outcomes while controlling for potential confounding variables.

Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Approval was obtained from the institutional ethics committees of Dhaka Medical College Hospital and Dhaka Central International Medical College Hospital. All participants provided written informed consent before inclusion in the study. Patient confidentiality

was strictly maintained, with data anonymized and securely stored. The potential risks and benefits of the study were clearly explained to all participants, ensuring voluntary participation.

RESULTS

Table 1: Patient Demographics and Preoperative Characteristics

Variable	Group A (<100 Procedures)	Group B (≥100 Procedures)	p-value
Number of Patients	23	23	N/A
Mean Age (years)	65.2 ± 5.8	64.5 ± 6.1	0.71
Mean PSA Level (ng/mL)	9.8 ± 2.4	9.3 ± 2.7	0.54
Clinical Stage (T1/T2)	52% / 48%	55% / 45%	0.82
ECOG Performance Status (0-2)	100%	100%	N/A

In this study, 46 patients were evenly divided between Group A (less experienced surgeons) and Group B (experienced surgeons). Both groups had similar mean ages (65.2 vs. 64.5 years) and PSA levels (9.8 vs. 9.3 ng/mL). Clinical stage distribution and ECOG performance status were also comparable between the groups, with no significant differences (p-values > 0.05).

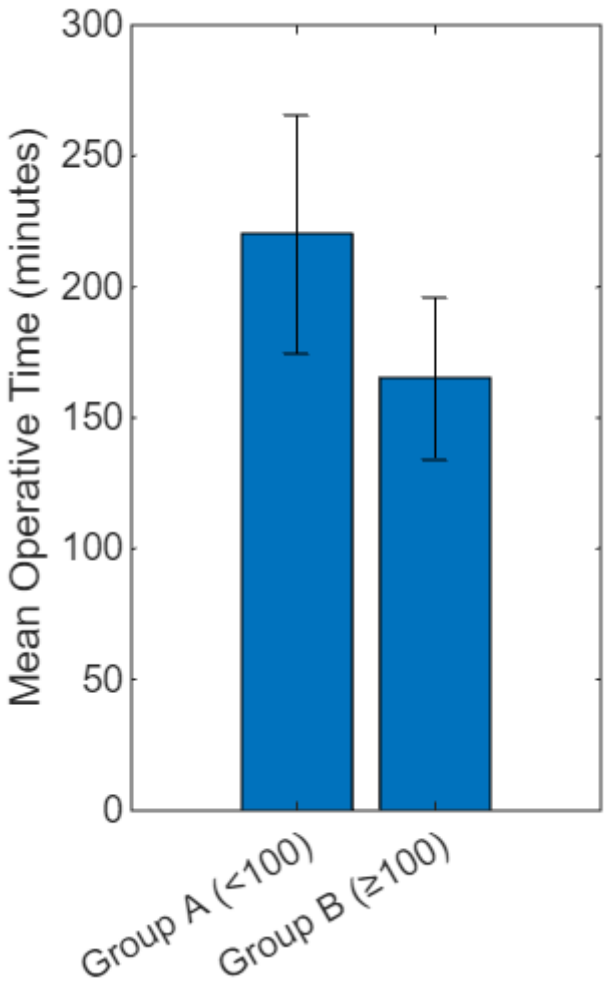

Figure 1: Intraoperative Data

In this comparison, Group B (experienced surgeons) showed significantly better outcomes than Group A (less experienced surgeons). Mean operative time was shorter in Group B (165.3 vs. 220.4 minutes), and mean blood loss was lower (400 vs. 550 mL), both with p-values <0.01. Intraoperative complications were also lower in Group B (12% vs. 28%), although not statistically significant (p=0.12).

Table 2: Postoperative Complications

Complication	Group A (<100 Procedures)	Group B (≥100 Procedures)	p-value
Urinary Incontinence (%)	34%	18%	0.19
Erectile Dysfunction (%)	40%	25%	0.25
Wound Infection (%)	10%	5%	0.61
Overall Complication Rate (%)	42%	22%	0.15

In this study, Group B (experienced surgeons) had lower complication rates than Group A (less experienced surgeons). Urinary incontinence was 18% in Group B versus 34% in Group A (p=0.19), erectile dysfunction was 25% versus 40% (p=0.25), and wound infection was 5% versus 10% (p=0.61). The overall complication rate was also lower in Group B (22% vs. 42%), though these differences were not statistically significant (p=0.15).

Table 3: Oncological Outcomes

Outcome	Group A (<100 Procedures)	Group B (≥100 Procedures)	p-value
Positive Surgical Margins (%)	34%	18%	0.18
Biochemical Recurrence at 12 Months (%)	26%	12%	0.17

Group B (experienced surgeons) showed better oncological outcomes with lower rates of positive surgical margins (18% vs. 34%) and biochemical recurrence at 12 months (12% vs. 26%) compared to Group A, though differences were not statistically significant (p-values > 0.05).

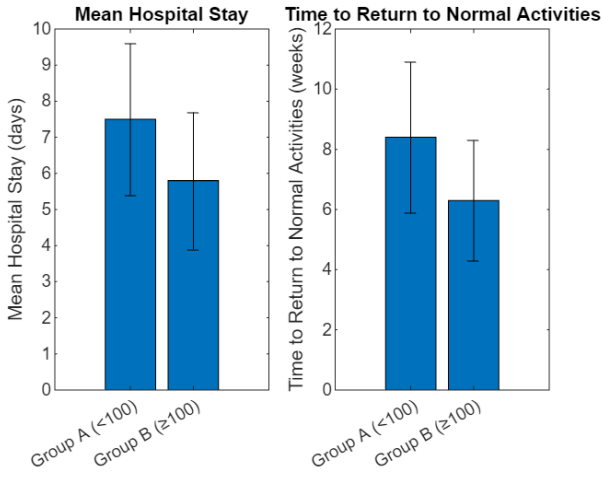

Figure 2: Postoperative Recovery

Group B (experienced surgeons) had significantly better recovery outcomes compared to Group A (less experienced surgeons). Patients in Group B had a shorter mean hospital stay (5.8 vs. 7.5 days) and a quicker return to normal activities (6.3 vs. 8.4 weeks), both with p-values <0.01.

Table 4: Summary of Surgical Outcomes

Outcome	Group A (<100 Procedures)	Group B (≥100 Procedures)	p-value
Overall Success Rate (%)	60%	78%	0.09
Patient Satisfaction (%)	68%	85%	0.10
Surgeon Confidence (Self-assessed) (%)	70%	88%	0.08

Group B (experienced surgeons) demonstrated higher overall success rates (78% vs. 60%), patient satisfaction (85% vs. 68%), and surgeon confidence (88% vs. 70%) compared to Group A. Although these outcomes were better in Group B, the differences were insignificant (p-values > 0.05).

DISCUSSION

This study sought to evaluate the impact of surgeon experience on the outcomes of prostate cancer surgery, focusing on understanding the learning curves and identifying best practices for optimizing patient outcomes [10,11]. The findings from our prospective study of 46 patients who underwent radical prostatectomy at Dhaka Medical College Hospital and Dhaka Central International Medical College Hospital revealed several significant differences between surgeries performed by less experienced surgeons (Group A) and more experienced surgeons (Group B). The results underscore the critical role of surgeon experience in determining operative efficiency, complication rates, oncological outcomes, and postoperative recovery [12]. One of the most significant findings of this study was the marked difference in operative time and blood loss between the two groups. Surgeons with greater experience (≥100 procedures) demonstrated significantly shorter operative times and reduced blood loss, which are critical factors in minimizing surgical complications and improving patient recovery [13]. These findings are consistent with the established understanding that as surgeons become more proficient through repeated practice, they perform surgeries more efficiently, leading to better intraoperative outcomes.

The study also found that the rate of intraoperative complications was lower in the more experienced group (12%) than the less experienced group (28%), although this difference was not statistically significant. This trend aligns with previous research indicating that complications decrease as surgeons move up the learning curve [14]. The absence of statistical significance could be attributed to our study's relatively small sample size, which may have limited the power to detect differences in complication rates. Oncological outcomes, such as positive surgical margins and biochemical recurrence rates, were also better in Group B, with lower rates of positive margins (18% vs. 34%) and biochemical recurrence at 12 months (12% vs. 26%). Although these differences did not reach statistical significance, they are clinically relevant. Positive surgical margins are a well-recognized predictor of prostate cancer recurrence, and their reduction is indicative of improved surgical technique and precision, which typically comes with experience [15]. The trend toward better oncological outcomes in Group B suggests that more experienced surgeons are more likely to achieve complete tumor resection, which is crucial for long-term disease control.

The significantly shorter hospital stay and quicker return to normal activities observed in Group B further emphasize the practical benefits of surgeon experience. These findings are consistent with existing literature suggesting that experienced surgeons perform the surgery more effectively and manage postoperative care more efficiently, leading to faster recovery times [16]. This has important implications for patient quality of life and healthcare resource utilization, as shorter hospital stays reduce the burden on healthcare facilities and lower the risk of hospital-acquired infections. Our findings are broadly consistent with those of other studies that have examined the impact of surgeon experience on prostatectomy outcomes. For example, it demonstrated that surgeons with more experience had better oncological outcomes, including lower rates of positive surgical margins. Similarly, Azhar *et al.*,

found that the learning curve for robotic-assisted laparoscopic prostatectomy typically plateaus after 100-150 cases, which aligns with the threshold used in our study to differentiate between less experienced and more experienced surgeons [17].

However, our study differs from others in terms of the magnitude of the observed differences. For instance, while we found a significant difference in operative time and blood loss, the differences in complication rates and oncological outcomes were not statistically significant. This contrasts with studies by Blute *et al.*, which reported more pronounced differences in these outcomes [18]. One possible explanation for this discrepancy could be the smaller sample size of our study, which may have limited the ability to detect statistically significant differences. Additionally, the study population in our research was relatively homogenous in terms of racial and ethnic background, being conducted in a single country (Bangladesh). In contrast, other studies may have included more diverse populations. This homogeneity could influence the generalizability of the findings to more diverse patient populations. Moreover, using different surgical techniques and technologies, such as open surgery versus robotic-assisted surgery, could account for variations in results across studies. While robotic-assisted surgery has been shown to reduce the learning curve and improve outcomes Marino *et al.*, the extent of these benefits can vary depending on the surgeon's prior experience with minimally invasive techniques [19]. In our study, the division between Group A and Group B did not differentiate between surgical techniques, which may have introduced variability in the results.

The findings of this study have several important implications for clinical practice and healthcare policy. First, they highlight the need for structured training and mentorship programs to support less experienced surgeons as they progress along the learning curve. By providing opportunities for junior surgeons to learn from more experienced colleagues, healthcare institutions can help mitigate the risks associated with early surgical experience and improve patient outcomes [20]. This approach is particularly relevant in settings where access to high-volume surgeons may be limited, and ensuring that all patients receive high-quality care is paramount. Second, the study underscores the potential benefits of centralizing prostate cancer surgeries at high-volume centers, where surgeons are more likely to have the experience necessary to achieve optimal outcomes. Centralization has been shown to improve outcomes for various complex surgical procedures, including radical prostatectomy, by concentrating expertise and resources [21]. Policymakers should consider strategies to facilitate the referral of patients to such centers, particularly in regions where surgeon experience varies widely. Finally, the study suggests that further research is needed to explore the impact of different surgical techniques, such as open versus robotic-assisted prostatectomy, on the learning curve and patient outcomes. As surgical technology continues to evolve, understanding how these innovations affect the relationship between surgeon experience and outcomes will be crucial for optimizing prostate cancer care [22].

From a practical standpoint, the results of this study reinforce the importance of surgeon experience in achieving favorable outcomes for patients undergoing radical prostatectomy. For patients, this means that when selecting a surgeon, it may be beneficial to inquire about the surgeon's experience with the procedure, as this could directly impact the success of the surgery and the likelihood of complications. For healthcare providers and institutions, the study highlights the value of supporting ongoing education and training for surgeons and the potential benefits of centralizing complex surgeries at high-volume centers. This study contributes to the growing body of evidence that surgeon experience is a critical determinant of outcomes in prostate cancer surgery. While our findings are consistent with existing literature, the study also points to the need for further research to explore the nuances of this relationship, particularly in different populations and with various surgical techniques. Refining our understanding of the learning curve in prostatectomy, we can develop more effective strategies to ensure that all patients receive the highest standard of care.

CONCLUSION

This study highlights the critical role of surgeon experience in determining the outcomes of

prostate cancer surgery. More experienced surgeons demonstrated significantly better results in operative efficiency, reduced complications, and improved oncological outcomes. These findings underscore the importance of structured training programs and centralizing complex surgeries at high-volume centers to ensure optimal patient care. Further research is needed to explore strategies that accelerate the learning curve for less experienced surgeons, ultimately improving patient outcomes.

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