ROBOTIC-ASSISTED RADICAL PROSTATECTOMY: A TWO-YEAR SINGLE-INSTITUTE REVIEW

Dr. Pranav Raja Yadav Senior Fellow, Tata Medical Center, Kolkata

ABSTRACT

Background: Prostate cancer is a leading cause of cancer-related morbidity and mortality worldwide. Robotic-assisted radical prostatectomy (RARP) has emerged as a preferred surgical technique for localized prostate cancer due to its precision and minimally invasive nature. This study aims to evaluate perioperative parameters, oncological outcomes, functional results, and postoperative complications of RARP over a two-year period at a single tertiary care institute.

Methods: A retrospective observational study was conducted on 50 patients with localized prostate cancer who underwent RARP between January 2022 and May 2024. Data collected included patient demographics, preoperative prostate-specific antigen (PSA) levels, Gleason scores, clinical staging, perioperative parameters, postoperative outcomes, and final histopathology results. Statistical analysis was performed using descriptive statistics, chi-square tests, and t-tests to compare outcomes based on Gleason scores and margin status.

Results: The mean age of patients was 66.9 ± 5.7 years. Preoperative PSA levels varied, with 52% of patients having PSA < 10 ng/mL. The mean operative time was 190 ± 35 minutes, and estimated blood loss was 150 ± 75 mL. Positive surgical margins were observed in 14% of cases, predominantly in patients with higher Gleason scores. Continence (defined as 0–1 pad/day) was achieved in 45% of patients within six weeks post-surgery. Biochemical recurrence occurred in 6% of patients at six-month follow-up. Upgrading of Gleason scores from biopsy to final histopathology was noted in several cases, indicating a higher grade of disease than initially diagnosed.

Conclusion: RARP demonstrates favorable perioperative and oncological outcomes with minimal complications, reduced hospital stay, and satisfactory functional recovery. The procedure is effective for managing localized prostate cancer and offers significant advantages over traditional surgical methods. Further long-term studies are warranted to assess sustained oncological control and functional outcomes.

Keywords: Robotic-assisted radical prostatectomy; prostate cancer; oncological outcomes; functional outcomes; positive surgical margins; perioperative complications.

INTRODUCTION

Prostate cancer is the second most common cancer among men globally and a significant contributor to cancer-related mortality [1]. The advent of prostate-specific antigen (PSA) screening has led to earlier detection, but also to challenges in managing localized disease effectively [2]. Radical prostatectomy is a standard treatment for localized prostate cancer, aiming to achieve oncological control while preserving urinary continence and sexual function [3].

Traditional open radical prostatectomy has been associated with considerable morbidity, including significant blood loss, prolonged hospitalization, and delayed functional recovery [4]. The evolution of minimally invasive techniques, particularly robotic-assisted radical prostatectomy (RARP), has transformed surgical management by offering enhanced precision, reduced perioperative morbidity, and improved functional outcomes [5]. The da Vinci Surgical System has been instrumental in this shift, providing surgeons with three-dimensional visualization and articulated instruments that mimic human wrist movements [6].

Several studies have demonstrated that RARP results in reduced blood loss, shorter hospital stays, and faster recovery of continence and erectile function compared to open surgery [7]. However, variability in surgical outcomes persists due to factors such as surgeon experience, patient selection, and institutional protocols [8]. Additionally, the accuracy of preoperative Gleason scoring and staging remains a concern, as discrepancies between biopsy and final histopathology can impact treatment decisions [9].

This study aims to evaluate the perioperative parameters, oncological outcomes, functional results, and postoperative complications of RARP performed over two years at our tertiary care institute. By analyzing our single-institute experience, we seek to contribute to the understanding of RARP's effectiveness and identify areas for improvement in patient care. We also examine the concordance between preoperative biopsy Gleason scores and final histopathology to assess the reliability of initial diagnostic evaluations.

MATERIALS AND METHODS

Study Design

This retrospective observational study was conducted at a single tertiary care center between January 2022 and May 2024. Institutional review board approval was obtained, and all procedures were performed following ethical guidelines.

Patient Selection

Inclusion Criteria:

- Male patients diagnosed with localized prostate cancer.
- Patients who underwent RARP at our institute during the study period.

Exclusion Criteria:

- Presence of metastatic prostate cancer.
- History of prior prostate surgery.
- Significant comorbidities contraindicating surgery.

Surgical Procedure

All RARPs were performed using the da Vinci robotic surgical system by a consistent team of experienced urological surgeons. The surgical approach included:

- **Nerve-Sparing Technique:** Employed when oncologically feasible and based on tumor characteristics and patient preference.
- **Pelvic Lymph Node Dissection (PLND):** Performed in all cases to assess lymph node involvement.

Data Collection

Patient data were collected from electronic medical records, including:

- **Demographics:** Age at the time of surgery.
- **Preoperative Parameters:** PSA levels, Gleason score from transrectal ultrasound-guided biopsy, clinical staging.
- **Perioperative Parameters:** Operative time, estimated blood loss (EBL), length of hospital stay, catheterization time.
- **Postoperative Outcomes:** Pathological Gleason score, surgical margin status, lymph node involvement, postoperative PSA levels.
- **Functional Outcomes:** Urinary continence status (defined as the use of 0–1 pad per day) at six weeks postoperatively.
- **Complications:** Recorded and classified according to the Clavien-Dindo grading system.

Statistical Analysis

- **Descriptive Statistics:** Used to summarize patient characteristics and outcomes.
- **Continuous Variables:** Presented as mean ± standard deviation (SD).
- **Categorical Variables:** Expressed as frequencies and percentages.
- **Comparative Analysis:** Chi-square tests for categorical variables and t-tests for continuous variables to compare outcomes based on Gleason scores and surgical margin status.
- **Significance Threshold:** A p-value of < 0.05 was considered statistically significant.

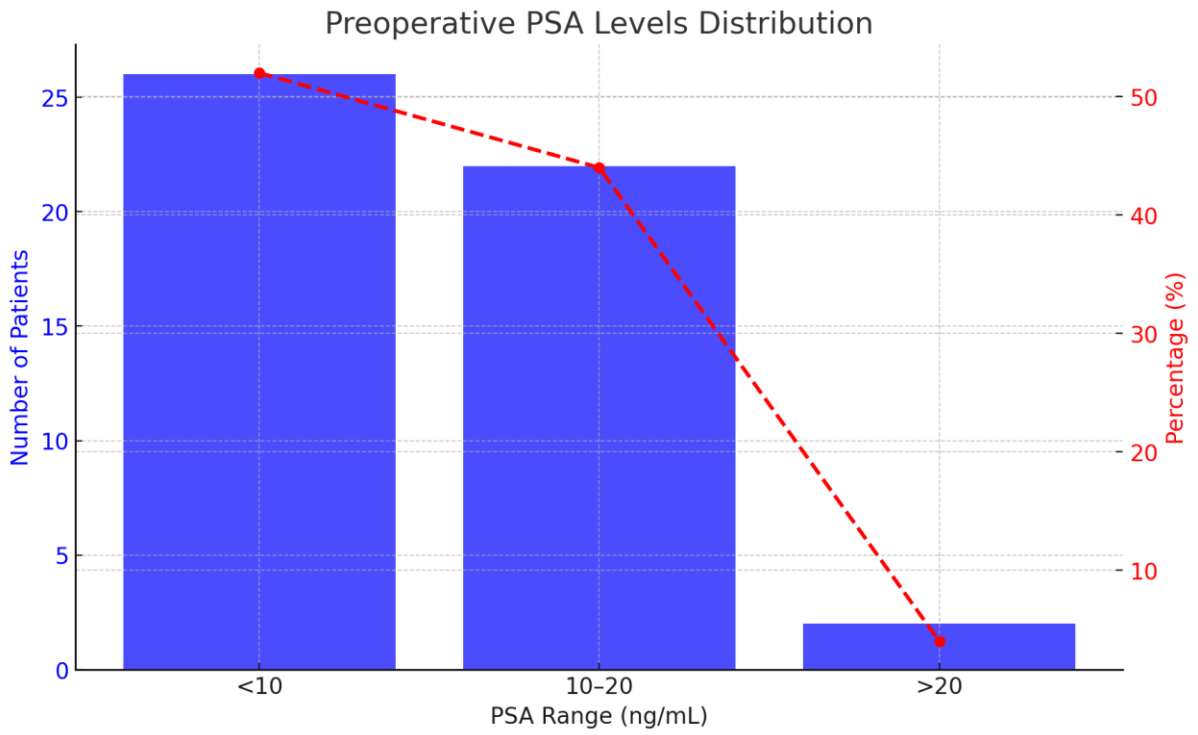
RESULTS

Patient Demographics

A total of 50 patients underwent RARP during the study period. The mean age was 66.9 ± 5.7 years. Preoperative PSA levels varied, with the distribution shown in **Table 1**.

TABLE 1. PREOPERATIVE PSA LEVELS

PSA Range (ng/mL)	Number of Patients	Percentage (%)
<10	26	52.0
10–20	22	44.0
>20	2	4.0
Total	**50**	**100.0**



Preoperative Gleason Scores

The distribution of Gleason grade groups from preoperative biopsy is presented in **Table 2**.

TABLE 2. PREOPERATIVE GLEASON GRADE GROUPS

Gleason Grade Group	Number of Cases	Percentage (%)
1	15	30.0
2	23	46.0
3	5	10.0
4	7	14.0
5	0	0.0
Total	**50**	**100.0**

Perioperative Parameters

- **Operative Time:** Mean of 190 ± 35 minutes.
- **Estimated Blood Loss (EBL):** Mean of 150 ± 75 mL.
- **Length of Hospital Stay:** Mean of 2.5 ± 1.2 days.
- **Catheterization Time:** Catheters were removed two weeks postoperatively in all patients.

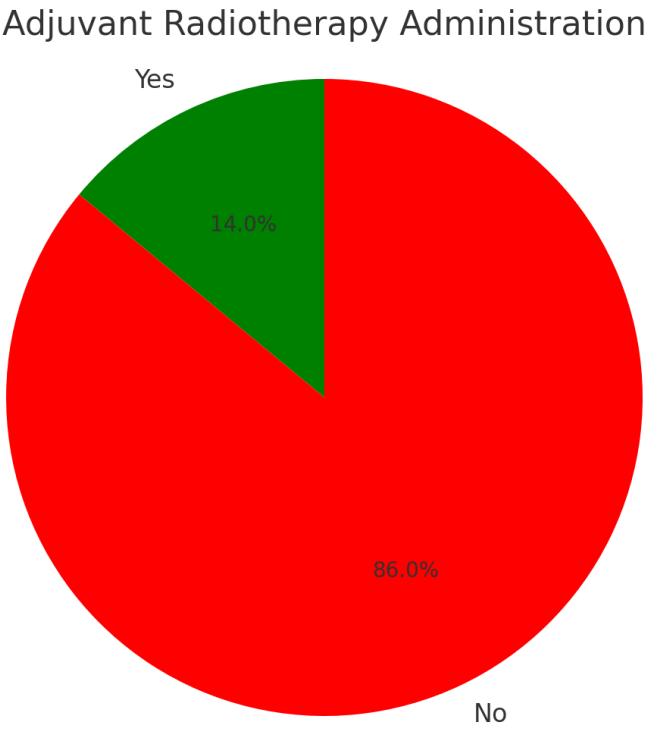
Oncological Outcomes

- **Positive Surgical Margins (PSM):** Observed in 7 patients (14%), predominantly in those with higher Gleason scores.
- **Lymph Node Involvement:** Detected in 4 patients (8%).

- **Biochemical Recurrence:** Defined as postoperative PSA > 0.2 ng/mL, occurred in 3 patients (6%) at six-month follow-up.
- **Adjuvant Radiotherapy:** Administered to all patients with PSM and biochemical recurrence (Table 3).

TABLE 3. ADJUVANT RADIOTHERAPY ADMINISTRATION

Adjuvant Radiotherapy	Number of Patients	Percentage (%)
Yes	7	14.0
No	43	86.0
Total	**50**	**100.0**



Functional Outcomes

- **Continence:** Achieved in 45% of patients (n = 22) within six weeks post-surgery.
- **Pad Usage:** Distribution detailed in **Table 4**.

TABLE 4. PAD USAGE IN FIRST SIX WEEKS POSTOPERATIVELY

Pads per Day	Number of Patients	Percentage (%)
1	21	42.0
2	16	32.0
3	4	8.0
4	6	12.0
5	1	2.0
6	1	2.0
8	1	2.0
Total	**50**	**100.0**

Gleason Score Upgrading

Upgrading from preoperative biopsy to final histopathology was noted, indicating a higher grade postoperatively (**Table 5**).

TABLE 5. PREOPERATIVE VS. POSTOPERATIVE GLEASON GRADES

Gleason Grade Group	Preoperative Cases	Postoperative Cases
1	15	5

2	23	32
3	5	8
4	7	3
5	0	2
Total	**50**	**50**

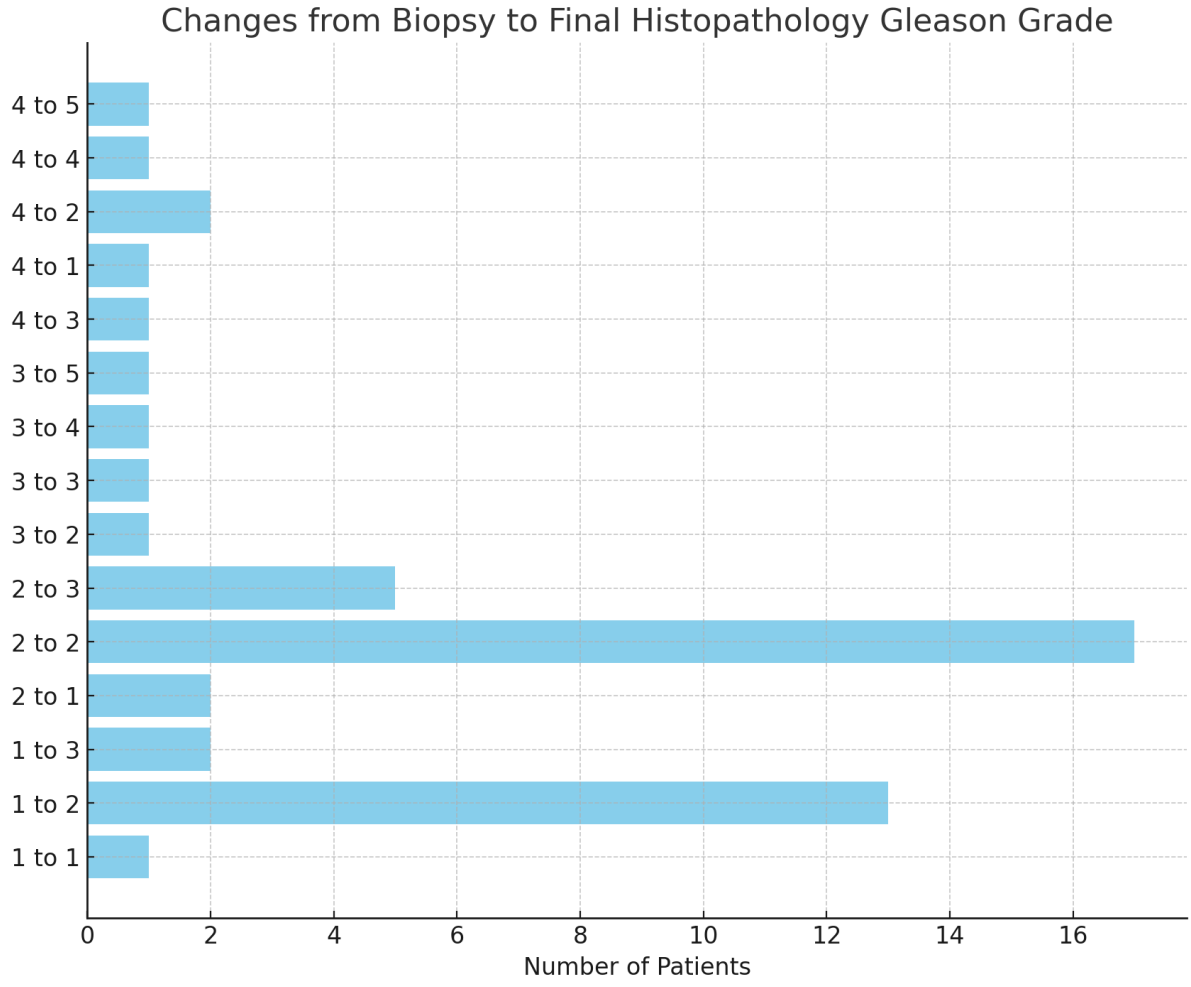
Upstaging and Downstaging

Upstaging from biopsy to final histopathology was observed in several patients (**Table 6**).

TABLE 6. CHANGES FROM BIOPSY TO FINAL HISTOPATHOLOGY

Biopsy to HPE Gleason Grade	Number of Patients
1 to 1	1
1 to 2	13
1 to 3	2
2 to 1	2
2 to 2	17
2 to 3	5
3 to 2	1
3 to 3	1
3 to 4	1
3 to 5	1

4 to 3	1
4 to 1	1
4 to 2	2
4 to 4	1
4 to 5	1
Total	**50**



DISCUSSION

Our two-year experience with RARP demonstrates favorable perioperative, oncological, and functional outcomes in patients with localized prostate cancer. The mean operative time and estimated blood loss were comparable to those reported in other studies, underscoring the efficiency and minimally invasive nature of RARP [5,6]. The reduced length of hospital stay and early catheter removal highlight the benefits of robotic surgery in enhancing patient recovery [7].

The positive surgical margin (PSM) rate of 14% aligns with the reported range of 10–25% in similar patient populations [8,9]. Higher PSM rates in patients with elevated Gleason scores suggest a correlation between tumor aggressiveness and surgical margins, emphasizing the need for meticulous surgical technique in high-risk cases [10]. Early detection of PSM allows for timely intervention with adjuvant therapies, potentially improving long-term outcomes [11].

Biochemical recurrence at six months was observed in 6% of patients, consistent with rates reported in other series [12]. All patients with PSM and biochemical recurrence received adjuvant radiotherapy, in line with clinical guidelines recommending additional treatment in high-risk patients [13]. Long-term follow-up is necessary to assess the impact of these interventions on disease-free survival.

Functional outcomes, particularly urinary continence, are critical for patient quality of life post-surgery. Our finding that 45% of patients achieved continence within six weeks is encouraging but indicates potential for improvement [14]. Factors influencing continence recovery include patient age, preoperative function, nerve-sparing techniques, and surgeon experience [15]. Enhanced recovery protocols and pelvic floor rehabilitation may further improve continence rates.

A significant observation was the upgrading of Gleason scores from preoperative biopsy to final histopathology in several cases. This discrepancy highlights the limitations of biopsy sampling and the heterogeneity of prostate cancer [16]. Upgrading was most notable from Gleason grade groups 1 and 2 to higher grades, impacting treatment decisions and prognostication [17]. Accurate assessment of tumor grade is essential for risk stratification and personalized management strategies.

The upstaging from clinical to pathological staging underscores the importance of thorough surgical evaluation, including extended pelvic lymph node dissection (PLND). Detection of lymph node involvement in 8% of patients supports the role of PLND in accurate staging and guiding adjuvant therapy decisions [18].

Limitations: The retrospective design and relatively small sample size are limitations of this study. Additionally, the follow-up period is insufficient to evaluate long-term oncological outcomes such as overall survival and metastasis-free survival. Prospective studies with larger cohorts and extended follow-up are needed to validate these findings.

CONCLUSION

Robotic-assisted radical prostatectomy at our institute over two years has shown promising outcomes in terms of oncological control, functional recovery, and perioperative safety. The procedure offers significant advantages, including reduced blood loss, shorter hospitalization, and acceptable rates of continence recovery. The observed upgrading of Gleason scores underscores the importance of comprehensive pathological evaluation. RARP is a reliable and effective option for managing localized prostate cancer. Further studies with longer follow-up are necessary to assess long-term outcomes and optimize patient care strategies.

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