American Journal of Biomedicine and Pharmacy
https://biojournals.us/index.php/AJBP
ISSN: 2997-7177

A Comparative Study of Bladder Neck Preservation Versus Bladder Neck Reconstruction during Retropubic Radical Prostatectomy in Term of Urinary incontinence

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Received: 2025, 15, Nov
Accepted: 2025, 21, Dec
Published: 2026, 24, Jan

Annotation: Background: Urinary continence remains a critical functional outcome following radical prostatectomy. Bladder neck preservation has been advocated to improve postoperative continence. While BNR has been widely reported, evidence focusing on the impact of BNP, particularly on early continence following open retropubic radical prostatectomy (RRP), remains limited.

Objective: To evaluate early and late urinary continence outcomes following bladder neck preservation during open retropubic radical prostatectomy and to compare these results with bladder neck reconstruction outcomes reported in the literature.

Patients and Methods: This prospective study was conducted at Al-Sadr Teaching Hospital, Al-Najaf, between January 2022 and January 2025. Patients with clinically localized prostate cancer underwent open retropubic radical prostatectomy with intentional bladder neck preservation. Postoperative follow-up was performed at 3, 6, and 12 months. Primary outcomes included early and late urinary

continence recovery. Secondary outcomes included vesicourethral anastomotic stenosis and surgical margin status.

Results: Bladder neck preservation was associated with favorable early continence recovery, with a notable proportion of patients achieving continence within the first postoperative months. Continence rates further improved over time, resulting in high late continence rates at 12 months, comparable to late continence outcomes reported in bladder neck reconstruction series. At the 3-month follow-up, urinary continence was achieved in 90% of patients. This proportion further increased to 95% at 6 months. By the 12-month follow-up, all patients (100%) had achieved full urinary continence. Vesicourethral anastomotic stenosis occurred in two patients and was successfully managed endoscopically. All patients demonstrated negative surgical margins.

Conclusion: Bladder neck preservation during open retropubic radical prostatectomy appears to confer its principal functional advantage in enhancing early urinary continence, while maintaining late continence outcomes comparable to bladder neck reconstruction techniques reported in the literature. This approach offers a meaningful early quality-of-life benefit without compromising oncological safety and represents a viable alternative to bladder neck reconstruction.

Introduction

Prostate cancer is among the most prevalent male malignancies globally and represents a leading cause of cancer-related mortality. In 2023 alone, an estimated 1.4 million new prostate cancer cases were diagnosed worldwide, resulting in approximately 375,000 deaths[(1)]. The disease predominantly affects individuals aged over 65 years, and earlier detection through PSA screening has shifted the presentation toward more localized stages, allowing for timely curative treatment decisions[(2)].

The global incidence of prostate cancer varies significantly across regions, largely due to differences in screening practices, genetic predisposition, and healthcare infrastructure. In North America and Western Europe and australia where PSA screening is widely used, prostate cancer is often diagnosed at earlier stages, contributing to better outcomes. In contrast, in developing regions, the diagnosis is frequently delayed due to limited access to screening and diagnostic tools, resulting in more advanced disease at presentation[(3)].

Regionally, Middle Eastern and North African countries report increasing incidence rates of prostate cancer, attributed to population aging, improved cancer registries, and increased awareness[4]. However the absence of organized screening programs mean that prostate cancer diagnosed at advanced stages in this regions.Indicating the need for locally relevant studies evaluating surgical outcomes in these settings.

Adenocarcinoma of the prostate, originating from the acinar glands, constitutes over 95% of all prostate cancers. Other rare variants include ductal adenocarcinoma, mucinous adenocarcinoma, and small-cell neuroendocrine carcinoma, all of which carry worse prognoses[5].

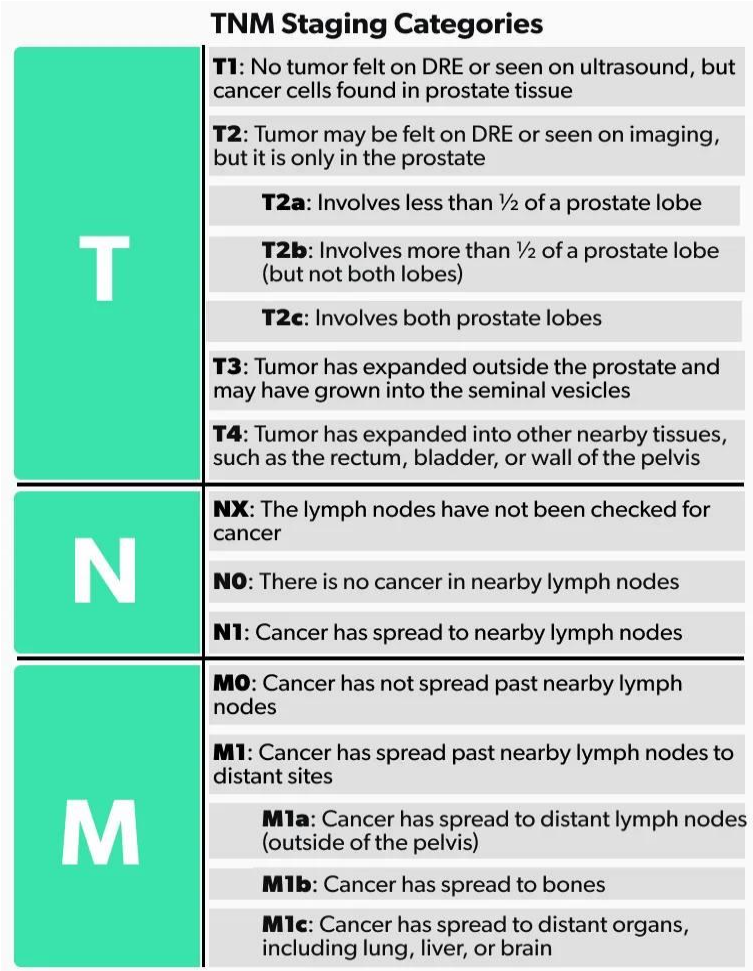
The Gleason grading system remains the cornerstone for histologic risk assessment. It is based on architectural patterns of tumor glands, with scores ranging from 6 to 10. The 2014 ISUP modification consolidated Gleason scores into Grade Groups (1–5), improving clinical utility and prognostic stratification based on Table 1:[6]

Table 1.1 ISUP Grade Group Classification and Corresponding Gleason Scores

Grade Group 1:	Gleason 3+3=6
Grade Group 2:	Gleason 3+4=7
Grade Group 3:	Gleason 4+3=7
Grade Group 4:	Gleason 8
Grade Group 5:	Gleason 9–10

The tumor-node-metastasis (TNM) system, as recommended by the AJCC and adopted by EAU and AUA, is the most widely used method for clinical and pathological staging of prostate cancer. The stages are:

Table 1.2 T Classification of Prostate Cancer According to the TNM Staging System



Lymph node metastasis (N1) is a major prognostic factor. Common metastatic sites include bone (especially spine and pelvis), lungs, and liver. Bone scans, CT, and MRI are standard imaging tools, while novel modalities like PSMA PET-CT are revolutionizing staging accuracy[7].

Patients and Methods

Study Design and Setting

This prospective single-center observational study was conducted at Al-Sadr Teaching Hospital in Al-Najaf, Iraq, over a period of three years, from January 1, 2022 to January 1, 2025.

A total of 22patients, aged between 50 and 73 years, were initially enrolled in the study. After appling exclusion criteria and accounting for dropouts, 20 patients who underwent open radical prostatectomy with bladder neck preservation successfully performed and completed the 12-month follow-up were included in the final evaluation. Postoperative follow-up was conducted at 3, 6, and 12 months to assess urinary continence and other clinical outcomes.

Ethical Consideration

Before collecting any data and performing any intervention, we obtained verbal and written consent from each patient after being informed of the study's objectives. All patient had the right to withdraw from the study at any time without consequences. Patients were assured that the confidentiality of their data was guaranteed throughout the study. Information regarding demographic data, medical history, physical examination, laboratory data (including PSA, general urine examination, urine culture and sensitivity before and after intervention), and imaging, were collected directly from the patients.

Inclusion Criteria

Patients with clinically localized prostate cancer who were eligible for open radical prostatectomy with curative intent, and were totally continent preoperatively.

Exclusion Criteria

- ✓ History of incontinence or lower urinary tract dysfunction
- ✓ Neurological disorders affecting continence.
- ✓ Major pelvic surgery.
- ✓ History of radiation.
- ✓ Intraoperative requirement for bladder neck reconstruction.
- ✓ Patients lost to follow-up before 12 months postoperatively.

Preoperative Evaluation

Each patient underwent a standardized preoperative workup, which included:

- ✓ Patient characteristics, history, clinical evaluation
- ✓ Digital rectal examination (DRE).
- ✓ Serum PSA testing.
- ✓ Transrectal ultrasound-guided prostate biopsy with at least 12 cores.
- ✓ PSMA PET/CT or multiparametric pelvic MRI
- ✓ Baseline continence assessment based on pad usage and structured interview.
- ✓ urinalysis, full blood count, renal function test, liver function test

Surgical Technique

1. Preoperative Preparation and Incision

All patients received a rectal enema in the morning prior to surgery, preoperative antibiotic prophylaxis was administered, under spinal or general anesthesia, the patient was placed in the supine position with pad below hip bones and flexion of couch 30 degree , The skin was prepared and draped in the usual way. A No. 16 Silastic Foley catheter is passed into the bladder, inflated with 20 mL of saline and a lower midline infraumbilical incision was made to create the retropubic space.

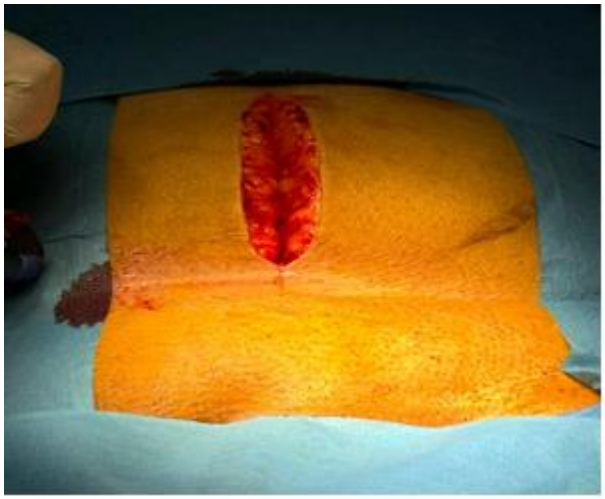


Figure 2.1 Infra-umbilical midline incision

2. Exposure of the Retropubic Space

The space of Retzius was developed by incising the transversalis fascia and bluntly mobilizing the bladder. The anterior surface of the prostate and bladder neck were exposed using sharp and blunt dissection.

3. Endopelvic Fascia Incision and DVC Ligation The endopelvic fascia was incised sharply bilaterally. The dorsal venous complex (DVC) was identified and ligated using 1-0 silk in a figure-of-eight suture technique to achieve hemostasis and minimize bleeding during apical dissection.

4. Preservation of Puboprostatic Ligaments

The puboprostatic ligaments were preserved to support the external urethral sphincter and facilitate early return of continence.

5. Apical Dissection and Urethral Transection

The apex of the prostate was carefully dissected. The anterior wall of the urethra was incised first to expose the urethral lumen. A stay suture of 4-0 VICRYL was initially placed. The posterior wall of the urethra was then sharply transected. The Foley catheter was cut and retracted which later aid in posterior dissection of urethra, and a total of 8 stays sutures of 4-0 VICRYL were placed circumferentially to aided in orientation. A 2-3 mm safe margin was maintained at the distal urethra to ensure oncological safty while preserving sphincter function for continence.

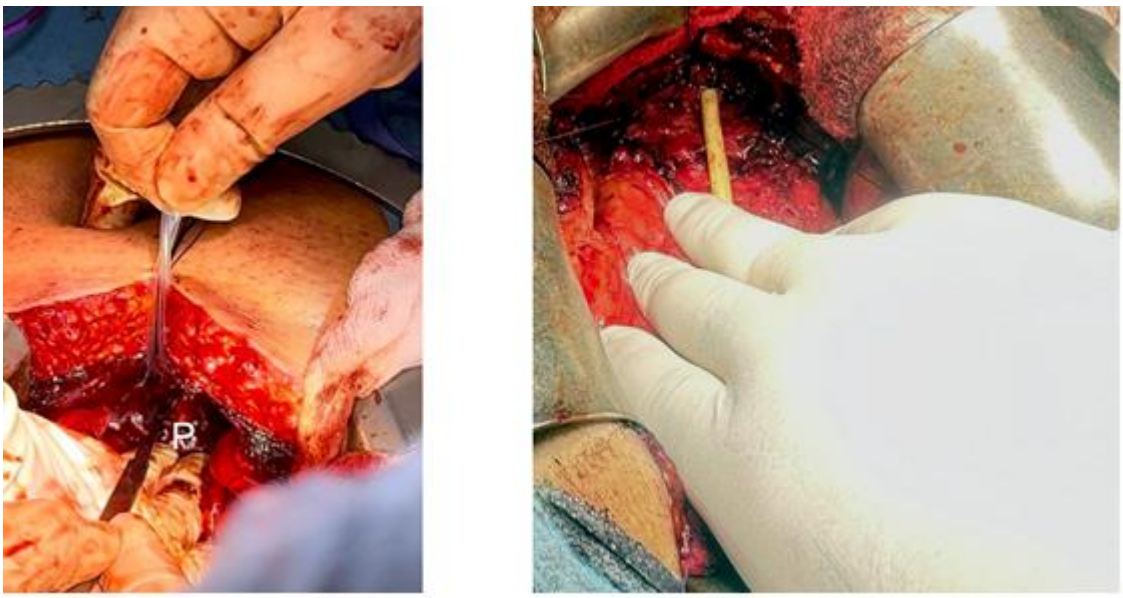


Figure 2.2 Apical Dissection and Urethral Transection with six stay sutures were placed circumferentially (p:prostate)

6. Posterior Dissection and Rectal Protection

A surgical plane was developed between the rectum and the prostate by carefully dividing the rectourethral is muscle. Sharp and blunt dissection was then carried out with meticulous care to avoid rectal injury and to maintain oncological safety with clear posterior margins.

7. Lateral Pedicle Control

The lateral prostatic pedicles were identified and controlled using a 5 mm curved Ligasure device. Dissection proceeded with no attempt to preserve the neurovascular bundles.

8. Vas Deferens and Seminal Vesicle Dissection

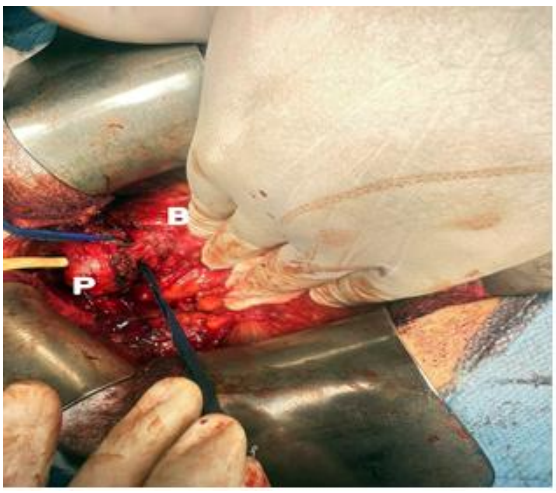
The vas deferens and its ampulla were identified and clipped bilaterally. The seminal vesicles were then carefully dissected and excised with attention to hemostasis and preservation of surrounding anatomical structures.

9. Retrograde Prostate Mobilization

After apical, posterior, and lateral release, the prostate was mobilized in a retrograde fashion from apex to base toward the bladder neck, dissection proceed posterior to denonvilliers fascia which had already been incised during posterior approach allowing for safe and controlled mobilization of the gland while maintaining oncological principles.

10. Bladder Neck Preservation

The bladder neck was dissected using a telescopic technique, proceeding in a layered, circumferential manner. The muscular and mucosal structures of the bladder neck were preserved.



Figur 2.3. Bladder Neck dissection during RRP

(B:Bladder; p :prostate)

11. Vesicourethral Anastomosis

After removal of the prostate, seminal vesicles, and vas deferens, the bladder mucosa was everted to facilitate a clean edge for reconstruction. After removal of pad and straight of couch, a tension-free vesicourethral anastomosis was then performed between the preserved bladder neck and the urethral stump using 4-0 absorbable suture (VICRYL) in an interrupted fashion.

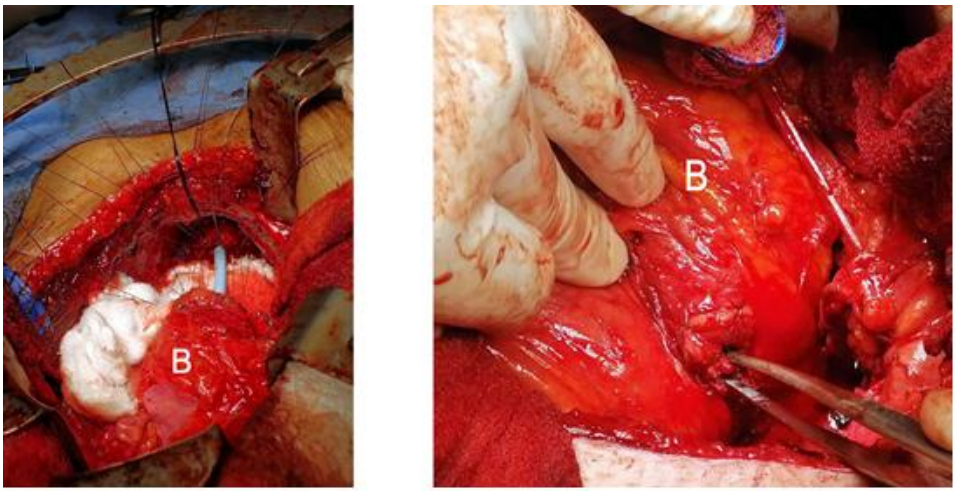


Figure 2.4 Bladder mucosal eversion and Vesicourethral anastomosis

(B: Bladder)

12. Pelvic Lymph Node Dissection (PLND)

A selective pelvic lymph node dissection was routinely performed in all patients. In cases with suspicious lymphadenopathy observed intraoperatively, or in patients with preoperative high-risk features, an extended pelvic lymph node dissection was carried out.

The boundaries of the selective PLND included:

- ✓ Medially: bladder wall and perivesical fat
- ✓ Laterally: external iliac vein
- ✓ Cranially: bifurcation of the common iliac artery
- ✓ Caudally: cloquet nodes
- ✓ Posteriorly: obturator nerve and pelvic floor

The lymph nodes typically removed in selective PLND were from the external iliac, obturator, and hypogastric (internal iliac) regions. All lymphatic tissue was submitted for histopathological examination, and meticulous hemostasis was ensured to minimize postoperative complications such as lymphocele formation.

Postoperative Management

1. Intravenous antibiotics and thromboembolic prophylaxis (6000 IU for 28 days) were administered postoperatively.
2. Pain control and early ambulation were encouraged.
3. A closed-suction pelvic drain was placed and typically removed within 24 to 48 hours.
4. A 16 Fr silicone Foley catheter was left in situ for 21 days.
5. A flexible cystoscopy was performed 2 to 4 weeks postoperatively to assess anastomotic healing and rule out stricture.
6. Serum PSA was measured at one month postoperatively to determine nadir, and monitored at each follow-up visit.

Follow-Up and Outcome Assessment

Patients were followed up at 3, 6, and 12 months postoperatively in the urology outpatient clinic. The primary endpoint was urinary continence, defined as:

- ✓ Complete continence: 0 pads/day.
- ✓ Social continence: Use of 1 safety pad/day.
- ✓ Incontinence: Use of ≥2 pads/day.

Continence status was recorded based on patient interviews, pad usage, and continence questionnaires.

Secondary outcomes included:

- ✓ Positive surgical margin rates.
- ✓ Bladder neck stricture

Statistical Analysis

This study was conducted as a prospective single-arm cohort study. Data were collected prospectively and analyzed using IBM Statistical Package for the Social Sciences (SPSS), version 26, and Microsoft Excel, version 2018. Descriptive statistics were used to summarize patient characteristics and study variables. Categorical variables were expressed as frequencies and percentages. Due to the small sample size and the presence of low expected cell frequencies, comparisons of categorical variables, including urinary continence status at different follow-up intervals, were performed using Fisher's exact test. All statistical analyses were two-tailed, and a p-value < 0.05 was considered statistically significant.

Results

Twenty patients with prostate cancer, who underwent radical prostatectomy with bladder neck preservation, were enrolled in this study. The mean age in the study sample was 62.60 years with range between 50 years and 73 years. Sixty percent of patients were older than 60 years while the rest were 60 years or younger (figure 3.1). Average body mass index of the enrolled patients was 28.31 kg/m^2 with 60% of patients were lower than 30 kg/m^2 (figure 3.2). Two patients (10%) were diabetic and 5 patients (25%) were smokers. Prostate size of the included patients ranged between 30 cm^3 and 58 cm^3. Demographic characteristics are illustrated in Table 3.1.

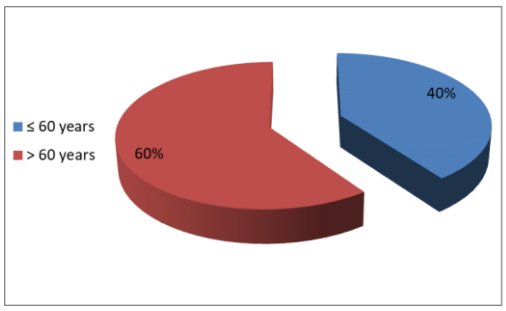


Figure 3.1: Age distribution in the study population.

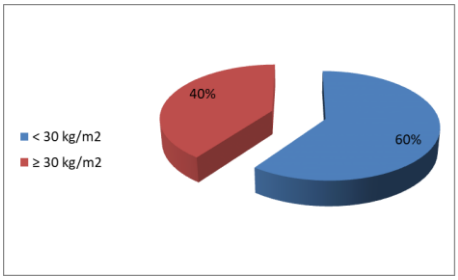


Figure 3.2: Body mass index groups in the study population.

Table 3.1: Demographics of the study sample

Parameter	Study population (n=20)
Age(years) Mean(range)	 62.60(50-73)
Age group; n(%) ≤ 60 years > 60 years	 8(40%) 12(60%)
Body mass index(kg/m^2) Mean(range)	 28.31(25-32)
Body mass index group; n(%) < 30 kg/m^2 ≥ 30 kg/m^2	 12(60%) 8(40%)
Diabetes mellitus; n(%) Yes No	 2(10%) 18(90%)
Smoking status; n(%) Yes No	 5(25%) 15(75%)
Prostate size(cm^3) Mean(range)	 44.65(30-58)

Three months postoperatively 18 (90%) patients were continent while at 6 months of follow-up continence rate was 95%. At 12 months of follow-up, all patients were fully continent. Table 3.2 shows incontinence rate in the study sample.

Table 3.2: Continence rate according to follow up duration.

Follow-up	Continence; n(%)		*P-value*
	Yes	No	
3 months	18(90%)	2(10%)	>0.05*
6 months	19(95%)	1(5%)	
12 months	20(100%)	0	

**P-value* 0.54 for 3 months versus 6 months, *P-value* 0.14 for 3 months versus 12 months, *P-value* 0.31 for 6 months versus 12 months

Tables; 3.3, 3.4, & 3.5 illustrate pad usage rates as well as pad wetting. Daytime pad usage was seen in 10% of patients at 3 months and in 10% and 5% of patients at 6 months and 12 months respectively. With respect to nighttime pad usage, 10 patients (10%) wore pads at 3months and one patients (5%) still kept using pads at six months and none wore night pads at 12 month. Diurnal and nocturnal pad wetting was recorded in 10%, 5%, 0% of the study sample at three months, six months, and 12 months respectively.

Table 3.3: Daytime pad use according to follow up interval.

Follow-up	Pad use; n(%)		*P-value*
	Yes	No	
3 months	2 (10%)	18 (90%)	>0.05*
6 months	2 (10%)	18 (90%)	
12 months	1(5%)	19(95%)	

**P-value* 1.00for 3 months versus 6 months, *P-value* 0.54 for 3 months versus 12 months, *P-value* 0.54 for 6 months versus 12 months

Table 3.4: Nighttime pad use according to follow up interval.

Follow-up	Pad use ; n(%)		*P-value*
	Yes	No	
3 months	2 (10%)	18 (90%)	>0.05*
6 months	1 (5%)	19 (95%)	
12 months	0	20 (100%)	

**P-value* 0.54 for 3 months versus 6 months, *P-value* 0.14 for 3 months versus 12 months, *P-value* 0.31 for 6 months versus 12 months

Table 3.5: Daytime pad wetting according to follow up interval.

Follow-up	Pad wetting; n(%)		*P-value*
	Yes	No	
3 months	2 (10%)	18 (90%)	>0.05*
6 months	1 (5%)	19 (95%)	
12 months	0	20 (100%)	

**P-value* 0.54 for 3 months versus 6 months, *P-value* 0.14 for 3 months versus 12 months, *P-value* 0.13 for 6 months versus 12 months

Table 3.6: Nighttime pad wetting according to follow up interval.

Follow-up	Pad wetting ; n(%)		*P-value*
	Yes	No	
3 months	2(10%)	18(90%)	<0.05*
6 months	1(5%)	19(95%)	
12 months	0	20(100%)	

**P-value* 0.001for 3 months versus 6 months, *P-value* 0.0002 for 3 months versus 12 months, *P-value* 0.31 for 6 months versus 12 months

In addition to functional outcomes, secondary oncological and surgical safety endpoints were evaluated. All patients in the present cohort demonstrated negative surgical margins, suggesting that bladder neck preservation did not compromise oncological adequacy in the short term.

Postoperative vesicourethral anastomotic complications were infrequent; two patients developed anastomotic stricture, both of whom were successfully managed with surgical intervention. These findings indicate that bladder neck preservation can be performed with acceptable perioperative safety and without an apparent increase in positive surgical margin rates, although longer follow-up is required to assess long-term oncological outcomes.

Discussion

Radical prostatectomy is an effective curarive treatment option for patients with organ-confined prostate cancer [8,9]. Although, this operation was historically associated with serious morbidity and mortality in its earlier form, it underwent significant technical improvements and refinement that yielded superior outcomes with respect to the clinical and functional aspects.[10] Incontinence rate following radical prostatectomy was variable with different surgical approach and series [11,12]. Hence, the current study enrolled 20 patient who had radical retropubic prostatectomy to study continence status in association with bladder neck preservation technique.

The current study showed that Three months postoperatively 18 (90%) patients were continent while at 6 months of follow-up continence rate was 95%. At 12 months of follow-up, all patients were fully continent. Daytime pad usage was seen in 10% of patients at 3 months and in 10% and 5% of patients at 6 months and 12 months respectively. With respect to nighttime pad usage, 2 patients (10%) wore pads at 3 months and one patients (5%) still kept using pads at six months and none wore night pads at 12 month. Diurnal and nocturnal pad wetting was recorded in 10%, 5%, 0% of the study sample at three months, six months, and 12 months respectively. In agreement with the present study, in patients who had radical prostatectomy with bladder neck preservation, 84.21% of patients were continent at 3 months postoperative and 89.47% of them were continent at 6 months while at one year of follow-up, 94.73% were continent[13-15] .and his co-authors demonstrated that ,in patients who had bladder neck preservation in association with radical prostatectomy, continence rate was 89.58%, 91.66%, and 95.83% at 3 months, 6 months, and 12 months respectively[16]. Conducted a study on 272 patients who had radical prostatectomy and found that preservation of bladder neck yielded continence rate of 77% and 83% at 3 months and 12 months respectively. On contrary, other series reported lower continence rates than mentioned studies after bladder neck preserving radical prostatectomy[17]. Differences in continence rates after radical prostatectomy in previous literature may be explained by differences in continence definition and patients' demographics. [18,19]

Preservation of bladder neck in association with radical prostatectomy may provide an advantage over the alternative bladder neck resection technique in term of continence control. A recent meta-analysis, which was, involved analyzing data from 13 trails and 2284 participants with an aim to assess the outcomes between radical prostatectomy with preserving bladder neck and without[20]. This review concluded that preservation of bladder neck was associated with superior results with respect to continence status in early (less than 12 month postoperative) and late (more than one year postoperative) follow-up. Ma et al 2016 demonstrated that odd ratios 2.04 (1.39-3.00; P-value 0.0003) at 3 months, 2.22 (1.42-3.47; P-value 0.0004) at 2 to 4 months, 1.72 (1.25-2.37; P-value 0.0010) at 6 months, 1.46 (1.06-2.02; P-value 0.02) at 12 months, 3.30 (1.26-8.66; P-value 0.02) at late follow-up (12 months or more). However, another meta-analysis, which was performed by Gong et al 2016 and his co-colleagues, did not find reported significant difference in continence rate in patients who had radical prostatectomy with bladder neck preservation and without[21,22]. This meta-analysis was limited by smaller numbers of included articles and higher heterogeneity among these series.

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