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Ultrapreservation in Robotic Assisted Radical Prostatectomy Provides Early Continence Recovery

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ABSTRACT

Background and Objectives: We aimed to evaluate oncological and functional results of the ultrapreservation anterior-sparing technique in patients with localized prostate cancer.

Methods: In this single-center study, patients with low to intermediate risk prostate cancer, who were treated with the ultrapreservation anterior-sparing technique, were included retrospectively. The oncological and functional outcomes were recorded. After the functional and pathological evaluation in the first month, patients' prostate-specific antigen levels were followed, as well as continence and potency status bimonthly for one year. Continence is defined as no leakage and zero pads for security. Patients' potency was evaluated using the Sexual Health Inventory for Men, with ≥ 17 considered potent.

Results: A total of 118 patients were included in the study. The pathological stage was pT2 in 78% (n = 92) of patients, with pT3 in 22% (n = 26). Surgical margin positivity occurred in 13.5% (n = 16) of patients. No complications were observed intraoperatively. Continence rates were 25.4% after catheter removal, rising to 88.9% in the first month, 91.5% in the third, 93.2% in the fifth, and 95.7% a year later. Thirty-five (40%) of 86 potent patients were potent in the first postoperative month, 48 patients (55.8%) were potent in the third month, and 58 patients (67.4%) were potent in the twelfth. The total complication rate was 8.4%, with no major complications observed.

Conclusion: The ultrapreservation anterior-sparing technique for patients with prostate cancer shows safe, acceptable functional and oncological results in short-term follow-up. However, long-term comparative studies with a larger number of patients are needed.

Key Words: Erectile dysfunction, Prostatectomy, Robotic-assisted surgery, Urinary incontinence.

INTRODUCTION

Prostate cancer is one of the most common cancers in men.[1] Recent evidence suggests that its incidence is rising while mortality seems to be decreasing.[2] Radical prostatectomy is an accepted treatment method for prostate cancer. The main aim of surgery is eradicating cancer, although the quality of life (QoL) deteriorates due to incontinence and erectile dysfunction.[3,4]

Improvements in surgical techniques lead to better results over time. Laparoscopic and robot-assisted radical prostatectomy are viable options for prostate cancer patients; however, robotic surgery provides better functional outcomes in terms of potency and continence.[5] New techniques and different nerve protection methods have emerged within the technological developments in robotic surgery and increased surgical experience. Restoration of the posterior rhabdosphincter, puboprostatic collar preservation, suspension sutures, bladder neck plication, and Retzius-sparing surgery have been introduced as a minimally invasive approaches for continence recovery.[6–10]

To optimize continence outcomes with robotic surgery, a new technique was used by de Carvalho et al., in which the endopelvic fascia and dorsal venous complex were preserved by releasing the neurovascular bundles from a retrograde perspective.[11] Recently, Wagaskar et al. presented a novel technique (the "Hood Technique"), using an anterior method to preserve the detrusor apron, with

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the puboprostatic ligament; vessels; and the fibers of the detrusor muscle. The membranous urethra, external urinary sphincter, and supportive tissues are the protected area with the hood.[12] Similar to these techniques, we aimed to share our oncological and functional results of the ultrapreservation anterior sparing technique in patients with localized prostate cancer.

METHODOLOGY

In this single-center study, patients who were treated with ultrapreservation technique with at least one-year follow-up were included retrospectively. Patients with low to intermediate risk according to the Internal Society of Urologic Pathology (ISUP) grade group 1–2-3 prostate cancer, were treated with the ultrapreservation technique. Patients with multiparametric magnetic resonance (MR) imaging-proven anterior tumors were excluded, as were those with high risk, ISUP grade groups 4–5, with a history of hormonotherapy, radiotherapy, and endoscopic resection of the prostate. The Briganti nomogram and MR imaging findings were used for lymph node dissection. The Institutional Review Board approved the study.

Surgical Technique

After creating the pneumoperitoneum with a Veress needle, five ports were inserted. The vas deferens and seminal vesicles were dissected posteriorly with an athermal technique. From the posterior view of the prostate, the capsule and Denonvilliers' fascia was dissected with sharp, blunt dissection. Subsequently, the peritoneum was dissected anteriorly to expose the Retzius area. The bladder neck was incised and the seminal vesicles and vas deferens were transferred from the incision area (**Figure 1A**). Superficial veins are the main anatomical landmarks for the dissection of prostatic capsule. A plane between the capsule and pedicular vessels was created bilaterally with sharp dissection carefully to avoid bleeding, while polymer clips were used for ligation of only prostatic vessels, and endopelvic fascia was preserved (**Figure 1B**). The dorsal venous complex was ligated with a 4/0 Vicryl suture (**Figure 1C**). The detrusor apron was spared from the prostate (anterior fibromuscular layer) with blunt dissection carefully for the avoidance of anatomical structures and the urethra was exposed (**Figure 1D**). After dissection of the urethra, the prostate was removed (**Figure 1E-F**). Finally, the bladder neck and urethra were approximated, urethrovesical anastomosis

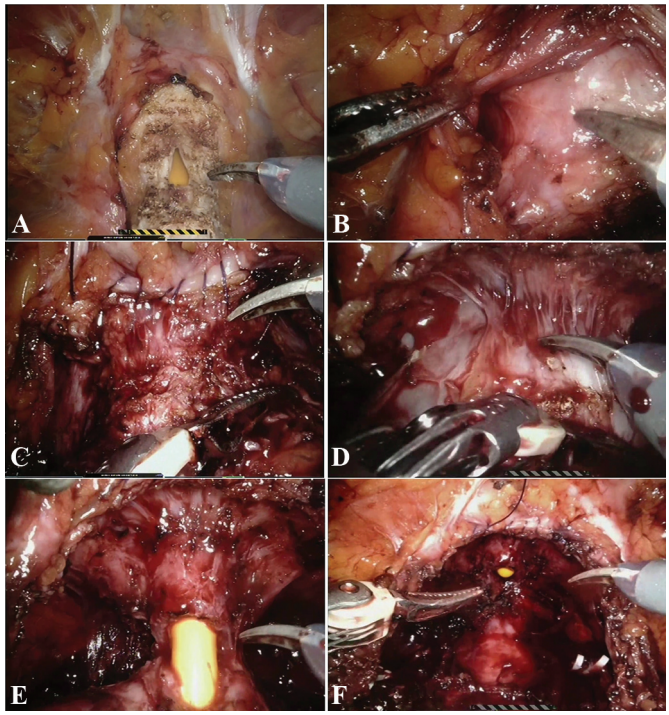

Figure 1. The surgical technique of ultrapreservation. (**A**) incision of bladder neck, (**B**) creation of a plane between the capsule and pedicular vessels, (**C**) the ligation of dorsal venous complex, (**D**) the detrusor apron was spared from the prostate, (**E**) dissection of the urethra, (**F**) final appearance after prostatectomy.

was done using a 3/0 poly (Glycolide-Co-Caprolactone) suture, and Foley catheter was placed.

Intraoperative and postoperative data were recorded: operative time and console time, estimated blood loss, length of hospital stay, catheter removal time, and complications which evaluated for one year were noted. After the functional and pathological evaluation in the first month, patients' prostate-specific antigen (PSA) levels were followed for biochemical recurrence, as well as continence and potency status bimonthly for one year. Continence was defined as no leakage and zero pads for security.[13,14] Potency was evaluated with the Sexual Health Inventory for Men (SHIM), with ≥ 17 considered potent. For recovery of potency, patients were administered 5 mg or 20 mg of tadalafil after surgery if there were no clear-cut contraindications. If patients were unable to achieve potency, a vacuum device was offered or intracavernosal injections were given for appropriate patients.

Statistical analysis was carried out with SPSS v.200.0 (IBM Corp., 2011 or IBM SPSS Statistics for Windows, v. 200.0., Armonk, NY, USA). The median and mean were recorded

for the continuous variables, depending on the distribution of the data, while the rates were reported for the categorical variables.

RESULTS

A total of 118 patients were included. The patient demographics can be seen in **Table 1**. The mean age was 60.98 ± 6.17, and the median body mass index (BMI) was 26.4 (22 – 35.49). The median PSA level was 6.35 (2 – 50). Biopsies done pre-operatively were ISUP Grade group 1 in 60 (50.8%) patients, Grade group 2 in 49 (41.5%) patients, and Grade group 3 in 9 (7.6%) patients.

The mean operative and console times were 188.13 ± 30.76 min and 108.17 ± 20.36 min. The perioperative and postoperative data for the patients is summarized in **Table 2**. Lymph node dissection was performed in 10 (8.4%). The median estimated blood loss was 120 cc (20 – 310 cc). Bilateral nerve sparing surgery was performed in 84.7% of patients. In the final pathological stage, 78% (n = 92) of patients were in pT2, while 22% (n = 26) were in pT3. Surgical margin positivity occurred in 13.5% (n = 16); margin positivity occurred in 6.5% (8/92) of patients in pT2, 19% (6/21) of patients in pT3a, and 40% (2/5) in pT3b. The location of the surgical margin positivity was lateral in nine patients (56.2%), apical in five patients (31.2%), and basal in two patients (12.5%). No biochemical recurrence was observed during the follow-up.

Table 1.
Demographics and Pre-operative Patient Data

Age (mean ± S.D)	60.98 ± 6.17
Prostate-specific antigen ng/mL (median/min-max)	6.35 (2 – 50)
Body Mass Index (median/min-max)	26.4 (22 – 35.49)
Prostate Volume (ml) (median/min-max)	42 (21 – 74)
ISUP grade n (%)	
Grade 1	60 (50.8)
Grade 2	49 (41.5)
Grade 3	9 (7.6)
SHIM score n (%)	
< 17	32 (27.2)
≥ 17	86 (72.8)

Abbreviations: S.D., standard deviation; ISUP, Internal Society of Urologic Pathology; SHIM, Sexual Health Inventory for Men.

Table 2.
Perioperative and Oncological Patient Outcomes

Time of the surgery (mean ± S.D.) (min)	188.13 ± 30.76
Time of the console (mean ± S.D.) (min)	108.17 ± 20.36
Estimated blood loss (median/min-max) (cc)	120 cc (20 – 310 cc)
Lymph node dissection n (%)	
Yes	10 (8.4)
No	108 (91.6)
Pathological Stage n (%)	
pT2	92 (78)
pT3a	21 (17.7)
pT3b	5 (4.3)
Surgical margin positivity n (%)	
Yes	16 (13.5)
No	86 (72.8)
Margin positivity due to pathological stage n (%)	
pT2	8/92 (6.5)
pT3a	6/21 (19)
pT3b	2/5 (40)

Patients were discharged median of 2 (1 – 4 days) days after surgery. No complications were observed intraoperatively. In six patients we found urinary tract infections, and in two we observed wound infections were revealed with intravenous antibiotics (Clavien Dindo grade 2). Two patients also received blood transfusions. The urinary catheter was removed on postoperative day 10.

During removal of the catheter, 25.4% (n = 30) of patients were continent, and these rates increased 88.9% (n = 105) in the first month, 91.5% (n = 108) in the third month, and 93.2% (n = 110) in the fifth month. Continence rates were 94% (n = 111), 94% (n = 111), 94.9% (n = 112) in the seventh, ninth, and eleventh-month follow-up. In the twelfth, 95.7% (n = 113) of patients were continent.

Thirty-five (40.6%) of 86 pre-operative potent patients remained potent for a month after surgery. Of these potent patients, 30 used tadalafil 5 mg and 5 of used tadalafil 20 mg for recovery. At three-month follow-up, 48 patients (55.8%) were potent. In these potent patients, 36 used tadalafil 5 mg and 12 used tadalafil 20 mg for recovery. At five-month follow-up 53 patients (61.6%) were potent. Thirty-five of the 53 patients used tadalafil 5 mg, nine of them used tadalafil 20 mg, and nine of them used intracavernosal injections. At seven-month follow-up 54

patients (62.7%) were potent. Thirty patients used tadalafil 5 mg and five used tadalafil 20 mg, 12 used intracavernosal injections, and seven used vacuum erectile device. At nine-month follow-up, 56 patients were potent, 25 used tadalafil 5 mg, four used tadalafil 20 mg, 16 used intracavernosal injections, and 11 used vacuum erectile device. At 12-month follow-up, 58 (67.4%) patients were potent; 24 used tadalafil 5 mg, four used tadalafil 20 mg, 18 used intracavernosal injections, and 12 used vacuum erectile device (**Table 3**).

DISCUSSION

Radical prostatectomy is a therapeutic option for men with localized prostate cancer. The main aim of surgery is to eradicate cancer; however, incontinence and erectile dysfunction are the potential complications and can alter patients' QoL.[15] In this study, we observed the eradication of prostate cancer with low margin positivity, early recovery of incontinence, and preserved erectile function using an ultrapreservation technique with a minimum of one-year follow-up.

Robot-assisted radical prostatectomy is the surgical technique for patients with prostate cancer. Recently, over 85% of prostatectomies were performed with the robotic technique.[16] The development of robotic instruments, visuality, flexibility, and increased robotic surgical experience has led to new modifications in surgery. Puboprostatic ligament and anterior musculofascial sparing surgery have emerged in open radical retropubic prostatectomy; along with this technique, robotic surgery was used to preserve the anterior musculofascial structure.[11,17] Among recent approaches, the 'Hood technique' was also described.[12] Our aim was to preserve anterior anatomical landmarks, such as the musculofascial structure and dorsal venous complex, without dissecting the endopelvic fascia, which stabilizes the external urinary sphincter.

The most important consideration when performing a prostatectomy is oncological safety. In terms of margin positivity, our results are consistent with the literature in 13.5% of patients. In a systematic review that evaluated margin positivity, the positive surgical margin rate was found in 15% (6.5% – 32%).[18] In a multicenter trial, surgical margin positivity was found in 12.1% patients, and in a long-term follow-up, 37.2% of positive surgical margin patients developed biochemical recurrence.[19] In another systematic review, comparing Retzius-sparing surgery vs. standard robotic assisted radical prostatectomy (RARP), the overall positive surgical margin in the Retzius group was 18%, but in the standard RARP, it was 16%; biochemical recurrence was higher in the standard RARP.[20] With the anterior preservation technique, a positive surgical margin was 13.3%, while with the Hood technique, it was 6%.[11,12] Biochemical recurrence with the anterior preservation technique occurred in 7% of patients; although follow-up was shorter, no biochemical recurrence was observed in our study.[11]

Incontinence is the one of the major issues after radical prostatectomy in terms of the trifecta.[21] Robot-assisted radical prostatectomy provides better outcomes for 12-month urinary continence rates.[22] In this study, continence rates were, 25.4% at catheter removal, 88.9% in the first month, 91.5% in the third month, 93.2% in the fifth month, and 95.7% in the postoperative twelfth month. For early recovery of continence, the Retzius-sparing technique was used by Galfano et al. with no incontinence after catheter removal.[10] They also showed that 91% of patients were continent immediately after surgery, with 96% achieving continence the twelfth month, which is consistent with our results.[23] As per our approach, the anterior preservation technique, the median continence recovery was seven days, with 85.9% in the

Table 3.
Continence and Potency Patient Outcomes

	Time after Surgery				
	Catheter Removal Time	1 Month	3 Months	5 Months	12 Months
Continence n (%)					
Yes	30 (25.4)	105 (88.9)	108 (91.5)	110 (93.2)	113 (95.7)
No	88 (74.6)	13 (11.1)	10 (8.5)	8 (6.8)	5 (4.3)
Potency n (%)					
Yes	–	35 (40.6)	48 (55.8)	53 (61.6)	58 (67.4)
No	–	51 (59.4)	38 (44.2)	33 (38.4)	28 (32.6)

first month, 97.7% in the sixth month, and 98.4% in the final follow-up.[23] In Hood technique, continence results were similar to our results, with 21% after catheter removal, 88% at six weeks, and 95% at the twelfth month after surgery.[12] Nerve-sparing surgery, with an inherent risk to stratification, was an independent factor for early urinary continence recovery.[24] The authors found that baseline lower urinary tract symptoms and erectile function affected early recovery of incontinence.

Recovery of erectile function is another issue that affects patients and their partners, with respect to QoL.[25] Age, potency status prior to surgery, nerve-sparing surgery status, and comorbidities are the factors affecting erectile function after robot-assisted radical prostatectomy.[26] The recovery of potency is better in robotic surgery compared to laparoscopic surgery.[27] In this study, first-month potency was 40% and twelfth month was 67.4%, which is consistent with the literature. In the anterior preservation technique using robot-assisted surgery, the authors found potency rates in the first, third, and twelfth months were 53%, 70%, and 87%, respectively.[11] In the Retzius-sparing technique, first month intercourse rate was 40% for the first 100 patients vs. 40.4% in the second 100 patients; this was 81% and 71% in the twelfth month.[23] In extraperitoneal, full neurovascular-sparing robotic technique, third month potency rates were 70.4% and twelfth month potency rates were 80.9%.[28] In the veil and superveil robotic techniques, 98% and 94% of patients, respectively, were able to penetrate.[29]

The different terminology with potency has also led to different results in potency status. Variations in potency were assessed by Krupski et al., and they showed QoL outcomes vary depending on the definition used.[30] A study by Finley et al., showed that two questions; "Are your erections adequate for vaginal penetration?" and "Are your erections satisfactory?" were related with the mean International Index of Erectile Function-5 (IIEF-5) score. The mean IIEF-5 score was 19.0 and 21.2 in unilateral and bilateral nerve sparing surgery if the answer was 'yes' for the both questions.[31] There is no accepted definition for potency. In systematic review, it was shown that there are several definitions used for potency; such as erection sufficient for intercourse, SHIM $\geq$ 21, SHIM $\geq$ 18, SHIM $\geq$ 17, SHIM $\geq$ 16, and SHIM $\geq$ 15.[26] According to this review, the threshold of SHIM score is another issue for standardization. We evaluated potency with SHIM score and SHIM $\geq$ 17 considered potent, based on a several studies as previously described.[32,33]

Perioperative and postoperative complications are another issue in nerve-sparing techniques. In this study, the total complication rate was 8.4% without any major complications observed. In a systematic review, the mean complication rate was 9% with robotic surgery and the transfusion rate was 2%, which is consistent with our findings.[34] Similar to our technique, the complication rate was 10.4% with a majority having lymphocele, which was not observed in our series, but which may have been related to our lower lymph node dissection rate.[11] In the Hood technique 9.7% of patients coped with complications, yet our results show the majority (5.7%) were urinary tract infections.[12] Our findings can be explained by surgical experience and patient characteristics, with the majority being low to intermediate risk, along with a lower BMI and younger age.

The retrospective nature of the study, single center experience, no comparison with standard RARP, the learning curve of the surgical technique, small sample size, and highly selected patients with short term follow-up were the main limitations of this study. The difference in the definition of potency and continence recovery is another limitation in comparing our results with the current literature. The surgeon's robotic experience (over 750 surgeries) with an experienced team and attentive patient follow-up for the continence and potency, which were evaluated bimonthly for a year, were the main strengths.

CONCLUSION

The ultrapreservation anterior-sparing technique for patients with prostate cancer is shown to be safe and has acceptable functional and oncological results in the short-term follow-up. Long-term comparative studies with a larger number of patients are needed.

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