

Bladder neck sparing during robot-assisted laparoscopic radical prostatectomy: Six-year experience

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ABSTRACT

OBJECTIVE: Prostate cancer is the most frequently diagnosed cancer among men in developed countries. Radical prostatectomy (RP) is the standard surgical treatment for patients with organ-confined disease and robot-assisted laparoscopic radical prostatectomy (RALP) procedures get more popular in the past 20 years. The most important factor of continence after RP is the preservation of the functional sphincter mechanisms. Tunc et al. described the novel bladder neck preserving technique in RALRP in 2015. The purpose of this study is to present our long-term results of our novel technique during RALP performed by single surgeon (LT).

METHODS: In this study, 331 patients who went under procedure RALP between January 2012 and December 2017 analyzed retrospectively. Bladder neck sparing technique was performed for all patients used by a four-armed da Vinci robotic surgical system (Intuitive Surgical, Inc., Sunnyvale, CA). Quality of life (QoL) scores were assessed before RALP, after urethral catheter removal, and at the 1st month after RALP used by SF-12 QoL questionnaire. Patients without urine leakage during coughing or sneezing, as well as those who stayed totally dry, were considered as continent. Those who used more than 1 protective pad per day and/or had urine leakage during coughing, sneezing, or during the night were considered incontinent.

RESULTS: The mean operation time, docking time, and anastomosis time were 76.9±28.9, 7.2±2.2, and 18±3.1 min, respectively. Estimated blood loss was 51.6±22.9 ml. The mean hospital stay was 2.2±0.8 days. The mean duration of the catheter was 7.1±1.3 days. After catheter removal, 310 (93.6%) of patients were continent immediately. During follow-up, 318 (96%) were continent after 1 month and 329 (99.3%) were totally continent after 1 year. No patient received surgical treatment for stress incontinence.

CONCLUSION: Since we have defined bladder neck sparing technique, we have realized that our technique is very effective with our long-term results. Our novel technique provided very early continence at the time of catheter removal after RALP within short-term follow-up in addition to favorable oncologic results.

Keywords: Bladder neck sparing; continence; prostate cancer; robot-assisted laparoscopic prostatectomy.

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Prostate cancer is the most frequently diagnosed cancer among men in developed countries, and the incidence and prevalence of prostate cancer will increase as life expectancy increases [1]. Radical prostatectomy (RP) is the standard surgical treatment for patients with organ-confined disease. As minimal invasive approaches being preferred laparoscopic and robot-assisted laparoscopic radical prostatectomy (RALP) procedures get more popular duration of the past 20 years [2, 3].

To achieve better quality of life (QOL) and functional outcomes, surgeons search many surgical techniques. Early continence and erectile functions are the main intention of the techniques described [4–7]. Despite developing techniques, urinary incontinence remains major post-operative morbidity disrupting QOL. There are also certain anatomic and surgical factors that are of significance in continence preservation. The most important factor of continence after RP is the preservation of the functional sphincter mechanisms [7]. Bladder neck sparing techniques were first reported in 1993 in attempt to protect the sphincter to avoid incontinence [8]. Then, laparoscopic and robot-assisted laparoscopic approaches adapted different modifications. Tunc et al. [9] described the novel bladder neck preserving technique in RALRP in 2015. After the surgeries are started to perform using this technique, many details about the anatomy of the prostate became easier to understand [10]. Long-term results of the technique have not been reported since this procedure has been routinely performed.

The purpose of this study is to present our long-term results of our novel technique during RALP that performed by single surgeon (LT).

MATERIALS AND METHODS

This study was planned as a retrospective analysis of single surgeon experience on bladder neck sparing RALP. After the Institutional Review Board and ethics committee approval at June 13, 2017 with research code 2017-296, the data of RALP performed patients between January 2012 and December 2017 were collected.

Patient Selection

Patients who have urinary incontinence, history of external beam radiotherapy, and comorbidities that may affect urinary continence (diabetes mellitus, neurogenic disorders, etc.) were excluded from the study. Finally, 331 patients were included in the study.

Highlight key points

- Defining avascular connective tissue between bladder neck and prostate and starting dissection from here is the most important point of this technique.
- Advantages of this technique are; early continence, short catheterization time and better QoL results.
- Bladder neck sparing technique gives very promising long-term results.

Data Collection

Demographic data including age, body mass index, comorbidities, and ASA score; perioperative parameters of creatinine, hemoglobin, and prostate-specific antigen (PSA) level, digital rectal examination, Gleason score, and D'Amico classification; perioperative data including operation time, estimated blood loss (EBL), nerve sparing status, dissections of lymph nodes, and blood transfusion; post-operative data including hospital stay, duration of catheter, and continence status after catheter removal; and pathologic data including Gleason score, surgical margin status, extracapsular extension, and invasion of seminal vesicles were recorded.

QoL scores were assessed before RALP, after urethral catheter removal, and at the 1st month after RALP used by SF-12 QoL questionnaire. Complications were classified according to the Clavien-Dindo classification. Furthermore, we recorded biochemical results and any adjuvant therapies applied during follow-up.

Surgical Technique

Bladder neck sparing technique was performed for all patients used by a four-armed da Vinci robotic surgical system (Intuitive Surgical, Inc., Sunnyvale, CA) an used surgical technique as we described before [8, 9]. Briefly, pneumoperitoneum was created through carbon dioxide insufflation; then, trocars were placed. Posterior peritoneum of the rectovesical space horizontally incised and seminal vesicles and vas deferens dissected and mobilized. Then, anterior peritoneum between umbilical ligaments was incised to reach Retzius space. After removing the adipose tissue on prostate and bladder, endopelvic fascia was opened. The muscle fibers of levator ani were removed to isolate and mobilize prostate. In this step, we used robotic arms to feel the zone between bladder neck and prostate by touching and pulling the urethral catheter could help to be sure of the area. Dissection was started from this fatty avascular connective tissue between bladder neck and prostate with monopolar scissors. We re-

duced the power of energy to 30 mA to preserve the integrity of the prostate tissue. The positioning of the arms of monopolar scissor should be closed and directed down at an about 30° angle. Circular muscle fibers of the internal sphincter were seen in all patients. After dissection of bladder wall, already dissected seminal vesicles were seen from the aperture. The apex of prostate was dissected carefully to provide longer urethra. If indicated, lymph node dissection was added to the procedure.

Urinary Continence Status

After completion of anastomosis, bladder was filled with 150 mL of saline to control the water tightness of anastomosis. A drainage catheter was inserted and the specimen bag was removed at the end of the operation.

Continence status was also evaluated by physical examination including Valsalva or cough stress test. Patients without urine leakage during coughing or sneezing, as well as those who stayed totally dry, were considered as continent. Patients who were consistently dry but had to use a safety pad occasionally during normal daily activity (walking, physical exercising, etc.) were also considered as continent. Those who used more than 1 protective pad per day and/or had urine leakage during coughing, sneezing, or during the night were considered incontinent. Continent immediately after catheter removal was identified as very early continent, continent after 1 month was identified as early continent, and continent after 1-year follow-up identified as late continent patient.

Statistical Analysis

The paired samples t-test was used for statistical analysis. Statistical analyses were performed by the Statistical Package for the Social Sciences for Windows 22.0 (SPSS Inc., Chicago, USA). Statistical significance was accepted at $p < 0.05$.

RESULTS

A total of 331 patients who performed RARP with our novel bladder neck sparing technique were involved in this recent study. Mean age was 62.2 ± 4.2 years; mean follow-up was 15.7 ± 3.2 months. Mean preoperative PSA level was 8.5 ± 6.6 ng/dL, mean body mass index was 23.2 ± 2.1 kg/m², mean Gleason score was 6.6 ± 0.7 . Clinical stage and D'Amico risk classification are shown in Table 1.

Intraoperative outcomes are shown in Table 2. The mean operation time, docking time, and anastomosis time

TABLE 1. Demographics, pre-operative, and operative data of patients

Parameters	Value (n±SD)
Mean age	62.2±4.2
Mean follow-up (months)	15.7±3.2
Mean BMI (kg/m ²)	23.2±2.1
Pre-operative mean PSA	8.5±6.6
Mean pre-operative Gleason score	6.6±0.7
	%
Pre-operative T score	
T1c	48.3
T2a	5.4
T2b	20.2
T2c	15.4
T3a	10.7
D'Amico classification	
Low risk	98 (29.6)
Medium risk	161 (48.6)
High risk	72 (21.8)
Mean operation time (min)	76.9±28.9
Mean EBL (mL)	51.6±22.9
Nerve sparing surgery	
Unilateral	22.5
Bilateral	72.5

SD: Standard deviation; BMI: Body mass index; PSA: Prostate-specific antigen; EBL: Estimated blood loss.

TABLE 2. Post-operative characteristics of patients

Parameters	Value (n±SD)
Mean hospital stay (day)	2.2±0.8
Duration of urethral catheter (day)	7.1±1.3
Mean post-operative Gleason score	7.1±1.3
	%
Pathology score	
T2a	27.5
T2b	17
T2c	29
T3a	13.9
T3b	12.7
Positive surgical margin	3.3
Seminal vesicle extension	12.7
Urinary continence	
Very early	310 (93.6)
Early	318 (96)
Late	329 (99.3)

were 76.9 ± 28.9 , 7.2 ± 2.2 , and 18 ± 3.1 min, respectively. None of the patients needed blood transfusion during operation and the mean EBL was 51.6 ± 22.9 ml. Mean dissection time for the space we described was 5.1 ± 1.2 min. The nerve sparing technique was performed to 315 patients. According to patient's status, nerve-sparing surgery was performed unilateral in 75 (22.5%) and bilateral in 240 (72.5%) of patients.

The mean hospital stay was 2.2 ± 0.8 days. The mean duration of the catheter was 7.1 ± 1.3 days. The QoL score was classified as before RALP, after catheter removal, and 1 month after surgery. Mean QoL scores were 2.4 ± 1 , 3.6 ± 1 , and 2.6 ± 1.1 , respectively. There was a significant difference in QoL before RALP and after catheter removal, however, there was no statistical difference between before and 1 month after RALP (respectively; $p < 0.001$ and $p = 0.5$). There was no complication such as bladder neck stricture, acute/chronic urinary retention, as well as no Clavien III, IV, and V complications. The most common complication was post-operative fever in 33 (10%) patients treated by oral antipyretics. Six (2%) patients had wound infection, 2 (0.66%) patients had pneumonia. Additional surgery was not needed in any of the RALP cases.

After catheter removal, 310 (93.6%) of patients were continent immediately. During follow-up, 318 (96%) were continent after 1 month and 329 (99.3%) were totally continent after 1 year. No patient received surgical treatment for stress incontinence.

The results of pathologic findings are shown in Table 2. The mean Gleason score of the patients was 6.9 ± 0.9 . During follow-up, 18 (5.43%) patients had biochemical recurrence, 32 (9.66%) patients needed external beam radiotherapy because of positive surgical margin due to extracapsular extension or biochemical recurrence, and 13 (3.9%) patients got adjuvant hormone deprivation therapy. There was no death due to oncologic reason in follow-up period.

DISCUSSION

Since RALP is performed as regular approach many surgical techniques proposed to ensure better oncologic and functional results. In this study, we retrospectively reviewed our patients with prostate cancer underwent RALP with our bladder neck sparing technique promising very early continence status.

Bladder neck is a part of complex sphincter mechanism. The urethral sphincter is formed by an inner

lissosphincter of smooth muscle and an outer rhabdosphincter of skeletal muscle. The smooth muscle is the primary structure responsible for continence. For better and earlier continence results, bladder neck sparing technique has been used to protect these muscle tissues, adopted in open, laparoscopic, and RALP [11, 12]. Neurovascular bundle and bladder neck preservation have been performed during open RP for more than 20 years, it still remains unclear how this technical refinement affects urinary continence. Golabek et al. [13] performed laparoscopic bladder neck preservation and their urinary continence rate was 59.23%, 85.86%, and 90.21%, during the follow-up 3, 6, and 12 months, respectively. Young et al. [14] declared their continence status after open perineal RP achieved by 81–98.5% of patients by 24 months follow-up. In a 365 patients study of open radical retropubic prostatectomy, bladder neck preserved that continence rates was 70% before 6 months and 88% after 6 months which was comparable with literature [15]. A different bladder neck preservation technique during RALP was described by Lee et al. [16], and they declared the important role of BNP similar to our technique. Hashimoto et al. [17] studied predictors of continence and reported that only bladder neck preservation significantly associated with early continence in multivariate analyses.

One of the latest procedure, the Retzius-sparing RALP was first described by Schuessler et al. [2] in 2010, sparing structures such as Santorini plexus, pubourethral ligaments, pudendal arteries, and minimal damage of peritoneum which may be related with less blood loss, continence, or erectile function [18]. The first largest study of RS-RALP presented by Galfano et al. [19], with the 90–92% rate of continence. Lim et al. [20] declared 70% of patients completely dry and 92% had 0-pad usage among 50 patients after 1 month. In another study used Retzius-sparing approach, immediate continence within the 1st week was 73.3% and 91% after 1 month [21]. The continence results of these studies seem among the best results. Besides these, with our bladder neck sparing approach in 93.6% of patients, we observed immediate continence after catheter removal, also 1st month and 1st year, continence percentages were 96% and 99.3%. We believe that the main reason of these promising results is sparing the bladder neck, dissecting technique of the area between bladder and prostate comprised with fatty tissue. This area has no blood vessels so bloodless dissections could

be performed, ensure to protect around tissues including internal sphincter and this helped to provide very early continence.

Prostate size is not an independent risk factor for incontinence. It can be relevant with surgical difficulty or dissection time but there was no significant difference of continence status between the groups higher than 60 g of prostate and lower [22]. Another risk factor for continence is patient's age. Kumar et al. [23] reported that age is an important factor on postoperative early continence. On the other side, Sasaki et al. [24] declared that there is no functional significant difference according to age. Our findings may support the association of age. Comorbidities, functional status before the surgery, and weak muscle fibers are some potential issues for elder populations. In this study, only 21 (6.4%) patients were incontinent at the end of the 1st week but during the 1st year follow-up, the number was 3 (0.7%). Twenty-one patients who were incontinent at the 1st week of catheter removal were older than 65 years old; however, only 3 of 21 patients were still incontinent at 1-year follow-up.

It could be thought that preserving bladder neck can cause positive surgical margins more often. Several studies proved that there is no significant difference. Bellangino et al. [11] have reported overall positive surgical margin and bladder neck positive surgical margin 7–36% and 0–16.3%, respectively, in a systemic review. Similarly, Tewari et al. [25] have reported in a systematic review RALP has comparable surgical margin results with a not better functional outcomes comparing to open and laparoscopic RP. In this study, positive surgical margin rate was 3.3% and final pathology results of patients were pT3 disease according to bladder neck invasion.

Conclusion

Since we have defined bladder neck sparing technique, we have realized that our technique is very effective with our long-term results. Our novel technique provided very early continence at the time of catheter removal after RALP within short-term follow-up in addition to favorable oncologic results. This is a promising progress for early recovery and better QoL scores after RALP. Our challenging continence results can really establish the standard for preserving the bladder neck during RALP. This is the best strategy to diminish perioperative amount of bleeding and presents with fascinating very early continence results.

Ethics Committee Approval: The Gazi University Clinical Research Ethics Committee granted approval for this study (date: 13.06.2017, number: 2017-296).

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