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Does the Apical Dissection Technique Affect the Oncological and Functional Outcomes in Robot-assisted Laparoscopic Radical Prostatectomy? Collar Technique vs Standard Technique

Robot Yardımlı Laparoskopik Radikal Prostatektomide Apikal Diseksiyon Tekniği Onkolojik ve Fonksiyonel Sonuçları Etkiler mi? Collar Tekniği vs Standart Teknik

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Abstract

Objective: To compare the oncological and functional results of the collar technique (CT) with the standard technique (ST) used for the apical dissection in robot-assisted laparoscopic radical prostatectomy (RALP).
Materials and Methods: Sixty-five patients were operated using ST, and 61 patients with CT. The oncological and functional results of the two techniques were compared.
Results: The continence rates at 1st and 6th months after catheter removal were 59.0% and 90.2% in the CT, and 36.9% and 87.6% in the ST groups, respectively (p=0.02, and p=0.78). There was no significant difference between the two groups in terms of detection rates of surgical margin positivity (p=0.54). In multivariable logistic regression analysis only the choice of the surgical technique was found to be statistically significantly correlated with the continence rate at the first month after the catheter removal (p=0.023).
Conclusion: The CT is a surgical technique, which can be used safely in the RALP procedure, with relatively higher early-term continence rates and oncologic outcomes comparable to the standard technique.

Keywords: prostate cancer, robotic, radical prostatectomy, apical dissection, technique

Öz

Amaç: Robot yardımlı laparoskopik radikal prostatektomide (RALP) apikal diseksiyonda kullanılan collar tekniği (CT) ile standart tekniğin (ST) onkolojik ve fonksiyonel sonuçlarını karşılaştırmak.
Gereçler ve Yöntemler: 65 hastada ST kullanılırken, 61 hastada CT kullanıldı. İki tekniğin onkolojik ve fonksiyonel sonuçları karşılaştırıldı.
Bulgular: Kateter çıkarıldıktan sonra 1. ve 6. aylarda kontinans oranları CT grubunda sırasıyla %59.0 ve %90.2, ST grubunda %36.9 ve %87.6 idi (p=0.02, p=0.78). Cerrahi sınır pozitifliği açısından iki grup arasında anlamlı fark yoktu (p=0,54). Çok değişkenli lojistik regresyon analizinde sadece kateter çıkarıldıktan sonra 1. aydaki kontinans oranı ile kullanılan cerrahi teknik arasında istatistiksel olarak anlamlı korelasyon saptandı (p=0,023).
Sonuç: CT, RALP prosedüründe yüksek erken kontinans oranları ve ST ile benzer onkolojik sonuçları ile güvenle uygulanabilecek bir cerrahi tekniktir.

Anahtar kelimeler: prostat kanseri, robotic, radikal prostatektomi, apikal diseksiyon, teknik

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Introduction

Prostate cancer is the second most common cancer in men, and approximately 1.1 million new cases are diagnosed annually [1]. Prostate cancer in more than 90% of the patients is organ-confined at the time of diagnosis [2]. Radical prostatectomy (RP) is the only definitive treatment alternative in localized disease, while it is performed as a part of multimodal therapy in locally advanced disease. In the 2020 EAU guidelines, there is a weak recommendation that none of the RP techniques (open, laparoscopic, robotic) is superior to each other in terms of functional and oncological results [3].

Over the years, thanks to the better definition of deep dorsal venous complex, puboprostatic ligaments, prostate shape and sphincter anatomy, RP techniques developed and contributed favorably to oncological and functional results [4-6]. In spite of the improvement in surgical techniques, urinary incontinence after RP remains an important complication that adversely affects patients' quality of life. In a meta-analysis including 51 articles, incontinence rates of patients who underwent RALP were evaluated. According to this meta-analysis, in the studies in which no pad use was accepted as full continence, the mean rate of incontinence at postoperative 12th months was shown as 16% (4-31%). In other studies which defined full continence as either no urine leakage or usage of security pads, this rate dropped to 9% (8-11%) [7].

Consequently, the preservation of urinary continence is an important target in patients undergoing RP. Anatomical and functional studies have shown that the length of the functional urethra is between 1.5-2.4 cm, and a significant part of it is located intraprostatically between the prostate apex and the colliculus seminalis [8-11]. In 2011, it was shown that the continence rate in patients who underwent open RP with the full functional-length urethral (FFLU) sphincter preservation technique defined by Schlomm et al. was significantly higher in the first week after catheter removal compared to patients who did not undergo this surgical technique. However, no significant difference was found between these two techniques in terms of continence rates at 12 months after catheter removal. Even if long-term continence results are comparable, early-term continence is an important desirable outcome for patients with incontinence anxiety. FFLU technique aims to preserve the functional urethral length in the patient by maintaining the integrity of the intraprostatic part of the urethra, including the colliculus seminalis [12]. The "collar technique" (CT) described by the Bianchi L et al. is the adaptation of the FFLU technique to RALP. Before the collar technique was described in the literature, we were performing the RALP procedure in our clinic by applying almost the same technique and planning to describe this technique. However, after this demonstrative new technical article published by Bianchi L et al., we have just aimed to compare our results with those of the standard technique [13].

Materials and Methods

Patients

One hundred and twenty-six patients who underwent RALP between January 2014, and March 2020 in our clinic were analyzed retrospectively. All patients were operated on by a single surgeon (AU). Before this study, the surgeon (AU) had completed his learning curve with 50 cases of RALP. Sixty-five patients were operated on with standard technique (ST), and 61 patients with CT. All surgical cases were performed using transperitoneal RALP procedure. Patients with preoperative bladder contraction disorder were excluded from the study. This study was approved by the local Ethical Committee of Gazi University Faculty of Medicine Clinical Research Ethics Committee, Decision No: 2021/193).

Method

Early-, and late-term continence rates, apical surgical margin positivities, ages of the operated patients, preoperative prostate-specific antigen (PSA) values, International Society of Urological Pathology (ISUP) grades of surgical specimens, pathological T stages, prostate volumes, blood losses during the procedures, hospital stays, operative times, The International Index of Erectile Function (IIEF-5) scores after six months of surgery, biochemical recurrence rates of both groups were compared. Continence status was evaluated with self-administered questionnaires at the 1st and 6th months after the removal of the urinary catheters. Continence was described as no use of pads and lack of any urine leakage.

Surgical Method

The da Vinci SI Surgical System is used. With the patient in the lithotomy position, one camera, one assistant and three robotic arm ports are placed after insufflation. After this step, the patient is laid in the 30-degree Trendelenburg position. The entire procedure is performed through transabdominal route. After the dissection of the seminal vesicle, the Retzius cavity is entered for anterior dissection. Endopelvic fascia is opened and the puboprostatic ligaments are cut bilaterally. The deep dorsal vein complex is ligated with 1-0 Vicryl sutures before the prostate is dissected away from the bladder neck. Following separation of the prostate from the bladder neck, the lateral pedicles are clipped with Hem-O-Lock clips and cut. At this stage, if the preservation of the neurovascular bundle (NVB) is planned, then NVB is peeled off from the prostate capsule by interfascial dissection. Subsequently, the previously sutured deep dorsal vein complex is cut at an angle of 45 degrees with monopolar cautery. Since control of the deep dorsal vein complex will reduce bleeding at this stage, surgeon can keep on dissection safely under a clear vision.

Description of the steps of the collar technique for apical dissection.

1. Apical dissection is started with a cold scissor incision starting from the 2-millimeter distal from the caudal border of the apex.
2. Apical dissection is continued until the smooth muscle layers at the transition between the membranous urethra and prostatic urethra are approached.
3. After exposure of the smooth muscle layer, dissection is continued into the prostate leaving a long urethra by cutting the urethra at a proximal point as far as possible from the rhabdosphincter.
4. After the sufficient length of urethral tissue is dissected, the anterior wall of the urethra is incised.
5. The urethral catheter is pulled out into the anterior urethra.

The urethra is pulled through under the posterior wall with Maryland forceps.

6. The prostatectomy is completed by dissecting the posterior wall of the urethra away from the proximal of the colliculus seminalis and just distal of verumontanum (**Figure 1,2 and 3**).
7. The urethrovesical anastomosis is performed using continuous 3.0 V-lock sutures.

Using collar technique comparatively longer functional urethra can be left for anastomosis. The only difference of our technique from the collar technique is that we dissected away the deep dorsal vein complex before proceeding with apical dissection.

Statistical Analysis

The two surgical groups were statistically compared using the chi-square test or one-way analysis of the variance. Univariable and multivariable logistic regression analyses were performed to determine the predictive factors affecting the continence rate in the first month after the catheter removal. Statistical significance was accepted as $p<0.05$. IBM SPSS Statistics 22.0 was used for the statistical analysis of research data.

Results

The mean operative time was 154.1 minutes in the CT group and 149.5 minutes in the ST group without any statistically significant difference between the two groups (p=0.612). Also, there was no statistically significant difference between the two groups in terms of hospital stay (p=0.877), urethral catheter extraction time (p=0.265), surgical margin positivity (p=0.54), and postoperative biochemical recurrence rates (p=0.288) **(Table 1)**. The rates of continence at 1st and 6th months after catheter removal were 59.0% and 90.2% in the CT group and 36.9% and 87.6% in the ST group, respectively (p=0.02, and p=0.78). Mean follow-up period was 52.3 months in the CT group and 54,6 months in the ST group. The 1st month continence results were classified by age, pT stage, ISUP scores, preoperative PSA levels, prostate volumes, and surgical techniques (CT vs ST) in a univariable and multivariable logistic regression analyses. Only the surgical technique used was found to be statistically significantly correlated with the continence rates in the first month after the catheter removal in multivariable logistic regression analysis (p=0.023) **(Table 2).**

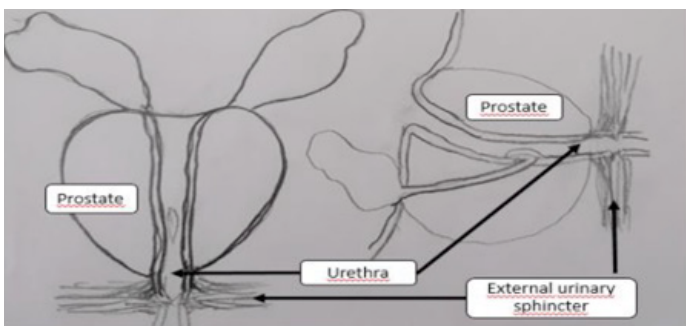

Figure 1. Transverse and lateral view of the prostate, urethra, and external urinary sphincter

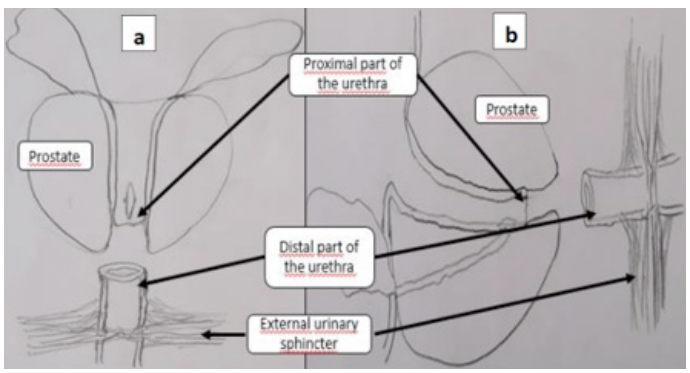

Figure 2. After being cut the urethra from proximal of verumontanum

Discussion

The urethral sphincter complex consists of an external striated sphincter and an internal smooth muscle layer crucial to ensure urethral closure pressure [14]. The external urinary sphincter is in a close anatomical relationship with the membranous urethra. Many studies have shown that preservation of the integrity of the functional membranous urethral length (MUL) is associated with early continence. Paparel et al. investigated the effect of preoperative and postoperative MUL values and the percentage of change in these parameters on early-term continence by using endorectal MRI to measure MUL. According to this study, the longer preoperative and postoperative MUL was associated with better continence. Besides, lesser postoperative change in MUL was associated with an earlier return of continence [11]. Song et al. showed that preoperative MUL of ≤16 mm, postoperative MUL of ≤14 mm, and >18% change in MUL were significantly associated with urinary incontinence at six months after catheter removal [15]. Another study has shown the presence of a significant correlation between MULs measured preoperatively using endorectal coil MRI and the postoperative International Consultation on Incontinence Questionnaire (ICIQ) scores. The same study showed that both stretched urethral length (distance from the perineal membrane to the prostate apex on stretch) and cut urethral length (urethral stump length) correlated with decreased return time to continence [16]. Although we did not

Figure 3. Preserved functional urethra in collar technique

Table 1. Patient characteristics

	CT Group (n=61)	ST Group (n=65)	P value
Age, year			
mean	63.7	64.7	0.381
min-max	49-76	47-79	
Preop PSA, ng/ml			
mean	10.02	8.51	0.129
min-max	2.6-42	2.5-29	
ISUP Grade, no (%)			
1	21 (34.4)	32 (49.2)	
2	19 (31.2)	22 (33.8)	
3	12 (19.7)	5 (7.7)	0.091
≥4	9 (14.8)	5 (7.7)	
Prostate volume, ml			
mean	60.04	60.92	0.882
min-max	30-160	20-200	
pT Stage, no (%)			
T2	35 (57.49)	52 (80)	
T3a	17 (27.9)	12 (18.5)	**0.005**
T3b	9 (14.8)	1 (1.5)	
Blood loss, ml			
mean	42	51	0,264
min-max	10-300	10-330	
Continence rate 1st mo, no (%)	36 (59.0)	24 (36.9)	**0.02**
Continence rate 6th mo, no (%)	55 (90.2)	57 (87.6)	0.78
IIEF-5 score 6th mo			
mean	11.13	10.01	0.22
min-max	5-22	5-22	
Operation time (mean)	154.1 min	149.5 min	0.612
Hospital stay (mean)	4.81 day	4.86 day	0.877
Urethral cat. ext. time (mean)	12.37 day	12.21 day	0.265
Follow-up, mo			
mean	52.3	54.6	0,654
min-max	72-9	83-11	
Biochemical recurrence no (%)	7 (11.4)	5 (7.7)	0.288
PSM (%)	21.3	21.5	0.54
PSM location			
Apical	9.9%	13.8%	
Bladder neck	3.2%	1.5%	0.604
Others	8.2%	6.2%	

CT: collar techique; PSA: prostate-specific antigen; ISUP: International Society of Urological Pathology; PSM: positive surgical margin

Table 2. Univariete and multivariate logistic regression model for the predictive factor of urinary continence 1 month after catheter removal

	Univariate Analysis			Multivariate Analysis		
	CI 95%	**OR**	**P Value**	**CI 95%**	**OR**	**P Value**
Surgical Technique						
CT vs ST	1.20-5.03	2.46	**0.014**	1.12-4.91	2.35	**0.023**
Age	0.97-1.09	1.03	0.23			
Preoperative PSA	0.86-1	0.93	0.071	0.87-1.01	0.94	0.12
Prostate Volume	0.99-1.02	1	0.13	0.99-1.02	1.01	0.13
ISUP Grade						
1 vs 2	0.65-3.44	1.50	0.33			
1 vs 3	0.36-3.23	1.08	0.88			0.33
1 vs 4	0.14-3.54	0.72	0.68			
1 vs 5	0.01-1.42	0.16	0.10			
pT Stage						
T2 vs T3a	0.27-1.46	0.63	0.28			0.40
T2 vs T3b	0.13-1.96	0.51	0.33			

CI: confidence interval; OR: odds ratio; CT: collar techique; PSA: prostate-specific antigen; ISUP: International Society of Urological Pathology

measure preoperative or intraoperative MUL in our study, we think that probably we left a longer urethral stump in patients operated with CT compared to those operated by the ST. We think that the better early-term continence rates in our patients operated with CT are related to longer urethral stump left postoperatively, which is in line with the literature results.

The integrity of the fibers of the rhabdosphincter muscle that extend into the prostate is preserved in the CT used for apical dissection and postoperatively a longer functional urethral stump is left. The study published by Lee et al., has shown that the prostate apex covered a significant part of the functional urethra (anteriorly and/or posteriorly) in >70% of the patients who underwent RP [17]. In 2011 Schlomm defined the FFLU preservation technique for open RP that aims to maintain a longer urethra in the patient by preserving the intraprostatic part of the urethra, including the colliculus seminalis [12]. In this study, we achieved similar oncological and functional results compared to the RALP procedure by adopting the CT for apical dissection which provides higher early-term continence rates without compromising oncological principles.

Many studies have shown that post-RP urinary incontinence and erectile dysfunction negatively affect patients' psychological status [18-20]. For this reason, newly defined techniques or treatment methods are built on the principle of the least damage to urinary continence and erectile functions without affecting oncological results. Surgical margin positivity is one of the earliest indicators predicting the oncological success of surgical treatment. With the CT, we achieved higher early-term continence with similar surgical margin positivity rates in the RALP procedure compared to the ST. We could not compare the preoperative and postoperative erectile function status of our patients due to the retrospective nature of our study. However, there was no significant difference between the two groups in terms of postoperative IIEF scores.

The two groups were statistically significantly different from each other in terms of the rates of pathological T stage histologically detected in the radical prostatectomy specimens which is an indicator of heterogeneity between these two groups. However, Egawa et al. showed that the pathological T stage does not contribute to the prediction of incontinence after RP [21]. In accordance with this study, in our study we have also found that the pathological T stage did not affect 1st-month continence rates in univariable logistic regression analysis. Although the patients in the CT group had higher pathological T stages, their higher early-term continence rates could be interpreted in favor of the CT.

While performing apical dissection using CT, it is aimed to leave postoperatively longer functional urethra extending into the prostate. Still, it may be thought that this approach may pose a risk in terms of the apical positive surgical margin (PSM). In a multicenter series of 4001 patients who underwent RALP, Dev et al. reported that 27% of all PSMs were detected at the apex of the prostate gland. According to this study, only surgically positive margins of the apical regions were independent predictors of biochemical recurrence relative to basal margins (hazard ratio: 2.03) [22]. In the CT, which was defined by Bianchi L. et al., no significant difference was found with the standard technique in terms of locations of PSM [13]. In addition, in this study, CT was shown to be superior to ST in terms of overall PSM and apical PSM rates in the presence of apical tumors detected in preoperative MRI. In our study, any difference was not found between the two techniques in terms of both total PSM rates

and PSM locations. This significant finding has shown that compliance of CT with oncological principles is not inferior to the ST.

In a systematic review that compared the recently popular Retzius-sparing RALP technique with the ST, shorter operative time and higher 1st, 3rd, 6th, and 12th-month continence rates of the Retzius-sparing technique were revealed while surgical margin positivity was observed less frequently in the ST (15.2% vs 24%, p=0.01) [23]. The surgical margin positivity status after RP is an essential factor indicating effective cancer control. In the "trifecta" study of Bianco Jr et al., the 5-year disease-free survival rate was found to be 51% in patients with PSM, while this rate was 86% in patients with negative SM [24]. With increasing surgical experience, PSM rates may decrease in the Retzius-sparing technique, but we think that a new technique to be defined for RP should not have higher PSM rates than a globally accepted ST. We have revealed lack of any statistically significant difference between CT and ST in terms of PSM and biochemical recurrence rates.

The limitations of the study were that the study had a retrospective design, the length of the urethral stumps was not measured in the preoperative and intraoperative period, and the preoperative IIEF scores of the patients were not known.

Conclusion

The CT for apical resection is used safely in RALP with higher early-term continence rates and similar oncologic outcomes compared to ST. There is a need for prospectively designed studies with higher number of patients having urethral stump measurements.

Ethics Committee Approval: This study was approved by the Clinical Research Ethics Committee of Gazi University Faculty of Medicine (Approval date, and registration number: 22.02.2021-193).
Informed Consent: Written informed consent was obtained from patients who participated in this study.
Publication: The results of the study were not published in full or in part in form of abstracts.
Peer-review: Externally and internally peer-reviewed.
Authorship Contributions: Any contribution was not made by any individual not listed as an author. Concept – A.U., S.C.; Design – S.C., F.P.; Supervision – A.U., F.P, A.A.; Resources – S.Y., M.Y.K., E.C.B.; Materials – S.Y., M.Y.K., E.C.B.; Data Collection and/or Processing – S.Y., M.Y.K., E.C.B.; Analysis and/or Interpretation – S.Y., M.Y.K., E.C.B.; Literature Search – S.Y., M.Y.K., E.C.B.; Writing Manuscript – A.U., S.C.; Critical Review – A.U., A.A.
Conflict of Interest: None
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