An Open Radical Prostatectomy Approach That Mimics the Technique of Robot-assisted Prostatectomy: A Comparison of Perioperative Outcomes.

Orkunt Özkaptan[1]*, Muhsin Balaban[2], Cuneyd Sevinc[3], Tahir Karadeniz[3]

Purpose: To report on an ascending radical retropubic prostatectomy (RRP) technique and determine whether this technique has better perioperative, oncological and functional outcomes than the standard RRP technique applied in our clinic.

Materials and Methods: The perioperative and functional outcomes of the 246 patients that underwent standard RRP (N = 150) or modified RRP (N = 96) were evaluated, retrospectively. In the modified RRP technique the dorsal vascular complex (DVC) was controlled at first. Thereafter, the bladder neck was incised at the prostate-vesical junction. After seminal vesicles and vasa were exposed, posterior dissection was continued until to the apex. Finally, the urethra was divided.

Results: The mean volume of estimated blood loss (EBL) was significantly longer in the standard RRP group than in the modified RRP group (610 vs. 210 ml, respectively; $P = .001$). The mean operative time (OT) was significantly less in the modified RRP group (177 vs. 134 min, respectively; $P = .003$), as were the transfusion rate TR ($P = .041$). With regard to the rate of postoperative complications, a statistically significant difference was observed between the two groups ($P = .014$). Continence rates after 3 and 12 months postoperatively were 98.95% and 98.95 % in the modified RRP group, and 97.33% and 98.66% in the standard RRP group, respectively ($P = .83$).

Conclusion: We observed that the EBL, TR and OT were significantly lower when we applied the modified RRP technique to patients. This modified technique might be applicable for institutions as an alternative procedure for the standard RRP technique.

Keywords: Perioperative outcome; Prostate cancer; Surgical technique; Radical prostatectomy

INTRODUCTION

Radical prostatectomy is the current treatment of choice for clinically localised prostate cancer. Open retropubic radical prostatectomy (RRP) has become a refined surgical procedure with excellent outcomes over the last decade. Nevertheless, the narrowness of the pelvis and complexity of the pelvic anatomy makes this procedure still challenging for the surgeons. In recent years, there has been a significant trend towards the utilisation of minimally invasive approaches to radical prostatectomy for the treatment of prostate cancer.[1] Binder was first to report on robot-assisted prostatectomy (RARP) in Germany in 2001; this technique was then refined in the USA by Menon et al.[2,3] RARP was introduced in an attempt to attain more precision during surgery, which enables urologist to preserve neurovascular bundles and to achieve better continence rates. Although there is no large-scale randomised controlled trial demonstrating its superiority over RRP, observational cohort studies and meta-analyses reported the benefit of RARP over RRP with regards to blood transfusions, length of stay (LOS) and lower rates of perioperative complications.[4-7]

The aims of RARP and RRP are to obtain a favourable oncological and functional outcome; however, the two technical approaches towards prostate dissection and urethrovesical anastomosis are quite different. RARP is mostly performed in an antegrade fashion. On the other hand, RRP is conducted in a retrograde fashion.

The advancements in RARP have also contributed to the advancement of RRP. After beginning to perform RARP at our institution, we attempted to adapt the operative techniques/manoeuvres of RARP to RRP; an antegrade approach during open RRP was conducted for prostate dissection instead of the standard retrograde technique.

Therefore, the primary objective of this study was to report on an ascending RRP technique and determine whether this technique has better perioperative, oncological and functional outcomes than the standard RRP technique applied in our clinic.

MATERIALS AND METHODS

Study Population

This study was conducted after the approval of the

[1] Department of Urology, Kartal Training and Research Hospital, Kartal, Istanbul 34890, Turkey.
[2] Department of Urology, Biruni University Medical School, Topkapı, Istanbul 34010, Turkey.
[3] Department of Urology, Medical Faculty, □stinye University, Be□ikta□, Istanbul 34450, Turkey.
*Correspondence: Department of Urology, Kartal Training and Research Hospital, Kartal, Istanbul 34890, Turkey
Tel: +905058296107, Fax: +9002163520083, E-mail: ozkaptanorkunt@gmail.com.

Table 1. Patient characteristics and operative parameters.

Variables[a,b]	Modified RRP (N=96)	Standard RRP (N=150)	P-value
Age, year; mean ± SD (range)	61.96 ± 5.2 (48-77)	61.34 ± 5.9 (45-77)	.254
BMI, kg/m2; mean ± SD (range)	27.12 ± 2.5 (20.7-33.8)	26.98 ± 2.9 (20.3-34.4)	.456
Prostate volume, mL; mean ± SD (range)	49.1 ± 14.8 (17-109)	48.5 ± 15.9 (19-111)	.344
Preoperative PSA, ng/dL; mean ± SD (range)	13.12 ± 7.0 (2.4-95)	9.98 ± 8.2 (1.8-59)	.043
OT (minutes), mean ± SD (range)	134 ± 50.1 (106-188)	177 ± 64.3 (116-201)	.003
EBL, mL; mean ± SD (range)	210 ± 90.1 (5-600)	610 ± 220.3 (190-1800)	.001
PLND, (n%)	54 (51.8)	61 (40.7)	.023
Lymph positivity	9 7		
Pathological stage, n (%)			.024
T2	70 (72.9)	119 (79.3)	
T3	26 (27.1)	31 (20.7)	
Nerve Sparing			.98
Bilateral, n(%)	44 (45.8)	69 (46)	
Pathological Gleason score, n(%)			
6	22	39	
7	48	85	
8	14	17	
9	7	9	
10	1	0	
ASA, n (%)	.95		
1	62 (64.6)	98(65.4)	
2	29 (27.8)	42 (28)	
3	5 (4.8)	8 (4.6)	
Readmission rates, n(%)	1 (1.04)	2 (1.33)	1
Overall complication rate n(%)	14 (14.6)	42 (28)	.014
Gastrointestinal (constipation, subileus)	7 (7.3)	11 (7.3)	
Transfusion Rate	7 (7.3)	36 (24)	< 0.001
Urinary]nfection	5 (5.2)	7 (4.7)	
Wound Infection	3 (3.12)	3 (2)	
Cardiac 2(2.1)	4 (2.7)		
Respiratory	2 (2.1)	3 (2)	
Anastomosis stricture	2 (2.1)	2 (1.3)	
Deep venous thrombosis	1 (1.05)	1 (0.7)	
Ureteral injury	1(0.7)		
Lymphorrhoea	4 (4.2)	4 (2.7)	

Abbreviations: BMI, Body Mass Index; OT, operative time; EBL, estimated blood loss; PLND, pelvic lymph node dissection; ASA, American Society of Anesthesiologists score.
[a]Continuous variables were compared by independent sample *t*-test; bcategorical variables were compared by Chi-square test or Fisher's exact test.

Ethics Committee of Medicana International Hospital (No. [2018] 1775). The data from 246 patients without history of suergery, radiotherapy and hormonotherapy, who underwent RRP for prostate cancer between 2013 and 2017 with two different open approaches and who had at least 12 months follow-up, was evaluated retrospectively from an electronic database. Because of the retrospective nature of the study a written patient consent was not taken from the patients. The standard RRP technique was applied between 2013 and 2015, whereas the modified RRP technique was performed in 2015-2017. Of the patients, the final 96 were operated on using an ascending RRP technique as described by Patel et al.[8]. These patients were the first patients who were operated with the ascending technique. All other patients prior to that time underwent the standard RRP technique described by Walsh.[9] The last 150 patients of the standart RRP group who were eligible for the study were included. All patients were operated by the same senior surgeon who had performed over 900 RRP procedures. All patients had a minimum of one year follow-up.

Variables including patient characteristics, perioperative parameters, pathologic data, postoperative complications reported according to the Clavien-Dindo classification system and postoperative incontinence rates were evaluated between the two techniques.[10]   The

perioperative outcomes included the duration of surgery (defined as skin incision to skin closure time in both procedures), EBL volume (mL) during RRP, hospitalization time (HT, day), days of catheterization and intra/post-operative transfusion rate (TR, units). Continence was defined as using no pads and having no urine leakages. To determine the anastomosis integrity, drain fluid was assessed for creatinine in all patients, postoperatively. Routine cystography in the absence of suspicion was not performed. The recovery of continence was evaluated in routine controls at 3 and 12 months after the operation. The short term oncological outcome was assessed by surgical margins and biochemical recurrence at the 1 year follow-up. Sexual function was defined as the ability to have complete sexual intercourse (with or without oral pharmacological therapy). Postoperative complications that occurred within 90 days were recorded.

Surgical technique
During surgery, the adipose tissue from the prostate was removed to expose the endopelvic fascia. Once adequate exposure had been obtained, the endopelvic fascia was incised from near the pelvic sidewall anteriomedially, preserving the   puboprostatic ligaments. Proceeding from the base to the apex, the levator fibres were moved away from the prostate until the dorsal

vein complex (DVC) and urethra could be visualized. Titanium clips and hem-o-lock clips with a rectangular applicator in different sizes were used. Magnification glasses with a 3.5-fold magnification and a Xenon headlight were also used. Extensive dissection of the apex was avoided at this time. A slip knot with a non-braided Caprosyn suture using a large needle was performed for the DVC control. A second suture was placed to suspend the urethra to the pubic bone and secondarily ligate the DVC. The DVC was encircled and then stabilized against the pubic bone along with the urethra. Thereafter the bladder neck was incised at the prostate-vesical junction. The bladder was dissected away from the prostate at the midline with monopolar energy and Ligasure. After the midline of the bladder neck was opened, either side of it was dissected and the foley catheter was retracted out upwards. The posterior bladder neck was dissected in the cranial direction to locate the seminal vesicles. After the vasa and seminal vesicles were identified, the vasa was retracted upwards and followed posteriorly to find the base of the seminal vesicles. Small vessels were controlled with Ligasure or clipped with 5 mm clips. After dissection of seminal vesicles, they were retracted upwards and the Denovillier's fascia was stripped down from the prostatic capsule. The periprostatic fascia was not incised in the nerve sparing technique, only blunt dissection was performed. Care was taken to avoid any injury to the neurovascular bundle (NVB), which runs in close proximity to the tips of the seminal vesicles. Dissection was continued gradually towards the apex. The seminal vesicles were elevated to allow exposure of the prostatic pedicles, which were clipped and cut directly on the surface of prostatic capsule (Dissection of the NVB was performed without coagulation in order to avoid thermal damage of the fibres. The posterior part of the prostate was dissected until the urethra. Apical dissection and division of the urethral was carried out with cold scissors and sharp dissection. The urethra was then incised at the apex of the prostate under direct vision. Bipolar energy was used for coagulation if necessary. The urethra was divided and detached from the prostate; the prostate was then mobilised from the remainder of the periprostatic fascia toward the apex and NVB's. Bladder-neck sparing was not attempted. The bladder outlet was narrowed (0.8 - 1 cm) with 2-0 vicryl continuous seromuscular sutures using a tennis racquet technique. Five 3-0 vicryl sutures with a UR-6 needle were placed along a 22 Fr urethral catheter without eversion of the bladder mucosa. The sutures were placed at 5, 7, 9, 2 and 12 o'clock.

Statistical analysis

Baseline characteristics and overall outcomes were summarized as the mean and standard deviation (SD) for continuous variables, and frequencies and percentages for categorical variables. To assess the differences between the two groups for patient characteristics and perioperative outcome, the independent sample T-test was used. Differences between the two groups for complication, margin rates, continence, erectile function and biochemical recurrence were assessed using Chi-square test or Fisher's exact test. SPSS version 17.0 (Chicago, Il, USA) was used for statistical analyses. A P value of <0.05 was considered statistically significant.

RESULTS

Patient characteristics

The average age at diagnosis was 64 (42-77 years). Preoperative clinical characteristics such as mean age, preoperative prostate specific antigen (PSA), prostate volume and histopathologic characteristics of the patients are presented in **Table 1**. The mean follow-up for the standard RRP group and the modified RRP group was 14 ± 10.3 months and 12 ± 9 months, respectively.
Operative variables
According to the variables of operative difficulty, some statistically significant differences were observed. **Table 2** presents the operative and postoperative results, as well as the complications in both groups. The mean volume of EBL was significantly longer in the standard RRP group than in the modified RRP group (610 vs. 210 ml, respectively; $P = .001$). The mean OT was significantly lower in the modified RRP group (177 vs 134 min, respectively; $P = .003$), as was the TR ($P < .041$). However, no significant difference was noted for the amount of time spent in recovery unit (3.2 (2.0-6.3) vs. 3.3 (2.2-7.4) hours, respectively; $P = .87$).

Postoperative variables

Patients who underwent the modified RRP operation had a shorter mean HT (3.0 (1-15) days) than those who underwent the standard RRP (4.3 (2-17 days; $P = 0.03$). Regarding the time to the recovery of continence, the outcomes for both groups were similar ($P = .83$). Incontinence after 12 months was observed in one (1.05 %) and two (1.34%) patients in the modified RRP and standard RRP groups, respectively.
The positive surgical margin (SM) rates were similar between the two groups (7.3% in the modified RRP

Table 2. Pentafacta rates between Standard RRP and Modified RRP at 3 and 12 months.

Variables	3 months Modified RRP (N=96)	Standart RRP (N=150)	P-value	12 months Modified RRP (N=96)	Standart RRP (N=150)	P -value
Number of Complication, n(%)	82 (86.6)	108 (72)	.014			
Negative SM, n(%)	89 (92.7)	140 (93.33)	.85			
Continence, n(%)	95 (98.95)	146 (97.33)	.38	95 (98.95)	148 (98.66)	.83
Erectile function at Months, n(%)	27 (28.12)	43 (28.66)	.93	35 (36.5)	57 (38)	.81
BCR, n (%)	2 (2.08)	1 (0.67)	.56	3 (3.12)	3 (2.67)	.57
Pentafacta rates, n(%)	25 (25.9)	36 (24)	.71	30 (31.3)	45 (30)	.83

Abbreviations: Biochemical recurrence, BCR.
aContinuous variables were compared by independent sample t-test; bcategorical variables were compared by Chi-square test or Fisher's exact test.

group vs. 6.7% in the standard RRP group) and no intergroup difference was observed (P = .85). Biochemical recurrence after 12 months was observed in 3.12% vs. 2.67% of patients in the modified and standard RRP groups, respectively (P = .56).

With regards to the rate of postoperative complications, a statistically significant difference was observed between the two groups (P = .014). Complications classified as grade 1, grade 2 and grade 3a were observed in 6.7%, 16.3% and 1.9% of patients in the modified RRP group, and 4.7%, 32.7% and 1.4% patients in the standard RRP group, respectively. The overall complication rate was 22.8%. Twenty-nine complications were encountered in 14 (14.6%) patients in the modified RRP group, whereas 56 complications were observed in 42 (28%) patients in the standard RRP group. The observed complications are listed in Table 2. In addition, readmission rates were lower in the modified RRP group, although this was not statistically significant (1.04% vs. 1.33%; P = .97).

Pelvic lymph node dissection (PLND) was performed in 54 (51.8%) and 61 (40.7%) patients in the modified RRP group and standard RRP group, respectively. Furthermore, a nerve sparing approach was applied in 44 (45.8%) and 69 (46%) patients in the modified RRP group and standard RRP group, respectively. Both differences were not significant (P =.023 and P = .98, respectively).

The percentage of patients who achieved a functional erection at 3 months postoperatively was similar in both groups (P = .93). This result did not change after 12 months. The overall potency rate after 12 months was 36.5 % in the standard RRP and 38% in the modified RRP group (P = .81).

The pentafecta rate at 3 months postoperatively was 25.9% and 24% in the modified RRP and standard RRP groups, respectively (P = .71). The pentafecta rate at 12 months was 31.3% and 30% for each group, respectively (P = .83). The difference in the pentafecta rate did not reach statistical significance.

DISCUSSION

RRP is a well-established technique for the treatment of prostate cancer. It is performed through a small incision that is infrequently associated with significant pain, has relatively short HT and provides excellent oncological outcomes.[11,12] RARP is gaining popularity with the help of intensive marketing; however, patients with a lower socioeconomic status prefer to undergo open RRP due to the lower costs.[13,14]

Even though the majority of patients have an unaffected postoperative course, the overall rate of complications, EBL, TR and the functional and oncological outcome may vary between different techniques. RARP is reported to result in decreased EBL and TR, and quicker convalescence.[5-7,11,15,16] Previous studies reporting on the complications associated with the standard RRP technique determined an EBL of 1100 (800-1600) ml and 540 ml.[17,18] Another review regarding the two different approaches determined an EBL of 951 ml in RRP vs. 164.2 ml in RARP.[19] The EBL rate in the standard RRP group in our study was similar with that reported in recent studies for open RRP, whereas the EBL rate was significantly lower using the modified RRP technique (210 ml).[20] Decreased intraoperative blood loss has been reported to be the main advantage of RARP.

[19] This is explained by the pneumoperitoneum and the early identification and precise ligation of vessels, which facilitates the limitation of the EBL. However, the EBL rates in our study operated using an ascending technique were close to the RARP and laparoscopic radical prostatectomy EBL rates.[16,19,21,22] Therefore, with an ascending approach, you overcome the disadvantage of working in the deep pelvis without optimal vision and a lack of optimal movement. This technique provides better visualization of the surgical field, better access to the surgical field and early identification and more precise ligation of vessels. Consequently, the factors above mentioned may be the reason for the lower EBL rates in the modified technique. The use of Ligasure loops and clips also contributes to the more precise control of vessel ligation. A 3.5-fold magnification lens and Xenon head light were used to combine the advantages of RARP (magnification and optimal light) with the advantages of open surgery (tactile sensation and a 3-dimensional view).

The complication rates for the standard technique group were similar to those reported in the studies by Loppenberg et al. which fulfills the Martin criteria.[17] The complication rates using the modified technique were lower compared to the standard technique (14.6% vs 28%). According to studies comparing RRP and RARP, Lawrence et al. and Hu et al. found a similar rate of overall postoperative complications, while other studies concluded that RARP was superior to RRP.[7,23,24] The rate of complication and the way of reporting the complication rates after RRP or RARP appears to vary between different institutions. Therefore, it is not easy to compare the complication rates of RARP and RRP. The results of the current study indicate that the rate of complications were significantly lower in the modified RRP group than in the standard RRP group, even though most patients had an unaffected postoperative course. The reasons for the slightly higher complication rate using the standard RRP technique were mainly related to the TR, which is categorised as a complication in the Clavien-Dindo classification system.[10] The rate of other complications were similar between the two groups. The difference in the TR between the two groups was remarkable. The need for transfusion was lower in the modified RRP group, which was closer to that previously observed using RARP.[16] The TR for the standard RRP group was comparable with other reports; however, the transfusion criteria varies between different studies.[18]

The OT was longer for patients in the standard RRP group than for those in the modified RRP group (177 vs 134 min, P = .003). OT of the modified technique was comparable with previous reported RARP series.[25] The ascending technique provides an improved vision of the operative field. In particular, the access to prostate pedicules after the prostate base and the seminal vesicles were dissected and freed was easier in the ascending technique. Bleeding can also be controlled more easily with this approach. Furthermore, dissection of the apical prostate can be performed more precisely and easily after the posterior part of the prostate is released. All of the above mentioned factors contribute to the shorter operative time achieved with the ascending technique. Regarding the HT, the RARP procedure is often reported to result in a shorter HT compared to RRP (1.43 vs. 3.48 days, respectively).[6,15,19] According to our study,

the HT was shorter in the modified RRP group, which may be related to the lower rate of complications and reduced need for transfusion in the modified RRP group having an effect on the patient recovery time.

In our study, the surgical approach made no difference in the rate of positive SMs, a surrogate marker of oncological outcome. In both groups, the positive SM rates were relatively low, which could be explained by the experience of the surgeon. These rates were low in comparison to those reported in a large case series.[24,26] In agreement with another study, our results indicate that the surgical approach makes no difference to the positive SM rate; the experience level of the surgeon is the most important factor beside the cancer characteristics.[20]

Another important favourable surgical outcome is the recovery of continence. The same interrupted suturing technique for urethral anastomosis was performed in both groups. In our opinion, it is technically easier to perform this technique in RRP than to use a running suturing technique. In addition, the results of this study showed continence rates and urethral stricture to be, in our opinion, in a good range (1.62%). As we have much experience with this suturing technique, we did not see any reason to change our anastomosis technique. Further, a previous study comparing RARP using continuous suturing and RRP performed with an interrupted anastomosis technique found no difference in continence rates between the two groups.[20] Overall, it is difficult to compare our results with the outcomes of RARP; however, our study did demonstrate that the TR, EBL and complication rates were lower in the modified RRP group than in the standard RRP group. Some potential limitations to this study are the retrospective design and the small sample size of the study. These facts precludes us to make any definitive conclusion from this study. Another weakness of the study is the difference of the period when each study group underwent the surgeries. More reliable results would be obtained in a prospective randomised study design. Further, the fairly short follow up time for biochemical recurrence is also a limitation. Finally, we did not use questionnaires to define erectile function and continence. More reliable and objective findings regarding continence and erectile function could have been determined by the use of questionnaires.

CONCLUSIONS

Open RRP is a well-known and established procedure with excellent outcomes, and advancements in the RARP technique have contributed to the advancement of open RRP. We observed that the EBL, TR and operative time were significantly lower when we applied the modified ascending RRP technique to patients. In our opinion, RRP can be performed more easier with the ascending than in the standard RRP technique. As RARP is becoming a more preferential approach for the localised treatment of prostate cancer, we believe that this modified technique might be applicable for institutions performing RRP as an alternative procedure for the standard RRP technique.

CONFLICT OF INTEREST

The authors report no conflict of interest.

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