Yeni Üroloji Dergisi - *The New Journal of Urology* **2023;18(1):62-69. doi: 10.33719/yud.2023;18-1-1204096**

Original Research / Özgün Araştırma

Effect of large prostate volume on perioperative, oncological and functional outcomes after robotic radical prostatectomy: A retrospective clinical study

Büyük prostat hacminin robotik radikal prostatektomi sonrası perioperatif, onkolojik ve fonksiyonel sonuçlar üzerine etkisi: Retrospektif klinik çalışma

Taner Kargı[1], Alper Bitkin[1], Ubeyd Sungur[1], Serdar Karadağ[1], İsmail Evren[1], Ahmet Hacıislamoğlu[1], Hakan Polat[1], Necati Gürbüz[1], Volkan Tuğcu[2], Ali İhsan Taşçı[1]

1 Bakirkoy Dr. Sadi Konuk Training and Research Hospital, Department of Urology, Istanbul, Turkey

2 İstinye University, Department of Urology, Istanbul, Turkey

Geliş tarihi (Submitted): 2022-11-14
Kabul tarihi (Accepted): 2023-01-27

Yazışma / Correspondence
Ubeyd Sungur
Zuhuratbaba Mah, Dr. Tevfik Sağlam Cd No:11, 34147 Bakırköy, İstanbul, Turkey
Email: ubeydsungur@gmail.com
Tel: +90 553 495 7980
Fax: +90 212 414 7280

ORCID

T.K.	0000-0001-5874-3489
A.B.	0000-0003-4724-3053
U.S.	0000-0002-8910-9859
S.K.	0000-0002-1420-4536
İ.E.	0000-0003-4008-8038
A.H.	0000-0002-6117-2098
H.P.	0000-0003-1525-1243
N.G.	0000-0003-2488-5571
V.T.	0000-0002-4136-7584
A.İ.T.	0000-0002-6943-6676

Özet

Amaç: Bu çalışmada büyük prostat volümünün Robot yardımlı radikal prostatektomi (RARP) uygulanan prostat kanserli hastalarda cerrahi, onkolojik ve fonksiyonel sonuçlara etkisinin değerlendirilmesini amaçladık.

Gereç ve Yöntemler: Bu çalışmada prostat kanseri nedeniyle tek cerrah tarafından RARP uygulanan hastalar 75 cc'nin üzerinde büyük prostat hacmi (Grup-1) ve 75 cc'nin altında prostat hacmi (Grup-2) olmak üzere iki gruba ayrılmış ve bu iki grup retrospektif olarak karşılaştırılmıştır. Hastalar 12 aylık takip süresince değerlendirildi.

Bulgular: Yaş, preoperatif PSA seviyesi, klinik evre dağılımları , Gleason skoru, D'Amico risk sınıflaması, cerrahi öncesinde potens ve kontinans değerlendirmesi açısından iki grup arasında anlamlı fark yoktu (p>0.05). Operasyon süresi grup 1 ve 2'de sırasıyla 169.9 ± 62.5 dakika ve 145.6 ± 56.1 dakika saptandı ve Grup 1'de anlamlı olarak daha yüksekti (p = 0.02). Grup 1 ve 2'de sırasıyla 17 (%35) ve 2 (%3) hastaya mesane boynu rekonstrüksiyonu yapıldı ve grup-1'de istatiksel anlamlı olarak yüksekti (p = 0.001). Grup 1 ve Grup 2'de üretral kateter çıkarıldıktan sonra tam kontinans ve potens oranları 1 yıllık takip süresince benzerdi (p > 0.05). 6. ay ve 1. yılda biyokimyasal nüks oranları Grup 1 ve Grup 2'de benzer izlendi (p > 0.05).

Sonuç: Büyük prostat hacmine sahip prostat kanserli hastalarda RARP daha uzun operasyon süresi ile sonuçlanır ve mesane boynu rekonstruksiyonu gerekebilir. Ancak deneyimli cerrahlar tarafından gerçekleştirilen operasyonlarda büyük prostat hacminin cerrahi, fonksiyonel ve onkolojik sonuçlara olumsuz etkisi yoktur.

Anahtar Kelimeler: robotik cerrahi işlemler, prostatektomi, prostat, organ büyüklüğü

Abstract

Objective: In this study, we aimed to evaluate the effect of large prostate volume on surgical, oncological and functional outcomes in prostate cancer patients who underwent Robot-assisted radical prostatectomy (RARP).

Material and Methods: In this study, patients who underwent RARP due to prostate cancer by a single surgeon were divided into two groups as large prostate volume over 75 cc (Group-1) and prostate volume less than 75 cc (Group-2), and these two groups were compared retrospectively. Patients who were followed up for 12 months were assessed.

Results: There was no significant difference between the two groups in terms of age, preoperative PSA level, clinical stage distributions, Gleason score, D'Amico risk classification, preoperative potency and continence assessment (p>0.05). The operative time was 169.9 ± 62.5 minutes and 145.6 ± 56.1 minutes in Groups 1 and 2, respectively, and was significantly higher in Group 1 (p= 0.02). Bladder neck reconstruction was performed in 17 (35%) and 2 (3%) patients in Groups 1 and 2, respectively, and it was statistically significantly higher in Group-1 (p=0.001). After removal of the urethral catheter in Group 1 and Group 2, full continence and potency rates were similar during the 1-year follow-up (p >0.05). Biochemical recurrence rates at 6 months and 1 year were similar in Group 1 and Group 2 (p >0.05).

Conclusion: In prostate cancer patients with large prostate volume, RARP results in longer operative time and bladder neck reconstruction may be required.. However, in operations performed by experienced surgeons, large prostate volume does not have a negative effect on surgical, functional and oncological outcomes.

Keywords: robotic surgical procedures, prostatectomy, prostate, organ size

The study was approved by University of Health Sciences, Dr. Sadi Konuk Training and Research Hospital Ethical Committee, (Decision No: 2021/482).
All research was performed in accordance with relevant guidelines/regulations, and informed consent was obtained from all participants.

INTRODUCTION

When the cancers observed in men are examined, prostate cancer is the second most common cancer type and the fifth leading cause of cancer-related deaths (1). Prostate specific antigen (PSA) as a screening test has become widespread in most countries, and with this, patients are beginning to be diagnosed and treated at an earlier stage (2). Prostate hyperplasia is a general condition that increases in prevalence with aging in men (3). With PSA screening tests, prostate cancer is also detected in the patients with large prostates, and the rate of cancer patients with large prostate volumes is increasing compared to the period before PSA was used (4).

Radical prostatectomy (RP) is the current gold standard curative treatment option in organ-confined prostate cancer, which includes the removal of the entire prostate and, if possible, aims to preserve continence and erectile functions (5).

The relationship between prostate volume and the degree of prostate cancer, functional and oncological results in the post-surgical period, and biochemical recurrence were examined and it was stated in the literature that progression was observed more frequently in the group of patients with small prostate volumes after surgery and prostate volume could be a predictive criterion for biochemical recurrence (6,7). In RP operations for large prostates, there are disadvantages such as limitation of mobility, difficulty in visualization, and the risk of adversely affecting functional and oncological results after the operation, especially in the patient group with narrow pelvis structure (8,9).

With the introduction of robot-assisted laparoscopic radical prostatectomy (RARP) after 2000, the Da Vinci robotic system has provided advantages such as similarity to wrist movements, three-dimensional image, microscopic magnification, ease in dissection and anastomoses, and has had a very common usage area (10).

In this study, we aimed to consider the effect of large prostate volume on perioperative, oncological and functional outcomes in the patients with RARP, which is frequently performed in our clinic.

MATERIAL AND METHODS

In this retrospective study, 256 patients between March 2016 and March 2018 were examined. RARP was applied to all patients. The study was conducted in our urology clinic after the approval of the ethics committee. History of prostate surgery (Transurethral or transvesical prostatectomy) and abdominal surgery was determined as the exclusion criteria. Prostate cancer patients with an enlarged median lobe of the prostate that median lobe larger than 1 cm in diameter were excluded from the study. Forty-eight patients who met the inclusion criteria of 75 cc and above were identified, and these patients were identified as having a large prostate volume and 51 consecutive patients who met the inclusion criteria among the patients below 75 cc were included in the study and formed the normal prostate volume group. The patients included in the study in both groups were operated by the same surgeon (V.T) who had sufficient experience and completed the learning curve (11). The Frankfurt technique described by Wolfram et al. was used as the surgical technique (12).

All patients underwent Multiparametric Magnetic Resonance Imaging (MpMR) of the prostate before the operation. According to the D'amico classification, the patients in the intermediate and high risk groups were examined with whole body bone scintigraphy. RARP was performed on the patients without adjacent organ invasion or distant metastasis. Nerve sparing method was not applied in the high risk group and in the cases with high tumor burden. A nerve-sparing technique was used in all other patients. Extended pelvic lymph node dissection was performed in the patients in the intermediate and high risk groups.

Before the operations, the demographic information of the patients, (age, body mass index (BMI)), preoperative PSA value, clinical stage, biopsy Gleason score, international prostate symptom score (IPSS), prostate size, the risk group they are included according to D'Amico risk classification was retrospectively scanned and noted according to the data of our clinic. Preoperative MpMR images were used for prostate size measurement. The patients with 75 cc and above were determined to have large prostate volume and the patients below 75 cc formed the other group.

To monitor functional results before RARP, a five-item international index of erectile function (IIEF-5) was applied for each patient for potency evaluation. Those who scored above 17 were considered normal (13). In addition, the preoperative patients were asked whether they had urinary incontinence. All of the patients included in the study consisted of fully continent patients. The patients were examined in terms of functional results in our outpatient clinic during the postoperative follow-up period. (7th day, 1st month, 3rd month, 6th month, 12th month, for the first year, after urethral catheter removal). Penile rehabilitation was routinely performed with catheter removal after surgery, and phosphodiesterase 5 inhibitors were used in patients. To evaluate the erectile function, the patients were asked if they could reach penile stiffness enough to allow penetration during sexual intercourse in the postoperative 6th and 12th months. Those who responded positively were considered potent. For the evaluation of continence, which is another functional condition, the patients were asked about their urinary incontinence status at the postoperative 1st week, 1st month, 6th month and 12th month. Three options were offered in response to this question. The group with no urinary incontinence and no need to use pads was the first option, and the group who rarely had urinary incontinence, incontinence with stress and only occasionally used pads for safety made up the second option. The third option was composed of the patients who had urinary incontinence and routinely needed to use one or more pads a day.

In all RARP cases, perioperative blood loss amount, total operation time, console time, anastomosis time, whether nerve-sparing technique was applied, bladder neck reconstruction requirement, postoperative hospital stay, urethral catheter removal time, pathological stage, Gleason score and surgical margin positivity data was recorded. This clinical study was conducted in accordance with the Principles of the Declaration of Helsinki.

Statistical Method

Mean, standard deviation, minimum maximum median, frequency and ratio values were used in the descriptive statistics of the data. The Kolmogorov Smirnov test was used to measure the distribution of variables. Mann-Whitney u test and independent sample t test were used in the analysis of quantitative data. Chi-square test was used in the analysis of qualitative data, and fischer test was used when the chi-square test conditions were not met. SPSS 22.0 software was used in the analyses.

RESULTS

In our study consisting of 99 patients, prostate volume was measured above 75 cc in 48 patients (group 1) and below 75 cc in 51 patients (group 2).

In the age, BMI, preoperative PSA value, clinical stage pathology examination, there was no statistically significant difference between Gleason score, preoperative IPSS and IEFF values of the two groups ($p > 0.05$) (Table -1).

Operation time, console time and urethrovesical anastomosis (UVA) time were found to be statistically and significantly longer in group 1 compared to group 2 ($p = 0.020$, $p= 0.021$, $p=0.007$). The amount of bleeding, catheterization time, and hospital stay were similar between the two groups ($p > 0.05$). The data on perioperative findings are given in Table-2.

There was no statistically significant difference between the two groups in terms of nerve-sparing procedure, surgical margin positivity, lymph node dissection rate, and biochemical recurrence ($p > 0.05$). Bladder neck reconstruction was performed in 17 patients (35%) in Group-1, and in 2 patients (3%) in Group-2. Bladder neck reconstruction rate was statistically significantly higher in group-1 compared to group-2 ($p = 0.001$).(Table 3).

In the examination of the complications, pulmonary embolism was seen in 1 patient in group-1 and urethral stenosis was seen in 2 patients in group-1, which was considered in Clavien 3-4 group. Minor complications grouped as Clavien 1-2 developed in 4 patients in group-1, while they were observed in 3 patients in group-2 and were not found to be statistically significant. ($p=0.233$) Major complications grouped as Clavien 3-4 developed in 3 patients in group-1, but not in group-2. It was not found statistically significant ($p=0.371$). Complications are listed in Table -4.

The postoperative functional evaluation is stated in Table-5. There was no significant difference in continence rates between the two groups at the 1st week, 1st month, 3rd month, 6th and 12th months after catheter

Table1. Patient demographic characteristics

		Prostate Volume > 75 cc				Prostate Volume ≤ 75 cc				p
		Ave.±SD /n-%		Med (Min-Max)		Ave.±SD/n-%		Med (Min-Max)		
Age		62.1 ±	5.1	62	53-71	61.0 ±	5.6	61	45-71	0.464
BMI (kg/m2)		27.3 ±	1.7	27	24-32	27.5 ±	1.7	27	25-30	0.688
ASA Score	I	16	34%			14	27%			0.509
	II	29	59%			36	71%			
	III	3	7%			1	2%			
Preop PSA		8.1 ±	4.9	7	1-27	9.0 ±	5.0	7	4-25	0.465
Prostate Weight		91.0 ±	16.1	83	75-130	45.0 ±	13.4	45	20-71	0.000
Clinical Stage	T1c	41	86%			39	76%			0.295
	T2a	7	14%			12	24%			
Preop IPSS	Mild	16	34%			15	29%			0.465
	Modarate	12	24%			8	16%			
	Severe	20	41%			28	55%			
Preop IIEF-5	≥17	34	72%			27	53%			0.087
	<17	14	28%			24	47%			
D'Amico Risk Classification	Low	28	59%			21	41%			0.133
	Intermediate	18	38%			29	57%			
	High	2	3%			1	2%			
Preop Gleason Score		6.2 ±	0.4	6	6-7	6.4 ±	0.5	6	6-7	0.173
Specimen Gleason Score		6.1 ±	0.4	6	6-7	6.4 ±	0.6	6	6-8	0.038

Mann-whitney u test / Chi-square test
***Ave. ±SD**: Average ± Standart Deviation; **PSA**: prostate-specific antigen; **ASA**: American Society of Anesthesiologists; **BMI**: body mass index ; **IPSS:** International Prostatism Symptom Score; **IEFF:** International Index of Erectile Function*

Table 2. Perioperative and postoperative data

	Prostate Volume > 75 cc				Prostate Volume ≤ 75 cc				p
	Ave.±SD		Med (Min-Max)		Ave.±SD		Med (Min-Max)		
Operation Time (min)	169.9 ±	62.5	170	130-360	145.6 ±	56.1	140	110-355	**0.020**
Console Time (min)	125.3 ±	43.3	125	100-320	106.0 ±	33.6	100	80-300	**0.021**
UVA Time (min)	34.3 ±	8.7	33	20-50	22.1 ±	7.1	24	17-45	**0.007**
Perioperative Hemorrhage (ml)	124.1 ±	44.1	105	75-300	110.5 ±	33.5	100	50-200	0.163
Catheterization time(day)	10.0 ±	0.7	10	8-12	10.1 ±	1.4	10	7-14	0.571
LOS (day)	4.5 ±	1.7	4	4-14	4.5 ±	1.8	4	4-14	0.472

*Mann-whitney U test **UVA:** Urethrovesical anastomosis; **LOS:** Length of Hospital Stay*

Table 3. Perioperative technique and postoperative oncological data

		Prostate Volume > 75 cc		Prostate Volume ≤75 cc		p
		n	%	n	%	
NVB Saved	Unilaterally	0	0%	1	2%	
	Bilaterally	43	90%	47	92%	0.466
	None	5	10%	3	6%	
Positive Surgical Margin	Negative	45	93%	45	88%	0.485
	Positive	3	7%	6	12%	
PLND	Bilaterally	0	0%	4	8%	0.291
	None	48	100%	47	92%	
Bladder Neck Reconstruction	No	31	65%	49	97%	0.001
	Yes	17	35%	2	3%	
Biochemical Recurrence	Yes	46	97%	50	98%	0.296
	No	2	3%	1	2%	

Chi-square test/ Mann-whitney u test
NVB Saved: *neurovascular bundle saved ;* ***PLND*** *: Pelvic Lymph Node Dissection*

Table 4. Complication rates

	Prostate Volume > 75 cc	**Prostate Volume < 75cc**	**p**
	n(%)	**n(%)**	
Minor Clavien 1-2			0.233
Anastomosis leakage	2 (4.2%)	1 (2 %)	
Urinary Tract Infection	1 (2.1%)	0 (0 %)	
Ileus	0 (0%)	1 (2 %)	
Bleeding	1 (2.1%)	1(2 %)	
Major Clavien 3-4			0.371
Pulmonary emboli	1 (2.1%)	0 (0%)	
Urethral stricture	2 (4.2%)	0 (0%)	
Totals	7 (14.6%)	3 (6%)	

Table 5. Functional outcomes

		Prostate Volume > 75 cc		**Prostate Volume ≤ 75 cc**		**p**
		n	**%**	**n**	**%**	
Urinary Continence Status 7.Days	Complete	16	33%	15	29%	
	Mild	21	45%	32	63%	0.879
	Incontinent	11	23%	4	8%	
Urinary Continence Status 1.Months	Complete	16	33%	30	59%	
	Mild	28	58%	21	41%	0.986
	Incontinent	4	10%	0	0%	
Urinary Continence Status 3.Months	Complete	28	58%	37	73%	
	Mild	19	40%	14	27%	0.784
	Incontinent	1	3%	0	0%	

Urinary Continence Status 6.Months	Complete	34	70%	43	84%	0.505
	Mild	13	28%	8	16%	
	Incontinent	1	3%	0	0%	
Urinary Continence Status 1.Year	Complete	43	88%	45	88%	0.545
	Mild	4	10%	6	12%	
	Incontinent	1	3%	0	0%	
Potency 6.Months	Yes	13	28%	10	20%	0.411
	None	35	72%	41	80%	
Potency 1.Year	Yes	34	70%	22	43%	0.657
	None	14	30%	29	57%	

Chi-square test

removal (p >0.05). When the potency was examined, the results were found to be similar between the two groups at the 6th and 12th months, no statistically significant difference was observed (p >0.05).

DISCUSSION

Robotic surgery for radical prostatectomy may have advantages such as facilitating dissection and achieving better functional results. However, the patients with larger prostates may experience difficulties as vision and mobility in the pelvis are affected (8). The effect of prostate size on functional and oncological outcomes after RP is discussed as a controversial issue. Despite many publications on this subject, no clear results could be obtained. In the meta-analysis examining prostate volume with oncological and functional results in the literature, it was seen that prostate volume sizes were different in different studies and there was no clear cut-off value. (14).

Large and small for prostate volume is not a clear definition. In the literature, the threshold value varies between 40 and 100 cc (15). In this study, the results of RARP applied in patients with prostates larger than 75 cc, which we accept as the threshold value, and prostates with normal volume were compared.

In the publications investigating the relationship between prostate volume and oncological outcomes, Allaparthi et al. reported that large prostate volume (PV) has a significant positive effect on pathological features, positive surgical margin rate, and biochemical recurrence-free survival (16). These results are similar to those of Moschini et al. and demonstrated that larger PV is an independent predictor for favorable disease traits (17). In these studies, it should not be ignored that prostate biopsies performed due to high PSA values in the patients with large PV with PSA elevation associated with diffuse benign prostatic hyperplasia potentially have better oncologic results by detecting earlier tumor stages (4). When the cases with localized prostate cancer are examined, it has been stated that the large amount of prostate tissue surrounding the cancerous lesion facilitates dissection and provides an advantage in terms of surgical margin negativity in the surgery of large-volume prostates (14). In our study, the mean preoperative PSA values, pathology results and D'amico risk classifications were similar between the two groups. When analyzed in this way, we found that there was no significant difference in positive surgical margin and biochemical recurrence rates between the two groups.

In the literature, Hirasawa et al. stated that as the prostate size increases, the amount of perioperative bleeding increases due to wider resection margins and increased vascularization and Kim et al. reported that the operation times are longer in RARPs with large PV (18,19). In our results, operation time and console time were found to be significantly longer in RARP cases with large PV, but there was no significant difference in the amount of bleeding.

As the prostate size increases, more dissection of the bladder neck may be required, resulting in a larger defect in the area to be anastomosed at the bladder

neck. In such cases, the bladder neck is anastomosed to the urethral stump using additional techniques (20). Yasui et al. published that patients with large prostate had longer anastomosis time, but this was not statistically significant (21). In our study, the UVA time and the necessity of bladder neck reconstruction were significantly higher in the group with large prostate.

Functional outcomes of RP are primarily evaluated depend on erectile function and continence status. Conservation of erectile and urinary functions is related to the nerve sparing procedure (22). Galfano et al. stated that there was no significant difference in 1-year potency ratios according to prostate volumes in the patients who underwent RARP (23). In our study, bilateral nerve-sparing procedures were applied to a large extent in both groups, and we found that large prostate volume did not have a negative effect on potency ratios at 1-year follow-up. It has been reported in the literature that there is a trend towards better early continence after RARP in the patients with small prostate volumes. However, it should be noted that the definition of continence is different between studies and the parameters and query forms used in the evaluation of continence are not standardized (14). On the other hand, Yasui et al. stated in their study that PV has no effect on the recovery of urinary functions after RARP (21). Although the literature contains contradictions in the relationship between prostate volume and functional results in the patients undergoing RARP, the continence rates were not significantly different between the two groups in our study, both in the early period and at the end of the first year.

The limitation of our study is its retrospective design and the fact that it was conducted with a relatively small number of patients.

CONCLUSION

RARP can be considered a more challenging operation in the patients with large prostates, due to having difficulties such as a long operation time and the need for bladder neck reconstruction. However, the prostate size does not have a negative effect on the oncological and functional outcomes in the procedures performed by experienced surgeons.

Conflict of Interest

The authors declare to have no conflicts of interest.

Financial Disclosure

The authors declared that this study has received no financial support.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

Ethical Approval

The study was approved by University of Health Sciences, Dr. Sadi Konuk Training and Research Hospital Ethical Committee (Decision No: 2021/482) and written informed consent was received from all participants. The study protocol conformed to the ethical guidelines of the Helsinki Declaration.

Author Contributions

Conception and design; Sungur U, Evren İ, Gürbüz N, Taşçı Aİ, Data acquisition; Kargı T, Karadağ S, Polat H, Data analysis and interpretation; Ekşi M, Evren İ, Tuğcu V, Drafting the manuscript; Sungur U, Gürbüz N, Critical revision of the manuscript for scientific and factual content; Kargı T, Hacıislamoğlu A, Polat H, Statistical analysis; Ekşi M, Karadağ S, Supervision; Sungur U, Evren İ, Hacıislamoğlu A,Gürbüz N, Taşçı Aİ.

REFERENCES

1. Sung H, Ferlay J, Siegel RL, et al. Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwidefor36Cancersin185Countries.CACancerJClin. 2021;71(3):209-249. https://doi.org/10.3322/caac.21660
2. Culp MB, Soerjomataram I, Efstathiou JA, et al. Recent Global Patterns in Prostate Cancer Incidence and Mortality Rates. Eur Urol. 2020;77(1):38-52. https://doi.org/10.1016/j.eururo.2019.08.005
3. Lim KB. Epidemiology of clinical benign prostatic hyperplasia. Asian J Urol. 2017;4(3):148-151. https://doi.org/10.1016/j.ajur.2017.06.004
4. Foley CL, Bott SR, Thomas K, et al. A large prostate at radical retropubic prostatectomy does not adversely affect cancer control, continence or potency rates. BJU Int. 2003;92(4):370-4. https://doi.org/10.1046/j.1464-410x.2003.04361.x

5. Mottet N, van den Bergh RCN, Briers E, et al. EAU-EANM-ESTRO-ESUR-SIOG Guidelines on Prostate Cancer-2020 Update. Part 1: Screening, Diagnosis, and Local Treatment with Curative Intent. Eur Urol. 2021;79(2):243-262. https://doi.org/10.1016/j.eururo.2020.09.042
6. Freedland SJ, Isaacs WB, Platz EA, et al. Prostate size and risk of high-grade, advanced prostate cancer and biochemical progression after radical prostatectomy: a search database study. J Clin Oncol. 2005;23(30):7546-54. https://doi.org/10.1200/JCO.2005.05.525
7. Moschini M, Gandaglia G, Suardi N, et al. Importance of prostate volume in the stratification of patients with intermediate-risk prostate cancer. Int J Urol. 2015;22(6):555-61. https://doi.org/10.1111/iju.12748
8. Skolarus TA, Hedgepeth RC, Zhang Y, et al. Does robotic technology mitigate the challenges of large prostate size? Urology. 2010;76(5):1117-21. https://doi.org/10.1016/j.urology.2010.03.060
9. Pettus JA, Masterson T, Sokol A, et al. Prostate size is associated with surgical difficulty but not functional outcome at 1 year after radical prostatectomy. J Urol. 2009;182(3):949-55. https://doi.org/10.1016/j.juro.2009.05.029
10. Binder J, Kramer W. Robotically-assisted laparoscopic radical prostatectomy. BJU Int. 2001;87(4):408-10. https://doi.org/10.1046/j.1464-410x.2001.00115.x
11. Novara G, Ficarra V, Rosen RC, et al. Systematic review and meta-analysis of perioperative outcomes and complications after robot-assisted radical prostatectomy. Eur Urol. 2012;62(3):431-52. https://doi.org/10.1016/j.eururo.2012.05.044
12. Wolfram M, Bräutigam R, Engl T, et al. Robotic-assisted laparoscopic radical prostatectomy: the Frankfurt technique. World J Urol. 2003;21:128–132. https://doi.org/10.1007/s00345-003-0346-z
13. Rosen RC, Cappelleri JC, Smith MD, et al. Development and evaluation of an abridged, 5-item version of the International Index of Erectile Function (IIEF-5) as a diagnostic tool for erectile dysfunction. Int J Impot Res. 1999;11(6):319-26. https://doi.org/10.1038/sj.ijir.3900472
14. Fahmy O, Alhakamy NA, Ahmed OAA, et al. Impact of Prostate Size on the Outcomes of Radical Prostatectomy: A Systematic Review and Meta-Analysis. Cancers (Basel). 2021;13(23):6130. https://doi.org/10.3390/cancers13236130
15. Min SH, Park YH, Lee SB, et al. Impact of prostate size on pathologic outcomes and prognosis after radical prostatectomy. Korean J Urol. 2012;53(7):463-6. https://doi.org/10.4111/kju.2012.53.7.463
16. Allaparthi SB, Hoang T, Dhanani NN, et al. Significance of prostate weight on peri and postoperative outcomes of robot assisted laparoscopic extraperitoneal radical prostatectomy. Can J Urol. 2010;17(5):5383-9.
17. Moschini M, Gandaglia G, Suardi N, et al. Importance of prostate volume in the stratification of patients with intermediate-risk prostate cancer. Int J Urol. 2015;22(6):555-61. https://doi.org/10.1111/iju.12748
18. Kim MS, Jang WS, Chung DY, et al. Effect of prostate gland weight on the surgical and oncological outcomes of extraperitoneal robot-assisted radical prostatectomy. BMC Urol. 2019;19(1):1. https://doi.org/10.1186/s12894-018-0434-4
19. Hirasawa Y, Ohno Y, Nakashima J, et al. Impact of a preoperatively estimated prostate volume using transrectal ultrasonography on surgical and oncological outcomes in a single surgeon's experience with robot-assisted radical prostatectomy. Surg Endosc. 2016;30(9):3702-8. https://doi.org/10.1007/s00464-015-4664-1
20. Zorn KC, Orvieto MA, Mikhail AA, et al. Effect of prostate weight on operative and postoperative outcomes of robotic-assisted laparoscopic prostatectomy. Urology. 2007;69(2):300-5. https://doi.org/10.1016/j.urology.2006.10.021
21. Yasui T, Tozawa K, Kurokawa S, et al. Impact of prostate weight on perioperative outcomes of robot-assisted laparoscopic prostatectomy with a posterior approach to the seminal vesicle. BMC Urol. 2014;14:6. https://doi.org/10.1186/1471-2490-14-6
22. Moris L, Gandaglia G, Vilaseca A, et al. Evaluation of Oncological Outcomes and Data Quality in Studies Assessing Nerve-sparing Versus Non-Nerve-sparing Radical Prostatectomy in Nonmetastatic Prostate Cancer: A Systematic Review. Eur Urol Focus. 2021:S2405-4569(21)00161-9. https://doi.org/10.1016/j.euf.2021.05.009
23. Galfano A, Panarello D, Secco S, et al. Does prostate volume have an impact on the functional and oncological results of Retzius-sparing robot-assisted radical prostatectomy? Minerva Urol Nefrol. 2018;70(4):408-413. https://doi.org/10.23736/S0393-2249.18.03069-2