



# Predictors for immediate recovery of continence following Retzius-sparing robot-assisted radical prostatectomy: a case–control study

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## Abstract

**Purpose** We evaluated urinary continence in a series of consecutive patients who underwent Retzius-sparing robot-assisted radical prostatectomy (RS-RARP) to identify the preoperative predictors of the return to immediate urinary continence.

**Methods** 110 consecutive patients who underwent RS-RARP for clinically localized prostate cancer were retrospectively collected. Patients reported freedom from using safety pad (0 pad/day) within 7 days after removal of urinary catheter were defined as immediate urinary continent.

**Results** A total of 85 patients (77.27%) were immediate urinary continent after RS-RARP. Patients with immediate urinary continence were significantly younger ( $66.92 \pm 5.73$  vs.  $69.68 \pm 4.99$  years,  $p = 0.031$ ) than those who were incontinent. Furthermore, the prostate volume was significantly smaller (30.90 vs. 44.60 ml,  $p = 0.001$ ) and preoperative international prostate symptom score (IPSS) was significantly lower (Mild 76.5% vs. 24.0%, Moderate 20.0% vs. 32.0%, and Severe 3.5% vs. 44.0%,  $p = 0.000$ ) in patients with immediate urinary continence compared with those who were not. On univariable regression analysis, patient's age (OR 0.907,  $p = 0.035$ ), prostate volume (OR 0.935,  $p = 0.000$ ), moderate (OR 0.196,  $p = 0.007$ ), and severe IPSS (OR 0.025,  $p = 0.000$ ) (compared with mild IPSS) were independent adverse predictors of immediate urinary continence. On multivariable analysis, prostate volume (OR 0.955,  $p = 0.032$ ) and severe preoperative IPSS (OR 0.044,  $p = 0.000$ ) (compared with mild IPSS) were independent adverse predictors of immediate urinary continence after RS-RARP.

**Conclusions** RS-RARP hastens the recovery of urinary continence after surgery. Prostate volume and severe preoperative IPSS were independent adverse predictors of the return to immediate urinary continence.

**Keywords** Prostate cancer · Radical prostatectomy · Retzius sparing · Immediate urinary continence · Predictors

## Introduction

Prostate cancer is the most common cancer affecting men in developed countries [1]. Recently, the incidence of prostate cancer is increasing due to the widespread application of serum prostate-specific antigen (PSA) testing in China [2]. Radical prostatectomy (RP) is considered to be one of the standard strategies for the treatment of organ-confined

prostate cancer. In 2005, Dr. Bianco proposed “cancer free, continence and potent” (trifecta) as the goal for RP [3]. Among them, urinary continence following RP is suggested to be one of the most important indicators of the quality of life (QoL) and treatment satisfaction [4]. Approximately 30% of men continue to experience urinary incontinence at 1 year following open surgery [5, 6]. Recently, with the utilization of robotic platform, more than 80% of men could regain urinary continence in one year [7], and more will regain up to 2 years after surgery [3]. However, early recovery of urinary continence after RARP is still poor, with more than 70% patients at 6 weeks after surgery and more than 50% of patients at 3 months after RARP requiring pads, even when operated by the most experienced surgeons [7].

Several surgical techniques have been developed to improve the recovery of continence after RARP such as preservation of internal and external of urinary sphincters and their neural supply and anatomical supporting, secure

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vesicourethral anastomosis, anterior and posterior reconstruction supporting anastomosis [8]. Recently, Dr. Bocciadi and his colleagues have proposed Retzius-sparing technique which resulted in incredible immediate urinary continence rate (more than 90%) after removal of catheter [9, 10]. A recent randomized controlled trial conducted by Dr. Menon and his group also demonstrated that Retzius-sparing robot-assisted radical prostatectomy (RS-RARP) was a feasible and safe approach for low-intermediate localized prostate cancer and could optimize the early recovery (within 3 months) of urinary continence [11], even this effect was muted at 12-month follow-up [12].

Despite the significant improvement of early recovery of urinary continence after RS-RARP, some patients who underwent RS-RARP still suffered from urinary incontinence early after surgery. Till now, there is no literature reporting the possible predictive factors of immediate recovery of urinary continence after RS-RARP. In this study, we retrospectively examined patients who underwent RS-RARP to investigate the possible relationship between the preoperative factors and the immediate recovery of urinary incontinence after RS-RARP.

## Methods

### Patient selection

From June 2017 to June 2018, a total of 110 consecutive patients with localized prostate cancer who underwent RS-RARP performed by the same surgeon (Dr. HG) with at least 3 months of follow-up in our center were retrospectively analyzed. All patients had multiparameter magnetic resonance imaging (mpMRI) to assess extraprostatic extension (EPE) and seminal vesicle invasion (SVI) before surgery. Bone scan was applied to rule out the metastatic bone disease.

Patients with locally advanced cancer (T3a or T3b), suspected lymph nodes involvement (N1), metastatic cancer (M1), or who had received neoadjuvant androgen deprivation therapy (ADT) were excluded. The ethics committee of our hospital approved this study with a waiver of written informed consent given the retrospective nature of this study.

### Surgical technique

RS-RARP was performed under general anesthesia, using a transperitoneal approach similar to those described by Galvano et al. [9, 10] and Lim et al. [13]. Briefly, the patients were put into a steep Trendelenburg position. The bilateral seminal vesicles and vas deferens were exposed and incised by an incision up over the peritoneum in the rectovesical space. The plane between Denonvilliers' fascia and the

posterior prostatic fascia were developed as far as possible to the apex. Then, a lateral plane between prostatic capsule and lateral prostatic fascia was exposed by dissection of prostatic pedicles and continued to the prostatic apex and dorsal venous complex (DVC). After recognizing, isolating, and sectioning vesicoprostatic junction, the anterior surface of the prostate was separated from the DVC. The urethra was incised when the apex was completely isolated. After removal of prostate, the anastomosis was performed using a running suture from the 12 o'clock position. In patients with high risk of prostate cancer, extended lymph nodes dissection was performed. All patients were managed according to our standard postoperative protocol for RARP. Catheters were removed 7–10 days after RS-RARP and patients were discharged 3–5 days after surgery.

### Evaluated variables

For each patient, we prospectively collected the following clinical and pathologic information: age, body mass index (BMI), Eastern Cooperative Oncology Group (ECOG) performance status, the history of Diabetes Mellitus and Hypertension, preoperative IPSS, prostate volume, preoperative total PSA level, biopsy Gleason score, clinical tumor stage, as well as pathological T stage, final Gleason, and surgical margin status.

### Follow-up

All patients were subsequently reviewed after surgery to assess their urinary continence by completing self-administered questionnaire. Urinary continence was evaluated using the Expanded Prostate Cancer Index Composite Urinary Assessment (EPIC). Continence was defined as freedom from the use of safety pads (0 pad/day). Immediate urinary continence was defined when patients used no pad within 7 days after removal of catheter.

### Statistics

Continuous normally distributed variables were reported as the mean and standard deviation (SD). Continuous non-normally distributed variables were presented as the median and interquartile range (IQR). The *T* test, Mann–Whitney *U* test, and Pearson's  $\chi^2$  test were used to evaluate the possible statistical correlation between the risk of incontinence and several preoperative variables. Logistic regression analysis was applied for univariable and multivariable analysis. The Box-Tidwell transformation was utilized to test the linearity of the continuous variables in the model. Four biological factors including age, BMI, Prostate Volume, and Preoperative IPSS were taken into the multivariable regression model [14]. All data analyses were performed using SPSS

21.0 statistical software (IBM SPSS, Chicago, IL, USA). In all analyses,  $p < 0.05$  was considered statistically significant.

## Results

Table 1 shows the basic information including clinical and pathological characteristics of all 110 included patients. Mean age of the patients was  $67.55 \pm 5.67$  years old. Median

serum PSA at diagnosis was 9.83 ng/ml (IQR 6.09–16.55). All patients were continent before surgery. A bilateral, intra-fascial nerve sparing technique was performed in all 110 cases.

Follow-up data showed that in 1 week after removal of catheter, 85 patients (77.27%) reported not using any pad or protection system during the day. The remaining 25 patients who were not immediate continent reported using a median of 1 pad (IQR 1 to 2) daily.

**Table 1** Association of immediate urinary continence status with preoperative biological and pathological factors

	Whole Pts	Immediate urinary continence		<i>p</i> Value
		Continent Pts	Incontinent Pts	
No. Pts (%)	110 (100.00)	85 (77.27)	25 (22.73)	
Mean Age (year) ( $\pm$ SD)	67.55 ( $\pm$ 5.67)	66.92 ( $\pm$ 5.73)	69.68 ( $\pm$ 4.99)	0.031
Mean BMI (kg/m <sup>2</sup> ) ( $\pm$ SD)	24.17 ( $\pm$ 3.06)	24.36 ( $\pm$ 3.12)	23.50 ( $\pm$ 2.77)	0.216
No. ECOG (%)				0.393
0	82 (74.5)	65 (76.5)	17 (68.0)	
1	28 (25.5)	20 (23.5)	8 (32.0)	
No. Diabetes Mellitus (%)				0.748
Yes	20 (18.2)	16 (18.8)	4 (16.0)	
No	90 (81.8)	69 (81.2)	21 (84.0)	
No. hypertension (%)				0.771
Yes	50 (45.5)	38 (44.7)	12 (48.0)	
No	60 (54.5)	47 (55.3)	13 (52.0)	
No. preoperative IPSS (%)				0.000
Mild	71 (64.5)	65 (76.5)	6 (24.0)	
Moderate	25 (22.7)	17 (20.0)	8 (32.0)	
Severe	14 (12.7)	3 (3.5)	11 (44.0)	
Median prostate volume (ml) (IQR)	31.85 (25.53–43.83)	30.90 (23.4–40.85)	44.60 (30.15–59.4)	0.001
Median preoperative PSA, ng/ml (IQR)	9.83 (6.09–16.55)	9.30 (6.09–15.06)	11.20 (5.85–21.54)	0.521
No. biopsy Gleason score (%)				0.431
$\leq 6$	41 (37.3)	33 (38.8)	8 (32.0)	
7	48 (43.6)	38 (44.7)	10 (40.0)	
$\geq 8$	21 (19.1)	14 (16.5)	7 (28.0)	
No. clinical T stage (%)				0.292
$\leq$ T1c	14 (12.7)	13 (15.3)	1 (4.0)	
T2a	56 (50.9)	43 (50.6)	13 (52.0)	
$\geq$ T2b	40 (36.4)	29 (34.1)	11 (44.0)	
No. pathological Gleason score (%)				0.082
$\leq 6$	28 (25.5)	25 (29.4)	3 (12.0)	
7	67 (60.9)	47 (55.3)	20 (80.0)	
$\geq 8$	15 (13.6)	13 (15.3)	2 (8.0)	
No. pathological T stage (%)				0.251
$\leq$ T2	60 (54.5)	50 (58.8)	10 (40.0)	
T3a	40 (36.4)	28 (32.9)	12 (48.0)	
$\geq$ T3b	10 (9.1)	7 (8.2)	3 (12.0)	
No. surgical margin status (%)				0.323
Negative	79 (71.8)	63 (74.1)	16 (64.0)	
Positive	31 (28.2)	22 (25.9)	9 (36.0)	

*Pts* patients, *IPSS* Mild (0–7); Moderate (8–19); Severe (20–35)

Patients with immediate urinary continence after RS-RARP were significantly younger ( $66.92 \pm 5.73$  vs.  $69.68 \pm 4.99$  years old,  $p = 0.031$ ) than those who were not immediate urinary continent. The prostate volume was significantly smaller ( $30.90$  (IQR  $23.4$ – $40.85$ ) vs.  $44.60$  ( $30.15$ – $59.4$ ) ml,  $p = 0.001$ ) in patients with immediate urinary continence compared with those without immediate continent. Furthermore, patients with immediate urinary continence had significantly lower IPSS (Mild  $76.5\%$  vs.  $24.0\%$ , Moderate  $20.0\%$  vs.  $32.0\%$ , and Severe  $3.5\%$  vs.  $44.0\%$ ,  $p = 0.000$ ) compared with those were not immediate continent. All the other clinical and pathological characteristics were similar between the groups (Table 1).

On univariable regression analysis, patients without immediate urinary continence following RS-RARP were with older age at surgery (OR  $0.907$ ,  $p = 0.035$ ), larger prostate volume (OR  $0.935$ ,  $p = 0.000$ ), and moderate (OR  $0.196$ ,  $p = 0.007$ ) and severe (OR  $0.025$ ,  $p = 0.000$ ) preoperative IPSS (mild IPSS was set as referent). On multivariable regression analysis, prostate volume (OR  $0.955$ ,  $p = 0.032$ ) and severe IPSS (OR  $0.044$ ,  $p = 0.000$ ) were independent adverse predictors of immediate urinary continence rates (Table 2). Other variables such as age, BMI, preoperative PSA, and pathological staging were not statistically significant predictors of immediate urinary continence.

## Discussion

The results of this case–control study revealed that  $77.27\%$  of patients can achieve immediate recovery of urinary continence after RS-RARP. We reported that prostate volume and preoperative IPSS were independent predictors of immediate recovery of urinary continence after RS-RARP. To our knowledge, this is the first case–control study to evaluate predictors of immediate urinary continence following RS-RARP.

Conventional retropubic RP causes both anatomical and functional alterations in the sphincter and surrounding supporting structures [15], resulting in urinary incontinence.

Therefore, most of patients undergoing RARP encounter urinary incontinence immediately after catheter removal, despite the stabilization of bladder condition within two years after surgery [7]. Unlike conventional retropubic access route, RS-RARP accesses through pouch of Douglas, avoiding surgical destruction to puboprostatic ligaments, dorsal venous complex, arcus tendinous fascia, endopelvic fascia, veil of Aphrodite, and detrusor apron [9, 10, 13], which are believed to play a role in maintenance of continence [16]. Therefore, RS-RARP improves the early recovery of urinary continence compared to the conventional RARP [11, 13, 17, 18].

Despite  $71\%$ – $92\%$  of patients post RS-RARP could be immediately continent, there is still a small part of patients experiencing different periods of urinary incontinence [11, 13, 17, 18]. Patients are always anxious due to the lack of information on predicting the status and duration of urinary incontinence. Therefore, identification of possible predictors of immediate continence recovery could offer prognostic information to surgeons, which might be helpful for clinical judgment and decision-making, as well as relieve the anxiousness of patients.

Several studies have reported the possible predictive factors of recovery of urinary continence after RARP. Among them, surgeon experience and surgical techniques have been demonstrated to be associated with the recovery of urinary continence [14, 19]. However, surgeon experience and surgical techniques are operator-dependent. It is difficult to validate the prognostic effect of the experience and technique between different surgeons. Preoperative biological factors (e.g., age, BMI, TURP before RP, pre-existing LUTs) were also reported to be associated with early recovery of urinary continence [14], which could directly reflect the result of RARP, therefore provide relatively validated prognostic information of immediate recovery of urinary continence after RS-RARP.

Though prostate volume was reported not to be associated with urinary continent status at 1-year follow-up after RS-RARP [20, 21], for the immediate urinary continence, our results revealed that prostate volume was an

**Table 2** Logistics regression analysis of immediate urinary continence

	Univariable analysis			Multivariable analysis		
	OR	95% CI	<i>p</i> Value	OR	95% CI	<i>p</i> Value
Age (continuous)	0.907	0.828–0.993	0.035	0.925	0.819–1.045	0.213
BMI (continuous)	1.100	0.946–1.280	0.215	1.004	0.826–1.220	0.968
Prostate volume (continuous)	0.935	0.902–0.969	0.000	0.955	0.916–0.996	0.032
Preoperative IPSS			0.000			0.001
Mild	1	Referent	–	1	Referent	–
Moderate	0.196	0.060–0.642	0.007	0.358	0.094–1.353	0.130
Severe	0.025	0.005–0.116	0.000	0.044	0.008–0.240	0.000

OR odds ratio, CI confidence interval

independent predictor after RS-RARP, which was consistent with the previous cohort report [21]. Patients with larger size of prostate have been shown to have poorer continence outcomes after RARP compared with men with smaller size of prostate in many studies [22, 23]. Theoretically, RP is associated with excision of relatively more part of urethra in patients with large prostate, which results relatively wider bladder neck size. Preservation of urethra [24, 25] and bladder neck [26, 27] has been demonstrated to be associated with early continence after RP. Furthermore, the difficulty in mobilizing a large prostate in pelvis makes preservation of neural vascular bundle (NVB) challenging. This difficulty is significantly magnified in the very limited operating space during RS-RARP [9].

In this study, a severe preoperative IPSS was also demonstrated to be an independent predictor of not returning to immediate urinary continence following RS-RARP. It has been hypothesized that higher preoperative IPSS likely suggests detrusor overactivity due to benign prostatic hyperplasia (BPH), which may contribute significantly to delay recovery of urinary continence after RARP [28]. Our finding is consistent with results from other studies that there is a higher likelihood of continence in patients with a lower preoperative IPSS [29].

There are several limitations of this study. First, this was a retrospective study with a small number of evaluated patients. Then, data on the consistency of preoperative pelvic floor exercises and training, which is considered to play an important role in returning of postoperative urinary continence, were not collected in this study. Finally, we used patient-reported pad usage to define urinary continent status, which was not a quantitative measurement with an objective aspect.

## Conclusion

In this study, 77.27% of patients who underwent RS-RARP returned to immediate urinary continence, with prostate volume and preoperative IPSS being the independent adverse predictors of the return to immediate urinary continence. Patients of advanced age and with lower urinary tract symptoms prior to RS-RARP should be counseled appropriately on the increased risk of urinary incontinence in the very early stages after surgery.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that no conflict of interest exists.

**Ethical approval** All procedures performed in studies were approved by the Ethics Committee of the Drum Tower Hospital, Medical School of Nanjing University, with a waiver of written informed consent given the retrospective nature of this study.

## References

1. Siegel RL, Miller KD, Jemal A (2016) Cancer statistics, 2016. *Cancer J Clin* 66 (1):7–30. <https://doi.org/10.3322/caac.21332>
2. Chen W, Zheng R, Baade PD, Zhang S, Zeng H, Bray F, Jemal A, Yu XQ, He J (2016) Cancer statistics in China, 2015. *Cancer J Clin* 66(2):115–132. <https://doi.org/10.3322/caac.21338>
3. Bianco FJ Jr, Scardino PT, Eastham JA (2005) Radical prostatectomy: long-term cancer control and recovery of sexual and urinary function (“trifecta”). *Urology* 66(5):83–94. <https://doi.org/10.1016/j.urology.2005.06.116>
4. Sanda MG, Dunn RL, Michalski J, Sandler HM, Northouse L, Hembroff L, Lin X, Greenfield TK, Litwin MS, Saigal CS, Mahadevan A, Klein E, Kibel A, Pisters LL, Kuban D, Kaplan I, Wood D, Ciezki J, Shah N, Wei JT (2008) Quality of life and satisfaction with outcome among prostate-cancer survivors. *N Engl J Med* 358(12):1250–1261. <https://doi.org/10.1056/NEJMoa074311>
5. Begg CB, Riedel ER, Bach PB, Kattan MW, Schrag D, Warren JL, Scardino PT (2002) Variations in morbidity after radical prostatectomy. *N Engl J Med* 346(15):1138–1144. <https://doi.org/10.1056/NEJMsa011788>
6. Barry MJ, Gallagher PM, Skinner JS, Fowler FJ Jr (2012) Adverse effects of robotic-assisted laparoscopic versus open retropubic radical prostatectomy among a nationwide random sample of medicare-age men. *J Clin Oncol* 30(5):513–518. <https://doi.org/10.1200/jco.2011.36.8621>
7. Ficarra V, Novara G, Rosen RC, Artibani W, Carroll PR, Costello A, Menon M, Montorsi F, Patel VR, Stolzenburg JU, Van der Poel H, Wilson TG, Zattoni F, Mottrie A (2012) Systematic review and meta-analysis of studies reporting urinary continence recovery after robot-assisted radical prostatectomy. *Eur Urol* 62(3):405–417. <https://doi.org/10.1016/j.eururo.2012.05.045>
8. Sridhar AN, Abozaid M, Rajan P, Sooriakumaran P, Shaw G, Nathan S, Kelly JD, Briggs TP (2017) Surgical techniques to optimize early urinary continence recovery post robot assisted radical prostatectomy for prostate cancer. *Curr Urol Rep* 18(9):71. <https://doi.org/10.1007/s11934-017-0717-4>
9. Galfano A, Ascione A, Grimaldi S, Petralia G, Strada E, Bocciardi AM (2010) A new anatomic approach for robot-assisted laparoscopic prostatectomy: a feasibility study for completely intrafascial surgery. *Eur Urol* 58(3):457–461. <https://doi.org/10.1016/j.eururo.2010.06.008>
10. Galfano A, Di Trapani D, Sozzi F, Strada E, Petralia G, Bramero M, Ascione A, Gambacorta M, Bocciardi AM (2013) Beyond the learning curve of the Retzius-sparing approach for robot-assisted laparoscopic radical prostatectomy: oncologic and functional results of the first 200 patients with  $\geq 1$  year of follow-up. *Eur Urol* 64(6):974–980. <https://doi.org/10.1016/j.eururo.2013.06.046>
11. Dalela D, Jeong W, Prasad MA, Sood A, Abdollah F, Diaz M, Karabon P, Sammon J, Jamil M, Baize B, Simone A, Menon M (2017) A pragmatic randomized controlled trial examining the impact of the Retzius-sparing approach on early urinary

- continence recovery after robot-assisted radical prostatectomy. *Eur Urol* 72(5):677–685. <https://doi.org/10.1016/j.eururo.2017.04.029>
12. Menon M, Dalela D, Jamil M, Diaz M, Tallman C, Abdollah F, Sood A, Lehtola L, Miller D, Jeong W (2018) Functional Recovery, oncologic outcomes and postoperative complications after robot-assisted radical prostatectomy: an evidence-based analysis comparing the Retzius sparing and standard approaches. *J Urol* 199(5):1210–1217. <https://doi.org/10.1016/j.juro.2017.11.115>
  13. Lim SK, Kim KH, Shin TY, Han WK, Chung BH, Hong SJ, Choi YD, Rha KH (2014) Retzius-sparing robot-assisted laparoscopic radical prostatectomy: combining the best of retroperitoneal and perineal approaches. *BJU Int* 114(2):236–244. <https://doi.org/10.1111/bju.12705>
  14. Heesakkers J, Farag F, Bauer RM, Sandhu J, De Ridder D, Stenzl A (2017) Pathophysiology and contributing factors in postprostatectomy incontinence: a review. *Eur Urol* 71(6):936–944. <https://doi.org/10.1016/j.eururo.2016.09.031>
  15. Walz J, Epstein JI, Ganzer R, Graefen M, Guazzoni G, Kaouk J, Menon M, Mottrie A, Myers RP, Patel V, Tewari A, Villers A, Artibani W (2016) A critical analysis of the current knowledge of surgical anatomy of the prostate related to optimisation of cancer control and preservation of continence and erection in candidates for radical prostatectomy: an update. *Eur Urol* 70(2):301–311. <https://doi.org/10.1016/j.eururo.2016.01.026>
  16. Walz J, Burnett AL, Costello AJ, Eastham JA, Graefen M, Guillonneau B, Menon M, Montorsi F, Myers RP, Rocco B, Villers A (2010) A critical analysis of the current knowledge of surgical anatomy related to optimization of cancer control and preservation of continence and erection in candidates for radical prostatectomy. *Eur Urol* 57(2):179–192. <https://doi.org/10.1016/j.eururo.2009.11.009>
  17. Chang LW, Hung SC, Hu JC, Chiu KY (2018) Retzius-sparing robotic-assisted radical prostatectomy associated with less bladder neck descent and better early continence outcome. *Anticancer Res* 38(1):345–351. <https://doi.org/10.21873/anticancer.12228>
  18. Sayyid RK, Simpson WG, Lu C, Terris MK, Klaassen Z, Madi R (2017) Retzius-sparing robotic-assisted laparoscopic radical prostatectomy: a safe surgical technique with superior continence outcomes. *J Endourol* 31(12):1244–1250. <https://doi.org/10.1089/end.2017.0490>
  19. Lee S, Yoon CJ, Park HJ, Lee JZ, Ha HK (2013) The surgical procedure is the most important factor affecting continence recovery after laparoscopic radical prostatectomy. *World J Men's Health* 31(2):163–169. <https://doi.org/10.5534/wjmh.2013.31.2.163>
  20. Santok GD, Abdel Raheem A, Kim LH, Chang K, Lum TG, Chung BH, Choi YD, Rha KH (2017) Perioperative and short-term outcomes of Retzius-sparing robot-assisted laparoscopic radical prostatectomy stratified by gland size. *BJU Int* 119(1):135–141. <https://doi.org/10.1111/bju.13632>
  21. Galfano A, Panarello D, Secco S, Di Trapani D, Barbieri M, Napoli G, Strada E, Petralia G, Bocciardi AM (2018) Does prostate volume have an impact on the functional and oncological results of Retzius-sparing robot-assisted radical prostatectomy? *Minerva Urol Nefrol* 70(4):408–413. <https://doi.org/10.23736/S0393-2249.18.03069-2>
  22. Konety BR, Sadetsky N, Carroll PR (2007) Recovery of urinary continence following radical prostatectomy: the impact of prostate volume—analysis of data from the CaPSURE database. *J Urol* 177(4):1423–1425. <https://doi.org/10.1016/j.juro.2006.11.089> discussion 1425–1426.
  23. Boczek J, Erturk E, Golijanin D, Madeb R, Patel H, Joseph JV (2007) Impact of prostate size in robot-assisted radical prostatectomy. *J Endourol* 21(2):184–188. <https://doi.org/10.1089/end.2006.0163>
  24. Nguyen L, Jhaveri J, Tewari A (2008) Surgical technique to overcome anatomical shortcoming: balancing post-prostatectomy continence outcomes of urethral sphincter lengths on preoperative magnetic resonance imaging. *J Urol* 179(5):1907–1911. <https://doi.org/10.1016/j.juro.2008.01.036>
  25. Paparel P, Akin O, Sandhu JS, Otero JR, Serio AM, Scardino PT, Hricak H, Guillonneau B (2009) Recovery of urinary continence after radical prostatectomy: association with urethral length and urethral fibrosis measured by preoperative and postoperative endorectal magnetic resonance imaging. *Eur Urol* 55(3):629–637. <https://doi.org/10.1016/j.eururo.2008.08.057>
  26. Nyarangi-Dix JN, Radtke JP, Hadaschik B, Pahernik S, Hohenfellner M (2013) Impact of complete bladder neck preservation on urinary continence, quality of life and surgical margins after radical prostatectomy: a randomized, controlled, single blind trial. *J Urol* 189(3):891–898. <https://doi.org/10.1016/j.juro.2012.09.082>
  27. Friedlander DF, Alemozaffar M, Hevelone ND, Lipsitz SR, Hu JC (2012) Stepwise description and outcomes of bladder neck sparing during robot-assisted laparoscopic radical prostatectomy. *J Urol* 188(5):1754–1760. <https://doi.org/10.1016/j.juro.2012.07.045>
  28. Shikanov S, Desai V, Razmaria A, Zagaja GP, Shalhav AL (2010) Robotic radical prostatectomy for elderly patients: probability of achieving continence and potency 1 year after surgery. *J Urol* 183(5):1803–1807. <https://doi.org/10.1016/j.juro.2010.01.016>
  29. Laviguer-Blouin H, Noriega AC, Valdivieso R, Hueber PA, Bienz M, Alhathal N, Latour M, Trinh QD, El-Hakim A, Zorn KC (2015) Predictors of early continence following robot-assisted radical prostatectomy. *Can Urol Assoc J* 9(1–2):e93–e97. <https://doi.org/10.5489/cuaj.2086>