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ARTICLE

Multicentric comparative analysis of Retzius versus Retzius sparing robotic assisted simple prostatectomy in the management of large prostate glands

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ABSTRACT

Aim: Robot-assisted simple prostatectomy (RASP) is a minimally invasive alternative to open simple prostatectomy in the management of patients with large prostate glands suffering from moderate-to-severe lower urinary tract symptoms (LUTS). Our study aimed to evaluate two transvesical robotic approaches in order to compare functional outcomes and postoperative complications.
Materials and methods: Clinical data from 111 consecutive patients from three tertiary robotic centers were retrospectively collected. Patients were divided into two groups depending on the surgical approach: 58 Retzius sparing and 53 Retzius approach RASP. We evaluated peri-operative outcomes (operating time, blood loss, transfusion rate, length of hospital stay), as well as intra-operative and early complications using a Clavien Dindo scale. Fisher's exact test, chi-square test and Mann–Whitney *U* test were applied for statistical analyses. A p-value <0.05 was considered statistically significant.
Results: Neither subgroup differed significantly in age ($p = 0.104$), Charlson comorbidity index ($p = 0.088$) or prostate volume ($p = 0.507$), total IPSS score (0.763) and Q_{max} ($p = 0.651$). Total complication rates were lower for the Retzius approach subgroup (19 vs 11.9%) without reaching statistical significance in multivariate analysis (HR = 1.21, 95% CI = 0.17 − 8.44, $p = 0.84$). No significant differences based on IPSS total score and Q_{max} could be observed between the two subgroups during follow-up.
Conclusions: Both RASP approaches provide similar results in terms of functional outcomes and present a good safety profile in the management of large prostatic adenomas. Larger trials are needed in order to establish the indications for each robotic technique.

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Robotic assisted simple prostatectomy; large prostate; LUTS; Retzius approach; Retzius sparing

Introduction

Current urologic guidelines still consider open simple prostatectomy as the main treatment option for the treatment of benign prostatic enlargement–lower urinary tract symptoms among men with large glans over 80 ml [1,2]. However, robotic assisted simple prostatectomy (RASP) seems to be more attractive whenever compared with open simple prostatectomy as it is a minimally invasive procedure offering a shorter hospital stay and better morbidity profile [3]. RASP was first described by Sotelo in 2008 and since then, transperitoneal or extraperitoneal approaches with transvesical or extravesical access to adenoma have been described in the effort to decrease the risk of perioperative complications [4–6]. In our study, we evaluated the perioperative and functional outcomes of two different techniques of transperitoneal transvesical robotic assisted simple prostatectomy, as defined by Autorino et al. [7]. In order to simplify the terms used in the manuscript, the technique described by Sotelo et al. [4] will be referred as the 'Retzius approach', while the bladder dome approach designed by Leslie et al. [8] will be defined as the 'Retzius sparing' approach.

Materials and methods

Patients

Clinical data from 111 consecutive patients from three high volume tertiary robotic centers (Bucharest, (Romania), Bamberg (Germany) and Thessaloniki (Greece)) that underwent RASP between 2017 and 2020 were retrospectively collected from medical records. All surgeons (C.S, V.Z, A.L.) that performed the procedure present a large experience in performing robotic urological procedures. Patients were included into two groups: 53 patients underwent RASP using a Retzius approach and 58 patients (78.5%) underwent Retzius sparing RASP (techniques described in the next

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section). Patients were divided into groups depending on the surgeon's preference, but there was no specific criteria for assignment to either surgical procedure.

The indications for RASP were the same as for open simple prostatectomy, namely a prostate volume $\geq$80 mL, measured by transrectal ultrasound of the prostate (TRUS) with no history or suspicion of prostate cancer. Baseline characteristics included age, body mass index, American Society of Anesthesiologists score (ASA), preoperative PSA level (ng/dL) and preoperative international prostate symptom score (IPSS questionnaire). We evaluated peri-operative outcomes (operating time, estimated blood loss, peri-operative transfusion rate), as well as intra-operative and complication rates using a Clavien Dindo scale [9]. Patients were re-evaluated at 4 weeks postoperatively and afterwards at a 3-month interval using physical examination, uroflowmetry and IPSS questionnaire.

Surgical technique

All procedures were performed with a four-arm da Vinci-Xi or Si Surgical System (Intuitive Surgical, Sunnyvale, CA), using patient positioning and port placement similar to that for radical prostatectomy. Four instruments are used: Hot Shears (Intuitive Surgical) monopolar curved scissors, ProGrasp forceps (Intuitive Surgical), large needle driver and a robotic tinaculum grasper.

Using the Retzius approach, the bladder was filled with 200 ml of saline via an indwelling catheter and then released from the anterior abdominal wall down to the endopelvic fascia. A transverse *U* shaped cystotomy was made at the bladder neck to expose the prostate base and the trigone. 2 monocryl 1–0 stay stitches on the bladder edge can be used to improve visualization.

For adenoma enucleation, a horizontal incision was made on the vesical mucosa overlying the prostate lobes at the level of the bladder neck and continued circumferentially at the edge of the prostate. In order to improve retraction of the adenoma, the tinaculum grasper is placed over the median lobe or at the 3 or 9 o'clock position, depending on which lobe is being dissected. The adenoma was freed from the prostate capsule by dissecting in the subcapsular plane outside the prostatic adenoma using a combination of mono/bipolar electrocautery and blunt dissection. When a median lobe was present, it was completely mobilized and transected at its junction to the lateral lobes. Dissection continues caudally towards the apex and the prostatic urethra is divided with cold scissors under direct vision using the catheter as a guide to avoid injury to the external sphincter. Rigorous hemostasis was performed using electrocautery and figure eight sutures using 2–0 Monocryl on the prostatic arteries. The incised edge of the bladder neck mucosa was sutured approximated to the posterior edge of the urethra or to the prostatic fossa floor using an uninterrupted 2–0 Monocryl suture. A 22Ch three-way Foley catheter with 30–40 cc balloon was placed and the incision on the anterior bladder wall was closed using a double layer 2–0 Monocryl suture in a running manner. Watertight closure test was performed at the end with 200 cc of saline to ensure the integrity of the cystorrhaphy. A 22Ch drain was placed in the Retzius space and the specimen was removed using an EndoCatch™ bag (Figure 1).

Applying the Retzius sparing approach, the bladder was filled with 200 ml of saline via an indwelling catheter in order to expose the posterior bladder wall and the ureters. A vertical incision on the posterior bladder wall was performed and two to four Monocryl 1–0 stay stitches on the bladder edge were used to improve visualization. Adenoma enucleation and hemostasis were performed in a similar matter as described above. The bladder neck was reconstructed using two running barbed sutures starting from the 3 or 9 o'clock position. The bladder mucosa was approximated to the urethra circumferentially. In cases with large adenomas, plication of the posterior prostatic capsula using 2-0/3–0 Monocryl was performed in order to complete the urethrovesical anastomosis. A 22Ch three-way Foley catheter with 30–40 cc balloon was placed and the incision on the posterior bladder wall was closed using a double layer 2–0 Monocryl suture in a running manner. A watertight closure test was performed at the end with 200 cc of saline to ensure the integrity of the cystorrhaphy. A 22Ch drain was placed in the Denonvilliers' space and the specimen removed using an EndoCatch™ bag (Figure 2).

Concerning postoperative care, continuous bladder irrigation was maintained until the hematuria resolved. Short-term antibiotic prophylaxis using third generation I.V. cephalosporins and thromboprophylaxis with low molecular weight heparin was used on all patients. NSAID's were used on demand for pain management. The drain was removed after 24 h if there was no leakage. The bladder catheter was removed 7–10 days postoperatively and the patient was discharged afterwards. Cystography was used only in cases with suspicion of urinary fistula after catheter removal.

Statistical analysis

The primary endpoints of the current study were perioperative and functional outcomes of two different techniques of transperitoneal, transvesical robotic simple prostatectomy after a follow-up of up to 12 months. Fisher's exact test, chi-square test and Mann–Whitney *U* test were applied for univariate analyses of categorical variables and continuous variables, whenever indicated. For multivariable analysis of predictive features for total postoperative complication rate, a binary logistic regression model was applied. A *p*-value $<$0.05 was considered statistically significant.

Results

Patients characteristics and functional outcomes

In total, 111 patients were included in the study. Patients' characteristics are summarized in Table 1. Briefly, subgroups did not differ significantly in age ($p = 0.104$), Charlson comorbidity indexes ($p = 0.088$) as well as preoperative benign prostatic obstruction parameters such as PSA serum levels

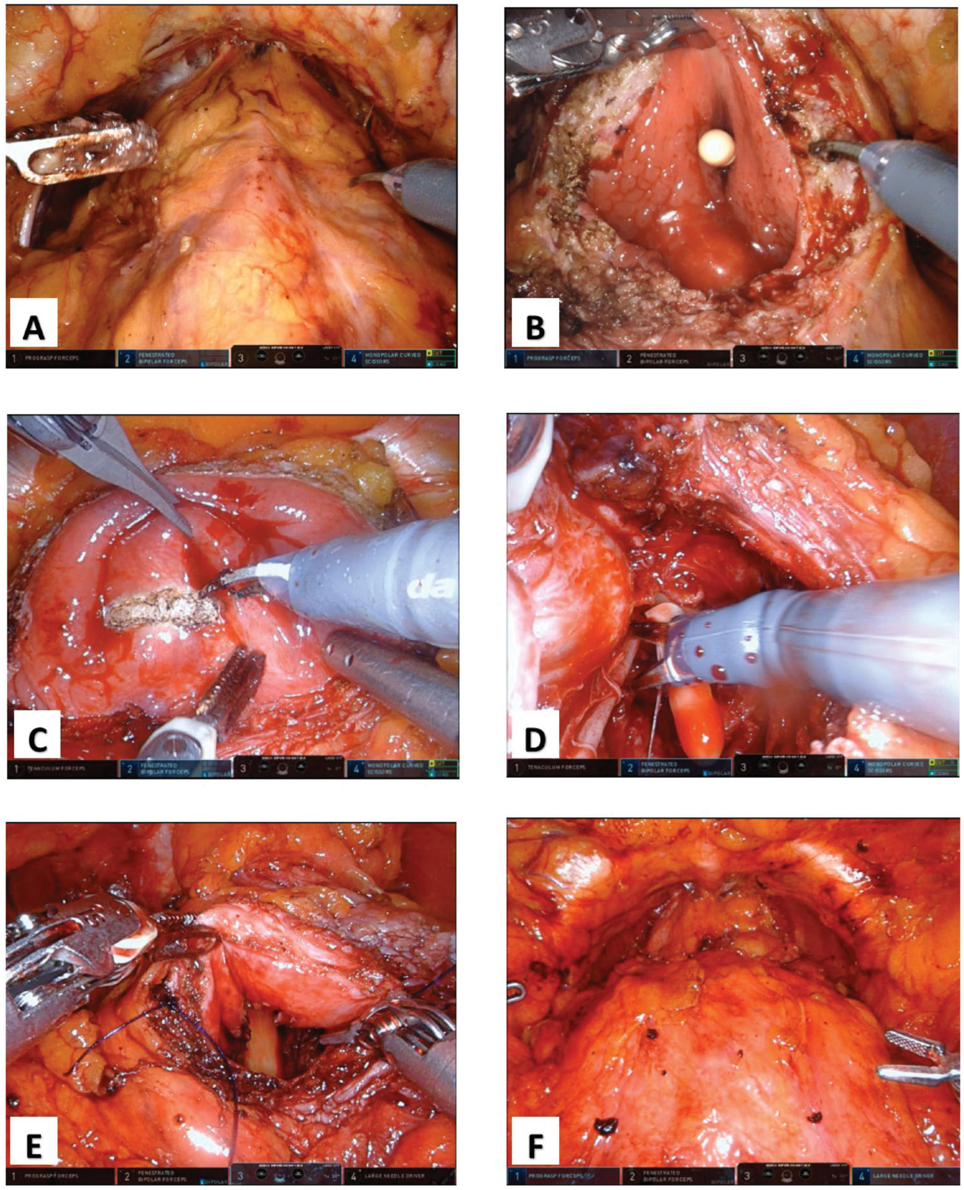

Figure 1. Retzius approach technique. (a) Anterior bladder wall dissection; (b) Transverse cystotomy; (c) Incision of the posterior bladder neck; (d) Cold cut of the urethra; (e) Double layer 2-0 monocryl cystorrhaphy; (f) Final aspect.

($p = 0.897$), prostate volume ($p = 0.507$), total IPSS score (0.763), as well as Q_{max} ($p = 0.651$).

Postoperative follow-up was assessed 1 month, 3 months, and 12 months postoperatively. In terms of functional outcomes, median International Prostate Symptom Score at 1 year declined from 30 preoperatively to 8.3 in the Retzius sparing group and from 29.9 to 5.7 in the Retzius approach group ($p < 0.05$). Median Q_{max} increased from 9.3 preoperatively to 16.9 ml/s in the Retzius sparing group and from 8.4 to 17.4 ml/s in the Retzius approach group ($p < 0.05$). No statistically significant differences based on IPSS total score and Q_{max} could be observed between the two subgroups during follow-up (Figure 3).

Perioperative outcomes

We found decreased intraoperative blood loss (79 vs 199 ml, $p = 0.616$) for the Retzius sparing subgroup and subsequently a decreased need for blood transfusion (0 vs 9.4%, $p = 0.022$). Complications stratified by Clavien–Dindo scale as well as specific complications are summarized in Table 2. Most adverse events recorded were Clavien grade 1 (urinary retention, prolonged hematuria/clots) or grade 2 (anemia requiring transfusion). In the Retzius sparing group, four (6.89%) patients presented clot retention that required endoscopic removal and one (1.72%) case developed myocardial infarction 48 h postoperative that needed coronary angioplasty. No Clavien grade ≥3 adverse events were recorded in the Retzius group. The increased incidence of major complications and recurrent BPO that required endoscopic revision in the Retzius sparing group were recorded in the initial stages of implementation of this approach, but decreased over time due to progressive adjustments of the technique. However, total complication rates were lower for the Retzius approach subgroup without reaching statistical significance in univariate (19 vs 11.9%, $p = 0.548$) as well as multivariate

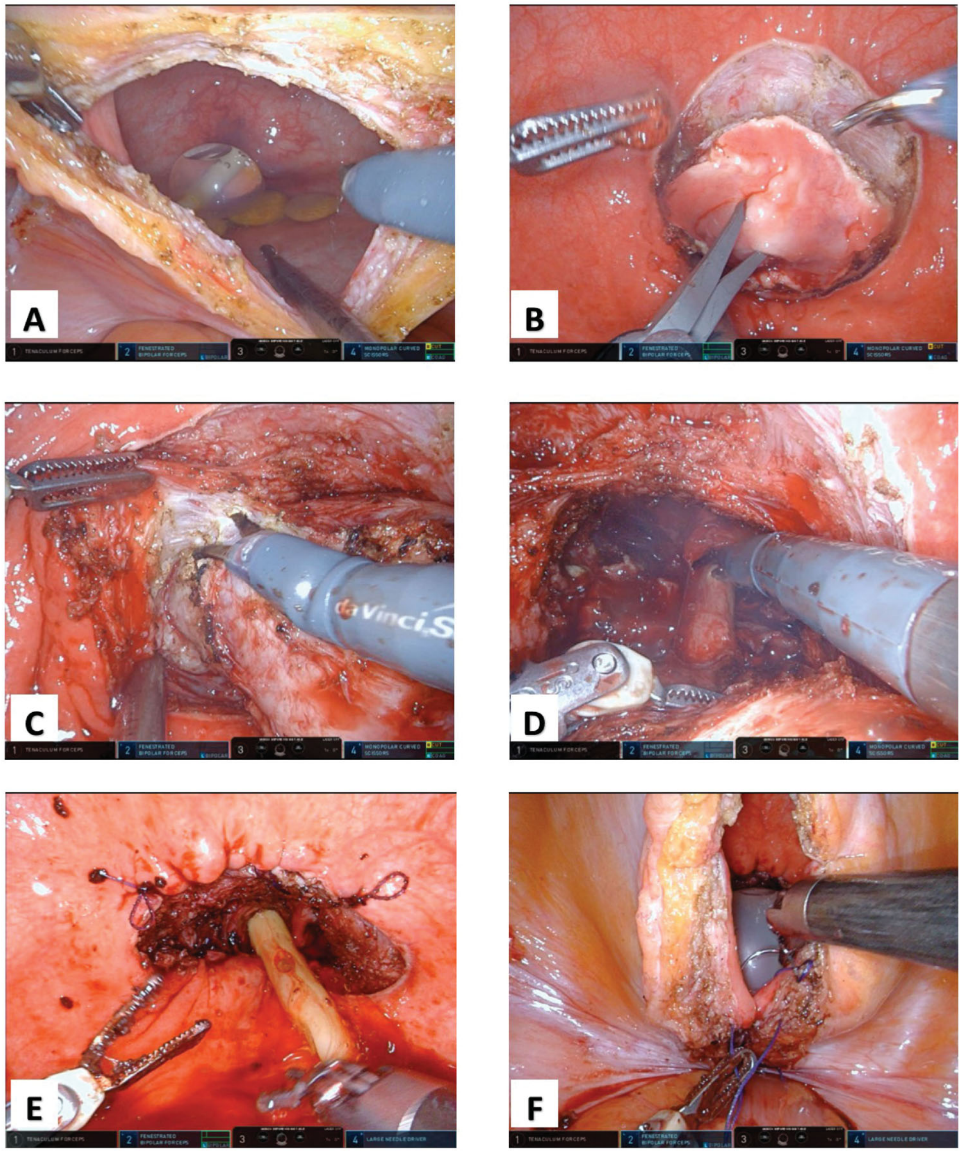

Figure 2. Retzius sparing approach. (a) Posterior cystotomy with multiple bladder stones; (b) circumferential incision of the bladder neck; (c) dissection of the adenoma in the subcapsular plane; (d) cold cut of the urethra; (e) bladder neck reconstruction; (f) double layer 2–0 monocryl cystorrhaphy.

analysis, stratified for body-mass index as well as the existence of preoperative UTI, both of which varied significantly during preoperative patient assessment (Table 1). Results of the multivariable analysis are summarized in Table 3.

Discussion

Robot-assisted simple prostatectomy (RASP) is a minimally invasive alternative to open simple prostatectomy, with the potential advantage of reduced morbidity in patients with large prostate glands suffering from moderate-to-severe LUTS. Similar to the laparoscopic approach, different techniques have been described of robotic simple prostatectomy, trans or extraperitoneal, trancapsular, transvesical or trans Douglas, each with its specific profile [7,10]. While the adenoma enucleation technique is similarly described in most studies, irrespective of approach, the highest variability is found in the bladder neck reconstruction. Several technical refinements have been described that may decrease the risk of late complications such as approximation of the posterior edge of the bladder neck to the urethra or to the prostatic fossa floor (so called trigonization) [4], modifications to the van Velthoven continuous vesicourethral anastomosis [11–14], 360 degree circumferential reconstruction [15] or urethral sparing RASP [16].

Although several reviews reported no significant differences in terms of safety and functional outcomes between techniques, no head-to-head comparisons between different RASP techniques has been performed so far [5,7,17]. Therefore, the present study aimed to evaluate for the first time the perioperative and functional outcomes of two robotic transperitoneal transvesical approaches in the management of large prostate glands.

The Retzius approach was initially performed in all three centers since it was technically more familiar, as most surgeons develop the Retzius plane and perform bladder detachment during robotic assisted radical prostatectomy. However, the horizontal or U shaped cystotomy on the

Table 1. Demographics and preoperative data of patients according to each group treated between 2017 and 2020.

Variable	Retzius sparing RASP	Retzius approach RASP	*p*-value
N (%)	58	53	
Bamberg, Germany	0 (0)	29 (54.71)	0.021
Bucharest, Romania	27 (46.55)	10 (18.86)	0.217
Thessaloniki, Greece	31 (53.44)	14 (26.41)	0.174
Age	70.3 (7.7)	67.3 (9.7)	0.104
BMI	26.9 (4.7)	29.3 (3.4)	0.014
Charlson Comorbidity Index [*n* (%)]			
1	1 (3.0)	5 (15.6)	0.088
2	3 (9.1)	8 (25.0)	
3	10 (30.3)	4 (12.5)	
4	12 (36.4)	7 (21.9)	
5	2 (6.1)	4 (12.5)	
6	5 (15.2)	4 (12.5)	
Preoperative transurethral catheter [*n* (%)]	7 (12.1)	12 (22.6)	0.207
Preoperative UTI [*n* (%)]	0 (0.0)	14 (27.5)	0.029
Preoperative alpha-inhibitors [*n* (%)]	42 (72.4)	39 (73.6)	1.000
Preoperative alpha-reductase-inhibitors [*n* (%)]	26 (44.8)	29 (54.7)	0.482
Preoperative OAB [*n* (%)]	12 (20.7)	8 (15.1)	0.470
Preoperative obstructive renal failure [*n* (%)]	5 (8.6)	2 (3.8)	0.441
Preoperative IPSS	30.2 (3.2)	29.9 (3.4)	0.763
Preoperative Q_{max}	9.3 (1.8)	8.4 (2.2)	0.651
Prostate volume (cc)	131.2 (44.4)	141.5 (36.9)	0.507
Preoperative PVR	201.4 (273.9)	131.9 (62.7)	0.728
Preoperative PSA	4.5 (4.7)	4.4 (4.0)	0.897

Data are mean (±SD), unless stated otherwise.
RASP, robot-assisted simple prostatectomy; BMI, body mass index; UTI, urinary tract infection; OAB, overactive bladder; IPSS, International Prostate Symptom Score; Q_{max}, maximum flow rate; PVR, postvoidal residual urine; PSA, prostate specific antigen.

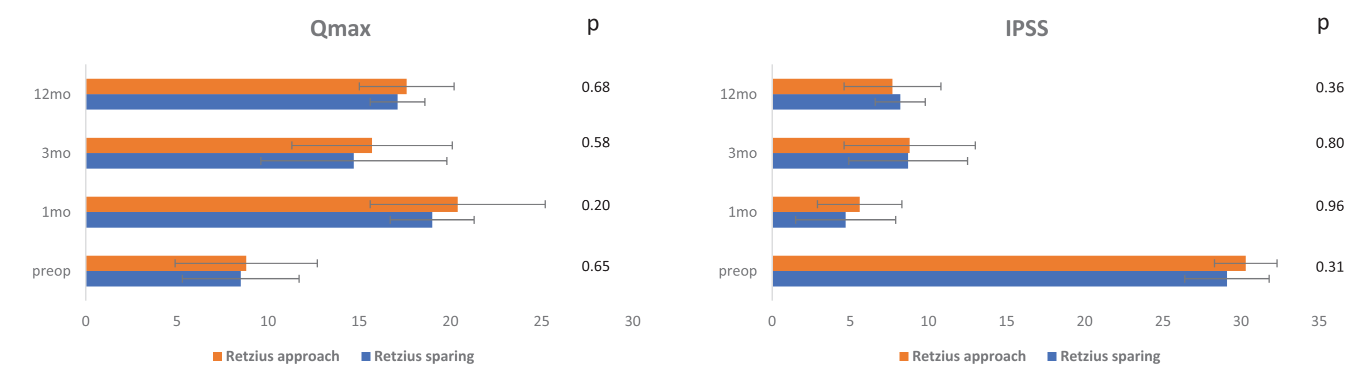

Figure 3. Functional outcomes after RASP.

Table 2. Intra- and perioperative outcomes of patients.

Variable	Retzius sparing RASP	Retzius approach RASP	*p*-value
Operative time (min)	98 (108)	112 (107)	0.322
Blood loss (ml)	207 (79)	260 (199)	0.616
Catheter indwelling time (days)	10.3 (2.0)	10.2 (0.7)	0.499
Perioperative blood transfusion [*n* (%)]	0 (0.0)	5 (9.4)	0.022
Any postoperative complication [*n* (%)]	8 (19.0)	5 (11.9)	0.548
High-grade complication [Clavien 3–5; *n* (%)]	5 (11.9)	0 (0.0)	0.056
Postoperative bladder neck contracture [*n* (%)]	4 (6.5)	2 (5.7)	0.405
Postoperative acute urinary retention [*n* (%)]	2 (11.8)	4 (10.3)	1.000
Postoperative fistula [*n* (%)]	1 (2.4)	0 (0.0)	1.000
Postoperative UTI [*n* (%)]	2 (11.8)	3 (7.7)	0.634
Postoperative SUI [*n* (%)]	3 (7.1)	2 (5.1)	1.000
Revision due to recurrent BPO [*n* (%)]	4 (6.5)	0 (0.0)	0.117

Data are mean (±SD), unless stated otherwise.
RASP, robot-assisted simple prostatectomy; UTI, urinary tract infection; SUI, stress urinary incontinence; BPO, benign prostatic obstruction.

bladder neck lowers the anterior wall and limits the visualization of the trigone and ureteral orifices, with limited capabilities of accurate hemostasis on the anterior prostatic capsule. Also, an accurate 'trigonization' can be difficult, especially in very large glands, due to the inability of advancing the instruments into the prostatic fossa caused by a very steep angle of instruments that come into contact with the anterior prostatic capsule. Dissection of the Retzius plane and bladder detachment are not without complications such as bleeding from the abdominal wall or small bowel obstruction, caused by formation of suprapubical adhesions [18]. These complications can be avoided using a Retzius sparing

Table 3. Multivariate analysis of predictors for appearance of perioperative complications (any grade) in our cohort.

Predictive feature	Regression coefficient	Odds ratio	95% CI	*p*-value
Retzius sparing RASP	0.19	1.21	0.17 – 8.44	0.849
BMI	0.06	1.06	0.86 – 1.31	0.577
Preoperative UTI	2.34	10.37	1.06 – 101.53	0.045

RASP, robot-assisted simple prostatectomy; UTI, urinary tract infection.

approach [19]. The transverse cystotomy on the posterior wall requires limited pelvic dissection, allows for better advancement of instruments inside the bladder, a larger field of view inside the prostatic fossa, better hemostasis on the anterior capsula and easier trigonization, since the urethra is aligned with the instruments. Although no statistical differences were found between techniques in our study, a higher blood loss and need for transfusion were observed more frequently in the Retzius approach group, possibly related to the limitations described above.

As the number of patients treated using minimal invasive procedures is rising, the comparison of various procedures may translate into clinical utility in the future. Since the majority of robotic surgeons are accustomed with the Retzius approach used in the treatment of prostate cancer, this experience does not necessarily overlap with the management of benign prostatic pathology [10]. Surgeons must adapt and be skilled in different techniques in order to overpass the limitations of a specific procedure.

Several systematic and comprehensive reviews have demonstrated that RASP is an effective and safe treatment option for large prostate glands, with similar results in Qmax and IPSS as open simple prostatectomy or HoLEP [5,17,20,21].

Transurethral techniques for treatment of benign prostate hyperplasia are more attractive to the patient, as they do not require abdominal incisions. Modern endoscopic techniques using holmium (HoLEP) or other high-powered lasers have demonstrated good long-term outcomes in large prostates [22,23]. However, these techniques have several disadvantages, such as a steep learning curve, the need of specialized endourological equipment, prolonged urethral instrumentation and the need to morcellate in order to extract the prostate specimen [24]. Due to these drawbacks, HoLEP remains underutilized in many countries, despite the favorable outcomes reported [25]. In hospitals that already have a solid robotic program, the usage of RASP will increase due to its short learning curve, good safety profile and decreased length of stay [5]. This approach can also be used in order to resolve concomitant urologic issues such as bladder stones, bladder diverticula or other abdominal wall defects (umbilical or inguinal hernias) [26].

The retrospective nature of our study and the low number of patients included can be considered as limitations of our study and the inability to reach statistical significance might not be due to no effect but due to the underpower of the study. Selection of technique was based on surgeons' preference rather than patient-specific criteria. Each group performed the procedure and follow-up according to local protocols, which had an impact on the analysis of parameters such as length of stay, catheter-indwelling time and health-related quality-of-life assessment. Since this study included patients treated during the COVID-19 pandemic, follow-up data evaluation was altered since some of the patients postponed their scheduled visit due to local restrictions Also, we did not use any preoperative urodynamic evaluation of the patients other than uroflowmetry and PVR in order to establish eligibility criteria. Further studies with inclusion of larger populations will clearly establish the advantages of each technique.

Conclusions

Both transperitoneal transvesical robotic assisted simple prostatectomy approaches provide similar results in terms of functional outcomes and present a good safety profile in the management of large prostatic adenomas. Larger trials are needed in order to establish the indications for each robotic technique.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The present study is a retrospective one; for this type of study formal consent is not required.

Author contributions

Study conception and design: Surcel, Labanaris, Zugor. Sinescu, Gandaglia, A. Kretschmer, Mirvald

Acquisition of data: Najjar, Labanaris, Zugor, Kajaia, Heidegger, Kretschmer, Mirvald

Analysis and interpretation of data: Surcel, Labanaris, Heidegger, Gandaglia, Kretschmer, C. Mirvald

Drafting of manuscript: Surcel, Najjar, Labanaris, Kajaia, Heidegger, Sinescu, Gandaglia, Kretschmer, Mirvald

Critical revision: Surcel, Zugor, Heidegger, Sinescu, Gandaglia, Kretschmer, Mirvald

Disclosure statement

No potential conflict of interest was reported by the author(s).

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