Simple prostatectomy using the open and robotic approaches for lower urinary tract symptoms: A retrospective, case-control series

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Abstract

Introduction: We aimed to assess the outcome of our series of simple prostatectomy at our institution using the open simple prostatectomy (OSP) and robotic-assisted simple prostatectomy (RASP) approaches.

Methods: We conducted a retrospective chart review of men who underwent OSP and RASP at Western University, in London, ON. Preoperative, intraoperative, and postoperative data were collected and analyzed.

Results: From 2012–2020, 29 men underwent a simple prostatectomy at our institution. Eight patients underwent an OSP and 21 patients underwent a RASP. The median age was 69 years. Preoperative median prostate volume was 153 cm^3 (range 80–432). The surgical indications were failed medical treatment, urinary retention, hydronephrosis, cystolithiasis, and recurrent hematuria. The median operative time was 137.5 minutes in OSP and 185 minutes in RASP (p=0.04). Median estimated blood loss was 2300 ml (range 600–4000) and 100 ml (range 50–400) in the open and robotic procedures, respectively (p=0.4). The mean length of hospital stay was shorter in the RASP group, one day vs. three days (z=4.152, p<0.005). Perioperative complication rates were significantly lower in the group undergoing RASP, with no complications recorded in this group (p=0.004). Both groups demonstrated excellent functional results, with most patients reporting complete urinary continence (p=0.8).

Conclusions: We report very good perioperative outcomes, with a minimal risk profile and excellent functional results, leading to marked improvement in patients' symptoms at followup after both the OSP and RASP approaches. RASP was associated with a shorter length of hospital stay, decreased blood loss, and a lower complication rate.

Introduction

The preferred surgical technique for the treatment of an enlarged prostates (≥80 g), leading to lower urinary tract symptoms (LUTS), remains controversial. Historically, open simple prostatectomy (OSP) has been regarded as the gold standard for the treatment of large prostate glands; however, this technique can also be associated with higher blood loss and transfusion rates, and a longer hospital stay.[1] In 2008, Sotelo et al were the first to report the robotic-assisted simple prostatectomy (RASP) technique.[2] Since introduction, this procedure has slowly gained popularity. The increased availability of surgical robots, as well as the higher frequency of robotic-assisted procedures, especially robotic-assisted laparoscopic radical prostatectomy (RARP) for prostate cancer, has naturally led to the expanded use of this approach for simple prostatectomies. RASP has been reported to be a good surgical option for men with large prostate glands (≥80 g), with surgical outcomes comparable to holmium laser enucleation of prostate (HoLEP) and superior to OSP.[3,4]

In 2015, Hoy et al reported on the initial Canadian experience performing RASP.[5] Their robotic cohort included four patients. They concluded that compared to OSP, the robotic approach was associated with reduced length of hospital stay and intraoperative blood loss. They recommended further investigation and consideration at other Canadian centers. We report the experience of our institution in performing both OSP and RASP for the treatment of LUTS and urinary retention, secondary to an enlarged prostate.

Methods

Following institutional review board approval, we performed a retrospective chart review of all patients that underwent simple prostatectomies at Western University. OSP were performed by two fellowship-trained, experienced surgeons. RASP was performed using the da Vinci Si surgical system by a single fellowship-trained, experienced surgeon. The decision on the type of procedure was based on surgeon preference. All patients were followed up in the clinic postoperatively.

This review includes demographic data, as well as preoperative, intraoperative, and postoperative data. Study data were collected and managed using REDCap electronic data capture tools hosted at Lawson Health Research Institute.[6,7]

Statistical analysis

Descriptive statistics were used to assess demographics. Statistical analysis for differences in patient age, body mass index (BMI), pathological weight of adenoma, and drop in hemoglobin (Hb) were performed using Student t-test. Length of operation was tested using Welch t-test, as variances were not equal. Mann-Whitney U test was performed to analyze non-parametric data (length of hospitalization, length of followup, and complications). Indications for the surgery and need for transfusion were analyzed using Fisher's exact test. Comparison between transrectal ultrasound (TRUS) and abdominal ultrasound (US) was performed using Mann-Whitney U test and differences in adenoma weight by Wilcoxon signed-rank test. For all analyses, reported p-values are from two-tailed tests and considered statistically significant if $p<0.05$ with 95% confidence interval (CI). All analysis was performed using IBM SPSS® Statistics version 26.0 (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0 Armonk, NY: IBM Corp.)

The operative technique

OSP was performed through a lower midline incision in an extraperitoneal trans-capsular technique. All RASP procedures were performed via a transperitoneal six-port approach, with the prostate approached trans-vesically, for adenoma enucleation.

Postoperative management

In the open approach, the urethral catheter is typically removed 14 days following the procedure, whereas in the robotic approach it is removed after seven days. The timing of removal of the catheter was dependent on the clarity of the urine and the discretion of the operating surgeon.

Results

We studied the records of 29 patients who underwent simple prostatectomy from 2012–2020. Eight of the patients had OSP, whereas 21 underwent RASP. Demographic and preoperative data are presented in Table 1. Mean preoperative estimated prostate volume was 229 cm^3 (standard deviation [SD] ±114.8 cm^3) and 152 cm^3 (SD±49.2 cm^3) in the OSP and RASP groups, respectively (p=0.03). The surgical indications were failed medical treatment (25%, 28.5%), urinary retention (37.5%, 52.3%), hydronephrosis (25%, 14.2%), cystolithiasis (0%, 4.7%) and recurrent hematuria (4.7%, 12.5%) for OSP and RASP, respectively (p=0.5). Some of the patients had multiple indications. Operative and postoperative data are provided in Table 2. Median operative time was 137.5 minutes (range 86–240) in the open surgical approach and 185 minutes (range 140–283) in the robotic approach (p=0.04). None of the robotic procedures were converted into an open approach.

Median estimated blood loss was 2300 ml (range 600–4000) and 100 ml (range 50–400) in the open and robotic procedures, respectively (p=0.4). The mean postoperative drop in hemoglobin was 39 g/L and 22 g/L in OSP and RASP, respectively (p=0.03). Patients undergoing RASP had a significantly lower risk of postoperative blood transfusion (p=0.06), with none requiring any blood products, compared with two patients (25%) in the OSP cohort who needed blood transfusions perioperatively, requiring a total of nine units of packed red blood cells. While there was no significant difference between the two surgical approaches in

Table 1. Demographic and preoperative data

Demographic	OSP (n=8)	RASP (n=21)	p
Age, median (range)	69 (59–78)	69 (54–86)	0.74
Median BMI, kg/m² (range)	29.8 (24.9–32.1)	26.9 (19.9–34.6)	0.34
Mean preoperative estimated prostate volume, cm³ (SD)	229 (±114.8)	152 (±49.2)	0.03
Prostate volume estimation technique, n (%)			
TRUS	5 (62.5)	7 (33.5)	0.04
Abdominal US	3 (37.5)	12 (57.1)	
Cystoscopy	0 (0)	1 (4.7)	
MRI	0 (0)	1 (4.7)	
Median PSA, ng/mL (range)	12.5 (2.98–42.6)	7.2 (2.06–19.5)	0.09
Prior prostate biopsy, n (%)	5 (62.5)	9 (42.8)	0.427
Preoperative urinary retention, n	3	11	NS
Mean preoperative PVR, ml (SD)	378 (±229)	324 (±390)	0.93
Comorbidities, n (%)			
Diabetes mellitus	1 (12.5)	4 (19)	NS
Hypertension	4 (50)	10 (47.6)	NS
Dyslipidemia	2 (25)	6 (28.5)	NS
CVA	0 (0)	1 (4.7)	NS
OSA	0 (0)	1 (4.7)	NS
Surgical indication, n (%)			0.57
Failed medical treatment	2 (25)	6 (28.5)	
Urinary retention	3 (37.5)	11 (52.3)	
Hydronephrosis	2 (25)	3 (14.2)	
Cystolithiasis	0 (0)	1 (4.7)	
Recurrent hematuria	1 (12.5)	0 (0)	

BMI: body mass index; CVA: cerebrovascular accident; DRE: digital rectal exam; MRI: magnetic resonance imaging; NS: non-significant; OSA: obstructive sleep apnea; OSP: open simple prostatectomy; PSA: prostate-specific antigen; PVR: postvoid residual; RASP: robotic-assisted simple prostatectomy; SD: standard deviation; TRUS: transrectal ultrasound; US: ultrasound; UTI: urinary tract infection.

Table 2. Operative, postoperative outcomes, and complications

Demographics	OSP (n=8)	RASP (n=21)	p
Median operative time, minutes (range)	137.5 (86–240)	185 (140–283)	0.04
Conversion to open procedure: n (%)	–	0	–
Median estimated blood loss, ml (range)	2300 (600–4000)	100 (50–400)	0.4
Blood transfusion, n (%)	2 (25%)	0 (0)	0.06
Mean postoperative drop in hemoglobin, g/l (SD)	39 (±21)	22 (±17)	0.03
Perioperative complications, n (%)			
Significant hematuria	1 (12.5)	0 (0)	0.004
Urinary tract infection	1 (12.5)	0 (0)	
Bladder neck stricture	1 (12.5)	0 (0)	
Mean length of hospital stay, days (SD)	3 (±1.03)	1 (±0.46)	<0.005
Median length of followup, months (range)	15 (3–81)	4 (3–12)	0.09
Incidental finding of prostate adenocarcinoma, n (%)	2 (25)	3 (14)	1.0
Median pathological weight of adenoma, grams (range)	121 (63–255)	103 (52–240)	0.17
Median postoperative PSA, ng/mL (range)	0.88 (0.1–1.4)	0.81 (0.007–5.2)	0.7
Mean postoperative PVR, ml (SD)	25.6 (36.2)	21.5 (29.5)	0.7
Patient-reported urinary continence, n (%)			
Completely continent	7 (87.5)	19 (90)	0.7
Minimal incontinence	0 (0)	2 (10)	
Moderate incontinence	0 (0)	0	
Severe incontinence	1 (12.5)	0	

OSP: open simple prostatectomy; PSA: prostate-specific antigen; PVR: postvoid residual; RASP: robotic-assisted simple prostatectomy; SD: standard deviation.

terms of blood loss, likely secondary to the small sample size, RASP was associated with a significantly lower postoperative decrease in Hb and blood transfusion rate.

The RASP cohort also had a shorter length of hospital stay, with a mean stay of one day (±0.46), compared to three days (±1.03) in the OSP group (p<0.005). A urethral catheter was left indwelling for 14 and seven days in all patients undergoing OSP and RASP, respectively, at the discretion of the operating surgeon. All patients were able to void spontaneously after the urethral catheter was removed and none of the patients required re-catheterization due to urinary retention. Median length of followup was 15 (range 3–81) and four (range 3–12) months for OSP and RASP, respectively. Most (92.8%) patients reported complete urinary continence at followup, with no statistical significance between the two surgical approaches (p=0.7). In the OSP group, one patient reported severe urinary incontinence and is planned to undergo insertion of an artificial urinary sphincter (AUS). Comparatively, in the RASP group, two patients (10%) reported minimal incontinence that required no further treatment. All preoperatively diagnosed hydronephrosis resolved on postoperative ultrasound imaging. The mean difference between the pre- and postoperative postvoid residual (PVR) was 364 ml (p=0.1). The median decrease in prostate-specific antigen following the surgical procedures was 5.91 (z=-3.75, p<0.0005).

There was no difference in pathological weight of resected adenoma between OSP and RASP approaches, with median weights of 121g (range 63–255) and 103 g (range 52–240), respectively (p=0.1). There was a significant difference between preoperative prostate volume estimation, by both abdominal US and TRUS, and resected adenoma weight by a median difference of 55g (z=-4.782, p<0.0005). In comparing both preoperative imaging modalities, TRUS and abdominal US, we report no significant differences between the two in the ability to estimate resected prostate size (p=0.3). Twenty-three patients (79%) were reported to have benign tissue in the pathology report. Three patients had an incidental finding of low-risk prostate adenocarcinoma, while three patients were found to have intermediate-risk prostate cancer.

The rate of perioperative complications was found to be significantly higher in the OSP group, with no complications being reported in patients undergoing RASP (p=0.04). In the OSP group, a total of six (75%) patients experienced postoperative complications. Two patients had a grade 1 Clavien Dindo complication, including one patient who had a urinary tract infection (UTI), which was treated with antibiotics; and a second patient with persistent gross hematuria that required prolonged continuous bladder irrigation until it resolved without further management. Two patients had a grade 2 Clavien Dindo complications and required a blood transfusion. Finally, two patients had a grade 3b Clavien Dindo complication; including one patient who developed a bladder neck stricture treated with bladder neck incision, and a second patient who developed significant urinary incontinence and is planned to undergo insertion of an AUS.

Discussion

We report on our experience with simple prostatectomies, for both OSP and RASP approaches, in the treatment of patients with large, obstructing prostates.

In our cohort, RASP was found to have a very good safety profile with minimal blood loss. The patients experienced an unremarkable postoperative period with no complications, short hospital stay, and excellent functional outcomes at followup.

The most recent European Association of Urology (EAU) guideline[8] indicates that the standard surgical techniques for simple prostatectomy are OSP, HoLEP, and bipolar enucleation. The guidelines conclude that both laparoscopic and

RASP seem comparable to OSP in terms of efficacy and safety, providing similar improvements in maximum urinary flow rate (Qmax) and International Prostate Symptom Score (IPSS). However, these results are based on retrospective studies. In the 2018 American Urological Association (AUA) guideline,[9] no surgical technique is specified as the preferred one, and it is advised to choose the technique according to the surgeon's expertise. Alternatively, the Canadian Urological Association (CUA) guideline[10] still recommends OSP as the first choice for the treatment of a large prostate, and does not include RASP as one of the potential management options. *(Editor's Note: The LUTS/BPH guideline is currently being updated and should be available by spring 2022.)*

Hoy et al described the initial Canadian experience with RASP.[5] They performed a retrospective chart review of four patients undergoing RASP and 28 undergoing OSP. They reported that RASP had significantly longer operative time (161 vs. 79 minutes, p=0.008) but a shorter length of hospital stay (2.3 vs. 5.5 days, p=0.0001). In their series, OSP was associated with higher blood loss (835.7 vs. 218.8 mL, p=0.0001); however, there was no significant difference in the overall complication rate between the two techniques.

In our study, we report similar results with regard to operative time and length of hospital stay; while we were unable to demonstrate a difference in intraoperative blood loss, OSP was associated with a significantly high postoperative Hb drop and blood transfusion rate. In addition, in our cohort, OSP was associated with a significantly higher complication rate (p=0.004).

Opponents of RASP have noted the longer operative time when compared to OSP and HoLEP. Studies comparing the operative times have reported that RASP took significantly longer than OSP (161 vs. 79 minutes, p <0.008)[1] and HoLEP (103 vs. 274 minutes, p<0.001).[8] In our study, we report statistically significant longer operative time in RASP, with a median operative time of 137.5 and 185 minutes for OSP and RASP, respectively (p=0.04). The longer operative time is likely due to the docking and undocking of the robot, as well as the extraction of the specimen.

Multiple studies have reported on the significantly decreased blood loss in minimally invasive simple prostatectomies when compared to OSP.[1,4,11,12] We report that the median estimated blood loss (EBL) in our cohort was 2300 ml and 100 ml for the open and robotic approaches, respectively. Two patients undergoing OSP received blood transfusions perioperatively, while none of the patients undergoing RASP required any blood products. To note, in our cohort, the indication in one of the patients undergoing OSP was severe recurrent hematuria. The patient required blood transfusions perioperatively. This may have resulted in skewing the results of EBL and blood transfusions. Nevertheless, we believe that the reduced blood loss in the robotic approach favors the robotic approach over the open procedure.

A literature review by Shah et al reported that major complications, considered as Clavien Dindo ≥3, were almost double in OSP compared to RASP.[1] The major complications noted were extensive bleeding, persistent hematuria leading to clots that required intervention, and bladder neck or urethral strictures. We report similar results, with postoperative complications occurring only in the OSP group (p=0.004). In our cohort, there were two grade 1, two grade 2, and two grade 3b Clavien Dindo complications in the OSP cohort.

It is well-documented that minimally invasive surgeries (MIS) usually result in a shorter hospital stay when compared to open procedures.[1] Mourmouris et al reported that hospitalization times were significantly shorter in RASP compared to OSP (3.4 vs. 8 days, p<0.001).[11] Our results mirror this finding, with the median length of hospital stay in our study being statistically longer in the OSP cohort (three days) compared to patients treated with RASP (one day) (p<0.005).

Studies comparing the functional outcomes of MIS, including both laparoscopic and robotic simple prostatectomy to OSP, have demonstrated that MIS offer similar improvement in patient-reported IPSS score, quality of life, Qmax, and PVR urine volume.[13,14] A previous prospective study demonstrated comparable functional outcomes with both RASP and OSP techniques.[9] A recently published prospective randomized control trial (RCT) comparing extraperitoneal laparoscopic simple prostatectomy (LSP), RASP, and HoLEP in prostate volumes ≥120 ml reported that LSP and RASP had equivalent efficacy, perioperative morbidity, and functional outcomes when compared to HoLEP.[15]

In our study, most patients in both groups reported excellent functional outcomes, with no significant difference between the two cohorts (p=0.7). In the OSP group, one patient suffered from severe urinary incontinence, whereas in the RASP group, two patients reported persistent minor incontinence, but they did not require any treatment. Unfortunately, IPSS scores were not collected within our series.

The opponents of RASP have noted the increased cost associated with robotic procedures. Sutherland et al compared the operative costs of RASP and OSP and found that the average cost for RASP was $5212 USD compared to $2415 USD for OSP.[3] On the other hand, Matei et al reported that RASP was actually less costly than OSP, mainly due to the associated longer period of bladder continuous irrigation, lower transfusion rate, and shorter length of hospital stay.[16] At our institution, we estimated the total cost of RASP to be $13 166 CAD per case. The estimated cost of OSP was found to be $10 052 CAD. These price estimates include the labor, instrumentation used during the procedure, robotic service contract, as well as the price of hospital stay.

In our study, we report on a significant discrepancy in preoperative prostate volume estimation and the volume of resected prostate adenoma reported by pathology. Both TRUS and abdominal US significantly over-estimated prostate volume preoperatively. A study by Matthews et al compared TRUS prostate volume estimates to volumes of unfixed radical prostatectomy specimens.[17] Authors reported that the preoperative estimates differed significantly from the volumes of corresponding prostatectomy specimens. In their study, they found that TRUS tended to over-estimate the volume in small prostates (<30 ml) and under-estimated the volume in large (>50 mL) prostate glands. Studies comparing TRUS to abdominal US reported a strong correlation between the transrectal and transabdominal approaches, with no statistically significant differences.[18,19] In our study, we report that both abdominal US and TRUS significantly over-estimated the prostate volume by a median difference of 55 cm^3 ($p<0.0005$). Although the whole prostate is not removed in simple prostatectomies, which affects the postoperative pathology prostate weight, we believe that this over-estimation is significant and may have impacted preoperative surgical decision-making and patient counselling. When comparing the preoperative volume assessment using TRUS and abdominal US with the final volume of resected adenoma in the pathology report, we found no significant differences between the two modalities (p=0.3).

To our knowledge, our study is the largest series of RASP described in Canada. However, there are some limitations. First, the cohort is relatively small and retrospective, with the inherent biases. In addition, all robotic surgical procedures were performed by a single experienced surgeon and, thus, generalization of the results would need to be evaluated. Third, we do not routinely record IPSS scores and uroflowmetry perioperatively and, therefore, we are unable to report on functional outcomes with that tool. Fourth, OSP were performed several years prior to RASP and, thus, a true contemporaneous comparison cannot be made. Fifth, the followup time in the RASP group was shorter than the OSP group, making it difficult to compare long-term results and complications. A randomized, prospective study would be required to improve the level of evidence.

Conclusions

Our experience demonstrates excellent functional results for both OSP and RASP. Furthermore, our experience with RASP exhibits the feasibility at a Canadian urological center.

RASP was associated with low blood loss, shorter length of hospital stay, and a lower complication rate when compared to OSP. The main disadvantages we identified with the robotic approach were the longer operative time and higher cost. We believe that both OSP and RASP are excellent choices in treating men with enlarged obstructing prostates. Our study has demonstrated that RASP can be safely and effectively performed in centers with sufficient expertise, with excellent postoperative outcomes.

Competing interests: The authors do not report any competing personal or financial interests related to this work.

This paper has been peer-reviewed.

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