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# Minimally invasive simple prostatectomy: Robotic-assisted versus laparoscopy. A comparative study

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**Summary**

***Purpose:** Robotic-assisted simple prostatectomy (RASP) is a novel surgical procedure for the management of obstructive symptoms caused by enlarged prostate glands. Before the introduction of minimally invasive techniques, the standard approach was the open simple prostatectomy (OSP). The aim of our study was to compare intraoperative and perioperative outcomes of robotic (RASP) and laparoscopic (LSP) simple prostatectomy.*
***Methods:** We retrospectively analyzed data from patients who underwent minimally invasive simple prostatectomy at the Urological Department of Portogruaro Hospital, Portogruaro, and at the Urological Department of "San Bassiano" Hospital, in Bassano del Grappa, from March 2015 to December 2020. Data collected from medical records included age, body mass index, prostate volume, operative time, preoperative International Prostatic Symptoms Score (IPSS), postoperative IPSS, time with drainage, blood transfusion, intraoperative complications, perioperative complications and length of hospital stay.*
***Results:** Robotic-assisted (n = 25) and laparoscopic simple prostatectomy (n = 25) were performed with a transvesical approach. No significant differences were observed regarding baseline characteristics, body mass index, prostate volume and IPSS. Operative time was lower in the laparoscopic group (122 min vs 139 min) (p = 0.024), while hospital stay was lower in the robotic group (4 days vs 6 days) (p = 0.047).*
***Conclusions:** Robotic-assisted simple prostatectomy is a safe technique with results comparable to laparoscopic simple prostatectomy, encompassing the advantage of a shorter hospitalization. Considering the costs and the limited availability of robotic-assisted simple prostatectomy, laparoscopic simple prostatectomy is a valid and safe alternative for experienced surgeons.*

*KEY WORDS: Minimally invasive simple prostatectomy; Benign prostatic hyperplasia; Laparoscopy; Robotic-assisted surgery.*

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## INTRODUCTION

Benign prostatic hyperplasia (BPH) represents one of the most common diseases in ageing men, affecting over 210 million men worldwide. Up to 50% of men over 50 years experience *lower urinary tract symptoms* (LUTS) from BPH, requiring medical or surgical therapy (1). Although medical therapy could provide, in selected patients, satisfying results, the superior efficacy and cost-effectiveness of surgery have led more patients and physicians to prefer the surgical approach (2, 3). In addition, urinary retention, impaired renal function and dilatation of the upper urinary tract secondary to obstruction represents a strong indication toward a surgical approach (4).
The *European Association of Urology* (EAU) guidelines currently recommends, for prostate larger than 80 ml, simple prostatectomy, bipolar or monopolar enucleation or laser enucleation/vaporization of the prostate (5).
Before the introduction of minimally invasive techniques, as well as novel endoscopic laser approach, *open simple prostatectomy* (OSP) was considered the gold standard treatment. Despite favorable functional outcomes, which comprehend decreased symptoms score, increased flow and decreased post-void residual, OSP is usually associated with substantial peri and postoperative complications (including prolonged catheterization time, increased estimated blood loss and length of hospital stay), reaching a morbidity rate of 42% and a transfusion rate of 24% (6). In order to overcome those limitations, a variety of minimally invasive surgical techniques have been explored to treat large obstructing prostate adenomas. Since the first *laparoscopic simple prostatectomy* (LSP) described by *Mariano et al.*, the minimally invasive approach for BPH has widely and quickly extended, up to include the robotic approach, the *robot-assisted simple prostatectomy* (RASP) (7, 8). Minimal invasive simple prostatectomy, including laparoscopic or robot-assisted approach, presents similar efficacy and safety compared to OSP, although data are still lacking and both procedures should be considered as under investigation (9, 10).
The aim of our study was to compare peri and postoperative outcomes of RASP and LSP in two experienced centers.

No conflict of interest declared.

## Methods

Consecutive patients who underwent minimally invasive prostatectomy from March 2015 to December 2020 at the *Urological Department of Portogruaro Hospital, Portogruaro*, and *Urological Department of "San Bassiano" Hospital, Bassano del Grappa*, were retrospectively analyzed. No specific criteria were used to assign patients to either laparoscopic or robotic procedures. Prostate volume was assessed by *transrectal ultrasound* (TRUS). All procedures, in both hospitals, were performed by an experienced surgeon as first operator. Data collected from medical records were age, body mass index, prostate volume, surgical approach, operative time, blood loss, time with drainage, blood transfusions, intraoperative complications, pre and postoperative *International Prostate Symptom Score* (IPSS) (collected at least 6 months after surgery), perioperative complications and length of hospital stay. No patients underwent prior abdominal/pelvic surgery.

### *Laparoscopic simple prostatectomy*

After the induction of general anesthesia, the patient was positioned supine and in slight Trendelenburg on the surgical table. The procedure was performed via transperitoneal approach. A skin incision was made at the umbilical level, entering the abdominal cavity using the Hasson technique and inducing the pneumoperitoneum at 20 mmHg. Five trocars were successively positioned, after the insertion of a 18 F urinary catheter. A 12-mm Hasson trocar for the insertion of 0° optic was placed at the umbilical incision while another 12 mm trocar was positioned along the right margin of lateral rectus, a finger lower on umbilical line, for the insertion of the Harmonic, monopolar scissors, or needle driver. A 5 mm trocar was positioned on the contralateral side (left margin of lateral rectus) for the insertion of a bipolar grasper or needle driver while a 12 mm trocar was placed laterally (8-10 cm from the umbilical trocar) on the right side. Finally, a 5 mm trocar for the suction device was similarly positioned, contralaterally (Figure 1).

The fat covering the prostatic capsule was dissected, while bladder and prostate were identified by moving the urinary catheter. A longitudinal incision was performed approximately 1cm below the bladder neck. Stay sutures were placed between the edges of the open bladder to skin on each side. Ureteral ostia were consequently identified while Harmonic was used for the exposure and development of the plane between the surgical prostate capsule and the adenomatous tissue, proceeding, bluntly, towards the prostatic apex. Using the urinary catheter to facilitate the identification of nearby structures, the dissection proceeded until the whole adenomatous tissue has been freed, separating, carefully, the urethra. After the excision of the adenoma, the specimen was temporarily placed in the lateral prostatic fossa, waiting for further removal. Trigonization was accomplished by two or four sutures of 2-0 Vycril placed posteriorly to the bladder neck and to the internal posterior prostatic fossa. The urinary bladder catheter was then replaced with a 22F irrigation catheter.

### *Robotic-assisted simple prostatectomy*

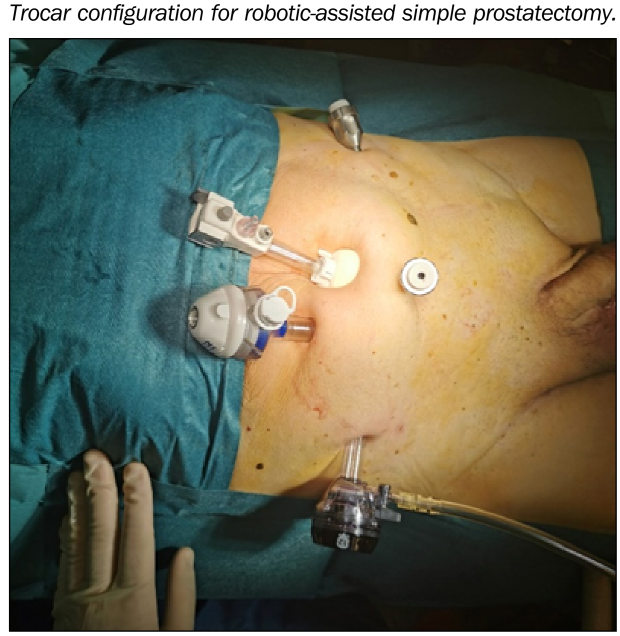
Camera port (12 mm) was placed in a midline supraumbilical position. A 12-mm assistant port was placed about 3 cm medially to the right iliac crest. On the left-hand side, an 8-mm robotic port, for the fourth arm, was inserted exactly in the corresponding position of the 12-mm assistant port on the right side. Two robotic 8-mm trocars were placed para-rectally on the left- and right-hand sides in a more caudal position, at a distance of about 10 cm from the camera port. Lastly, a 5-mm assistant port was placed midway between the camera port and the right robotic port. The procedure was then identical to the laparoscopic one (Figure 2).

### *Statistical analysis*

Descriptive statistics were reported as median and *interquartile range* (IQR) for continuous variables, while frequencies and percentages were obtained for categorical

***Figure 1.***
*Trocar configuration for laparoscopic simple prostatectomy.*

***Figure 2.***
*Trocar configuration for robotic-assisted simple prostatectomy.*



variables. According to the non-normality of data, assessed via the Kolmogorov-Smirnov test, Mood's Median Test was utilized, considering, as statistically significant, $p < 0.05$. Statistical analysis was performed using IBM SPSS Statistics® software (*IBM Corp. Released 2017; IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY*).

## Results

50 simple prostatectomies were performed with a minimally invasive approach. 25 were performed as LSP and 25 as RASP. All cases were successfully performed without proceeding to open surgery conversion and no patient repositioning or change in port assignment/redocking was needed. Median age of patients involved was 71.5 (58-81) while median BMI was 25 (20-38) kg/m$^2$. Both groups were comparable in terms of age, BMI, prostate volume and preoperative IPSS (Table 1). Regarding operative findings, both groups were comparable in terms of blood loss, transfusion rate and complications, albeit patients who underwent RASP reported a longer operative time (139 min; IQR 108-225) compared to patients who underwent LSP (122 min; IQR 110-150) ($p = 0.024$). Overall, median length of hospitalization was 5 days, with a slightly shorter hospitalization in RASP patients (4 days; IQR 3-6) compared to LSP patients (6 days; IQR 4-10) ($p = 0.047$). Median drainage time was 4 days. All patients had urinary catheter until hospital discharge. Five patients needed a transfusion, and four intraoperative complications were recorded. Postoperative IPSS score was comparable in both groups.

## Discussion

Our results suggest that both laparoscopic and robotic prostatectomy can be associated with limited blood loss, short postoperative recovery, and low postoperative complications. Compared to OSP, those characteristics represent a clear advantage. OSP is indeed a demanding procedure, associated with significant perioperative morbidity, that correlates with prostate volume, and blood loss (6). Minimally invasive approaches as LSP and RASP allow minimizing blood losses due to different factors: the use of cauterizing instruments during the enucleation of the adenoma from the surgical capsule; the compressive effect of insufflation gas on vessels; the better visualization of bleeding points provided by a better view. The increased field of view associated with both techniques permit, indeed, to manage perioperative bleeding and avoid potentially serious complications as urethral injury, ostia injury or improper dissection plane. As result, the utilization of OSP is steadily decreasing, in favor of minimally and endoscopic approaches, considering, in particular, comparative results in terms of functional outcomes (11-13). In addition, the use of a minimally invasive approach reduces operative time and length of hospital stay, although its cost-effectiveness is still controversial (14, 15). In our study, we sought to compare operative and functional outcomes of both minimally invasive approaches, LSP and RASP. Despite both techniques could be performed via transperitoneal or extraperitoneal approach, in order to minimize potential biases and further considering our higher experience with the laparoscopic transperitoneal approach, both procedures were performed as transperitoneal (16). In addition, we performed in both techniques (LSP and RASP) a transvesical approach. The reason is related, partly to the higher experience with this technique, partly to the possibility of directly visualizing the prostatic adenoma, exploring the bladder and, more importantly, the bladder neck. A possible limitation of this approach, however, is related to the limited visualization of the apex and the potential difficulty in controlling bleeding compared to the retropubic (or Millin) technique. The latter permit, indeed, to properly visualize the remnant adenoma and properly expose the prostate, allowing better control of bleeding (17). Despite those differences, however, clinical outcomes are similar (18). Although data are quite explicative, a few comments are interesting. As reported by our findings, LSP reported a shorter operative time compared to RASP. This could be related, however, to the time needed to dock and prepare the robot, consistently with data reported in the literature (19). Similarly, blood loss and transfusion rates among both approaches were comparable, as well as complications rates (20).

Finally, the length of hospital stay was slightly favoring RASP and this could be explained by an improved field of view which permit to avoid unnecessary maneuvers on the gastrointestinal tract and, consequently, a faster recovery. Anyway, this difference was quite clinically insignificant and could be also related to differences related to non-medical factors.

Lastly, although we did not mainly consider the transurethral approach, it has to be acknowledged that the use of novel and powerful lasers which permit, safely and effectively, the enucleation of large prostatic adenomas, represents an important and feasible alternative to OSP in minor centers which do not have the robotic-assisted surgery or enough experience with the laparoscopic approach. In particular, as reported by Schiavina et al., with the same effectiveness in clinical outcomes, *Holmium laser enucleation of the prostate* (HoLEP) yielded significantly lower costs compared to OSP (2174.15€ *versus* 4064.97€) (21). However, a relative limitation of HoLEP is related to the necessity of performing at least 25-50 cases to achieve a significant efficacy in this approach (22).

We are conscious of several limitations afflicting our study. Firstly, the retrospective nature of our work. Secondly, the

***Table 1.***
*Baseline and perioperative outcomes.*

| | LSP n = 25 | RASP n = 25 | P |
|---|---|---|---|
| Age, years | 72 (65-79) | 71 (58-81) | 0.572 |
| BMI | 25,5 (21-30) | 25 (20-38) | 0.776 |
| Prostate volume, ml | 141 (100-210) | 135 (94-245) | 0.777 |
| Operative time, min | 122 (110-150) | 139 (108-225) | 0.024 |
| Blood loss, ml | 150 (100-500) | 150 (50-250) | 0.753 |
| Preop IPSS | 29.5 (23-35) | 29 (22-32) | 0.777 |
| Postop IPSS | 7 (3-9) | 3 (2-7.25) | 0.396 |
| Drainage time, days | 5 (3-7) | 5 (2-12) | 0.396 |
| Blood transfusion | 4 (16%) | 1 (4%) | 0.346 |
| Intraop complication | 2 (8%) | 2 (8%) | 0.602 |
| Periop complication | 2 (8%) | 4 (16%) | 0,663 |
| Lenght of hospital stay, days | 6 (4-10) | 4 (3-6) | 0.047 |

limited sample size, partly explained by the limited use of robotic-assisted surgery for non-oncologic diseases. Thirdly, the lack of a standardized follow-up and the potential differences in non-medical factors among hospitals.

## Conclusions

RASP is a safe and efficient technique, showing results comparable to LSP, with the advantage of lower blood loss and hospitalization. Taking into consideration the costs of RASP and the unavailability of robot-assisted surgery in small centers, LSP still represents a valid and safe alternative in the hand of an experienced surgeon.
Further studies are necessary to properly evaluate the cost-effectiveness of minimally invasive surgery compared to endoscopic approaches.

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