RESEARCH ARTICLE

Revolutionizing the management of enlarged prostate: unveiling the success of robot-assisted simple prostatectomy using Versius robotic system

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Abstract

Objective: : To assess the outcomes of robot-assisted simple prostatectomy by analysing postoperative complications and patient-reported outcomes, and to scrutinise the effectiveness and safety of a surgical robotic system.

Method: The prospective cohort study was conducted at the Department of Robotics and Minimally Invasive Urology, Sindh Institute of Urology and Transplantation, Karachi, from November 2021 to June 2023, and comprised patients with treatment-resistant lower urinary tract symptoms attributed to significant prostatic enlargement exceeding 80ml on transrectal ultrasound, and who were slated for robot-assisted simple prostatectomy. Perioperative and postoperative data was noted along with outcomes and complications. Data was analysed using SPSS 25.

Results: There were 82 male patients with mean age 66.6±8.88 years, mean duration of lower urinary symptoms 4.59±1.59 years, and mean volume of prostate 133.24±27.31ml. The mean procedure time was 160.56±33.04 minutes, and mean blood loss was 678.05±314.85ml. Baseline maximum flow rate on uroflowmetry was 5.86±1.59ml/s compared to 17.00±7.57ml/s postoperatively (p=0.0001).

Conclusion: The robot-assisted simple prostatectomy was found to be a safe procedure with acceptable patient outcomes.

Keywords: Benign prostatic enlargement, Robot-assisted simple prostatectomy, Lower urinary tract symptoms, Versius robotic system. (JPMA 75: 1354; 2025) **DOI: https://doi.org/10.47391/JPMA.20402**

Introduction

Benign prostatic enlargement (BPE) poses a significant health concern, leading to lower urinary tract symptoms (LUTS), particularly affecting around 80% of elderly men. The progression of these symptoms, despite lifestyle modifications, and the inadequate response to standard treatments are often correlated with the enlargement of the prostate, specifically when it exceeds 80ml.[1,2]

As per the American Urological Association (AUA) recommendations, patients with renal insufficiency, recurrent urinary tract infections, bladder stones, or gross haematuria due to BPE, as well as those with LUTS refractory to other therapies and medical management, are all candidates for surgery.[2] Transurethral resection of the prostate (TURP), the traditional surgical therapy for BPE, has its limitations due to the prostate's size and the length of time needed to perform the procedure. As a result, uncomplicated prostatectomy has emerged as the standard treatment for these men.[3,4]

For men grappling with moderate to severe LUTS and a prostate volume exceeding 80ml, open simple prostatectomy (OSP) stands as the gold standard surgical therapy.[4] However, this approach comes with substantial risks, including bleeding, the necessity for blood transfusion, and the potential need for revision surgery. To address these challenges, minimally invasive surgical techniques, such as laser enucleation and robot-assisted prostatectomy, have been introduced into clinical practice. Although laser enucleation demonstrates efficacy, its adoption is hindered by a steep learning curve and its association with persistent stress urine incontinence (SUI).[3,5-7]

Robot-assisted simple prostatectomy (RASP) has emerged as a promising alternative, with successful implementations.[8] The inception of RASP suggests a potential reduction in invasiveness compared to OSP. Nevertheless, the effectiveness of RASP and OSP remains a subject of ongoing debate regarding their roles as suitable treatments for significant BPE.[8,9]

The global medical community has conducted numerous studies employing various robotic surgical systems to explore the outcomes of these interventions. Despite these efforts, substantial variations in results persist, contributing to the ongoing discourse surrounding the optimal surgical approach for addressing significant BPE.[9-13]

The current study was planned to assess the outcomes of RASP by analysing postoperative complications and patient-reported outcomes, and to scrutinise the

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effectiveness and safety of a surgical robotic system.

Patients and Methods

The prospective cohort study was conducted at the Department of Robotics and Minimally Invasive Urology, Sindh Institute of Urology and Transplantation (SIUT), Karachi, from November 2021 to June 2023. After approval from the institutional ethics review committee, the sample size was calculated using OpenEpi[14] calculator with the help of formula (n=[Np(1-p)]/[(d2/Z21-α/2(N-1)+p(1-p)])[15] with 95% confidence level. The sample was raised using non-probability consecutive sampling technique. Those included were patients with refractory LUTS due to prostatic enlargement, having size >80ml on transrectal ultrasound (TRUS), and who were planned for RASP. Patients with bleeding disorders, chronic liver disease, uncontrolled diabetes mellitus, and those not fit for general anaesthesia were excluded.

After taking informed written consent, baseline serum prostate-specific antigen (PSA) of each patient was assessed a week before surgery. Each patient was admitted in the ward at least one day prior to surgery for anaesthesia and cardiac re-evaluation. Patients with positive urine culture were treated with antibiotics according to culture and sensitivity. Prophylactic anticoagulation with enoxaparin sodium 1mg/kg by subcutaneous route was administered to each patient along with deep vein thrombosis (DVT) stockings 12 hours prior to surgery. Prophylactic broad-spectrum antibiotics were administered to each patient at the time of anaesthesia induction after giving a test dose.

Following the administration of anaesthesia in a sterile environment, the patient was positioned supine, and an 11mm camera port was inserted sub-umbilically using an open technique. Pneumoperitoneum was established by insufflating carbon dioxide (CO_2) at a pressure of 12-14mmHg. Under laparoscopic guidance, three 5mm robotic arm ports were subsequently inserted: one at the lateral border of each rectus abdominis, 10cm away and slightly below the camera port; and two fingerbreadths above and medial to the anterior superior iliac spine. Additionally, a 5mm assistant port was placed at the level of the umbilicus and the midpoint of an imaginary line between the two robotic ports on the left side. Another 12mm assistant port was inserted two fingerbreadths above and medial to the right anterior superior iliac spine. In total, six ports were inserted (Figure 1).

Following port placement, the patient was repositioned into the reverse Trendelenburg position (Figure 2). The surgery was conducted by a skilled robotic surgeon utilising the transperitoneal trans-vesical technique with

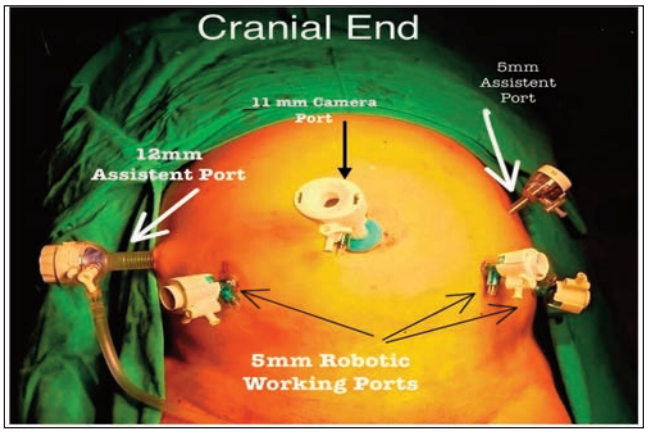

Figure-1: Surgical port placement for robotic-assisted prostatectomy.

Figure-2: Positioning of the patient in reverse trendelenburg position for robotic-assisted prostatectomy.

the Versius surgical robotic system. Specimens were removed by extending one of the assistant ports, measured with scales, and weighed. A single intraperitoneal drain was inserted, and port-site wounds were closed with Polyglactin 1-0 suture. After the completion of surgery and the reversal of anaesthesia, the patient was monitored in the recovery room for 2-3 hours before being transferred to the high dependence unit (HDU) once fully awake.

Early mobilisation for each patient, coupled with physiotherapy, was strongly encouraged. Patients remained admitted until their drain output was nil or <50ml/24 hours. Stable patients were discharged after drain removal, with instructions to follow up in the outpatient department (OPD) for catheter removal and a trial of voiding without a catheter.

Post-discharge, each patient was followed for three months to assess postoperative complications, urinary flow rate, and post-void residual (PVR) volume. Patient data, including age, residence (urban/rural), duration of symptoms, prostate volume on TRUS, serum PSA, body mass index (BMI), operative time, blood loss, blood product transfusion, volume of the removed specimen, hospital stay, duration of catheterisation, conversion to open

surgery, system malfunctions (technical glitches and/or instrument clashes), preoperative international prostate symptom score (IPSS)[16] pre- and post-operative maximum flow rate (Qmax), PVR volume, and complications according to the Clavien Dindo Classification (CDC)[17] system, were recorded in a pre-designed proforma.

Data was analysed using SPSS 25. Quantitative data was presented as mean±standard deviation. Qualitative data was presented as frequencies and percentages. Effect modifiers were studied by data stratification. Chi-square test or paired *t*-test was used to compare pre- and post-operative data. P≤0.05 was taken as statistically significant.

Results

There were 82 male patients with mean age 66.6±8.88 years, and mean BMI 29.5±5.4kg/m^2. There were 12(14.6%) patients having rural residence, while 70(85.4%) had urban residence.

Mean duration of LUTS was 4.59±1.59 years, mean size of prostate was 133.24±27.31g, mean serum PSA was 6.5±3.3ng/dl, mean preoperative PVR volume was 392.56±161.75ml, and mean preoperative IPSS was 26.27±1.61.

The mean procedure time was 160.56±33.04 minutes, mean blood loss was 678.05±314.85ml, mean length of hospital stay (LOS) was 4.07±1.79 days, and the mean duration of catheterisation was 7.03±3.73 days.

There were 30(36.5%) patients requiring blood transfusion. Overall, 6(7.3%) patients had concomitant vesical calculus. Conversion to open procedure was required in 8(9.8%) patients; in 4(50%) such patients, there was system malfunction, while in the other 4(50%) patients, there was haemorrhage compromising vision. On measurement, the mean weight of the specimen was 130.05±15.77g (Figure 3).

At 3-month follow-up, 40(48.7%) patients remained free of complications, while 34(41.4%) encountered CDC grade-I and grade-II complications that were managed by either observation or pharmacological treatment. CDC grade-III complications were observed in 7(8.5%) patients. There was 1(1.2%) case of CDC-IV complication (Table). Mean post-surgery PVR was 34.70±14.66ml that was significantly lower than pre-procedure PVR (p<0.0001). Baseline Qmax on uroflowmetry was 5.86±1.59ml/s compared to 17.00±7.57ml/s postoperatively (p=0.0001).

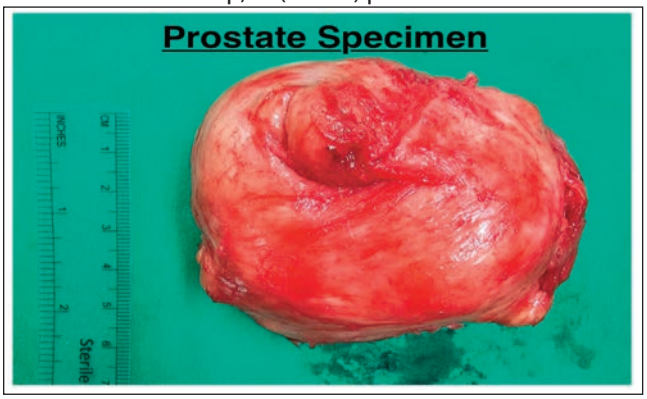

Figure-3: A gross specimen of prostate removed by robotic-assisted prostatectomy and its size.

Table: Descriptive data along with complications of patients undergoing robotic-assisted prostatectomy for the treatment of benign prostatic hyperplasia (BPH).

		Mean±SD
Age (years)		66.6±8.88
Duration of lower urinary tract symptoms (years)		4.59±1.59
Pre-operative Serum PSA (ng/dl)		6.5±3.3
Prostatic Volume on TRUS (cm3)		133.24±27.31
Preoperative Maximum flow rate (Qmax)		5.86±1.59
Preoperative post void residual volume (ml)		392.56±161.75
Operative time (minutes)		160.56±33.04
Blood loss (ml)		678.05±314.85
Specimen Weight (grams)		130.05±15.77
Hospital Stay (Days)		4.07±1.79
Duration of catheterisation (Days)		7.03±3.73
Postoperative Maximum flow rate (Qmax)		17.00±7.57
Postoperative post void residual volume (ml)		34.70±14.66
Complications	**Clavien Dindo Grade**	**n (%)**
Fever	Grade-I	11 (13.4)
Port site Wound Infection	Grade-II	5 (6.09)
Paralytic Ileus	Grade-II	7 (8.5)
DVT	Grade-II	4 (4.8)
Haematuria	Grade-II	7 (8.5)
Rectal Injury	Grade-III	3 (3.6)
Wound dehiscence	Grade-III	4 (4.8)
Death	Grade-V	1 (1.2)

PSA: Prostate-specific antigen, TRUS: Transrectal ultrasound, SD: Standard deviation.

Upon stratification by age (<65 years vs ≥65 years), prostate volume (80-100ml vs >100ml), BMI, diabetes and hypertension, none of the factors had a significant impact on key outcomes, including operative time, blood loss, complication rates, or post-operative Qmax and PVR volume (p>0.05).

Discussion

To the best of our knowledge, the current study is the first from a developing country using Versius robotic system.

Problems have been linked to TURP, which has been considered for a long time to be the standard surgical therapy for BPE. These problems include the risk of bleeding and TURP syndrome. The likelihood of experiencing issues rises in proportion to the size of the prostate.[18]

The success rate of surgery and the incidence of complications can both be improved by using alternative techniques. Patients with severe BPE have found RASP to be an effective therapeutic option. When tested on patients with prostates >80ml, RASP was effective. The perioperative mortality and postoperative complications of RASP are higher than those of OSP despite its lower transfusion rate, shorter indwelling catheter length, and shorter LOS.[13,19]

In a study, the mean operative time was 182±25.41 minutes, transfusion was required in 9.4%, mean catheter removal time was 5±1.5 days, mean LOS was 5±1.96 days, mean IPSS was 5.2±2.21, mean post-op PVR was 24.9±3.41ml compared to mean pre-op PVR 177.5±10.74ml, postoperative complications were noted in 25% patients, and conversion to open surgery was need in 0%.[10]

Another study reported mean operative time 133.6±14.41 minutes, mean catheter removal time 3±1.3 days, mean LOS 3.4±1.45 days, mean pre-op PVR 178.5±14.34ml, mean post-op PVR 25.5±4.21ml, postoperative complications 3.8% and zero conversion to open surgery.[9] Another study reported mean operative time was 150±17.43 minutes, transfusion required in 8%, mean catheter removal time 7±2.4 days, mean LOS 3±1.31 days, mean IPSS 6±2.14, mean pre-op PVR 175±12.26ml, mean post-op PVR 30±9.74ml, postoperative complications 30% and zero conversion to open surgery.[11]

Steinberg et al.[12] reported remarkable outcomes in terms of mean catheter removal time (1.9±0.5 days) and mean LOS (1.1±0.43 days), that were much lower than the current findings. Results of Dotzauer et al.[13] were comparable to the current study with mean blood loss 248±363 ml, mean catheter removal time 6±3.1 days, mean operative time 182±45 minutes, transfusion required in 8%, and CDC >II complications 23%.

When the optical and articular apparatus of the robot are utilised during the surgical intervention, the level of accuracy achieved by the procedure is improved. When compared to other surgical techniques, the RASP learning curve is typically considered to be easier for surgeons to navigate. In addition, it is simpler to carry out on patients compared to traditional laparoscopy. The similarity between this procedure and robot-assisted radical prostatectomy is one factor that contributes to its high rate of success.[15]

According to the most recent set of recommendations issued by the European Association of Urology (EAU), the conventional surgical procedures for performing a simple prostatectomy are OSP, Holmium laser enucleation of prostate (HoLEP), and bipolar enucleation.[20]

In terms of effectiveness and safety, the recommendations found that laparoscopic and RASP were on par with OSP, both increasing Qmax and decreasing IPSS.[18] However, these findings rely on research that looked backward rather than forward. According to the recent recommendations from the European Urological Association (EUA) and the Canadian Urological Association (CUA), surgeons should select an appropriate surgical approach based on their own knowledge and experience.[20,21]

Hoy et al. detailed the early RASP implementation in Canada. Four RASP patients and 28 OPS individuals had their medical records reviewed retrospectively. While RASP cases required a longer surgical time (161 vs 79 minutes), LOS was 2.3 days compared to 5.5 days.[22]

Similar outcomes were observed in the current study regarding operational time, LOS, intraoperative blood loss, and the need for blood transfusions.

In another study, RASP was shown to have a substantially longer operating time than OSP (161 vs 79 minutes; p=0.001) or HoLEP (103 vs 274 minutes; p=0.001).[21] The current investigation showed that, on average, RASP took 160.56 minutes to complete. Time spent docking and undocking the robot, as well as specimen removal, certainly contributed to the lengthier total operating time.

Minimally invasive simple prostatectomies have been shown in many trials to dramatically reduce blood loss compared to open simple prostatectomy.[9,23] It has been shown time and again that patients may expect to spend less time in the hospital following minimally invasive operations as opposed to open ones. Hospital stays were much lower in RASP than in OSP (3.4 days vs. 8 days), according to a stusy.[9] The current findings corroborated the observation, with a mean LOS of 4.07 days.

Functional outcomes of laparoscopic and robotic simple prostatectomy have been studied and found to be comparable to those of OSP in terms of improvement in IPSS, quality of life, Q-=max, and PVR.[22,24,25]

Functional effects from RASP and OSP were shown to be equivalent in a prior prospective analysis. When comparing laparoscopic simple prostatectomy (LSP), RASP and HoLEP for prostate volumes 120ml, a prospective randomised control trial (RCT) found that LSP and RASP were equal in effectiveness, perioperative morbidity and functional results.[20,25]

The current study has llimitations which include a short follow-up period because long-term complications, like

post procedure bladder neck stenosis and stricture urethra, usually take some time to develop. Another limitation is the non-inclusion of quality of life and sexual health post-procedure as assessment markers. The single-arm design of the study is another limitation that warrants future prospective studies where outcomes of all surgical modalities, such as laser enucleation of prostate, RASP and open prostatectomy, need to be compared.

To determine RASP's usefulness in the present surgical care of BPE, further prospective research is needed, focussing on cost-effectiveness analysis, quality of life assessments, and long-term follow-up studies. Additionally, RCTs comparing RASP with open and minimally invasive alternatives are essential to define its precise role in the treatment landscape of BPE.

Conclusion

The RASP was found to be safe with acceptable patient outcomes.

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Conflict of Interest: None.

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HHQ: Study concept, data collection and literature review.
NAM: Concept, study design, data analysis, drafting, data interpretation and literature review.
RM: Concept, data analysis, drafting, literature review and final approval.
RAL: Literature search, literature review, drafting and critical analysis.
MF: Concept, literature search, literature review and critical analysis.
UQ: Study design, data analysis, literature review and drafting.