

Henry Ford Health

Henry Ford Health Scholarly Commons

Urology Articles

Urology

6-1-2023

Solving clinical challenges in prostate cancer using the single-port robot system

Alison Levy

Samantha Wilder

Mohit Butaney

Sami Majdalani

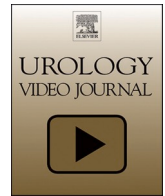
James O. Peabody

See next page for additional authors

Follow this and additional works at: https://scholarlycommons.henryford.com/urology_articles

Authors

Alison Levy, Samantha Wilder, Mohit Butaney, Sami Majdalani, James O. Peabody, Wooju Jeong, and Craig G. Rogers



Solving clinical challenges in prostate cancer using the single-port robot system

Alison Levy, Samantha Wilder^{*}, Mohit Butaney, Sami Majdalany, James Peabody, Wooju Jeong, Craig Rogers

Henry Ford Hospital, Vattikuti Urology Institute, 2799 W. Grand Boulevard, Detroit, MI 48202, USA

ARTICLE INFO

Keywords:

Minimally invasive surgery
Prostatectomy
Robotics
Single-port surgery
Prostate cancer

ABSTRACT

Objective: Patients who desire or require surgical management for prostate cancer, but are poor candidates for multi-port robotic surgery, can present a clinical challenge. Use of single port (SP) robotic technology may help overcome these challenges. We present our initial experience with robotic-assisted radical prostatectomy (RARP) using the da Vinci SP robot for prostate cancer in patients who would otherwise not be good surgical candidates for conventional multi-port transabdominal robotic surgery.

Patients and surgical procedure: Fourteen of 41 patients who underwent SP-RARP from November 2020 to February 2022 for biopsy confirmed, organ-confined prostate adenocarcinoma at a single tertiary care institution qualified for inclusion in our study due to specific considerations posing challenges for conventional multiport transperitoneal RARP. Perioperative metrics, pathologic findings and functional outcomes were collected prospectively. The accompanying video shows two cases demonstrating our transvesical and extraperitoneal approaches to SP-RARP.

Results: All patients underwent successful procedures without need to convert to multi-port robotic or open approach. Most patients had prior abdominal surgery (13/14, 93%) including aborted multi-port RARP (2), hernia repairs (5), bowel diversions (3), and peritoneal dialysis catheters (2) among others. Most underwent extraperitoneal (9/14, 64%) followed by transvesical (5/14, 36%) approach. There were no intraoperative complications and one Clavien III post-operative complication. Positive margin rate was 29%, most of which were microscopic (≤ 3 mm, 3/4, 75%). Eighty-five percent of patients had undetectable nadir PSA.

Conclusions: Our initial experience using the SP robot suggests that this technology can facilitate surgery for prostate cancer patients who might otherwise not be considered surgical candidates. Operative outcomes are not compromised despite a smaller incision and working space. We have found the SP system to be a valuable tool for carefully selected patients.

Introduction

Patients who desire or require surgical management for prostate cancer but are poor candidates for multi-port robotic surgery are a clinical challenge. Common reasons that multiport robotic prostatectomy cannot be performed are the presence of significant abdominal adhesions making placement of multiple transperitoneal ports unsafe, need for maintenance of peritoneal dialysis access, and inability to tolerate steep Trendelenburg position. Alternatives for treatment could include radiation or open prostate surgery but may be undesirable options in the setting of enlarged prostates, prior bowel surgery or inflammation, or in patients with transplants or who are awaiting

transplants. Additionally, open surgery is becoming increasingly rare and is associated with more frequent complications, and may confer worse continence and sexual outcomes [1].

The da Vinci Single Port surgical system (SP) (Intuitive, Sunnyvale, CA, USA) was approved by the United States FDA for use in urologic surgery in 2018. The SP system was designed to facilitate robotic surgery through a 3–4 cm skin incision to minimize morbidity without compromising surgical outcomes. Prostatectomy using a variety of surgical approaches has been described using the SP with acceptable clinical results [2,3]. The learning curve, robotic platform availability, and lack of demonstrated clear benefit has created some reluctance for widespread adoption. The smaller working space that facilitates

^{*} Corresponding author at: Henry Ford Hospital, Vattikuti Urology Institute, 2799 W. Grand Boulevard, Detroit, MI 48202, USA

E-mail address: Swilder2@hfhs.org (S. Wilder).

<https://doi.org/10.1016/j.urolvj.2023.100222>

Received 10 August 2022; Received in revised form 13 February 2023; Accepted 1 April 2023

Available online 3 April 2023

2590-0897/© 2023 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

extraperitoneal or transvesical access is a unique advantage of the SP system that led us to offer robotic assisted radical prostatectomy (SP-RARP) to some patients who would otherwise not be good surgical candidates for a conventional multi-port transperitoneal robotic approach. We present our initial experience performing SP-RARP for prostate cancer in this challenging group of patients.

Methods

Study entry criteria

Patients from a single tertiary care institution who underwent SP-RARP from November 2020- February 2022 were followed prospectively. Patients were included in this study if they had biopsy proven, clinically localized prostate cancer and underwent SP-RARP because they had specific considerations posing challenges for conventional multi-port transperitoneal robotic prostatectomy. SP-RARP was performed by one of three surgeons (CR, JP, WJ). Perioperative metrics, pathologic findings and functional outcomes were collected prospectively.

Surgical technique

Patient position and port placement were performed as described with minor adjustments depending on patient anatomy. As this study highlights our initial experience with the single-port robot, our procedure rapidly evolved with growing familiarity and evolving literature in the field. Nerve sparing was performed based on a discussion of patient priorities and disease characteristics. We used an extraperitoneal or transvesical approaches as previously described where the SP has a unique advantage [2,4]. The accompanying video shows two cases demonstrating examples of our transvesical and extraperitoneal approaches to SP-RARP.

Outcomes

The primary outcome was the ability to complete surgery without need for conversion to multi-port robotic or open approach or aborting for alternate therapy. Secondary outcomes were cancer control (undetectable PSA at nadir), social urinary continence and complication rate. The study was IRB approved.

Results

Baseline characteristics

Between November 2020 and February 2022, 41 patients underwent SP-RARP of which 14 met inclusion criteria for this study. Patient characteristics are listed in Table 1. Median patient age was 64 (IQR 61–66), median BMI 27.4 (IQR 24.9–29.4), median preoperative PSA was 6.8 (IQR 5.2–9.6). Eighty seven percent of patients had primary ISUP Grade group 1 or 2 on preoperative prostate biopsy.

All but one patient had prior abdominal or pelvic surgery. Two patients had previously undergone attempted multiport RARP that was aborted due to extensive abdominal adhesions. Three patients had history of bowel diversion. Two patients had peritoneal dialysis catheters and wished to avoid a transperitoneal approach that would require temporary transition to hemodialysis. One patient had a LVAD and was recommended to undergo single port extraperitoneal approach to minimize risk of bleeding, since he would be required to restart anticoagulation post-operatively. Five patients had prior hernia repairs with mesh. The patient who had no prior abdominal or pelvic surgery had a history of Crohn's disease and was referred for SP-RARP after tumor board discussion.

Table 1

Patient characteristics.

Parameter	N (%)	Median (IQR)
Age		64 (61–66)
BMI		27 (25–29)
Prior surgery	13 (93%)	
Hernia	5 (35%)	
Bowel diversion	3 (21%)	
Peritoneal dialysis catheter	2 (14%)	
LVAD	1 (7%)	
Other abdominal surgery	2 (14%)	
Crohn's disease	1 (7%)	
PSA before RP		6.8 (5.2–9.6)
Clinical stage		
cT1b	1 (7%)	
cT1c	12 (92%)	
Pathological stage		
pT2	8 (57%)	
pT3a	4 (29%)	
pT3b	2 (14%)	

Operative outcomes

All patients had successfully completed surgeries and there were no intraoperative complications. Most patients (9/14, 64%) underwent extraperitoneal SP-RARP and the remainder (5/14, 36%) underwent transvesical SP-RARP. Median length of stay was 1 day (range 1–2 days). Our standard practice is to leave urethral catheter in place for 7 days unless a bladder neck reconstruction or difficult anastomosis is performed in which case it is left in for longer. Median operative time was 282 min (range 178–334 min). There was one post operative complication in a patient who had an LVAD and restarted therapeutic anticoagulation several hours post operatively. This patient required return to the operating room for hematoma evacuation and anastomosis revision, which was performed using a multiport robotic approach. There were no conversions to open or multi-port robotic approach at the time of index surgery.

Oncological and functional outcomes

Four (29%) patients had positive margins on final pathology, most of which (75%, 3/4) were microscopic (≤ 3 mm). Positive margins were associated with Gleason 3 disease in 2 cases, Gleason 4 in 1 case, and one was not reported. Six patients upgraded ISUP Grade Group on final pathology whereas 2 patients downgraded. Eighty-four percent (11/13) of patients had undetectable PSA at nadir. Of the two patients with detectable PSA, one had Gleason 4 disease at the positive margin, the other had ISUP Grade Group 4 disease on final pathology and did not undergo a lymph node dissection. At one month 50% (6/12) patients were not using pads or had social continence.

Discussion

Our initial experience using the single-port robot suggests that the smaller required working space can facilitate surgery for prostate cancer patients who would otherwise not be considered surgical candidates for a conventional transperitoneal multiport approach. In carefully selected patients we have found the single port system to be a valuable tool to perform radical prostatectomy, particularly to facilitate an extraperitoneal or transvesical approach.

Prostatectomy using a SP surgical system was first described by Kaouk et al. in 2019 using an intraperitoneal approach [5]. Subsequently, reports of SP-RARP via extraperitoneal and transvesical approach were published and larger studies demonstrated safety and feasibility of these techniques [2,4]. Though the outcomes of experienced surgeons have been favorable, questions have been raised regarding widespread use of SP technology given no demonstrated

objective benefit. To our knowledge, no existing publications have specifically addressed the population of patients who would otherwise not be considered good candidates for a multi-port transabdominal approach.

Studies have shown that prior abdominal surgery, comorbidities, and increased operative time could all contribute to an increased length of stay and more complicated peri-operative convalescence [6]. In our series, all surgeries were successfully completed and we observed one serious post-operative complication. Our positive surgical margin rate of 29% was consistent with other contemporary published studies and during short-term follow up did not confer biochemical recurrence for Gleason 3 disease at the margin [7,8]. Our early oncological and functional outcomes associated with urinary continence are within acceptable ranges particularly for significant procedural change over this period.

During our study period, none of the patients that underwent transvesical SP-RARP underwent limited LND. Though limited LND has been demonstrated to be feasible during transvesical SP-RARP [2], limitations in performing extended LND via a transvesical approach have raised questions regarding its oncological safety. The extent of LND is still an area of controversy, with recent studies suggesting no difference in rates of biochemical recurrence between extended and limited LND in RARP [9,10]. Moreover, our study population consisted of patients who were not good candidates for a transabdominal approach, and therefore would have been unsuitable for transperitoneal extended LND (Table 2).

The aim of innovation in medicine and surgery is to improve care of individual patients. The patients included in this study desired extirpative surgery or were required to have their prostates removed to be eligible for organ transplantation. Each patient had a specific anatomical consideration that presented challenges to traditional, multi-port robotic RARP. The SP approach facilitated safe and successful surgery for all these patients. The decreased requirement of pneumoperitoneum, Trendelenburg position, and bowel manipulation from an extraperitoneal SP approach may have convalescence benefits, even in such a potentially highly comorbid patient population. As more surgeons utilize the SP system it is likely that improvements in technique and changes to the robotic system and instruments will contribute to procedural efficiency and innovation. With advancements, we will be able to safely offer robotic surgery to highly complex patients such as these.

This study has some limitations. Our findings may not be generalizable as the SP system is not currently available at all centers. However, the patients included in this study are more likely to have been referred to tertiary care centers due to factors that make them challenging surgical candidates. Our series highlights a sample of patients where utilization of the SP robot reduced risk compared to otherwise more complex surgeries potentially aiding both the patient and the surgeon. We were unable to report potency outcomes in this series due to incomplete data and identified this as an opportunity for quality improvement given the major impact on patient quality of life.

In summary, our study supports that the single-port robot may facilitate prostatectomy in patients who are not ideal candidates for multi-port transperitoneal robotic surgery and that perioperative outcomes are not compromised despite a smaller incision and working space. We have found the single port system to be a valuable tool for carefully selected patients.

Table 2
Peri-operative outcomes.

Parameter	
Surgical approach	
Extraperitoneal	9 (64%)
Transvesical	5 (36%)
OR time, median (IQR)	282 (254–308)
EBL (ml), median (IQR)	100 (56–150)
Positive margin, n (%)	4 (29%)
Length of stay (days), median (IQR)	1 (1,1)
Complications	
Clavien I	0
Clavien II	0
Clavien III	1
Undetectable PSA nadir	11/13 (85%)
30-day social continence rate	6/12 (50%)

Patient consent statement

Written, informed consent was obtained from all patients included in the study, including the use of pictures and video for the cases presented.

The video related to this article can be found online at: [doi:10.1016/j.urolvj.2023.100222](https://doi.org/10.1016/j.urolvj.2023.100222).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] Seo H.J., Lee N.R., Son S.K., et al. Comparison of Robot-Assisted Radical Prostatectomy and Open Radical Prostatectomy Outcomes: a Systematic Review and Meta-Analysis. (1976-2437 (Electronic)).
- [2] J. Kaouk, A.T. Beksac, M. Abou Zeinab, et al., Single port transvesical robotic radical prostatectomy: initial clinical experience and description of technique, *Urology* 155 (Sep) (2021) 130–137.
- [3] H.T. Vigneswaran, L.S. Schwarzman, S. Francavilla, et al., A comparison of perioperative outcomes between single-port and multiport robot-assisted laparoscopic prostatectomy, *Eur. Urol.* 77 (6) (2020) 671–674, 2020/06/01/.
- [4] Kaouk J., Valero R., Sawczyn G., et al. Extraperitoneal single-port robot-assisted radical prostatectomy: initial experience and description of technique. (1464-410X (Electronic)).
- [5] J. Kaouk, R. Bertolo, M. Eltemamy, et al., Single-port robot-assisted radical prostatectomy: first clinical experience using the SP surgical system, *Urology* 124 (Feb) (2019) 309.
- [6] Aminsharifi A., Wilson C.A., Sawczyn G., et al. Predictors Associated with a Prolonged Hospital Stay After Single-Port Extraperitoneal Robotic Radical Prostatectomy: a Comparative Analysis of Outpatient Versus Inpatient Care. (1557-900X (Electronic)).
- [7] Pooli A., Salmasi A., Johnson D.C., et al. Positive surgical margins at radical prostatectomy in the United States: institutional variations and predictive factors. (1873-2496 (Electronic)).
- [8] Yossepowitch O., Briganti A., Eastham J.A., et al. Positive surgical margins after radical prostatectomy: a systematic review and contemporary update. (1873-7560 (Electronic)).
- [9] J.F.P. Lestingi, G.B. Guglielmetti, Q.D. Trinh, et al., Extended versus limited pelvic lymph node dissection during radical prostatectomy for intermediate- and high-risk prostate cancer: early oncological outcomes from a randomized phase 3 trial, *Eur Urol* 79 (5 May) (2021) 595–604.
- [10] K.A. Touijer, D.D. Sjoberg, N. Benfante, et al., Limited versus extended pelvic lymph node dissection for prostate cancer: a randomized clinical trial, *Eur. Urol. Oncol.* 4 (4) (2021) 532–539.