Journal of Endourology

DOI: 10.1089/end.2021.0660

Original Article

Single-Port versus Multi-Port Robot-Assisted Radical Prostatectomy: A Propensity Score Matching Comparative Study

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Running title: Single-port versus multi-port robot-assisted radical prostatectomy

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Keywords: Robotic-assisted radical prostatectomy; da Vinci Single Port; Prostate cancer

Abstract

Purpose: To compare the perioperative outcomes of patients who underwent single-port (SP) robot-assisted radical prostatectomy (RARP) and those who underwent multi-port (MP)-RARP.

Methods: Data on 40 consecutive patients who underwent SP-RARP between June 2020 and February 2021 and 129 who underwent MP-RARP between June 2019 and February 2021 were retrospectively reviewed. Using logistic regression, 31 patients who underwent SP-RARP were matched to 31 patients who underwent MP-RARP (1:1) based on propensity scores. The available perioperative parameters and outcomes were analyzed.

Results: Compared to MP-RARP, SP-RARP showed no significant differences in perioperative parameters, including the console times (111.0±15.7 vs. 102.6±18.8 minutes, p=0.569), operation time (151.3±15.1 vs. 158.7±20.3 minutes, p=0.863), estimated blood loss (121.1±64.7 vs. 140.5±90.5 mL, p=0.638), positive surgical margins (19.4% in both groups), and 3-month continence (77.4% vs. 83.9%, p=0.563) and potency (45.2% vs. 48.4%, p=0.891) rates. Patients who underwent SP-RARP had lower proportions of complete nerve sparing than those who underwent MP-RARP (SP-RARP vs. MP-RARP in subjective scores: 4.0±0.8 vs. 4.4±0.9, p=0.046; SP-RARP vs. MP-RARP in pathologic score of 5, 35.5% vs. 64.5%, p=0.049; score of 4, 41.9% vs. 19.4%, p=0.038; score of 3, 19.4% vs. 9.7%, p=0.398; score of 2, 3.2% vs. 0.0%, p=0.365; and score of 1, 3.2% vs. 3.2%, p=0.932, respectively).

Conclusions: SP-RARP showed lower nerve sparing scores than MP-RARP, the present study suggests that SP-RARP is safe and feasible with comparable short-term functional outcomes as those of MP-RARP.

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Introduction

With the adoption of robotics in the treatment of prostate cancer (PCa), robot-assisted radical prostatectomy (RARP) has become the primary modality for the treatment of localized PCa,[1-3] and its role and application has been expanded to include locally advanced PCas.[4]

In the era of minimally invasive surgery, robotic laparoendoscopic single-site radical prostatectomy (R-LESS RP) was first reported in 2008 by Kaouk et al. with multiarmed robots.[5] However, multiple arms in the limited space proved challenging.[6] After a 2014 report on a single-port (SP) robot platform prototype by the same group in 2014,[7] the newly developed the da Vinci SP robot platform (Intuitive Surgical, Inc., Sunnyvale, CA, USA) was approved in 2018 by the US Food and Drug Administration and has been attracting interest as to whether it could lead to a paradigm shift in the robotic surgical management of clinically localized PCa.

The da Vinci SP has a flexible camera and three articulating instruments via a single-access trocar, which was introduced to overcome the drawbacks of the conventional multiarmed single-site approach.[8,9] SP-RARP is safe and feasible in multiple single institutional series by most experienced robotic surgeons and may provide improved cosmesis and convalescence.[10,11]

However, most studies on SP-RARP were performed by limited or specific groups and few have compared SP-RARP to conventional MP-RARP; hence, the clinical significance and objective benefits of SP-RARP remain unclear. Furthermore, some authors have described that SP platforms need greater working distance and have lower traction, dissection, and tissue-gripping capacity than MP platforms.[12] We have also noted differences in the SP and MP platforms, and these differences may influence the grade of nerve sparing.

In the present study, we compared the perioperative outcomes, including the subjective and pathologic nerve-sparing scores (NSSs), of propensity score-matched patients who underwent SP-RARP versus MP-RARP under a single surgeon.

Materials and Methods

Data source and patient selection

A total of 169 patients with localized PCa who underwent RARP by a single surgeon were identified. Among them, 40 patients who underwent SP-RARP between June 2020 and February 2021 and 129 who underwent MP-RARP between June 2019 and February 2021 were reviewed retrospectively.

We excluded the initial five patients who underwent SP-RARP to overcome the learning curve. To reduce bias, propensity score matching on 31 of 35 patients who underwent SP-RARP were matched to 31 patients (1:1) from a cohort of 129 who underwent MP-RARP using the da Vinci Si or Xi system (Intuitive Surgical, Sunnyvale, CA, USA). All demographics and perioperative outcomes of matched patients who underwent SP-RARP and MP-RARP were compared.

Propensity score matching

Propensity score matching was used to account for clinical differences between the SP-RARP and MP-RARP groups. The propensity scores were matched using a logistic regression including the following variables: age at surgery, body mass index (BMI), preoperative Sexual Health Inventory for Men (SHIM) score, prostate-specific antigen (PSA) level, prostate volume, and biopsy grade. These variables were selected based on the known influencing factors and potential confounders on surgical outcomes. Logistic regression and nearest-neighbor matching were performed using IBM SPSS (version 24.0; IBM Corp., Armonk, NY, USA).

Surgical techniques and postoperative protocols

For the SP-RARP, the da Vinci SP robot platform (Intuitive Surgical, Inc., Sunnyvale, CA, USA) was used with the single-incision plus one-port method. A supraumbilical, 3-cm-long vertical incision was made to place the SP multichannel port under direct vision with Hasson's technique and an additional port for table-side assistance. MP-RARP was performed using a six-port approach with the da Vinci platform. Except for the port placement, basically, we applied the same surgical technique (transperitoneal approach and nerve sparing with retrograde early neurovascular bundle [NVB] release) on conventional MP-RARP and SP-RARP.

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The preoperative evaluation and postoperative care protocols did not differ between the two groups. Postoperative ambulation was encouraged, postoperative pain was controlled mainly by nonsteroidal analgesics, and the Foley catheter was removed 1 week postoperatively.

Nerve sparing techniques and scoring

We performed athermal ligation and retrograde early NVB release (Figure 1).[13,14]

For minimizing thermal damage to NVB, we minimized the use of monopolar and bipolar energy devices while applying the clips the assistant applied the clips through the additional port. In addition, for retrograde early NVB release, the toggling technique was applied to develop the plane between the prostate and rectum and the interfascial plane between the posterolateral aspect of the prostate and NVB.

For assessment of nerve sparing, we reviewed the surgeon's subjective NSSs (SNSSs) and all of the specimens based on the area of residual tissue on the mid-prostate level. For the SNSSs,[15] the surgeon utilized a 5-point NSS system to intraoperatively assess the quality of nerve preservation. For pathologic score assessment, a uropathologist who was blinded to SNSS scored the grade of the nerve-sparing status based on the residual tissue as follows: 5, full nerve sparing medial to the landmark artery; 4, near-to-complete nerve sparing medial to the landmark artery and >75% of the NVB; 3, nerve sparing lateral to the landmark artery with >50% of the NVB; 2, nerve sparing lateral to the landmark artery with <50% of the NVB; and 1, no NVB preservation with wide excision (Figure 2).[16] We classified the complete nerve sparing with grade 5, partial nerve sparing with grades 4, 3, and 2, and no nerve sparing with grade 1.[12]

Definitions of continence and potency.

We defined continence as no use of pads by patient interviews and potency as the ability to achieve and maintain an erection for successful intercourse. (SHIM questions 2, 3: achieve and maintain erection for intercourse for more than half the time, with or without the use of oral phosphodiesterase type 5 inhibitors).

Data collection and statistical analysis

Data on demographic data, perioperative data (e.g., operation time [total operation time/console time], estimated blood loss [EBL], perioperative complications by

the Clavien-Dindo classification), pathologic data (e.g., pathologic stage, nodal yield, number of positive nodes, extraprostatic extension [EPE], nerve sparing extent, positive surgical margins), and early functional outcomes (e.g., continence, as assessed by the number of pads used or duration to continence, andpotency) were collected and analyzed. Available perioperative clinical parameters and outcomes were collected and analyzed using the t-test, chi-square test, and Fisher's exact test. Cross-tabulation analysis was performed using IBM SPSS.

Results

Patient demographics

The SP-RARP and MP-RARP groups showed similar demographics and no significant differences in clinical parameters and biopsy grades after propensity score matching (mean age [years], 68.5±6.3 vs. 67.0±6.1, p=0.182; mean PSA level [ng/mL], 9.9±6.2 vs. 8.8±5.0, p=0.235; mean prostate volume [mL], 33.9±10.8 vs. 37.0±15.0, p=0.153; biopsy grade 1, 25.8% vs. 29.0%; grade 2, 38.7% vs. 35.5%; grade 3, 29.0% vs. 32.3%,; grade 4, 6.5% vs. 3.2%, p = 0.490; and mean SHIM score, 11.7±6.2 vs. 10.9±7.4, p=0.432). Table 1 shows the demographics of the two cohorts.

Perioperative outcomes

No significant differences were noted between the SP-RARP and MP-RARP groups in terms of console times (111.0±15.7 vs. 102.6±18.8 minutes, p=0.569), operation time (151.3±15.1 vs. 158.7±20.3 minutes, p=0.863), pelvic node dissection time (39.3±11.3 vs. 35.7±17.5 minutes, p=0.461), number of dissected nodes (16.2±7.9 vs. 18.1±10.5, p=0.643), and EBL (121.1±64.7 vs. 140.5±90.5 mL, p=0.638), respectively (Table 2).

Pathological and oncological outcomes

Of the 31 patients who underwent SP-RARP and 31 who underwent MP-RARP, 22 (71.0%) and 20 (64.5%) had pT2 tumors and 9 (29.0%) and 11 (35.5%) had ≥ pT3 tumors, respectively, with similar proportions.

The pathologist in this study defined a positive surgical margin (PSM) as resection margins involved by the tumor. PSMs showed no significant difference (p=0.984); six patients (19.4%) had PSM in the SP-RARP group (3 of 22 [13.6%] patients with pT2 tumors and 3 of 9 [33.3%] with ≥pT3 tumors) and six patients (19.4%) had PSM in the MP-RARP group (2 of 20 [10.0%] patients with pT2 tumors and 4 of 11 (36.4%) with ≥pT3 tumors;

Table 2). During the follow-up period, none of the patients had biochemical recurrence, which was defined as PSA level of >0.2 ng/mL.

Nerve sparing score

The MP-RARP group had a higher SNSS than the SP-RARP group (4.4±0.9 vs. 4.0±0.8, p=0.046). The proportion of pathologic scores was also different in the SP-RARP vs. MP-RARP groups (score 5, 35.5% vs. 64.5%, p=0.049; score 4, 41.9% vs. 19.4%, p=0.038; score 3, 19.4% vs. 9.7%, p=0.398; score 2, 3.2% vs. 0.0%, p=0.365; score 1, 3.2% vs. 3.2%, p=0.932).

Postoperative pain and complications

The SP-RARP and MP-RARP groups had no differences in terms of median pain scores at 1 day after surgery (median, 2 [1–3] vs. 2.5 [1–4], p=0.412) and opioid use (29.0% vs. 32.3%, p=0.305; Table 2). No intraoperative complications, blood transfusions, or serious complications requiring readmission (Clavien-Dindo classification of ≥2) were reported.

Early functional outcomes

The patients' functional outcomes, including continence and potency, were evaluated at 14 days and at 1, 3, and 6 months after surgery.

Continence

The achievement rates of continence with no usage of pads after 14 days and at 1, 3, and 6 months were 48.4%, 67.7%, 77.4%, and 80.6% in the SP-RARP group and 51.6%, 70.9%, 83.9%, and 87.1% in the MP-RARP group, respectively (P = 0.899, P = 0.896, P = 0.563, and P = 0.750, respectively; Table 3, 4).

Potency

The achievement of potency was defined as having successful intercourse. At 14 days and 1, 3, and 6 months, the achievement rates of potency were 19.4%, 22.6%, 45.2%, and 67.7% in the SP-RARP group and 22.6%, 29.0%, 48.4%, and 74.2% in the MP-RARP group, respectively (p=0.509, p=0.556, p=0.891, and p=0.788, respectively; Table 3, 4).

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Discussion

After approval of the da Vinci SP platform in 2018, various procedures and outcomes using SP-RARP have been reported.[17-19] SP-RARP has been considered safe and feasible, with comparable intraoperative (mean operative time: 190.55 min; EBL: 198.4 mL; intraoperative complication: almost zero), oncological (PSM rate: 33%), and complication (15%) outcomes as those of MP-RARP.[10] Regarding early functional outcomes, continence and potency rates at 3 months were 55% and 42%, respectively.[10] In addition, some authors have reported the benefits of SP-RARP in terms of improved postoperative pain scores and early discharge rates.[20] However, since the SP-RARP is a recently adopted technique, there are only few short-term follow-up data, and the practical benefits remain unclear.[12] Thus, well-designed comparative studies are needed to establish the practical advantages of the SP platform.

In the current study, the SP platform provided comparable perioperative outcomes as the MP platform in terms of console times, operation times, and oncologic outcomes in PSM.

However, some differences between the two platforms were observed. Moschovas et al.[8] described the difference between the SP and MP platforms. SP platform needs a greater working distance and constant use of the relocation pedal to target toward the operative field than the MP platform. In addition, SP platform has a lower arm strength, resulting in lower traction, dissection, and tissue-gripping capacity. These factors might be related to delayed console and operation times as SP platform needed repositioning of the arms for effective tissue-gripping, traction, and dissection due to weak arm strength and constant use of the relocation pedal. We noted that these differences influenced the nerve sparing status. In the present study comparing between SP-RARP and MP-RARP, although the console and operation time were not significantly different, whereas the SNSSs and pathologic NSSs were lower in SP-RARP. In particular, the pathologic NSS based on histopathologic examination by a uropathologist revealed that the proportion of full NSS was lower in SP-RARP than MP-RARP (SP-RARP vs MP-RARP; score 5, 35.5% vs. 64.5; score 4, 41.9 vs. 19.4, respectively). Several complex factors may have influenced NSSs. The SP system is considered to improve the feasibility of robotic surgery in small cavities; however, this system sometimes requires a longer working distance and wider working

space for the use of a double-articulated wrist with several concerns regarding SP-RARP. The limitations in the range of arm-motion were indicated through colored alarm in systemic navigator, which could be observed at the bottom of the screen (Figure 1B), occasionally led to insufficient work space. In addition, the SP platform had a weak arm strength relatively, which needed arm repositioning for effective traction with holding and gripping tissue structures, and the weak sweeping and traction strength may have influenced NVB dissection. Insufficient strength and limitation in motion of range in SP arms may be marked in patients with high BMI, large prostate volume, and high oncologic stage. Moschovas et al.[8] described inclusion criteria for SP-RARP that were a prostate sized <80g, body index <35 kg/m^2, and no previous local treatment. We believed that the following selection criteria were needed, especially for beginners with SP-RARP: 1) small prostate size (<60 g), 2) BMI <30 kg/m^2, and 3) clinical stage <T3. In addition, SP-RARP may be consider avoiding in patients with a medical history of prostatitis, pelvic radiation, or previous pelvic surgery, which are known factors for the presence of severe and extensive peri-prostatic adhesion.

However, despite our concerns that the differences and limitations of SP platform may influence functional outcomes as SNSSs and pathologic NSSs lower in SP-RARP, short-term functional outcomes of SP-RARP were not inferior to those of MP-RARP. Since the SP-RARP was a recently adopted, this study was analyzed only few short-term follow-up data. Therefore, larger, longer, and more well-designed comparative studies between the SP and MP platforms are required to verify these results.

Some authors reported the advantages of SP-RARP over MP-RARP in the improvement of cosmesis, postoperative pain, and shortened length of hospital stay (LOS).[11,20] In our study, the postoperative pain scores and rates of opioid use did not differ between the two approaches. The postoperative pain after day 1, the use of nonsteroidal analgesics is usually sufficient during the period of administration.

A limitation of our study was that we could not approach the parameters that are related to LOS. Korea has a unique health insurance system to ensure universal health coverage, covering >95% of the treatment costs in cancer patients. For this reason, regardless of cost, the Korean population has specialized trends to discharge after completing the primary management, such as removal of the Foley catheter and stitches.

Thus, in our cohort, LOS was not a suitable variable for comparing between the two groups.

Conclusion

The present propensity matched comparative study showed that SP-RARP is safe and feasible. Although SP-RARP showed lower NSSs than MP-RARP, the potency after SP-RARP were comparable as those of MP-RARP at least in the short term. Therefore, larger and longer follow-up studies are needed to establish the practical advantages of the SP platform.

Author Disclosure Statement

The authors have no conflicts of interest to disclose.

Funding Information

No funding was received for this study.

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References

1. Cao L, Yang Z, Qi L, Chen M. Robot-assisted and laparoscopic vs open radical prostatectomy in clinically localized prostate cancer: perioperative, functional, and oncological outcomes: A Systematic review and meta-analysis. Medicine (Baltimore) 2019;98:e15770.
2. Hakenberg OW. A brief overview of the development of robot-assisted radical prostatectomy. Arab J Urol 2018;16:293-296.
3. Kang SG, Shim JS, Onol F, Bhat KRS, Patel VR. Lessons learned from 12,000 robotic radical prostatectomies: Is the journey as important as the outcome? Investig Clin Urol 2020;61:1-10.
4. Mazzone E, Dell'Oglio P, Rosiello G, et al. Technical Refinements in Superextended Robot-assisted Radical Prostatectomy for Locally Advanced Prostate Cancer Patients at Multiparametric Magnetic Resonance Imaging. Eur Urol 2021;80:104-112.
5. Kaouk JH, Goel RK, Haber GP, Crouzet S, Stein RJ. Robotic single-port transumbilical surgery in humans: initial report. BJU Int 2009;103:366-369.
6. White MA, Haber GP, Autorino R, et al. Robotic laparoendoscopic single-site radical prostatectomy: technique and early outcomes. Eur Urol 2010;58:544-550.
7. Kaouk JH, Haber GP, Autorino R, et al. A novel robotic system for single-port urologic surgery: first clinical investigation. Eur Urol 2014;66:1033-1043.
8. Covas Moschovas M, Bhat S, Rogers T, et al. Technical Modifications Necessary to Implement the da Vinci Single-port Robotic System. Eur Urol 2020;78:415-423.
9. Kaouk J, Garisto J, Bertolo R. Robotic Urologic Surgical Interventions Performed with the Single Port Dedicated Platform: First Clinical Investigation. Eur Urol 2019;75:684-691.
10. Checcucci E, De Cillis S, Pecoraro A, et al. Single-port robot-assisted radical prostatectomy: a systematic review and pooled analysis of the preliminary experiences. BJU Int 2020;126:55-64.
11. Huang MM, Schwen ZR, Biles MJ, et al. A Comparative Analysis of Surgical Scar Cosmesis Based on Operative Approach for Radical Prostatectomy. J Endourol 2021;35:138-143.

12. Moschovas MC, Bhat S, Sandri M, et al. Comparing the Approach to Radical Prostatectomy Using the Multiport da Vinci Xi and da Vinci SP Robots: A Propensity Score Analysis of Perioperative Outcomes. Eur Urol 2021;79:393-404.
13. Coughlin G, Dangle PP, Palmer KJ, Samevedi S, Patel VR. Athermal early retrograde release of the neurovascular bundle during nerve-sparing robotic-assisted laparoscopic radical prostatectomy. J Robot Surg 2009;3:13-17.
14. de Carvalho PA, Barbosa J, Guglielmetti GB, et al. Retrograde Release of the Neurovascular Bundle with Preservation of Dorsal Venous Complex During Robot-assisted Radical Prostatectomy: Optimizing Functional Outcomes. Eur Urol 2020;77:628-635.
15. Kang SG, Schatloff O, Haidar AM, et al. Does surgeon subjective nerve sparing score predict recovery time of erectile function following robot-assisted radical prostatectomy? J Sex Med 2015;12:1490-1496.
16. Schatloff O, Chauhan S, Sivaraman A, Kameh D, Palmer KJ, Patel VR. Anatomic grading of nerve sparing during robot-assisted radical prostatectomy. Eur Urol 2012;61:796-802.
17. Lai A, Dobbs RW, Talamini S, et al. Single port robotic radical prostatectomy: a systematic review. Transl Androl Urol 2020;9:898-905.
18. Agarwal DK, Sharma V, Toussi A, et al. Initial Experience with da Vinci Single-port Robot-assisted Radical Prostatectomies. Eur Urol 2020;77:373-379.
19. Jones R, Dobbs RW, Halgrimson WR, et al. Single port robotic radical prostatectomy with the da Vinci SP platform: a step by step approach. Can J Urol 2020;27:10263-10269.
20. Vigneswaran HT, Schwarzman LS, Francavilla S, Abern MR, Crivellaro S. A Comparison of Perioperative Outcomes Between Single-port and Multiport Robot-assisted Laparoscopic Prostatectomy. Eur Urol 2020;77:671-674.

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Table 1. Patient demographics

Parameter	SP-RARP (n=31)	*MP-RARP* (n=31)	p-value
Age, years	68.5±6.3	67.0±6.1	0.182[a]
BMI, kg/m^2	24.6±2.8	24.9±4.6	0.422[a]
PSA level, ng/mL	9.9±6.2	8.8±5.0	0.235[a]
Prostate volume, mL	33.9±10.8	37.0±15.0	0.153[a]
Biopsy grade group*, n (%)			0.490[b]
1	8 (25.8)	9 (29.0)	
2	12 (38.7)	11 (35.5)	
3	9 (29.0)	10 (32.3)	
4	2 (6.5)	1 (3.2)	
5	0 (0.0)	0 (0.0)	
Preoperative SHIM score	11.7±6.2	10.9±7.4	0.432[a]
≥ 17, n (%)	12 (38.7)	10 (32.3)	0.780[b]
< 17, n (%)	19 (61.3)	21 (67.7)	0.560[b]

* Grade groups: 1 = Gleason 6 (or less), 2 = Gleason 7(3+4), 3 = Gleason 7(4+3), 4 = Gleason 8, 5 = Gleason 9 or 10. BMI=body mass index; PSA=prostate-specific antigen; SHIM=Sexual Health Inventory for Men (22–25, no erectile dysfunction; 17–21, mild erectile dysfunction; 12–16, mild-to-moderate erectile dysfunction; 8–11, moderate erectile dysfunction; 5–7, severe erectile dysfunction)

[a]Student's t-test, [b]Chi-square test

Table 2. Comparison of perioperative outcomes between the SP-RARP and MP-RARP groups

Parameters	SP-RARP	*MP-RARP*	p-value
Console time, min	111.0±15.7	102.6±18.8	0.569
Operation time, min	151.3±15.1	158.7±20.3	0.863
EBL, mL	121.1±64.7	140.5±90.5	0.638
Specimen grade group, n (%)			0.393
1	4 (12.9)	5 (16.1)	
2	14 (45.1)	12 (38.7)	
3	10 (32.2)	8 (25.8)	
4	2 (6.5)	5 (16.1)	
5	1 (3.2)	1 (3.2)	
Pathologic stage, n (%)			0.508
pT2	22 (71.0)	20 (64.5)	
≥ pT3	9 (29.0)	11 (35.5)	
Positive surgical margin, n/N (%)	6/31 (19.4)	6/31 (19.4)	0.184
In pT2 tumors, n/N (%)	3/22 (13.6)	2/20 (10.0)	
In ≥pT3 tumors, n/N (%)	3/9 (33.3)	4/11 (36.4)	
Lymph node dissection, n (%)	5 (16.1)	6 (19.6)	0.513
time, min	39.3±11.3	35.7±17.5	0.461
yield of node, n	16.2±7.9	18.1±10.5	0.643

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positive node, n	0 (0.0)	1 (3.2)	0.829
Postoperative pain			
Pain score on day 1 (IQR)	2 (1-3)	2.5 (1-4)	0.412
Usage of opioids, n (%)	9 (29.0)	10 (32.3)	0.305

* Grade groups: 1 = Gleason 6 (or less), 2 = Gleason 7(3+4), 3 = Gleason 7(4+3), 4 = Gleason 8, 5 = Gleason 9 or 10.

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Table 3. Comparison of nerve sparing status

	SP-RARP	MP-RARP	P-value
Subjective surgeon's score	4.0±1.0	4.4±0.8	0.046
Pathologic score	3.9±0.8	4.5±0.9	0.030
5	11 (35.5)	20 (64.5)	0.049
4	13 (41.9)	7 (19.4)	0.038
3	4 (19.4)	3 (9.7)	0.398
2	1 (3.2)	0 (0.0)	0.365
1	1 (3.2)	1 (3.2)	0.932

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Table 4. Comparison of functional outcomes between the SP-RARP and MP-RARP groups

	SP-RARP	MP-RARP	P-value
Achievement of potency, n (%)			
14 days	6 (19.4)	7 (22.6)	0.509
1 month	7 (22.6)	9 (29.0)	0.556
3 months	14 (45.2)	15 (48.4)	0.891
6 months	21 (67.7)	23 (74.2)	0.788
Continence, n (%)			
14 days	15 (48.4)	16 (51.6)	0.899
1 month	21 (67.7)	22 (70.9)	0.896
3 months	24 (77.4)	26 (83.9)	0.563
6 months	25 (80.6)	27 (87.1)	0.750

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Figure legends

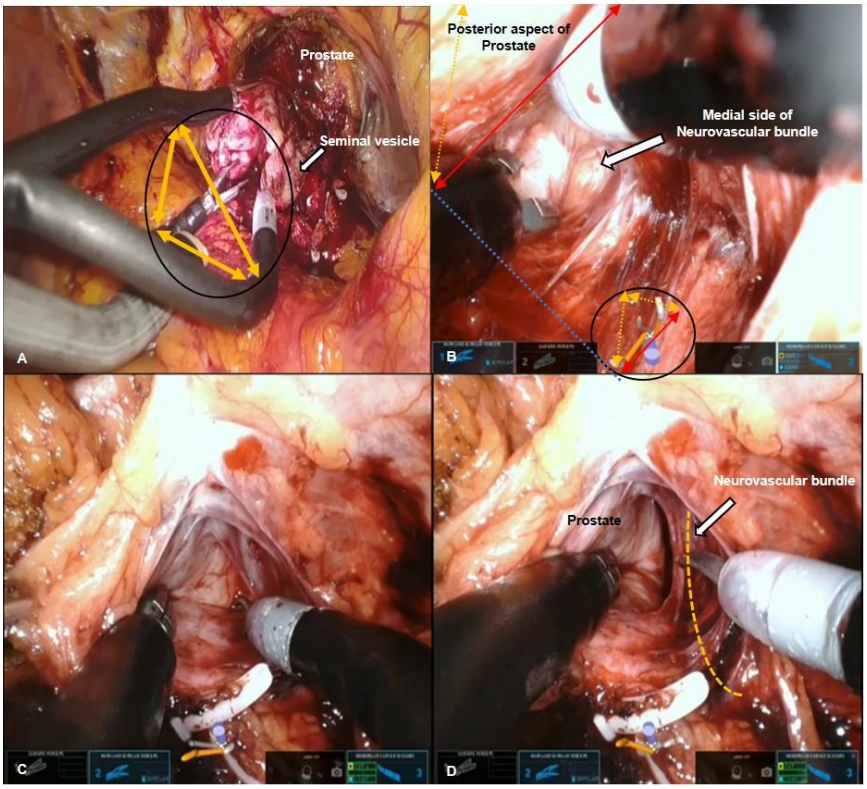

Figure 1. Key steps for single-port robotic-assisted radical prostatectomy

A. Outside view of the SP platform; the working space was presented with black circle and orange arrow. B. Toggling technique; interfascial plane dissection to separate the NVB from the posterolateral aspect of the prostate with 30° upward cobra-shaped camera, and the orange color at the bottom of screen signaling limitation of the range of motion. C. Retrograde early NVB release, and interfascial plane dissection between the NVB and prostatic fascia. D. Successful tunneling between the NVB and prostatic fascia.

NVB, neurovascular bundle.

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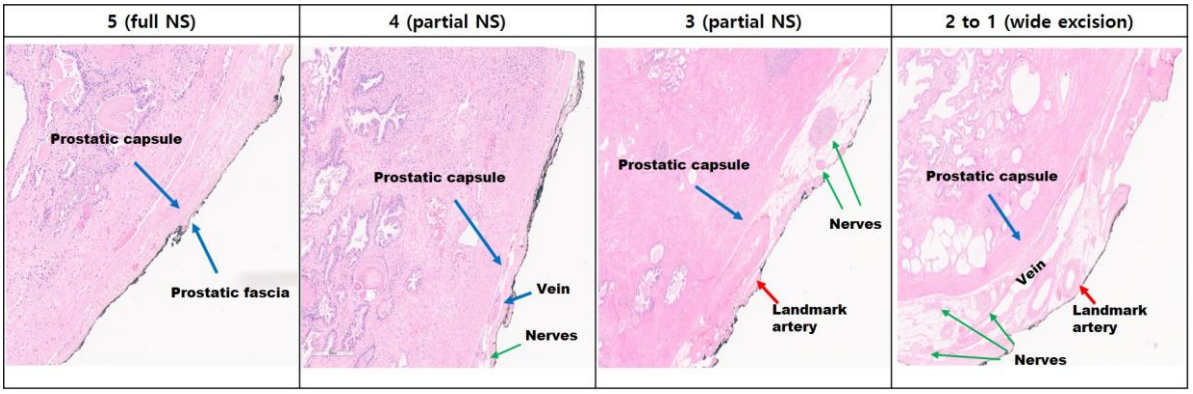

Figure 2. Pathologic nerve-sparing score

Nerve-sparing score based on the residual tissue of specimen: 5, full nerve sparing medial to the landmark artery; 4, near-to-complete nerve sparing medial to the landmark artery and >75% of the neurovascular bundle; 3, nerve sparing lateral to the landmark artery with >50% of the neurovascular bundle; 2, nerve sparing lateral to the landmark artery with <50% of the neurovascular bundle; 1, no NVB preservation with wide excision.

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Abbreviations used

EBL = estimated blood loss

EPE = extraprostatic extension

FDA = Food and Drug Administration

GrGP = grade group

GS = Gleason score

MP-RARP = multiport robot-assisted radical prostatectomy

MRI = magnetic resonance imaging

NSS = nerve sparing score

NVB = neurovascular bundle

PCa = prostate cancer

PSA = prostate-specific antigen

PSM = positive surgical margin

SHIM = Sexual Health Inventory for Men

SNSS = Subjective nerve-sparing score

SP-RARP = single-port robotic-assisted radical prostatectomy