Single-Port Robot-Assisted Perineal Radical Prostatectomy: Our Initial Experience

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Research

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Single-Port Robot-Assisted perineal radical prostatectomy: Our initial experience

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Abstract

Purpose: To evaluate the clinical value of robot-assisted perineal radical prostatectomy (RPRP) in the treatment of early localized prostate cancer.

Methods: We retrospectively analyzed 3 consecutive patients diagnosed with prostate cancer from January 2020 to May 2020 who received RPRP in our center. The main outcomes assessed were operating time, perioperative complications and need for conversion to open surgery.

Results: 3 patients successfully underwent RPRP with no conversion to open surgery. No intra-operative complications were seen. Average operative time was 201.67±61.53 min, console time was131.67 ± 32.53 min, with an estimated blood loss of 183.33 ± 28.87mL. 2 patients were discharged within 10 days postoperatively with perineal drainages removed. The Foley catheter was removed 2 weeks after surgery. One patient had a positive surgical margin (33.3%). 2 patients were continent immediately after removal of the Foley catheter, 1 patient was continent 1 month postoperatively. The sexual function of 2 patients recovered within 1 month and 1 patient recovered within 3 months. The PSA reexamination was 0-0.1μg/L one month after operation.

Conclusion: For patients with early localized prostate cancer, robot-assisted perineal radical prostatectomy is a safe and effective method, and has outstanding advantages in radical tumor resection and postoperative urine control.

Keywords: Prostate cancer; Robot-Assisted perineal radical prostatectomy; single-port

Introduction

Radical prostatectomy (RP) is the standard procedure for the treatment of localized prostate cancer. Great advances in surgical techniques have improved the oncology results and quality of life. At the beginning of the 21st century, with the advent of laparoscopic radical prostatectomy (LRP) and robot-assisted laparoscopic radical prostatectomy (RARP), people's interest in minimally invasive methods is increasing day by day [1, 2]. Since the first report of radical perineal prostatectomy (RPP) in the 20th century, it has been regarded as a basic method for the treatment of prostate cancer for many years because of its advantages such as less bleeding and rapid recovery[3, 4]. In this article, we will introduce the method of robotic perineal radical prostatectomy using Leonardo da Vinci robot platform.

Methods

From January 2020 to May 2020, 3 patients diagnosed with prostate cancer were hospitalized. All patients were examined by magnetic resonance imaging and bone scintigraphy, and all 3 patients were organ-confined. Two patients underwent radical sigmoidectomy for sigmoid cancer. The operation uses Leonardo da Vinci robotic surgery platform and is performed by the same surgeon.

Patients were required to eat a half-stream diet 1 days before operation. Polyethylene glycol and clean enema were given one day before operation.

Surgical procedure

An exaggerated lithotomy position was adopted with a hip flexion >90°, and the Trendelenburg position was 15 °to 30 °. A 6~8 cm arc incision was made at 2 cm above the anus to reach the bilateral ischial tubercle. Separate the subcutaneous tissue, identify and cut off the central tendon of the perineal body. (Fig.1a) Then find the rectus muscle and cross-cut it to expose the space below the membranous part of the urethra. Next, the special multi-channel single-site surgical port is placed in place. A 12 mm trocar is placed at 12 o'clock for the camera port; two 8 mm robotic trocars are placed at 3 o'clock and 9 o'clock for radical perineal prostatectomy; and a 10 mm trocar is placed at 6 o'clock. (Fig.1b) After the docking of the robotic device. The standard insufflation was used in the whole process, and the pressure was 12-15 mmHg.

First find the urethral membrane, cut the Denonvilliers fascia to expose the posterior plane of the prostate, then dissect the neurovascular bundle, (Fig.2a) and then further expose the vas deferens and seminal vesicles. (Fig.2b)When the posterior plane of the prostate is completely exposed, cut off the tip of the urethra. Then, grasp the prostate and retrograde the anterior plane downward until the bladder neck is found. (Fig.2c) After complete prostatectomy, the intraoperative pressure was reduced to 10 mm Hg and cystourethral anastomosis was performed with 3-0 bidirectional prickly suture (Fig.2d). Place drainage tube before wound closure(Fig.1c).

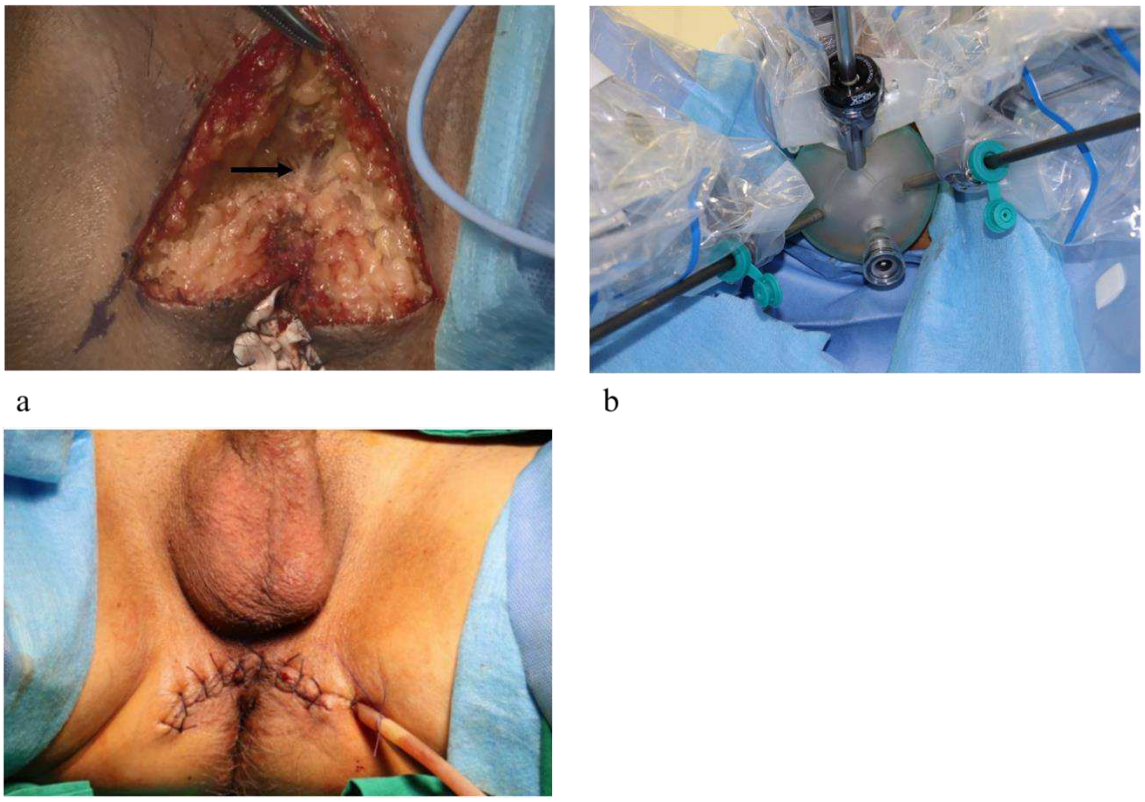

Fig. 1. a, Exposure and separation of the central tendon in the perineal space. b, placement of robotic arm docking. Surgical platform: da Vinci Si HD; camera, 12 mm 30° endoscope; robotic

arm 1, 8-mm monopolar scissors; robotic arm 2, 8-mm Maryland bipolar forceps; robotic instrument for anastomosis, large-needle drivers. c, Perineal incision after sutured wound.

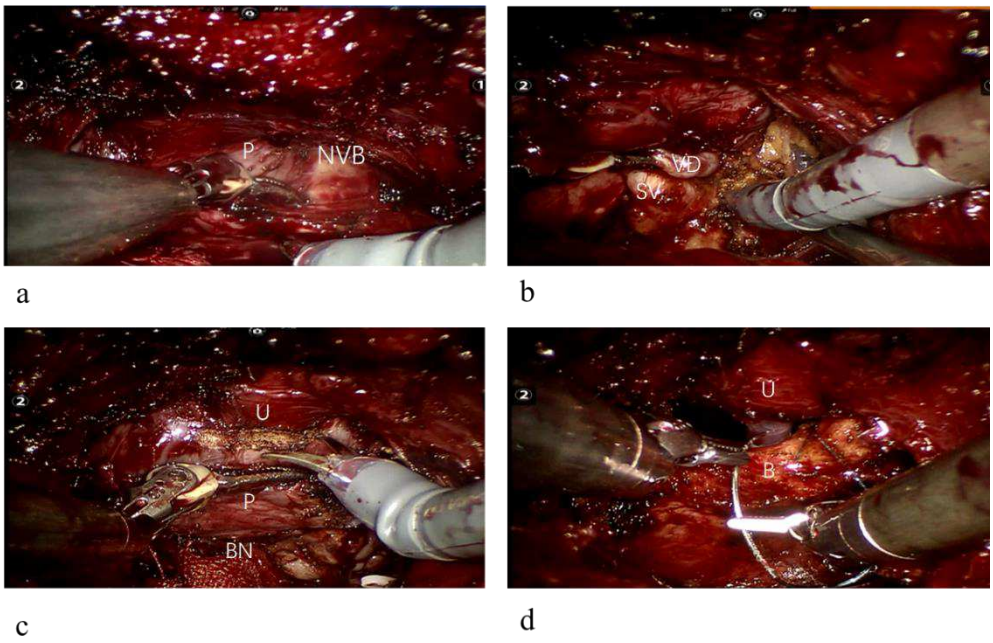

Fig. 2. a, Dissection of the neurovascular bundles. b, Dissection of the vas deferens and seminal vesicles. c, Transection of the bladder neck. d, Vesicourethral anastomosis.
P, prostate; NVB, neurovascular bundles; VD, vasdeferens; SV, seminal vesicle; B, bladder; BN, bladder neck; U, urethra.

Results

A total of three robotic perineal radical prostatectomies were performed. The demographic clinical data of the patients are shown in Table 1. The mean age of the patients was 70.33 ±1.53 years old, and the average body mass index was 23.63±1.37 kg/m^2. Preoperative radiological examination showed that all patients were organ-restricted, and the operations were completed successfully in 3 cases, and there was no conversion to open operation or reoperation. There was no organ, vascular or nerve injury. Average operative time was 201.67±61.53 min, console time was131.67 ± 32.53 min, with an estimated blood loss of 183.33 ± 28.87mL. with no blood transfusions. One patient had a positive surgical margin on the apical junction. Two patient was continent immediately after removal of the Foley catheter, One was continent 1 month postoperatively. The sexual function of 2 patients recovered within 1 month and 1 patient recovered within 3 months（assessed by IIEF）. The PSA reexamination was 0-0.1μg/L one month after operation. (Table 2)

Table 1 patient clinical data

	Case 1	Case 2	Case 3	Mean±SD
Age	69	72	70	70.33 ±1.53
BMI（kg/m^2）	22.05	24.39	24.45	23.63 ±1.37
Prostate volume（ml）	47.07	20.5	24.71	30.76 ± 14.28

PSA（μg/L）	7.67	22.00	7.20	12.29 ± 8.41
Clinical stage	cT2aN0M0	cT2cN0M0	cT2cN0M0	
Biopsy gleason score	3+4=7	4+3=7	4+3=7	
Abdominal surgery	Yes	Yes	No	

BMI: Body mass index; PSA: Prostate-specific antigen.

Table 2. perioperative and follow-up parameters of patients

	Case 1	Case 2	Case 3
Operative time(min)	262	204	139
Console time(min)	165	130	100
EBL(ml)	200	200	150
Postoperative LOS(d)	20	18	14
Pathological Gleason score	3+3=6	4+5=9	4+3=7
Postoperative PSA（μg/L）	0.1	0	0
PSM	Negative	Positive	Negative
Pathological stage	3+3=6	4+5=9	4+3=7
Continence recovery	immediately	1month	immediately
Sexual function	1 month	1 month	3 months

EBL: Estimated blood loss; PSM: Positive surgical margin

Discussion

Hugh et al first demonstrated the method of transperineal radical prostatectomy in 1904 and was the most commonly used technique in prostate cancer surgery until the 1970s [5]. Millin proposed retropubic radical prostatectomy (RRP) in 1947. Since Walsh redefined the retropubic anatomical approach in the early 1980s, it has become popular around the world[6-8]. Due to the limited surgical space, RPRP has not been widely publicized so far. With the development of robots and single-port access devices, we can now significantly reduce the difficulty of surgery and further explore its clinical value.

However，RRP is not suitable for all patients, for obese patients or patients with a history of surgery, RPRP may be a better choice. In terms of patient selection, we recommend that patients with T1-2N0M0 stage and no bone metastasis be selected. The volume of the prostate is no more than 60ml, because the excessive volume of the prostate will have a certain effect on the visual field during the operation. Then, patients with a history of abdominal surgery had no effect on transperineal surgery. Two patients in this study had a previous history of colon cancer surgery and were able to accept RPRP successfully. Imperatore et al. suggested using RPP instead of RRP in patients who have previously had prostate or bladder surgery[9]. And there are obvious anatomical adhesions in patients with a history of abdominal surgery[10]. Due to the proximity of the prostate to the perineal area and its extraperitoneal position, previous abdominal surgeries do not have any

disadvantages to the setting of RPP[11, 12].

RPRP provides a relatively easy anatomical passage of the prostate through a small incision. The high position of the prostate in the pelvis (deep surgical field), the narrow surgical field of vision of the surgeon, and the human anatomical problems that affect the surgeon are all challenging aspects of the perineal approach, which hinder its application. The application of robot system in RPRP is helpful to overcome the above obstacles in conventional RPP[13]. RPRP provides a more minimally invasive approach, providing more convenience for surgeons and auxiliary surgeons[14]. We recommend the use of a 30 °endoscope, which faces up throughout the operation to minimize collisions with external robots. When establishing a surgical pathway, once the membranous urethra is determined, the surgeon should stick to the posterior plane of the prostate and, if necessary, use rectal digital examination during the operation.

The difficulty of cystourethrostomy is mainly because the visual field is in the opposite direction, and the anatomical position is different from that of RPP. With the development of knot-free barbed line and robot vehicle， these difficulties have been overcome. The first suture was at 12 o'clock, starting from the outside to the front of the bladder neck in a clockwise direction. Place the second suture on the anastomosis counterclockwise to complete the anastomosis. Once the anastomosis is performed, a new 20-Fr catheter is replaced and the anastomosis is tested by injecting sterile saline into the bladder.

In a short-term comparative study, Frazier et al reported that the median intraoperative blood loss of perineal approach and retropubic approach was 565ml and 2000ml ($p<0.001$), respectively[15]. Similarly, studies comparing the two methods have shown that the transperineal approach can reduce the need for blood transfusion by up to 50%[16]. Our study showed that the average blood loss was 183.33 ±28.87ml, and none of them received blood transfusion.

The purpose of surgery is to achieve radical resection. so far, several studies have compared the effects of RPP and other methods on intraoperative tumor control[17]. Mirza reported that the incidence of surgical margin positive PSM in RPP, RRP and RARP was 22.8%, 28.9% and 13.6%, respectively($p=0.007$)[18]. After adjusting the percentage of tumor volume or pathological tumor stage, there was no significant difference in PSM among the three types of surgery. In this study, there was one patient with positive PSM.

There are several advantages to performing RPRP. First of all, compared with the traditional approach, it is a satisfactory recovery of continence. The continence was recovered immediately after extubation in 2 cases and within 1 month after operation in 1 case. This is due to the intrafascial dissection of the anterior fascia, causing minimal interference to the supporting structure around the urethra. In a study of 220 patients who received RPP, Weldon et al reported voiding controllable rates of 23%, 56% and 90% at 1 month, 3 months and 6 months, respectively[19]. Keeping the external sphincter of urethra intact and the integrity of bladder neck can explain the improvement of urine control after RPP[20].

Secondly, the operation is carried out outside the peritoneum without any interference to the intra-abdominal organs. Two patients in our study had a history of abdominal surgery. RPRP can be used as a patient-friendly and safer method, which also applies to obese patients. In addition, the perineal approach provides faster postoperative recovery, less pain reported by patients, and less use of anesthetics. Janoff and Parra point out that the potential benefits of RPP compared with RRP are less bleeding, less postoperative pain, shorter hospital stay and faster recovery[21]. Some reports show that RPP is much more cost-effective and has a shorter learning curve than laparoscopic radical

prostatectomy[22, 23].

However, there are still some wound-related complications in this study, and wound infection occurred in 3 patients, there may be several reasons. First, the wound is close to the anus and is easy to be contaminated. Second, the operation time is long, and the wound is oppressed by single-port for a long time, which leads to ischemia and is not easy to recover, the damage to the vascular tissue in the perineal area will also affect the wound recovery. Third, the wound is located in a special position and is prone to infection. The solution is to control the time of the operation, detect the wound early or open the wound.

This study has several limitations. The conclusions were drawn from a small sample retrospective study and need to be further validated by a prospective comparative study comparing RPRP with traditional multiport transperitoneal laparotomy. And it had a relatively short patient follow-up time so it was not possible to analyse the long-term oncological outcomes.

Conclusion

With the rapid development of minimally invasive surgical equipment and fine anatomy of the prostate, a variety of modified radical prostatectomy techniques emerge in endlessly, especially with the help of robotic surgery platform. the feasibility and safety of all kinds of surgery is no longer a thorny problem. RPRP is becoming more and more feasible. A longer comparative study is needed for postoperative oncology results and other postoperative detailed evaluation.

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Author contributions

HB: project development, data collection, data analysis, manuscript writing. WYK: data collection, manuscript writing. LYZ: data analysis. CJX: project development, manuscript editing. CLW: project development, manuscript editing. CJX and CLW are the corresponding authors.

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Availability of data and materials

The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The Ethics Committee of the First Affiliated Hospital, Sun Yat-sen University approved this retrospective study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

References

1. WW Schuessler, PG Schulam, RV Clayman et al. Laparoscopic radical prostatectomy: initial short-term experience. Urology, 1997, 50(6): 854-857.
2. CC Abbou, A Hoznek, L Salomon et al. [Remote laparoscopic radical prostatectomy carried out with a robot. Report of a case]. Progres en urologie : journal de l'Association francaise d'urologie et de la Societe francaise d'urologie, 2000, 10(4): 520-523.
3. E Comploj, A Pycha. Experience with radical perineal prostatectomy in the treatment of localized prostate cancer. Therapeutic advances in urology, 2012, 4(3): 125-131.
4. VH Nargund, F Zaman. Radical prostatectomy--too soon to abandon the perineal approach? Nature reviews. Urology, 2011, 8(4): 179-180.
5. HH Young. The early diagnosis and radical cure of carcinoma of the prostate. Being a study of 40 cases and presentation of a radical operation which was carried out in four cases. 1905. The Journal of urology, 2002, 168(3): 914-921.
6. T Millin. Retropubic prostatectomy: a new extravesical technique report on 20 cases. 1945. The Journal of urology, 2002, 167: 976-979, 980.
7. PC Walsh, H Lepor, JC Eggleston. Radical prostatectomy with preservation of sexual function: anatomical and pathological considerations. The Prostate, 1983, 4(5): 473-485.
8. PC Walsh, PJ Donker. Impotence Following Radical Prostatectomy: Insight into Etiology and Prevention. The Journal of urology, 2017, 197: S165-S170.
9. V Imperatore, F Cantiello, F Fusco et al. Radical perineal prostatectomy versus radical retropubic prostatectomy after previous prostate surgery: surgical and functional outcomes. Urologia internationalis, 2011, 86(2): 140-145.
10. Di Pierro GB, P Grande, L Mordasini et al. Robot-assisted radical prostatectomy in the setting of previous abdominal surgery: Perioperative results, oncological and functional outcomes, and complications in a single surgeon's series. International journal of surgery (London, England), 2016, 36: 170-176.
11. JP Weiss, BA Schlecker, AJ Wein et al. Preservation of periprostatic autonomic nerves during total perineal prostatectomy by intrafascial dissection. Urology, 1985, 26(2): 160-163.
12. V Tugcu, A Simsek, I Yigitbasi et al. Robot-Assisted Perineal Radical Prostatectomy in a Post-Kidney Transplant Recipient. Journal of endourology case reports, 2018, 4(1): 21-24.
13. J Garisto, R Bertolo, CA Wilson et al. The evolution and resurgence of perineal prostatectomy in the robotic surgical era. World journal of urology, 2019.
14. V Tuğcu, O Akça, A Şimşek et al. Robotic-assisted perineal versus transperitoneal radical prostatectomy: A matched-pair analysis. Turkish journal of urology, 2019, 45(4): 265-272.
15. HA Frazier, JE Robertson, DF Paulson. Radical prostatectomy: the pros and cons of the perineal versus retropubic approach. The Journal of urology, 1992, 147: 888-890.
16. F Haab, L Boccon-Gibod, V Delmas et al. Perineal versus retropubic radical

prostatectomy for T1, T2 prostate cancer. British journal of urology, 1994, 74(5): 626-629.
17. S Wroński. Radical perineal prostatectomy - the contemporary resurgence of a genuinely minimally invasive procedure: Procedure outline. Comparison of the advantages, disadvantages, and outcomes of different surgical techniques of treating organ-confined prostate cancer (PCa). A literature review with special focus on perineal prostatectomy. Central European journal of urology, 2012, 65(4): 188-194.
18. M Mirza, K Art, L Wineland et al. A comparison of radical perineal, radical retropubic, and robot-assisted laparoscopic prostatectomies in a single surgeon series. Prostate cancer, 2011, 2011: 878323.
19. VE Weldon, FR Tavel, H Neuwirth. Continence, potency and morbidity after radical perineal prostatectomy. The Journal of urology, 1997, 158(4): 1470-1475.
20. A Giannantoni, E Mearini, A Zucchi et al. Bladder and urethral sphincter function after radical retropubic prostatectomy: a prospective long-term study. European urology, 2008, 54(3): 657-664.
21. DM Janoff, RO Parra. Contemporary appraisal of radical perineal prostatectomy. The Journal of urology, 2005, 173(6): 1863-1870.
22. J Garisto, R Bertolo, CA Wilson et al. The evolution and resurgence of perineal prostatectomy in the robotic surgical era. World journal of urology, 2020, 38(4): 821-828.
23. E Checcucci, De Cillis S, A Pecoraro et al. Single-port robot-assisted radical prostatectomy: a systematic review and pooled analysis of the preliminary experiences. BJU international, 2020, 126(1): 55-64.

Figures

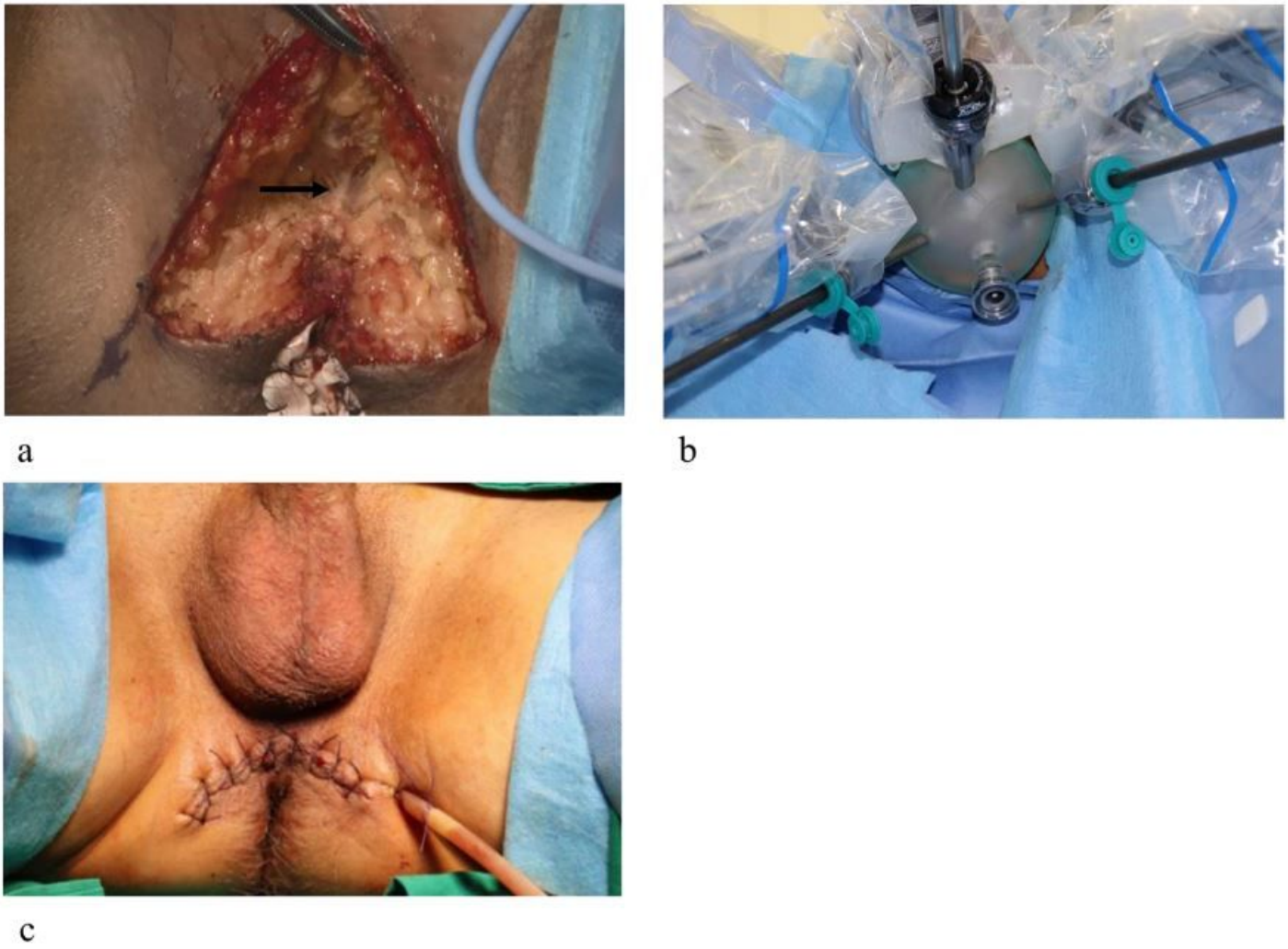

Figure 1

a, Exposure and separation of the central tendon in the perineal space. b, placement of robotic arm docking. Surgical platform: da Vinci Si HD; camera, 12 mm 30° endoscope; robotic arm 1, 8-mm monopolar scissors; robotic arm 2, 8-mm Maryland bipolar forceps; robotic instrument for anastomosis, large-needle drivers. c, Perineal incision after sutured wound.

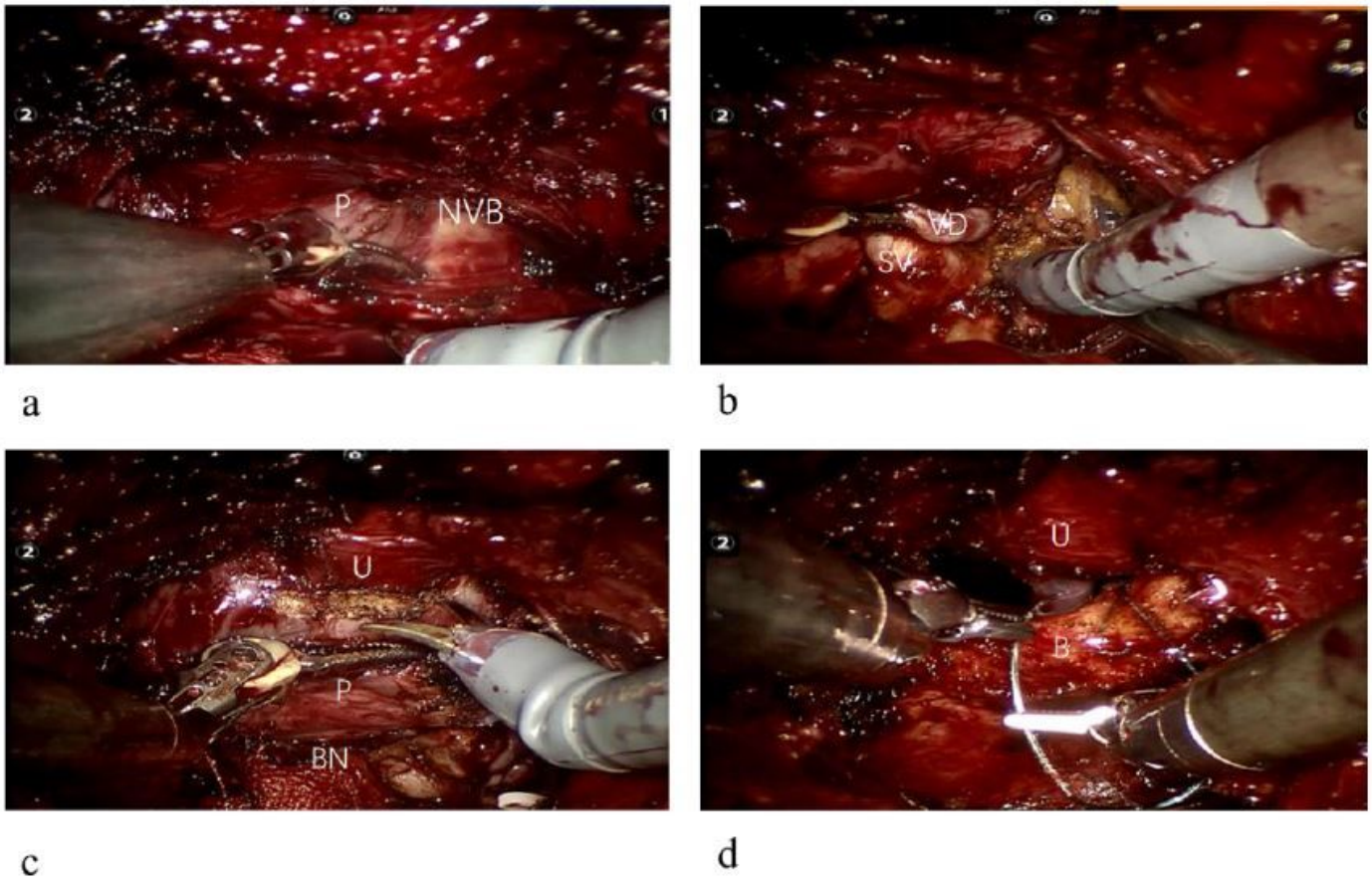

Figure 2

a, Dissection of the neurovascular bundles. b, Dissection of the vas deferens and seminal vesicles. c, Transection of the bladder neck. d, Vesicourethral anastomosis. P, prostate; NVB, neurovascular bundles; VD, vasdeferens; SV, seminal vesicle; B, bladder; BN, bladder neck; U, urethra.