



Description of Extraperitoneal Single-Port Robot-Assisted Radical Prostatectomy

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ABSTRACT

Extraperitoneal SP-RARP (single Port -Robot-assisted radical prostatectomy) is currently the standard minimally and safe invasive procedure for the surgical management of localized prostate cancer. When compared to open surgery, it has been demonstrated that the minimally invasive robotic approach provides comparable oncologic and functional outcomes with potential benefits, such as reduced blood loss, a shorter hospital stay, and a quicker recovery time. Due to its larger scope and early adoption, the transperitoneal RARP approach is typically the one used most frequently by robotic surgeons. The extraperitoneal approach has, however, been reported to have similar oncologic outcomes. Extraperitoneal RARP is less frequently used today because of its alleged technical complexity. However, this strategy has advantages, especially when peritoneal access is difficult due to severe adhesions from prior operations. To treat locally advanced prostate cancer, extraperitoneal SP-RARP is a feasible safe surgical option. Using the more recent single-port (SP) robotic system or the more traditional multiport robotic system, both transperitoneal and extraperitoneal approaches can be carried out. With

regard to extraperitoneal RARP, the SP system has seen a rise in popularity due to its alleged benefits, which include better cosmesis, fewer postoperative analgesic and opioid needs, and a shorter length of hospital stay. For evidence supporting these benefits, additional research must be conducted.

Keyword: Extaperitoneal, single-port, radical prostatectomy, prostate cancer, minimally invasive surgery

INTRODUCTION

In men with locally advanced prostate cancer, radical prostatectomy is the treatment of choice [1]. In the past 20 years, the surgical approach to treating prostate cancer has fundamentally changed from an open retropubic procedure as was initially described by Millin in 1945 to a laparoscopic one [2]. The FDA's (Food and Drugs and administration) initial approval of the da Vinci surgical robotic platform (Intuitive Surgical, Sunnyvale CA, USA) in 2000 is arguably the single most important factor that has influenced minimally invasive surgery [3]. Widespread use of robotic technology for radical prostatectomy has been demonstrated by reductions in postoperative radiation use, perioperative blood loss, and hospital stay time [4]. Robotic technology may be linked to improved erectile function and urinary continence postoperatively, despite the fact that there is significant heterogeneity in studies. The most widely used robotic oncologic procedure in the United States is the robotic prostatectomy [5]. The rapid rate of diffusion of the surgical robot in urology is highlighted by the fact that, by 2013, 85% of all radical prostatectomies were carried out robotically [6]. Since the introduction of the first da Vinci robotic platform, subsequent iterations have incorporated a multi-arm design with a fixed laparoscopic camera.

In fact, using robotic assistance during laparoscopic procedures has shown to shorten hospital stays and decrease perioperative blood loss [4]. Additionally, dubious and contentious research has suggested that robotic radical prostatectomy may have improved postoperative erectile function and delivered higher rates of urinary continence compared to other approaches [7]. Over the past 20 years, improved versions of the da Vinci robotic platform have been made available; these models all feature multiple arms and a fixed laparoscopic camera. Reduced postoperative pain and complications from incisions were the goal of laparoscopic single-site surgery (LESS) and natural orifice transluminal endoscopic surgery (NOTES), which were intended to take minimally invasive surgery into the future [8]. However, despite their potential benefits of lowering surgical morbidity, enhancing cosmesis, and decreasing pain. These single-site techniques are still not commonly used due to a number of important factors, including rigid instrumentation, extremely long surgical time, significant challenges with instrument clashing, and limited operative space. In 2014 it was initial clinical series of single port (SP) robotic surgery using a purpose-built robotic platform [9]. The da Vinci Single Port (SP) system for urologic surgery was authorized by the FDA a few years later, in 2018. This innovative platform accommodates all the robotic instruments including cameras through a single multichannel 2.5 cm port inserted through a single skin incision, as opposed to the multiple trocars commonly employed during standard multiport robotic procedures. The preferred surgical procedure for treating prostate cancer is robotic-assisted radical prostatectomy (RALP)[5]. It has typically been carried out via a transperitoneal procedure. Alternative strategies have been investigated with the SP robotic system in order to maximize the

advantages that this new platform can provide [10]. Since Kaouk et al. [11] first described SP-RALP, numerous centers have reported various methods and results with this novel procedure.

INSTRUMENTS ARMAMENTARIUM FOR DA VINCI SP AND DA VINCI™

For da Vinci SP, there are seven instruments in the da Vinci SP surgical system. a 10 x 12-mm flexible camera, a monopolar scissors, a bipolar grasper, a Cadierre grasper, two needle holders, and an applier for Weck clips. Additional instruments include a GelPOINT™ mini advanced from Rancho Santa Margarita, California, a robotic 25-mm multichannel port, a 12-mm laparoscopic port, a 14-mm nasogastric tube for suction, and an AirSeal system for insufflation with a pneumoperitoneum pressure of 12 mmHg (Figure:1 a,b)



Fig1a

Fig1b

Fig: 1a, b: Da Vinci SP surgical system shows AirSeal system for insufflation with a pneumoperitoneum pressure of 12 mmHg.

For The da Vinci™ Surgical System of robotic surgical system consisting with three main components: The InSite™ Vision System offers the surgeon a real minimally invasive 3-D perspective of the surgical field. The EndoWrist™ Instruments are part of the surgical cart. The EndoWrist instruments are made to move like a human hand, wrist, and finger. The master controls for operating the EndoWrist instruments are located on the surgeon console. Using the da Vinci Surgical System has the following advantages: The capacity for the surgeon to do intricate minimally invasive treatments in the same method as open surgery procedures without experiencing the tiredness associated with an extended procedure. Numerous advantages for the patient are achievable with current laparoscopic techniques, including less bleeding, less pain, a lower risk of internal scarring, a short hospital stay and a quicker recovery. The movements of the human hand, wrists, and fingers are faithfully replicated by the EndoWrist instruments. A wide range of motion enables precise tissue manipulation, dissection, and suturing. Dual 3-chip digital cameras on the InSite™ Vision System allow for "inside" surgery on patients. Depth of field and resolution are offered by the sole technology with genuine 3-D vision. The natural hand-eye coordination required for open surgery is provided by a 3-D image positioned over the master controls. Vision system on-site scope of an onsite vision system. The da Vinci Surgical System from Intuitive Surgical, Inc., is an enabling the next generation of surgery. The da Vinci Surgical System, which combines the most recent developments in robotic and computer technology, is the only operative surgical robot that has been approved by the US Food and Drug Administration as being safe and effective for

performing surgery. Several surgical specialties and a large range of surgical procedures can be performed with the da Vinci Surgical System. Patient Benefits of Robotic Prostate Surgery. The da Vinci Surgical System's 3-D perspective makes it easier for the surgeon to see important anatomy, like the delicate nerves around the prostate. The EndoWrist™ Instruments give the surgeon the dexterity necessary to accomplish a delicate and accurate surgical dissection and restoration of the bladder and urethra without the use of traditional laparoscopic instruments.

Initial Incision:

A single 3-cm infra-umbilical incision is made ~2 cm below the umbilicus (figure 2). The anterior rectus fascia is incised using Metzenbaum scissors as the abdominal planes are meticulously dissected until it is reached. A retraction suture is then placed at the inferior edge of the incision. Through the facial incision, blunt dissection is performed by first making a gap under the anterior rectus fascia in the preperitoneal area with the index finger. After that, a kidney shaped Spacemaker™ balloon (Covidien, Dublin, Ireland) is introduced through the facial incision towards the pubic bone and the tip positioned in the pre-pubic bone area. The balloon is inflated and the preperitoneal working area is created using approximately 400 mL of air. Extraperitoneal was used to install the single port disposable multichannel laparoscopic access platform. Examining the created space with a 10-mm, 0° lens laparoscopic endoscope is an optional step. The port placement was done. (Figure: 3).

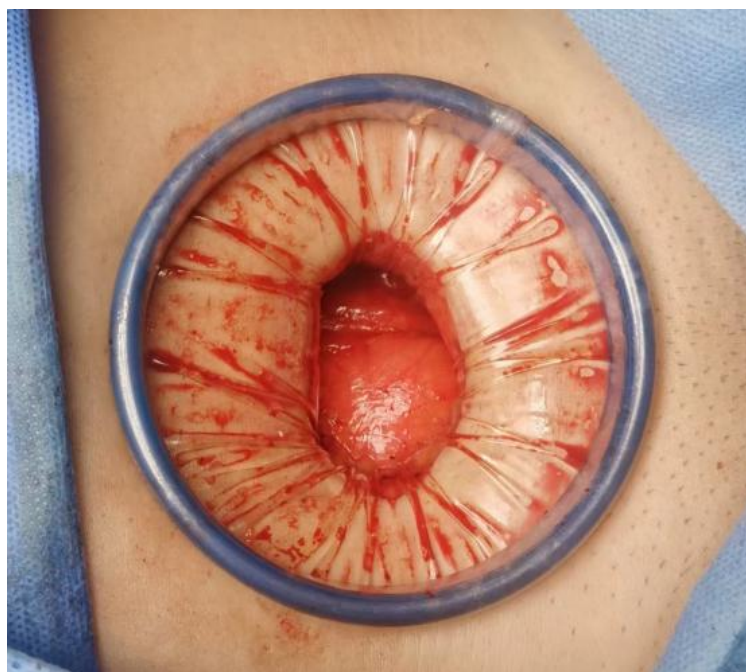


Fig2: Initial incision, a single 3-cm infra-umbilical incision is made ~2 cm below the umbilicus.

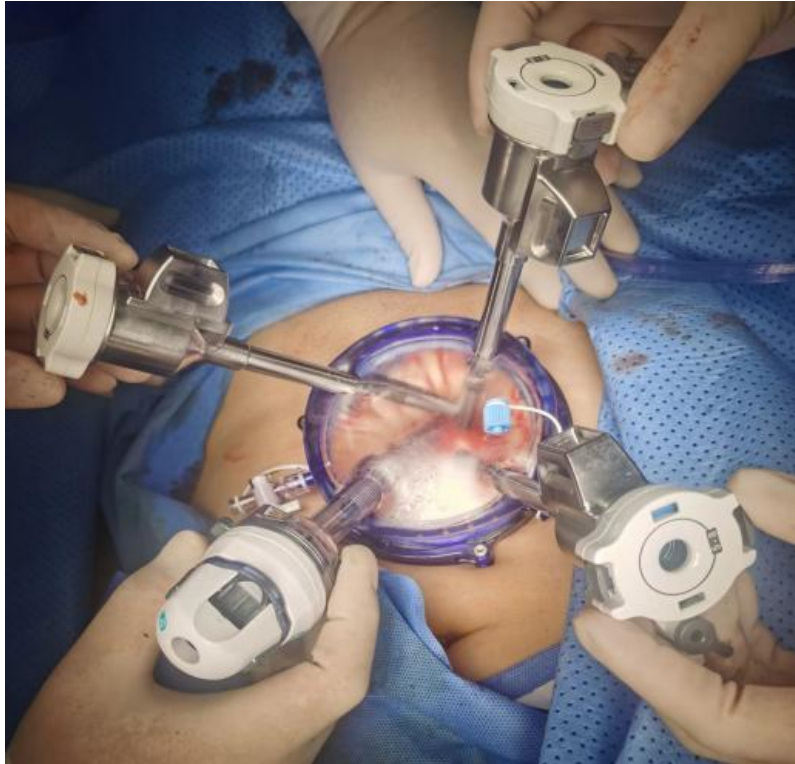


Fig 3: The single port disposable multichannel laparoscopic access platform was inserted in extraperitoneal.

The port was placed with Robotic arms (figure:4) the initial experience the procedure must be performed by surgeons with previous robotic experience, and surgeons must try to replicate their experience with previous robotic platforms, move to different approaches with new techniques until simulation devices was difficult learning instruments are developed . After surgery over suturing was done with easy and single 4cm incision (figure: 5)



Fig: 4 The port was placed with Robotic arms.



Fig: 5 After suturing it is single 4cm incision

APPROACH

In order to drop the bladder and develop the Retzius space, we began with the instruments in the positions mentioned above (bipolar-Cadiere-scissors) and the scope in a neutral straight Position. Dissection of the anterior and posterior bladder walls was carried out following bladder neck identification with movement of the Foley catheter balloon and recognition of the cessation of vesicoprostatic fat. The instrument's location (bipolar and cadiere) at the six and nine o'clock positions (for dissection and exposure of the seminal vesicle and Vas deferens) had been changed to retract the Foley catheter. While limiting thermal injury, the bipolar and scissors were used to dissect the vas deferens and seminal vesicles, and the assistant applied the clips for athermal ligation (Figure:6). Then, using the toggling technique, we designed the interfascial plane and the plane between the prostate and rectum for neurovascular bundle (NVB) retrograde early release and preservation. The scope was directed towards an upward angulation facing the posterior portion of the prostate for toggling after the Denonvilliers fascia was released. The medial side of the NVB and the posterior part of the prostate were dissected using the toggling technique. The scope was angled downward toward the posterior after adjusting for early retrograde NVB release. Sharp and minimum incisions were made to the endopelvic fascia. The lateral prostatic fascia was exposed and then separated from the NVB through the interfascial plane. Using a sweeping motion and H-lok, which the helper clipped through an additional 12-mm port, the NVB was split after entering and tunneling to the already divided Denonvillier the space. Based on the athermal retrograde early release of the NBV, we accomplished NVB preservation and pedicle control (Figure:7). The Santorini plexus was then dissected apically and sutured. In this step, we modified apical dissection to protect the prostate's anterior apical attachments. The Santorini plexus transected, and we used a 0 -V-Loc™ 180 absorbable wound closure suture to close it. (Covidien™). The urethra was then transected at its longest possible length. A 0 -V-Loc™ 180 absorbable wound closure suture (Covidien™) was used for bladder neck reconstruction and posterior reconstruction. Additionally, anterior reconstruction and vesicourethral anastomosis were carried out using 0 -V-Loc™ 180 absorbable wound closure suture. Figure:8

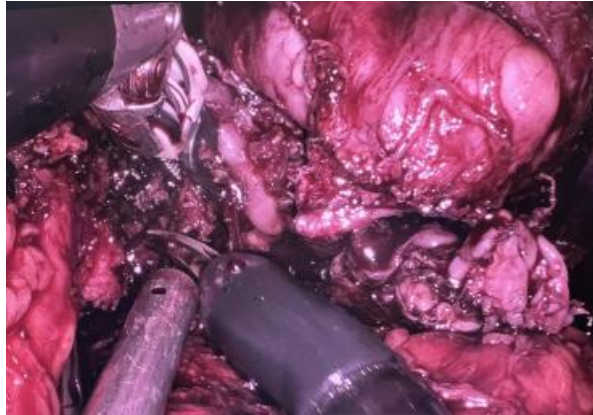


Fig:6 Dissect the vas deferens and seminal vesicles while minimizing thermal damage



Fig: 7 The interfascial plane for neurovascular bundle (NVB) retrograde early release and preservation



Fig: 8 Bladder neck reconstruction and posterior reconstruction

DISCUSSION

Kaouk et al. reported the first case of SP-RARP (prototype) in 2014 [9]. The intraoperative and early functional effects of SP-RARP have been documented in numerous case studies following FDA approval [12-14]. Its safety and viability were demonstrated by a meta-analysis by Checcucci et al. of six studies published on the intraoperative outcomes of SP-RARP [15]. The intraoperative complication rate was practically zero, the mean surgical time was 190.55 min,

the estimated blood loss was 198.4 mL, and the prostate surface margin (PSM) rate was 15%. Additionally, 15% of subjects had two or more postoperative problems according to the Clavien-Dindo system, with only one case of urine leakage and one major complication (transient ischemic stroke) being noted. The total positive margin rate is 33% according to the pathologic outcomes published literature [15]. But only a small number of specific groups carried out the majority of these research. Therefore, it is necessary to have these results verified through multiple operators. The early experiences, insights learned from the learning curve, including selection criteria for newcomers conducting SP-RARP. In the 30 cases studied in this study, SP-RARP was conducted without any major difficulties, even from our limited experience. Additionally, the intraoperative results were feasible and safe. MP-RARPs had a reported PSM rate of 25.1% [16]. The study reports that PSM was 16.7% (2 of 21 [9.5%] patients with stage pT2 disease and 3 of 9 [33.3%] with stage pT3 disease), a rate comparable to that for MP-RARPs. Moreover, 80% of patients in this study achieved full continence and 46.7% showed potency recovery at 12 weeks after the SPRARP [17]. The 12-week continence and potency recovery rates were 55% and 42%, respectively, for these functional outcomes for SP-RARP that have been reported in the published literature [15]. The outcomes of our initial use of SP-RARP show that it is safe and feasible, with perioperative and early functional outcomes that are comparable to those of the admired multiport system. Additionally, an SP approach could decrease pain and has undeniable benefits in terms of appearance [18, 19]. We found no significant challenges using the SP system at the same level as the multiport in regards to suturing; as a result, prostatectomy using the SP system resolves some of the drawbacks of the current version of R-LESS (Robotic-assisted Laparoendoscopic Single-Site Surgery). These results thus give justification for using SP-RAR. According to Moschovas et al., the SP system necessitates taking advantage of a double-articulated wrist and a wider working distance. Moreover, they described several concerns regarding SP-RARP such as, Due to decreased grip and dissection strength and decreased sweeping motion and strength in tissue dissection, it is challenging to retract the structures with the proper traction; as a result, NVB release may be challenging. We tried to perform high-quality radical prostatectomy while retaining patient safety when implementing the new SP platform. Targeting the operative field on the SP platform necessitates continuous use of the relocation pedal. To prevent potential harm, it is necessary to adjust the system using a relocation pedal while keeping focus on all of the instruments. After gaining enough experience with multiport RARP and the sponsor's (Intuitive Surgical) supported program to instructors surgeon-led procedures, the SP platform was selected. This description of technique will aid in the successful adoption of the SP platform. Therefore, a learning curve required rotating and positioning the arms during different surgical step with certain amount of skill [20]. We believe that this description technique will aid in the successful adoption of the SP platform. According to our observations, the joint's range of motion is limited and it has less sweeping power than the multiport system. Patients with a high BMI, a large prostate, and a high oncologic stage can find these limitations has become more of special significance.

The study of Moschovas et.al also reported selection criteria for SP-RARP including low BMI, medium and medium or low-volume oncological disease [21]. In cases of large prostate sizes, the limited range of motion and lack of grabbing and sweeping strength may necessitate repositioning of the arms for holding and effective traction; these procedures may lead to increased operating times and a lack of space for the procedure. The toggling technique and retrograde early release of NBV may not be able to preserve NBV due to the limited range of

motion and sweeping power of the SP arms. In order to further dissect the Denonvilliers space and preserve the NVB, the third arm continued to exert traction on the prostate and seminal vesicles while developing the plane between the prostate and rectum. There is a limit to the distance between the two arms doing the dissection and the third arm holding the prostate during this technique. Using an alarm during system navigation, we could identify the limitation on motion ranges. Several complex factors (e.g., periprostatic adhesion, Prostate cancer (PCa) stage, and medical history of pelvic radiotherapy or previous pelvic surgery) may influence nerve sparing and postoperative potency. Furthermore, the SP platform's limited range of motion and inadequate arm strength could have impacted the NVB dissection. Because NVB preservation is a good predictor of postoperative potency [22], To evaluate these elements of the SP platform, a comparative research of single- and multi-port RARPs will be necessary. Based on our initial experience and lessons learnt from overcoming the learning curve, we recommended the following criteria for surgeons who are performing SP-RARP for the first time: 1) modest prostate size (60 cc), 2) patient BMI of 30 kg/m², and 3) clinical stage T3 [17]. The adoption of a pure SP technique limits bed-side assistant participation during surgery, the surgeon must perform additional responsibilities, such as suctioning. Also, we understand that the cost per case are expected to be greater with the newly developed instruments and technique, as with all new emerging technologies; the expectation is that with outpatient management. We would be able to offset some of the procedure's costs. The inclusion of additional costs for the use of a unique platform, instruments, and other equipment (Spacemaker) may be a disadvantage [23].

Thus, SP-RARP technological advancements may lead to improvements in not just the quality of operations, but also the quality of life (QOL) following surgery, including pain and cosmetic elements. These findings on SP-RARP advances and uses may also give a foundation and perspective for improving the oncological, functional, and QOL outcomes of PCa patients. SP-RARP can be safely and feasibly conducted by operators with adequate MP-RARP expertise, as the learning curve does not necessitate as many 5 cases. However, more well-designed comparison research are needed [17].

CONCLUSION

The new modified technique, which involves an extraperitoneal single-incision robotic-assisted laparoscopic radical prostatectomy, is both safe and feasible. This technique has satisfactory surgical results, improved cosmesis, reduced pain requirement, improved operative visualization during critical operative step and no additional lateral ports, no intraoperative Trendelenburg positioning (especially relevant in obese patients). There may be fewer incision-related problems, reduced pain and narcotic use, no drain, and, in most cases, same-day discharge. The new method shows satisfactory urine control, tumor control, and erectile function recovery. Furthermore, this new method is not restricted to specific dedicated access devices, which facilitates its application. For allows to minimize surgical invasiveness by avoiding the need to access the peritoneal cavity. While high-quality comparison studies are limited, preliminary results from high-volume centers show excellent oncological, functional, and perioperative outcomes. More research is needed to validate the benefits in coming future of clinical experience and use.

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