Surgical Techniques in UROLOGY

# Pure Single-Site Robot-Assisted Partial Nephrectomy Using the SP Surgical System: Initial Clinical Experience

**Jihad Kaouk, Juan Garisto, Mohamed Eltemamy, and Riccardo Bertolo**


**OBJECTIVES** To describe the technique of pure single-site trans-peritoneal robotic partial nephrectomy using the da Vinci SP surgical system.

**METHODS** Three consecutive patients who were diagnosed with contrast-enhanced renal masses amenable of partial nephrectomy were scheduled for robot-assisted partial nephrectomy to be performed using the SP Surgical System.

Data collection received Institutional Review Board Approval (IRB 13-780). Subjects were provided with informed consent explaining the adoption of the novel surgical platform.

The procedures were performed by reproducing the steps of the standard institutional multiarms robotic approach to partial nephrectomy.

**RESULTS** The surgeries were successfully performed. There was no need for conversion to standard multiports robotic approach nor need for additional ports placement. All the procedures were completed according to a pure single-site approach. No intraoperative complications occurred. The total robotic operative time averaged 180 minutes. The warm ischemia time averaged 25 minutes. Blood loss averaged 180 mL. One patient had postoperative acute bleeding and underwent angioembolization. All patients had negative surgical margins.

**CONCLUSION** The feasibility of pure single-site transperitoneal robot-assisted partial nephrectomy using the novel SP surgical system is demonstrated. Further studies are needed to confirm the results reported herein. UROLOGY 124: 282–285, 2019. © 2018 Elsevier Inc.


The recent advances in robotic technology in parallel with the pursuit of reducing the invasiveness of surgery led to the development of novel robotic platforms specifically designed for single-port surgery.[1]

The da Vinci SP surgical system (Intuitive Surgical, Sunnyvale, CA) has been recently approved by the Food and Drug Administration as a purpose-built robotic platform dedicated to single-site and single-port surgery.[2]

The compact profile of its working element is proper to operate within smaller working spaces. Indeed, the feasibility of unconventional single-port approaches to various urologic interventions has been demonstrated in the preclinical model by using the premarketing prototype SP1098.[3-5]

In this report, we described the step-by-step technique of single-site trans-peritoneal robotic partial nephrectomy using the da Vinci SP surgical system.

## MATERIALS AND METHODS

Three consecutive patients who were diagnosed with contrast-enhanced renal masses amenable of partial nephrectomy were scheduled for robot-assisted partial nephrectomy to be performed using the SP Surgical System.

Data collection received institutional review board approval (IRB 13-780). Subjects were provided with informed consent explaining the adoption of the novel surgical platform.

### The Da Vinci SP Surgical System

The da Vinci SP surgical system is the latest version available on the market of the former SP999 and SP1098 single-port robotic platforms.[6]

An instrument arm, which is attached to the patient side cart, contains 4 instrument drives that control the articulating camera and 3 double-jointed articulating robotic instruments. A dedicated 25-mm multichannel port accommodates a 12 × 10-mm

**Financial disclosure:** *Jihad H. Kaouk certifies that all conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript (e.g., Employment/affiliation, grants or funding, consultancies, honoraria, stock ownership or options, expert testimony, royalties, or patent filed, received or pending) are the following: Endocare, Inc, Intuitive.*

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*Submitted: October 16, 2018, accepted (with revisions): November 14, 2018*


https://doi.org/10.1016/j.urology.2018.11.024
0090-4295

articulating robotic camera, three 6-mm double-jointed articulating robotic instruments, and an additional 6-mm accessory laparoscopic instrument. The SP instruments preserve the 7° of freedom at the wrist joint, with the main feature of an additional "elbow" joint maintaining the intracorporeal triangulation. Moreover, the system's single-arm enables a 360° anatomic access.

Further features include an instrument guidance system able to track the locations of the robotic camera and instruments within the operative field, high-definition 3-dimensional optics, and enhanced instrument arm control. The surgeon's console is similar to the previous da Vinci platforms, but an additional foot clutch is included to allow for concurrent movements of the camera and instruments as an individual piece or as a unit.

### Surgical Technique

The patient is placed in flank position (45°-60°) and flush against the edge of the table with a lightly flexion. A 2.5 cm periumbilical incision is made with further dissection to get into the abdominal cavity to allow for the insertion of the Alexis component of the GelPOINT advanced access platform (Applied Medical, Rancho Santa Margarita, CA). Through the GelSeal cap membrane, the 25-mm multichannel port is placed. One 10-mm assistant port is placed through the membrane adjacent to the 25-mm port (Fig. 1).

A suction device tube can be introduced through the GelSeal cap. A wired is tied at the intracorporeal extremity of the tube so that the console surgeon has complete control over suction and the 10-mm port is available to the assistant for other instruments.

If needed, an optional 5-mm port can be placed at the level of the xiphoid for liver retraction during right-sided procedures. The patient cart has a robotic arm that swivels on an overhead boom, allowing the robot to be docked from any position. For the transperitoneal approach to nephron-sparing surgery, the robot is docked in the contralateral side with the robotic base, parallel and perpendicular to the bed, as previously described in our preclinical studies (Fig. 2).[7] The procedure is performed by reproducing the steps of the standard institutional multiarms robotic approach to partial nephrectomy.[8]

The hilum is isolated and prepared for clamping. The defatting of the kidney is performed, and the lesion identified, then intraoperative ultrasonography is used to confirm the tumor boundaries. The ultrasound probe is introduced through the 10-mm assistant port. During ultrasonography, the resection margin can be scored with mono-polar cautery by using the robotic scissors. Clamping of renal artery is obtained by Scanlan bulldog (Health Aid Company, Inc., Tampa, FL) introduced by the assistant. Tumor enucleo-resection is performed combining blunt and sharp dissection. Renorrhaphy is performed in double-layer reproducing the "sliding-clip" technique.[9] During the renorrhaphy phase, the 8-mm Hem-o-Lok clips (Weck, Teleflex Medical, Research Triangle, NC) are placed by the assistant through the 10-mm port. Once renorrhaphy is completed, the clamp is removed. Hemostasis is perfectioned if needed. The integrity of the Gerota capsule can be restored by using Hem-o-Lok clips. The specimen is extracted via the initial single-incision into an Endo-Bag. A Jackson-Pratt drain is placed through the incision. Wound closure is performed in 2 layers. Intradermal suture is performed for skin closure.

## RESULTS

We report the outcomes of the first 3 partial nephrectomies performed.

There was no need for conversion to standard multiports robotic approach nor need for additional ports placement. All the procedures were completed according to a pure single-site

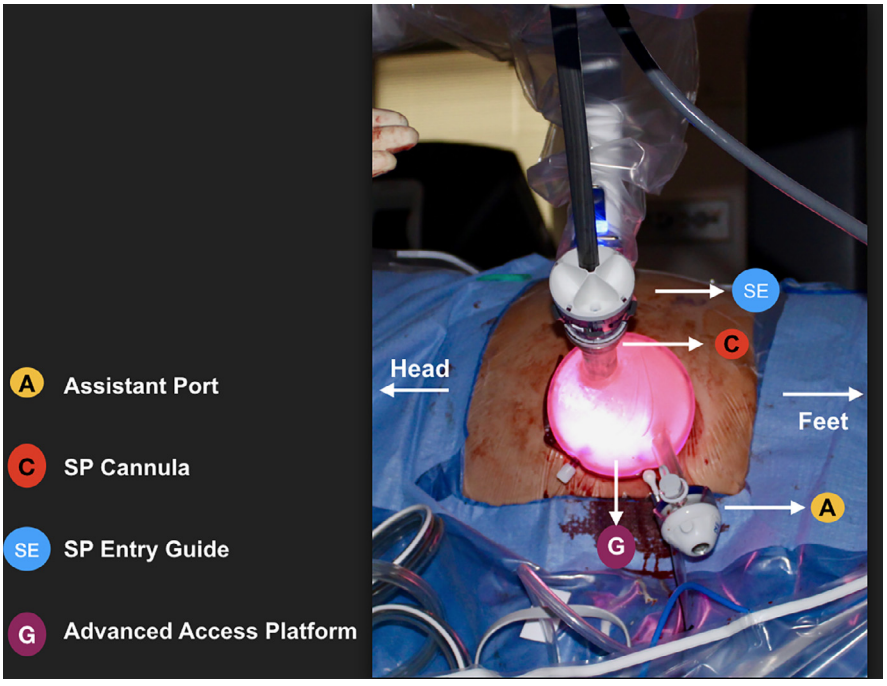


**Figure 1.** The GelPOINT advanced access platform accommodating the SP dedicated 25-mm multichannel port and one 10-mm port for the assistant. (Color version available online.)

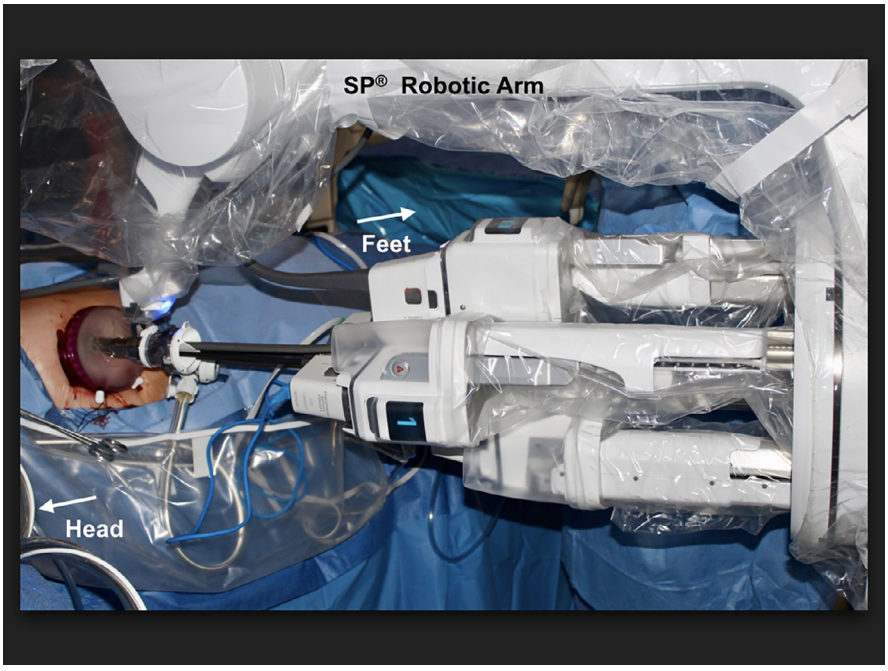


**Figure 2.** The SP surgical system docked during left robot-assisted partial nephrectomy. (Color version available online.)

approach. Complete baseline patients' demographics, clinical scenarios, and perioperative outcomes are reported in Supplementary Table 1.

The total robotic operative time averaged 180 minutes. The warm ischemia time averaged 25 minutes. Blood loss averaged 180 mL. No intraoperative complications occurred. One patient required angioembolization due to postoperative acute bleeding. Cosmetic result was encouraging (Fig. 3). All patients were found with malignancies. None of them had positive surgical margins (Supplementary Table 1).

## DISCUSSION

In this report, we demonstrated the feasibility and effectiveness of pure single-site transperitoneal robot-assisted

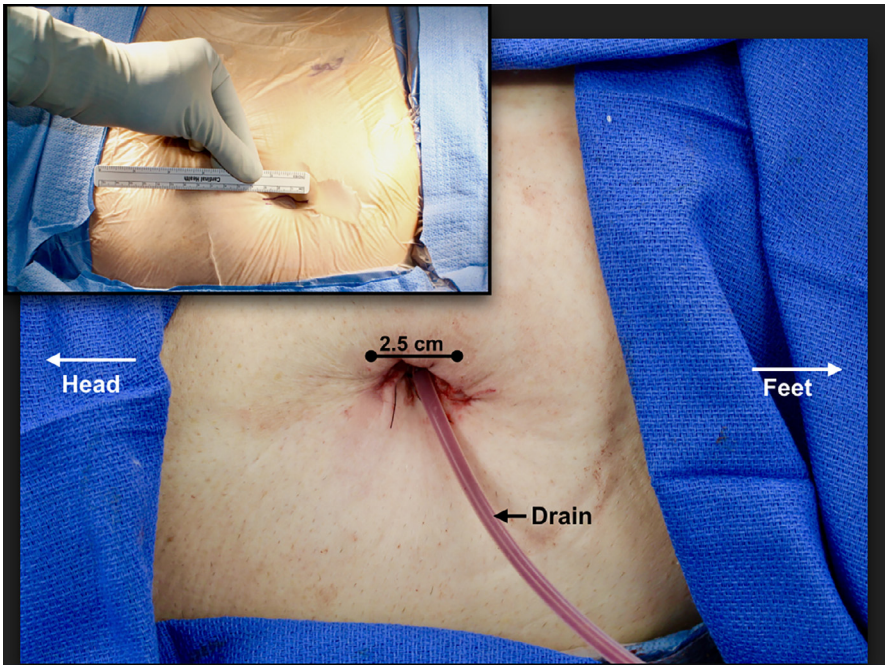


**Figure 3.** The 2.5 cm incision is performed at the beginning of the procedure to accommodate the GelPOINT platform (top left corner). The final result after intradermal suture is showed. The drain is placed through the initial incision. (Color version available online.)

partial nephrectomy using the novel SP surgical system. To our knowledge, this is the first case-series of robotic partial nephrectomy performed by using the SP surgical system.

In the setting of a prospective Innovation, Development, Exploration, Assessment, Long-term phase 1 study, Kaouk et al performed 4 left robotic partial nephrectomies in 2010, by using the da Vinci SP999 prototype.[10] Tumor size ranged 1.6-4 cm. No conversions were reported. Median operative time was 232 minutes (range 182-292). Median blood loss 550 mL (range 300-2500). A median warm ischemia time of 38 minutes (range 26-45) was reported. The perioperative results obtained with the initial experience reported herein seem to be encouraging.

We underline that a learning curve exists when embarking with this surgery. The instruments of the SP surgical system allows for degrees of freedom comparable to those of the standard multiports da Vinci platforms, but differences are perceived, particularly during intracorporeal suturing, due to the novel elbow.

Moreover, in common with single-site/single-port surgery in general, a good coordination between the console surgeon and the assistant is required due to the limited working space.

The future perspectives of the system in the field of nephron-sparing surgery have been partially anticipated by our group.[11]

The premarketing da Vinci SP1098 platform was used to perform retroperitoneal single-site partial nephrectomy. Access was obtained 2 cm anterior and inferior to the tip of the 12th rib. By such modified location of the single-port site, the new system allowed to work equally well on both the anterior and posterior surfaces of the kidney, permitting excellent visualization and maneuverability even during a retroperitoneal access.

Comparative studies with standard laparo-endoscopic single-site surgery and multiports robotics are needed. After the initial experience reported, we are unable to suggest a minimum number of procedures to be performed to feel confident with the technology. Ideally, we suggest consistent robotic experience.

Comparative studies with standard laparo-endoscopic single-site surgery and multi-ports robotics are needed.

Moreover, larger sample size and longer follow-up are awaited.

The urologic community needs to define the optimal indications of the novel platform. Undoubtedly, the perspective of a single-universal access allowed by the platform for both anterior and posterior tumors is promising and will be investigated in future clinical studies.

## CONCLUSION

We demonstrated the feasibility of pure single-site transperitoneal robot-assisted partial nephrectomy using the novel SP surgical system. Further studies are needed to confirm the results reported herein.

## SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.1016/j.urology.2018.11.024.

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