Robotic Revelation: Laparoscopic Radical Prostatectomy by a Nonlaparoscopic Surgeon

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In most areas of surgery, minimally invasive procedures have made significant inroads because of major advances in the realm of laparoscopy. But laparoscopic surgery is an entirely new skill to be learned by the well-trained open surgeon. For the classically trained open surgeon, the drawbacks to laparoscopy are many: two-dimensional view, disjunction between the actual surgical field and the view of the surgeon (ie, the television screen is not aligned with the actual surgical field), poor haptic feedback, inability of the surgeon to physically control the view of the surgical field, and the need for continual counterintuitive movement of instruments in order to access the surgical site. Given these substantial hurdles, many urologic surgeons have elected to shun laparoscopic surgery, awaiting further proof of benefit or a less rigorous alternative.

Recently, two three-armed robotic systems have become available that provide the surgeon with both control of the camera and the two working ports. One of these, the da Vinci system (Intuitive Surgical Inc) has end effectors that provide six degrees of freedom similar to the human wrist. The instrumentation provides a three-dimensional view of the surgical field at 10 to 12× magnification and intuitive movement of the instruments. In addition, the controls have 1:5 motion scaling and insensitivity to intention tremor. The ergonomic robotic console is separate from the table, allowing the surgeon to sit comfortably while viewing the surgical field. The surgeon neither scrubs nor gowns, but a table-side surgical assistant is required to aid in tissue retraction, suction, instrument exchanges, and the introduction and removal of suture material.1

The presumption has been that in order to perform robotic laparoscopic surgery, intense training and mastery of basic and advanced laparoscopic skills are necessary. But the current model of the da Vinci robot truly mimics the movements made during standard open surgery, raising the question: Using the da Vinci robot as an interface, does an accomplished open surgeon still require intense training in laparoscopy in order to perform a complex laparoscopic procedure? Herein we report the successful completion of a robotic laparoscopic prostatectomy by an experienced open surgeon with no formal basic or standard laparoscopic training.

Experience and background

In May 2002, a da Vinci robotic system (Fig. 1) was obtained at the University of California, Irvine Medical Center. At that time, the operating and assistant surgeons (TA and RVC, respectively) underwent training on the robot. The surgeon (TA), with no previous laparoscopic training or experience, is a fellowship-trained urologic oncologist and has performed more than 500 open radical retropubic prostatectomies. The assistant (RVC) has extensive laparoscopic experience and over a 12-year period has performed or participated in more than 20 laparoscopic radical prostatectomies. Training on the technical aspects of the robot was accomplished by performing a porcine robotic laparoscopic cholecystectomy and nephrectomy. Port site placement and docking the robot was mentored by an Intuitive Surgical training center technician. The laparoscopic cholecystectomy and nephrectomy were performed in standard open technical fashion facilitated by the robotic interface. No assistant was necessary for these procedures because the porcine specimen was lean and planes were obvious. At this point, the foundation of the robotic fundamentals was achieved. Next the primary and assistant surgeons took a 2-day human cadaver session to become familiar with the principles and their respective steps for performing a laparoscopic radical prostatectomy. In principle, the laparoscopic approach is the same as the standard Campbell’s approach, where the prostate is detached from the bladder and dissected in an antegrade fashion. The cadaver also nicely approximates the steps of the urethrovesical anastomosis.
Case report
A 63-year-old man presented with a PSA of 6.5 ng/mL; rectal exam revealed a small, benign prostate. Sextant needle biopsies revealed a Gleason 4/5 prostatic adenocarcinoma in five of six cores, and his bone scan was negative. Given the nature of his cancer, the patient was counseled about radiation therapy or surgery. It was noted that a radical prostatectomy would likely control the local disease and in conjunction with hormonal therapy, might prolong survival. The patient opted for surgical intervention. After thorough counseling about the risk of conversion to an open procedure, the patient elected to be our first patient to undergo a robotic laparoscopic prostatectomy. On June 18, 2002, the patient underwent a robot-assisted laparoscopic non-nerve sparing radical prostatectomy. Although a pelvic lymph node dissection was planned it was not performed because the patient had been in stirrups (counting total set-up time) for more than 8 hours. We will follow his PSA closely and institute hormonal therapy whenever there is clear evidence of PSA progression.

Methods
The primary surgeon (TA) performed the procedure from the robotic console with two tableside assistants (RVC and a resident in training, EP). The experienced laparoscopic assistant directed the placement of the six ports (two 12-mm, two 8-mm, and two 5-mm trocars) and provided exposure and suction as needed. The second assistant provided additional exposure when needed. All steps were performed or directed by the console surgeon. Dissection of the prostate was performed using the Mountsorour transperitoneal retrovesical antegrade technique. The anastomosis was performed completely by the console surgeon in a running fashion in the style of van Velthoven (Fig. 2).

Results
The time to dock the robot was 15 minutes. Total console time for the prostatic dissection required 6.5 hours, of which the anastomosis took 35 minutes. Estimated blood loss was approximately 300 mL and the discharge hemoglobin was 13.2 g/dL. Postoperatively the patient was eating and ambulating the next morning and was discharged from the hospital within 24 hours of the procedure. The final pathology demonstrated T4a involvement with a Gleason score of 5 + 4. The bladder neck margin was positive, but the seminal vesicles were free of carcinoma. With 6 months of followup the PSA remains nondetectable.

On postoperative day 7, a voiding cystogram was performed; it revealed an intact anastomosis with no extravasation or obstruction. The catheter was not replaced. The patient was immediately continent.
Discussion

The initial laparoscopic prostatectomy was performed by Schuessler, Kavoussi, and Clayman in 1991. Subsequently, between 1991 and 1995, nine procedures were completed, with an average operating room time of 9.4 hours. The outcomes of these procedures were not an improvement over standard retropubic open prostatectomy and the procedure was abandoned. In 1998, Vallancien and Guillonneau reexplored the laparoscopic prostatectomy. While suffering through a similar early experience to that of Schuessler and colleagues, they persevered through the learning curve, showing that after 40 cases, operative times could be reduced significantly (4.8 hours). Nonetheless, among their initial 40 cases, it was necessary to convert to an open procedure in 10%. Since that time, other urologists have adopted a laparoscopic approach to retropubic prostatectomy. All have attested to a learning curve of 40 to 50 cases despite the procedure being largely performed by individuals already well experienced in laparoscopic surgery. In no case has there been a report of a completely laparoscopically naïve surgeon proceeding to perform this type of surgery successfully.

In 1994, the first surgical robotic assistant was approved for human use. The AESOP robot (Computer Motion, Inc) was equipped solely to control the laparoscope, initially by foot or hand control and later by voice control. Subsequently, this company introduced a three-armed robot, ZEUS. With this robot, the surgeon could complete an entire laparoscopic procedure while seated at the control console. But the end effectors only provided four degrees of freedom and control of the laparoscope was by voice. In 1997 the three-armed da Vinci robotic system was approved for human use. Major advances in this robotic system included true three-dimensional viewing, motion scaling, hand control of the laparoscope, and end effectors with six degrees of freedom. The last feature provided the surgeon with instrumentation that could easily mimic all movements of the human wrist.

The da Vinci robotic system has only recently been used to perform laparoscopic prostatectomy. Initially, Abbou and colleagues reported on their experience with da Vinci prostatectomy, noting a case time of 7 hours with an anastomosis time of 30 minutes. Of interest, at the time of this report, Abbou was already an accomplished laparoscopic prostatectomist, having performed more than 50 cases and having reduced his initial operative time of 9 hours down to 3.5 hours. A month later, Guillonneau, Menon, and colleagues reported on five da
Vinci radical prostatectomies, with an average case time of 3.7 hrs and a hospital stay of 5.5 days. Again, their robotic experience was preceded by more than 100 laparoscopic radical prostatectomies (BG).

The leaders in laparoscopic surgery have, in every case, been endourologic surgeons who have adapted laparoscopic techniques to other fields, most notably that of oncology. This has been particularly true in the area of radical prostatectomy. Indeed, of all the laparoscopic procedures performed to date, perhaps the most difficult and challenging has been the radical prostatectomy given its requirements for meticulous ablative and reconstructive surgery. In each case, when a laparoscopic surgeon has embarked on laparoscopic prostatectomy, the initial case times have been in the 8 to 10 hour range.3-5

In contrast to the foregoing paradigm, our case report represents the initial experience in which a laparoscopically naïve, albeit fellowship-trained urologic oncologist, by using a robotic interface, has been able to successfully transfer his open surgical skills directly to a laparoscopic field. The procedure time, and in particular, the time to complete the anastomosis, were remarkably similar in many respects to the initial experience of highly skilled laparoscopic surgeons. These results run exactly counter to reports on skills training in laparoscopy. Specifically, these studies have routinely shown that open surgical skills do not transfer to the standard laparoscopic realm. Indeed, in one study, senior surgical residents and interns performed similarly in a suturing laparoscopic training module despite the obvious advanced open surgical skills of the former.8 As such, we believe that this report might serve as the initial example in an evolving paradigm in which the skilled open oncologic surgeon, after brief introductory training on a da Vinci robot, can progress immediately to the successful performance of both simple and highly complex laparoscopic procedures. To do this, a tableside assistant with at least basic laparoscopic skills is needed for obtaining the pneumoperitoneum, port placement, tissue retraction, and suture introduction. This development might empower many more urologists, especially those who already have basic laparoscopic skills, to be able to offer their patients a laparoscopic alternative to open surgery.

REFERENCES