Robotic-Assisted Laparoscopic Sacrocolpopexy

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Robotic surgery represents the latest development in gynecologic laparoscopy, enabling surgeons to use a minimally invasive approach for more complex procedures.

FOCUSPOINT

The FDA's approval of the da Vinci robotic system for gynecologic procedures gives appropriately trained surgeons access to an interesting new technology.

Advancements in technology always pose a dilemma for practicing physicians. Adopting technologies too early may have potentially disastrous results, but waiting too long for technology to prove itself can deprive patients of optimum care. This balance is difficult to achieve as sound scientific studies continue to be outpaced by constantly evolving technologies.

The FDA's approval of the da Vinci robotic system for gynecologic procedures gives appropriately trained surgeons access to an interesting new technology. As physicians search for ways to improve patient care, conversion of traditionally "open" procedures to laparoscopy is gaining popularity. Decreased patient morbidity with equal or improved outcomes has been proven for numerous laparoscopic techniques. Gynecologists have played a major role in developing laparoscopic technology and approaches, but have been relatively resistant to adopting it for more complex procedures. With few exceptions, laparoscopy is limited to relatively minor gynecologic surgery. Robotic technology may help to change this situation.

A robot is a programmable, multifunctional device that manipulates objects with programmed motions to perform a task. Initially, robots were primarily used to replace humans in hazardous environments.[1] The concept of robotic surgery became a reality in 1999, when the first 2 da Vinci systems were installed in US operating rooms; by the end of 2006, more than 400 systems were in place. Specialties such as cardiothoracic surgery and urology have led the way in using robotics for well established procedures. Performing major heart surgery without sternotomy significantly decreases patient morbidity, and patients undergoing radical prostate surgery now enjoy same-day discharge—leading to a similar impact on urology. Lagging somewhat behind, gynecology is now adopting laparoscopic/robotic procedures for radical hysterectomy, lymph node sampling, myomectomy, tubal reanastomosis, and sacral colpopexy to improve patient care. Robotic

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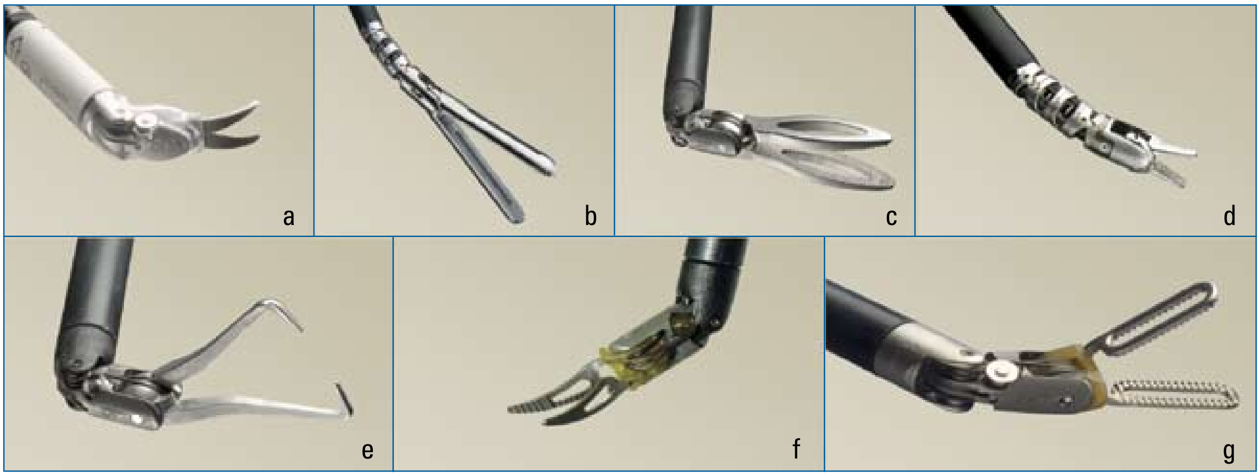

FIGURE 1. Robotic instruments. From top left: (a) 8-mm monopolar curved cautery scissors, (b) 5-mm bowel grasper, (c) 8-mm thoracic grasper, (d) 5-mm needle driver, (e) 8-mm tenaculum forceps (if hysterectomy is involved), (f) 8-mm fenestrated bipolar forceps, (g) fenestrated bipolar forceps (if hysterectomy is involved for larger pedicles).

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surgery can help to make the transition from complex laparotomy procedures to minimally invasive approaches, with all of the attendant benefits.

BACKGROUND

Pelvic organ prolapse (POP) is a common medical condition in which prevalence increases with age.[2] Up to 250000 operations to correct POP are performed each year in the United States alone,[3] and as the proportion of older women rises, the demand for these surgeries is expected to increase by approximately 50%.[4] Although no specific operation can truly be considered the "gold standard" for the correction of POP, abdominal sacrocolpopexy was recently dubbed the "main abdominal approach" for prolapse surgery.[5,6] This distinction seems appropriate, given that reported POP cure rates from sacrocolpopexy studies range from 85% to 100%.[7-9]

FOCUSPOINT

When performed laparoscopically, sacrocolpopexy offers comparable clinical results with very little morbidity.

Sacrocolpopexies are traditionally performed through a large abdominal incision; its invasive nature has relegated it to only the most severe cases of prolapse. When performed laparoscopically, however, sacrocolpopexy offers comparable clinical results with very little morbidity. Still, relatively few surgeons currently possess the advanced skills necessary to perform laparoscopic sacrocolpopexy using the same methods employed in open abdominal surgery. Given the financial and time constraints currently faced by most surgeons, acquiring such skills may not be feasible.

Robotic assistance from the da Vinci system can significantly shorten the learning curve associated with laparoscopic sacrocolpopexy. The tools and techniques for performing a robotic-assisted laparoscopic sacrocolpopexy (RALSC) using the da Vinci surgical system are outlined in Figures 1 and 2.

PROCEDURE

Preoperative Care

Simple bowel preparation using magnesium citrate or a similar preparation should be implemented on the day and night before surgery to decompress the large and small bowels. One dose of prophylactic intravenous (IV) antibiotics is given no sooner than 2 hours and no later than 30 minutes before surgery begins.

No further peri-operative oral or IV prophylactic antibiotics are necessary.

Patient Positioning

The patient should be placed in a low dorsal lithotomy position, with her arms tucked and padded at her sides (Figure 3). Well-padded stirrups should be used. Shoulder pads can keep the patient from sliding on the table. Once the patient is secured from slipping, she should be placed in a very steep Trendelenburg position for preparation and draping.

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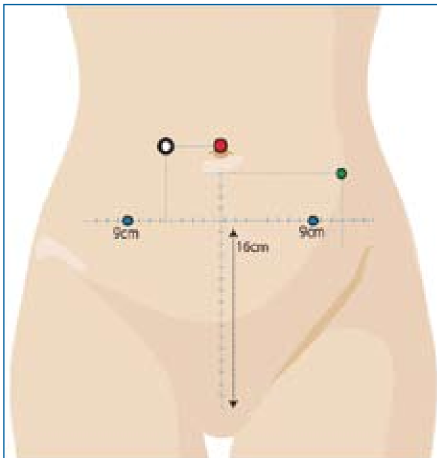
Hysterectomy

When the uterus is present, a hysterectomy should be performed prior to RALSC. This allows the surgeon to use the subsequent graft to cover both the anterior and posterior vaginal walls. Performing a total hysterectomy with RALSC may predispose the patient to graft erosion at the level of the vaginal cuff.[8] Therefore, a supracervical hysterectomy is preferred so that the cervix can serve as a buffer between the graft material and the vagina.

For the hysterectomy, the operator can use a fenestrated bipolar forceps in the left hand and wristed cautery shears in the right hand. Once removed, the uterine fundus is placed in the upper abdomen for morcellation after the sacrocolpopexy is completed and the robot is undocked.



- Camera port: umbilical, 12-mm diameter, extra-long disposable trocar
- Main operative ports: midline is marked 16 cm cephalad to the inferior margin of the symphysis pubis; proper left and right port placement sites will be approximately 9 cm perpendicular to this point, with a full hand's-breadth between the iliac crest and the port site
- Third instrument arm port: left side, 4 cm superior and 3 cm lateral to the main operative port on that side; a generous space should be allowed between the port site and the iliac crest
- Assistant port: 12-mm diameter disposable port, 5 to 6 cm lateral to the camera port

FIGURE 2. Port placement; measurements are performed after insufflation.

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Preliminary Steps

The bowel grasper (the third robotic arm on the patient's left) is used to retract the rectum slightly to the left side, exposing the right paracolic gutter and the sacral promontory. It is important to clear the pelvis of any adhesions before initiating dissection along the vagina. An assistant places a stent to fully demarcate the length and width of the vagina. At this point, the surgeon can determine the length of any anterior and/or posterior defects to be corrected. The graft material can then be tailored to fit these defects.

Vaginal Dissection

The peritoneum overlying the vaginal apex is incised in a transverse fashion using the cautery shears. The thoracic grasper is useful for creating countertraction throughout the dissection phase of the procedure, and can then be used along with the cautery shears to dissect the vagina free from the bladder and rectum. The assistant who is holding the vaginal stent can greatly facilitate dissection by repositioning the stent as directed by the surgeon. The stent can be replaced by a Breisky retractor for dissecting the posterior compartment, as the stent may obscure the posterior view because of its round shape.

Sacral Dissection

A 0° endoscope may be used for the entire sacrocolpopexy. The middle sacral vessels are usually easy to visualize in the midline, running directly over the anterior longitudinal ligament. All other soft tissue should be cleared from this ligament at the upper portion of the sacrum near the promontory. If this dissection is performed too far down the sacrum or too far lateral, it may result in serious bleeding from the lateral sacral venous plexus.

Vaginal Graft
Multiple interrupted sutures are used to fasten the mesh to the vaginal tissue. Traditionally, these sutures should be monofilament and permanent. Alternatively, delayed absorbable suture (eg, polydioxanone sulfate [PDS]) can be used. The graft itself must be trimmed to fit the specific defect. When suturing the graft to the vagina anteriorly, care should be taken to place sutures symmetrically. As long as the sutures are placed at or near the sacral promontory (where the ligament is quite thick and strong), only 2 or 3 permanent sutures are required.

The graft material should be buried beneath the peritoneum with a running stitch using 0- synthetic absorbable monofilament suture; this prevents bowel from intruding between the graft and the pelvis. Clips made of PDS suture material are used on either end of the running suture in lieu of knots, saving time and keeping the peritoneum flat on top of the mesh. A retropubic sling can be placed after completing the robotic portion of the procedure if required for stress urinary incontinence.

Postoperative Care
A vaginal pack is inserted as a pressure dressing, and can be removed on the morning after surgery. No IV narcotics are needed unless NSAIDs and/or oral narcotics do not provide adequate pain relief. Patients are discharged on the first postoperative day after completing a voiding trial.

CONCLUSION
The RALSC can be used to treat a variety of POP configurations in addition to apical prolapse. As there are no technical differences between the laparotomy and laparoscopy surgical approaches, this procedure can provide the best possible prolapse surgery using the least invasive technique. The high success rates and minimal morbidity are other advantages of RALSC. The robotic system offers improved instrument dexterity and precision, combined with improved three-dimensional visualization. Feasibility studies have identified a wide variety of gynecologic surgeries that may benefit from robotic assistance. Prospective studies are now needed that directly compare clinical, quality-of-life, and economic outcomes for robotic and standard procedures. Most potential drawbacks of a robotic system involve cost—a $1.2 million capital expense and spending for instrumentation, drapes, system maintenance, training for surgeons, proctoring, and a dedicated robotic operating room staff. The major functional disadvantage of the robot is the lack of tactile feedback (haptics). Models are under development that will incorporate tactile sensation, but this technology is still far off.


FIGURE 3. Patient positioning.

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FOCUSPOINT

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