MASTER CLASS

Robotic-Assisted Lymphadenectomy

BY CHARLES E. MILLER, M.D.

Despite the early, pioneering efforts of physicians such as Dr. Denis Querleu in France, as well as Dr. Joel Childers and our author, Dr. Farr R. Nezhat, in the United States, the acceptance of laparoscopic surgery by gynecologic oncologists has been lackluster at best. Lately, however, no area of our specialty has shown faster adaptation to minimally invasive surgery than has gynecologic oncology. In fact, secondary to the interest in laparoscopic oncologic procedures, the AAGL has recently created a gynecologic oncology specialty group. Due to his vast experience, Dr. Nezhat has been given a leadership role in this endeavor. It is this editor's belief that the utilization of robotics is the single factor that has created such a rapid movement within the gyne-oncology community to embrace laparoscopic surgery. The 3-D visualization, combined with the seven degrees of motion of robotic instrumentation, has enabled the gynecologic oncologist to work precisely and efficiently. Despite his vast experience in laparoscopic surgery, our guest author was an early convert to robotic-assisted surgery.

Dr. Nezhat is the director of minimally invasive surgery and gynecologic robotics, as well as chief of the gynecologic robotic, minimally invasive surgery fellowship, in the division of gynecologic oncology at St. Luke's–Roosevelt Hospital Center, New York. He has written more than 100 articles in peer-reviewed journals, many of which involve laparoscopic surgery. Dr. Nezhat is truly one of the thought leaders of our specialty. It is an honor to have him write this current column of the Master Class in gynecologic surgery. ■

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Robotic Technology Overcomes Previous Limitations

BY FARR R. NEZHAT, M.D.

The first reports of laparoscopic pelvic and para-aortic lymphadenectomy appeared in the literature in the late 1980s and early 1990s—that is, 15-20 years ago. Yet despite the real advantages of laparoscopy over laparotomy, the acceptance of a laparoscopic approach to lymphadenectomy in the gynecologic oncologic community has been slow.

The tepid response is due largely to conventional laparoscopy having significant drawbacks. In a standing position, surgeons use a flat, 2-D image and instruments that are long and nonarticulating. Motions are counterintuitive and the learning curve, consequently, is long.

With the robotic technology currently available, such limitations are largely overcome. Advantages of the technology include a 3-D view, an increase in instrument "wrist" mobility from four to seven degrees, and movements that are significantly more intuitive.

These improvements facilitate better vision, easier suturing, and more precise dissection of tissue around sensitive areas such as major blood vessels and the ureters. And because the surgeon sits at a console unit instead of in an awkward position at the operating table, surgeon fatigue is significantly reduced.

This merging of the advantages of laparotomy and laparoscopy—and the more precise gynecologic surgery that results—is changing lymphadenectomy just as it is other types of gynecologic surgery.

The first laparoscopic radical hysterectomy was performed in June 1986; however, until recently, fewer than 1,000 cases of laparoscopic radical hysterectomy with lymphadenectomy had been reported. Now, with the availability of the da Vinci robotic system, more and more gynecologic oncologists in both teaching and community hospitals are routinely performing this procedure and other lymphadenectomies in patients with endometrial, cervical, early ovarian, fallopian tube, and other gynecologic malignancies.

In fellowship training programs specifically, the application of the technology has increased the usage of laparoscopy in gynecologic oncology—with learning curves documented as being significantly shorter than the learning curves associated with conventional laparoscopy.

Pelvic Lymphadenectomy

In terms of patient selection, there are no more limitations to the use of the robotic approach than with conventional laparoscopy. Robotic lymph node dissection can be offered to all patients for whom laparoscopy is deemed appropriate. It is advantageous, in fact, for women who are obese since the robotic approach bypasses the fulcrum effect that is especially challenging in patients with a thick abdominal wall.

As with other robotic-assisted gynecologic procedures, robotic lymphadenectomy is performed using the da Vinci system, an integrated computer-based system consisting of three interactive robotic arms and a camera arm with a remote control console. The system is the only robotic device with FDA approval for use in gynecologic surgery at the present time.

For pelvic lymphadenectomy, with the patient under general endotracheal anesthesia, we place our primary robotic trocar (a 12-mm port) through the umbilicus for the laparoscope. Two 8-mm trocars are placed 8-10 cm bilaterally and 2-3 cm lower than the umbilicus. Such placement enables optimal movement of the robotic arms and minimizes the risk of collisions (Fig. 1).

A 10- to 12-mm assistant port is then placed on one side (most often the right side) of the umbilicus (between the camera port and one of the 8-mm trocars, 1-2 cm high). Through this port, the assistant can introduce suture and instrumentation used for retraction and suction/irrigation, as well as remove specimens. We use the Harris-Kronner Uterine Manipulator-Injector (Humi) for our gynecologic cancer patients whenever possible. Although some physicians believe its use during either conventional or robotic-assisted laparoscopy may cause dissemination of the cancer, we have found this not to be the case.

In a series of cases in which we performed laparoscopic staging for both cervical and endometrial cancer using the manipulator and compared it with conventional staging through laparotomy, we found no compromise in recurrence or in the survival rate (Int. J. Gynecol. Cancer 2007:17;1075-82 and J. Minim. Invasive Gynecol. 2008:15;181-7).

Once the trocars are placed, the patient is placed in a steep Trendelenburg's position and the robotic tower is docked between the patient's legs. The surgeon sits at a console, and the assistant stands to the patient's left or right side. Occasionally, we use a second assistant—most often when the assistant cannot adequately reach the vagina of an obese patient.

After a survey of the pelvic cavity to rule out any sign of metastases in the abdominal cavity and to identify any associated pathology that needs to be treated, such as adhesions that need to be lysed, we proceed with the lymphadenectomy.

The procedure is usually performed with bipolar forceps placed through the left robotic port, and a monopolar electrosurgical spatula, or scissors, placed through the right port. If necessary, a 10-mm clips applier or blood vessel sealing devices can be placed through the assistant's port.

Pelvic wall dissection involves coagulating and cutting the round ligaments on either side of the pelvic wall and then making an incision over the peritoneum between the infundibular pelvic ligament and the vessels in the pelvic side wall.

The retroperitoneal space is developed and the ureter is identified medially, and if the ovary is to be removed, which is the case in most patients, the infundibular ligament is isolated, desiccated, and divided using the bipolar forceps and scissors.

The paravesical and pararectal spaces are then developed by retracting the umbilical ligament (the superior vesicle artery) medially and performing blunt dissection between this artery and the pelvic side wall.

The obturator nerve can usually be identified at this point, and the obturator fossa nodes and hypogastric lymph nodes can be removed. Occasionally, when the obturator nerve cannot be identified initially, the obturator fossa nodes must be dissected and retracted medially, under the external iliac vein. Then, when the nerve is identified under these lymph nodes using blunt dissection, all nodes from the obturator fossa all the way up to the hypogastric vessels can be resected (Fig. 2).

After removing the lymphatic nodes from the obturator fossa and the hypogastric vessels, we remove all nodes along the external iliac vessels from the external common iliac artery down to the deep circumflex vein.

Blunt and sharp dissection performed with the scissors, forceps, and suction irrigator is used for resection of all these

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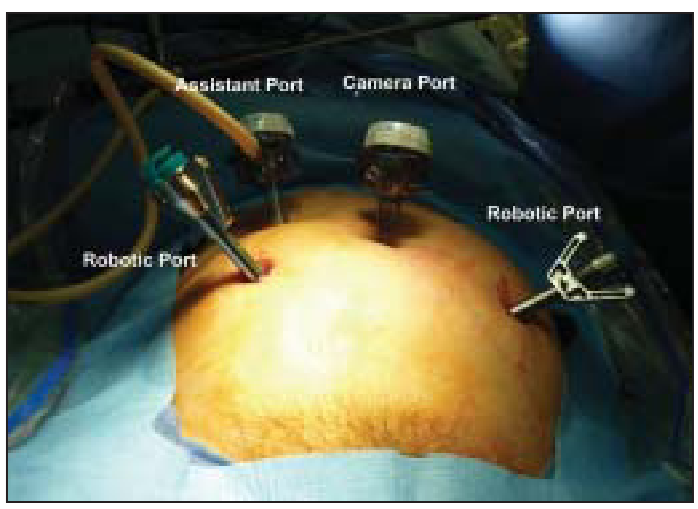
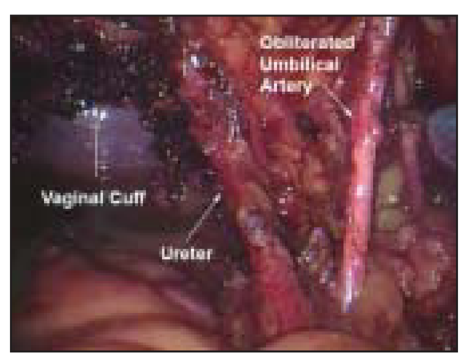


Fig. 1: Two 8-mm trocars are placed 8-10 cm bilaterally and 2-3 cm lower than the umbilicus.



PHOTOS COURTESY DR. FARR R. NEZHAT

Fig. 2: All lymph nodes from the obturator fossa to the hypogastric vessels are removed.

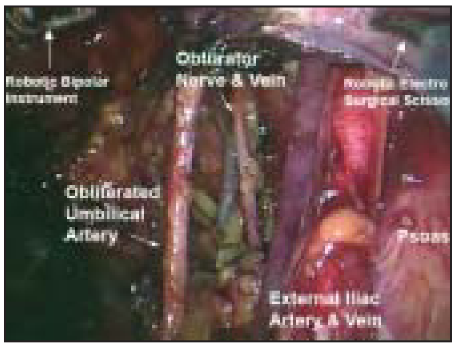


Fig. 3: Sidewall retroperitoneal anatomy is shown after total lymphadenectomy.

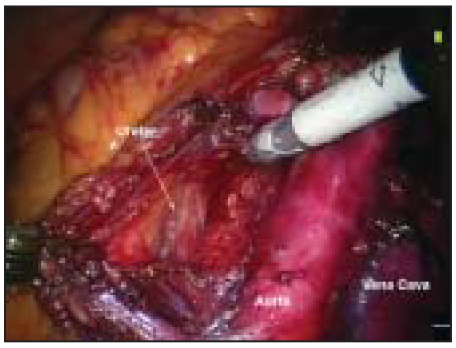


Fig. 5: The para-aortic node below the inferior mesenteric artery is removed.

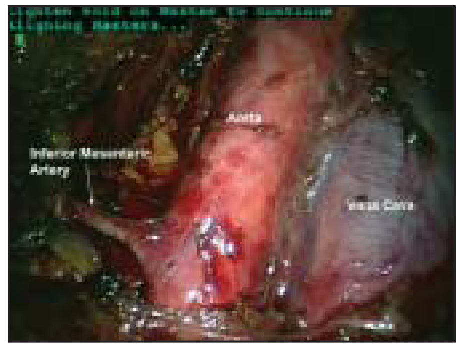


Fig. 6: Lymph nodes from the vena cava, and around the inferior mesenteric artery have been removed.

Photos courtesy Dr. Farr R. Nezhat

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nodes, and bipolar and unipolar forceps are used to achieve hemostasis and to clear the lymphatic channels (Fig. 3).

This is the same process we follow during conventional laparoscopic lymphadenectomy, except that the conventional laparoscopic approach can be done using ultrasonic shears, which are multifunctional and may lower the risk for tissue damage. With the current da Vinci system, we are limited to using electrosurgery instrumentation for coagulation and cutting, but we have found that these instruments are more than adequate.

Para-Aortic Lymphadenectomy

For para-aortic lymphadenectomies in which node dissection will extend up to the inferior mesenteric artery, the trocar positioning is the same as for pelvic lymphadenectomy.

If node dissection above the inferior mesenteric artery is planned, however, trocar placement must be modified, with the camera port placed approximately 5-8 cm above the umbilicus and the other trocars adjusted accordingly, based on the different camera port placement (Fig. 4).

The peritoneum is incised over the right common iliac artery, and the incision is extended cephalad over the inferior vena cava and lower abdominal aorta to the level of the duodenum, above the inferior mesenteric artery. The right ureter should be identified first, with the retroperitoneal space gradually developed toward the left side, and the left ureter then identified (Fig. 5).

The assistant port or the fourth arm of the robot is used to retract the ureter or the bowel laterally. The lymph adenectomy starts from below and gradually extends upward toward the insertion of the ovarian vein to the vena cava on the right side and the renal vein on the left side.

The nodes are removed using the same technique as for pelvic lymphadenectomy, with bipolar forceps used as a grasping forceps and for coagulation of the small blood vessels and unipolar forceps used for cutting and achieving hemostasis for these vessels (Fig. 6).

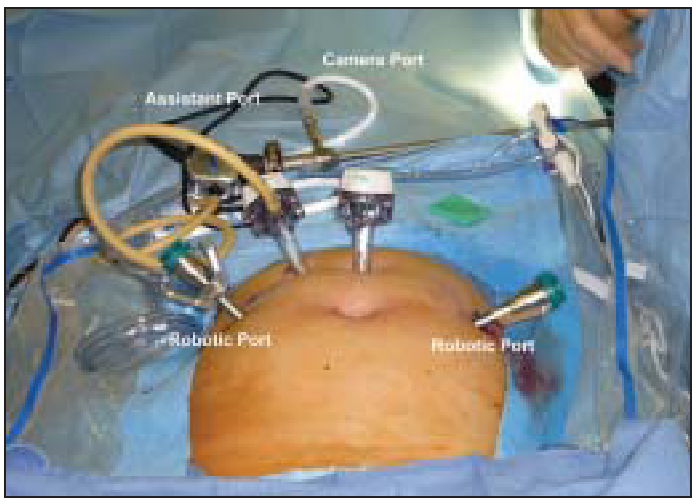


Fig. 4: Trocar sites for para-aortic lymphadenectomy up to renal vein: Camera port is about 5-8 cm above the umbilicus.

Final Steps, Outcomes

In patients also undergoing a hysterectomy, lymphadenectomy can be performed before or after the hysterectomy, depending on the indication.

Lymph nodes dissected with the robotic approach can be stored and removed in a laparoscopic bag that is introduced through the assistant's port. In patients undergoing a hysterectomy, the bag can be stored in the abdomen during the procedure and then removed through the vagina afterward.

After we complete lymphadenectomy, the pelvic cavity is thoroughly irrigated, Seprafilm slurry is applied to prevent adhesions, and all trocar sites are routinely closed. Closing all ports, even the 8-mm sites, is important since a small bowel trocar-site herniation has been reported. We also inject Marcaine in all trocar sites. Depending on the patient's condition, she can be discharged on the same day or after 1 or 2 days.

Gynecologic surgeons have developed various techniques for robotic-assisted laparoscopic lymphadenectomy that include different placement of the trocar sites. We have been performing robotic lymphadenectomy and radical hysterectomy since 2003 and have modified our technique to be as feasible and reproducible as possible.

We recently compared the experiences of 43 women with early cervical cancer who were treated with either robotic radical hysterectomy with pelvic lymphadenectomy or laparoscopic radical hysterectomy with pelvic lymphadenectomy.

The treatments—using either conventional laparoscopy or robotic-assisted laparoscopy—were equivalent with respect to operative time, blood loss, hospital stay, and oncologic outcome. The mean pelvic lymph node count was similar in the two groups (JSLS 2008;12:227-37).

While this analysis did not include cases involving open radical hysterectomy and lymphadenectomy, we know from other series and reports that the number of resected lymph nodes increases with a laparoscopic approach, whether or not it is robotically performed.

In studies in our fellowship training program, moreover, we have found that fellows who have less experience with laparoscopic surgery than attendings achieved the same number of lymph node retrievals as the attendings through either conventional laparoscopic or robotic lymphadenectomy. Such ease and reproducibility portends well for the future of robotic technology in gynecologic oncology.

Some of the major advantages of robotic-assisted surgery are that it provides 3-D views, allows intuitive motions, and involves less operator fatigue. In addition, tremor filtration facilitates more precise movements. It entails a shorter learning curve than does conventional laparoscopy. Robotic-assisted surgery has also paved a pathway to telesurgery and telementoring. This may expand the availability of advanced minimally invasive surgeries throughout the globe.

Dr. Nezhat had no financial conflicts of interest to disclose. ■

Laparoscopic Surgeons' Work-Related Symptoms on the Rise

BY ROBERT FINN

San Francisco Bureau

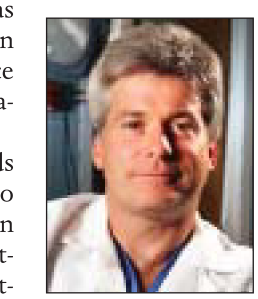
SAN FRANCISCO — Nearly 9 out of 10 laparoscopic surgeons said they experienced physical discomfort or symptoms related to performing surgery, according to the results of an online survey.

Feedback from 317 laparoscopic surgeons in North America and Europe who responded to the anonymous survey showed a marked increase in symptoms, compared with a 1999 study, Dr. Adrian Park said at the annual clinical congress of the American College of Surgeons.

According to that study, 8%-12% of laparoscopic surgeons reported pain or numbness and 9%-18% reported stiffness in the neck, shoulder, arm, or wrist (Surg. Endosc. 1999;13:466-8). In contrast, 42% of 2008 survey respondents reported neck stiffness. Other common complaints were numbness in the left and right hands (28% and 32%, respectively); stiffness and pain in the back (31% and 36%, respectively); and fatigue in the eyes (27%), neck (23%), left arm (24%), right arm (33%), and back (26%).

"If we were subjected to any of the kinds of worksite inspections that manufacturing facilities are ... the surgical work space would be shut down," said Dr. Park of the University of Maryland, Baltimore. "There's no question that we need to study further the ergonomics of the perioperative environment, and we need absolutely to be [studying] the surgeon-patient and the surgeon-equipment interface. It's a bit of a conjecture, but I would suggest that no less than surgical career longevity may be at risk."

Dr. Park said the response rate was a bit under 30%; the respondents' average age was 44.3 years, and 83% were male. On average they had been in practice for 9.8 years and performed 212 laparoscopic procedures annually.


'I've already had one wrist operated on, and I'm waiting for the next wrist [to be done].'

DR. PARK

Surgeons with high caseloads were significantly more likely to report physical symptoms than those with low caseloads. Right-handed surgeons were significantly more likely to report right-hand symptoms than left-hand symptoms (54% vs. 40%). But left-handed and ambidextrous surgeons showed no significant differences in symptoms between hands.

More than 80% of the symptoms occurred during or immediately after a case, but about 15% of surgeons said that their symptoms were persistent. Unfortunately, little work has been done to identify which surgical movements are causing the problems. "Our base knowledge of surgical movement is abysmal. You can have your backhand evaluated, you can have your golf swing evaluated, but we can't tell you what optimal surgical movement is," he said.

Dr. Park highlighted several areas that may be causing problems. Open surgery allows a surgeon to move with about 20 degrees of freedom, but in laparoscopic surgery there are only 4-6 degrees of freedom. The surgeon has a three-dimensional view in open surgery, but only a two-dimensional view in laparoscopic surgery. Laparoscopic surgeons enjoy less tactile feedback than open surgeons, and laparoscopic instruments provide less force transmission than open instruments. And the "fulcrum effect," which requires the surgeon to move the instrument handle in the direction opposite from the desired direction of the instrument tip, may play a role.

"I've practiced minimally invasive surgery my entire career. I've already had one wrist operated on, and I'm waiting for the next wrist to be operated on," said Dr. Park.

He disclosed that he has financial relationships with Stryker Endoscopy, Surgiquest Inc., Apollo Endosurgery Inc., and W.L. Gore & Associates. ■