SCIENTIFIC PAPER

Making the Transition From Standard Gynecologic Laparoscopy to Robotic Laparoscopy

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ABSTRACT

Objectives: To determine the feasibility of using a simple procedure, a bilateral tubal ligation, as a transition procedure when adopting robotic laparoscopy for gynecologic surgery.

Method: To obtain robotic credentialing and gain experience with the robotic system, the surgeons first went through robotic training, then 4 women desiring permanent sterilization had robotically assisted laparoscopic bilateral tubal ligations performed, using the Parkland method.

Results: Total operating room time varied from 1 hour 25 minutes to 2 hours 31 minutes. Improvement in operating time for each surgeon was noted with each successive case. Best times in robotic cases were similar to those of standard laparoscopy.

Conclusion: Robotically assisted laparoscopic tubal ligation using the Parkland method is a satisfactory procedure to provide transition for gynecologic surgeons and operating room personnel to gynecologic robotic surgery.

Key Words: Standard laparoscopy GYN surgery, Robotic laparoscopy GYN surgery.

INTRODUCTION

Interest in robotics in surgery is increasing. Third-generation robotics have been shown to enhance the field of cardiac surgery. The da Vinci robotic surgical system (Intuitive Surgical, Mountain View, CA) is used to perform procedures in cardiac, urologic, and general surgery. Some of these procedures include mitral valve repair, pelvic lymph node dissection, adrenalectomy, and Nissen fundoplication. Surgeons at the East Carolina University Brody School of Medicine in Greenville, North Carolina, use the system extensively for cardiac and general surgery applications.[1,2] Despite rapid advances in cardiac surgery, robotic surgical systems have had limited use in gynecologic surgery. Robotically assisted gynecologic procedures in humans described in the current literature have been limited to bilateral tubal reanastomosis[3,4] and more recently hysterectomy.[5]

Using robotics in surgery has numerous advantages. The da Vinci robotic system overcomes many of the limitations of standard laparoscopic surgery: 2-dimensional images, hand tremors, and dexterity limitations. The da Vinci generates a 3-dimensional image by using two 5-mm wide-angle cameras within a single 12-mm laparoscope. Articulated instruments at the ends of each surgical arm greatly improve mobility. The 7 degrees of motion freedom give the surgeon a "wrist-like" feel inside the abdomen. The surgeon operates from a remote console in constant control of the robot using a combination of foot pedals and hand controls. The foot pedals allow control of camera movement, focus, and provide a clutching mechanism for repositioning and centering the hand controls. The hand controls operate the instruments, which are capable of manipulation, dissection, coagulation, and suturing, as well as camera movement. The robotic system does have the capability of harmonics and monopolar cautery, but lacks bipolar cautery. The system's computer also provides scaling of movement, tremor elimination, and graduated instrument grip. The limitations of the da Vinci system include setup time, cost, and tactile/haptic feedback.

Robotic systems are seldom used in gynecologic surgery. It has not yet been determined whether robotic systems will significantly help in complex gynecologic surgery.

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Initiation into robotic surgery is a difficult task. A low-risk, simple procedure was chosen for our foray into robotic surgery cases. To gain the maximum benefit from robotic surgery for a relatively simple procedure, the sterilization procedures were performed via the Parkland method.[7] This technique was chosen because it requires several different laparoscopic maneuvers (cautery, sharp dissection, suture ligation), is very familiar to surgeons, and provides excellent sterilization results.

METHODS

Implementation of robotic surgery requires special training for surgeons and operating room personnel prior to performing procedures. This includes an intensive 2-day training session followed by inanimate and animate labs. Credentialing to perform robotically assisted laparoscopic surgery was obtained according to our institutional policies.

Patients in outpatient gynecology clinics at the East Carolina University Brody School of Medicine requesting tubal ligation from October 2001 through November 2001 were selected to undergo the procedure using the da Vinci robotic system. The standard indications and contraindications for sterilization were discussed. The patients consented to the procedure after they were counseled about contraceptive alternatives and specifically about the use of the robotic system for their surgery.

Two surgeons performed each procedure, one stationed at the console and the other as the patient-side surgeon. The surgeons alternated positions with each case. After standard scrub and draping, a Hulka tenaculum was placed in the uterus for uterine manipulation. A 12-mm trocar at the umbilicus was placed in standard fashion for camera access. Two 8-mm trocars were placed in the lower quadrants, lateral to the inferior epigastric arteries, for instrument access. The robot was then positioned just medial to the patient's right lower extremity and attached to the instrument and camera trocars. This positioning allowed the patient-side surgeon access to the uterine manipulator and access to the robotic arms for instrument replacement. The da Vinci robotic system was then used for all aspects of the sterilization procedure. The fallopian tube was grasped in the isthmic portion with the fimbriated end clearly visible. A window was created in the mesosalpinx at an avascular site using the robotic monopolar cautery. A 3-cm tubal segment was ligated proximally and distally using ligatures tied with robotic instruments. The intervening tubal segment was excised with robotic scissors and removed. Hemostasis was ensured. The robotic system was removed from the operating site, and the procedure was concluded in standard fashion. The fascia at the 12-mm port site was closed. Finally, the skin incisions were closed. The tubal segments were sent to pathology.

The operative time was defined as the total time the patient spent in the operating room, which included preoperative preparation, anesthesia induction, surgical equipment setup, procedure time, anesthesia reversal, and postoperative transportation to the postanesthesia care unit.

RESULTS

The average age of the 4 patients selected for robotic surgery was 30±5.6 years; average height was 1.62±0.091 meters; average weight was 71±17.7 kilograms; and average body mass index was 26±3.6. All 4 patients were healthy with no medical contraindications to general anesthesia. One patient had a past surgical history of a diagnostic laparoscopy with lysis of adhesions. The other patients had no prior surgeries.

Operative time varied from 1 hour 25 minutes to 2 hours 31 minutes with an average operative time of 1 hour 56 minutes ±27 minutes. For comparison, the average total operative block time for a standard laparoscopic tubal ligation (clip or band application) in our institution is 1 hour 30 minutes, including preoperative preparation, anesthesia induction, surgical equipment setup, procedure time, anesthesia reversal, and postoperative transportation to the postanesthesia care unit. Each surgeon was able to decrease actual operative time by 20% on the second procedure. We successfully performed all procedures using the Parkland method. No complications occurred during the robotic procedures. The postoperative course was consistent with conventional laparoscopic tubal ligation.

DISCUSSION

By performing a simple procedure with robotic adaptation, we were able to improve our robot setup time, improve trocar and robot positioning, and gain more familiarity with the surgical instrumentation with each successive operation. Our best operative time for surgery with robotic assistance was similar to the standard block time allotted for laparoscopic tubal ligation. We were also able to determine where robotic techniques would have to be supplemented with currently available laparoscopic instruments for gynecology. Bipolar cautery would be helpful as would better graspers designed for uterine,

tubal, and ovarian manipulation. This is especially important for complex procedures because robotic instrumentation has been developed specifically for general and cardiac surgery applications.

CONCLUSION

Based on our experience, performing simple laparoscopic procedures, such as bilateral tubal ligations, is a safe and effective means to gain familiarity with the system before advancing to more complex gynecologic procedures. Although it was time-consuming, each surgeon was able to greatly decrease operative times. The future of minimally invasive surgery involves the development of techniques and instruments that will enable the surgeon to perform progressively more intricate and complex surgical tasks in a rapid and safe manner. Many complex gynecologic procedures require more advanced surgical technique and extensive dissection with larger, abdominal incisions. While the initial training in robotic surgery was time-consuming, we believe the robotic system makes complex laparoscopic skills easier to perform and will therefore increase a surgeon's minimally invasive armamentarium.

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Disclosure: None of the authors have any financial interests in or were supportedby finances from Intuitive Surgical, Inc.