

Laparoscopic Hysterectomy with Automatic Stapling Devices

Kalyani M. Kumar, MD, Reese Tabb, CST

ABSTRACT

Purpose: To evaluate outcomes including operating time, blood loss, length of stay (LOS), return to work and complications of laparoscopic hysterectomy performed with automatic stapling devices.

Methods: Between 6/11/91 and 11/23/95, 127 laparoscopic hysterectomies were performed with automatic stapling devices. On an average, 6 firings with the stapler were done per case. Postoperative telephone survey and retrospective review of records were done.

Results: Data averages for operating time, blood loss, LOS and return to work, respectively, were 90 minutes, 190 cc's, 1.1 day and 2 weeks. Significant complications included delayed postoperative bleeding in 4 patients, all of which occurred within the first 35 cases. One was controlled laparoscopically and 3 others required exploratory laparotomies. Since certain precautionary measures as described were taken, hemorrhagic complications were eliminated.

Conclusions: Laparoscopic hysterectomy can be performed safely and effectively with automatic stapling devices in properly selected patients. A potential hazard inherent with this technique includes intraoperative and postoperative bleeding from the staple lines, the incidence of which can be minimized by taking certain precautionary measures such as the use of white cartridges only and bipolar desiccation of staple lines when indicated.

Key Words: Laparoscopic hysterectomy, Automatic stapling device.

INTRODUCTION

Minimally invasive surgery is being performed with increasing frequency in recent years for the performance of various gynecologic procedures including oophorectomy, myomectomy, hysterectomy, presacral neurectomy, etc.¹⁻⁴ The first laparoscopic hysterectomy was reported in 1989 by Reich and DeCaprio.³ The technique utilized included aquadissection to develop appropriate tissue planes and bipolar electrosurgery to achieve hemostasis. The same authors also defined "laparoscopic hysterectomy," which denotes laparoscopic ligation of uterine vessels by electrosurgical desiccation, suture ligatures, or staples and "laparoscopic assisted vaginal hysterectomy" in which uterine vascular pedicles are ligated vaginally.⁵ Laparoscopic hysterectomy using the Multifire Endo GIA 30 surgical stapler was described by Nezhat, et al, in 1990.⁶ The technique included the use of Multifire Endo-GIA-30 stapler on the infundibulopelvic ligaments and broad ligaments bilaterally and uterine vessels on one side. The uterine vessels on the other side were triply clamped, using large individual titanium clips, placed perpendicular to the artery.

In this report, we describe our experience with 127 cases of laparoscopic hysterectomy performed with Multifire Endo GIA-30 surgical stapler including evaluation of outcomes, and avoidance and management of hemorrhagic complications.

MATERIALS AND METHODS

One hundred and twenty-seven laparoscopic hysterectomies were performed by the primary author between June 11, 1991 and November 23, 1995. One hundred and nine cases were performed in the United States in Richmond, Virginia (Columbia Henrico Doctors' Hospital, St. Mary's Hospital, and Metropolitan Hospital). Eighteen cases were performed in overseas training courses, which included United Arab Emirates (Mafraq Hospital, Abudhabi, Fujairah Hospital, Fujairah), Bahrain (Bahrain Defense Hospital), and India (H-N Hospital, Bombay).

Address reprint request to: Dr. Kalyani M. Kumar, Obstetrics and Gynecology Associates, Ltd., Parham Medical Village, 2103 East Parham Road, Richmond, VA 23228
Phone: (804) 262-6780 Fax: (804) 266-5919

Indications for the procedure, in the order of decreasing frequency, included uterine leiomyomata, adenomyosis, menorrhagia, dysfunctional uterine bleeding, dysmenorrhea, endometriosis, cervical intraepithelial neoplasia (CIN), pelvic inflammatory disease, and endometrial carcinoma (Stage I). The age range was 31 - 65 years with a mean of 42 years. Patient weight ranged from 108 - 230 pounds, with a mean of 165 pounds. The largest uterus removed in this series of patients was 550 grams.

When a hysterectomy was contemplated, the following selection criteria were used: laparoscopic approach was used when difficulty was anticipated with vaginal approach. Patient desire for shorter recovery time was also a significant factor in choosing laparoscopic approach. An abdominal approach was used in patients with extremely large uteri, marked obesity, or when the laparoscopic approach was felt to prolong operating time significantly. Vaginal approach was used when no technical difficulties were anticipated.⁷ Overseas hospitals were notified of author's selection criteria for laparoscopic hysterectomy, which were adhered to strictly. All procedures in the United States were performed by the primary author. Overseas procedures were performed by the primary author along with local physicians. Same Operating Room personnel were maintained in an attempt to reduce O.R. time by coordination of the surgical team.

All patients were counselled extensively preoperatively regarding stapling techniques, energy delivery systems, possibility of laparotomy or conversion to abdominal hysterectomy, intraoperative or delayed postoperative bleeding, transfusion and possible organ injuries to bladder, bowel or ureter.

Technique

Under endotracheal general anesthesia, the surgical procedure was initiated with the insertion of the laparoscope and trocars in the usual fashion. A four-puncture technique was used in all patients. After insufflation of the abdomen, the initial puncture was made with the 12 mm trocar infraumbilically. After the insertion of the laparoscope, a direct coupler was attached. Video recording of the procedure was routinely done. All other punctures were made under direct visualization. The second puncture site was made in the mid suprapubic region using a 5 mm trocar. Two other puncture sites were made laterally 6 to 8 cms. away from the umbilical incision using 12 mm trocars. These trocars were placed far enough lateral to avoid rectus hematoma. The tenaculum was placed on the anterior lip of the cervix. A Kohn cannula was placed in the cervical canal and fixed to the tenaculum which was used for manipulations of the uterus during the procedure. Prior to initiating the procedure, the ureters

were visualized bilaterally but not routinely dissected. Multifire Endo GIA-30 surgical stapler (U.S. Surgical Corporation, Norwalk, CT) was used on the infundibulopelvic or utero-ovarian, round ligaments and uterine arteries. On an average, six firings per case with the stapler were done.

Multifire Endo GIA-30 Surgical Stapler

The stapler places two triple staggered rows of titanium staples and knife blade cuts simultaneously between them. The cut stops short of the staple line; the length of the staple line being 32.5 mm; staple height is either 2.5 mm or 3.5 mm before closure and 1.0 mm or 1.5 mm, respectively, after closure. The disposable loading units are available as blue (3.5) and white (2.5) cartridges; the former intended to be used for non-vascular pedicles and the latter for vascular pedicles.

Initially, the laparoscope is brought in from the umbilical port and the stapler is brought in from the lateral ports on the ipsilateral side of the firing. Initial firing is done on the infundibulopelvic or utero-ovarian ligaments, depending on whether the adnexa is being removed or not. The first firing is extended up to, but not including, the round ligament. The stapler, once in place, is always checked for proper application and to make sure that no other unintended structure is included in the jaws of the stapler. In the earlier series of patients (first 35 cases), the white cartridge of the stapler was used for the vascular structures and the blue cartridge was used for the non-vascular structures. The Endo Gauge was not used by the author, because it was felt to prolong operating time with no added benefits. After the first 35 cases, the author abandoned the use of the blue cartridges because of incidence of intraoperative and delayed postoperative bleeding which was attributed to the use of the blue cartridges. The author felt that tighter closure was provided by the use of the white cartridges thereby reducing incidence of bleeding.

The round ligaments were secured with blue cartridges initially, and with white cartridges after the first 35 cases. Round ligament stapling was carried down to a point just below the round ligament in order to avoid accidental inclusion of the ureter in the stapler prior to bladder mobilization.

The vesico-uterine visceral peritoneal fold (V.U.V.P. fold) is held on traction with two 5 mm disposable Endo Grasp instruments. The V.U.V.P. fold dissection is done with the use of laser energy (KTP laser in 47 cases, contact Nd:Yag laser in 33 cases), hydrodissection and Endo-Kittner in the earlier cases. More recently, Harmonic scalpel (31 cases) or bipolar shears (2 cases) were used with significant cost

savings. Harmonic scalpel use eliminated the need for hydrodissection due to cavitation effect and facilitated dissection. Also, a cost savings of \$650 per case was realized by the use of the Harmonic scalpel (Ultracision, Inc.) as compared to the contact Nd:Yag laser (Surgical Laser Technologies).⁸ Monopolar shears were frequently used overseas due to lack of availability of other energy delivery systems. Endo-Kittner is used to mobilize the bladder, while the cervix is simultaneously pushed in by the assistant.

Uterine arteries are skeletonized bilaterally, clamped with the white cartridge of the stapler and secured after proper application is confirmed. The stapler is always placed in close proximity to the uterus and/or cervix to avoid accidental ureteral injuries. If this is not feasible, the laparoscope is brought in from the lateral port (on the ipsilateral side of the firing) and the stapler is brought in from the umbilical port. This is done to facilitate the placement of the stapler in close proximity to the uterus and cervix and thereby reducing chances of ureteral injuries. In some cases, the cardinal ligaments were stapled with the white cartridge laparoscopically (6 cases). When this was done, the Endo TA 30 stapler was used to avoid ureteral injuries.

The Endo TA 30 stapler, which places only three rows of staples with no knife blade, has a narrower cartridge, thereby reducing the chances of ureteral injury. If the Endo TA 30 stapler was used, the stapler was first fired after proper application is checked. Before releasing the stapler, the tissue was cut on the inside of the stapler with the use of laser energy, Harmonic scalpel or bipolar shears. Monopolar energy was never used in proximity to the staple line. Once the tissue is divided, the stapler is released. If the stapler is released prior to dividing the tissue, there is a chance of accidentally cutting into the staple line, thereby increasing the chances of intraoperative bleeding.

The rest of the procedure is completed vaginally. Anterior and posterior colpotomies are done. The uterosacral and cardinal ligaments were clamped, cut and ligated using #1 Vicryl sutures. The uterus is delivered by Heaney technique (more frequently) or by Doderlein technique (less frequently). Peritoneal closure and vaginal cuff closure is done vaginally. Final laparoscopic view is done under lowered intraabdominal pressure to ascertain hemostasis. The peritoneal cavity is routinely irrigated and suctioned out. Staple lines are inspected. Minimal oozing is controlled with bipolar desiccation. After instruments are removed, the lateral incisions are closed with #1 Vicryl sutures on the fascia. All incisions are closed with skin staples (Proximates) (Ethicon Endo-Surgery, Cincinnati, Ohio). Ninety percent of the patients were discharged

from the hospital within the 23-hour observation period, and 10 percent in less than 48-72 hours. The patients were seen at the office for postoperative follow-up at four days for skin staple removal, at 2-3 weeks to evaluate before return to work, and at six weeks for pelvic exam. Postoperative patient survey and retrospective review of records was done. A telephone survey was done by the office nurse at 2-3 weeks postoperatively. Questions asked typically included inquiries about their activity level, and whether they returned to work, or when they plan to return to work. All patients done in the U.S. (109) were called and none were lost to follow-up. All overseas patients (18) were lost to follow-up regarding length of stay and return to work. No complications related to surgery were reported from the overseas cases confirmed via inquiries through the course coordinator.

RESULTS

Data averages for operating time, blood loss, length of stay (LOS) and return to work respectively were 90 minutes (range 45 minutes - 160 minutes), 190 ccs (range 50 ccs - 600 ccs), 1.1 day (range 9 hours - 72 hours), and two weeks (range 5 days - 24 days). The average hospital charges per procedure in the U.S. were estimated to be approximately \$9,500 as derived from the data obtained from the business offices of the three hospitals used in Richmond, Virginia (Columbia Henrico Doctors' Hospital, St. Mary's Hospital of Bon Secours System, and Metropolitan Hospital of Paracelsus System). Variation in charges between the three health care provider systems were averaged in estimating the approximate charges. Operating time was slightly prolonged in overseas training courses. In two patients, the procedure was converted to abdominal hysterectomy, one due to extensive pelvic adhesions and one due to intraoperative bleeding from the left uterine artery. Significant complications included delayed postoperative bleeding within the 23-hour observation period in four cases, one of which was controlled laparoscopically. Three others required exploratory laparotomies, all of which occurred in the first 35 cases. At laparotomy, bleeding was noted to be from staple lines, which was attributed by the author to the blue cartridges with resultant closure being not as tight as with the white cartridges. One patient had bleeding from the 12 mm trocar site on the right side (Bahrain Defense Hospital, Bahrain), which was controlled laparoscopically and the procedure was completed through the other three puncture sites. One patient had a pelvic hematoma that resolved spontaneously. No incisional hernias resulted in this series of patients. No organ injuries to the bladder, bowel or ureter occurred in any of the patients. No complications related to the use of energy delivery systems occurred. No other complications related to stapling occurred.

CONCLUSION AND DISCUSSION

Minimally invasive surgical procedures have been embraced with great enthusiasm by patients, insurance carriers and health care providers with expectations of favorable outcomes. Although in most situations, outcomes are favorable, occasionally, minimally invasive surgical techniques can be associated with significant complications and can be fraught with danger, particularly in inexperienced hands with inadequate training and lack of adequate knowledge of the technology and energy delivery systems.

The operator should be aware of the potential complications prior to attempting extensive operative laparoscopic procedures, and be totally familiar with the available technology, including advantages and pitfalls.

Emerging technology has increased the ability of the operators to convert major surgical procedures into less invasive procedures. However, new and emerging technology needs to be evaluated objectively and correlated with clinical outcomes. Efforts to avoid complications should begin preoperatively.

Extensive Preoperative Counseling

Extensive preoperative counselling in the office with patient and family including discussion of expected outcomes and possible complications is extremely important. For laparoscopic hysterectomy, preoperative counselling should include discussions regarding possible organ injuries to bladder, bowel, and ureter; major vascular injuries; blood transfusions; energy delivery systems used; and possible conversion to laparotomy.

Patient Selection

Proper patient selection is the key to successful outcomes in laparoscopic hysterectomy. The author believes that laparoscopic approach is not indicated for all hysterectomies, particularly in the hands of an average gynecologist. Operators should realize their own individual limitations of skill, training, and expertise and choose the approach that provides optimal outcomes in their hands.

Conversion to Laparotomy Surgical Complication or Sound Clinical Judgement?

With the increasing emphasis on minimally invasive surgery, laparoscopic approach for various surgical procedures is being used with increasing frequency. In spite of increased enthusiasm with endoscopic approach, it is essential to realize the need for conversion to laparotomy when indicated. Conversion to laparotomy is not to be

looked upon as a complication rather than as sound clinical judgment. Early conversion to laparotomy in certain situations may obviate the need for blood transfusions and reduce operating time. Trying to deal with major vascular injury through the laparoscope, especially by those inexperienced with endoscopic suturing techniques, may lead to adverse outcomes which otherwise could have been avoided by early laparotomy.

Maintain the Same Surgical Team

The successful outcomes in laparoscopic procedures are also dependent upon the training and skills of the support staff. Operating Room personnel should be made aware of the continuing modifications to current technology and should be trained to be familiar with new technology.

With rapidly emerging and changing technology, the need to train the staff to keep pace with technology cannot be overemphasized.

Maintaining the same surgical team will reduce operating time and minimize complications associated with lack of Operating Room personnel's knowledge of energy delivery systems, etc.

Early Recognition of Complications

Early recognition of complications is essential for better outcomes. Support staff should be trained to identify and recognize serious warning signals. Earlier intervention is essential to reduce the intensity of adverse outcomes.

Automatic stapling devices offer an effective alternate method for performing laparoscopic hysterectomy and appear to be safe when certain precautionary measures are taken and the operator is aware of the limitations of the instrument. Stapling techniques offer several advantages, which include easy adaptability, and are less cumbersome and less time-consuming, which may offset the increased cost associated with stapling.

The average hospital charges per procedure in our series were \$9,500, which is slightly higher than reported in the literature for laparoscopic hysterectomy with automatic stapling devices.⁹ Although stapling devices are expensive, they may still be cost-effective by reducing O.R. time. The author used specially priced disposable kits in an effort to minimize cost. In the current health care environment of cost containment and managed care, as physicians are being profiled by insurance companies, reduced O.R. times and favorable clinical outcomes (such as shortened length of stay and early return to work) become significant factors in the evaluation of overall cost-analysis as opposed to O.R. cost alone.

Even though in this series of patients no organ injuries to bladder, bowel, or ureter resulted, ureteral injuries with the endoscopic linear stapler have been reported.¹⁰ Although ureteral dissection was not routinely done by the author, mobilization of the bladder and skeletonization of uterine arteries was routinely done to avoid ureteral and bladder injuries.

Although delayed postoperative bleeding was encountered in the early part (first 35 cases) of the author's experience, several corrective measures were taken subsequently which successfully eliminated this complication. The author eliminated the use of Endo Gauge instrument and blue cartridges after the first 35 cases. However, if the white cartridge does not close properly, then the stapler is not used. It is essential to make sure that the stapler closes easily with no resistance prior to firing. It is also essential to avoid "bunching tissue" and make sure that tissue is not protruding through the proximal end of the stapler prior to firing. This is an important step in minimizing bleeding from staple lines.

Bipolar desiccation along the staple line is frequently used to control bleeding. In the author's experience, the staple line is not weakened by the routine use of prophylactic bipolar desiccation along the staple line. At the end of the procedure, final laparoscopic view is routinely done to ensure hemostasis, which is done under lowered intraabdominal pressure to eliminate the tamponade effect of the gas that may mask any potential intraperitoneal bleeding.

The author concludes that laparoscopic hysterectomy can be performed safely and effectively with automatic stapling devices in properly selected patients if proper precautionary measures are taken to avoid hemorrhagic complications and urinary tract injuries.

However, it is essential for the operators to be proficient at various laparoscopic hysterectomy techniques, to include suturing, stapling and electrosurgical techniques, rather than to rely on any single technique. Operators should be able to use various techniques interchangeably,

particularly in the event of malfunction of any particular modality or if it is not an appropriate technique of choice in any given situation.

References:

1. Daniell JF, Kurtz BR, Lee JY. Laparoscopic oophorectomy; comparative study of ligatures, bipolar coagulation, and automatic stapling devices. *Obstetrics and Gynecology*. 1992;80:325.
2. Daniell JF, Gurley LD. Laparoscopic treatment of clinically significant uterine fibroids. *Journal of Gynecological Surgery*. 1991;7:37.
3. Reich H, DeCaprio J, McGlynnis F. Laparoscopic hysterectomy. *Journal of Gynecological Surgery*. 1989;5:213.
4. Perez JJ. Laparoscopic presacral neurectomy. *Journal of Reproductive Medicine*. 1991;35:625.
5. Reich H. Laparoscopic Hysterectomy. *Surgical Laparoscopy and Endoscopy*. 1992;2:85-88.
6. Nezhat C, Nezhat F, Silfen, S. Laparoscopic hysterectomy and bilateral salpingo-oophorectomy using Multifire Endo GIA30 Surgical Stapler. *Journal of Gynecological Surgery*. 1990;6:287.
7. Kumar KM. Comparison of laparoscopic, abdominal, and vaginal approaches to hysterectomy. Abstract. American College of Obstetricians and Gynecologists 1993.
8. Kumar KM. Laparoscopic Assisted Vaginal Hysterectomy (LAVH), Comparison of techniques (Use of contact Nd:Yag laser vs. harmonic scalpel). Abstract. World Congress of Gynecological Endoscopy 1995.
9. Daniell JF. Laparoscopically assisted vaginal hysterectomy, the initial Nashville, Tennessee experience. *Journal of Reproductive Medicine*. 1993;38:537-542.
10. Woodland MB. Ureter injury during laparoscopy assisted vaginal hysterectomy with the endoscopic linear stapler. *American Journal of Obstetrics and Gynecology*. 1992;167:756-757.

Presented at Prevention and Management of Laparoendoscopic Surgical Complications, the Society of Laparoendoscopic Surgeons, September 26-28, 1996, New York, NY.