Laparoscopic Hysterectomy Using Laparosonic Coagulating Shears: Experience of 15 Cases

CHARTCHAI SRISOMBUT, M.D.*,
SAWAEK WEERAKIET, M.D.*

Abstract

In conventional laparoscopic hysterectomy, adequate hemostasis is provided by bipolar coagulation, staple, and suture. The Laparosonic Coagulating Shears (LCS) have been proven to give both hemostasis and cutting. The objective of this study was to evaluate the efficacy of the LCS for laparoscopic hysterectomy. Fifteen patients indicated for hysterectomy were enrolled for laparoscopic hysterectomy using LCS. Each procedure was performed under general endotracheal anesthesia. The LCS were operated at power level 1 though 5. All pedicles, blood vessels, and tissues were coagulated and cut by LCS. The cardinal ligaments were cut and ligated transvaginally. The uterus was removed through the vagina. The operative finding, uterine volume and weight, operative time, CO_2 volume, blood loss and hospital stay were recorded. Among the 15 cases, the indications were myoma uteri (7 cases), adenomyosis (6 cases) and adenomyosis with endometriomas (2 cases). The mean volume of the uterus was 226.8 cm^3 (range 77-399 cm^3) and mean weight was 188.8 g (range 85-320 g). Mean operative time was 171.6 min (range 114-210 min) and CO_2 loss was 313.8 liters (range 120-650 liters). Blood loss was 366.7 ml (range 100-1,500 ml). LCS can be used for coagulation and cutting simultaneously. Minimal charring and smoke was observed during operation. In general, the hospital stay was 3 days (range 2-4 days), except for one case of recto-sigmoid injury and 2 cases of ureteric injury when the hospital stay was 7, 10, and 12 days, respectively. The injuries occurred in cases with anatomic distortion, profuse bleeding, and dense adhesion. LCS can be used as an alternative instrument for coagulation and dissection. According to our experience, it produces less charring and smoke compared to electrocoagulation. However, a high rate of complications were still encountered.

Key word : Harmonic Scalpel, Laparoscopic Hysterectomy, Laparosonic Coagulating Shears

SRISOMBUT C & WEERAKIET S
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* Reproductive Endocrinology Unit, Department of Obstetrics and Gynecology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand.

In 1988, Reich et al[1] introduced laparoscopic hysterectomy (LH) in which *via* a laparoscope the upper pedicles and uterine vessels were transected with the rest of the procedure then being performed vaginally. This procedure is now accepted worldwide as an alternative to abdominal hysterectomy. In conventional laparoscopic hysterectomy, adequate hemostasis has been provided by bipolar coagulation, stapling and suturing.

An ultrasonically activated scalpel, which gives both hemostasis and cutting, was first used for laparoscopic cholecystectomy in 1991[2]. Since then, Laparosonic Coagulating Shears (LCS, Ultracision, Smithfield, USA) were developed for gynecologic surgery, and the first laparoscopic-assisted vaginal hysterectomy (LAVH) using LCS was reported in 1995[3]. A comparative study of LCS and Endostapler was also carried out in laparoscopic supracervical hysterectomy[4]. They found that both instruments result in similar outcomes with regard to operating time, blood loss, and hospital stay. However, LSC is still not widely used especially in Thailand. We reported the preliminary experience of using LCS while performing laparoscopic hysterectomy at Ramathibodi Hospital.

MATERIAL AND METHOD

From October 1998, patients on the waiting list for hysterectomy were selected as candidates for LH. Exclusion criteria included obesity, nulliparity, uterine enlargement greater than 12 weeks gestational size, previous pelvic surgery, and having any medical disease. The patients were asked to give written informed consent after being counseled regarding the pros and cons of laparoscopic hysterectomy and total abdominal hysterectomy.

Operative procedure

Under general endotracheal anesthesia, the patient was placed in the low dorsolithotomy position. A Hulka uterine mobilizer was placed in the uterus. After adequate pneumoperitoneum was created through a Veress needle, a 5-mm trocar was inserted through a subumbilical incision. About 20-degree Trendelenburg position was then adjusted and the 5-mm 0-degree telescope was inserted through the cannula.

After inspection of the pelvic organs, 5-mm and 10-mm cannulas were inserted in the left and right quadrants of the lower abdomen respectively. With the surgeon standing on the right side of the patient, the LCS was passed through a 10-mm port and operated at power level 1 through 5[3]. Adhesion band, round ligaments, infundibulopelvic or utero-ovarian ligaments were coagulated and incised by LCS. The anterior broad ligament was incised and the bladder was then dissected off the lower uterine segment. The broad ligament on each side was skeletonized down to the uterine vessels and any significant bleeding was coagulated with the LCS by using the blunt side of the blade and coagulated on low power. The uterine vessels and uterosacral ligaments were then coagulated and incised. Anterior or posterior colpotomy was performed by LCS at the power of 5.

The cardinal ligaments were ligated and cut transvaginally. The uterus was removed through the vagina and the vaginal wall was closed. The pelvis was reinsufflated and all pedicles were reinspected to confirm complete hemostasis.

The operative finding, uterine volume and weight, operative time, CO_2 volume, estimated blood loss and hospital stay were recorded. Operative time was determined from the first incision for primary trocar until the last suture. Estimated blood loss was calculated by subtracting the volume of irrigation fluid from the total amount of fluid obtained in the suction bottle plus the amount of blood which was carefully collected while performing the vaginal part. Uterine volume was calculated by using the prorated ellipse equation : Volume = (0.521)(D1)(D2)(D3), where D1, D2, D3 represent the three largest diameters; length, transverse, and anteroposterior[5]. Hospital stay was determined from admission day to discharge day.

RESULTS

A total of 15 LH were performed between October 1998 and March 1999. The indications for hysterectomy were myoma uteri (7 cases), adenomyosis (6 cases) and adenomyosis with endometriomas (2 cases). The LCS can be used for coagulation and cutting simultaneously. Minimal charring and smoke was observed during the operation.

Mean age of the patient was 39.3±3.3 years which ranged from 32 to 44 years. Mean uterine volume was 226.8±110.5 cm^3 (range 77-399 cm^3) and weight was 188.8±68.4 g (range 85-320 g). Mean operative time was 171.6±35.2 minutes (range 114-210 minutes) and 313.8±175.4 liters of CO_2 gas (range 120-650 liters) was used during the operation. Estimated blood loss was 366.7±413.6

ml (range 100-1500 ml). In non-complicated cases, the hospital stay was 3±0.6 days (range 2-4 days). There were 3 cases of operative injuries (one case of bowel and two cases of ureteric injury). In the case of bowel injury, the recto-sigmoid colon was accidentally incised at the step of uterosacral ligament cutting. Laparotomy was performed to repair the colon and hysterectomy was completed by laparotomy. The patient made an uneventful recovery and was discharged from the hospital 7 days after the operation. The first case of ureteric injury was myoma uteri. The ureters were injured bilaterally and not detected intra-operatively. In retrospect, the injury on the left side resulted from inadequate mobilization of the bladder and uterus that made the left ureter proceed transversely to the uterus in the same direction as the uterine artery. The ureter was transected when it was mistaken for the uterine artery. The right ureter was injured while trying to stop the profuse bleeding from premature dissection of the uterine artery. Seven days after the operation, the patient complained of abdominal pain and foul smell watery discharge from her vagina. Abdominal ultrasonography revealed bilateral hydronephrosis and hydroureter. Intravenous pyelogram (IVP) showed leakage of contrast media into the vagina. At laparotomy, a complete cut of the left ureter was found 2 cm from the bladder orifice. The right ureter was partially disrupted at 4 cm from the bladder orifice. Bilateral ureteroneocystostomy was performed. The patient was admitted for 10 days. The second case of ureteric injury was adenomyosis with left ovarian endometrioma and severe adhesion. Pelvic organs were markedly distorted. The left ureter was completely transected by LSC near the uterine vessels. The injury was not recognized at the time of surgery until 10 days later when the patient presented with peritonitis and ascites. Transabdominal ultrasonography revealed a large urinoma (6.8x9.2x7.5 cm) above the vaginal stump. IVP showed leakage of the distal left ureter. Ureteroneocystostomy of the left ureter was performed successfully and the patient was discharged from the hospital 7 days post-operatively.

DISCUSSION

Hemostasis of the large vessels is a crucial part in performing laparoscopic hysterectomy. Although this can be achieved by various methods such as electrosurgery, lasers, stapling, and suturing, these methods have their own limitations. Various complications can also be encountered with these methods. Serious injuries by laparoscopic electrosurgery can be found although the safety of electrical energy has been proven when used during laparotomy. Unrecognized energy transfer outside the view of the laparoscope is the potential cause of the injuries[6]. Even though stapling devices were developed to ease the procedure and to overcome the complications caused by electrical energy, complications can still be found, including ureteral injuries[7], mechanical small bowel obstruction[8], and delayed postoperative bleeding[9]. However, endostaplers are preferred by many laparoscopic surgeons in the United States, because they are easy to use, shorten the operative time and reliably occlude the pedicles hemostatically. These instruments are however very expensive and may not be suitable for developing countries.

It has been recognized that lasers are suitable for cutting, while electrosurgery is excellent for coagulation. An ideal laparoscopic instrument should be able to carry out both coagulation and cutting. The ultrasonically activated scalpel was originally developed to meet this purpose. It can perform surgical incisions with concomitant hemostasis[2]. The instrument, the so called Harmonic Scalpel, consists of a generator, reusable handpiece, and blade. The generator converts electrical energy to mechanical energy in the handpiece by a piezoelectric crystal that is transmitted to the blade. The blade vibrates over a distance of 80 microns at a frequency of 55,500 Hz. Because no electrical energy is delivered to the tissue, there is no risk of stray or conductive current. Instead of coagulating blood vessels by heat, the rapid motion of the ultrasonic blade breaks down hydrogen bonds which mechanically denature the protein and form the coagulum. This mechanism makes less heat production and thermal injury compared to electrosurgery and lasers.

By using the same technology, Laparosonic Coagulating Shears (LCS) were modified to provide a wider application since they coagulate and simultaneously divide larger arterial vessels. To evaluate that this technology is efficacious and safe to be used for major operations, this pilot study was conducted by using LCS for laparoscopic hysterectomy. Complete hemostasis was ensured in all cases even in large pedicles by using only LCS. Laparoscopic hysterectomy was successfully performed in all cases. Coagulation was achieved by

variable mode which set the power level at 2 to 3 and applied with the blunt side of the LCS blade. Transection of the tissue was performed by power level 5, using the sharp side of the blade and greater grip force[3]. As observed by others[2-4], we found that charring and smoke was minimal during the operations. Hambley et al[10] demonstrated improved wound healing by using the Harmonic Scalpel compared with electrosurgery and lasers. This may result from lower thermal damage, good hemostasis, and less char production. Minimal heat production also allows the blade of the LCS to remain relatively cold so that accidental injury from contact of the non-activated blade and tissues can be avoided.

There is evidence that a large amount of smoke produced from electrosurgery or lasers can significantly increase the levels of methemoglobin and carboxyhemoglobin in the circulation[11,12]. So LCS decrease the risk of smoke poisoning occurring by elevation of these substances. Moreover, less smoke makes better visualization. Other advantages of this technology are facilitating procedures by decreasing the requirement of instrument exchanges, irrigation, and smoke evacuation. Whether or not these advantages will decrease the operative time remain to be seen as coagulating consumes more time than both stapling and bipolar coagulation.

Mean operative time and blood loss in this study were comparable with other studies which used conventional instruments[13,14]. However, these factors are related to coexisting pathologies in individual study groups[13]. The period of hospitalization was relatively short compared to abdominal hysterectomy if there was no surgical complication. In cases with complications that needed laparotomy, the hospital stay may extend much longer. The LCS itself did not directly cause the complications. However, premature dissection can easily occur if the grip force is not properly applied. Premature dissection can cause profuse bleeding from the large vessels especially the uterine artery and ovarian artery which lie close to the ureter. Trying to stop the profuse bleeding at these areas blindly may easily cause injury to the ureter. Adequate mobilization of the uterus is another important factor to prevent ureteric injury by separating the lower part of the uterus from the bladder reflection. This will also make the ureter run longitudinally instead of transversely to the uterus. In cases with severe endometriosis, transperitoneal identification of the ureter is difficult due to endometriotic lesions and fibrosis on the peritoneum which cover the course of the ureter. Fibrosis may bring the ureter closer to the uterine artery or displace its course. In this situation, the uterine artery should be ligated transvaginally to avoid ureteric injury.

SUMMARY

The LCS can provide effective coagulation and dissection. Therefore, it can be considered as an alternative instrument for laparoscopic hysterectomy. There are advantages including less charring and smoke, better visualization, less thermal injury, and decreased instrument exchange during operation. However, balancing the use of the power, type of blade, and grip force must be carefully applied to prevent premature dissection. The cost-effectiveness of LCS should be further investigated compared to electrosurgery.

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การผ่าตัดมดลูกผ่านทางกล้องด้วย Laparosonic Coagulating Shears : ประสบการณ์ 15 ราย

ชาติชัย ศรีสมบัติ, พ.บ., เสวก วีระเกียรติ, พ.บ.**

การผ่าตัดมดลูกผ่านทางกล้องโดยทั่วไปจะใช้วิธีห้ามเลือดด้วยเครื่องจี้ไฟฟ้าชนิด bipolar เครื่องมือเย็บตัดอัตโนมัติ หรือการเย็บด้วยเข็มผ่านทางกล้อง Laparosonic Coagulating Shears (LCS) เป็นเทคโนโลยีใหม่ที่นำมาใช้ ซึ่งสามารถห้ามเลือดและตัดเนื้อเยื่อได้ในตัว จุดประสงค์ของการศึกษานี้เพื่อประเมินประสิทธิภาพของเครื่องมือชนิดนี้ในการผ่าตัดมดลูกผ่านทางกล้องจากประสบการณ์ในผู้ป่วย 15 ราย โดยที่เนื้อเยื่อและเส้นเลือดทั้งหมดจะถูกตัดและห้ามเลือดโดย LCS เท่านั้น ส่วน Cardinal ligaments จะถูกตัดผ่านทางช่องคลอด และนำมดลูกออกทางช่องคลอด พยาธิสภาพ น้ำหนักและปริมาตรของมดลูก เวลาที่ใช้ในการผ่าตัด ปริมาณก๊าซคาร์บอนไดออกไซด์ ปริมาณเลือดที่เสีย และจำนวนวันที่นอนโรงพยาบาลจะถูกบันทึกไว้

จากการศึกษานี้ผู้ป่วยทั้ง 15 ราย ป่วยเป็น myoma uteri 7 ราย adenomyosis 6 ราย และ adenomyosis ร่วมกับถุงน้ำรังไข่ชนิด endometriosis 2 ราย น้ำหนักของมดลูกเฉลี่ย 188.8 กรัม (พิสัย 85-320 กรัม) มีปริมาตรเฉลี่ย 226.8 ลบ.ซม. (พิสัย 77-399 ลบ.ซม.) เวลาที่ใช้ในการผ่าตัดเฉลี่ย 171.6 นาที (พิสัย 114-210 นาที) ปริมาณก๊าซคาร์บอนไดออกไซด์ที่ใช้เฉลี่ย 313.8 ลิตร (พิสัย 120-650 ลิตร) ปริมาณเลือดที่เสียเฉลี่ย 366.7 มิลลิลิตร (พิสัย 100-1,500 มิลลิลิตร) เครื่องมือ LCS สามารถห้ามเลือดและตัดเนื้อเยื่อทั้งหมดขณะทำการผ่าตัดมดลูกได้อย่างมีประสิทธิภาพ พบว่าเนื้อเยื่อที่ไหม้และควันเกิดขึ้นน้อย โดยทั่วไปผู้ป่วยพักในโรงพยาบาลนาน 3 วัน (พิสัย 2-4 วัน) ยกเว้นในรายที่ผ่าตัดถูกลำไส้ใหญ่ส่วนปลาย 1 ราย และผ่าตัดถูกท่อไต 2 ราย ซึ่งต้องนอนพักในโรงพยาบาลนาน 7, 10 และ 12 วัน ตามลำดับ

จากการศึกษาพบว่าเครื่องมือ LCS สามารถใช้ในการห้ามเลือดและตัดเนื้อเยื่อ ในการผ่าตัดใหญ่ เช่น การตัดมดลูกทางกล้องได้อย่างมีประสิทธิภาพ

คำสำคัญ : มีดฮาร์โมนิค, การผ่าตัดมดลูกผ่านทางกล้อง, เครื่องมือเย็บตัดอัตโนมัติ

ชาติชัย ศรีสมบัติ, เสวก วีระเกียรติ
จดหมายเหตุทางแพทย์ ฯ 2543; 83: 915-920

* หน่วยเอนโดครีนนรีเวช, ภาควิชาสูติศาสตร์-นรีเวชวิทยา, คณะแพทยศาสตร์ โรงพยาบาลรามาธิบดี, มหาวิทยาลัยมหิดล, กรุงเทพ ฯ 10400