



## Original Article

## A case-controlled study comparing harmonic versus electrosurgery in laparoscopic myomectomy

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## ABSTRACT

**Objective:** To compare the safety and effectiveness of the harmonic scalpel and conventional electrosurgery in laparoscopic myomectomy (LM).**Materials and Methods:** We performed a retrospective chart review of 591 women with symptomatic uterine fibroids who underwent LM. Thirty-three cases of LMs with harmonic scalpel (LMH) were compared with a matched control group that underwent conventional electrosurgery (LME). Outcome measures for both groups were studied comparatively in terms of the amount of blood loss, requirement of blood transfusion, length of operative time, cost, and hospital stay.**Results:** There was no incidence of switching to abdominal laparotomy. Length of postoperative stay was significantly lower in the LMH group than in the LME group ( $2.0 \pm 0.4$  days vs.  $2.5 \pm 0.7$  days,  $p < 0.001$ ), but the hospital charges were significantly higher in the LMH group than in the LME group ( $39,207.7 \pm 9315.0$  new Taiwan dollar vs.  $24,078.4 \pm 11,051.3$  new Taiwan dollar,  $p < 0.001$ ). Four minor complications were noted in the LME group; two developed lower-grade febrile morbidity, one had urinary tract infection, and one had subcutaneous ecchymosis at the left ancillary port site. Length of operation, blood loss, hemoglobin decrease, and requirement of blood transfusion were not significantly different between the two groups.**Conclusion:** Harmonic scalpel is as safe and effective as conventional electrosurgery, and may offer an alternative option for patients undergoing LM. Harmonic scalpel has advantage over conventional electrosurgery in less postoperative hospital stay but disadvantage in higher cost.© 2017 Taiwan Association of Obstetrics & Gynecology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

For surgically dealing with symptomatic uterine fibroids, hysterectomy provides a permanent resolution if childbearing is complete and uterine preservation is not important to the individual. As many women today have delayed marriage, myomectomy is a reasonable approach for women who desire future fertility and conservative therapy. Laparoscopic instruments and techniques have improved remarkably in the past two decades and

laparoscopic myomectomy (LM) is now a feasible and safe alternative to open myomectomy [1,2].

Three major aspects were involved in LM: enucleation of myomas, repair of uterine defect, and removal of specimens. Therefore, LM is still considered a time-consuming, bloody, and skillful procedure. Unipolar and bipolar electrocautery are most commonly used for energy generation in LM. Unipolar diathermy offers good cutting function but produces much plume and indeterminate dispersion of current. Bipolar forceps provide effective coagulation but uncontrolled thermal spread and charcoal formation [2,3]. Although the relationship between surgical smoke and health risk is still unclear, at least five carcinogenic compounds could be detected when using an electrocautery device in laparoscopic surgery [4]. Bleeding of LM usually occurs during incision of the myometrium and can be controlled by effective uterine defect

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repair. Because mastering the laparoscopic suture skills cannot be achieved in one step, it is necessary to investigate the evolutionary energy device providing same cutting and coagulating functions as traditional electro-surgery devices while preventing the aforementioned drawbacks.

Based on an ultrasonically activated shear, vibrating at 55,500 cycles/s and generating sound waves, the harmonic scalpel (Ethicon Endo-Surgery, Inc., Cincinnati, OH, USA) can coagulate and cut simultaneously. The hemostatic seal is approved for vessels up to 5 mm in diameter [5,6]. Furthermore, the ultrasonic shears do not permit electric transference through the patient as well as diminish the generation of smoke and minimize lateral thermal damage [5,7,8].

A search of the literature showed few published studies discussing the ultrasound energy, although it had already been used in laparoscopic and open surgeries [5,9–11]. The purpose of this study was to compare the results of LM performed using harmonic scalpel with a matched control standard LM performed with conventional electro-surgery.

## Materials and Methods

This study consisted of 33 women (age range, 23–49 years; mean,  $38.4 \pm 6.3$  years) with different indications scheduled to undergo LM with harmonic scalpel (Ethicon Endo-Surgery, Cincinnati, OH, USA) performed by one of the authors (C.J.W.) at Chang Gung Memorial Hospital at Linkou between February 2010 and August 2014. Five hundred fifty-eight women receiving LM with conventional electro-surgery (LME) performed by the same surgeon (C.J.W.) were also retrospectively studied to avoid specific clinical bias. We introduced harmonic scalpel for LM since 2010. However, we did not routinely use this system in daily practice because this needed extra charge for patients according to the insurance policy in our country. The indications for surgery in these patients included menorrhagia, abdominal pain, bulk-related symptoms (urine frequency or rectosigmoid compression), and infertility. Before the surgery, all patients underwent preoperative assessments, including detailed medical history, pelvic examination, and ultrasonography. Patients with sex experience were screened for the absence of cervical malignancy. Diagnostic hysteroscopy was performed to exclude pathologic lesion in the uterine cavity for patients who suffered from menometrorrhagia and anemia. The risks of surgery were explained to the patients, including the potential need to switch to laparotomy during the operation and the risks of intraoperative bleeding, transfusion, and adhesion. Written informed consent was obtained from all patients. All women had bowel preparation in the morning of surgery. Intravenous cephalosporin prophylaxis was given just before surgery.

Preoperative clinical and demographic characteristics including age, body mass index, weight of excised fibroids (g), number of cesarean delivery, and pretreatment with gonadotropin-releasing hormone agonist (GnRH<sub>a</sub>) were abstracted. Similarly, operating time, number of fibroids removed, main fibroid size, estimated blood loss, hemoglobin decrease, postoperative stay, requirement of blood transfusion, and any perioperative complications (e.g., fever, bowel injury, or genitourinary tract injury) were recorded. Total hospital charges (this amount does not include the cost covered by the National Health Insurance) were obtained from hospital financial records. The study was approved by the Institutional Review Board of Chang Gung Memorial Hospital.

### LM technique

The patient was placed in the dorsolithotomy Trendelenburg position with both legs protected by elastic bandages, and a Foley

catheter was inserted for constant urinary drainage. After induction of general anesthesia, intravenous cephalothin (1 g) was administered as prophylaxis. LM was performed following procedures as described by Wang et al [2]. In brief, laparoscopic examination of the pelvis and lower abdomen was performed first to determine accessibility of the surgical field, and spaces between the rectum and cervix, and the parametrium and ureter. Four trocars were routinely used.

After identifying the location of all fibroids, a transverse elliptical incision was made on the serosa overlying the largest tumor by conventional unipolar electro-surgery or harmonic scalpel (5 mm in size) until its pseudocapsule was reached. Additional fibroids located at the same area were removed through the same incision. However, for removal of nonadjacent fibroids, creating a new incision was necessary. A myoma screw, or a second puncture, was then inserted into the fibroid to apply traction and countertraction movements. The unipolar electrode or harmonic scalpel was used to dissect pseudocapsule attachments further. After fibroid removal, the uterine defect was irrigated. Bleeding points were identified and controlled with electrocoagulation (bipolar diathermy or harmonic scalpel). The uterine surgical defect was closed in two layers with a zero monofilament polyglactone 25 (MONOCRYL, Ethicon Inc., Somerville, NJ, USA) continuous nonrunning-lock suture and intracorporeal knots. Specimens were extracted through posterior colpotomy routinely. After removal of all fibroids, the colpotomy incision was closed with 2-0 polyglycolic acid suture (Ethicon Inc., Somerville, NJ, USA). If the specimen had to be removed from the abdominal wall (for women with no prior sexual activity), a 15-mm electromechanical morcellator (Ethicon Endo-Surgery, Cincinnati, OH, USA) was used to ease extraction of the specimen. Pneumoperitoneum was re-established at this time, and the peritoneal cavity was irrigated and lavaged until fluid was ran clear. After achieving hemostasis completely, all port sites were sutured with 3-0 polyglycolic acid suture (Ethicon Inc., Somerville, NJ, USA) at the level of the fascia to prevent herniation. The skin was approximated by sterile adhesive tape.

### Statistical analysis

Continuous variables were compared with Student *t* test and categorical values with Pearson  $\chi^2$  analysis and Fisher exact test. To reduce the effects of confounding by some covariates, the propensity score was used, which is a statistical matching technique that attempts to select a set of patients who have similar distribution of measured baseline covariates between patients of two different treatments. Multiple logistic regression was used to estimate the likelihood of undergoing an LM with harmonic scalpel (LMH) for all patients based on age, body mass index, the number of cesarean delivery, specimen weight, and pretreatment with GnRH<sub>a</sub>. The logistic model produces a zero to one propensity score based on the predicted probability of undergoing LMH versus LME, which was dependent on differences in patient demographic and preoperative clinical characteristics [12]. These propensity scores were then used to measure selection bias. Patients undergoing LME with low scores would have been unlikely to undergo an LMH, and therefore were excluded them from comparative analysis.

Six clinical outcomes (number of fibroids removed, main fibroid size, estimated blood loss, hemoglobin decrease, incidence of blood transfusion, and perioperative complications) and three efficiency outcomes (operating time, postoperative stay, and hospital charges) were compared between groups. We compared a propensity score-matched sample of 93 LME patients with the 31 LMH patients using a “nearest neighbor” approach. In this approach, each LMH patient was matched to three LME patients with the closest propensity scores. Differences in outcomes by procedure

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