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Comparison of barbed suture *versus* traditional suture in laparoendoscopic single-site myomectomy

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ABSTRACT

Objective: To compare the surgical outcomes between uterine wall repairs using barbed suture *versus* traditional suture during laparoendoscopic single-site myomectomy (LESS-M).
Study design: Data were prospectively collected from 60 consecutive patients with uterine myomas at three institutions. Patients were managed by LESS-M with either traditional suture (the first 30 patients) or barbed suture (the next 30 patients). Operative time, blood loss, and technical difficulty were assessed for each patient.
Results: Patient characteristics (age, body mass index, other demographic data, number of myomas, and location and size of the largest myoma) were similar between the two study groups. No significant differences in operative complications, failure rate of the intended surgeries, degree of postoperative pain, or hospital stay duration were observed between the two groups. The use of barbed suture significantly reduced the suturing time for treating the uterine wall defects ($P = 0.014$), as well as the total operative time ($P = 0.027$). The use of barbed suture was also associated with less operative blood loss ($P = 0.040$) and less technical difficulty ($P = 0.001$) compared with traditional suture.
Conclusion: The use of barbed suture in LESS-M effectively reduces the time required for suturing, thereby decreasing the total operative time, the operative blood loss, and the surgical difficulty.

Introduction

Uterine myomas, also referred to as leiomyomas or fibroids, are very common tumors in women of childbearing age. Uterine myomas are clinically diagnosed in 20–50% of all women, with their incidence increasing in the later portion of a woman's reproductive years [1]. Laparoscopic myomectomy is an established alternative to standard transabdominal myomectomy for managing uterine myomas, and is associated with significant advantages including less postoperative pain, shorter hospital stays, faster recoveries, and improved cosmetic satisfaction [2–7]. Recently, conventional laparoscopy with multiple trocars has been replaced by laparoendoscopic single-site (LESS) surgery, which has the advantage of improving the cosmetic results by reducing the number of incisions [8–13]. However, LESS myomectomy (LESS-M) has not been widely performed due to its technical difficulties. In particular, laparoscopic suturing of uterine wall defects is one of the most difficult and time-consuming tasks when performing in LESS-M.

Barbed suture is a new technology that has the potential to greatly facilitate laparoscopic suturing. Among the available equipment for barbed suture, the V-Loc wound closure device (Covidien, Mansfield, MA, USA) consists of a unilateral barbed absorbable thread, armed with a surgical needle at one end and a loop at the other end, which is used to secure the suture. The barb and loop ends allow the approximation of tissues without the need to tie surgical knots. Barbed suture has been used in a number of conventional laparoscopies using multiple trocars, including hysterectomies [14], myomectomies [15,16], colectomies [17], hernia repairs [18], and gastrointestinal anastomoses [19] with good results. However, the use of barbed suture has not yet been tested for LESS-M. Therefore, the aim of this study was to compare the surgical outcomes of barbed *versus* traditional suture in the repair of uterine wall defects during LESS-M.

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Materials and methods

This is a cohort study including 60 consecutive patients who underwent LESS-M between February 2012 and April 2013 at three institutions (CHA, Gangnam Medical Center, Seoul, Republic of Korea; National Health Insurance Service Ilsan Hospital, Goyang, Republic of Korea; Samsung Medical Center, Seoul, Republic of Korea). Data for the first 30 patients, who underwent LESS-M using traditional intracorporeal suture, were compared with data for the next 30 patients, who underwent LESS-M using an absorbable unidirectional knotless barbed suture device to repair the uterine wall defects. After institutional review board approval had been obtained for this study, all patients gave written informed consent for their data to be analyzed prospectively.

All patients underwent transvaginal and/or transabdominal ultrasonography within 30 days before surgery, in which the number, sizes, and locations of the myomas were assessed and recorded. The inclusion criteria for this study included: women with myomas causing symptoms such as menorrhagia, pelvic pressure/pain, or infertility; women who were planning to undergo laparoscopic myomectomy; women who had $\leq$3 myomas, with the largest myoma $\leq$12 cm; women who were not pregnant at the time of presentation; and women between 18 and 55 years of age. Exclusion criteria included: women with a dominant pedunculated subserosal or submucosal type myoma; women who underwent concomitant complex surgical procedures at the time of laparoscopic myomectomy, such as severe adhesiolysis or resection for severe endometriosis; women with any suggestion of malignant uterine or adnexal diseases; women with major medical comorbidities or psychiatric illnesses, which could affect follow-up and/or compliance; and women who refused to participate or give consent to the procedures.

One surgeon from each participating institution performed all the surgeries at that institution. All participating surgeons had comparable surgical skills and a preference for LESS surgery. After the introduction of general anesthesia, patients were placed in the Trendelenburg position, and a single multi-channel port was inserted through the umbilicus. The use of various ports and laparoscopic instruments was allowed during the LESS-M procedures, based on each surgeon's preference. Before initiating the uterine incision, a local vasoconstrictor such as dilute vasopressin was injected into the serosal and/or overlying myometrium, and just around the myoma, to reduce blood loss. Using a Harmonic Scalpel (Ethicon Endo-surgery, Cincinnati, OH, USA) or a SonoSurge (Olympus Medical, Tokyo, Japan), a longitudinal myometrial incision was made over the myoma. After identifying the cleavage plane, the myoma was enucleated by means of adequate traction with a laparoscopic myoma screw or forceps. Coagulation of significant bleeding was obtained with bipolar forceps. In the traditional suture group, myometrial closure was performed in one to two layers, depending on their size and depth. Closure was performed in a continuous manner with Vicryl 1-0 sutures (Ethicon, Somerville, NJ, USA), using intracorporeal knots to secure each suture end. In the barbed suture group, myometrial closure was performed in a single or double layer. Closure was performed using a 30-cm 1-0 polyglyconate unidirectional barbed suture with a 37-mm half circle taper-point needle (V-Loc 180; Covidien). The first stitch was locked by a loop at one end of the uterine incision, and then a continuous suture was passed through to the opposite end of the uterine incision and cut without tying a knot. The myomas, which were placed into the specimen retrieval endopouch, were removed transumbilically with a knife morcellation protected with a wound retractor connected to a single-port system. On occasion, the myomas were removed with an electrosurgical morcellator (Wisap, Sauerlach-Munchen, Germany) through the 10-mm channel of the umbilical port. The procedure was completed by establishing control of uterine hemostasis, washing the pelvic cavity, and absorbing any clots that had formed.

A specific form was designed to prospectively collect data concerning patient characteristics, intraoperative details, surgical outcomes, and perioperative complications. The total operative time, which was electronically recorded, was defined as the time from skin incision to skin closure. The times required to perform each phase, including the enucleation time for all myomas, the suturing time for all uterine wall defects, and the morcellation times, were measured and calculated with the digital time counter. Operative blood loss was calculated by the anesthesiology unit as the difference between the total amount of suction and irrigation plus the difference between the total gauze weight before and after surgery. Failure of the intended operation was defined as the use of one or more additional ports (entailing a conversion to conventional laparoscopy using multiple ports) and conversion to laparotomy. At the end of each operation, the degree of total surgical difficulty, enucleation difficulty, and suturing difficulty were evaluated by the operator using a visual analog scale (VAS) varying from 1 (low difficulty) to 10 (high difficulty), as described by Vassiliou et al. [20]. Postoperative pain assessments were performed using a VAS at 12, 24, and 48 h postsurgery by several assessors who were not associated with the investigators. The scale was presented as a 10-cm line with verbal descriptors indicating "no pain" and "pain as bad as it could be". In both groups, a blood sample was taken within 24 h after surgery. The hemoglobin change was defined as the difference between the preoperative hemoglobin level and the hemoglobin level on postoperative day 1. Patients were discharged from the hospital after restoration of bowel activity, successful ambulation, the absence of postoperative fever, and when they no longer needed narcotic analgesics. The length of the hospital stay was defined as the time from the operation day to the day of discharge. All intraoperative and postoperative complications arising within 30 days of the surgery were recorded. All patients were scheduled for follow-up examinations at 1 week and 1 month postsurgery.

All statistical analyses were performed using SPSS 13.0 (SPSS Inc., Chicago, IL, USA). Data are presented as means $\pm$ standard deviation (SD) or medians (range) for continuous variables, and frequencies (percentages) for categorical variables. Baseline clinical characteristics and study outcomes were compared between the two groups using Student's *t*-test or the Mann–Whitney test for continuous variables, and the chi-squared test or Fisher's exact test for categorical variables, as appropriate. *P*-values < 0.05 were considered to be statistically significant.

Results

Baseline characteristics including age, body mass index, marital status, parity, menopausal status, abdominal surgical history, and preoperative hemoglobin concentration were similar between the two study groups (Table 1). The mean age and body mass index of the study patients were 39.2 ± 5.4 years and 22.0 ± 3.3 kg/m^2, respectively. The main indication for myomectomy, number of uterine myomas, and diameter and location of the largest myoma also did not differ between the two groups ($P > 0.05$ for all).

The surgical outcomes of each group are shown in Table 2. The median operative time for the entire surgical procedure was shorter in the barbed suture group than in the traditional suture group (69 min [25–215 min] *versus* 91 min [32–218 min], $P = 0.027$). The time required for uterine defect suturing was also shorter in the barbed suture group than in the traditional suture group (19 min [6–65 min] *versus* 27 min [9–100 min], $P = 0.014$). However, no differences were observed between the groups for the other operative time segments, including myoma enucleation time and morcellation time. The degree of surgical difficulty for the overall procedure and the uterine defect suturing were lower in the