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Suturing method as a factor for uterine vascularity after laparoscopic myomectomy

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ABSTRACT

Objective: To evaluate the vascularity of the myometrium after laparoscopic myomectomy sutured by two different methods using contrast-enhanced Magnetic Resonance Imaging.
Study design: Twenty-eight women who had symptomatic leiomyomas and underwent laparoscopic myomectomy between June 2013 and July 2014 were included in the present study. In the first half period, continuous sutures were used in 12 patients, and in the latter half period, single interrupted sutures were used in 16 patients. Contrast-enhanced Magnetic Resonance Imaging was used 3 or 6 months after surgery to evaluate vascularity after laparoscopic myomectomy. We defined avascularity index as the percentage of avascular area after surgery to cross sectional area of myoma before surgery. The Wilcoxon rank-sum test was applied to compare avascularity indeces in the two study groups.
Results: At 3 months after surgery, avascularity index in continuous sutures group was significantly higher than that in single interrupted sutures group (median 5.0 vs.1.2, $p < 0.001$), suggesting a poorer vascular recovery of the myometrium sutured continuously.
Conclusion: Simple interrupted suturing might be superior to continuous suturing in terms of vascularity evaluated using contrast enhanced Magnetic Resonance Imaging.

Introduction

Uterine myoma is a common tumor of the pelvis among women and causes menorrhagia, abdominal pain, abdominal discomfort, and subfertility. Approximately 20–40% of women of reproductive age have uterine myomas, and the frequency increases in the later reproductive years [1,2]. Myomectomy is the most popular treatment option for women who desire to preserve their child-bearing potential. Laparoscopic myomectomy (LM) was described for the first time in 1980 [3]. Due to advances in laparoscopic devices and procedures, the indication of LM have expanded from small subserous myomas to large intramural ones. LM is more advantageous than traditional abdominal myomectomy (AM) in terms of operative blood loss, postoperative pain, recovery time, and overall complications [4–6]. Therefore, in recent years, LM has become a common procedure in numerous institutions throughout the world.

Uterine rupture during pregnancy or labor is a rare but serious complication associated with myomectomy. There have been only a few studies on the risk of uterine rupture after laparoscopic myomectomy, and the risk has been reported to be 0.6–1% [7,8]. There have been several papers comparing the risk of uterine rupture after LM versus after AM. In some of them, the perinatal outcomes show no significant differences between LM and AM [9,10]. However, a retrospective study conducted in Korea revealed 2 cases of uterine rupture or dehiscence in 54 patients who underwent LM [11]. In another study that evaluated the wound of myomectomy at the time of cesarean section, the results showed that the scars of LM were thinner than those of AM [12].

Several factors that might be related to uterine rupture after LM have been reported. Cobellis et al. suggested that the imperfect healing process observed following LM might be related to thermal damage with bipolar coagulation [12]. An animal study showed that carbon dioxide pneumoperitoneum might be related to wound healing [13]. A review of previous reports on uterine rupture after LM recommended a multilayer closure, as well as limited use of electrosurgery [14].

The relationship between suturing methods and wound healing has been more intensively studied for Cesarean sections. Single-layer closure was previously reported to be related to shorter operative time [15] and larger scar defects [16], and have a four-fold increase in the risk of uterine rupture to a double-layer closure [17]. Ceci et al. compared 2 types of single-layer sutures used for cesarean sections and reported that continuous sutures seem to

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cause larger defects than interrupted sutures [18]. Sumigama et al. reported that continuous sutures are related to increased incidence of placenta accreta for subsequent pregnancies [19].

To our knowledge, to date, there have been no reports comparing the different suturing methods in terms of wound healing after LM. Therefore, this study was conducted to evaluate the vascularity of the myometrium after LM closure with 2 different suturing methods, by using contrast-enhanced magnetic resonance imaging (CE-MRI).

Methods

This prospective cohort study was approved by the Institutional Review Board of Sanraku Hospital. Patients who had symptomatic leiomyomas and who underwent LM in Sanraku Hospital between June 2013 and July 2014 were eligible for the study. In the first 7 months, between June and December 2013, continuous sutures were used (group A). In the latter 7 months, between January and July 2014, single interrupted sutures were used (group B). Small myomas with single layered suture were excluded from the analysis, and two to three layered continuous or interrupted sutures were made in each group.

The surgeries included in the study were operated by three gynecologists (C.M., Y.H., and A.H.). All the three doctors had more than three years of experiences in gynecological laparoscopic surgery. All the surgeries were performed under guidance by A.F., who had more than ten years of experiences in gynecological laparoscopic surgery and was authorized by Japan Society of Gynecologic and Obstetric Endoscopy and Minimally Invasive Therapy.

Prior to surgery, MRI was conducted on all patients to accurately diagnose uterine myoma and to evaluate the size, position, and number of leiomyomas (Fig. 1A). A gonadotropin-releasing hormone (GnRH) agonist was not mandatory. It was not administered to those who had leiomyomas <6 cm, had no anemia, and hoped to undergo surgery as soon as possible.

LM was performed as follows: diluted vasopressin was injected and a horizontal incision was made using ultrasonic scalpel; leiomyomas were then enucleated; two to three layered sutures were made by using a multifilament thread (0-POLYSORB®, Covidien Japan Co. LTD., Tokyo, Japan); and, leiomyomas were removed by using an electrical morcellator or trans umbilical manual morcellation.

When making interrupted sutures, we used the threads without cutting. After suturing the myometrium, we pulled out the needle through the 12-mm port until the short tail became suitable for handling, and made slip knots intracorporeally. When making continuous sutures, we used the threads which were cut into half, and kept them intracorporeally until the end of one layer suturing. We did not choose extracorporeal suturing nor barbed suture to minimize cost of surgery. The aim of the present study was to compare suturing methods, therefore, we used multifilament threads in both groups and not barbed sutures, which were exclusively used for continuous sutures and not for interrupted ones.

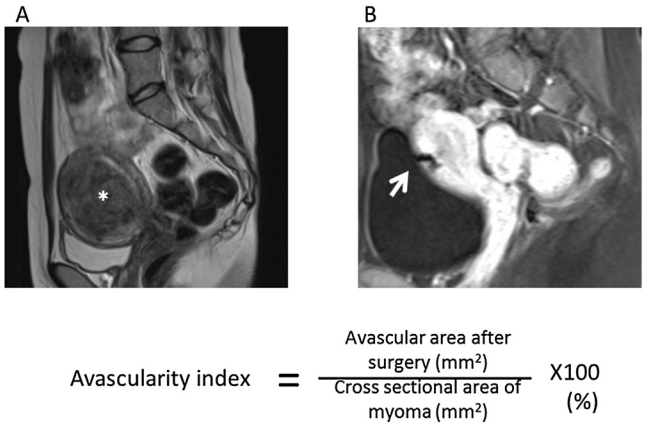

Fig. 1. Examples of MRI conducted before surgery (A) and CE-MRI that was taken 3 months after surgery (B) in the same patient. The asterisk shows intramural myoma nodule in the anterior wall, and the arrow shows avascular area in the myometrium where myoma was removed and sutured.

All the patients underwent CE-MRI 3 months after surgery. Some of them repeated CE-MRI 6 months after surgery.

In the CE-MRI that was taken after surgery, avascular areas were observed in accordance with the positions of leiomyomas (Fig. 1B). To evaluate the vascularity after LM quantitatively, the researchers defined an avascularity index, as the percentage of avascular area after surgery to the cross-sectional area of myoma before surgery (Fig. 1).

Excel Statistics Ver.6.0 (Esumi Co Ltd, Tokyo, Japan) was used as a statistical software program. The chi-square and Fisher's exact probability tests were used to investigate the distribution of categorical variables. The Wilcoxon rank-sum test and signed-ranks test were applied to compare continuous unpaired and paired variables, respectively. Statistical significance was set at $p < 0.05$.

Results

During the study period, 12 patients underwent LM with continuous sutures (group A), and 16 with single interrupted sutures (group B). All patients underwent CE-MRI 3 months after surgery. Seven patients in group A underwent another MRI 6 months after surgery.

The characteristics and outcomes of the surgery are listed in Table 1. There were no significant differences in age, body mass index, myoma size, number of myomas, myoma position, myoma classification, presence or absence of GnRH agonist before surgery, operation time, or blood loss between groups A and B.

Fig. 2 shows the distribution of the avascularity index in the MRI performed 3months after surgery in the 2 study groups. The avascularity index in group A (median 5.0, min 2.1–max 9.0) was significantly higher than that in group B (median 1.2, min 0.1–max 3.7, $p < 0.001$). This result suggested poorer vascular recovery of the myometrium that was sutured continuously compared to that of the one with interrupted sutures. In both groups, preoperative administration of GnRH agonist had no influence on the avascularity index (data not shown).

The date of MRI after surgery was planned irrespective of the menstrual cycles. The menstrual periods after surgery were noted in 9 and 10 patients in group A and B, respectively. In all the 19 patients, the uterine myometrium surrounding the avascular area was clearly and evenly enhanced, and there was no relation between menstrual cycle and avascularity index.

The avascularity index was then compared among the 7 cases in group A, 3 months versus 6 months after surgery (Fig. 3). The avascularity index at 6 months after surgery was significantly lower than that at 3 months after surgery ($p = 0.028$), indicating a better vascular recovery in 6 months than in 3 months after surgery with continuous sutures.

The avascularity index was then compared between the MRI of group B patients 3 months after surgery and that of group A patients 6 months after surgery (Fig. 2). The avascularity index in group A 6 months after surgery (median 4.2, min 2.2–max 7.5) was still significantly higher than that in group B 3 months after surgery (median 1.2, min 0.1–max 3.7, $p < 0.001$).