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REVIEW ARTICLE

A Comparison of Combined Laparoscopic Uterine Artery Ligation and Myomectomy *vs* Laparoscopic Myomectomy in Treatment of Symptomatic Myoma

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ABSTRACT

Uterine leiomyomas are one of the most common benign smooth muscle tumors in women, with a prevalence of 20 to 40% in women over the age of 35 years. Although many women are asymptomatic, problems, such as bleeding, pelvic pain, and infertility may necessitate treatment. Laparoscopic myomectomy is one of the treatment options for myomas. The major concern of myomectomy either by open method or by laparoscopy is the bleeding encountered during the procedure. Most studies have aimed at ways of reducing blood loss during myomectomy. There are various ways in which bleeding during laparoscopic myomectomy can be reduced, the most reliable of which is ligation of the uterine vessels bilaterally. In this review, we propose to discuss the benefits and possible disadvantages of ligating the uterine arteries bilaterally before performing laparoscopic myomectomy.

Keywords: Fibroids, Laparoscopic myomectomy, Myomectomy, Uterine artery embolization, Uterine artery ligation, Uterine devascularization.

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INTRODUCTION

Uterine myomas are the most common tumor of the female reproductive system among any age group.[1,2] The incidence of this form of tumor is reported to be between 20 and 40% among women 35 years of age and older.[3] Myomas can significantly decrease the quality of life for women as they can result in menorrhagia, dysmenorrhea, and pelvic pain. Large myomas can also stimulate urinary tract compression, causing increased urinary frequency and urgency.

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Among nonsurgical interventions, hormone therapy with gonadotropin-releasing hormone (GnRH) agonists has been the treatment of choice, and may result in symptomatic improvement and reduction in the size of the myoma.[1,4] However, rapid regrowth of the myomas to their original size has been reported to cause the recurrence of symptoms within a few months after the discontinuation of hormone treatment.[4] Furthermore, GnRH agonists can obliterate the myoma myometrial interface and as a result enucleation of myomas becomes more difficult.[5] As a result, hormone therapy has been limited to premenopausal use only.

Among the available modalities for surgical treatment of myomas, hysterectomy is the most common. In the United States, an estimated 600,000 hysterectomies are performed each year, with symptomatic uterine myomas cited as the main cause for approximately 30% of all hysterectomies. For women who wish to retain their childbearing potential, abdominal myomectomy has been the alternative.[6]

Less invasive alternatives, namely, laparoscopic and hysteroscopic myomectomy procedures, have also been developed in recent years.[7] Unfortunately, of these two approaches, the risk of reported recurring myomas is far greater with abdominal myomectomies[1,4] because, in cases with numerous myomas, the surgeon often removes the large and easily visible myomas, unintentionally leaving the smaller or *in situ* ones behind.[1,7,8] Postoperative intact myomas within the uterus may account for a persistence of menorrhagia and a high rate of myoma recurrence.

There are also controversies regarding all types of surgical intervention. Many researchers have reported that myomectomies (abdominal or laparoscopic), especially in the case of multiple myomas, have resulted in excessive blood loss, prolonged operating time, postoperative complication, and a prolonged hospital stay.[7]

To address these complications, an alternative treatment, the laparoscopic bilateral coagulation of uterine vessels, was introduced by Liu in 2000.[9] Other studies reported successful outcomes in treating symptomatic myomas by uterine artery ligation that reduced the patient's symptoms by 60 to 80% and the size of myoma by 40 to 50%.[10]

The exact mechanisms by which the uterine artery ligation causes the reduction in the size of myoma have not been established, yet cell apoptosis and necroses have been noted as possible explanations.[1] Noting these reported benefits, laparoscopic ligation of the uterine vessels, which causes fewer complications than other procedures, may be a better alternative to hysterectomy, despite the higher technical skill required to perform this procedure.[11]

Many studies in past evaluated the effect of combined laparoscopic uterine artery ligation (LUAL) and myomectomy as a therapeutic method in decreasing operative morbidities, such as intraoperative hemorrhage, operation time, and postoperative fever.

Some of the studies also evaluated myoma recurrence and symptom alleviation associated with recurrence as well as the fertility outcomes for relevant participants.

AIM

To determine the impact of uterine artery ligation in laparoscopic myomectomy, according to surgical results and clinical outcomes.

MATERIALS AND METHODS

A review of literature was performed in September 2015 using search engines: Highwire Press, Pubmed and Google. The searches used the keyword 'laparoscopic myomectomy with uterine artery ligation'. No statistical analyses have been performed. Data extraction was directly by full text of the publications in the Journals. In most of the studies main outcome measured was operating time, blood loss, blood transfusion, febrile morbidity, symptoms improvement, recurrence rate, and pregnancy rate. There were several studies performed in past on this topic. And in most of the studies uterine artery ligated at it origin.

RESULTS

A study by Saeed Alborzi et al of 152 women with symptomatic uterine myomas necessitating surgical intervention who wished to retain their uteri, 65 underwent laparoscopic uterine artery ligation and myomectomy (experimental group) and 87 received laparoscopic myomectomy only (control group). All the participants were recruited from women with symptomatic myomas during a 3-year period between 2003 and 2005. All the symptomatic myomas were diagnosed by transvaginal ultrasound or sonohysterography. All of the women wished to retain their uteri. In total, 152 women between the ages of 20 and 46 years, who could be followed up for 2 years, were selected. The women's symptoms included menstruation problems, mostly menorrhagia and/or lower abdominal pain. None of the patients was pregnant at the time of the study nor had amenorrhea. The patients were divided into two groups. Group A (n = 65), the experimental group, consisted of patients who underwent both LUAL and myomectomy. Group B (n = 87), the control group, included patients who were treated with laparoscopic myomectomy alone. Both groups had similar overall general characteristics including age, mean average size of myomas, and the number of myomas.

For a period of 24 months, all of the patients were evaluated every 3 months to assess their symptoms and check for the recurrence of myomas by transvaginal ultrasound. Patients graded their subjective symptomatic changes in terms of pain and bleeding using one of two choices: completely resolved or unchanged. Menorrhagia improvement was evaluated by the pads used during menstruation, and dysmenorrhea improvement was evaluated by the amount of analgesics used.

The average operating time and blood loss were 112 ± 18 minutes and 173 ± 91 ml for the experimental group and 95 ± 14 minutes and 402 ± 131 ml for the control group, respectively (statistically significant). A total of 15 (17.2%) of the control group patients required a blood transfusion, but none of the experimental group patients required one. Febrile morbidity occurred in 18.5% of the experimental group and 20.7% of the control group. In the experimental group, the recurrence of myoma was 6.2 and 98.1% of the patients reported symptoms improvement; however, in the control group, these figures were 20.75 and 83.1%, respectively (statistically significant). The pregnancy rates were not statistically significantly different in the experimental group (35%) and the control group (35.7%).

A study by Chin-Jung Wang et al 20 consecutive women with symptomatic uterine fibroids desiring to preserve the uteri underwent laparoscopic surgery with ligation of the uterine arteries with ligating clips, followed by myomectomy and removal of the clips.

Laparoscopic uterine artery ligation with reversible ligating clips was successfully performed in all patients. The median main fibroid diameter and fibroid weight were 7.3 cm [interquartile range (IQR) 7.0–9.0] and 210 gm (IQR 150–295 gm), respectively. The median operating time was 120 minutes (IQR 100–148 minutes) and blood loss was 100.0 ml (IQR 56.3–137.5 ml). The median number of fibroids removed was one (IQR 1–4.3). The median postoperative hospital stay was 3 days (IQR 2–3 days) and no patient developed complications. Menstrual bleeding problems and bulk-related symptoms were controlled in 90.0 and 100% of women, respectively after 6 months of follow-up. One woman conceived spontaneously

4 months after surgery and delivered a baby girl at 38 weeks gestation via cesarean section.

Another study performed by Ji Hae Bae et al in 90 patients. Results show 51 patients (56.6%) underwent laparoscopic myomectomy with uterine artery ligation (group A), and 39 patients (43.3%) underwent laparoscopic myomectomy alone (group B). The mean operating time was 100.0 ± 33.8 minutes in group A and 90.0 ± 37.1 minutes in group B. Both groups were similar with respect to mean blood loss (72.3 ± 109.0 *vs* 62.6 ± 77.3 ml). The myoma recurrence rate in group A was significantly less than in group B after a median follow-up period of 11.1 months (2 *vs* 13%).

A study by Z Holub et al assessed the effect of lateral uterine artery dissection (LUAD) on clinical outcomes in laparoscopic myomectomy (LM). Fifteen women with symptomatic fibroids (dominant fibroid size: 3–6 cm) were randomly allocated to laparoscopic myomectomy (group A) and 16 women to the combined operative procedures LM and LAUD (group B). They assessed the clinical outcomes: intraoperative and postoperative blood loss, operating time, hospital stay, hemoglobin fall, inflammatory response and tissue markers [C-reactive protein (CRP), creatinin kinase and white blood cells (WBC)]. The mean operating time was 69.5 minutes in group A and 76.5 minutes in the group B, and the mean length of hospital stay was 2.6 days *vs* 2.1 days, respectively ($p > 0.05$). For the laparoscopic myomectomy and combined operative procedure, respectively, the intraoperative blood loss was 134 ml (10–400 ml) and 93.7 ml (10–200 ml) ($p > 0.05$); the difference (92.4 *vs* 46 ml) in estimated postoperative blood loss was statistically significant ($p < 0.05$), and the decline in the hemoglobin level was 1.2 g/dl^{-1} (group A) *vs* 0.6 g/dl^{-1} (group B) on the 3rd postoperative day ($p < 0.05$). Group B demonstrated a less intense stress response in terms of CRP ($p < 0.001$) and WBC ($p < 0.01$). The LUAD had little impact on intraoperative blood loss. This may be due to the smaller fibroid size, but the statistical difference in hemoglobin fall on the 3rd postoperative day was significant. The dissection of the uterine artery in laparoscopic myomectomy is a feasible surgical procedure with a low rate of complication.

A study by Giuseppe Vercellino et al of 166 women with symptomatic uterine myomas necessitating surgical intervention who wished to retain their uteri, 80 underwent laparoscopic uterine artery clipping and myomectomy (experimental group) and 86 received laparoscopic myomectomy only (control group). Main outcome measures were operating time, number and weight of leiomyomas, blood loss, Doppler examination of the uterine arteries and complications of procedure.

In the experimental group, the median hemoglobin drop measured on day 3 postoperatively was 1.2 g/dl. In the control group, the mean hemoglobin drop measured on day 3 postoperatively was 1.45 g/dl. The time needed to put the clips in place (the time from the opening of the retroperitoneum and the positioning of the clips) varied between 6 and 40 minutes. No patient required blood transfusion. There were no conspicuous complications.

DISCUSSION

Excision of fibroids from the uterine corpus, repair of the uterine incision, control of operative blood loss, and removal of large fibroids are major concerns during LM. Control of operative blood loss might be the most critical consideration. Most intraoperative conversions to laparotomy reported in the literature have been because of intraoperative bleeding.[12] Previous studies study also confirmed the most serious complication during LM for large fibroids is severe intraoperative hemorrhage and subsequent blood transfusion.[13] More women with symptomatic uterine fibroids request laparoscopic management with preservation of the uterus. As the size of fibroids increases, it is necessary to develop a management strategy to circumvent surgical problems related to large fibroids. Pretreatment with GnRH agonist can shrink the fibroids and theoretically simplify myomectomy. However, GnRH agonist therapy may alter the myoma-myometrium interface and induce the disappearance of small fibroids; therefore, it may increase the difficulty of fibroid enucleation and the incidence of recurrent fibroids.[14-16] In addition, GnRH agonist therapy provides only a slight benefit in reducing blood loss.[17] Therefore, it is suggested that pretreatment with GnRH agonist be used in selected LM cases.

Vasopressin is a posterior pituitary hormone with a strong vasoconstrictive effect on smooth muscle. Local administration of vasopressin to the uterus is helpful in controlling bleeding during myomectomy.[18,19] Possible drawbacks include bleeding from the needle puncture sites, which often persists throughout the procedure, requiring later electrosurgical coagulation, and delayed bleeding in the myometrium.[20] If unexpected bleeding occurs, the goal of controlling operative bleeding will not be achieved.

Placing a tourniquet around the lower uterus to stop the blood flow to the uterus can facilitate a myomectomy. It is, however, difficult to perform during a laparoscopy because there are no appropriate instruments. Modified procedures have been introduced for this purpose in laparoscopic surgery.[7,21] They can effectively reduce blood loss during LM and have the potential to prevent fibroid recurrence. Nevertheless, suture and hemoclip ligations

Table 1: Comparison of various studies in term of operative time and intraoperative blood loss

	No. of participants			*Operating time (min)*		*Outcome Intraoperative blood loss (ml)*	
Study name	*Experimental group (E)*	*Control group (C)*	*Total*	*Experimental group (E)*	*Control group (C)*	*Experimental group (E)*	*Control group (C)*
Saeed Alborzi et al	65	87	152	112 ± 18	95 ± 14	173 ± 91	402 ± 131
Chin-Jung Wang et al	20	—	20	120 (100–148)	—	100 (56.3-137.5)	—
Ji Hae Bae et al	51	39	90	100 ± 33.8	90 ± 37.1	72.3 ± 109	62.6 ± 77.3
Z Holub et al	15	16	31	76.5	69.6	93.7	134
Giuseppe Vercellino et al	80	86	166	—	—	1.2 g/dl	1.45 g/dl

E: Experimental group, C: Control group

are permanent methods and might not be suitable for women who want to retain their childbearing capacity. Hem-o-lok clips can stop uterine blood flow at the uterine artery level and reperfusion occurs after removal. With the aid of this instrument, blood loss can be controlled and childbearing preserved when performing a uterine depletion procedure followed by a myomectomy.

Criticisms of the transient blocking uterine perfusion procedure are that the average 2 hours occlusion time might induce irreversible damage in the uterine myometrium and cause embolic events and pulmonary emboli after release of the clips.

Traditional uterine tourniquets usually require only an hour.[22] A review of the literature on ischemic, necrotic twisted adnexa showed no reports of embolic phenomena after detorsion.[23,24] In addition, the uterus has a dual extrinsic blood supply. The primary supply is from the uterine arteries, and the secondary supply is from branches of the ovarian arteries. If the uterine arteries are occluded, the myometrium is supplied by the ovarian arteries through the communicating arteries. If the ovarian arteries remain intact during the operation, damage to the myometrium theoretically would not occur, regardless of the length of time the uterine arteries are occluded.

Blood loss in myomectomy mainly occurs during removal of fibroids and uterine repair. Therefore, it is necessary to quickly suture the wound to avoid a massive hemorrhage. It is not easy to perform a perfect uterine repair with minimal blood loss within a short time in laparoscopic surgery unless surgeons are proficient in laparoscopy. A uterine depletion procedure can provide a relatively bloodless situation and let the surgeon perform laparoscopic suturing with ease.

After reviewing literature on uterine artery ligation prior to laparoscopic myomectomy shows that it significantly reduces blood loss compared to laparoscopic myomectomy without uterine artery ligation group (Table 1).

All of the studies also show that it slightly increases in operative time without any increase in morbidity in experimental group (Table 1).

In experimental group there is decrease in incidence of recurrence rate of myoma and blood transfusion compared to contol group.

CONCLUSION

In conclusion, LM offers several benefits to the patient. It is still a challenging technical procedure and might be associated with high surgical morbidity and incidence of blood transfusion. Surgical strategies are needed to overcome these problems in LM.

Uterine artery ligation prior to myomectomy can control operative blood loss in LM and preserve the childbearing capacity of the patient, However, larger studies to investigate the feasibility and effectiveness of this procedure are crucial before definite conclusions can be drawn.

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