Available online at www.sciencedirect.com

SciVerse ScienceDirect

Taiwanese Journal of Obstetrics & Gynecology 51 (2012) 539–544

www.tjog-online.com

Original Article

Short-term advantages of laparoscopic uterine vessel occlusion in the management of women with symptomatic myoma

Kuan-Chin Wang [a,1], Wen-Hsun Chang [b,c,1], Wei-Min Liu [d,e], Yuan-Kuei Yen [d,e], Nicole Huang [c], Peng-Hui Wang [f,g,h,i,*]

[a] *Department of Nursing, Oriental Institute of Technology, New Taipei City, Taiwan*
[b] *Department of Nursing, Taipei Veterans General Hospital, Taipei, Taiwan*
[c] *Institute of Hospital and Health Care Administration, National Yang-Ming University, School of Medicine, Taipei, Taiwan*
[d] *Department of Obstetrics and Gynecology, Taipei Medical University Hospital, Taipei, Taiwan*
[e] *Department of Obstetrics and Gynecology, Taipei Medical University, Taipei, Taiwan*
[f] *Department of Obstetrics and Gynecology, National Yang-Ming University, Taipei, Taiwan*
[g] *Institute of Clinical Medicine, National Yang-Ming University, School of Medicine, Taipei, Taiwan*
[h] *Department of Obstetrics and Gynecology, Taipei Veterans General Hospital, Taipei, Taiwan*
[i] *Immunology Research Center, Taipei Veterans General Hospital, Taipei, Taiwan*

Accepted 12 July 2012

Abstract

Objective: The aim of this study was to evaluate the short-term therapeutic outcome of women with symptomatic uterine myomas treated with laparoscopic uterine vessel occlusion (LUVO) or laparoscopic myomectomy (LM).
Methods: Ninety-five patients with symptomatic, uncomplicated myomas warranting surgical treatment who expressed a strong desire to retain their uterus were included in this study. Fifty-two patients underwent LUVO and 43 underwent LM. The outcome was measured by comparing blood loss, surgical time, postoperative recovery, postoperative pain (visual analog scale), complications, and success rate in both groups.
Results: The general characteristics of the patients were similar in both groups. There were no statistical differences in febrile morbidity, complications, success rate, therapeutic efficacy (symptom relief), and satisfaction rate between the two groups. LUVO had advantages over LM, including less surgical time, minimal blood loss, lower visual analog scale score, and rapid postoperative recovery.
Conclusions: Both LUVO and LM might be effective in the management of symptomatic myomas in selected cases, but LUVO seemed to be more acceptable and less invasive in this 1-year short-term follow-up.

Keywords: laparoscopic myomectomy; laparoscopic uterine vessel occlusion; myoma

Introduction

Approximately 20–40% of women of reproductive age are known to have uterine myomas [1], suggesting that uterine myomas are remarkably common [2]. Most of these myomas are asymptomatic [3], although some may cause symptoms that require a definite treatment [4]. There are many therapeutic strategies, but the management of women with symptomatic uterine myomas depends on the patient's age, the reasons for treatment, the issue of fertility preservation, and the patient's preference [5]. Although hysterectomy has long been considered a good choice if women have completed childbearing [6], there are many other therapeutic approaches available for preservation of the uterus [7–11], because psychologically, the uterus has been regarded as the regulator

* Corresponding author. Department of Obstetrics and Gynecology, National Yang-Ming University, School of Medicine and Taipei Veterans General Hospital, 201, Section 2, Shih-Pai Road, Taipei 112, Taiwan.
E-mail addresses: phwang@vghtpe.gov.tw, phwang@ym.edu.tw (P.-H. Wang).
[1] Both authors contributed equally to this work.

1028-4559/$ - see front matter
http://dx.doi.org/10.1016/j.tjog.2012.09.008

and controller of important physiologic functions, a sexual organ, a source of energy and vitality, and a maintainer of youth and attractiveness [12].

Laparoscopic surgery has seen significant improvement in its techniques and instruments and has been developed and used in the management of various kinds of benign diseases [13–16]. Although some concerns about the role of laparoscopic myomectomy (LM) as a treatment option for symptomatic uterine myomas are still present [17], it has become more acceptable. Many comparison studies have evaluated the safety and feasibility of abdominal myomectomy and LM [18–22]. These studies showed that LM is clearly associated with shorter hospitalization, faster recovery, less expense, less pain, less blood loss, less fever, and fewer surgical complications compared with abdominal myomectomy. Pregnancy rates and recurrence rates appear to be comparable between LM and abdominal myomectomy [22]. A recent study comparing LM and minilaparotomic (MLT) myomectomy also showed the significant benefits of LM compared with MLT myomectomy, if these treatments were applied in a highly selected population (women with uterine fibroids with a size less than 8 cm and the number less than 5) [21,22]. Therefore, the use of LM can be considered as one of the choices in the management of women with symptomatic uterine myomas.

Although the uterine-sparing treatment of choice for symptomatic uterine myomas has been myomectomy [23–26], uterine artery embolization (UAE) was introduced in 1995 as an alternative technique for treating fibroid tumors [27]. Since then it has become increasingly accepted as a minimally invasive, uterine-sparing procedure, and studies have reported relief of excessive menstrual bleeding or pressure in 80–90% of patients [28–32]. These studies have also shown a reduction in leiomyoma and uterus size 3–12 months after the procedure, as measured by ultrasonography or magnetic resonance imaging [30]. A similar concept, known as laparoscopic uterine vessel occlusion (LUVO) or laparoscopic uterine artery occlusion (LUAO), was first reported as a treatment for myomas in 1999 or earlier [33,34]. The difference between the LUAO and LUVO methods is that LUAO is uterine artery occlusion alone without simultaneous blockage of the uterine vessels and the anastomotic sites between the uterine vessels and the ovarian vessels, whereas LUVO is uterine artery occlusion with simultaneous blockage of the uterine vessels and the anastomotic sites between the uterine vessels and the ovarian vessels. Similar relief of symptoms and reduction of the uterus and leiomyoma size were reported in 2001 in a 7–12-month follow-up of 87 patients after LUVO [35]. Since that time, there has been rapid growth in the use of this treatment with various modifications, such as simultaneous myomectomy, and there has been considerable research into its outcome [36–42]. For example, two studies with follow-ups as long as 36 months after surgery have confirmed the results of LUVO [43,44].

The aim of this study was to assess the short-term outcome of LUVO and LM in the management of symptomatic uterine myomas.

Materials and methods

Patients

The population of this study was derived from the Myoma Registry in the Department of Obstetrics and Gynecology (initiated from 1995). Women booked for myoma treatment who had symptomatic uterine myomas were invited to participate in the current study. All the myoma treatment included uterine-sparing and uterine-sacrificed treatments. Uterine-sparing treatment included medical treatment, radiologic approach, and surgical procedures; for example, myomectomy, which was performed through traditional exploratory laparotomy, MLT, ultraminilaparotomy, laparoscopy, vagina, and hysteroscopy approaches; and blockage of the uterine vessels, such as LUVO, uterine vessel occlusion (UVO), LUAO, uterine artery occlusion (UAO); or any combination of the above-mentioned therapy. These women were informed that they could choose to be treated with any one of the previously mentioned procedures. All women were treated based on their willingness and preference. Patients fulfilled the following criteria of the Taiwan National Health Insurance Bureau (NHIB) to comply with the definition of uncomplicated myomas: symptomatic myoma; a wish to retain the uterus; absence of previous abdominal or pelvic surgery; a number of visible uterine masses (myomas) less than or equal to five intramural or subserous myomas (without peduncle); a maximum diameter of no more than 8 cm; and an absence of prominent or significant pelvic adhesion on clinical evaluation. The phrase "symptomatic" included either menstrual problems such as menorrhagia and pain, or compression syndrome, including a bulgelike sensation and frequency. To make this study even more uniform and consistent, the general characteristics of the patients in the two groups were evaluated continuously during the study period using a limited number of evaluated items, such as age, body mass index (BMI), and biochemical blood data. This study was designed to compare the short-term therapeutic outcome of women with uncomplicated uterine myomas treated with LUVO and LM. Therefore, the following criteria should be met: a single operator; uncomplicated myoma; complete 1-year follow-up; LUVO alone or LM alone; and adequate sample size. There were 95 patients who were analyzed, including 52 women (54.7%) undergoing LUVO (LUVO group) and the remaining 43 (45.3%) undergoing LM (LM group).

Surgical procedures

Both procedures were performed under general anesthesia with the patient in the dorsolithotomy position and the bladder catheterized.

The detailed procedure for the LUVO group has been described previously [34–36]. In brief, after establishing a laparoscopic surgical field, the anterior leaf of the broad ligament was opened with scissors, keeping the peritoneum at proper tension by shifting the uterus to the opposite side. A vertical 2- to 3-cm incision was made on the triangle enclosed by

the round ligament, external iliac artery, and infundibulopelvic ligament with careful dissection of the ureter and the internal iliac artery, and adequate bleeding avoidance. The bilateral uterine artery was then thoroughly occluded. The anatomic sites between the uterine vessels and the ovarian vessels were also occluded.

The detailed procedure used in the LM group has been reported previously [26], with some modification. Myomas were extracted through the 12-mm suprapubic port by morcellation with the help of an electromechanical morcellator (Ethicon, San Angelo, TX, USA). The myometrial edges were closed in one or two layers, according to the depth of the uterine wound by means of polyglactin 0 sutures.

Evaluation parameters

The parameters we considered for comparing the two groups were: surgical time (minutes); blood loss; interval between completing surgery and tolerance of food intake; maximal fever; and complications such as blood transfusion, wound infection, or hematoma. A visual analog scale (VAS) applicable to the wound of each group was used to evaluate postoperative pain for 24 hours after surgery. The VAS consisted of a nongraduated 10-cm line ranging from "no pain" to "pain as bad as it could be".

Leiomyoma-related symptoms, for example menstrual problems such as menorrhagia and pain, or compression syndrome, including a bulgelike sensation and frequency, were assessed using a yes/no improvement questionnaire at 3 months and 12 months after surgery. Recurrence was defined as any presence of "no" in a yes/no improvement questionnaire at 3 months and 12 months after surgery. A yes/no questionnaire was used at the discharge date and at the 3-month and 12-month follow-ups to evaluate satisfaction.

Statistical analysis

A sample size of 44 in each group will have 80% power to detect the differences in means of the selected outcome variables using a two-group Student t test with a 0.05 two-sided significance level.

SPSS Software Version 15.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Descriptive statistics were presented as means ± standard deviation or percentages. Means were compared by unpaired Student t test, and proportions were compared by Chi-square or Fisher exact tests, as appropriate. All calculated p values were two-tailed, and a p value less than 0.05 was considered statistically significant.

Results

Mean age, BMI, symptoms resulting from myoma, preoperative hemoglobin level, number of myomas, and maximal myoma diameter were similar in the two groups (Table 1). Significantly, surgical time in the LUVO group was shorter than in the LM group (36.9 ± 4.9 minutes vs. 86.7 ± 17.0 minutes); in addition, the amount of blood loss during the procedure in the LUVO group was also less than that in the LM group (24.7 ± 5.8 mL vs. 143.7 ± 81.7 mL). Postoperative recovery was significantly better in the LUVO group compared with the LM group because the mean of the maximal postoperative temperature of the LUVO group was significantly lower than that of the LM group, the VAS score in the LUVO group was significantly lower than that in the LM group, and food intake occurred sooner after surgery in the LUVO group compared with the LM group.

Table 1
Baseline characteristics of the enrolled women.

	LUVO (n = 52)	LM (n = 43)	p
Age (y)	41.8 ± 3.5	42.3 ± 3.3	0.408
Body mass index (kg/m^2)	22.5 ± 1.3	22.4 ± 1.5	0.998
Preoperative HgB (g/dL)	9.4 ± 1.8	9.7 ± 1.7	0.391
Symptom			
Pain	19.2% (n = 10)	16.3% (n = 7)	0.781
Menorrhagia	69.2% (n = 36)	69.8% (n = 30)	0.936
Bulge sensation	46.2% (n = 24)	39.5% (n = 17)	0.375
Frequency	40.4% (n = 21)	34.9% (n = 15)	0.415
Myoma			
Number (n)	2.0 ± 0.7	1.5 ± 0.6	0.062
Max diameter (cm)	5.9 ± 0.8	5.8 ± 0.8	0.081

HgB = hemoglobin level; LM = laparoscopic myomectomy; LUVO = laparoscopic uterine vessel occlusion.

The complication rate seemed to be higher in the LM group, although it did not reach statistical significance (Table 2). Five patients in the LM group were considered as having complications and some of them had complications comprising one or more events, two with abdominal conversion due to technique difficulty, three with blood transfusion because of a more than 500-mL blood loss during surgery, two with ileus, and one with spiking fever (≥39.0°C). There was only one patient in the LUVO group classified as having a complication. This patient had widespread subcutaneous ecchymosis extending from the right flank to the right thigh.

Most patients in both groups had symptom relief and elevated hemoglobin levels (ranging from 85.7% to 94.4% in the LUVO group and 83.3% to 95.3% in the LM group, based on different kinds of symptoms) at the first follow-up, which was evaluated at the end of 3 months after surgery (Table 3). These symptom-improvement effects continued in the 1-year follow-up in both groups. The cumulative recurrence rate in the LUVO group was 9.6% and 15.4% at the end of 3 months and 12 months after surgery, respectively, compared with 11.6% and 18.6% at the end of 3 months and 12 months after surgery, respectively, in the LM group. Neither was statistically significant.

Most patients in both groups still had symptom relief and had maintained the hemoglobin level (ranging from 80.0% to 90.4% in the LUVO group and 76.7% to 93.0% in the LM group) at the end of 12 months after surgery (Table 3). Patients in both groups showed a high immediate satisfaction rate (100% in the LUVO group vs. 97.7% in the LM group), and this satisfaction continued to the 3-month follow-up and the 1-year follow-up, as seen in Table 3, without statistical difference.

Table 2
Surgical and postoperative parameters following LUVO and LM.

	LUVO ($n = 52$)	LM ($n = 43$)	p
Surgical time (min) (95% CI)	36.9 ± 4.9 (35.0–38.7)	86.7 ± 17.0 (79.2–94.2)	0.0001
Blood loss (mL) (95% CI)	24.7 ± 5.8 (22.9–26.5)	143.7 ± 81.7 (102.8–184.7)	0.0001
Complications (95% CI)	1.9% ($n = 1$) (0–5.6)	11.6% ($n = 5$) (2.0–21.2)	0.069
Max fever (°C) (95% CI)	37.4 ± 0.2 (37.3–37.4)	37.7 ± 0.5 (37.5–37.9)	0.0001
VAS (95% CI)	3.1 ± 0.5 (2.9–3.2)	3.6 ± 0.3 (3.5–3.7)	0.0001
Tolerance to food intake (h) (95% CI)	4.7 ± 3.1 (3.7–5.6)	16.6 ± 7.3 (13.9–19.2)	0.0001
Satisfaction rate (95% CI)	100% (52/52)	97.7% (42/43) (93.2–100)	0.323

CI = confidence interval; complications = detailed information in the text; LM = laparoscopic myomectomy; LUVO = laparoscopic uterine vessel occlusion; VAS = visual analog scale.

Discussion

In gynecologic and reproductive surgeries, patients have been treated with different strategies and instruments depending on what is currently in vogue [45–47]. There is a growing consensus that patients undergoing surgery for benign gynecologic diseases would benefit from a minimally invasive approach [48]. The surgical accuracy and early postoperative advantages of laparoscopy have been documented recently in the treatment of benign and malignant gynecologic diseases [49,50]. In treating symptomatic uterine myoma, both LUVO [6,9,10,30,31,33–42] and LM [17–23,51] have been reported to provide satisfactory results.

We further confirmed in this study the concept that currently available instruments make LM feasible, although the wide application of this approach is limited by the size and number of myomas reasonably removed and the technical difficulty of the procedure and the laparoscopic suturing [17,32,50]. The criteria for our study population were limited to the definition of uncomplicated uterine myomas. However, the technical difficulties might have been overestimated with careful selection of a given population, such as those fulfilling the previously mentioned criteria. In this study, almost all LM operations were performed without difficulty. LM surgical time ranged from 56 minutes to 164 minutes, with a mean of 87 minutes. These data were neither superior nor inferior to that of reports from all available studies, because almost all spent more than 1 hour, ranging from 62 minutes to 223 minutes, to complete the surgery, except for one study reporting a range of 30–140 minutes [52]. Furthermore, compared with abdominal myomectomy either through conventional exploratory laparotomy (mean = 99 minutes) or ultraminilaparotomy (mean = 98 minutes) [10], LM was not inferior. With regard to the surgical time, it was not surprising that LUVO was significantly superior to LM because the mean surgical time in the LUVO group was only 37 minutes, which was less than half of the mean time spent in the LM group (87 minutes).

Table 3
Three-month and 12-month postoperative follow-up of the two groups of women.

	F-U (months)	LUVO ($n = 52$)	LM ($n = 43$)	p
Hemoglobin level	3	12.0 ± 0.5	11.8 ± 0.7	0.191
	12	11.7 ± 0.7	11.5 ± 0.9	0.951
Relief of symptoms (yes)				
Pain	3	90.0% (9/10)	85.7% (6/7)	1.00
	12	80.0% (8/10)	85.7% (6/7)	1.00
Menorrhagia	3	94.4% (34/36)	83.3% (28/30)	1.00
	12	88.9% (32/36)	76.7% (23/30)	0.729
Bulge sensation	3	91.7% (22/24)	94.1% (16/17)	1.00
	12	83.3% (20/24)	88.2% (15/17)	0.691
Frequency	3	85.7% (18/21)	93.3% (14/15)	0.627
	12	85.7% (18/21)	80.0% (12/15)	1.00
Recurrence rate	3	9.6% (5/52)	11.6% (5/43)	0.750
	12	15.4% (8/52)	18.6% (8/43)	0.676
Satisfaction rate	3	94.2% (45/52)	95.3% (41/43)	1.00
	12	90.4% (47/52)	93.0% (40/43)	1.00

F-U = follow-up; LM = laparoscopic myomectomy; LUVO = laparoscopic uterine vessel occlusion.

In terms of the postoperative recovery in both groups, LUVO also provided significant advantages, including less postoperative pain (lower VAS score), fewer patients suffering from postoperative fever with resultant lower mean temperatures postoperatively, and a shorter interval from surgery to tolerance to food intake.

LUVO had significant advantages, not only in shorter surgical time and less blood loss, but also in better postoperative recovery with lower VAS score, less fever, and a shorter interval to food intake after surgery. In terms of 1-year durable symptom control, they were evaluated at 3 months and 12 months after surgery, respectively.

All myoma-related symptoms in the LM group, either menstrual problems such as menorrhagia and pain, or compression syndrome, including a bulgelike sensation and frequency, showed significant improvement, although they varied from 83.3% to 94.1%, at the end of 3 months after surgery. The hemoglobin level increased from 9.7 g/dL to 11.8 g/dL. The efficacy of symptom relief was maintained for 1 year, with 76.7% to 88.2% of patients showing a symptom relief status. In addition, the hemoglobin level was still maintained at 11.5 g/dL.

The amount of estimated blood loss during LM in this study was 144 mL; this seemed to be a little more than in our previous study [23], which enrolled patients with the same criteria. The blood loss in the LUVO group was minimal. Furthermore, considering the complication rate in both groups, LUVO was also superior to LM, although this difference did not reach statistical significance. Based on the previously discussed findings, LUVO was a more feasible procedure in the management of uncomplicated uterine myoma, compared with LM.

All of these factors contributed to the high satisfaction rate in the LM group. A similar efficacy was shown in the LUVO group, because symptom relief was reported as 85.7% to 94.4% at the end of 3 months after surgery, and 80.0% to 88.9% at the end of 12 months after surgery. This also contributed to the more than 90% satisfaction rate up to the 1-year follow-up.

Although LUVO seems to have its advantages in this 1-year study, there are many unanswered questions regarding LUVO and LM. For example, the long-term outcome and future reproductive outcome are unknown, and this study was not a randomized study, which resulted in some selection bias. In addition, we could not compare the myoma changes after each treatment because, although the evaluable items in the LUVO group were the complete disappearance of the myomas, the decreased number of myomas (tumor shrinkage to invisible status), and decreased size of the myomas, the myomas in the LM group were theoretically removed during surgery; thus, the reappearance of myomas in the LM group during follow-up meant recurrence.

A publication evaluating the midterm clinical and first reproductive results of the comparison between UAE and myomectomy hinted that although UAE is less invasive and as symptomatically effective and safe as myomectomy, myomectomy appears to have superior reproductive outcomes in the first 2 years after treatment [53]. Therefore, some studies suggested that myomectomy should be recommended as the treatment of choice over UAE in most patients desiring future fertility [54], even though most pregnancies following UAE have good outcomes [55]. In comparing reproductive outcomes between UAE and LUAO in women with symptomatic uterine myomas, a recent study showed that the pregnancies of women who were treated with uterine embolization were at significantly increased risk for spontaneous abortion when compared with the pregnancies of women treated with LUAO [56]. In our previous studies, we also demonstrated that immediate follicle-stimulating hormone changes were not significant after LUAO procedure, but women treated with LUVO were associated with a greater risk of a significant increase in follicle-stimulating hormone level at the first month after operation, which may be a reflection of diminished ovarian function, although the therapeutic effects seemed to be better in those patients who underwent LUVO [57,58].

In conclusion, this study showed the acceptability of both LUVO and LM in the management of symptomatic women with uncomplicated uterine myomas for the purpose of short-term symptom control. The effectiveness of both procedures is similar, but the LUVO group experienced less surgical and postoperative suffering, so LUVO seemed to be a better choice in this short-term 1-year follow-up. Based on these short-term advantages of LUVO, the strategy to use this procedure in the management of a certain group of patients might be worthy of further study.

Acknowledgments

The authors (Dr Wang and Dr Chang) contributed equally to this article. This work was supported in part by grants from Veterans General Hospitals University System of Taiwan Joint Research Program (VGHUST99-G4), Taipei Veterans General Hospital (V99C1-085, V100C-054, V101C1-128, V101E4-004, and V101E5-006), and the National Science Council (NSC 99-2314-B-010-009-MY3), Taiwan.

References

[1] The Practice Committee of the American Society for Reproductive Medicine. Myomas and reproductive function. Fertil Steril 2008;90: S125–30.
[2] Behera MA, Leong M, Johnson L, Brown H. Eligibility and accessibility of magnetic resonance-guided focused ultrasound (MRgFUS) for the treatment of uterine leiomyomas. Fertil Steril 2010;94:1864–8.
[3] Cheng MH, Wang PH. Uterine myoma: a condition amendable to medical therapy? Expert Opinion Emerging Drugs 2008;13:119–33.
[4] Su WH, Lee WL, Cheng MH, Yen MS, Chao KC, Wang PH. Typical and atypical clinical presentation of uterine myomas. J Chin Med Assoc 2012;75:487–93.
[5] Wang PH, Liu WM, Fuh JL, Chao HT, Yuan CC, Chao KC. Symptomatic myoma treated with laparoscopic uterine vessel occlusion and subsequent immediate myomectomy- which is the optimal surgical approach? Fertil Steril 2009;92:762–9.
[6] Wu KY, Lertvikool S, Huang KG, Su H, Yen CF, Lee CL. Laparoscopic hysterectomies for large uteri. Taiwan J Obstet Gynecol 2011;50:411–4.
[7] Yoshiki N, Okawa T, Kubota T. Single-incision laparoscopic myomectomy with intracorporeal suturing. Fertil Steril 2011;95:2426–8.
[8] Bouwsma EV, Hesley GK, Woodrum DA, Weaver AL, Leppert PC, Peterson LG, et al. Comparing focused ultrasound and uterine artery embolization for uterine fibroids–rationale and design of the Fibroid Interventions: Reducing Symptoms Today and Tomorrow (FIRSTT) trial. Fertil Steril 2011;96:704–10.
[9] Kuzel D, Mara M, Horak P, Kubinova K, Maskova J, Dundr P, et al. Comparative outcomes of hysteroscopic examinations performed after uterine artery embolization or laparoscopic uterine artery occlusion to treat leiomyomas. Fertil Steril 2011;95:2143–5.
[10] Liu L, Li Y, Xu H, Chen Y, Shang G, Liang Z. Laparoscopic transient uterine artery occlusion and myomectomy for symptomatic uterine myoma. Fertil Steril 2011;95:254–8.
[11] Huang BS, Seow KM, Tsui KH, Huang CY, Lu YF, Wang PH. Fertility outcome of infertile women with adenomyosis treated with the combination of a conservative microsurgical technique and GnRH-agonist: long-term follow-up in a series of 9 patients. Taiwan J Obstet Gynecol 2012;51:212–6.
[12] Tsui KH, Lin LT, Yu KJ, Chen SF, Chang WH, Yu S, et al. Double-balloon cervical ripening catheter works well as an intrauterine balloon tamponade is post-abortion massive hemorrhage. Taiwan J Obstet Gynecol 2012;51:426–9.
[13] Sun HD, Huang BS, Chao HT, Ng HT, Wang PH. Tuberculosis peritonitis. Taiwan J Obstet Gynecol 2012;51:1–2.
[14] Chen SY, Huang SC, Sheu BC, Chang DY, Chou LY, Hsu WC, et al. Simultaneous enucleation and in situ morcellation of myoma in laparoscopic myomectomy. Taiwan J Obstet Gynecol 2010;49:279–84.
[15] Song T, Kim TJ, Kang HJ, Choi CH, Lee JW, Bae DS, et al. Single-port access laparoscopic surgery using a novel laparoscopic port (Octo-Port). Taiwan J Obstet Gynecol 2011;50:436–40.
[16] Chen ML, Lee KC, Yang CT, Hung KH, Wu MH. Simultaneous laparoscopy for endometriotic women undergoing in vitro fertilization. Taiwan J Obstet Gynecol 2012;51:66–70.
[17] Yen MS, Chao KC, Wang PH. Laparoscopic myomectomy. Taiwan J Obstet Gynecol 2010;49:392–3.
[18] Mais V, Ajossa S, Guerriero S, Mascia M, Solla E, Melis GB. Laparoscopic versus abdominal myomectomy: a prospective, randomized trial to evaluate benefits in early outcome. Am J Obstet Gynecol 1996;175:654–8.
[19] Seracchioli R, Rossi S, Govoni F, Rossi E, Venturoli S, Bulletti C, et al. Fertility and obstetric outcome after laparoscopic myomectomy of large

myomata: a randomized comparison with abdominal myomectomy. Hum Rep 2000;15:2663−8.
[20] Rossetti A, Sizzi O, Soranna L, Cucinelli F, Mancuso S, Lanzone A. Long-term results of laparoscopic myomectomy: recurrence rate in comparison with abdominal myomectomy. Hum Reprod 2001;16:770−4.
[21] Palomba S, Zupi E, Russo T, Falbo A, Marconi D, Dolino A, et al. A multicenter randomized, controlled study comparing laparoscopic versus minilaparotomic myomectomy: short-term outcomes. Fertil Steril 2007; 88:942−51.
[22] Palomba S, Zupi E, Falbo A, Russo T, Marconi D, Tolino A, et al. A multicenter randomized, controlled study comparing laparoscopic versus minilaparotomic myomectomy: reproductive outcomes. Fertil Steril 2007;88:933−41.
[23] Wen KC, Chen YJ, Sung BL, Wang PH. Comparing uterine fibroids treated by myomectomy through traditional laparotomy (LT) and two modified approaches: ultraminilaparotomy (UMLT) and laparoscopically-assisted ultraminilaparotomy (LA-UMLT). Am J Obstet Gynecol 2010;202:144.e1−8.
[24] Li KC, Yen MS, Wang PH. Parasitic leiomyosarcoma after myomectomy. Taiwan J Obstet Gynecol 2010;49:218−9.
[25] Wang PH, Liu WM, Fuh JL, Chao HT, Yuan CC, Chao KC. Comparison of ultramini-laparotomy for myomectomy through midline vertical incision or modified Pfannenstiel incision−A prospective short-term follow-up. Fertil Steril 2009;91:1945−50.
[26] Wen KC, Sung PL, Chao KC, Lee WL, Liu WM, Wang PH. A prospective short-term evaluation of uterine leiomyomas treated by myomectomy through conventional laparotomy or ultramini-laparotomy. Fertil Steril 2008;90:2361−6.
[27] Ravina JH, Herbreteau D, Ciraru-Vigneron N, Bouret JM, Houdart E, Aymard A, et al. Arterial embolisation to treat uterine myomata. Lancet 1995;346:671−2.
[28] Pron G, Bennett J, Common A, Wall J, Asch M, Sniderman K, et al. The Ontario Uterine Fibroid Embolization Trial. Part 2. Uterine fibroid reduction and symptom relief after uterine artery embolization for fibroids. Fertil Steril 2003;79:120−7.
[29] Huang JY, Kafy S, Dugas A, Valenti D, Tulandi T. Failure of uterine fibroid embolization. Fertil Steril 2006;85:30−5.
[30] Hald K, Kløw NE, Qvigstad E, Istre O. Laparoscopic occlusion compared with embolization of uterine vessels: a randomized controlled trial. Obstet Gynecol 2007;109:20−7.
[31] Edwards RD, Moss JG, Lumsden MA, Wu O, Murray LS, Twaddle S, et al. Uterine-artery embolization versus surgery for symptomatic uterine fibroids. N Engl J Med 2007;356:360−70.
[32] Horng HC, Wen KC, Su WH, Chen CS, Wang PH. Review of myomectomy. Taiwan J Obstet Gynecol 2012;51:7−11.
[33] Lee PI, Chang YK, Yoon JB. Preliminary experience with uterine artery ligation for symptomatic uterine leiomyomas. J Am Assoc Gynecol Laparosc 1999;6:S27−8.
[34] Liu WM. Laparoscopic bipolar coagulation of uterine vessels to treat symptomatic leiomyomas. J Am Assoc Gynecol Laparosc 2000;7:125−9.
[35] Liu WM, Ng HT, Wu YC, Yen YK, Yuan CC. Laparoscopic bipolar coagulation of uterine vessels: a new method for treating symptomatic fibroids. Fertil Steril 2001;75:417−22.
[36] Liu WM, Tzeng CR, Yi-Jen C, Wang PH. Combining the uterine depletion procedure and myomectomy may be useful for treating symptomatic fibroids. Fertil Steril 2004;82:205−10.
[37] Hald K, Langebrekke A, Klow NE, Noreng HJ, Berge AB, Istre O. Laparoscopic occlusion of uterine vessels for the treatment of symptomatic fibroids: initial experience and comparison to uterine artery embolization. Am J Obstet Gynecol 2004;190:37−43.
[38] Simsek M, Sadik S, Taskin O, Guler H, Onoglu A, Akar M, et al. Role of laparoscopic uterine artery coagulation in management of symptomatic myomas: A prospective study using ultrasound and magnetic resonance imaging. J Minim Invasive Gynecol 2006;13:315−9.
[39] Liu WM, Wang PH, Tang WL, Wang IT, Tzeng CR. Uterine artery ligation for treatment of pregnant women with uterine leiomyomas who are undergoing Cesarean section. Fertil Steril 2006;86:423−8.
[40] Liang Z, Xu H, Chen Y, Li Y, Zhang Q. Laparoscopic blockage of uterine artery and myomectomy: a new method of treating symptomatic uterine leiomyomas. Surg Endosc 2006;20:983−6.
[41] Liu WM, Wang PH, Chou CS, Tang WL, Wang IT, Tzeng CR. Efficacy of combined laparoscopic uterine artery occlusion and myomectomy via minilaparotomy in the treatment of recurrent uterine myomas. Fertil Steril 2007;87:356−61.
[42] Bae JH, Chong GO, Siong WJ, Hong DG, Lee YS. Benefit of uterine artery ligation in laparoscopic myomectomy. Fertil Steril 2011;95:775−8.
[43] Park KH, Kim JY, Shin JS, Kwon JY, Koo JS, Jeong KA, et al. Treatment outcomes of uterine artery embolization and laparoscopic uterine artery ligation for uterine myoma. Yonsei Med J 2003;44:694−702.
[44] Holub Z, Jabor A, Lukac J, Kliment L, Urbanek S. Midterm follow-up study of laparoscopic dissection of uterine vessels for surgical treatment of symptomatic fibroids. Surg Endosc 2004;18:1349−53.
[45] Tsai HW, Chen YJ, Ho CM, Hseu SS, Chao KC, Tsai SK, et al. Maneuvers to decrease laparoscopy-induced shoulder and upper abdominal pain: a randomized controlled study. Arch Surg 2011;146:1360−6.
[46] Yen MS, Ng HT, Wang PH. A delicate surgical method for cancer treatment is welcome. Taiwan J Obstet Gynecol 2012;51:329−30.
[47] Fang FY, Huang BS, Chao HT, Wang PH. Ruptured ovarian endometrioma. Taiwan J Obstet Gynecol 2012;51:145.
[48] Lee KC, Huang CY, Wang PH. Parasitic peritoneal leiomyomatosis mimicking intra-abdominal abscess with hematoma. Taiwan J Obstet Gynecol 2012;51:115−6.
[49] Horng HC, Wang PH. Ovarian cancer presenting as an acute abdomen was successfully diagnosed and managed by laparoscopy. Taiwan J Obstet Gynecol 2012;51:146−7.
[50] Tan SJ, Lin CK, Fu PT, Liu YL, Sun CC, Chang CC, et al. Robotic surgery in complicated gynecologic diseases: Experience of Tri-Service General Hospital in Taiwan. Taiwan J Obstet Gynecol 2012; 51:18−25.
[51] Wen KC, Sung PL, Lee WL, Li YT, Su WH, Wang PH. Myomectomy for uterine myomas through ultramini-laparotomy. J Obstet Gynaecol Res 2011;37:383−92.
[52] Viswanathan M, Hartmann K, McKoy N, Stuart G, Rankins N, Thieda P, et al. Management of uterine fibroids: an update of the evidence. Evidence Report/Technology Assessment No. 154. Prepared by RTI International−University of North Carolina Evidence-based Practice Center under Contract No. 290-02-0016. AHRQ Publication No. 07-E011. Rockville, MD: Agency for Healthcare Research and Quality. July 2007.
[53] Mara M, Maskova J, Fucikova Z, Kuzel D, Belsan T, Sosna O. Midterm clinical and first reproductive results of a randomized controlled trial comparing uterine fibroid embolization and myomectomy. Cardiovasc Intervent Radiol 2008;31:73−85.
[54] ACOG Uterine artery embolization. Committee Opinion No. 293. Obstet Gynecol 2004;103:403−4.
[55] Goldberg J, Pereira L. Pregnancy outcomes following treatment for fibroids: uterine fibroid embolization versus laparoscopic myomectomy. Curr Opin Obstet Gynecol 2006;18:402−6.
[56] Holub Z, Mara M, Kuzel D, Jabor A, Maskova J, Eim J. Pregnancy outcomes after uterine artery occlusion: prospective multicentric study. Fertil Steril 2008;90:1886−91.
[57] Lee WL, Liu WM, Fuh JL, Tsai YC, Shih CC, Wang PH. Basal FSH level changes after different types of uterine vessel occlusion in the management of uterine fibroids. Fertil Steril 2010;94:2286−90.
[58] Lee WL, Liu WM, Fuh JL, Tsai YC, Shih CC, Wang PH. Use of uterine vessel occlusion in the management of uterine myomas: two different approaches. Fertil Steril 2010;94:1875−81.