

Review Article

Review of myomectomy

Huann-Cheng Horng^{a,b}, Kuo-Chang Wen^{a,b}, Wen-Hsiang Su^{c,d}, Chien-Sheng Chen^{d,**},
Peng-Hui Wang^{a,b,*}

^aDepartment of Obstetrics and Gynecology, Taipei Veterans General Hospital, Taipei, Taiwan

^bDepartment of Obstetrics and Gynecology, National Yang-Ming University School of Medicine, Taipei, Taiwan

^cDepartment of Laboratory Medicine, Yee-Zen Hospital, Tao-Yuan, Taiwan

^dInstitute of Systems Biology and Bioinformatics, and Institute of Statistics, National Central University, Tao-Yuan, Taiwan

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Abstract

Uterine fibroids (also called leiomyomas or myomas) are the most common disorder among women of reproductive age, with an incidence of between 20% and 80%; they are often detected incidentally in routine healthy examinations, through bimanual pelvic and/or ultrasound examination, because uterine fibroids are rarely associated with symptoms. Sometimes, uterine fibroids may be complicated by a variety of symptoms, including menstrual disturbance (e.g., menorrhagia, dysmenorrhea, intermenstrual bleeding), pressure symptoms, bloated sensation, increased urinary frequency, bowel disturbance, or pelvic pain; therefore definite treatment is requested. Hysterectomy may be the first choice for women who have completed their child-birth; however, many women may prefer to keep the uterus if the uterine fibroids-related symptoms can be appropriately controlled. Among these conservative therapies, myomectomy may be one of the most popular methods for the woman who would like to preserve her future fertility, as the majority of symptoms can be relieved by myomectomy; this contributes to the value of this review. This review addresses the use of myomectomy in the management of symptomatic uterine fibroids.

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Keywords: fibroids; leiomyomas; myomas; myomectomy; uterus

Introduction

Uterine fibroids (also called leiomyomas or myomas) are the most common disorder among women of reproductive age; the incidence ranges from 20% to 80%, based on the different evaluation tools and definitions [1,2]. Uterine fibroids are often detected incidentally in routine healthy examinations, even by bimanual pelvic and/or ultrasound examinations. The majority of uterine fibroids are symptomless [3], although

sometimes, they may cause problems. Fibroid-related symptoms include menstrual disturbances (e.g., menorrhagia, dysmenorrhea, intermenstrual bleeding), pressure symptoms (e.g., bloated sensation, increased urinary frequency, bowel disturbance), and pelvic pain [4,5]. More rarely, uterine fibroids may influence the reproductive functions, especially the submucous location, with resultant subfertility, and pregnancy-associated complications, such as early pregnancy loss, myoma degeneration and pain, preterm labor or fetal malpresentation [6]. If these symptoms occur, definite treatment is sometimes required [7].

One of the most important definite treatments is hysterectomy, which is considered when women have finished bearing children [8]. Hysterectomy may be the second most common reason for exploratory laparotomy in women during the reproductive age [9]. However, psychologically, the uterus has been regarded as the regulator and controller of important

* Corresponding author. Department of Obstetrics and Gynecology, Taipei Veterans General Hospital, and National Yang-Ming University School of Medicine, Taipei, Taiwan.

** Corresponding author. Institute of Systems Biology and Bioinformatics, and Institute of Statistics, National Central University, Tao-Yuan, Taiwan.

E-mail addresses: jasonchen7@yahoo.com.tw (C.-S. Chen), phwang@vghtpe.gov.tw (P.-H. Wang).

physiological functions, a sexual organ, a source of energy and vitality, and a maintainer of youth and attractiveness [10], resulting in a modern trend whereby women may re-consider the possibility of organ-preservation [11]. For women who wish to retain their childbearing potential, an organ-preserving strategy, including expectant management [1], medical therapy [12,13], surgical intervention [14], uterine artery embolization [15], uterine artery ligation [16], uterine vessel occlusion or ablative techniques [17] etc. has been the preferred treatment [18]. However, malignant-type leiomyosarcomas should be kept in mind if conservative treatment is planned [19]. Therefore, a distinction between benign and malignant smooth muscle tumors should be attempted using, e.g., colored Doppler ultrasound, magnetic resonance imaging, positron emission tomography, or rapid growth of the tumor itself; unfortunately, none of these are sensitive or specific enough [20,21]. All contribute to the delayed diagnosis of the majority of leiomyosarcomas. In fact, they are frequently diagnosed after hysterectomy or myomectomy, at the time of the pathologic review [22]. Fortunately, the incidence of leiomyosarcoma is extremely rare [23]. In addition, the question of what should be done for women with symptomatic uterine fibroids who wish to preserve their uterus, is raised. In past years, the method of management of myomas has developed dramatically, and multidisciplinary approach is frequently used. Frequently, relatively less invasive procedures are designed to retain the uterus, with or without concern for future fertility [24]. Therefore, it is not easy to give an answer to this question, because each method has its own strengths and weaknesses [25,26]. In addition, some patients are treated with one of the therapies alone [6–17,23,25,26], while others are treated with combination therapy [9,18], which contains more than one of the methods [24].

The choice of fibroid treatment is dependent on the patient's age and preference, the reason for treatment, and the issue of fertility preservation [27], which results in individualization of selection of therapy. Although this may be reasonable, it may not be practicable, since the question "how should we treat women with symptomatic uterine fibroids who want uterine preservation?" is still unanswered. The following can make it easier to understand—if subsequent fertility is desired, myomectomy remains the standard of care for women with symptomatic fibroids seeking fertility preservation [28,29]. Therefore, the focus of this review is limited to discussing the use of myomectomy in the management of symptomatic uterine fibroids.

Conventional laparotomy for myomectomy (CLT-M)

As shown above, myomectomy may be one of the best choices in the management of young women who have a desire to retain their potential for future fertility. In the beginning of the 19th century, Bonney advocated myomectomy in the restoration and preservation of physiological function of the uterus and a higher surgical ideal than hysterectomy [30]; this was supported by many case-controlled studies. A retrospective study compared the

morbidity between total hysterectomy and myomectomy and concluded that myomectomy was associated with less risk of intraoperative visceral injuries and infection than total hysterectomy [31]. Another study showed significantly less estimated blood loss in the myomectomy group than in the total hysterectomy group, although there was a longer operative time in the myomectomy group [32]. These authors all concluded that myomectomy is a safe and alternative procedure to abdominal hysterectomy [31,32].

Large fibroids can be completely and successfully removed through conventional laparotomy for myomectomy (CLT-M), or even during cesarean section [33]. During CLT-M, an average skin incision of > 10 cm is made in the midline or Pfannenstiel direction [34,35]. The main advantage of CLT-M is adequate operative field exposure, which results in careful and thorough inspection and palpation of the whole uterus and fibroids and the entire myomectomy, not only for removal of fibroids but also for repair of the defect, can be easily performed. Favorable outcomes of CLT-M for the management of large uterine fibroids have been reported, and CLT-M can be used in the management of up to a 36 gestation-week size fibroid, with a weight of up to 2467 g, with acceptable operative times and estimated blood loss, and without conversion to hysterectomy [36].

Minilaparotomy for myomectomy (MLT-M)

Minilaparotomy (MLT) has recently been identified as another minimally invasive alternative to CLT. Similar to CLT, the incision can be made either through the midline or in the Pfannenstiel direction, although the Pfannenstiel approach is more popular, mainly based on cosmetic reasons. During MLT-M, a small suprapubic skin incision, ranging from 4 to 9 cm is made [37].

In a study which evaluated 78 women with various kinds of benign gynecological diseases, MLT was successfully performed in the majority of patients (96%); LT was performed in only 3 cases (4%), due to more obesity, isthmic leiomyomas, and pelvic adhesion [37]. Cagnacci et al studied the outcome of myomectomy by CLT, MLT and laparoscopically assisted minilaparotomy (LA-MLT), and found that MLT-M was the best choice; it had a similar efficacy to that of the early outcome with LA-MLT-M, a greater efficacy than that following CLT, and a shorter operative time than CLT-M and LA-MLT-M [38].

In a randomized, controlled study involving 99 women, the duration of surgery, postoperative hospital stay, and costs were significantly lower in the MLT-M versus the CLT-M group [39]. Since the immediate postoperative recovery was acceptable in women who underwent MLT-M, the MLT-M was attempted in an ambulatory setting [40,41].

Glasser studied 139 women undergoing MLT-M, and reported advantages such as improved uterine repair, ability to palpate the uterus, reduced operating time, same-day discharge, and rapid return to normal activity [40]. Thomas et al further confirmed that MLT-M is a safe, cost-effective treatment of most symptomatic uterine fibroids in an

ambulatory setting, as all patients were discharged successfully on the same day, following 3.5 hours of recovery time [41]. MLT-M fulfills the criteria of minimally invasive surgery, as it is more cost-effective and does not compromise the postoperative recovery of patients, compared with laparoscopic myomectomy (LM) [42].

Laparoscopic myomectomy (LM)

Although both CLT and MLT can be applied to nearly all women with uterine fibroids who need a myomectomy procedure, cosmetic consideration and postoperative recovery is always a concern, which results in the request of minimally invasive procedures [34,35,43]. Following the initial application of laparoscopic myomectomy (LM) in 1979 by Semm [44], this minimally invasive technique has become more and more popular worldwide. Conventionally, a three- to four-port wound technique is applied for LM. The main trocar (10 mm port) is inserted through the umbilicus to introduce the video system after pneumoperitoneum insufflation with carbon dioxide. Other two- or three-accessory trocars (5 mm port or 10 mm port) were inserted into the abdomen over the left lower quadrant, right lower quadrant, and suprapubic area, for the operative instruments and the suction irrigator machine [42].

Due to limited space during the laparoscopic procedures, especially for larger uterine fibroids, the trocar insertion sites sometimes need modification. For example, the Lee-Huang point or Palmer's point is used in the replacement of the traditional main trocar site [45,46]. With the Lee-Huang point, the main trocar site is moved to the midpoint between the xiphoid process and the umbilicus (middle upper abdomen). The accessory trocar can be made in the paramedian line parallel to the umbilicus [46]. With a subumbilical entry, a 1 cm vertical midline incision is made in the lower border of the umbilicus, whereas for Palmer's entry, a 1 cm horizontal incision was made in the left midclavicular line, approximately 3 cm caudal to the 10th rib [45].

Myomectomy is then performed after grasp with the second needle and injection with Pitressin into the myometrium around the fibroids, or after finishing laparoscopic uterine vessel occlusion [11,18,26,27,34,35,47]. Uterine fibroids are able to be separated from the surrounding uterine muscle or tissue by the electrocoagulation-unipolar electrode or bipolar electrode mode [48]. Removed uterine fibroids are extracted completely by both culdotomy (vaginal approach) [49] and electronic morcellator (Ethicon, San Angelo, TX, USA; abdominal approach) [50]. In conventional LM, morcellation is performed after complete enucleation of the myoma [51]; in modified LM, morcellation is performed while the myoma is still attached to the uterus, i.e., *in situ* morcellation (ISM) [52]. ISM has been confirmed as an efficient and safe procedure for the removal of large uterine fibroids during LM, because this technique might be more feasible compared with conventional morcellation, as it requires less operative time [51,52].

The myometrial edges were closed in one or two layers, according to the depth of the uterine wound, by means of polyglactin 0 sutures. If relatively inexperienced in laparoscopic

suturing, a modified suture technique, such as intracorporeal continuous suturing, can be used as an alternative method to finish LM successfully [53]. The use of intracorporeal suturing is a significant component of the learning curve for LM, and presents an even greater challenge with single incision LM [14]. In addition, some revised techniques or suture materials might be assisted by forceps insertion and continuous interlocking sutures using standard instruments [54].

LM has gained wide acceptance following advanced improvement in instruments; many randomized controlled trials have also proven the superiority of LM [55]. A recent meta-analysis of 6 randomized controlled trials enrolled 576 women in the comparison of LM and CLT-M [56]; it was concluded that LM has many advantages, such as less blood loss, less of a decrease in hemoglobin, faster recovery, diminished postoperative pain, shorter hospital stay, and better cosmetic effects, although LM seemed to require a longer operative time compared with CLT-M. LM is technically highly demanding and requires specialized surgical instruments, which is not popular for the majority of gynecologists [55].

Recently, robot-assisted laparoscopy, a new technology, has become popular in every aspect of surgery. Robotic-assisted LM was approved by the Food and Drug Administration in 2005, and has limited advantages over conventional laparoscopy according to the available evidence [57]. It has the benefit of better precision and dexterity, by eliminating the fulcrum effect experienced in conventional operative laparoscopy [58]. On the contrary, longer operative times, loss of tactile sensation necessary to detect intramural fibroids and high costs, are negative aspects of this technology [59,60].

Ultra-minilaparotomy for myomectomy (UMLT-M)

MLT-M is a safe, cost-effective treatment of most symptomatic uterine fibroids in an ambulatory setting; therefore, MLT-M can be considered as a minimally invasive surgery [27,34]. However, the incision wound of MLT-M is still larger than that of LM [61,62]. To be closer to the laparoscopic wound size and to further satisfy cosmetic requests, the incision wound of MLT is shortened. Since the average size of an incision wound in MLT was about 5 cm (ranging either from 4 to 9 cm or from 4 to 6 cm in length in different studies) [34,35,38,61], the ultra-minilaparotomy (UMLT) wound should not extend to 4 cm [34, 35]. The feasibility of UMLT for myomectomy (UMLT-M) has been recently tested. Similar to CLT or MLT, the incision of UMLT can be done either through the midline vertically, or using the modified Pfannenstiel approach, although the incision wound is much smaller when the UMLT-M is performed through the midline vertical direction [34,35,43]. However, the cosmetic effect might be better in the modified Pfannenstiel approach, as we could hide the whole incision wound of the modified Pfannenstiel approach below the pubic hair, and the transverse skin incision parallel to the natural "Langer line" of our body tends to heal with less scarring than the midline vertical approach [43].

A recent comprehensive review addressing the topic of the use of UMLT for myomectomy has been published [62]. There is more evidence supporting the advantages of UMLT-M, not

only in providing similarly effective symptom relief, but also in requiring only easy-to-perform techniques and less expensive instruments in treating symptomatic women with uterine fibroids, compared with CLT-M or LM.

The successful application of UMLT-M needs the following. The use of small Deaver retractors (width 2.5 cm) or thyroid retractors (width 1.5 cm) in place of the self-retaining retractor. The small end of the abdominal retractor (width 3 cm) is barely inserted into the wound of UMLT. The whole surgical procedure, including dissection, enucleation, and suturing, must be performed inside the abdomen through a small suprapubic wound. In our experience, the Backhaus towel clamp (Robbins Instruments Inc, Chatham, NJ, USA) was applied to grip the leiomyomas towards the incision wound for removal. Larger leiomyomas cannot be taken out with an intact shape and have to be pared, using a “piece by piece” procedure which is like peeling an apple. However, the size and total number of uterine leiomyomas, and the maximum diameter of the largest, is a crucial point for successful accomplishment of UMLT. The final incision wound of UMLT might be extended to >4 cm during surgery, if the total number of leiomyomas is more than five, or the maximum diameter is >8 cm [34,35,43,62]. The following criteria should be fulfilled in the selection of women with uterine fibroids, such as “uncomplicated fibroids”: (1) a number of visible uterine leiomyomas of five or less intramural or subserous masses; (2) a maximum diameter of ≤ 8 cm; (3) no dense peritoneal adhesion or an inflammatory process; this is a key factor for successful achievement of UMLT-M.

In conclusion, with advanced and improved technologies and anesthesia, myomectomy might replace hysterectomy as one of the most common procedures for women with symptomatic uterine fibroids, especially for those during the reproductive age. Although many important issues for myomectomy have been extensively described in this review article, many modified procedures, including the combination of preoperative gonadotropin-releasing hormone agonist, or the combination of other operative technologies, such as uterine vessel occlusion or uterine vessel ligation, combining laparoscopy and UMLT, and single-port laparoscopic myomectomy, have not been included in this article. In addition, some important issues, including the use of meta-analysis for different myomectomy procedures to compare the progress and/or the clinical impact among the procedures, and the decision making of the surgical methods (a flow chart: ultramini-laparotomy in the beginning, then expending the incisional length to mini-laparotomy due to some technical problems, and finally a conventional laparotomy) are not discussed in this article. Furthermore, topics on costs [63], quality of life, and future reproductive outcomes, were not included in this article. Finally, we should apologize for the omission of many valuable articles addressing the topic of myomectomy, due to limited space.

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