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Review Article

How to facilitate suturing in laparoscopic myomectomy

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Keyword:

Enhanced Recovery After Surgery. Preoperative Nutrition, Pre-operative fasting, Carbohydrate loading.

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background:

Uterine fibroids are the most common benign tumors of the uterus. Management depends on the symptoms, location and size of the fibroids, and the patient's desire to conceive. Surgical management of uterine fibroids has changed from laparotomy to minimally invasive surgery. Laparoscopic myomectomy is the best treatment option for symptomatic women with uterine fibroids who wish to maintain their fertility. Laparoscopic myomectomy consists of three steps: detachment of the fibroid from the uterus; uterine reconstruction and hemostasis; and removal of the fibroid from the abdominal cavity, Afterwards the step of laparoscopic suturing comes with a big challenge to the surgeon, hence we will demonstrate the main tips and tricks to facilitate it ***(Milad MP et al., 2001*) (Tulandi Tet al., 1996).**

In brief, the surgical technique starts with infiltrating the myometrium surrounding the fibroid with a dilute solution of vasopressin (20 units in 100 mL of saline) to decrease bleeding. An incision on the serosa and myometrium is then performed using a unipolar 'spoon', needle electrode or other energy sources. Once the cleavage plane is reached, the fibroid will protrude out, and complete enucleation can be achieved. Suturing is performed using polydioxanone suture material or polyglycan 910. The myometrium is repaired in single or multiple layers accordingly, this is done using 1-0 sutures, and the serosa using 3-0 sutures. The use of electromechanical morcellator is highly controversial and if used it must be in a bag, or better cold morcellation or colpotomy. At the completion of the procedure, irrigation and meticulous haemostasis are performed. ***(Mohamed Agdi et al., 2008)***

Despite being increasingly regarded as an alternative to open myomectomy, laparoscopic myomectomy should still be considered a complex procedure requiring specific operative skills and advanced surgical instrumentation**.** Therefore, many efforts were made to facilitate the different steps of laparoscopic myomectomy. In this review we will discuss the different methods to facilitate suturing in laparoscopic myomectomy.

Many methods are recommended to facilitate suturing in laparoscopic myomectomy including: alternative positioning of the trocars, direction of the uterine incision, use of endoscopic loops under progressive tension, modification of the classic technique of suturing, use of barbed sutures, laparoscopic assisted vaginal myomectomy, alexis wound retractor laparoscopic ultraminilaparotomy myomectomy and gasless (Isobaric) laparoscopic myomectomy.

Alternative positioning of the trocars

The insertion of the trocars is a crucial issue to accomplish the operation. In most instances, when small to midsize fibroids are concerned, the laparoscope can be placed in standard umbilical

position, using the closed- or open-entry technique of choice. However, depending on the size of the uterus, a supraumbilical insertion may be required for very large myomas in order to gain optimal view and room for surgical manipulation. It was suggested to place the laparoscope at the midpoint between the umbilicus and the xiphoid process (Lee-Huang point) if the uterine size is greater than 14 weeks' gestation; the Lee-Huang point could be useful not only to increase the working distance in case of large myomas, but also to prevent injuries in the umbilical area when adhesions are expected, notably in patients with previous abdominal or pelvic surgery.

Alternative placement of accessory trocars has been put forward with the use of one 10-mm trocar on the assistant's side, midway between the pubic symphysis and the umbilicus, and of two 5-mm trocars on the primary surgeon's side: one should be placed in a suprapubic position lateral to the insertion of the round ligament and one should be inserted lateral to the umbilical trocar and parallel to the suprapubic one. Alternatively, left and ipsilateral trocars may be used if this is more suitable to the primary surgeon. ***(Alberto Mattei et al., 2010)***

Direction of Uterine incision:

The direction of the uterine incision is a crucial issue in view of the following suture. Dubuisson et al. (2000a) recommend sagittal hysterotomies for posterior myomas and oblique hysterotomies for anterior myomas since the suture would be easier. They also suggest the use of low voltage, monopolar current to preserve the myometrium as far as possible. ***(Alberto Mattei et al., 2010)***

A transverse incision is put forward by Morita et al in 2004. They recommend it as it would be easier to suture. Also, they assume it will decrease blood loss , in contrary to the previous belief. in 1970 a detailed study was performed about the anatomy of intramyometrial arteries and veins;, clarifying the facts that transverse arcuate arteries exist in the myometrium, and in particular that

the right and left arcuate arteries join at the median line in a mutually anastomose formation. ***(MINETO MORITA et al., 2004)***

they also advise making an elliptical rather than a linear incision in order to remove excess myometrial tissue resulting from myomectomy. Transverse incisions could also be preferred when only two accessory lateral suprapubic trocars are placed.

Use of endoscopic loops under progressive tension:

Gambadarauro in 2010 described a novel technique for laparoscopic myomectomy of fibroids with a subserosal component which involves the use of endoscopic loops under progressive tension to avoid bleeding, facilitate enucleation and reduce the need of conventional sutures. Data analysis from a series of 34 consecutive operations shows that the use of endoloops helps achieving a good haemostasis, and no case of haemorrhage from the fibroid bed was ever recorded. Moreover, the need of diathermy was reduced, and the enucleation of the fibroids resulted facilitated by a bloodless field and the squeezing effect induced by the progressive tension on the loops. Although a reduction of number of traditional suturing was recorded, they do not recommend this technique to surgeons who are not familiar with conventional laparoscopic suturing. Overall, the suggested use of endoscopic loops seems to facilitate laparoscopic myomectomy on fibroids with at least a partial subserosal component.

Fibroids which are mainly subserosal or pedunculated with a large stalk are characterised by an acute angle between themselves and the uterine wall, that constitutes a comfortable groove where the loop is easily applied and tension applied. We then proceed with an incision on the serosa overlying the fibroid with a
monopolar electrode which goes as deep as the myomatous fibers are exposed. Right after the first incision, there is a possibility of bleeding, which is commoner when a thicker healthy tissue

overlies the fibroid, but a simple and progressive tension applied to the loop by pushing gently its knot is able to control haemorrhage.

On the contrary, fibroids which are mainly intramural might not offer the same acute angle with the healthy tissue. In these cases, we begin with an incision over the tumor. Once the fibroid is reached and exposed, it is grasped and pulled, so that it is tractioned towards the uterine surface and virtually converted into a subserosal one. Once this is achieved, the loop can be applied as previously described and the intervention continues by following a common pathway.

Fibroids are carefully and progressively enucleated by following the avascular cleavage plane between the pseudocapsule, which is constituted by compressed healthy tissue, and the tumour node. The endoloop is progressively tied, offering two important advantages: the first consists in mechanically reducing bleeding from perimyomatous vessels; the second is a better exposition of the cleavage plane thanks to the “squeezing” action exerted by the loop (Fig.1).

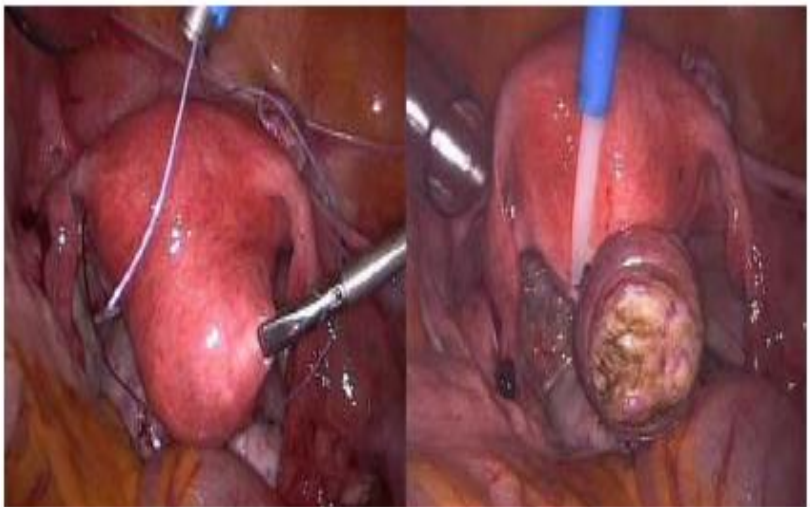


Figure (1): the endoloop is progressively tied during the fibroid enucleation, thus offering two important advantages, the first consists in mechanically reducing bleeding from perimyomatous vessels, the second is a better exposition of the cleavage plane thanks to the “squeezing” action exerted by the loop.

(Pietro Gambadauro et al., 2010)

Modification of the classic technique of suturing:

Yuen et al. in 2007 have described a modified laparoscopic suturing technique by controlling the tail of the suture with the surgeon’s hand while sewing laparoscopically. They suggested that this method can achieve a good approximation of uterine defect and is an acceptable alternative to help laparoscopic surgeons performing surgery assisted by an undertraining assistant to complete the procedure. In addition, if the technique is being used appropriately, this method can provide 1 more port site for the manipulation of an extra instrument so that the surgeon can accomplish the task more easily and smoothly. However, for the skillful laparoscopist, or when teaming up with an experienced assistant, this modified suturing technique would not help much in the repair of uterine defect because the technique would cause leakage of air and an extra-long suture line pulling in and out of the peritoneum.

The uterine surgical defect is closed in layers. A 0 monofilament poliglecaprone 25 sutures (Monocryl; Ethicon Inc., Somerville, NJ) on a large curved needle was used to make a deep and wide (1 cm from the cut edge of the incision) bite. Entering the uterus with a needle throughout the serosa to the myoma bed and emerging at the superficial level like a U shape, the needle was then grasped and reapplied in a reverse fashion. Intracorporeal knot tying was used at that time (Figure 2). The suture was pulled out of the pelvis from the suprapubic port site, leaving a

sufficient tail. The suture was grasped with a grasping forceps, and 2 loops were made around the needle-holder ***(Leung-To Yuenet al., 2007).***

Figure (2): String is pulled out of abdomen from suprapubic port site, and tension was kept by scrub nurse's hand.
(Leung-To Yuenet al., 2007)

The free end of suture was grasped with the needle-holder and brought inside the formed loops, and with grasping forceps and a needle-holder, the suture was tied over the tissue. Additional knots were applied over the suture, reversing the direction of the sutures with each successive knot. A continuous non-running-lock suture with 1-cm increments was then carried out, with each suture penetrating the full thickness of the myometrium. The string was then pulled out of the abdomen in every bite and grasped by the surgeon's or second assistant's hand to keep enough tension so that the approximation could be as tight as was done in the laparotomy manner.

Use of Barbed sutures:

In January 2007, bidirectional barbed suture was introduced in the United States (Quill Self-Retaining System; Angiotech Pharmaceuticals, Inc., Vancouver, British Columbia) after being approved by FDA in 2004. Although the suture material is relatively standard polydioxanone (PDO), nylon, and polypropylenedthe suture design is revolutionary. Rather than a traditional smooth monofilament or braided thread with a needle swedged on 1 end, this new suture consists of standard suture
material with tiny barbs cut into the length of the filament in a helical array set facing in opposite directions from the midpoint with a needle on each end (Figs. 1 and 2). This configuration allows tissue to be reapproximated without the need to tie a surgical knot.

After the evolution of this type of sutures, many types and modification appeared in the market. One of these sutures, the V-Loc (Covidien, Mansfield, MA) which is unidirectional consisting of a 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 end allow approximating the tissues without the need to tie surgical knots. There are three types of V-Loc sutures to fit for variable

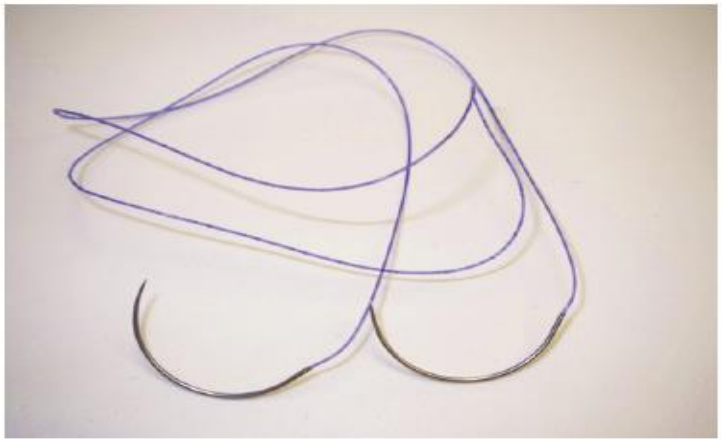


Figure (3): Bidirectional barbed suture

(James A. Greenberg et al., 2008)

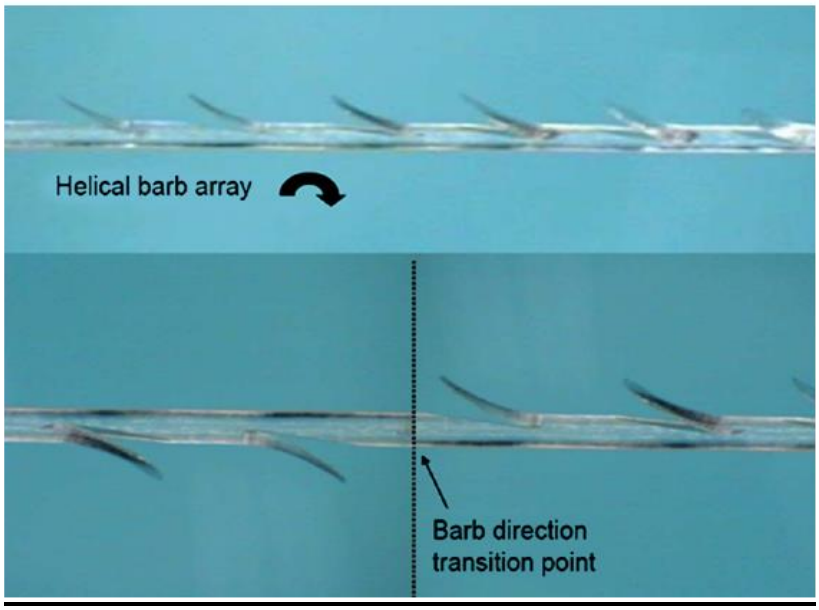
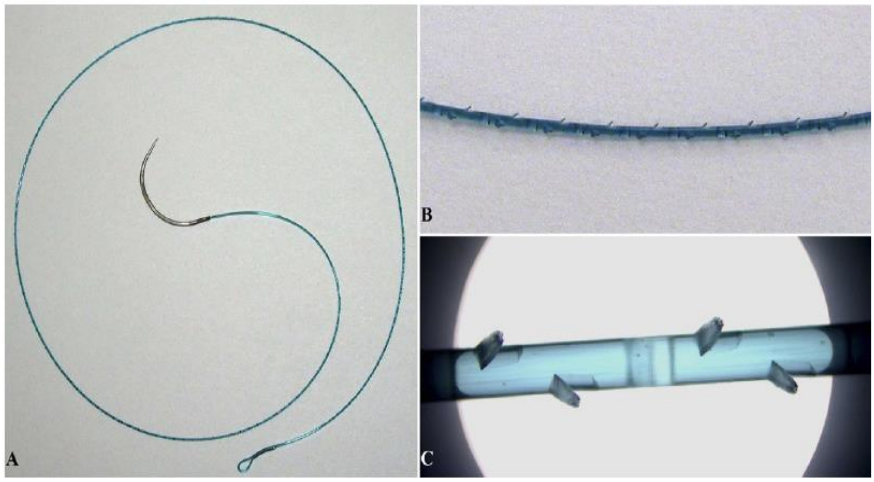


Figure (4): microscopic view of bidirectional barbed suture ***(James A. Greenberg et al., 2008)***



(Sang-Woong Lee et al., 2011)

figure (5): Thirty-centimeter 3-0 V-Loc 180 suture on a V-20 needle (26 mm tapered): (A) no barbs in the first 2 cm of the suture, allowing for readjustment of the throw without adverse effects, and a loop at the other end for passing the needle to secure the suture; (B) a close-up of unidirectional barbed suture; (C) micrograph of the laser-etched barbs

The first study describing the use of barbed sutures in laparoscopic myomectomy was published by James et al. in 2008. It was only small case series: 5 laparoscopic myomectomies. The myometrial defects were closed with a bidirectional barbed suture with a 36-mm half-circle taper point needle. The suture was started at 1 end of the defect and drawn through to the midpoint of the suture. The first layer was reapproximated, and the suture was passed through to the end of the distal end of the defect and cut without tying a knot. The next layer was then closed in the same fashion starting at the original end and finishing at the same end as the first layer and cutting the suture without a knot. The surgeons noted that reapproximating the myometrium was easier than with a traditional closure because the tissues remained approximated without recoil after the suture passed through them without any need for tension to be applied. All the myometrial defects were closed to the surgeon's satisfaction with good serosal reapproximation and excellent hemostasis ***(James A. Greenberg et al., 2008).***

Most recent, Nikolaos Kathopoulis in August 2024 through meta-analysis stated that the use of barbed sutures during laparoscopic myomectomy presents many is highly beneficial for the patient and the surgeon in shorter operative time, less blood loss, and how easiness . This technology may contribute to the expansion of laparoscopy on more difficult myomectomies. The application of barbed sutures resulted in significantly reduced operative time (2,111 patients, mean difference -12.04 minutes, 95% CI, -16.94 to -7.14, P <.001). This was also reflected when suturing time was separately analyzed (437 patients, mean difference -6.04 minutes, 95% CI, -7.43 to -4.65, P <.001) The mean difference in hemoglobin levels before and after surgery was significantly lower in the barbed suture group (1,277 patients, mean difference -0.40 g/dL, 95% CI, -0.72 to -0.09, P <.01) This was also observed in case of estimated blood loss, which was found to be lower in the barbed suture group (1,823 patients, mean difference -47.22 mL, 95% CI, -78.54 to -15.90, P =.003). ***(Nikolaos Kathopoulis et al., 2024)***

Laparoscopic-assisted vaginal myomectomy (LAVM):

After laparoscopic identification of the location of all fibroids, a guide suture is placed in the largest tumor for identification. A grasper is used to pull the guide suture into the vagina through the culdotomy incision. Enucleation and removal of the fibroid, repair of the uterine defect and hemostasis are performed vaginally
using conventional instruments. The advantages of LAVM are like those of laparoscopic myomectomy. However, laparoscopic myomectomy is mainly used to manage anterior and fundal fibroids, while LAVM is better suited for posterior and fundal masses. Vaginal capacity determines the difficulty of this procedure. LAVM is contraindicated in nulliparous women or those with a narrow pelvis. ***(Chyi-Long Lee et al., 2009).***

Alexis wound retractor laparoscopic ultraminilaparotomy myomectomy:

Alexis wound Retractor, is a single-use device made of a flexible polymer membrane formed into a cylindrical shape, serves a dual purpose as a wound retractor and protector. The device has been used to provide adequate and atraumatic wound retraction during surgery, together with its ability to reduce postsurgical infections ***(Hinkson L et al., 2016).***
Alexis wound retractor may be used in laparoscopic myomectomy to do ultraminilaparotomy with the conventional instruments. There were no sufficient papers to assume constant results.

Gasless (Isobaric) laparoscopic myomectomy:

Gasless (Isobaric) laparoscopic myomectomy was first introduced by Chang et al. in 1996. It was then reintroduced by Domiani et al. in 2003. This procedure - that is possible to perform also under local and regional (epidural or spinal) rather than general anesthesia - can be performed with conventional surgical instruments introduced through small abdominal incisions. This opportunity can permit to remove rapidly and safely uterine myomas especially larger and multiple myomas. Even it was reported to be done in a pregnant woman.

Initially, subcutaneous lifting of the anterior abdominal wall is obtained by using the Laparotenser system (Lucini Surgical Concept, Milan, Italy. Two curved 'pluriplan' needles with blunt tips are introduced subcutaneously through two very
small (2 mm) pubic skin incisions. They are suspended from a mechanical arm attached to a rigid pillar, and the arm is then elevated as far as necessary to obtain optimal exposure.

Although gasless myomectomy can be used, the laparoscopic myomectomy using CO2 remains the preferred minimally invasive approach for small and medium-sized myomas and when the total number of myomas removed does not exceed 2 or 3. Gasless laparoscopic myomectomy could be mainly indicated for removal of large intramural myomas (≥ 8 cm) and/or for multiple myomectomies (≥ 3 myomas per patient) ***(Francesco Sesti et al., 2006).***

Conclusion:

Laparoscopic myomectomy is still a complex procedure, it needs a well trained Surgeon with high skills to be performed. It also needs a deep understanding of ergonomics and many laparoscopic skills; one important skill is laparoscopic suturing which is a must for any surgeon willing to perform laparoscopic myomectomy.
laparoscopic suturing is considered as the most difficult step in the operation, many methods are suggested to facilitate this step, but remains depending on the surgeon's ability for suturing.

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