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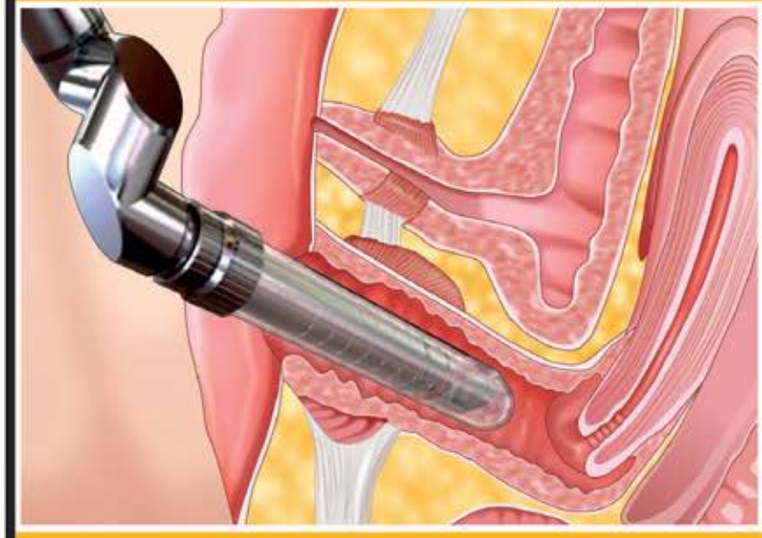
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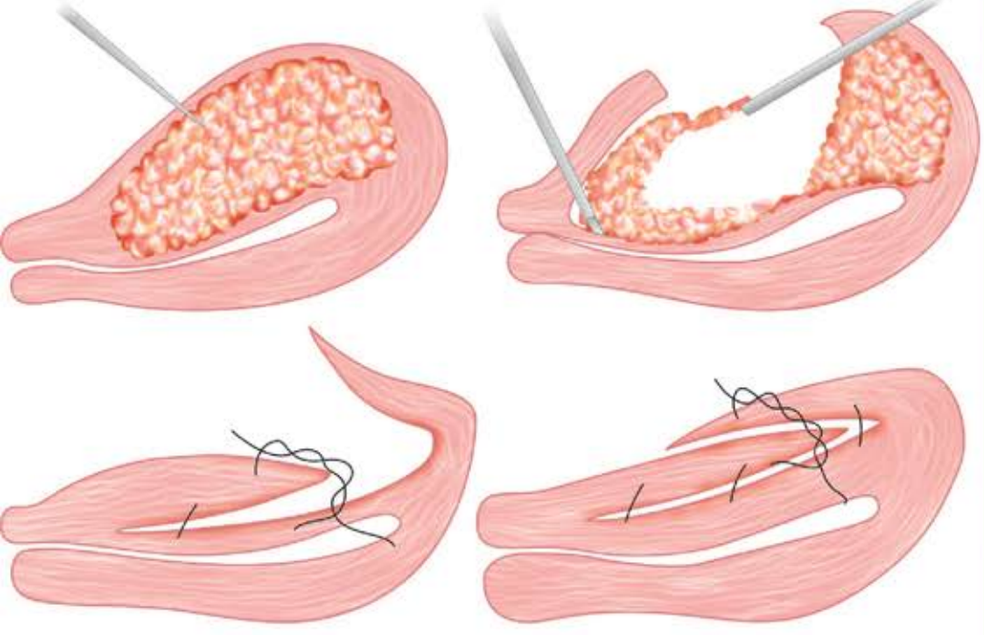
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CHAPTER

19

Leiomyoma Uterus

Rachana Ghanti, Aditi Rai, B Ramesh

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INTRODUCTION

Uterine fibroids, most common pelvic tumor in women, also known as *uterine leiomyoma, myoma, fibromyoma, fibroleiomyoma*, are benign smooth muscle tumors of the uterus. They are estimated to be present in a high percentage of all women of reproductive age and may be discovered incidentally during routine annual examination. Asymptomatic fibroids may be present in 40–50% of women older than 35 years of age.[1] Using ultrasonography screening, other authors have estimated a cumulative incidence by age 50 of greater than 80% in African-American women and nearly 70% in white women.[2]

Leiomyomas may occur singly but often are multiple. They may be subserosal, intramural, or submucosal in location within the uterus or located in the cervix, in the broad ligament, or on a pedicle. Most fibroids start in the muscular wall of the uterus. With further growth, some lesions may develop toward the outside of the uterus or toward the internal cavity. Secondary changes may develop within fibroids hemorrhage, necrosis, calcification, and cystic degenerations.

If the uterus contains too many to count, it is referred to as *diffuse uterine leiomyomatosis*.

Laparoscopic myomectomy was described for the first time as early as 1970s when it was exclusively restricted for subserosal myomas. Surgical science has seen a tremendous shift from open to minimal access surgery and with the recent advances in video endoscopic imaging technology and energy devices coupled with improved skill acquisition of the surgeons, laparoscopic myomectomy is being now preferred at most good centers worldwide. It is not any longer restricted to moderate <9 cm myoma or less than 5–7 myomas. Size, number, and location are no longer a restriction in experienced hands, although the technique has its learning curve.

Debatable issues about excessive blood loss, long time involved in surgery, and the strength of the obstetric scar are of lesser concern with the evolving trends showing results equal to if not better than the open approach.

However, the recent evolving concern is of morcellation and the upcoming contained bag morcellation is being advocated to combat this debate.

Although different studies reveal different criteria, it is generally considered that the laparoscopic approach is not feasible if there are three myomas of a diameter of about 8 cm each or a uterus of about 16 weeks with a 12-cm myoma. Nezhat recommends up to 15 cm in diameter.

SURGICAL ANATOMY

Classification of Fibroids

We can classify leiomyomas on the basis of their origin, location, symptoms they cause and the ease of removal/resection **(Table 1 and Figs. 1 to 13)**.

Classification of leiomyomas based on their location in the uterine wall:

- Subserosal
- Intramural
- Submucous

Submucous fibroids cause menorrhagia, dysmenorrhea, and infertility and need to be treated.

Table 1: Classification of leiomyoma based on their location.

Uterine	*Extrauterine*		*Unusual variants*
Fundus	Cervical		Diffuse leiomyomatosis
Body	Peritoneal		Lipoleiomyomatosis
Cornual	Broad ligament		Leiomyosarcoma
	True	Pseudo	
Lower segment	Parasitic fibroid		
Lateral wall			

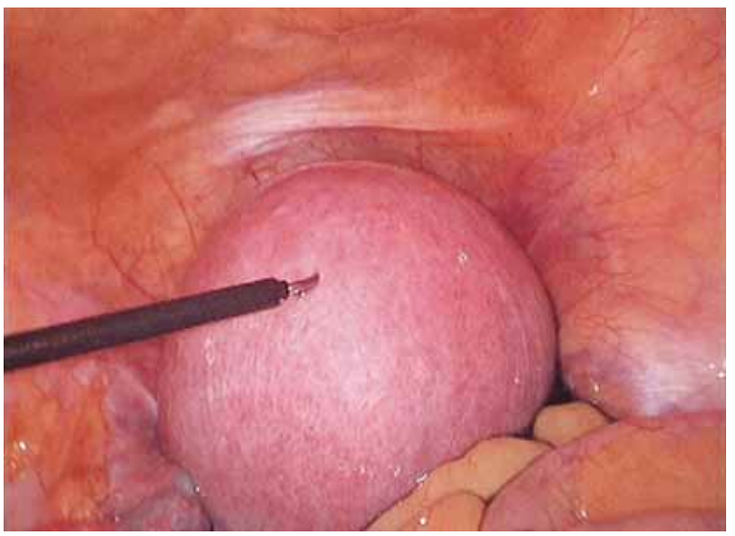


Fig. 1: Fundal fibroid.

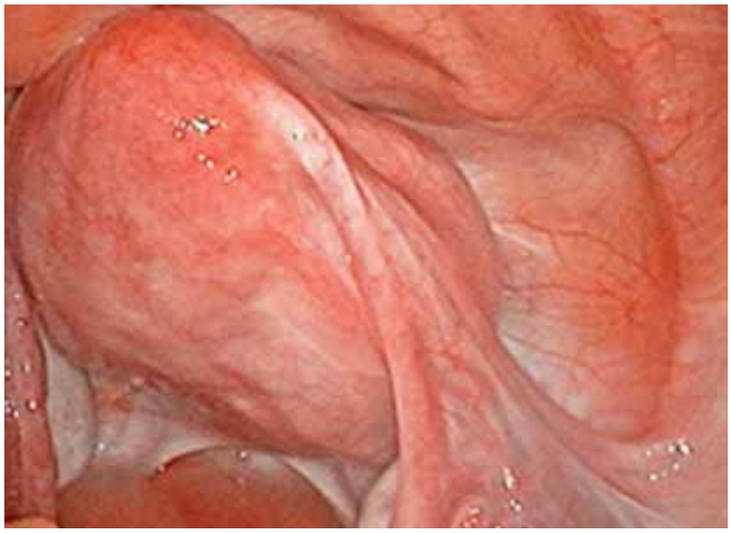


Fig. 2: Lower segment.

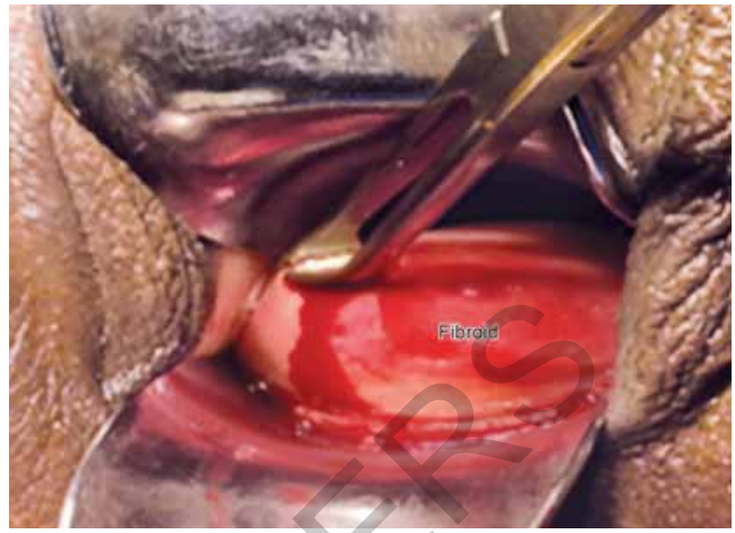


Fig. 4: Cervical fibroid.

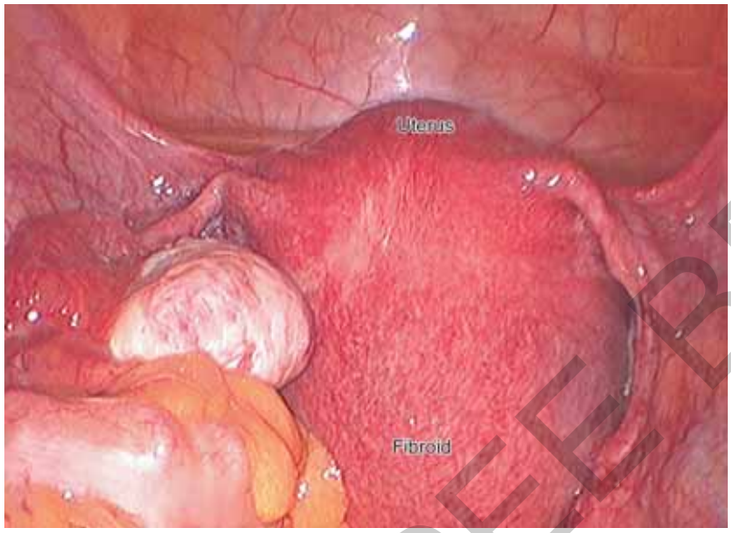


Fig 3: Posterior wall fibroid.

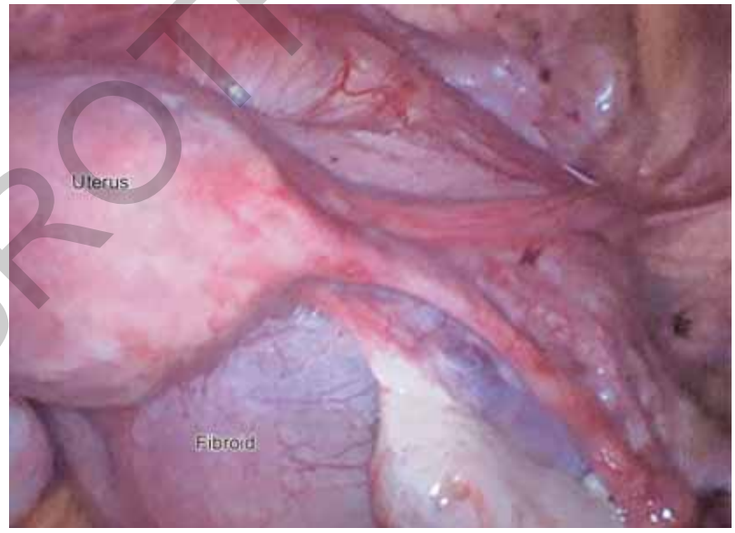


Fig. 5: Pseudobroad ligament.





Figs. 6A and B: Wandering fibroid.

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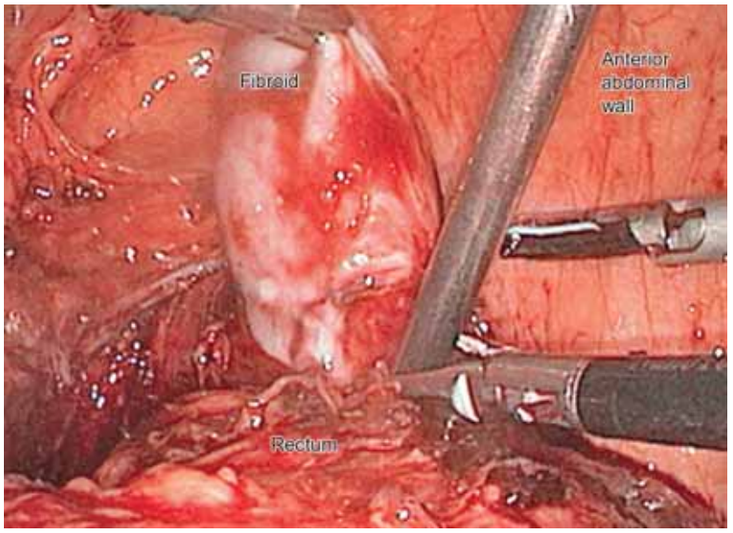


Fig. 7: Parasitic fibroid in the pelvic floor.



Fig. 10: Submucous fibroid.

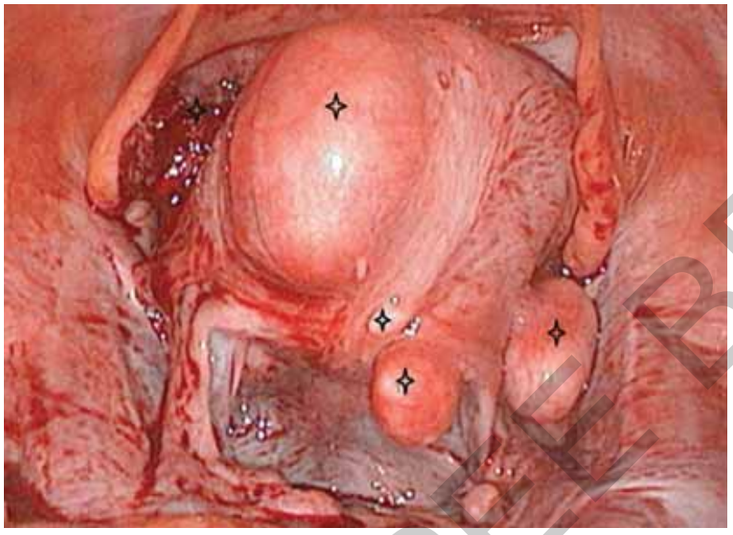


Fig. 8: Diffuse leiomyomatosis.

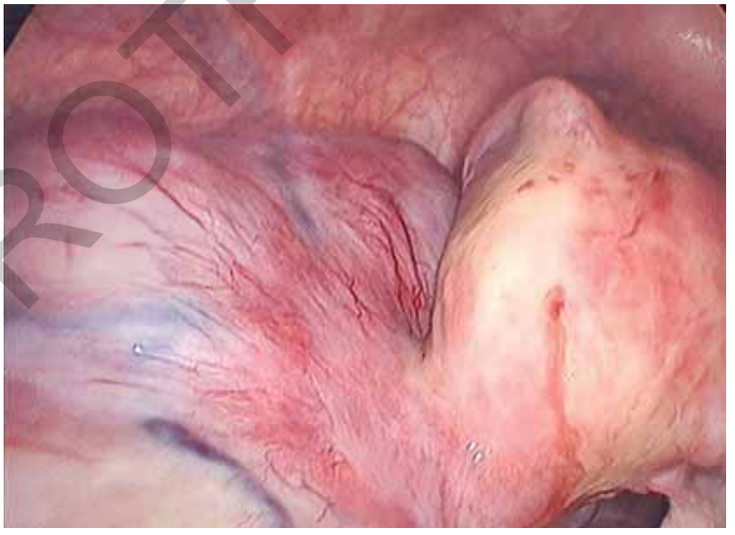


Fig. 11: Subserous fibroid.

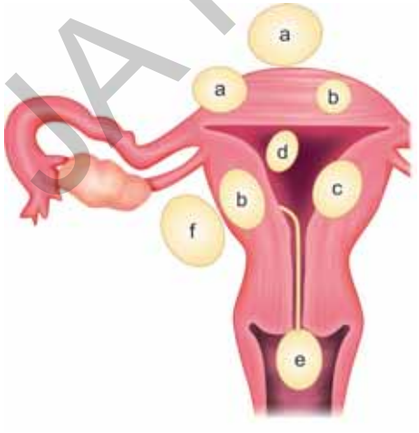


Fig. 9: Schematic drawing of various types of uterine fibroids. a: subserosal fibroids; b: intramural fibroids; c: submucosal fibroid; d: pedunculated submucosal fibroid; e: pedunculated cervical fibroid; and f: fibroid of the broad ligament.

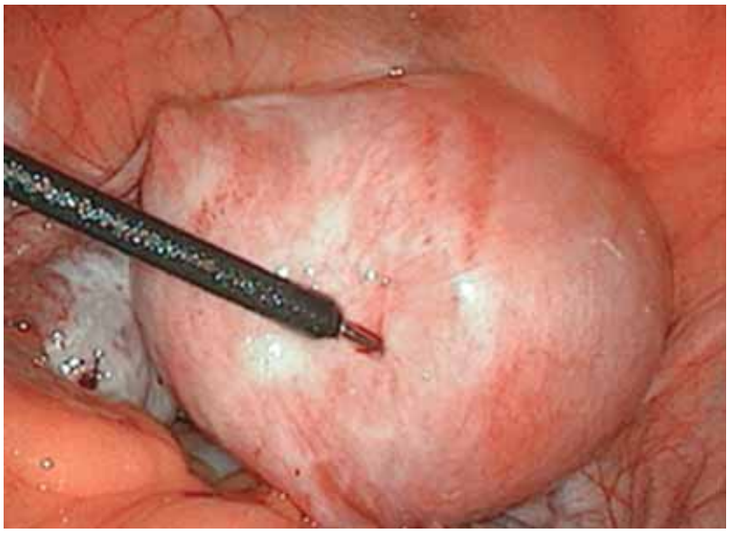


Fig. 12: Intramural fibroid.

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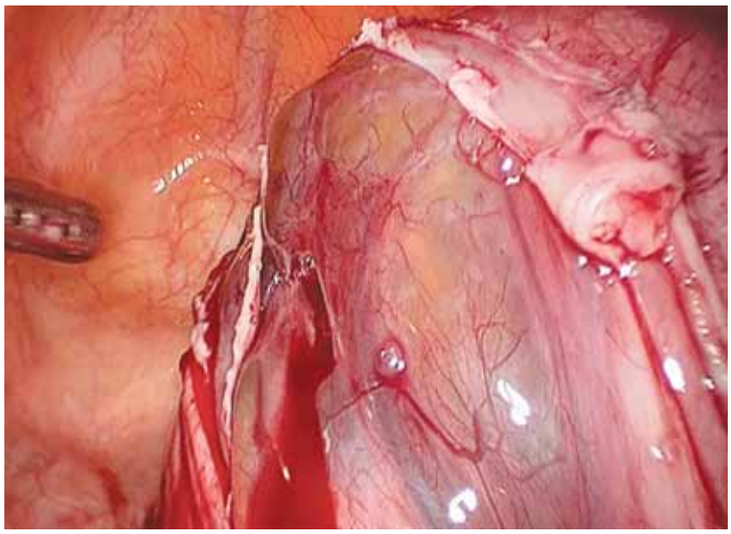


Fig. 13: Cystic degeneration with loss of plane.

Table 2: Classification of leiomyoma based on complications to the leiomyoma.

Uncomplicated	*Complicated*
	Degeneration
	Torsion
	Hemorrhage
	Malignant transformations

Intramural fibroids can be left alone if they are asymptomatic until they are more than 4–5 cm.

Subserous fibroids are usually asymptomatic and rarely cause any complications.

Classification of leiomyomas based on the symptoms ***(Table 2)****:*

- *Symptomatic*—menorrhagia, adjacent organ compression
- *Asymptomatic*

Classification of submucous fibroids has been proposed on the basis of feasibility of hysteroscopic resection of the same. This scoring system gives a fair idea about the possibility of complete hysteroscopic resection, necessity of multiple settings, need of laparoscopic assistance, and the probability of increased incidence of complications. This enables the operating team to formulate the approach strategy and helps in discussing the various options with the patient and preparing them for the outcome.

European Society for Gynaecological Endoscopy (ESGE): Classification of submucous myomas:

- *Type 0:* Pedunculated myoma within endometrial cavity.
- *Type I:* <50% myometrial extension (sessile), <90° angle of myoma surface to uterine wall.
- *Type II:* >50% myometrial extension (sessile), >90° angle of myoma surface to uterine wall.

Source: Modified from Wamsteker K, Emanuel MH, de Kruif JH. Transcervical hysteroscopic resection of submucous fibroids for abnormal uterine bleeding: results regarding the degree of intramural extension. Obstet Gynecol. 1993;82:736-40.

Myometrial extension is important when evaluating women for resectoscopic surgery. Thus, an ESGE type 2 leiomyoma that reaches the serosa is considered to be a type 2–5 lesion and therefore is not a candidate for resectoscopic surgery.

INDICATIONS

Surgery for uterine leiomyomata is complex and it is depend upon their medical comorbidities, surgical history, clinical scenario, and patient preference.

This procedure is considered when patient either has a *desire for future fertility or feels strongly about retaining their uterus.* The criteria are directed at relieving symptoms or improving quality of life by decreasing the patient's concerns. No indications exist for removing asymptomatic fibroids.

Excessive uterine bleeding:

- Heavy menstrual bleeding which changes the lifestyle of the person.
- Uterine bleeding leads to cause anemia.

Pelvic discomfort caused by myomata: Acute and severe.

Chronic lower abdominal pain or low back or pelvic pressure with evidence of sizeable leiomyoma on imaging studies.

Leiomyomata those are palpable abdominally: A definite risk exists for myoma recurrence after myomectomy and, with it, the need for a repeat surgical procedure in the future. If the patient no longer desires to retain her fertility or her uterus, hysterectomy is the usual procedure of choice.

PREOPERATIVE EVALUATION AND TREATMENT

If medical management failed and her symptoms are sufficiently severe, then surgery is the main option.[3] In women who complain of menorrhagia, the hematocrit is used to assess the degree of anemia. For anemic patients, preoperative gonadotropin-releasing hormone agonists (GnRH agonists) treatment will reduce the size of myoma, restoration of hematocrit value and decrease chance for blood transfusion. While some studies show a decrease in intraoperative blood loss after a course of GnRH agonist therapy.[4] After taking GnRH agonist, surgeons will get difficulty during procedure[5] because of loss of cleavage plane due to hydropic degeneration of myoma. Saline infusion sonography determines endometrial distortion by submucous fibroids. Periodic pelvic ultrasound examinations help monitor the growth rate of asymptomatic myomas. The presence of large broad ligament myoma needs for an intravenous urography to rule out ureteral obstruction. Patients are counseled regarding the risk of intra- and postoperative bleeding, adjacent organ injury, need for blood transfusion, and required laparotomy and rarely hysterectomy.

TYPES OF MYOMECTOMY

- *Total laparoscopic myomectomy*
- *Laparoscopically-assisted myomectomy:* Laparoscopically assisted myomectomy (LAM) is a safe alternative to laparoscopic myomectomy (LM). It is less difficult and requires less time to complete the decision to perform LAM. LAM may be superior to LM in the situation where myoma size is more than 8 cm, many myomas requiring extensive morcellation, and a deep, large, intramural myoma that requires uterine repair in multiple layers.

  Three major objectives of LAM are reduction of blood loss, prevention of postoperative adhesions, and maintenance of myometrial integrity. LAM, with "open" morcellation and conventional suturing, reduces the duration of the operation and the need for more extensive laparoscopic experience.

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- *Single-incision laparoscopic surgery (SILS)—myomectomy*
- *Robotic myomectomy and robotically-assisted myomectomy:* Robotic surgery has more advantage over straight laparoscopy such as shorter learning curves, a three-dimensional vision system, wristed instrumentation, and ergonomic positioning.[6] Because of its inherent advantages and principles similar to open surgery, robotic technology has the potential to facilitate utilization of a less invasive approach to the surgical management of myomas, thereby increasing this option for patients.
- *Myolysis:* Laparoscopic myolysis or leiomyoma coagulation can be used as an alternative to laparoscopic myomectomy for the treatment of small intramural or subserosal leiomyomas. The procedure was developed in Germany in 1986 and was first performed in the United States by Goldfarb in 1990.[7,8] Myolysis is designed to destroy the blood supply and subsequently cause stromal death of symptomatic myomas in order to achieve a decrease in their size.
- *High-intensity focused ultrasound (HIFU)*
- *Uterine artery embolization:* It involves the catheterization of both uterine arteries and the instillation of microparticles [polyvinyl alcohol (PVA)] to cause occlusion of blood supply to the myomas and subsequently leading to devascularization and infarction. Embolization did result in significant improvements in patient symptomatology.

MANAGEMENT OF FIBROIDS: LAPAROSCOPIC MYOMECTOMY

Surgical Equipment (Figs. 14 and 15)

- Gas insufflators
- Light source
- Video camera unit
- Suction irrigation device
- Monitor and documentation system
- Telescopes **(Figs. 15A and B)**:
  0°—10 mm, 30°—10 mm
  4 mm—30° standard hysteroscope
- *Trocars:* One 10 mm, two to three 5 mm
- *Operating instruments* ***(Figs. 15A and B)***—atraumatic and traumatic graspers:
  - Dissecting and hook scissors
  - Injection needle
  - *Myoma screw:* 5 mm and 10 mm
  - Needle holder
  - Port closure needle
- Energy sources—harmonic scalpel:
  - Bipolar forceps
  - Monopolar hook
- Morcellator **(Figs. 16A and B)**
- Suture materials

Steps of Surgery (Figs. 17 to 20)

- Ports placement
- Vasopressin injection **(Figs. 20A and B)**
- Uterine incision
- Enucleation
- Uterine repair
- Extraction of myoma
- Port closure

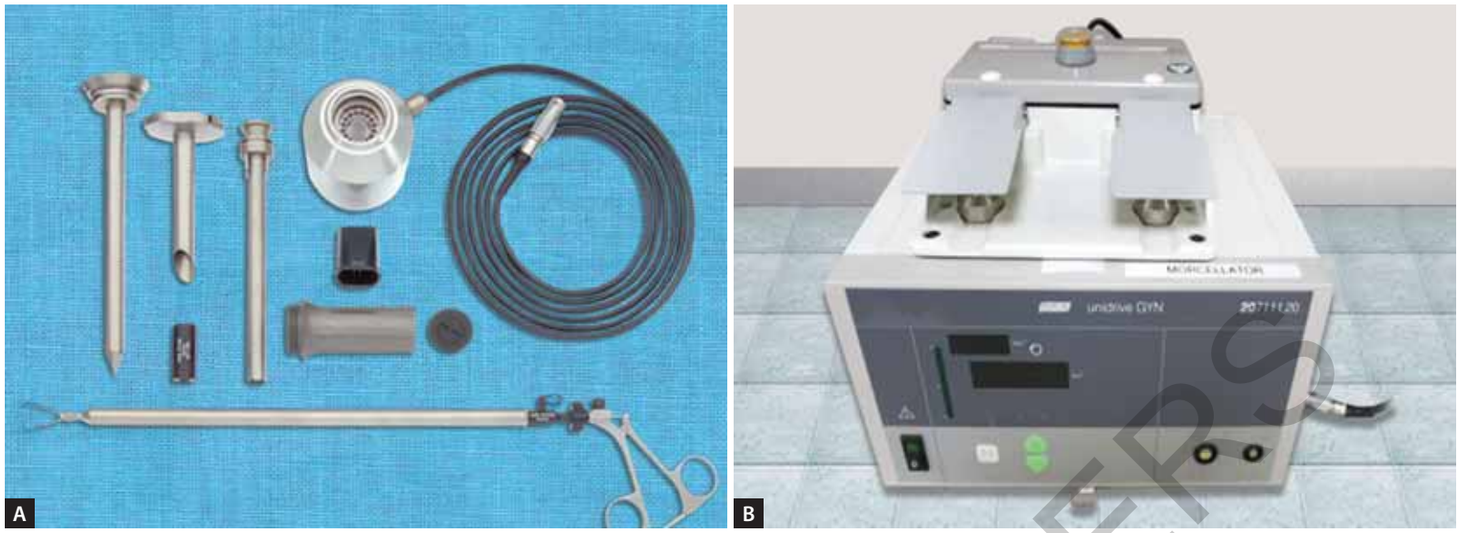


Fig. 14: Operation room (OR) setup.

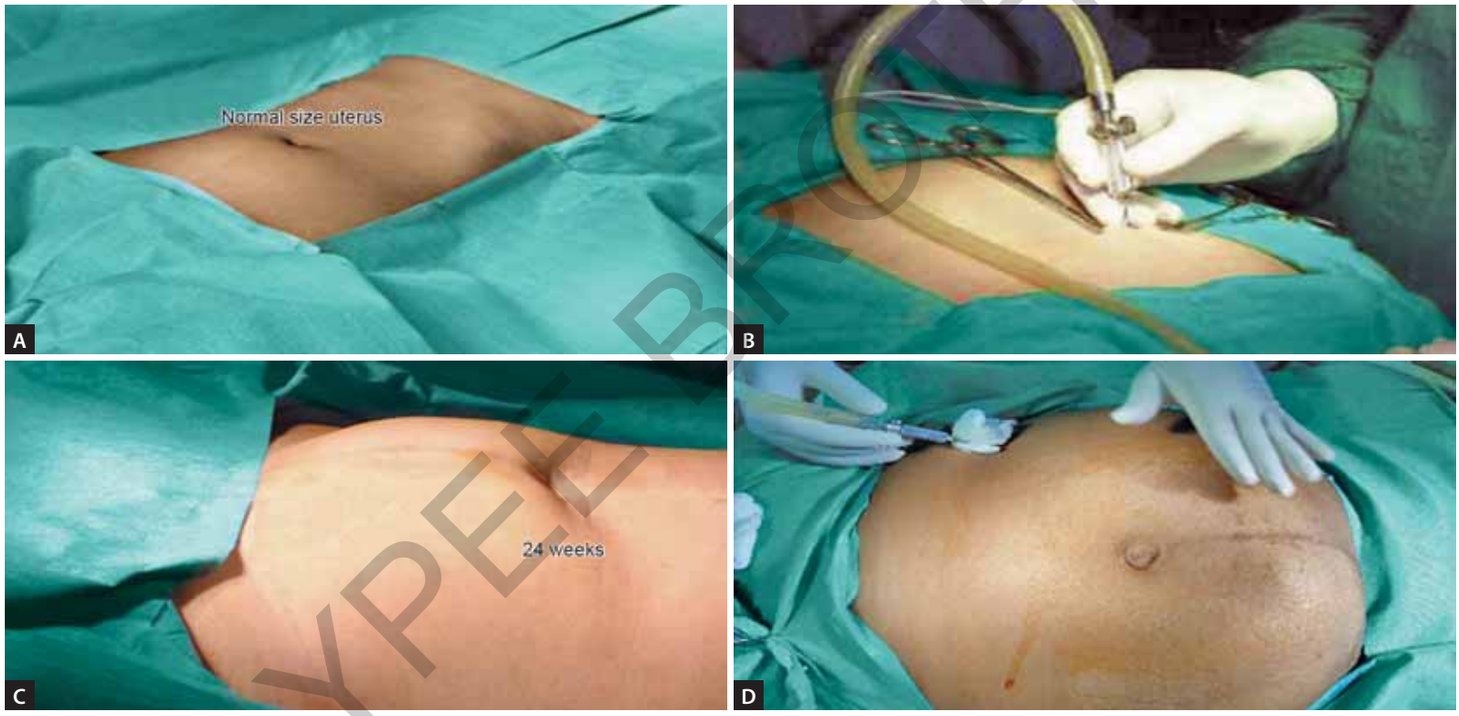


Figs. 15A and B: (A) Instruments—telescopes, graspers, scissors, suction irrigation cannula, myoma screw, claw forceps, port closure needle, and dilute vasopressin; and (B) Instruments—light cable, insufflations tube, trocars, and Veress.

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Figs. 16A and B: (A) Rotocut morcellator (conventional); and (B) Motor unit (Karl Storz unidrive).



Figs. 17A to D: Pneumoperitoneum—Veress insertion. (A) Normal size uterus; (B) Intraumbilical Veress placement; (C) 24 weeks size fibroid uterus; (D) Veress through Palmer's point.

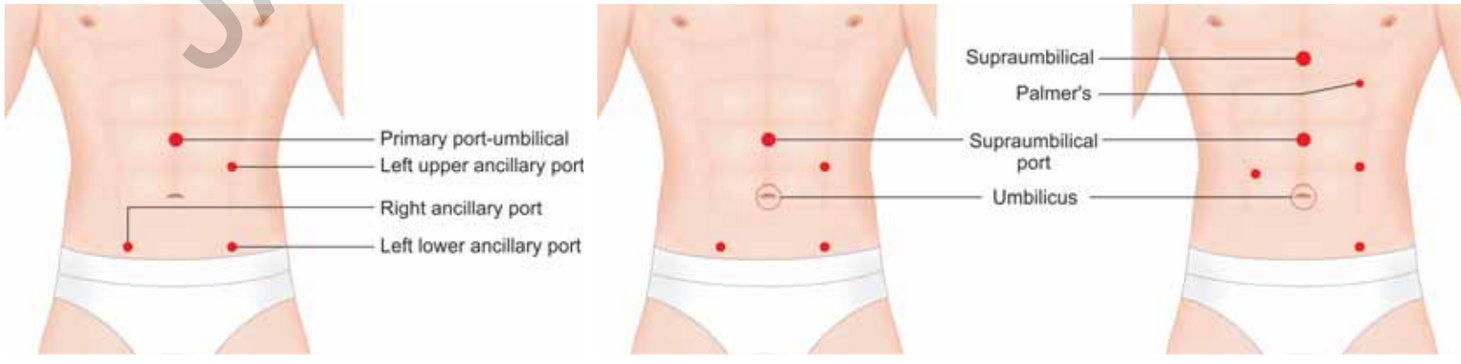


Fig. 18: Schematic diagram showing various primary and ancillary ports.

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Abdominal Entry and Port Placement

Each surgeon has his own entry protocol. We generally use the Veress needle through umbilicus **(Fig. 17B)** or Palmer's point **(Fig. 17D)** and insufflate to a pneumoperitoneum of about 18 mm Hg. If myoma or pathology is small (size < 8–10 cm), an umbilical or supraumbilical trocar 5 mm or 10 mm **(Fig. 18)** is put or else a primary trocar (5 mm) is taken at left upper quadrant which actually visualizes the fibroid and overall size of uterus and then accordingly a supraumbilical entry above the umbilicus is chosen and a 10-mm trocar is introduced under direct vision of a 5-mm optical trocar **(Figs. 19A to D)**.

A total of three 5-mm working ports are taken which may be chosen as per the style of suturing preferred by the surgeon. We generally choose two left ports lateral to inferior epigastric vessels and one lower right port for assistant. Many surgeons use a third suprapubic port.

Incision and Enucleation

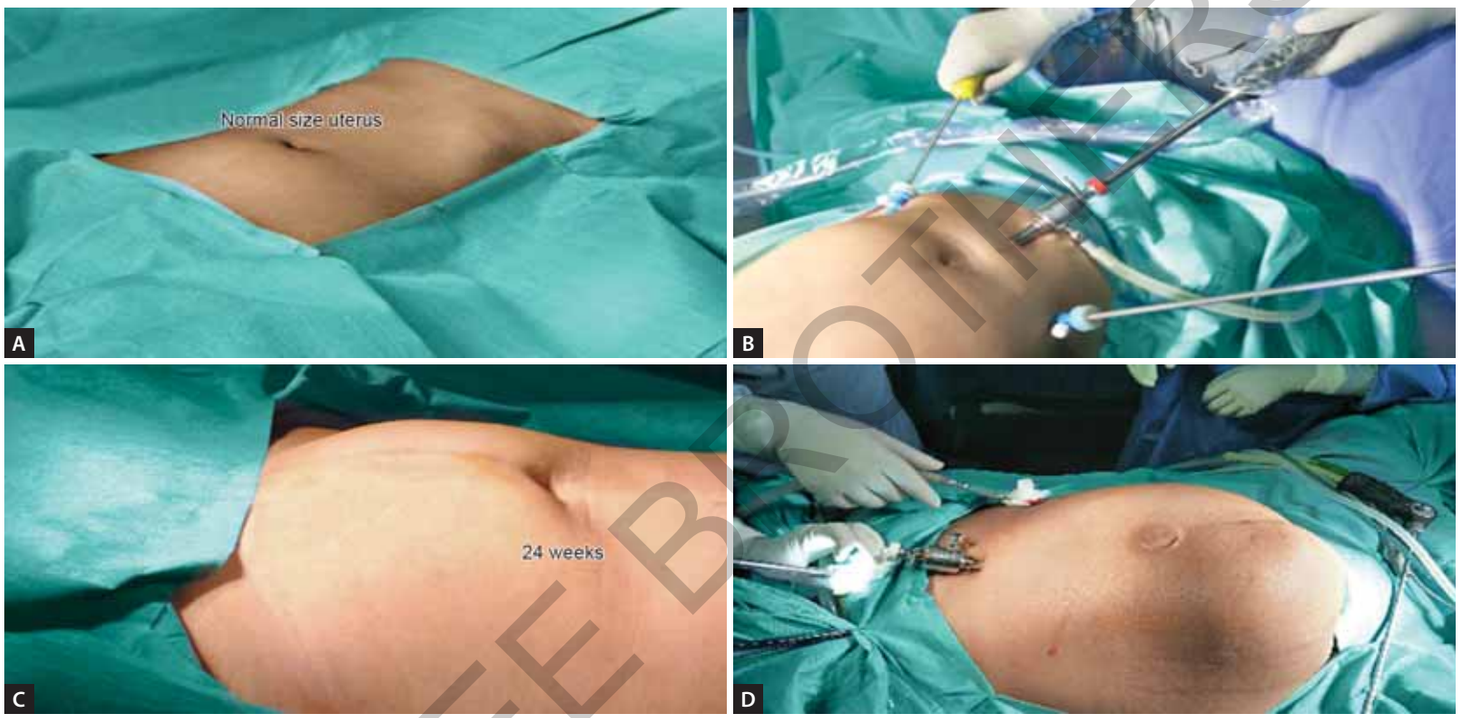
Refer to **Figures 21A to D**.

Enucleation of Myoma

Refer to **Figures 22A to D**.

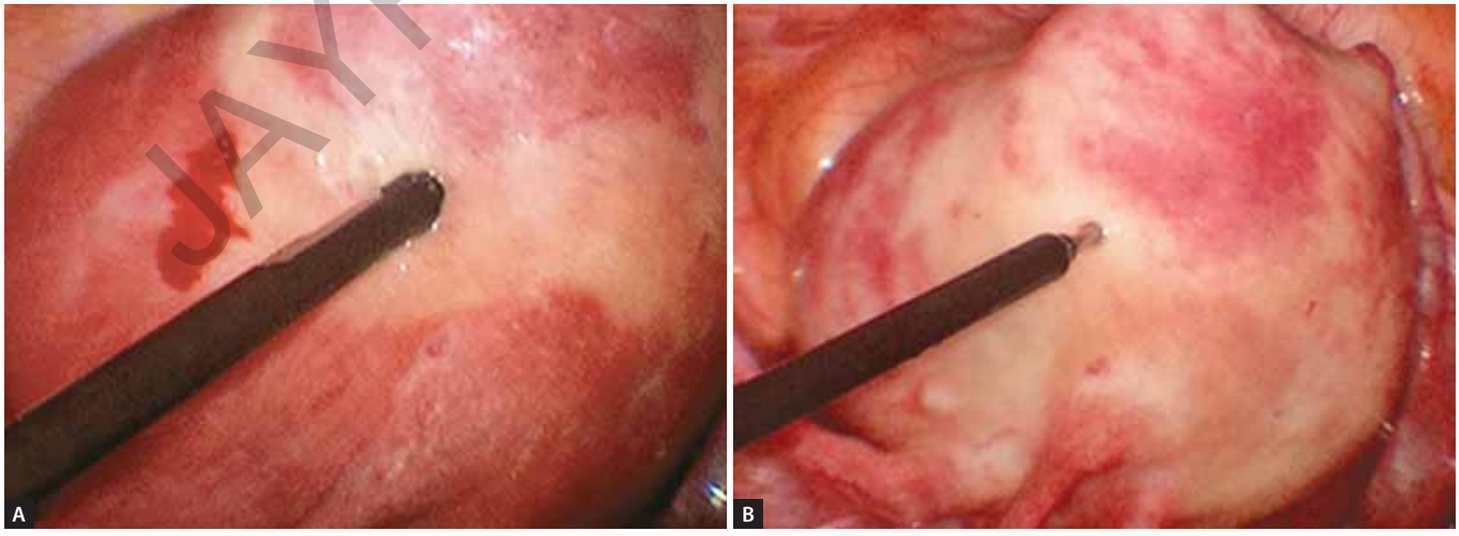
Suturing of Myoma Bed

Refer to **Figures 23A to D**.



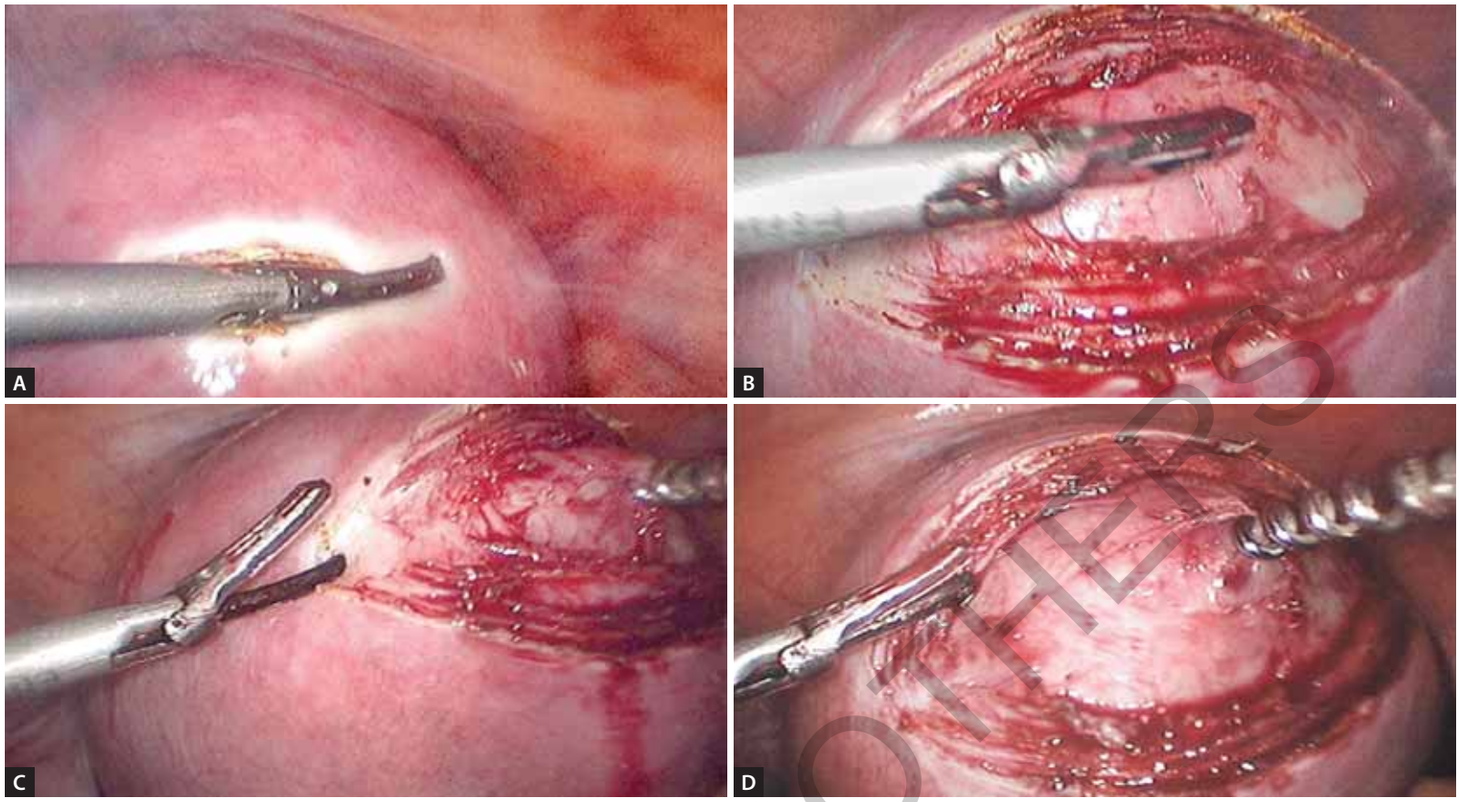
Figs. 19A to D: Port placement. (A and B) Primary and secondary port placement in normal size uterus; and (C and D) Primary port placement in a 24 weeks size uterus. Note higher placement of trocar just below xiphisternum (provides proper panoramic view for performing surgery).

Injection of Vasopressin

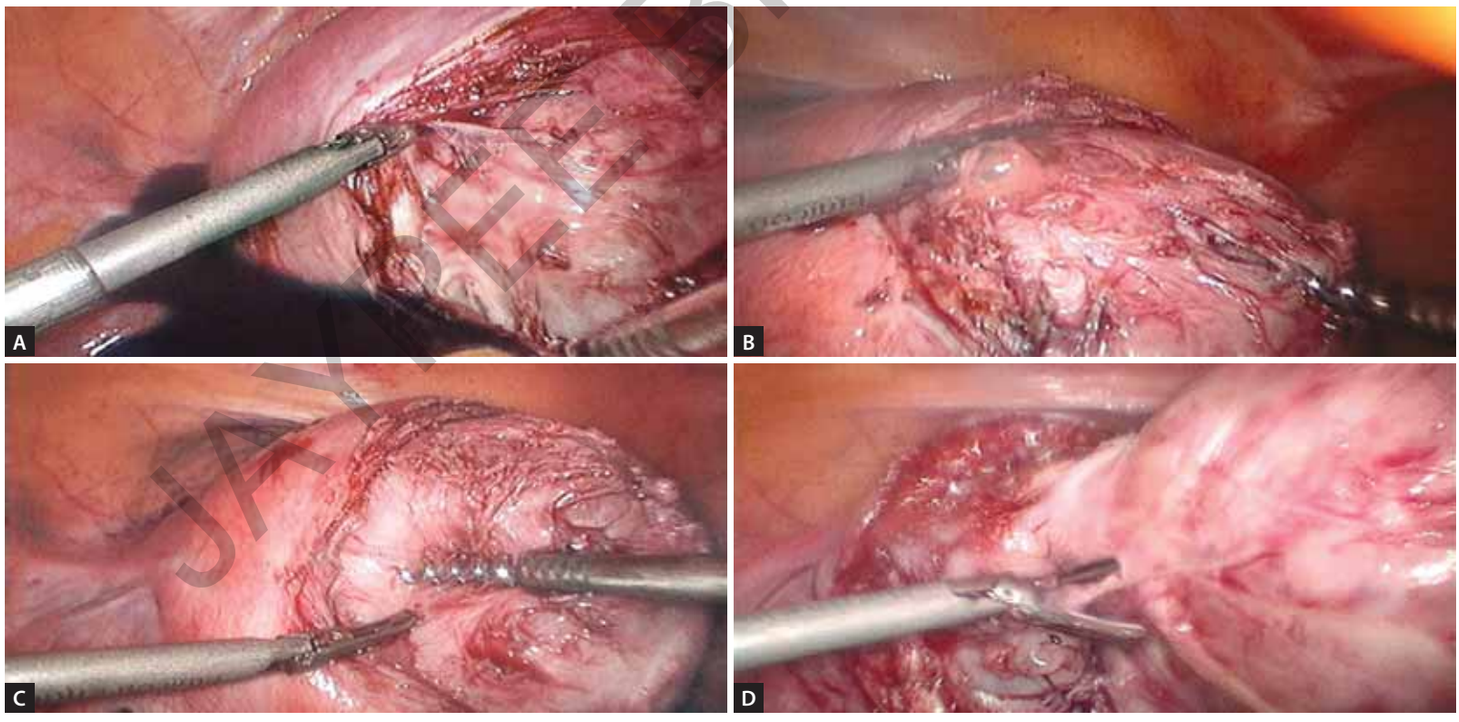


Figs. 20A and B: Vasopressin injection. (A) Diluted vasopressin (20 U in 200 mL of normal saline) injected into myoma myometrial junction; (B) Note the blanching seen after injection.

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Figs. 21A to D: Sequential images of incision and enucleation. (A) Incision over myoma using harmonic in an oblique fashion; (B) Myoma screw used to stabilize the uterus while incising with harmonic; (C) Myometrial layers and pseudocapsule being cut with harmonic. *Note:* Proper plane identification is the key step in enucleation; (D) Enucleation in process using 5 mm myoma screw.

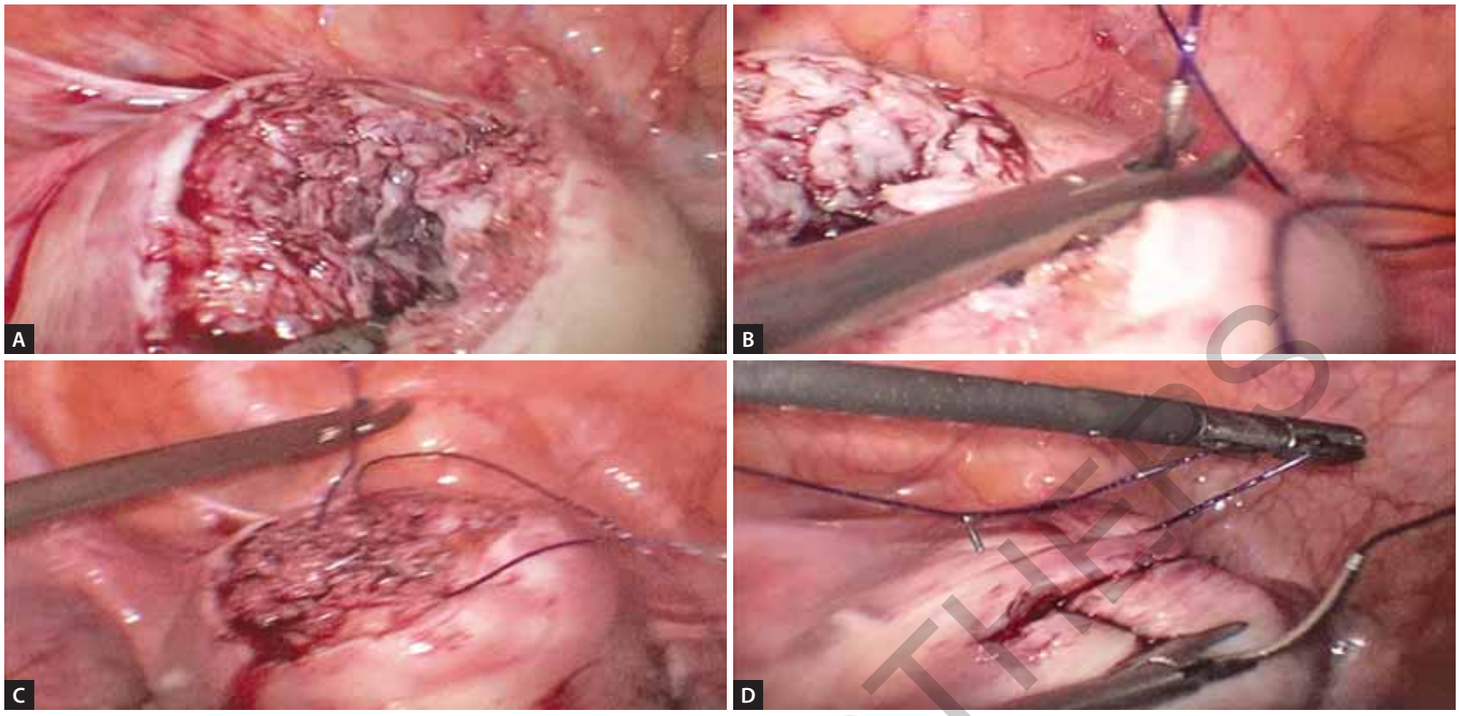


Figs. 22A to D: Continuation of enucleation. (A and B) Traction and countertraction with harmonic and myoma screw, (B) Myoma screw advanced near the margin to aid in enucleation; (C) Harmonic is used to cut through the tissues which hold back the myoma; and (D) Final step of enucleation. Myoma is cut from the bed.

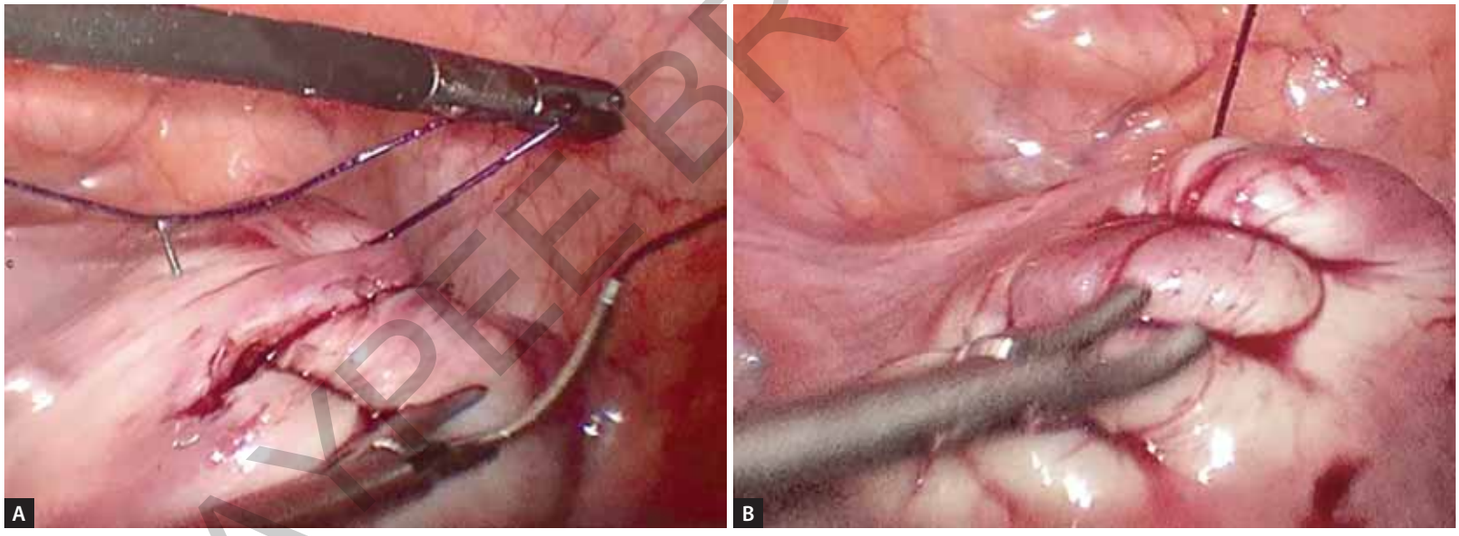
Baseball technique of suturing ***(Figs. 24 and 25)****:* Note the undermining of suture material and approximation of edges. Buried suture line prevents adhesion formation. Bites are taken inside out on both sides of the edges and suture tightened each time.

Suture materials: The author generally either uses standard Vicryl polyglactin no. 1 or 1-0 on a cutting needle (40 mm size) or (50 mm size) in large myomas for standard suturing. The author also finds the use of barbed suture useful.

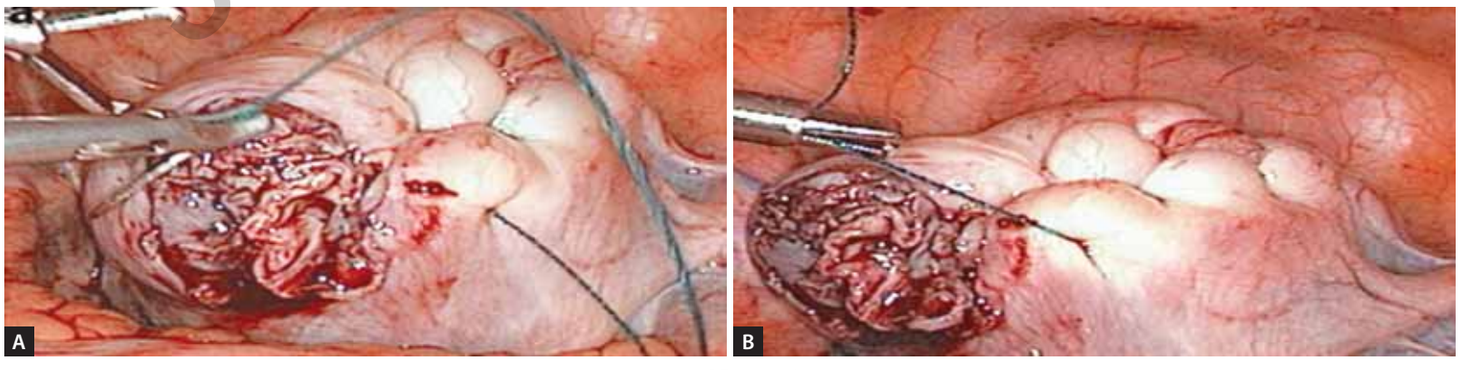
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Figs. 23A to D: Suturing—continuous nonlocking with barbed sutures. (A) Myoma bed after complete enucleation; (B) Holding the needle with needle holder. Note the angle at which needle is held; (B and C) First layer sutured using barbed sutures in continuous nonlocking manner; and (D) Second layer suturing in similar manner. Approximation of edges is very important.

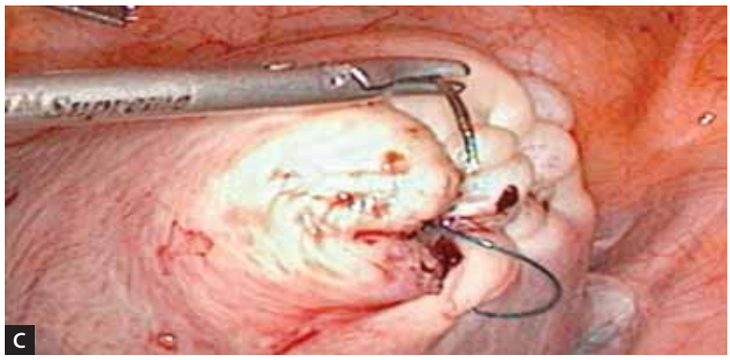


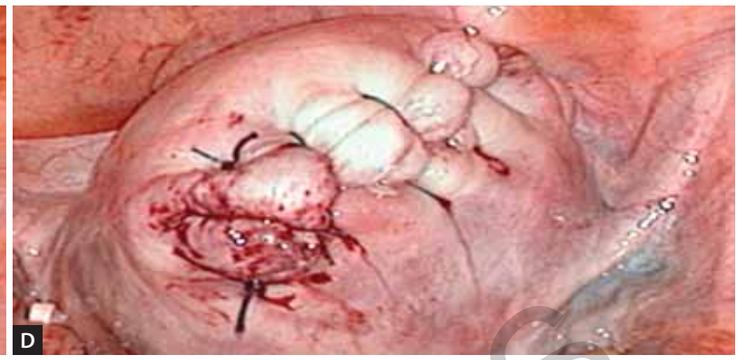
Figs. 24A and B: Final step of suturing. (A) Going beyond the angles of suture line. Note the depth of the bite taken; and (B) Suture line after completing second layer closure. Note the proper approximation of edges and the final bite should go beyond the angle of incision line.



Figs. 25A and B

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Figs. 25C and D

Figs. 25A to D: Baseball suturing.

Barbed suture ***(Fig. 26)****:* An innovation in suture design.

The bidirectional barb sutures were first introduced in 2007 in United States (Angiotech Pharmaceuticals). The material is polydioxanone, nylon or polypropylene, but it is the suture design that makes it revolutionary. This suture consists of standard suture material with tiny barbs cut into the length of filament **(Fig. 26)** in a helical array set facing in opposite directions from midpoint with a needle at each end. This allows tissues to be reapproximated without need of tying a surgical knot. It has had a profound impact on laparoscopic suturing, especially in laparoscopic myomectomies.

The tension on the suture material is evenly distributed across the length of suture rather than only on the ends at the knot. Unidirectional barbed sutures are also available **(Fig. 27)**.

In minimally invasive surgery, especially laparoscopic myomectomy, the ability to perform suturing quickly and properly is a challenge. In cases where knot tying is difficult, the use of barbed suture can approximate the tissues compactly with less time and with even distribution of tension.[9]

In the author's own experience, the use of barbed suture is very valuable especially when dealing with large myomas, where the suturing time is crucial. Also hemostasis obtained is much better than traditional sutures.[10]

The V-LOC suture by Covidien, introduced in 2009, is a unidirectional barbed suture with a loop at one end for facilitated fixation **(Fig. 28)**. This suture also makes suturing easy and fast.

The Stratafix by Ethicon-Endosurgery is also available.

The adhesion formation with barbed suture in animal studies has not been found to be different in comparison to standard suture materials.[11]

Significantly faster closure time in myomectomy with barbed suture has been seen in several in vivo studies now.[12]

Pregnancy outcomes are also comparable following suturing with barbed suture when compared with standard suture.[13]

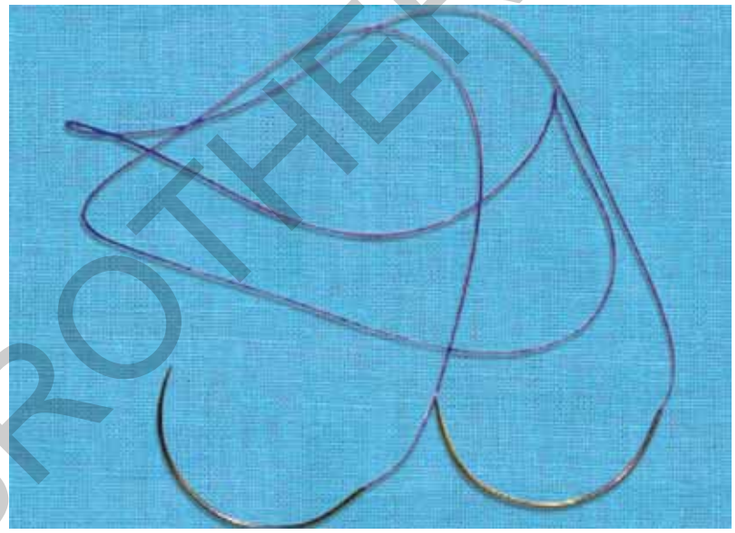


Fig. 26: Bidirectional barb suture.

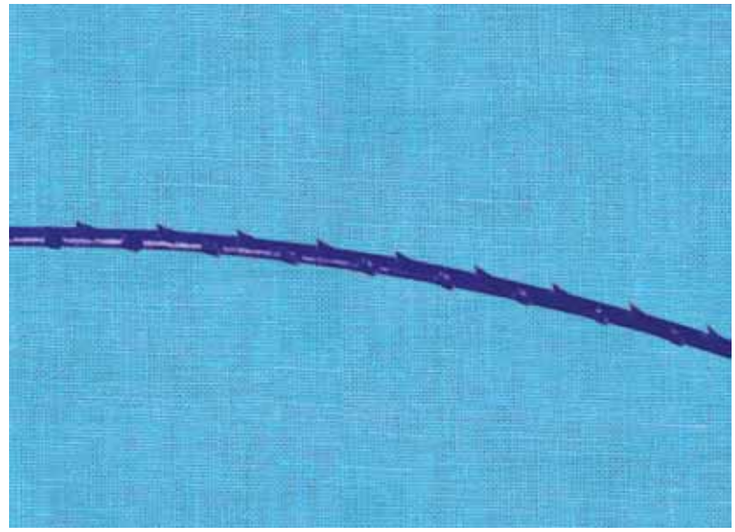


Fig. 27: Unidirectional barb suture loaded on a single needle.

Extraction

Various methods are possible for extraction of myomas:

- Standard electromechanical power morcellation
- Via posterior colpotomy
- Via Endoknife—appropriate for small myoma < 2–4 cm in diameter
- Contained morcellation in isolation bags
- Via minilaparotomy

Standard electromechanical morcellation: This was first introduced in 1993 to improve speed and ease of tissue extraction without the need of laparotomy.

Standard morcellation involves extension of the port size to 12–15 mm and guiding the morcellator under vision **(Figs. 16 and 29)**. It is recommended to activate the blade of the morcellator inside a trocar with an oblique end so that simple traction on the myoma peels it like an "orange" without small fragments. "Swiss cheese" effect should be avoided as this leads to fragmentation.

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The technique has potential for vascular and visceral injury and has to be performed under strict visual guidance and control. Concern regarding the power morcellation is further discussed in the upcoming sections below **(Figs. 30A to D)**.

Contained morcellation: 1 in 400 females undergoing surgery of myomas are at risk of having a leiomyosarcoma (American Cancer Society).

5-year survival for leiomyosarcoma is poor as seen from the data:

- Stage I: 60%
- Stage II: 35%
- Stage III: 22%
- Stage IV: 15%

Several studies have reported an increase in recurrence rate and decrease in rate of survival following morcellation which results in upstaging of disease. So, the methods of bag morcellation, minilaparotomy, and colpotomy are proposed to overcome this problem. For larger specimens a minilaparotomy with or without use of self-retaining retractors is advised.

In April 2014, Food and Drug Administration (FDA) issued a warning about power morcellation, concerning morcellation of unsuspected leiomyosarcomas.

According to American Association of Gynecologic Laparoscopists (AAGL) most females with uterine cancer can be diagnosed prior to surgery. 1 in 400 to 1 in 1000 females undergoing myomectomy will have uterine leiomyosarcoma, prognosis of these females is unusually poor and may be worsened in setting of power morcellation.

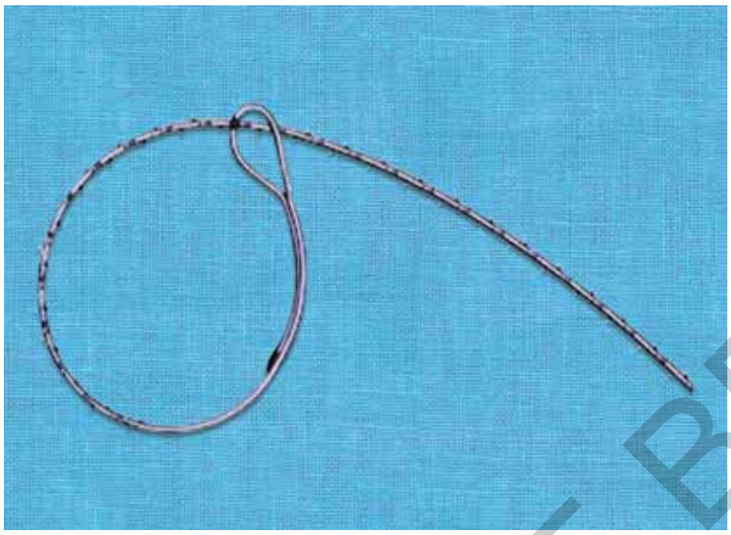
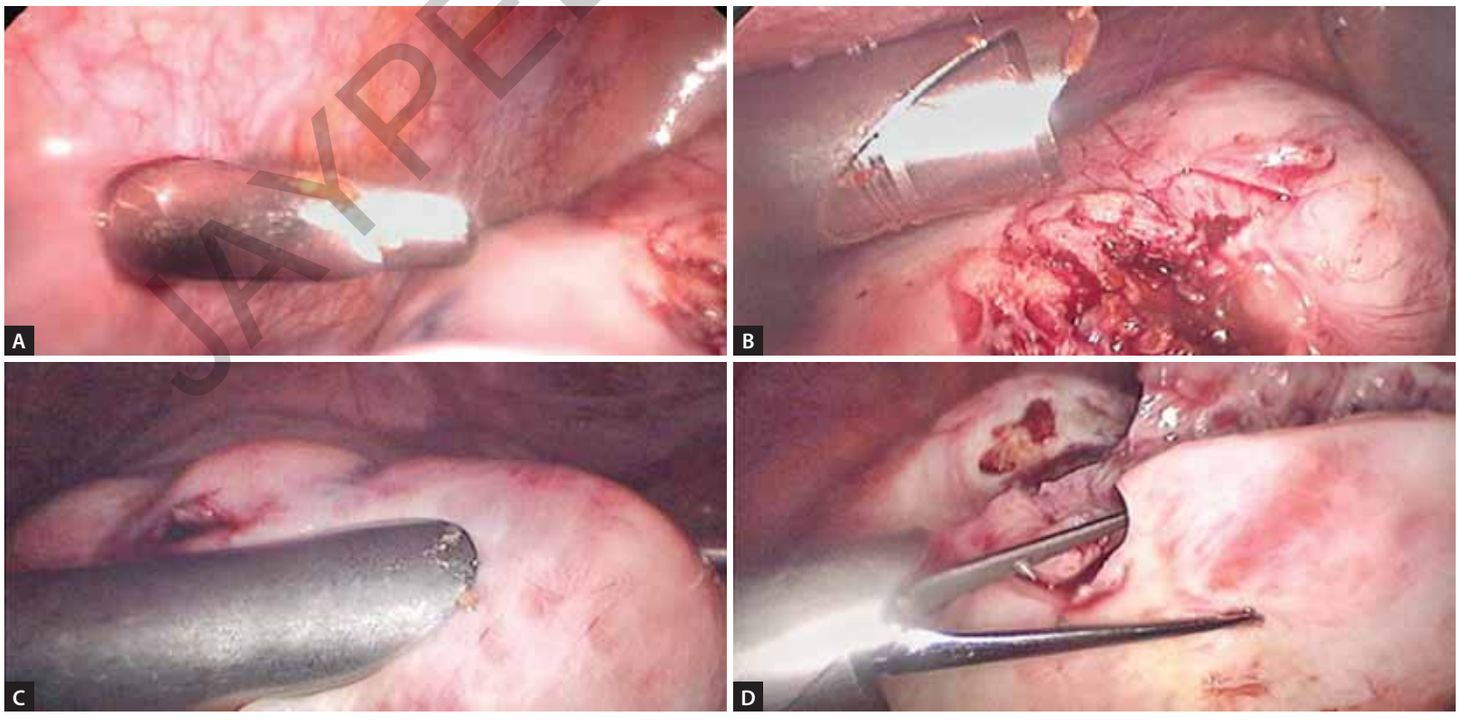


Fig. 28: V-Loc by Covidien.



Fig. 29: Outside view of standard morcellator assembled and ready for morcellation.



Figs. 30A to D: Laparoscopic view of morcellation. (A) 12 mm trocar inserted; (B) Outer sheath with rotating inner blade; and (C and D) Morcellation in process.

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Steps of in-bag morcellation **(Figs. 31A and B)***:* In-bag morcellation seems to be a viable alternative to open power morcellation and offers the advantage of no spillage of tissues or fluids during morcellation.[14]

This technique involves the placement of the specimen into a large plastic bag within abdomen, exteriorizing the opening of the bag, insufflating the bag within the peritoneal cavity and then using the power morcellator within the bag to remove the specimen in a contained manner.

A recent study from January 2013 to April 2014 which included 73 patients, concluded this as a feasible technique. Methods of morcellating uterine tissue in a contained manner may provide an option to minimize the risks of open power morcellation while preserving the benefits of minimally invasive surgery (level of evidence II).[15]

In the author's own personal experience, this method, once a couple of cases are performed, is fairly easy to perform and the author has morcellated specimens up to 2.3 kg with relative ease and without spill.

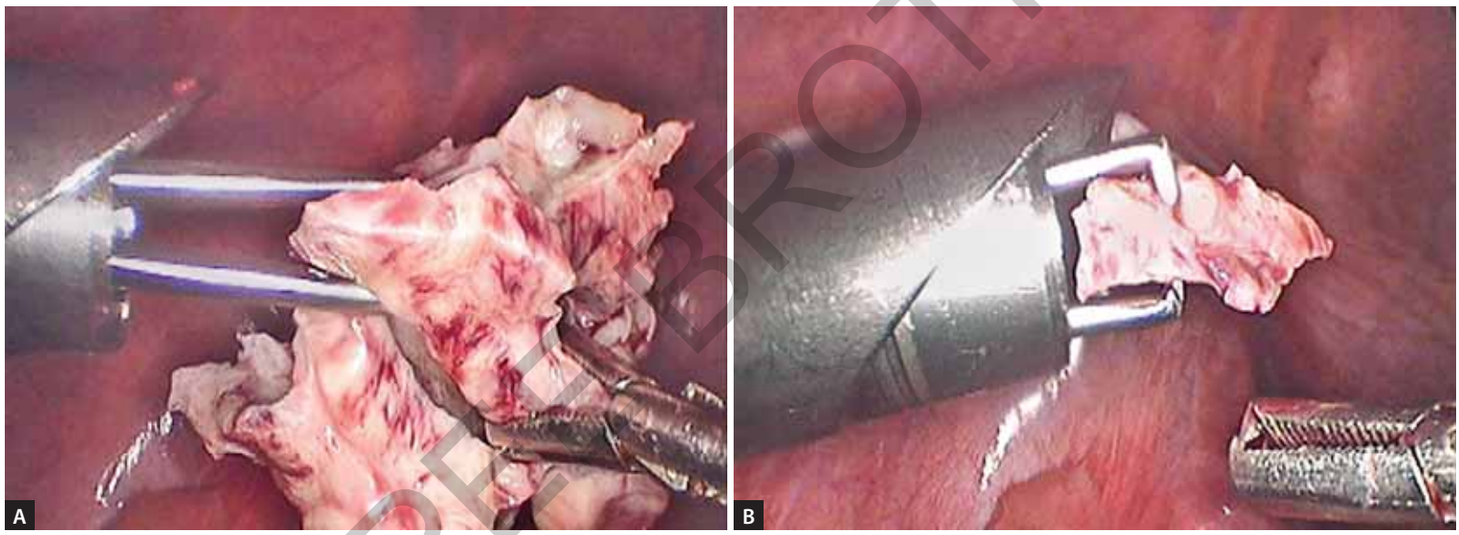
In addition to the risk involved to viscera and vessels, there has been concern for tissue dissemination. Retrospective studies show that disseminated parasitic myomas occur in 0.1–1% of cases with power morcellation.[16,17] The use of contained morcellation is likely to substantially reduce this particular complication.

Description of technique: The isolation bag **(Fig. 32)** is available in various sizes. The average size of large bag may be as big as 50 × 50 cm. The basic steps are illustrated in the following steps:

First step involves folding the bag in an accordion style and the air is compressed out of it **(Fig. 33)**. This folded bag is then placed inside the plastic trocar sleeve which holds the folded bag completely along its length and this trocar is now introduced through the side port being used for the morcellation **(Fig. 34)**.

After being completely pushed in the peritoneal cavity the plastic sleeve is withdrawn **(Fig. 35)** and the bag is spread inside in such manner that it gets unfolded by a coordinated action of the surgeon and his assistant **(Fig. 36)**.

- The closed base of the bag is placed snugly at the pouch of Douglas and the bag is opened wide with the instruments of the surgeon and assistant ports.
- Next, the parked specimen (usually right upper quadrant) is grasped and placed into the bag **(Figs. 37A and B)**.



Figs. 31A and B: Final steps of morcellation.

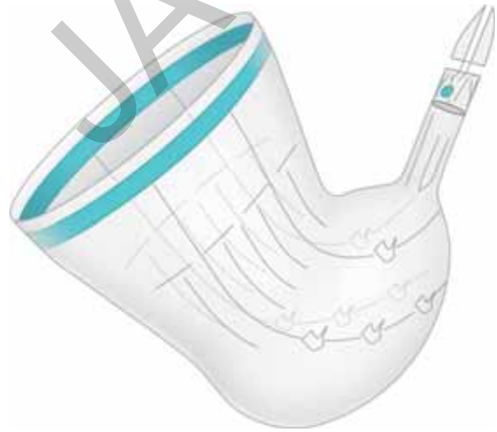


Fig. 32: MorSafe—Endobag.

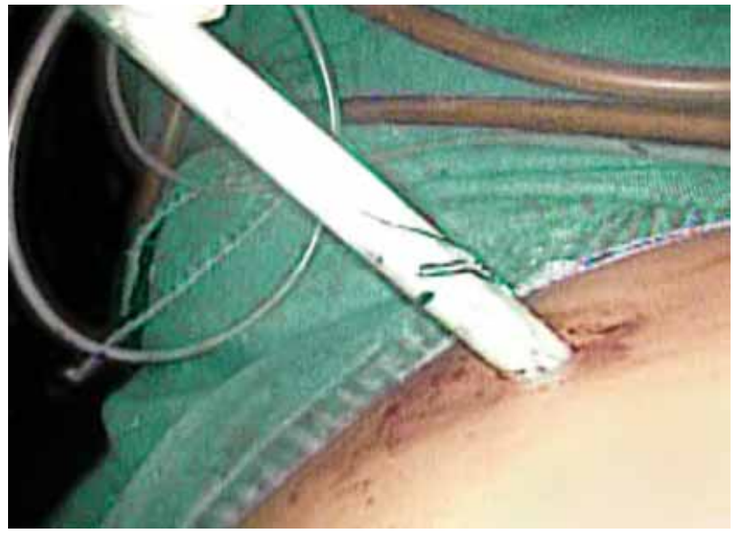


Fig. 33: Rolled bag placed inside sleeve.

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Operations in Obstetrics & Gynecology
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Salient Features

- Includes all operations in the specialty of obstetrics and gynecology. The purpose is to make the reader understand the steps of surgery at one go
- As we know one picture is better than thousand words, the book inculcated this principle, and including actual pictures of most of the surgeries in stepwise fashion and little theory to back it up and understanding purpose
- Focuses mainly on surgical technique, not on the other aspects
- Helpful to all the gynecologic surgeons especially when they are doing rare procedures like vesicovaginal fistula (VVF) repair, ureteric implantation, sling surgeries, etc., one glance at the steps of the surgery will make them more confident and they can replicate the surgery with ease
- A chapter on ART describes the procedures such as ovum pickup, embryo transfer, etc., which will be needful for the beginners
- As today's gynecologic surgeries are done mostly by endoscopic route, many laparoscopic surgeries and hysteroscopic surgeries are illustrated in picture form so that the reader can understand and replicate it during endoscopic surgeries and also chapter on complications describes how to correct the complications intraoperatively
- Surgical ready reckoner for gynecologic surgeons, practicing gynecologists and postgraduate students who can quickly see the steps of surgery in the picture form and understand easily
- Useful guide to undergraduate students to understand simple procedures such as cesarean section, hysterectomy, etc.
- Also can help the general surgeons, urologists and gastroenterologists who will be dealing with abdominal surgeries in day-to-day practice.

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Dr Ramesh is the first gynecologist to use 3D laparoscopic surgeries in India and has trained more than 1500 gynecologists, not only from all over India but also from other countries such as Malaysia, Middle East, Bangladesh, African Countries, Sri Lanka, England, etc. He conducts Fellowship courses affiliated to Rajiv Gandhi University of Health Sciences (RGUHS), Bengaluru. He is also the recipient of several awards including Karnataka Rajyotsava Award (2011).

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