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INSTRUMENTATION AND TECHNIQUES

Robotic Myomectomy: Five Modifications in Our Practice

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Abstract

We discuss five technical modifications made over 8 years in the technique of robotic myomectomy at our institution. Universal preoperative MRI was the first modification. Precise hysterotomy incisions were planned by accurate myoma mapping. The second modification was to reduce the number of ports. We performed surgery with one 12-mm-port for the camera and one 8-mm-port on either side of the patient for scissors and fenestrated bipolar forceps. Third modification was to reduce the number of robotic instruments by using laparoscopic myoma screw instead of robotic tenaculum during enucleation and discard the use of a second needle driver and prograsp forceps. So instead of six instruments in classical technique, we now use only three instruments thus reducing the cost of instruments by 40–50%. The fourth modification was to use a single 30 or 45 cm barbed suture. A single long suture efficiently managed by wristed needle driver of robot was sufficient in most cases for hysterotomy closure. This reduces the time needed for multiple needle pass and cost due to reduced number of sutures used. The fifth modification was to not use the electro mechanical morcellator and commercially available bags. We do cold knife morcellation in indigenous plastic bags. Over a period of eight years, we have made robotic myomectomy efficient and reduced the cost of instruments by 40–50% as compared to the classical technique. This has enabled wider adoption of robotic myomectomy at our institution thus reducing open myomectomy in all types of myomas.

Keywords Robotic · Myomectomy · Cost · Laparoscopy · Fibroid · Technique · Instruments · Modifications · Reduce

Introduction

Despite the well-established benefits of minimally invasive surgery, open surgery continues to be the commonest modality of accomplishing myomectomy even at premier institutions. Challenges with laparoscopic dissection and suturing have resulted in a sluggish adoption of this technique. 74% of responding surgeons performed open myomectomy in a UK study in 2017 [1]. It is undeniable that robot-assisted surgery is here to stay and is gaining widespread popularity. The technical benefits of robot-assisted surgery in dissection and suturing during myomectomy surgery are well-established, and this should logically have led to an immediate adoption of this technique wherever robotic platform was available [2]. However, cost of surgery has prevented universal use of the surgical robot for myomectomy. In India, about 35% of the population is covered by managed health care but the rest need to shoulder the cost of their surgery. Additionally, not all managed health care plans cover the additional cost associated with use of the surgical robot.

At the authors' institution, these five modifications have led to a considerable expansion of robot-assisted myomectomy to patients who have experienced the benefits of minimally invasive surgery regardless of challenges due to large or multiple fibroids or due to difficult body habitus. Herein we discuss the five key technical refinements that, we believe, have enabled this transformation.

Five Modifications—Apollo Hyderabad Technique.

The key to feasibility and cost-containment lies in reduction of operating time, robotic and surgical

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accessories. This can be achieved by the following five key modifications:

1. Preoperative MRI
2. Modified Port placement
3. Reduction in number of robotic instruments used during surgery
4. Effective and efficient suturing -Barbed suture (30 or 45 cms)
5. Cold knife morcellation and indigenous bags

Preoperative Assessment and Role Of MRI

Selecting the correct patient is the key to a successful robotic myomectomy. Adopting universal preoperative MRI of the pelvis is our *first modification.* Pelvic MRI can reveal additional findings in more than 40% of women presenting with symptoms assumed to be due to fibroids on ultrasound scan [3]. Such information prevents surgical surprises thus reducing intraoperative confusions which can increase operative time. Preoperative surgical planning done at the MRI console by the surgeon and the surgical team provides a detailed impression of number and location of fibroids for precise location of hysterotomy incision(s). MRI can raise a red flag regarding suspicion of sarcoma.

Modified Port Placement

We used DaVinci Si system. Classically, the primary port (12 mm- XL trocar -Ethicon Endo-Surgery) was placed in the midline either at umbilicus or 2–5 cms above the umbilicus, depending on the size of the fibroid. An additional 4 secondary ports (total 5 ports) were placed. Two 8-mm-ports on right side and one 8 mm on the left side of patient. An assistant port (11 mm) was placed on left side.(Fig. 1a) The *second modification* in our unit was to reduce the number of ports. A 12-mm-midline port for the camera was placed as in the classical technique and one 8 mm on each side of patient. An additional 5-mm-assistant port on left side was used for suction and irrigation. (Fig. 1b).

Reduction in Number of Robotic Instruments

We began doing robotic myomectomy in 2012 by classical technique described in the literature. We used scissors in arm 1 and tenaculum in arm 3 on the right side, fenestrated bipolar forceps in arm 2 on the left side of the patient during the myoma enucleation. During suturing we used two mega needle drivers in arm 1 and 2, prograsp forceps in arm 3 and an 11-mm-assistant port for passage of needle and

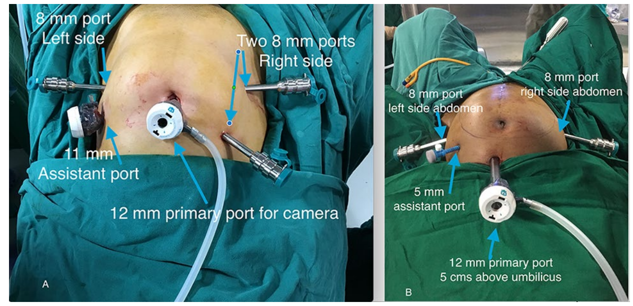

Fig. 1 **a** Classical port placement-12 mm telescope; Right side 8 mm (Arm 1) - Hot Shears while enucleation and Mega Needle holder while suturing; 8 mm (Arm 3)- Tenaculum while enucleation and Prograsp while suturing. Left side 8 mm (Arm 2)- fenestrated bipolar forceps while enucleation and Mega Needle holder while suturing. 11 mm port for assistance. **b** Modified port placement-12 mm telescope in midline; Right side- 8 mm (Arm 1)- Hot Shears while enucleation and Mega Needle holder while suturing. Left side-8 mm (Arm 2)- fenestrated bipolar forceps. 5 mm port for assistance.

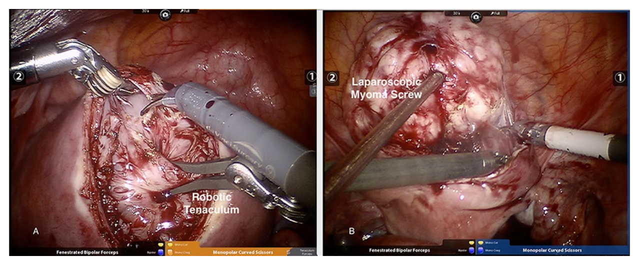

Fig. 2 **a** Classical technique- enucleation using robotic tenaculum. **b** Modified technique- use of laparoscopic myoma screw through a 5 mm port

electromechanical morcellation. Thus, in the initial classical technique we used a total of 6 instruments. In the modified technique, we use laparoscopic myoma screw instead of robotic tenaculum through a 5-mm-assistant port keeping the positions of scissors and bipolar forceps same. (Fig. 2a, b) Thus, the *third modification* was to reduce the number of instruments. As our experience increased, we discarded the use of robotic tenaculum, a second needle driver and prograsp forceps. Suturing was done with only one needle driver and the bipolar forceps. Thus, instead of 6 robotic instruments used in classical technique we used only 3 robotic instruments in our modified technique. Each of these instruments when used during surgery are the driving force behind the high cost of robot-assisted surgery [4] Behera et al. in their analysis show that if the cost of instruments during robot-assisted myomectomy is minimized, cost of this procedure would be relatively comparable to abdominal myomectomy [5]. This single modification at our institution has reduced our robotic instrument cost by 40–50%.

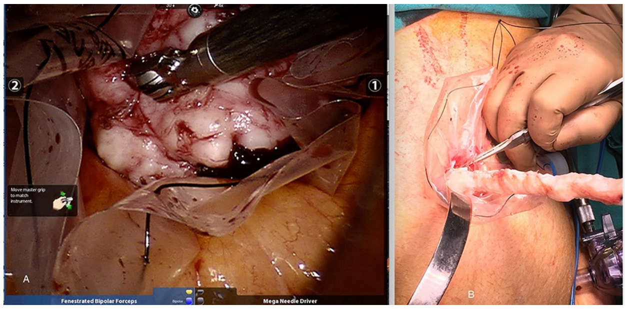

Fig. 3 **a** Placement of myoma in an indigenous bag. **b** cold knife morcellation technique via umbilical port. Multiple inverse C incisions and eventually converting a globular specimen into a longitudinal one.

Effective Suturing-Barbed Suture (30/45 cms)

Barbed suture facilitates laparoscopic suturing during myomectomy by reducing the total operative (suturing time) and blood loss. Unidirectional knotless barbed suture holds the edges together, provides adequate tension and uniform distribution of tension along the hysterotomy. We adopted the use of barbed suture as our *fourth modification* and use a length of 30/45 cms, VLoc-0 (Covidien). This is contrary to the concept of keeping the length of suture 10–12 cms for effective suturing during laparoscopic surgery. Long length of suture is effectively managed by endowrist instruments, and one suture is often sufficient to do multilayer closure of hysterotomy. This technique reduces the dead space enabling efficient and swift suturing in multiple layers. When less number of sutures are used it means fewer needle passes (saves time) and also reduces the cost as each additional suture that we use is billed to the patient.

Cold Knife Morcellation and Indigenous Bags

As our *fifth modification*, indigenous plastic bag with a purse string suture is used to collect the myoma, and scalpel (blade #11) is used to morcellate. (Fig. 3a, b). If fibroids are multiple, a suture is used to string them and then placed in the bag for removal. The umbilical port is commonly used although posterior fornix can be used in parous women. Multiple inverted C incisions converts a globular specimen into longitudinal one. Commercially designed bags and electromechanical morcellator add to the cost of the surgical procedure. Manual morcellation is reported to reduce operative time [6].

Discussion

Each of our five modifications strike at the heart of the chief impediment to a wider adoption of robotic myomectomy, the cost. In classical techniques, instruments and accessories used in robotic surgery cost an average of $1866 per procedure [7]. With the modifications described in this paper, we have tried to bring this cost of instruments and accessories down to $1000–1200.

Both laparoscopic and robotic myomectomy are feasible in skilled and experienced hands. However, the rare conversion to laparoscopic myomectomy in our center was associated with very large, multiple fibroids at difficult anatomical locations; but now, easily handled by using the surgical robot. Additionally, for inexperienced surgeons who might find the suture-intensive laparoscopic myomectomy challenging, the robot provides a relatively short learning curve for intracorporeal suturing. In their study, Chandra et al. suggest that, when performing complex tasks surgical robot is most useful for inexperienced laparoscopists who experience an early and persistent enabling effect. For experts, robotics is most useful for improving economy of motion, which may have implications for the highly complex procedures in limited workspaces [8]. Surgeons unequivocally find the robot easier to use with reduced fatigue, less occupational injuries possibly translating into longer surgical careers. So far, cost has been the major handicap in a wider uptake of this procedure. We believe that the technical modifications that we have suggested can go a long way in enabling a wider adoption of robotic myomectomy with consequent benefits to both patient and surgeon.

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Declarations

Conflict of interest The authors do not have any conflict of interest.

Ethical Statement The article describes surgical techniques and not clinical human data, hence ethical committee approval is not applicable.

Informed Consent Consent for publication was taken from the patient.

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