**Indian Experience of Robotics in Gynecology**

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**Abstract**

**AIMS:** To study the role of robotics in various gynaecological cases, benign and malignant. **MATERIALS AND METHODS:** A total number of 80 cases have been analyzed. Operative time, estimated blood loss, hospital stay, complications, conversion rates have been retrospectively studied in all cases. Nodal yield, vaginal margin and paracervical clearance have been studied in all malignant cases. This investigation was conducted at a single minimal access surgery institute. **RESULTS:** Of total 80 cases, 29 were benign and 51 were malignant cases. In benign cases, total robotic hysterectomies were 24, 2 cases of tubotuboplasty, 1 case of endometriotic cyst excision, 1 case of metroplasty and 1 case of rectovaginal fistula. In 51 cases, 37 of radical hysterectomy, 9 exenterations and 6 were parametrectomy. In benign cases, mean operative time was 80 min, estimated blood loss was 20 ml, mean hospital stay was for 1 day, no major complications and no conversions. In malignant cases, mean operative time was 122 min, estimated blood loss was 50-100ml, 2 cases of ureteric fistulas and no conversions, nodal yield was 30, vaginal margin was 2.5-3.8 cm and para cervical clearance was 3-3.5 cm. **CONCLUSIONS:** Ours is the largest series of robotic surgery in gynecological procedures in India. Benign and malignant cases were addressed robotically showing the feasibility.

**Keywords:** Hysterectomy, gynecological, laparoscopy, Robot

**INTRODUCTION**

The field of minimally invasive surgery is undergoing rapid advances. Robotic gynaecological surgery is being done at many centres in the world. The first TLH was done in 1985 by Harry Reich. Since then, many laparoscopic gynaecological surgeries have been performed. The main limitation of laparoscopic surgery is that it is skill based. Even after training, only a few skilled surgeons can perform these surgeries. Surgeons can overcome their limited laparoscopic skills by performing robotic surgeries using DaVinci Robotic system (DRS).

The benefits of minimally invasive surgery over open surgery are well known, both to the patients and the surgeon. There has been an increase in the demand for minimally invasive surgery by patients. Unfortunately this demand is more than the supply in terms of surgeons performing these surgeries. Robotic surgery fills the gap between having skills and not having one. A surgeon with limited skills can still perform robotic surgery with knowledge of operative steps and the anatomy. This leads to added advantage both to the patient as well as the surgeon. Notwithstanding the cost, robot helps to duplicate the laparoscopic surgeries which otherwise would be beyond the reach of surgeon with limitation of skills.

In April 2005, DaVinci robot was Food and Drug Administration cleared for gynaecologic procedures based on preliminary evidence of safety and efficacy from their early experience with myomectomy and hysterectomy at the University of Michigan. Robotics is best for single quadrant surgery and for fixed structures and hence is especially useful in gynaecological surgery. It has added advantages of 3D perception, wristed instrumentation, intuitive movements and dexterity.

**MATERIALS AND METHODS**

Since November 2009 until date, we have performed 80 robotic gynaecological cases in Galaxy care laparoscopy institute, Pune.
Preoperative work up was the same as any gynaecological procedure. The procedure was performed by team of surgeons with extensive experience in advanced laparoscopy. Case selection criteria were the same as that for any other laparoscopic procedure. Informed written consent was taken for conversion to laparoscopy in all cases.

We used a three arm DaVinci robotic system. (Intuitive surgical, Sunnyvale, CA, USA). Approval from the Institutional Review Board and Hospital Ethics Committee was obtained.

We standardized the port positions as
1. A 12 mm camera port was placed 2 cm above the umbilicus.
2. An 8 mm robotic port on the either side was placed 10 cm lateral and 12 cm caudal to the camera port.
3. The right sided robotic port was a mirror image of the left robotic port.
4. Two assistant 10 mm ports were placed pararectally at the level of the camera port.

The robotic cart was docked from in between the legs

A zero degree scope was used for the procedure.

For all the surgeries, the following parameters were analyzed.
1. Robotic docking time.
2. Console time surgical time.
3. Blood loss.
4. Complications.
5. Conversion to either lap or open

For the oncological surgeries, other parameters such as paracervical clearance, nodal yield and vaginal margins were also recorded.

RESULTS

Of the total of 80 gynecological cases performed robotically in our institute, 29 were benign and 51 were malignant cases. Of the benign cases, 24 were hysterectomies for various complex benign pathologies like big fibroids, previous abdominal surgeries. 2 tubotuboplasties, 1 endometriotic cyst excision, 1 metroplasty, 1 rectovaginal fistula repair were also performed with good results at our institute.

Of the total of 51 oncological cases performed robotically, 27 were robotic radical hysterectomies for cancer cervix, 10 total robotic hysterectomies with bilateral salpingo-opherectomy with iliobuturator node dissection for cancer endometrium, 2 were total robotic hysterectomy with bilateral salpingo-opherectomy and omentectomy for cancer ovary, 7 were exenterations, 5 were parastrectomy.

Comparative Data

Total robotic hysterectomy: We compared our outcomes with those of previously done standard studies as shown in the Table 1.

Our operative time, estimated blood loss was considerably lower when compared with other standard international studies. There was no conversion to open surgery; furthermore no major intraoperative or postoperative complications were noted.

Robotic radical hysterectomy: We have compared the results of our radical hysterectomies with those of other standard reported cases in literature. As shown in Table 2 our operative time, effective blood loss was less than that of others. Two cases of ureteric fistulas reported were during initial phase after acquiring the robot. As we got acquainted with these procedures our complication rates have also come down.

Table 3 below provides comparison of parameters between our laparoscopic cases with the robotic cases.

DISCUSSION

The advantages of robotic assistance include enhanced dexterity, improved 3-D vision, and more intuitive instrument.
The salient steps of our technique

a. Use of combined anaesthesia,

b. Ergonomic port positioning,

c. Use of myoma screw for traction,

d. Use of bipolar forceps medial to uterine stump,

e. Colpotomy at the level of uterosacral ligaments.

The standardization makes hysterectomy an easy procedure and can be mastered by many.

The main indication for Robotic surgery is stage IV endometriosis. All our patients had stage IV endometriosis and the rectum and ureter could be separated well due to the high magnification and the intuitive movements of the robot. It is proven that blood loss is less compared to laparoscopy in adnexectomy.[14] Robotic-assisted laparoscopic surgery promises to provide advantages in the management of women with severe endometriosis secondary to 3-dimensional visualization, decreasing surgeon’s fatigue and hand tremors and improving surgical precision.[15]

With the DaVinci system, the challenges of visibility with laparoscopy can be overcome as well as many other limitations of laparoscopy. Hence, the field of gynaecologic oncology has begun adopting the DaVinci system in performing oncological surgeries due to its shorter learning curve and ease of use.

Table 2: Comparison of our data of radical robotic hysterectomy with previously reported series

| Author       | Kim et al.[6] | Bogges et al.[7] | Nezhat et al.[8] | Lowe et al.[9] | Puntambekar et al.[10] |
|--------------|---------------|-----------------|-----------------|----------------|------------------------|
| Cases        | 10            | 51              | 13              | 42             | 37                     |
| Operative time (min) | 207          | 210             | 323             | 215            | 38 (95-300)            |
| Blood loss (ml)       | 200-450       | 96.5            | 157             | 50             | 50-100                 |
| Nodal yield         | 28            | 33.8            | 25              | 25             | 30 (18-38)             |
| Complications rate   | 10.0          | 7.8             | nk              | 16.8           | 7.4                    |

Table 3: Comparison of data of laparoscopic and robotic surgery

| Method | Blood loss (ml) | Time (min) | Lymph nodes (cm) | Vaginal margin (cm) | Paracervical clearance (cm) | Hospital stay (days) |
|--------|-----------------|------------|------------------|---------------------|-----------------------------|----------------------|
| Laparoscopic (10) | 150-500 | 65-120     | 18(14-30)        | 3.5+                | 3.5+                        | 3-6                  |
| Robotic       | 50-100         | 95-300     | 30(18-38)        | 2.5-3.8             | 3-3.5                       | 1-3                  |

Robotic ports allow surgery to be performed only in one region. Placement of robotic trocars has to be in such a way to prevent collision of robotic working arms and accessory ports. The accessory ports are used for retraction, for energy sources like ligasure or for applying clips. The preoperative planning helps in performing a smooth procedure as well as reducing the docking time. The docking time was previously 30 min which later reduced to 10 min because of standardization of ports, team gaining experience and getting acquainted with the system.

In 1989, laparoscopy was first used to perform a hysterectomy.[12] In 2002, the use of the DaVinci robot for hysterectomies was first reported.[13]

Payne and Dauterive[2] concluded that robotic hysterectomy was quicker and with less risk for abdominal conversion than standard laparoscopy.

We have an extensive experience in laparoscopic hysterectomies with which we have started doing Robotic hysterectomies. The patients with high body mass index and patients with narrow pelvis were preferred for robotic procedure. The time taken and blood loss was the same as in laparoscopy. No conversion to open or laparoscopy was needed. Standardization of procedure and proper training of the technique was necessary to prevent complications and for safe outcome.

The International Federation of Gynaecology and Obstetrics staging requires lymphadenectomy for assignment of stage, and morbid obesity is usually cited as the most common limiting factor for completing a satisfactory lymphadenectomy. The multi-centre Gynecologic Oncology Group Lap-2 trial with 1,696 laparoscopic cases reported a 23% conversion rate and a mean operative time of 3.3 hrs, indicating difficulty with a significant proportion of cases.[17]

Reasons for not adopting laparoscopic surgery often cited by surgeons are prolonged operating times, surgeon fatigue, a difficult and prolonged learning curve, and lack of formal training in advanced laparoscopic technique.
We have reported our experience of laparoscopic gynaec oncology procedures such as radical hysterectomy, anterior exenteration and total pelvic exenteration.\[18-20\] We described the “Pune technique” of laparoscopic radical hysterectomy. The same technique was adapted for robotic surgery also. We combined laparoscopic energy sources for safer and faster procedure. This is the “hybrid technique”. We had 2 ureteric fistulas. This was in the initial period. This may be because of excessive use of monopolar current. The oncological clearance of robotic surgery was comparable with that of laparoscopic outcome.

We reported the feasibility and oncological safety of laparoscopic anterior exenteration. Anterior exenteration is a complex procedure. We could achieve comparable results with robotic anterior exenteration. The use of hybrid technique and using bipolar energy near the ureters have prevented any further fistulas in subsequent patients. Blood loss and hospital stays were less in robotic than laparoscopy.\[21\] The two larger series from Boggess et al.,[7] and Lowe et al.,[9] show that there were no transfusions, length of stay was one day, and total complications were less than that usually associated with either open or laparoscopic approaches.

Our oncological results of robotic surgery are comparable with those of other authors.

CONCLUSION

Robotic surgery is safe in all types of gynaecological procedures. The results are comparable to those of laparoscopy. Robot helps to duplicate many procedures with exceptional laparoscopic skills.

This is the largest Indian experience of robotic surgery in gynaecological procedures.

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