21 Basics of Robotic Instrumentation and Robotic-Assisted Surgery for Endometrial Cancer

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Introduction

Carcinoma endometrium is a common genital cancer in women worldwide. Surgical management is the mainstay of initial treatment for majority of patients and comprehensive surgical staging guides in the postoperative adjuvant therapy. Minimally invasive surgery has gained acceptance for the surgical treatment of endometrial cancer as it is associated with fewer complications, shorter hospitalization, and faster recovery when compared with laparotomy [1–4]. Adoption of laparoscopic surgery for treatment of endometrial cancer has been slow, primarily because of a steep learning curve and limitations in obese women [5]. The benefits of robotic surgery as a minimally invasive surgical technique parallel those of traditional laparoscopy, with the added advantage of overcoming several barriers to the use of laparoscopy.

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Basics of Robot

The surgeon performs a surgery using a computer that remotely controls very small instruments attached to the robot. It allows surgeons to perform delicate operations by manipulating the robotic arms, which translate the surgeon's hand movements into smaller and smoother strokes. It has revolutionized the field of surgery by allowing the surgeon to perform less invasive and complex surgical procedures that was once possible only with open surgery. The robotic machine has three parts, namely, the surgeon console (Fig. 21.1), patient cart (Fig. 21.2), and optical cart. The surgeon console contains 3D monitor and joysticks which control the instruments. Patient cart has four arms for the instrument and camera. With changing technology, improved versions of the robot have better surgeon console and patient cart.

Robotic Technology

It enables the surgeon to be more precise, improve their technique, and enhance their capability in performing complex minimally invasive surgery.

1. Binocular stereoscopic 3D vision (Fig. 21.3) with stability of camera and 10× magnification.

   The robotic system also allows the surgeon to better visualize anatomy, which is especially

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Fig. 21.1 Surgeon console

Fig. 21.2 Patient cart

critical when working around delicate and confined structures like in the pelvis, chest, or abdomen. This allows surgeons to perform radical cancer surgeries with superior oncological outcome.

2. EndoWrist instrumentation technology (Fig. 21.4).

   It mimics the human hand in its flexible movement and also overcomes its limitations, like elimination of hand tremors. Despite the widespread use of laparoscopic surgery, adoption of laparoscopic techniques, for the most part, has been limited to a few routine procedures. This is due mostly to the limited capabilities of traditional laparoscopic technology, including standard video and rigid instruments. Surgeons have been slow to adopt to laparoscopy for complex procedures because they generally find fine-tissue manipulation such as dissecting and suturing to be more difficult (Table 21.1). Intuitive technology, however, enables the use of robot for complex procedures (Table 21.2). The robot allows for seven degrees of motion vs. the limited 4° of motion in laparoscopy. Robotic technology eliminates the fulcrum effect of laparoscopy (the robotic arms imitate the movements of the surgeon's hand).
3. Motion scaling and precision surgical movements improve the quality of surgery.
4. Extremely easy and allows fast suturing and knotting.
5. Multitasking instrumentation decreases operative time.
6. Surgeon sits and operates at ease which decreases fatigue, translating to safe surgery.

Surgical Technique

Preoperative Preparation

Patient takes clear liquids a day prior to surgery. On the night before the surgery, proctoclysis enema and two Dulcolax (bisacodyl) tablets are given per oral. We do not administer polyethylene glycol with electrolytes (Peglec) for bowel preparation as it causes dilatation of bowel.

Fig. 21.3 Binocular stereoscopic vision and camera

Fig. 21.4 EndoWrist instrumentation

Table 21.1 Disadvantages of laparoscopy

Steep learning curve
Limited dexterity
Counterintuitive motion
Two-dimensional field
Limited depth perception
Ergonomic difficulty

Table 21.2 Advantages of robotic technology

Binocular stereoscopic 3D vision
Stable high-definition camera with 10× magnification
EndoWrist instrumentation – increased dexterity
Extremely easy and fast suturing and knotting intracorporeally
Surgeons sit and operate at ease with arms rested
Multitasking instrumentations
Option of harmonic scalpel
Three arms in addition to the camera arm
Filters human tremor
Ergonomics with equal access with both left- and right-sided ports

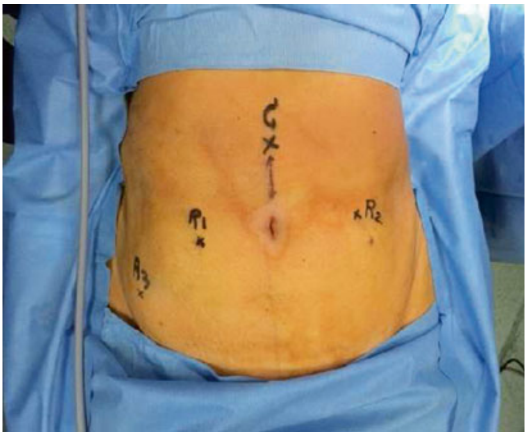

Fig. 21.5 Abdominal marking of port placement

Fig. 21.6 Port placement

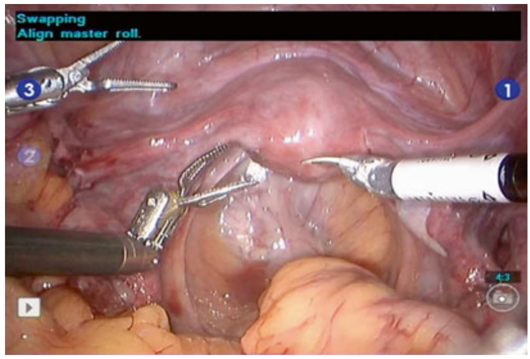

Fig. 21.7 Robotic instruments showing dexterity

Port Placement and Instrumentation

Port placement and instrumentation are shown in Figs. 21.5, 21.6, and 21.7, respectively. VCARE (Vaginal–Cervical Ahluwalia Retractor–Elevator) uterine manipulator is fixed to the cervix after placing the patient in lithotomy position. Intraoperatively, it helps in manipulating the uterus. A 12 mm camera port is placed 3 cm above the umbilicus in the midline with optical trocar. The rest of the ports are placed after insufflating the abdomen with gas and marking the port measurements. Arm one (8 mm) port is placed on the patient's right side, 3–5 cm below and at least 8 cm lateral to the camera port. Arm two (8 mm) port is placed on the patient's left side, 8 cm lateral and 3–5 cm below the level of the camera port. The third arm (8 mm) port is placed on the patient's right side, 2 cm above anterior superior iliac spine and 8 cm away from the first port. The assistant port (12 mm) is placed on the patient's left side, slightly cephalad to the camera port on an arc at the midpoint between the camera port and the instrument arm two port.

Zero degree scope is used for all the steps, except for para-aortic lymph node dissection where 30° down scope is used. In arm one, hot shears (monopolar curved scissors) are used; in arm two, fenestrated bipolar forceps; and in arm three, prograsp forceps.

Patient positioning is shown in Fig. 21.8, and docking of the patient cart is shown in Figs. 21.9 and 21.10.

After placing all the ports, the patient is positioned before docking the robot. Head end is lowered completely, and all the bowel loops are taken toward the upper abdomen. Pelvic wash is given, and fluid is taken for cytological examination.

Surgical Steps

Dissection is done in a circular fashion from one round ligament to the other.

Step 1: The uterus is retracted to the patient's left side with the help of the uterine

Fig. 21.8 Patient positioning: head end lowered to 45°

Fig. 21.9 Robot (patient cart) is docked

Fig. 21.10 Widely spaced arms after docking between legs

manipulator. Dissection starts with incising the peritoneum over infundibulopelvic triangle, isolating the ureter and ovarian pedicle. Then, the round ligament is transected near the inguinal ring with hot shear (monopolar diathermy). Incision is extended anteriorly into the anterior leaf of the broad ligament up to the lateral uterovesical junction. Coagulate and transect the right uterine pedicle and cardinal ligament. Careful attention to the course of the ureter at all times must be kept in mind.

Step 2: The urinary bladder is lifted up with the third arm, and the uterus is retroverted with the help of the uterine manipulator and second arm. The vesicouterine groove is identified, and the bladder is dissected away from the uterus, and adhesions if any are dissected with the cold knife (hot shear).

Step 3: Left side isolation of the ureter and dissection of the round ligament are done similar to Step 1. Both side ovarian pedicles are coagulated with bipolar diathermy but not divided until complete dissection is done.

Step 4: Posterior part dissection is done by separating the rectum from the uterus with the division of uterosacral ligaments on either side. The course of the ureter must be noted during this step.

Step 5: Anterior and posterior colpotomies are done by incising over the colpotomy ring. Finally, both the ovarian pedicles are divided. Specimen is delivered through the vagina by pulling out the uterine manipulator, and abdominal pneumatic pressure is maintained by packing the vagina with an adequate-sized mop inside a surgical hand glove.

Step 6: Bilateral pelvic lymphadenectomy (Figs. 21.11, 21.12, and 21.13) is done by exposing pararectal and paravesical spaces. A separate specimen bag is used for lymph nodes of either side, and specimen is delivered through the vagina. Para-aortic lymph node dissection is done when indicated. Vaginal cuff is closed with a 15 cm long self-retaining polydioxanone (monofilament, violet) barbed suture, and uterosacral ligaments are included laterally.

Fig. 21.11 Pelvic lymphadenectomy: distal boundary

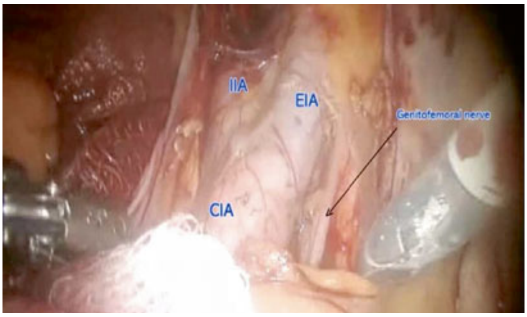

Fig. 21.12 Pelvic lymphadenectomy: lateral and proximal boundary

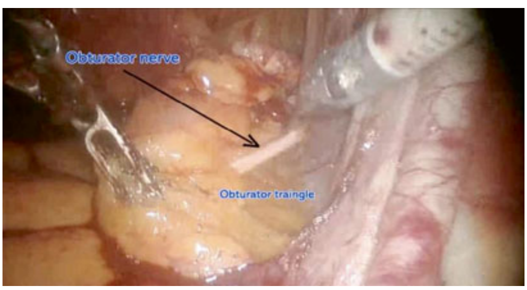

Fig. 21.13 Pelvic lymphadenectomy: inferior boundary

The role of systematic pelvic lymphadenectomy is an issue of current debate. Excision of suspicious or enlarged nodes is important to exclude metastasis. A more selective and tailored lymphadenectomy approach is now recommended to avoid systematic overtreatment [6]. No randomized trial data supports full lymphadenectomy [7] although some retrospective studies have suggested that it is beneficial [8]. A subset of patients may not benefit from lymphadenectomy, but it is difficult to preoperatively identify these patients because of the uncontrollable variable of change in grade and depth of invasion in final histopathology.

As the grade of the tumor increases, accuracy of intraoperative evaluation of myometrial invasion by gross examination decreases. Therefore, frozen section examination for evaluation of the histology, size of primary, grade, and depth of invasion is important. Pending further trials, pelvic lymphadenectomy is done in all patients. Para-aortic lymphadenectomy is indicated in high-risk patients. High-risk patients are with tumor size >2 cm, deep myometrial invasion, positive pelvic nodes, Grade 3 tumor, and high-risk (clear cell, papillary serous, squamous, or undifferentiated) histology.

Anatomical spaces in pelvic dissection:

1. Paravesical space
2. Pararectal space

Pelvic lymphadenectomy: anatomical boundaries

Distally – deep circumflex iliac vein
Proximally – common iliac vessels
Laterally – genitofemoral nerve
Inferiorly – obturator fossa

Para-aortic lymphadenectomy

Boundaries

Superiorly – renal vein
Inferiorly – common iliac vessels
Laterally – ureter

Efficacy of Laparoscopy

The Gynecologic Oncology Group (GOG) has completed a phase III randomized study (lamina-associated polypeptide (LAP) 2) comparing laparoscopy vs. laparotomy in endometrial cancer [9]. Patients with clinical stage I to IIA uterine cancer were randomly assigned to laparoscopy (n = 1,696) or open laparotomy (n = 920), including hysterectomy, salpingo-oophorectomy, pelvic cytology, and pelvic and para-aortic lymphadenectomy. Laparoscopy was initiated in 1,682 patients and completed without conversion in 1,248 patients (74.2 %). Conversion from laparoscopy to laparotomy was secondary to poor visibility in 14.6 %, metastatic cancer in 4.1 %, bleeding in 2.9 %, and other causes in 4.2 %. Laparoscopy had fewer moderate to severe postoperative adverse events than laparotomy (14 % vs. 21 %, respectively; P = .0001) but similar rates of intraoperative complications, despite having a significantly longer operative time (median, 204 vs. 130 min, respectively; P = .001). Hospitalization of more than 2 days was significantly lower in laparoscopy vs. laparotomy patients (52 % vs. 94 %, respectively; P = .0001). They concluded that laparoscopic surgical staging for uterine cancer is feasible and safe in terms of short-term outcomes and results in fewer complications and shorter hospital stay. Time to recurrence was the primary end point, with non-inferiority defined as a difference in recurrence rate of less than 5.3 % between the two groups at 3 years. The recurrence rate at 3 years was 10.24 % for patients in the laparotomy arm, compared with 11.39 % for patients in the laparoscopy arm, with an estimated difference between groups of 1.14 % (90 % lower bound, −1.278; 95 % upper bound, 3.996) [10]. Although this difference was lower than the prespecified limit, the statistical requirements for non-inferiority were not met because of a lower-than-expected number of recurrences in both groups. The estimated 5-year overall survival was almost identical in both arms at 89.8 %. These results, combined with previous findings from this study of improved QOL and decreased complications associated with laparoscopy, are reassuring to patients and allow surgeons to reasonably suggest this method as a means to surgically treat and stage patients with presumed early-stage endometrial cancers.

Another prospective randomized trial is ongoing at Australian and UK institutions. The Laparoscopic Approach to Cancer of the Endometrium (LACE) trial is anticipated to randomize 590 patients to total laparoscopic hysterectomy and lymph nodal staging vs. standard, open surgery [11].

Evidence for Robotic-Assisted Surgery

Obesity

Endometrial cancer is particularly suited for robotic surgery for several reasons. The majority of women with endometrial cancers are obese and at greater risk for postoperative wound complications and would benefit from a minimally invasive procedure with smaller incisions, resulting in less risk for wound breakdown. However, at the same time, obesity increases the degree of difficulty via laparoscopy to the extent that accomplishing the operation may be jeopardized. In a retrospective comparison of obese women and morbidly obese women undergoing traditional laparoscopic approach vs. robotic-assisted approach, better surgical outcomes were observed in the group undergoing robotic-assisted laparoscopy [12]. The group who underwent the procedure robotically had significantly shorter operating time, less blood loss, improved lymph node count, and shorter hospital stay suggesting that robotic-assisted laparoscopy greatly facilitates laparoscopic surgery in obese patients. In obese patients with greater abdominal surface area, adequate spacing between the ports and in turn clashing of the arms are seldom a problem.

Bernardini et al. [13] studied women with clinical stage I or II endometrial cancer and a BMI greater than 35 kg/m^2 treated with robotic surgery at their institution between November 2008 and November 2010 and compared the results with a historical cohort of similar patients who underwent laparotomy. A total of 86 women were analyzed in this study (robotic surgery, 45; laparotomy, 41). The overall intraoperative complication rate was 5.8 %. There was no statistical difference in age, number of comorbidities, BMI, prior abdominal surgery, and operative complications between the women who underwent robotic surgery and laparotomy. Postoperative complication rates were higher in the laparotomy group (44 % vs. 17.7 %; P = 0.007), and hospital length of stay was also higher in the laparotomy group (4 vs. 2 days; P G 0.001). There was no difference in rates of (pelvic) lymph node dissection; however, para-aortic node dissection was more common in the robotic surgery group.

Learning Curve

An analysis of robotic-assisted hysterectomy with lymphadenectomy vs. total laparoscopic hysterectomy with lymphadenectomy and laparotomy with total abdominal hysterectomy with lymphadenectomy was done by Lim PC et al. [14] Data was categorized by chronologic order of cases into groups of 20 patients each. The learning curve of the surgical procedure was estimated by measuring operative time with respect to the chronologic order of each patient who had undergone the respective procedure. Analysis of operative time for robotic-assisted hysterectomy with bilateral lymph node dissection with respect to the chronologic order of each group of 20 cases demonstrated a decrease in operative time: 183.2 (69) minutes (95 % CI, 153.0–213.4) for cases 1–20, 152.7 (39.8) minutes (95 % CI, 135.3–170.1) for cases 21–40, and 148.8 (36.7) minutes (95 % CI, 130.8–166.8) for cases 41–56. For the groups with laparoscopic hysterectomy with lymphadenectomy and traditional total abdominal hysterectomy with lymphadenectomy, there was no difference in operative time with respect to the chronologic group order of cases. It was concluded that the learning curve for robotic-assisted hysterectomy with lymph node dissection seems to be easier compared with that for laparoscopic hysterectomy with lymph node dissection for surgical management of endometrial cancer.

Survival Analysis

Retrospective study was conducted at two academic centers to compare the survival of women with endometrial cancer managed by robotic- and laparoscopic-assisted surgery [15].A total of 183 women had robotic- and 232 women had laparoscopic-assisted surgery. With a median follow-up of 38 months (range, 4–61 months) for the robotic and 58 months (range, 4–118 months) for the traditional laparoscopic group, there were no significant differences in survival (3-year survival 93.3 % and 93.6 %), DFS (3-year DFS 83.3 % and 88.4 %), and tumor recurrence (14.8 % and 12.1 %) for robotic and laparoscopic groups, respectively. Univariate and multivariate analysis showed that surgery is not an independent prognostic factor of survival. Robotic-assisted surgery yields equivalent oncologic outcomes when compared to traditional laparoscopic surgery for endometrial adenocarcinoma.

A retrospective chart review was performed for all consecutive endometrial adenocarcinoma patients surgically staged with robotic-assisted laparoscopy at the University of North Carolina Hospital from 2005 to 2010 [16]. Demographic data, 5-year survival, and recurrence-free intervals were analyzed. Assisted surgical staging was 85.2 % for stage IA, 80.2 % for stage IB, 69.8 % for stage II, and 69 % for stage III. Projected 5-year survival was 88.7 % for all patients included in the study. Nearly 82 % of cases were endometrioid adenocarcinoma, with papillary serous, clear cell, or mixed histology comprising 17.4 % of cases. Median follow-up time was 23 months, with a range of 0–80 months. Among stage IA, IB, II, and III patients, projected overall survival was 94.2 %, 85.9 %, 77.4 %, and 68.6 %, respectively. The results from this study demonstrate that robotic-assisted surgical staging for endometrial cancer does not adversely affect rates of recurrence or survival. These findings provide further evidence that robotic-assisted laparoscopic surgical staging is not associated with inferior results when compared to laparotomy or traditional laparoscopy.

Efficacy of Robotic Surgery

In our prospective randomized study [17] of 50 consecutive patients with carcinoma endometrium, estimated blood loss (81.28 ml), hospital stay (1.94 days), and perioperative complications were significantly less in robotic-assisted group in comparison to open method ($n=50$ patients, 25 in each arm). The mean number of lymph nodes removed was 30.6 versus 27.6 in open arm vs. robotic arm, which was statistically significant (P value, 0.071). Operative time decreased as the experience of the surgeon increased but remained higher than the open procedure after 25 robotic-assisted surgeries (mean operating time in robotic vs. open arm was 142.5 min and 117 min, respectively; P value <0.001). Mean hospital stay for open vs. robotic was 5.54 vs. 1.94 days with P value <0.001, and mean estimated blood loss for open vs. robotic was 234 ml vs. 81.28 ml (P value < 0.001 significant). All robotic surgeries were completed successfully without converting to open method. Robotic-assisted staging procedure for endometrial carcinoma is feasible without converting to open method, with the advantages of decreased blood loss, short duration of hospital stay, and less postoperative complications.

A cohort study [18] was performed by prospectively identifying all patients with clinical stage I or occult stage II endometrial cancer who underwent robotic hysterectomy and lymphadenectomy from 2006 to 2008 and retrospectively comparing data using the same surgeons' laparoscopic hysterectomy and lymphadenectomy cases from 1998 to 2005, prior to their robotic experience. Patient demographics, operative times, complications, conversion rates, pathologic results, and length of stay were analyzed. One hundred and eighty-one patients (105 robotic and 76 laparoscopic) met inclusion criteria. There was no significant difference between the two groups in median age, uterine weight, bilateral pelvic or aortic lymph node counts, or complication rates in patients whose surgeries were completed minimally invasively. Despite a higher BMI (34 vs. 29, P < 0.001), the estimated blood loss (100 vs. 250 mL, P < 0.001), transfusion rate (3 % vs. 18 %, RR 0.18, 95%CI 0.05–0.64, P = 0.002), laparotomy conversion rate (12 % vs. 26 %, RR 0.47, 95%CI 0.25–0.89, P = 0.017), and length of stay (median, 1 vs. 2 nights; P < 0.001) were lower in the robotic patients compared to the laparoscopic cohort. The odds ratio of conversion to laparotomy based on BMI for robotics compared to laparoscopy is 0.20 (95 % CI 0.08–0.56, P = 0.002). The mean skin to skin time (242 vs. 287 min, P < 0.001) and total operating room time (305 vs. 336 min, P < 0.001) were shorter for the robotic cohort. The study concluded that robotic hysterectomy and lymphadenectomy for endometrial carcinoma can be accomplished in heavier patients, in shorter operating times, and in lesser hospital stay. In addition, transfusion rates were lower with fewer conversions to laparotomy when compared to laparoscopic hysterectomy and lymphadenectomy.

Magrina JF et al. [19] did a prospective analysis of 67 patients undergoing robotic surgery for endometrial cancer between March 2004 and December 2007. Comparison was made with similar patients operated between November 1999 and December 2006 by laparoscopy (37 cases), laparotomy (99 cases), and vaginal/laparoscopy approach (vaginal hysterectomy, bilateral adnexectomy/laparoscopic lymphadenectomy) (47 cases) and matched by age, body mass index (BMI), histological type, and International Federation of Gynecology and Obstetrics (FIGO) staging. Mean operating times for patients undergoing robotic, laparoscopy, vaginal/laparoscopy, or laparotomy approach were 181.9, 189.5, 202.7, and 162.7 min, respectively (P = 0.006); mean blood loss was 141.4, 300.8, 300.0, and 472.6 ml, respectively (P < 0.001); mean number of nodes was 24.7, 27.1, 28.6, and 30.9, respectively (P = 0.008); mean length of hospital stay was 1.9, 3.4, 3.5, and 5.6 days, respectively (P < 0.001). There were no significant differences in intra- or postoperative complications among the four groups. The conversion rate was 2.9 % for robotics and 10.8 % for the laparoscopy group (0.001). There were no differences relative to recurrence rates among the four groups: 9 %, 14 %, 11 %, and 15 % for robotics, laparoscopy, vaginal/laparoscopy, and laparotomy, respectively. It was concluded that robotics, laparoscopy, and vaginal/laparoscopy techniques are preferable to laparotomy for suitable patients with endometrial cancer. Robotics is preferable to laparoscopy due to a shorter hospital stay and lower conversion rate and preferable to vaginal/laparoscopy due to a reduced hospitalization.

Ran L et al. recently reported a meta-analysis which included 22 studies [20]. These studies involved a total of 4,420 patients, 3,403 of whom underwent both robotic surgery and laparoscopy and 1,017 of whom underwent both robotic surgery and laparotomy. The estimated blood loss (P = 0.01) and number of conversions (P = 0.0008) were significantly lower, and the number of complications (P < 0.0001) was significantly higher in robotic surgery than in laparoscopy. The operating time (OT), length of hospital stay (LOHS), number of transfusions, and total lymph nodes harvested (TLNH) showed no significant differences between robotic surgery and laparoscopy. The number of complications ($P<0.00001$), LOHS ($P<0.00001$), EBL ($P<0.00001$), and number of transfusions ($P=0.03$) were significantly lower, and the OT time ($P<0.00001$) was significantly longer in robotic surgery than in laparotomy. The TLNH showed no significant difference between robotic surgery and laparotomy. The study concluded that robotic surgery is generally safer and more reliable than laparoscopy and laparotomy for patients with endometrial cancer. Robotic surgery is associated with significantly lower EBL than both laparoscopy and laparotomy, fewer conversions but more complications than laparoscopy, and shorter LOHS, fewer complications, and fewer transfusions but a longer OT time than laparoscopy.

Limitations of Robotic Surgery

Apart from the absence of level 1 evidence regarding robotic-assisted surgery for endometrial cancer, there are other limitations of robotic-assisted surgery to consider. These limitations can be categorized as physical limitations of the da Vinci system and cost considerations.

The limitations of robotic technology include: [21]

1. Additional surgical training
2. Increased costs and operating room time
3. Bulky devices
4. Instrumentation limitations (e.g., lack of a robotic suction and irrigation device, size, cost)
5. Lack of haptics (tactile feedback)
6. Risk of mechanical failure
7. Limited number of energy sources (i.e., less than with conventional laparoscopy)
8. Not designed for abdominal surgery involving more than two quadrants (the device needs to be re-docked and repositioned to operate in the quadrants it is not facing)

The development of the da Vinci Xi, with a longer reach and improved range, has in general enabled para-aortic lymph node dissection without much difficulty.

Robotic surgical systems are designed with features intended to minimize the potential effects of mechanical failures on patients [21]. Such features include system redundancy, the so-called "graceful" performance degradation or failure, fault tolerance, just-in-time maintenance, and system alerting. In simplified terms, there are several mechanical checks and balances built into current robotic surgical systems so that the risk of mechanical failure is minimized.

Also as a result of the robotic arms being limited in its ability to reach away or in the cephalad direction, the placements of the laparoscopic ports are typically higher in a patient than compared to traditional laparoscopy in order to have access to both the pelvis and the upper abdomen. These incisions, some of which are placed above the umbilicus, may be a cosmetic concern for some patients.

The absence of haptics or tactile feedback is also an important consideration in robotic-assisted surgery. Currently, there is no ability for the surgeon at the surgeon console to receive tactile feedback regarding the "firmness of tissue" or the degree of tension one is exerting on tissue as would be the case in an open laparotomy or traditional laparoscopy procedure in which the surgeon is actually touching the tissue or holding instruments that are in direct contact with the patient; however, most surgeons would agree that as one gains more experience with the robot, the surgeon is able to use visual cues which enable a "virtual" tactile feel.

Another limitation of the robot already discussed has been in the bulkiness of the arms of the robot holding the robotic instruments. These have a greater propensity to clash if not positioned with adequate spacing in between, a situation that sometimes cannot be avoided in small, petite patients, but is seldom a problem for most endometrial cancer patients. Truncal obesity resulting in a greater abdominal surface area ironically results in an advantage, overcoming this limitation for many patients with endometrial cancers. The recent-generation da Vinci Xi system which has a longer reach and thinner arms has improved many of the limitations discussed above.

Summary and Conclusion

Robotic-assisted surgery for endometrial cancer has brought in a new revolution in the technique of surgery. Laparoscopic method is established as a standard method with the landmark GOG LAP2 trial. Robotic surgery has overcome the deficiencies of laparoscopic method with comparable results. However, randomized trials are awaited. The only Indian study, randomized trial comparing robotic with open surgery for endometrial cancer [17], shows that robotic endometrial surgery and pelvic and high para-aortic lymphadenectomy are highly feasible and oncologically not inferior to gold standard open surgery and robotic surgery is superior, in terms of postoperative hospital stay, and has significantly less blood loss and better cosmetic outcome and shares all advantages and benefits of minimally invasive surgery. Larger multi-institutional multicentric similar studies are required.

Objectives in improving cancer treatment can be categorized as those that improve efficacy and those that lessen morbidity. Minimally invasive surgery seeks to decrease morbidity from surgery while maintaining at the very least equivalent efficacy. Robotic-assisted laparoscopic surgery has been able to further advance laparoscopy by greatly facilitating the learning curve, enabling surgeons to gain sufficient proficiency in cases that otherwise would have been problematic for mainstream surgeons.

Key Points

1. Binocular stereoscopic 3D vision with 10× magnification, EndoWrist instrumentation, and ergonomics have brought about a huge advantage in surgical technique.
2. Robotic technology has overcome major limitations of rigid laparoscopic instrumentation.
3. Head end is tilted down to 45°, and modified central docking is used.
4. The right hand handles two instruments namely monopolar diathermy and prograsper while the left hand uses one instrument, the fenestrated grasper with bipolar diathermy.
5. Identification and separation of the ureter in infundibulopelvic triangle is important before securing ovarian pedicle.
6. The urinary bladder is separated from the uterus and cervix, beyond uterine manipulator cup.
7. Para-aortic lymph node dissection can be done in the same docking position with 30° down camera and by placing the camera port higher than is done routinely, i.e., above the umbilicus.
8. Land mark GOG LAP2 trial has proved the efficacy of laparoscopy as the minimally invasive surgery in the management of carcinoma endometrium.
9. Many studies have proven the efficacy of robotic surgery; however, level 1efficacy data is awaited.

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