ORIGINAL RESEARCH

Minimally Invasive Sacrocolpopexy (Laparoscopic and Robotic): Its Outcomes and Complications—Our Experience

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Abstract

Introduction: The gold standard treatment for managing patients with pelvic organ prolapse (POP) is sacrocolpopexy. Initially, open sacrocolpopexy was adopted; however, over the years classic laparoscopic approach and its modifications in the form of single port laparoscopy, NOTES (vaginal-assisted laparoscopy) and robotic-assisted laparoscopic sacrocolpopexy (LSC) have emerged.

Usage of minimally invasive approaches has gained momentum in the recent past as they reduce the morbidity associated with open sacrocolpopexy, allowing faster recovery of the patient. Classic LSC has similar outcomes to abdominal sacrocolpopexy but is technically challenging especially due to the pelvic organ surgery offering limited area available for operating.

Overcoming these limitations, by the characteristic features of the robotic system such as a "simulated wrist" of the mechanical arm with its enhanced freedom of movement along with a three-dimensional field of view, has attracted significant interest in recent years for robotic sacrocolpopexy (RSC).

Aims: To evaluate outcomes and complications following minimally invasive sacrocolpopexy in patients with POP.

Materials and methods: We evaluated a total of 20 patients with POP, 15 of those underwent LSC and five patients underwent RSC. We assessed outcomes in both these groups in terms of operating times, blood loss, blood transfusion, surgery-related complications, total hospital stay, and recurrence rates at 1-year follow-up.

Results: Patients having RSC had a significantly lower rate of blood loss of ≤300 mL. Maximum postoperative complications were recorded as Clavien-Dindo grade I (seen in 75% of the patients). Most common among these were dysuria and urinary infection (seen in 40%). No Clavien-Dindo grade IVa, IVb, and V complications were recorded in either laparoscopic or robotic techniques conducted at our hospital. At 1 year of follow-up, no significant recurrence was seen in RSC (0%), while a low recurrence rate was seen in LSC (two patients, 13%).

Conclusion: Robotic technology provides some advantages as compared to classic laparoscopic surgery. However, both approaches appear to provide equivalent clinical outcomes. But the cost of utilizing and maintaining the robotic system appears to be significant. Hence LSC is the suitable method of treating POP, especially in a country like India. However large randomized trials comparing both techniques are warranted.

Keywords: Laparoscopic sacrocolpopexy, Pelvic organ prolapse, Robotic sacrocolpopexy.

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Introduction

Pelvic organ prolapse (POP) comprises a group of disorders including uterine prolapse as well as bulging of the anterior and posterior vaginal walls. Prolapse affects approximately 30% of middle-aged and older women to varying degrees, and 11–19% of these patients require surgical therapy.[1]

The abdominal sacrocolpopexy was once thought to be the gold standard treatment option in apical vaginal prolapse surgery. Minimally invasive procedures like laparoscopic and RSC reduce the morbidity associated with open surgery, allowing patients to recover faster and reducing the hospital stay. Laparoscopic sacrocolpopexy (LSC) is considered to be one of the most effective surgical treatments for POP treatment, with similar results to abdominal sacrocolpopexy but a significant learning curve due to the pelvic location offering limited area available for operating.[1,2]

Overcoming these limitations, by the characteristic features of the robotic technology such as a "simulated wrist" of the mechanical arm with its enhanced freedom of movement, improved dexterity along with a three-dimensional field of view, has attracted significant interest in recent years for RSC. The anterior longitudinal ligament on the pelvic surface of the S1 vertebral body is the usual site for suture fixation in LSC. The operative field for laparoscopic surgery in this area is extremely limited, especially if the pelvis is narrow, which might lead to damage to the presacral vascular

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plexus, resulting in excessive bleeding. The mesh can be accurately sutured onto the vagina with ease, and the robotic camera's three-dimensional imaging allows for close viewing of the vessels underlying the sacral promontory, perhaps resulting in improved vascular preservation and reduced blood loss.[2,3]

Materials and Methods

Inclusion Criteria

Patients undergoing sacrocolpopexy (robotic or laparoscopic) for POP, were included in this study. Outcomes included interventions performed during, immediately before, or within 24 hours before surgery only. Patients' hemoglobin was optimized well before surgery and blood transfusion due to blood loss during surgery was included in the postoperative period.

Exclusion Criteria

Patients adopting the open technique of sacrocolpopexy, bleeding disorders, uncontrolled diabetes, prior pelvic reconstruction surgeries, and patients unfit for general anesthesia or Trendelenburg were excluded.

Patients with POP were assessed preoperatively after obtaining complete history (including details of prior hysterectomy, or POP-related surgery) and clinical examination.

Surgical Technique

For LSC: Patient placed in dorsal lithotomy position and pressure points adequately padded and protected. Four to five laparoscopic ports were placed. Ten millimeters for the camera port just proximal to the umbilicus and 12 mm working port 6 cm lateral to the umbilical port and slightly caudal placed under direct vision. Five millimeters port on the left side, in the same line as the prior 12 mm port. Five millimeters assistant port (fourth port) just superior and medial to anterior superior iliac spine. Sometimes an additional 5 mm port on the left side in line with the fourth port may be used for traction. Colon is retracted superiorly. Dissection around the vault is completed using a laparoscopic harmonic device. Mesh is anchored to the vault in a double layer, Y-shaped pattern after adequate perennial pressure and superiorly fixed to the sacral promontory using tackers.

For RSC: Positioning of the patient is similar to laparoscopic technique except steep Trendelenburg is required for robotic docking. The positioning and placement of the ports are depicted in Figure 1. The first 12 mm camera port is 2 cm proximal to the umbilicus. Three 8 mm robotic ports were used. Eight millimeters port 8 cm lateral and slightly caudal to the camera port on the right and similar port inline on the left side. Final 8 mm port on the left inguinal region, 2 cm above and medial to the anterior superior iliac spine. Another 10 or 12 mm assistant port between the camera port and the 8 mm port on the right side maintains adequate triangulation preventing clashing of the arms during the procedure. Figure 2 shows the final position of the robotic console after docking onto the patient. The rest of the procedure of RSC is similar to the laparoscopic technique.

Outcomes of Interest

Outcomes of RSC and LSC were assessed under intraoperative, postoperative, and follow-up parameters as follows:

- Intraoperative observations included complications such as bladder/ureteral/bowel/vascular injury, blood loss (mL), and conversion to other approaches and operative time (minutes).

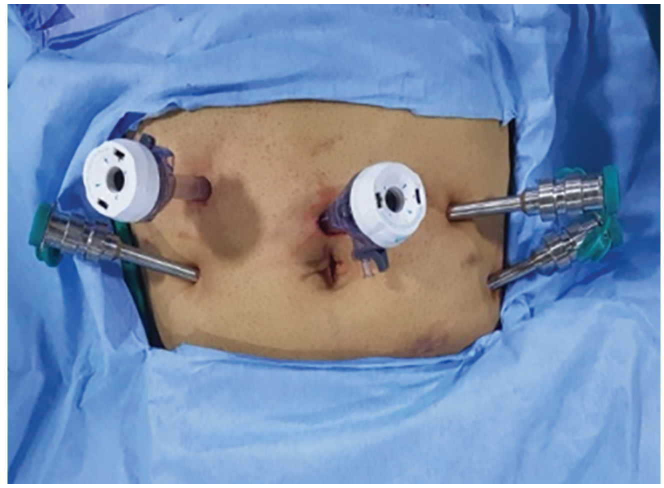

Fig. 1: Image depicting port placement in robotic sacrocolpopexy

Fig. 2: Image depicting the robotic da Vinci Si system after docking

- Postoperative observations such as the need for perioperative blood transfusion, all postoperative complications (the severity classified according to the Clavien-Dindo severity system), and length of hospital stay.[4]
- During follow-up at 1-year observations of patient symptoms including anorectal dysfunction, dyspareunia, mesh erosion, and recurrence rates were also assessed.

Recurrence is defined as POP ≥1 at 1 year of follow-up following LSC or RSC.

Results

Robotic sacrocolpopexy (RSC) demonstrated a mean blood loss of 280 mL whereas a mean of 506 mL was observed in LSC. Figure 3 shows the graphical representation of blood loss in RSC and LSC. The perioperative transfusion rate was 20% (three patients) in LSC but none of the RSC patients required blood transfusion. The higher percentage may be due to the small sample size. Risk factors predisposing to higher blood loss in these patients were due to prior laparotomy due to hysterectomy in two patients and due to prior PID which caused subsequent adhesion formation.

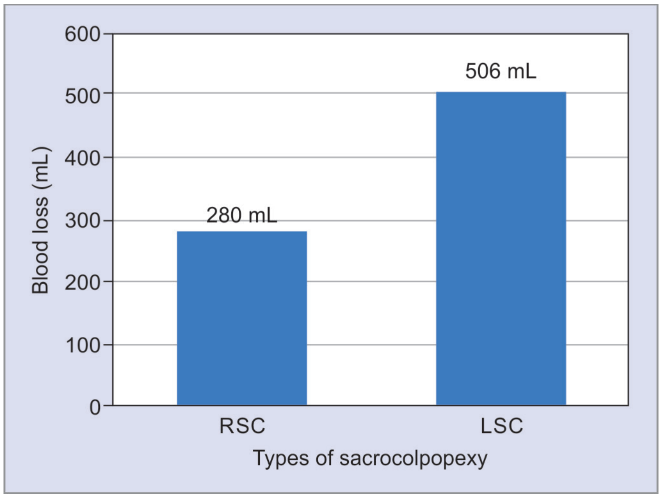

Fig. 3: Graph showing blood loss in mL

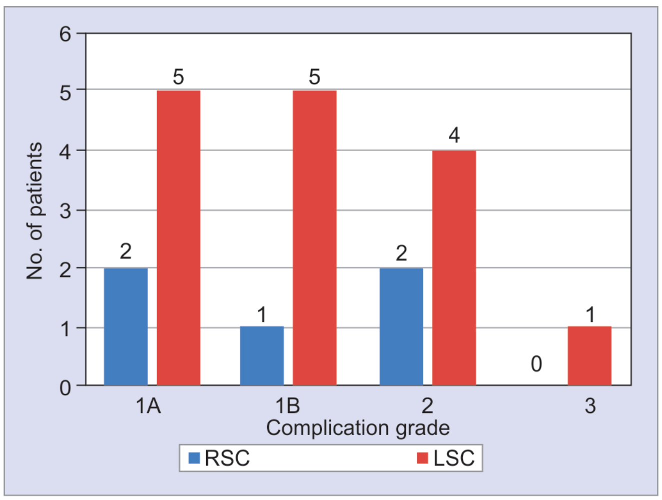

Fig. 4: Graph showing Clavien-Dindo complication grades in LSC and RSC

Mean operative time in RSC was 226 minutes as compared to 198 minutes in LSC. Slightly prolonged operative time in RSC can be correlated to the additional time required in docking of the robotic system and also additional procedures such as hysterectomy done in 40% (two patients).

In LSC, bladder injury (n = 2) was the most common intraoperative complication, followed by ureteral injury (n = 1), which was cautery related and managed conservatively (since the ureteral mucosa was uninvolved). However, no organ injury was observed in RSC patients.

No cases were converted to open.

In LSC postoperative complication as per Clavien-Dindo grading are: Clavien-Dindo grade I (11 patients, 75%), Clavien-Dindo grade II (three patients 15%), IIIa (one patient, 10%), while NO Clavien-Dindo grade IVa, IVb and V complications were recorded in our study.

In RSC, 80% (four patients) had Clavien-Dindo grade I complication and 20% (one patient) had Clavien-Dindo grade II complication.

Figure 4 shows the graphical representation of postoperative complications (Clavien-Dindo grading system).

Urinary dysfunction was the most frequent among the surgical complications observed (40%), followed by dysuria and urinary infection.

Prevalence of post-op ileus and wound infection/abscess was seen at 3% and 1% respectively.

All patients were discharged by post-op day 2 in RSC whereas patients who underwent LSC were discharged by an average of the fourth day.

At follow-up, 1-year after the surgery—No significant recurrence (POP ≥1) was observed in RSC (0%), while a minimal recurrence rate was seen in LSC (two patients, 13.3%).

Discussion

The "gold standard" for the treatment of patients presenting with POP is sacrocolpopexy.[5,6] Initially open sacrocolpopexy was adopted; however, over the years classic laparoscopic approach and its modifications in the form of single port laparoscopy, NOTES (vaginal-assisted laparoscopy) and robotic-assisted LSC have emerged.

Usage of minimally invasive approaches has gained momentum in the recent past as they reduce the morbidity associated with open sacrocolpopexy, allowing faster patient recovery.[7]

The pelvic surface of a body of the S1 vertebra of approximately 15 mm width is relatively safe for fixation of mess with tackers or mesh.[8] Anatomy of the pelvic region is complex, occupied by varied organs and their rich blood supply. Presacral veins appearing mesh-like are in close vicinity to the iliac vessels. And also sacrococcygeal curvature has concavity facing posteriorly, making it a "blind" area for laparoscopic surgery. Hence this area can be prone to venous injury. Resulting in torrential bleeding.[9,10]

Principal limitations of laparoscopic techniques are the two-dimensional vision, limited (set axes) degree of movements of the instruments, and limited area in the pelvis for dissection, making it pertinent for the laparoscopic surgeon to have high hand-eye co-ordination and long learning curve.

Overcoming these limitations and with the rise in usage of artificial intelligence, the usage of robotic technology has gained momentum. Specific advantages are the "simulated wrist" of the mechanical arm with its enhanced 7 degrees of freedom, improved dexterity along with a three-dimensional field of view, and ease of retraction with an additional arm (surgeon controlled) that overcomes the poor co-operation between the surgeon and the assistant.[11]

Three-dimensional view and depth perception, reduced fatigue, 90° articulation and shorter learning curve with maintained ergonomics are the additional features favoring its usage.[12]

We performed our surgeries using the da Vinci Si system of the robot.

Intraoperative injury and bleeding are the two of the key parameters which control the postoperative outcome and early recovery of the patient. Robotic sacrocolpopexy (RSC) demonstrated a mean blood loss of 280 mL whereas a mean of 506 mL was observed in LSC.

Significant reduction of bleeding and subsequent requirement of blood transfusion were the key factors gained in RSC. The perioperative transfusion rate was 20% (three patients) in LSC but none of the RSC patients required blood transfusion. The higher percentage may be due to the small sample size. Mean operative time in RSC was 226 minutes as compared to 198 minutes in LSC. Slightly prolonged operative time in RSC can be correlated to the additional time required to dock the robotic system (which adds an extra 15–20 minutes) and also additional procedures such as hysterectomy done in 40% (two patients). There was no conversion from minimally invasive (robotic or laparoscopic) to open surgery in our study group.[13]

Recurrence is defined as POP ≥1 at 1 year of follow-up following LSC or RSC. Both techniques had a high rate of cure and a low rate of recurrence. Hence, both the techniques were efficacious.

The inherent cost of utilizing and high maintenance are the principal disadvantages of the robotic surgery system preventing its widespread use for the majority of the patients especially, in developing countries like India. Many patients when counseled regarding the cost of the procedure still prefer to adopt laparoscopic techniques due to the cost. The study has the drawback of having a small sample size and more long-term follow-up can enable to identify the modest differences in surgical morbidity or long-term functional results.

Conclusion

Although the RSC appears to offer some advantages over traditional laparoscopic surgery, both methods tend to yield similar clinical outcomes. But the cost of utilizing the robotic system appears to be significant. Hence LSC is still the suitable method of treating POP in a developing country. In the future, large sample randomized trials comparing the two techniques are warranted to validate it for practical decision-making.

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