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REVIEW ARTICLE

Laparoscopic *vs* Robotic-assisted Sacrocolpopexy

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ABSTRACT

Background: Laparoscopic sacrocolpopexy has been in vogue since 1993. Robotic technique has started only since 2004.[1] In this article both the techniques are reviewed and an attempt is made to discuss the advantages of each.

Objective: Initially, a description of the procedure is given. Then, the article will review the recent published studies on the procedure, patient selection, intraoperative complications, postoperative complications, recovery, postoperative pain, quality of life and economic aspect of sacrocolpopexy performed laparoscopically and robotic assisted and discuss the merits of each.

Materials and methods: Literature review conducted from Google, PubMed, Springer Link, Highwire Press, da Vinci surgery community.

Conclusion: The minimal access approach offers reduced morbidity, shorter hospitalization, and decreased postoperative pain. The disadvantages of the laparoscopic approach compared to open include longer operating time and need for advanced laparoscopic surgical skills including suturing. Robot-assisted laparoscopic procedure allows the performance of complex laparoscopic maneuvers with less ergonomic difficulty, and thereby simplifies the complex procedure but is currently expensive.

Keywords: Sacrocolpopexy, Laparoscopic sacrocolpopexy, Robotic-assisted sacrocolpopexy.

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INTRODUCTION

Increasing life span of the world population in general is supposed to increase the incidence of pelvic organ prolapse. Currently the incidence of uterocervical prolapse is 11 to 14%[2] and the incidence of vault prolapse is estimated to be 1.3 for every 1,000 women.

Symptoms

1. Seeing or feeling bulge or protrusion
2. Pressure, heaviness
3. Urinary incontinence, frequency and urgency: Manual reduction of prolapsed required to start or complete voiding.
4. Bowel symptoms: Incontinence, feeling of incomplete emptying, straining, digital evacuation, splinting.
5. Sexual symptoms: Dyspareunia, lack of sensation.[3]

Aim of the sacrocolpopexy procedure is to restore the vagina to the normal anatomical location where it lies over the levator plate with the apex above the ischial promontory and axis pointing toward the sacrum. Apex of the vagina or cervix is attached to the anterior longitudinal ligament of the sacral promontory with a prolene mesh.

Preoperative considerations include demonstration of the prolapse with magnetic resonance imaging (MRI) colpocytogram in resting as well as straining position, urodynamic studies where indicated, general evaluation of morbidity factors considering the advanced age group of the patients, cardiovascular stability as long operative time and steep Trendelenburg position is required.

X-ray of the sacral promontory is indicated by some surgeons.

Laparoscopic Technique

Patient is placed in Trendelenburg position. Four ports are taken. The general abdominal cavity is explored. Adhesiolysis is performed as required. If uterus is to be removed, it is done first by total or subtotal as decided. Advantage of subtotal hysterectomy[4] is that the cervix acts as an anchor for the mesh but of course the woman is instructed on the need to go for regular pap screening.

If the procedure is done laparoscopically, in a patient with intact uterus, it is pushed up with an elevator and the peritoneal fold of the bladder is dissected from the anterior wall of the uterus. This causes the ureters to go below and thereby avoids injury. Then a paracervical buttonhole window is made by opening the anterior layer of the broad ligament and following it the posterior. This completes the anterior dissection.

Posteriorly, the peritoneum between the uterosacrals is held and cut. The incision is extended over the peritoneum of the uterosacrals to join the window made in the broad ligament. The peritoneum of the sacral promontory is cut on the right side to the rectum and the anterior longitudinal ligament is exposed.

A Y-shaped prolene mesh is taken.[5] Preformed mesh is not necessary. A 20 by 3 cm mesh is taken and cut in Y-shape such that the long limb is 10 cm and both curved limbs 10 cm. The cervix is encircled with the curve of the Y and sutures are placed attaching it to the anterior vagina. Anterior peritoneum is closed.

Posteriorly, the end of the vertical limb is sutured to the uterosacrals and posterior layer of the cervix. The first suture is taken through the uterosacrals and mesh to lift the enterocele and attached to the vagina. The vertical limb is folded into the shape of a U and sutured to posterior cervix. Now, the suture is passed through the loop of the U or bite is taken and attached to the anterior longitudinal ligament. The uterus is kept elevated during this step. It is checked that the round ligaments are horizontal. This ensures the uterus is pulled up just adequate. Peritoneum is closed. No. 1 Dacron or PTFE has high strength and is used for the procedure. Drain is placed.

Vault Prolapse

When the procedure is done for vault prolapse, Y-shaped mesh is not required. Instead, 2 long strips are taken. Here, dissection is begun by incising the peritoneum over the sacral promontory. Then anterior dissection is started. A ribbon retractor placed in the vagina and pushed up facilitates the separation of bladder.

Posterior cul-de-sac is separated on either side of the rectum. Pararectal dissection is carried out till the ischiorectal pad of fat is crossed and the levator ani is reached.

Posteriorly, the mesh is sutured to either side of the levator ani fascia and vaginal fascia. Middle of the mesh is sutured to the uterosacrals. The other end is sutured to the anterior longitudinal ligament. Redundant mesh is cut. Anteriorly, bladder is separated and bites are taken on the vaginal fascia and the mesh. Then both parts are sutured with three knots on either side with Dacron or silk. Partial reperitonization is done.

If the procedure includes a vaginal assisted hysterectomy, a sagittal posterior colpotomy incision is given and the specimen is removed. Culdotomy is closed and further surgery proceeds.

Robotic-assisted Laparoscopic Sacrocolpopexy

Patient is placed in lithotomy position. The shoulders are padded and the patient is secured.

Laparoscopic instrument ports are then placed in the abdomen. Veress needle is placed supraumbilically. A 12 mm camera is placed following intraperitoneal insufflation. Two 8 mm, robotic instrument ports are placed approximately one handbreadth away from the camera port to prevent collision between robotic arms. A third 8 mm robotic instrument port is placed inferiorly and far to the left to be used by the fourth arm for retraction, if needed. A 12 mm port is placed inferiorly and on the far right near the iliac crest to be used by the assistant surgeon.

The robot is docked between the patient's legs or side-docking is done to facilitate vaginal manipulation.[6]

The technique is almost similar to lap surgery. Tacker may or may not be needed.

DISCUSSION

According to the study results tabulated (Table 1) by Jason P Gilleran, the overall rates of success for the lap procedure range from 75 to 98% with follow-up mostly around 1 year. The success rates of RSC are comparable to LSC in short-term follow-up.[25]

The lowest time required to complete the procedure was 97 *vs* 186 minutes in the study. Study by Paraiso et al showed the time taken as 199 *vs* 265 minutes.[26]

Suturing is aided by the robot whereas handling suturing in the region of sacral promontory is difficult ergonomically and a tracker is preferred in LSC.

Olgaraam et al say that quicker recovery time is associated with minimally invasive procedures. Level III data suggest that early outcomes of robotic sacrocolpopexy are similar to those of open sacrocolpopexy. A single randomized trial has provided level I evidence that robotic and laparoscopic approaches to sacrocolpopexy have similar short-term anatomic outcomes, although operating times, postoperative pain and cost are increased with robotics.[6]

Improved visualization and dexterity is afforded by the robot and may decrease learning curves associated with conventional laparoscopy, leading to broader adoption of minimally invasive techniques. Likewise, robotic surgery has several unique limitations not encountered in laparoscopic or open surgery. Surgeons do not get haptic feedback or sensation when operating robotically; therefore, visual changes in tissue blanching and movement must be used to compensate for tactile differences in tissues and structures.

Patient satisfaction and long-term outcomes of both robotic and laparoscopic sacrocolpopexy are insufficiently studied. Existing studies rarely report outcomes beyond 1 year after prolapse surgery and are limited by retrospective study designs, small sample sizes, inconsistent nomenclature, nonstandardized prolapse quantification, lack of masking, and lack of validated symptom and quality-of-life measures. The cost per procedure was $8.508 for robotic, $7.353 for laparoscopic, and $5.792 for open sacrocolpopexy (Table 2).

Patient selection was comparable in both the procedures but RSC included women with more severe condition in few studies.[27,28]

According to the Table 3 data we can say that robotic surgery offers the advantage less blood loss, fewer complications but is more expensive and takes longer.

From Table 3 we can say that disadvantages of the robot include its clinical limitations, not being cost-effective at present, increased operating time and being redundant where precise dissection is not required.

Table 1: Outcomes: laparoscopic and robotic mesh sacrocolpopexy series

Author (year)	*Mean age (years)*	*Mean OT (min)*	*Mean LOS (days)*	*Mean follow-up (months)*	*Success rate*	*Definition of success*	*Complications/notes*
Laparoscopic sacrocolpopexy							
Akladios et al (2010)[7] (n = 48)	56 (36-78)	237	4 (3-15)	16	96%	No recurrent prolapse	33 supracervical hysterectomy, 3 transobturator slings, 4.1% complication rate
Antiphon et al (2004)[8] (n = 108)	59 (36-79)	261 ± 79	7 (2-32)	17	75%	POP ≥ grade 2	2.8% complication rate, comparison of 33 anterior only *vs* 71 ant/post, concomitant SUI surgery 74.1%
Claerhout et al (2009)[9] (n = 132)	65 ± 10	180	5.7	13	78% (2% apical)	POP-Q ≥ – 1 any point	18% posterior failure, 11% complication rate (6 mesh erosions), Q follow-up in multiple domains
Cosson et al (2002)[10] (n = 77)	47 (28-66)	276	3.5 (2-7)	11	94%	No recurrent prolapse	Burch in 74, SCH in 60, 7.2% conversion rate, 5% complication rate
Gadonneix et al (2004)[11] (n = 46)	59 (41-76)	171 ± 37	4.0 ± 2.1	??	83%	No recurrence ≥ grade 2	Bladder injury 7%, mesh erosion 2%, recurrent rectocele in 12%
Granese et al (2009)[12] (n = 165)	67 (58-76)	NR	3 (2-7)	43	95%	No recurrent vaginal vault prolapse	Vyprol (absorbable) mesh used early but abandoned due to early recurrence in 3 patients
Klauschie et al (2009)[13] (n = 43)	60	183	1.5	7	100%	No apical prolapse	Bladder injury 7%, no other difference between open and LSC, 14% of LSC underwent second POP repair
Marcickiewicz et al (2007)[14] (n = 60)	58 (30-83)	129	4 (2-21)	34 (13-60)	78% subjective 75% objective	Reoperation for prolapse	Compared vaginal sacrospinous fixation with LSC, most reoperations for cystocele or SUI
Rivoire et al (2007)[15] (n = 138)	60 ± 9.5	191 ± 50	5	34	88%	No recurrence >grade 2	Vaginal mesh erosion in 5, 46% with postop SUI, 2% required emergent reoperation
Ross and Preston (2005)[16] (n = 43)	67 (41-83)	96 ± 42	NR	NR* (all have 5-year follow-up)	93%	No recurrent prolapse	Complication 8% (mesh erosion), posterior mesh tacked to perineum
Rozet et al (2005)[17] (n = 363)	63 (35-78)	97	4 (2-7)	15	96%	Anatomic cure	Conversion to open in 2%, mesh erosion 0.9%, *de novo* UUI in 19 patients
Sarlos et al (2008)[18] (n = 101)	62 (36-81)	141	4.6 (2-8)	12	92% objective 98% subjective	Stage 0 in all compartments on POP-Q	No mesh erosion, 3 rectal injuries, 2 bladder injuries, 2 converted to open
Sundaram et al (2004)[19] (n = 10)	61 (43-83)	196	2 (1.5-3)	16	90%	Not defined	Gore-Tex patch used and not polypropylene mesh; mostly describe technique
Robotic sacrocolpopexy							
Akl et al (2009)[20] (n = 80)	67 ± 8.3	198	2.6	5	97%	No recurrent prolapse	Mesh erosion in 6%, conversion to open in 5%
Daneshgari et al (2007)[21] (n = 12)	64 (50-79)	317	2.4 (1-7)	3	100%	POP-Q scores	Mean C point + 2.1 (pre-) and – 8.3 (postop); 3/15 open conversion
Elliott et al (2006)[22] (n = 30)	67 (47-83)	186	1 (1-2)	24	95%	Not defined	Open conversion in 1, mesh extrusion in 2, recurrent rectocele in 1, apical prolapse in 1
Geller et al (2008)[23] (n = 73)	60	328 ± 55	1.3	NR	NR	POP-Q scores	Mean C point – 9 for RASC *vs* – 8 for open
Kramer et al (2009)[24] (n = 21)	66 (52-86)	194	1.1	25	95%	No apical prolapse	Apical support only; 12/21 underwent secondary repair of cystocele or rectocele

OT: Operative time; LOS: Length of stay; NR: Not reported; LSC: Laparoscopic sacrocolpopexy; SCH: Supracervical hysterectomy; SUI: Stress urinary incontinence[25]

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Table 2: Comparison between laparoscopic and robotic sacrocolpopexy[26]

	Laparoscopic (n = 47)	*Robotic (n = 20)*	*p-value*
Total operating time (min)	199 ± 47	265 ± 50	<0.001
Operative time (min)	231 ± 69	128 ± 48	<0.001
Mean blood loss (ml)	280	55	0.03
Mean duration of catheter (days)	3.1 ± 1.6	2.5 ± 1.8	0.03
Sacrocolpopexy time (min)	162 ± 47	227 ± 47	<0.001
Hospital stay (h)	34 ± 11	43 ± 37	0.17
Mean cost ($)	*$14,342 ± 2,941	$16,278 ± 3,326	0.008
Operating room cost ($)	Mean difference: +$1,667	—	0.008
Postop complications (Clavien classification)			
Grade I	10	4	0.3
Grade II	5	1	0.3
Grade IIIA	—	—	—
Grade IIIB	3	1	0.7

Table 3: Comparing both techniques in terms of general principles

Robotic surgery	*Laparoscopic surgery*
Three-dimensional vision	Two-dimensional vision
Motion scaling	Not possible
Wrist articulation	Limited range of movement
Fluid movement	Rigid movement
Tremor filter	Tremor is magnified
Remote sensing technology	Abdominal wall is the fulcrum
Ergonomically intuitive	Comparatively poor ergonomics
Multiple instrument ejection system	Not possible
Haptic feedback	Limited tactile feedback
Telesurgery and teleproctoring	Not possible
Small learning curve	Long curve
25 times magnification at 10 cm	10 times magnification
Expensive	Comparatively costs less

CONCLUSION

It can be said that laparoscopic as well as robotic-assisted sacrocolpopexy are close to each other in efficacy and robot can offer more comfort with ergonomics. ln the recent years lot of work is going on in the field of robotics. Robotic technique has certain definite advantages and is not just a fancy. Being a new technology and that too heavily machine dependent, the costs are understandable. As with all technical aspects, higher availability and future work may bring down the costs.

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