Award for New Investigators

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SACROCOLPOPEXY TRAINING: AN INTERNATIONAL NEED

Hypothesis / aims of study

Abdominal sacrocolpopexy has been found in systematic reviews to be the gold standard for correction of apical prolapse in women, with superior anatomic outcomes compared to transvaginal native tissue and transvaginal mesh procedures [1]. Compared to open sacrocolpopexy, minimally invasive techniques reduce morbidity while preserving efficacy. However, training in advanced, robotic-assisted sacrocolpopexy (RASC) has been associated with prolonged operative times during learning curves [2]. Longer operative time is a risk factor for perioperative complications after gynecologic surgery, as in other fields [3]. Surgical training must therefore balance the competing interests of providing adequate trainee experience for mastery of essential skills and maintaining appropriate operative times to ensure optimal patient care and safety. Robotic training pathways utilizing a step-specific approach have been described in other surgical fields, but no such pathway has previously been introduced for RASC. In an endeavor to formalize the balance between teaching and safety, we implemented a novel, structured fellow training pathway for RASC. The aim of this study was to compare step-specific and total operative times for RASC performed by Female Pelvic Medicine and Reconstructive Surgery (FPMRS) attendings to those performed by FPMRS fellows using this educational surgical innovation.

Study design, materials and methods

An Institution Review Board-approved protocol was implemented at two institutions at the time of robotics program initiation to track consecutive RASC between 2012-2016. At one institution, RASC were performed by Female Pelvic Medicine and Reconstructive Surgery (FPMRS) attendings (N=2); at the other, a training institution, RASC were performed by attendings (N=4) with or without FPMRS fellows (N=5). All attendings were experienced in laparoscopic sacrocolpopexy and RASC technique was standardized between institutions. The training institution implemented a novel robotic fellow education pathway consisting of 4 phases: (1) online and in-person da Vinci® system training, videos, and online assessment (approximately 7 hours), (2) demonstration of proficiency in 22 simulation modules, (3) observation of 3 RASC procedures, and (4) demonstration of console proficiency in the operating room. During console training, the fellow must demonstrate safe and efficient performance of each of five RASC steps: (1) hysterectomy, (2) vaginal dissection, (3) presacral dissection, (4) mesh attachment to vagina, and (5) mesh attachment to sacrum and reperitonealization. The fellow is allotted a maximum time of 20% greater than the established average attending time for each step, after which the attending assumes the primary surgeon role to complete that step. The fellow may then resume the console position for subsequent steps, depending on skill level and year of training. Similarly, if a complication occurs, the fellow is allowed to continue operating if appropriate for skill level; if not, the attending takes over the console position until the complication has been managed, after which the fellow resumes operating. We recorded total procedure time (incision to close), sacrocolpopexy time (start of anterior dissection to completion of reperitonealization), and times for six specific RASC steps: port placement, robot docking, robotic hysterectomy, vaginal dissection, sacral dissection, and mesh attachment. Fellows were designated F1-F3 according to year of training in 3-year FPMRS training program. We utilized independent samples t-tests and analysis of variance (ANOVA) with Bonferroni post-hoc analysis to compare operative times by fellow involvement and fellow year of training. Results are presented as mean ± standard deviation.

Results

Operative times were recorded for 296/299 (99%) of the 299 RASC procedures during the study period; 201 included robotic hysterectomy (179/201, 89% supracervical). Table 1 displays the total procedure times and average time per specific RASC step. Fellow operative participation (N=57) slightly increased total procedure time (215.4 ± 51.8 versus 195.0 ± 54.7 minutes, P=0.01); three specific steps were associated with increased time: hysterectomy (40.0 ± 23.7 versus 30.5 ± 19.1 minutes, P=0.01), vaginal dissection (22.0 ± 11.6 versus 17.3 ± 15.7 minutes, P=0.03), and sacral dissection (19.0 ± 12.1 versus 12.3 ± 10.3 minutes, P<0.001). The proportion of operative participation increased with each year of fellowship: F1: 60%, F2: 60-100%, and F3: 100%. Total procedure time was longest in F2 year (F1: 218.0 ± 56.5 minutes, F2: 238.5 ± 48.1 minutes, F3: 191.1 ± 41.2 minutes, P=0.01). F3 fellows achieved similar total procedure times to attendings (191.1 ± 41.2 versus 195.0 ± 54.7 minutes, P=0.75).

Interpretation of results

Fellow participation in RASC led to small but acceptable increases in operative time for total RASC procedure and several individual steps. F1 fellows perform only portions of the RASC procedure; by F3 year, fellows are able to perform the entire RASC procedure with efficiency similar to attendings. By the end of F2 year, fellows reach a proficiency level within the structured training curriculum that allows them to perform the entire RASC procedure, but they still have not optimized their surgical efficiency. This explains the observation that F2 total procedure times were the longest of the three fellowship years. Strengths of our study include prospective design, description and implementation of a novel training program for RASC, and detailed step-specific collection of operative times. Limitations include lack of comparison data on trainee operative times prior to implementation of structured training.

Concluding message

This robotic surgical training program provides safe time limitations for total and step-specific procedural times during fellowship education in sacrocolpopexy using the robotic-assisted approach, while still maximizing fellow participation and learning. This novel approach to surgical education warrants further development and study to determine its potential contribution to quality improvement and patient safety in the teaching environment.

Table. Comparison of operative times (average minutes ± standard deviation) for each step of robotic-assisted laparoscopic sacrocolpopexy (RASC) procedure by Female Pelvic Medicine and Reconstructive Surgery (FPMRS) fellow involvement and year of fellowship training.

Step of Procedure	**No fellows** ***N=239***	**Fellows** ***N=57***	***P* value***	**F1†** ***N=18***	**F2†** ***N=19***	**F3†** ***N=20***	***P* value***
Total procedure§	195.0 ± 54.7	215.4 ± 51.8	**0.01**	218.0 ± 56.5	238.5 ± 48.1	191.1 ± 41.2	**0.01** for Year 2 vs. 3
Sacrocolpopexy¶	101.2 ± 37.3	127.0 ± 30.1	**<0.001**	127.0 ± 27.4	131.8 ± 35.4	122.5 ± 27.6	0.63
Port placement	11.6 ± 7.2	11.0 ± 6.7	0.58	10.9 ± 4.5	13.4 ± 9.2	8.9 ± 4.7	0.10
Robotic docking	7.7 ± 6.3	7.4 ± 7.9	0.74	6.8 ± 1.7	9.3 ± 13.4	6.2 ± 2.7	0.43
Hysterectomy# (N=201)	30.5 ± 19.1	40.0 ± 23.7	**0.01**	41.9 ± 18.2	45.3 ± 32.8	32.1 ± 6.4	0.35
Vaginal dissection	17.3 ± 15.7	22.0 ± 11.6	**0.03**	24.7 ± 13.0	20.5 ± 10.4	20.9 ± 11.6	0.49
Sacral dissection	12.3 ± 10.3	19.0 ± 12.1	**<0.001**	18.4 ± 16.2	19.1 ± 9.0	19.3 ± 11.2	0.97
Mesh attachment	33.5 ± 19.4	38.7 ± 17.6	0.07	46.1 ± 25.3	39.3 ± 12.6	31.5 ± 9.1	**0.03** for Year 1 vs. 3

*Comparisons performed with independent samples t-test and analysis of variance (ANOVA) with post-hoc Bonferroni correction. ANOVA *P* values are presented without correction unless statistically significant, and then values significant after Bonferroni correction are presented.

†F1-F3: FPMRS Fellow Year 1, 2, 3.

§Total procedure time (incision to closure).

¶Sacrocolpopexy time (beginning of anterior dissection to completion of reperitonealization).

#Robotic-assisted hysterectomy, majority supracervical (179/201, 89%).

References

1. Maher C, Feiner B, Baessler K, et al. Surgical management of pelvic organ prolapse in women. Cochrane Database Syst Rev. 2013;4:CD004014.
2. Akl MN, Long JB, Giles DL, et al. Robotic-assisted sacrocolpopexy: technique and learning curve. Surg Endosc. 2009;23(10):2390-94
3. Catanzarite T, Saha S, Pilecki MA, et al. Longer operative time during benign laparoscopic and robotic hysterectomy is associated with increased 30-day periperative complications. J Minim Invasive Gynecol. 2015;22(6):1049-58.

Disclosures

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