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Research

Number of Cases to Achieve Mastery and Proficiency in Robotic Surgery Among Generalist and Subspecialist Gynecologists

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Abstract

Objective

To determine the case volume required to subjectively state proficiency and mastery of robotic surgery skills based on practice type among generalist and subspecialist gynecologic surgeons.

Study Design

After IRB approval, 2189 gynecologic surgeons who completed wet lab training for the DaVinci Surgical System (Intuitive Surgical Inc Sunnyvale, CA) were contacted using Survey Monkey® (Palo Alto, CA). Respondents were asked their opinions regarding robotic surgery, including the number of cases subjectively required to be 'proficient' (i.e. basic safety and surgical fundamentals) and 'master'(i.e. advanced surgical skills and confidence) robotic surgery. De-identified responses were compiled and categorical data compared using the chi-squared test regarding demographics, training, level of comfort, and opinions on robotic surgery.

Results

Of 2189 subjects contacted, 303 (14%) completed the survey. Respondents were mostly generalists in private practice 160 (53%) and subspecialists in academic practice 137 (45%). Among all respondents, the median number of robotic surgery cases performed was 25. Although not statistically significant, generalists reported requiring fewer cases to feel proficient in robotic surgery (median 6 cases for generalists and 10 cases for subspecialists). When divided by subspecialty type, minimally invasive surgery (MIS) and reproductive endocrinology, and infertility (REI) specialists reported fewer cases required for proficiency (6 MIS, 7.5 REI) while urogynecologists (Urogyn) and gynecologic oncologists (GynOnc) reported a median of 10 cases. When asked the number of cases to master robotic surgery, the median among all respondents was 20 cases. However, when separated by specialty, generalists believed a median of 14.5 cases was sufficient for mastery while subspecialists believed a median of 20 cases was needed. When further divided by specialty type, REI required the least number of cases and GynOnc the most cases to feel that they had mastered robotic surgery.

Conclusion

Subspecialists tended to require a greater number of cases than generalists to achieve both proficiency and mastery of robotic surgery. This discrepancy may be explained by the types of cases being performed by the different specialties (i.e. simple hysterectomy versus sacrocolpopexy versus tumor debulking and staging) as well as prior comfort with laparoscopic surgery (i.e. MIS and REI). Based on our findings, surgeons may be able to

determine if their personal acquisition of robotic skills is consistent with their peers based on practice type.

IQR (interquartile range) difference between 75th and 25th percentiles

Key Words: Robotic surgery; Surgical training; Robotics; Learning curve.

Introduction

Robotic surgery has been introduced to the field of minimally invasive surgery in the hopes of expanding the range of care surgeons can offer their patients through advanced laparoscopic procedures. With increasing interest in the prospective advantages offered by robotic surgery, numerous surgeons from a variety of fields have acquired these surgical skills, necessitating evaluation of the learning curve and educational strategies in mastering this surgical method.

Research is lacking, however, in the realm of robotic surgical training. For example, only 59% of European fellows training in gynecologic oncology recently reported some access to training opportunities in robotic surgery [1]. The recent GRACES program from Singapore reviewed their first 40 robotic gynecologic cases performed and studied docking and console times. The program concluded a robotics learning curve is most successful with first utilizing a dry docking lab, progression to simpler live cases such as myomectomies, and then credentialing and maintaining excellence in mastery over time. Other recommendations made to shorten learning curve included: maintaining operative and surgical staff proficient at robotic surgery, obtaining ideal patient positioning early in the case, identifying the robotic and vaginal instrumentation that work best for the surgeon's patient caseload [2].

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Urology was one of the first fields to heavily utilize robotic surgery. Extended training and proctoring programs have increased the number of robotic-assisted laparoscopic radical prostatectomies (RALP) [3]. Mehrabi et al. utilized an experimental large and small animal model using the Da Vinci® telemanipulator (Intuitive Surgical Inc, Sunnydale, CA) to evaluate outcomes of a training program in vascular and visceral surgery [4]. Other training programs have evaluated otolaryngology residents quantitatively on a variety of surgical tasks using the Da Vinci Surgical System® (Intuitive Surgical Inc, Sunnydale, CA) [5]. Bariatric surgery training programs have also developed similar training curriculums for teaching robotic surgery to fellowship trainees [6].

A variety of surgical fields are currently investigating methods of developing a standardized curriculum for traversing the learning curve required by all surgeons as they achieve initial proficiency and eventual mastery of robotic surgery. Grover et al. define the learning curve as the decreasing amount of time necessary to perform a repeated task until reaching a steady state in which repetition of the task no longer yields improvement [7]. For RALP, the learning curve appears to be widely estimated between 20 to 150 cases [8]; other investigators quote even wider ranges [9, 10]. The learning curve for Roux-en-Y gastric bypass surgery was evaluated in a stepwise approach by Ali showing statistically significant decreases in operative task time between the first ten cases and the subsequent ten cases [6]. One general surgery study showed robotic novices improving their efficiency at basic surgical training tasks approaching expert level by 10 cases [11].

A paucity of literature exists on the learning curve for gynecologic surgeries. A series of robotic-assisted laparoscopic myomectomies and hysterectomies showed significantly shorter operatives times after the first 20 cases [12]. To our knowledge no prior investigations have studied the learning curve among various gynecologic subspecialties. The aim of the present study was to determine the case volume required to obtain proficiency and mastery of robotic surgery skills based on practice type among generalist and subspecialist gynecologic surgeons.

Methods

After IRB approval, 2189 gynecologic surgeons who completed company-sponsored wet lab training for the DaVinci Surgical System (Intuitive Surgical Inc Sunnyvale, CA) in September 2010 were contacted using Survey Monkey® (Palo Alto, CA). Respondents were asked a total of 19 questions regarding their opinions of robotic surgery, including the number of cases subjectively required to be 'proficient' (i.e. basic safety and surgical fundamentals) and 'master' (i.e. advanced surgical skills and confidence) robotic surgery. In addition to gathering demographics, the survey queried characteristics of practice including years of practice, area of gynecologic practice or specialty (including fellowship training), type of practice, and presence of absence of teaching residents. Participants were asked which model of robotic console system they used, length of total time they have operated robotically, number of cases per month, and types of cases performed. Further questions asked about whether their institution created guidelines for privileges in robotic surgery and how many cases surgeons had

proctored other surgeons, if any. Finally, participants were asked to state during their learning curve how many cases they performed until subjectively gaining proficiency and also mastery. De-identified responses were compiled and categorical data compared using the chi-squared test regarding demographics, training, level of comfort, and opinions on robotic surgery.

Results

Of 2189 subjects contacted, 303 (14%) completed the survey. Respondents were mostly generalists in private practice 160 (53%) and subspecialists in academic practice 137 (45%). Among all respondents, the median number of robotic surgery cases performed was 25. Surgeons tended to perform robotic cases consistent with their practice type (Table 1). The surgeries included in the "other" categories were not further described. Although not statistically significant, generalists reported requiring fewer cases to feel proficient in robotic surgery (median 6 cases for generalists and 10 cases for subspecialists). When divided by subspecialty type, minimally invasive surgery (MIS) and reproductive, endocrinology, and infertility (REI) specialists reported fewer cases required for robotic proficiency (6 MIS, 7.5 REI) while urogynecologists (Urogyn) and gynecologic oncologists (GynOnc) reported a median of 10 cases. When asked the number of cases to master robotic surgery, the median among all respondents was 20 cases. However, when separated by specialty, generalists believed a median of 14.5 cases was sufficient for mastery while subspecialists believed a median of 20 cases was needed. When further divided by specialty type, REI required the least number of cases and GynOnc the most cases to state that they had mastered robotic surgery (Table 2).

Discussion

While several subspecialties of general surgery are beginning to examine the learning curve for robotic surgery, evaluation of robotic training in the field of gynecology has not been well studied. A comparison between gynecologic surgical subspecialties has not yet been investigated.

Respondents in this gynecologic surgical survey agreed that proficiency in robotic surgery appears to be achieved after a median of 10 cases, whereas mastery requires a median of 20 cases. Subspecialists tended to require a greater number of cases than generalists to achieve both proficiency and mastery of robotic surgery. This discrepancy may be explained by the types of cases being performed by the different specialties (i.e. simple hysterectomy versus sacrocolpopexy versus tumor debulking and staging) as well as prior comfort with laparoscopic surgery (i.e. MIS and REI). Based on our findings, surgeons may be able to determine if their personal acquisition of robotic skills is consistent with their peers based on practice type.

Strengths of this study include surgeons performing procedures overall consistent with their subspecialty. There were a large number of respondents from both private practice 109 (36.7%) and academic/university based centers 93 (31.3%). A total of 92 (31%) private practice respondents had affiliations with an academic center.

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Table 1.

Practice type	Gyn only (n=20)	OB/Gyn (n=156)	MIS (n=13)	REI (n=9)	Gyn Onc (n=52)	Urogyn (n=46)	Other (n=2)
Robotic Procedures Performed:							
Hysterectomy	16 (80%)	129 (83%)	11 (85)	2 (22%)	47 (90%)	32 (70%)	0
Tumor debulking	0	0	0	0	9 (17%)	0	1 (50%)
Cancer staging	0	2 (1%)	0	0	42 (81%)	0	0
Sacrocolpopexy	1 (5%)	29 (19%)	5 (38%)	0	9 (17%)	37 (80%)	1 (50%)
Tubal reanastomosis	2 (10%)	7 (4%)	3 (23%)	4 (44%)	1 (2%)	2 (4%)	
Adhesiolysis	11 (55%)	73 (47%)	6 (46%)	3 (33%)	23 (44%)	8 (17%)	
Fulgeration of endometriosis	8 (40%)	49 (31%)	4 (31%)	3 (33%)	8 (15%)	3 (6%)	
Myomectomy	11 (55%)	75 (48%)	10 (77%)	7 (78%)	14 (27%)	7 (15%)	
Uterosacral suspension	1 (5%)	16 (10%)	3 (23%)	0	1 (2%)	10 (22%)	
Burch procedure	0	4 (2%)	0	0	1 (2%)	4 (9%)	
Other	5 (25%)	28 (18%)	2 (15%)	0	16 (31%)	7 (15%)	

Table 2.

Practice type	Gyn only (n=20)	Ob/Gyn (n=156)	MIS (n=13)	REI (n=9)	GynOnc (n=52)	Urogyn (n=46)	Other (n=2)
Cases required for mastery of robotic surgery	16.3 (14)	13 (12)	22 (34)	15 (13)	25 (35)	20 (14)	13.5
Cases required for proficiency of robotic surgery Median, IQR	10 (5)	6 (5)	7.5 (16)	6 (7)	10 (19)	10 (6)	3

p<0.001 for comparison overall for learning curve and cases reported for mastery

p<0.033 for comparison overall for learning curve and cases reported for proficiency

Although 14% may seem like a low response rate, for an internet study it is actually a higher response rate than expected. Our contacts at Intuitive Surgical who were responsible for sending out the study expected no better than a 10% response rate and were elated to find a rate of response exceeding that number. Although only 303 subjects chose to return complete responses, this is actually quite significant given the method of the survey. Within the responses, REI was the most underrepresented subspecialty, which may have skewed our results.

As with all surveys, participants were subject to recall bias depending on how detailed of case records were kept by some surgeons versus others while undergoing robotic surgical training. Although the general gynecologists and general OB/GYN physicians provided a robust response, they may have become over-represented in the database.

Robotic surgery is rapidly growing in popularity in all areas of gynecologic surgery. As robotic surgery continues to prevail in the gynecologic surgical field, a learning curve is necessary to effectively train physicians in this technique both in residency programs and other surgeons desiring to expand their skills. More research is needed to investigate how many cases are necessary before proficiency and mastery are achieved for specific procedures among these subspecialties. These results could greatly assist residency programs, fellowships, and training courses in credentialing surgeons for robotic surgery.

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