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Laparoscopic Colorectal Training Gap in Colorectal and Surgical Residents

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ABSTRACT

Background and Objectives: Laparoscopic colorectal surgery is an established safe procedure with demonstrated benefits. Proficiency in this specialty correlates with the volume of cases. We examined training in this surgical field for both general surgery and colon and rectal surgery residents to determine whether the number of cases needed for proficiency is being realized.

Methods: We examined the Accreditation Council for Graduate Medical Education (ACGME) and American Board of Colorectal Surgeons (ABCRS) operative statistics for graduating general surgery and colon and rectal surgery residents.

Results: Although the number of advanced laparoscopy cases had increased for general surgery residents, there was still a significant gap in case volume between the average number of laparoscopic colorectal operations performed by graduating general surgery residents (21.6) and those performed by graduating colon and rectal surgery residents (81.9) in 2014.

Conclusion: There is a gap between general surgery and colon and rectal surgery residency training for laparoscopic colorectal surgery. General surgery residents are not meeting the volume of cases necessary for proficiency in colorectal surgery. This deficit represents a structural difference in training.

Key Words:

Complex Laparoscopy, Colorectal, Residency, Training

INTRODUCTION

Laparoscopic colorectal surgery has been established as a safe procedure with the demonstrated benefits of shorter hospital stay and decreased postoperative pain. Training for this complex procedure continues to be an area of interest in surgical training.

Proficiency in laparoscopic colorectal surgery is reflected in conversion-to-open rates, intra- and postoperative complications, and operative times. The volume of laparoscopic colon and rectal resections performed correlates with proficiency. Historically, a learning curve between 30 and 60 cases has been reported as necessary for the colorectal surgery resident to achieve proficiency, although recent studies suggest that the number may be as high as 150 cases.[3,14]

Using volume as a benchmark for proficiency, we previously reported on both the gap in laparoscopic colorectal resections between colon and rectal and general surgery residency training. We noted general surgery trainees were not achieving the numbers needed to reach proficiency. Since that initial report, studies such as the Clinical Outcomes of Surgical Therapy (COST) and Conventional versus Laparoscopic-Assisted Surgery in Patients with Colorectal Cancer (CLASICC) trials in the United Kingdom have demonstrated equivalent oncologic outcomes of laparoscopic surgery for colon and rectal cancer compared to open surgery—essentially increasing the application of this surgical modality.[4,8] In addition, the Accreditation Council for Graduate Medical Education (ACGME) established a minimum number of advanced laparoscopies required for general surgery residency training, as well as a minimum requirement for colorectal training. It is important to note that the Resident Review Committee is not clear on the definition of proficiency, just that a certain case volume is necessary to be board certified.

The primary purpose of this study was to compare the volume of laparoscopic colorectal resections performed during general surgery and colorectal training and to determine whether an adequate volume of cases is available to the resident to complete the learning curve and achieve proficiency. As a secondary purpose, we looked at the volume of and exposure to basic and advanced laparo-

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Table 1.
Accreditation Council for Graduate Medical Education General Surgery Defined Categories

Defined Category	Minimum Requirement (n)
Skin, soft tissue, and breast	25
Head and neck	24
Alimentary tract	72
Abdomen	65
Liver	4
Pancreas	3
Vascular	44
Endocrine	8
Thoracic	15
Pediatric	20
Plastic	5
Trauma	30
Endoscopy	85
Laparoscopic	
Basic	60
Complex	25

scopic cases in general surgery training, to determine whether overall exposure and skill acquisition occur during general surgery training.

METHODS

General Surgery Resident Data

U.S. general surgery residency operative data were obtained from the ACGME website. A yearly summary is published that provides operative statistics for procedures performed by residents. This information represents the cumulative operative experience of the graduating residents. The data are reported as the average number of operations performed during the careers of graduating general surgery residents.

The ACGME has established the minimum number of cases in given categories that residents must perform to achieve competency and be eligible for graduation (**Table 1**). These include a minimum number of basic and complex laparoscopies. The terms complex and advanced are used interchangeably. A 5-year period was selected from 2010 to 2014 for collecting data.

Colon and Rectal Resident Data

The American Board of Colon and Rectal Surgeons (ABCRS) publishes a yearly statistical summary of operative performance logs. The minimum number of colorectal laparoscopic cases was changed to 50 in 2012, with programs granted a 3-year grace period from the previous requirement of 30 cases.

RESULTS

General Surgery Resident: Basic Laparoscopic Experience

The number of general surgery residents and average number of major cases has remained stable from 2010 to 2014 (**Table 2**). The data from the Accreditation Council for Graduate Medical Education (ACGME) is currently reported as the average number of cases per resident per career.

The 2 most common basic laparoscopies performed overall are appendectomy and cholecystectomy. The average number of laparoscopic appendectomies and cholecystectomies per resident per career increased between 2010 and 2014 (**Table 3**). In 2009–2010 graduating residents performed an average of 41.8 laparoscopic appendectomies—33.7 of these within the chief year. In 2013–2014, graduating residents performed an average of 54.9 laparoscopic appendectomies—45.9 within the chief year. A similar increase was seen in cases of laparoscopic cholecystectomy.

General Surgery Residents: Advanced Laparoscopic Experience

Table 4 shows the type and volume of the most commonly performed advanced laparoscopic procedures in 2004 and 2014. Inguinal or femoral hernia repair was the most common advanced procedure. However, in 2004, the second most common advanced laparoscopic opera-

Table 2.
U.S. General Surgery Resident Experience

Training Year	Residents	Total Major Cases (Avg)
2009–2010	1040	960.7
2010–2011	1060	966
2011–2012	1092	980.2
2012–2013	1098	976.9
2013–2014	1105	982.2

Table 3.
U.S. General Surgery Resident Data Showing Average Cases Per Career and Chief Year for Appendectomy and Cholecystectomy

Training Year	Laparoscopic Appendectomy/GS/Career	Laparoscopic Appendectomy/GS chief	Laparoscopic Cholecystectomy/GS/Career	Laparoscopic Cholecystectomy/GS chief
2003–2004	17.8	4.6	90.5	21
2009–2010	41.8	33.7	101.1	76
2010–2011	46	37.7	105.7	79.4
2011–2012	50	41	108.8	82
2012–2013	52	43.5	110.3	83
2013–2014	54.9	45.9	112	85.2

GS, general surgery.

tion was the antireflux procedure, at an average of 5.1 cases per career. In 2014 the colorectal resection, at an average of 21.6 cases per career, became the second most common procedure. **Table 5** shows the volume and increase in the 3 most common advanced laparoscopic procedures from 2010 to 2014 for a residency career.

Colon and Rectal Residents: Laparoscopic Experience

The number of colorectal residents increased from 82 to 91 in the study time frame. The average number of laparoscopies per resident increased from 70.6 to 81.9 in from 2010 to 2014 (**Table 6**), a minimal increase of a factor of 1.2, indicating a plateau in volume over the period.

Comparison of laparoscopic colon resection experience for general surgery and colon and rectal residents is provided in **Table 7**. The ABCRS does not break down the type of laparoscopic resections from right or left colectomies. For 2014, the average number of laparoscopic colon resections for general surgery was 21.6 and 81.9 for colon and rectal residents. Half of the general surgery experience was acquired during the chief year.

Table 4.
U.S. General Surgery Resident Advanced Laparoscopic Experience Years 2004 and 2014

Advanced Laparoscopic Surgery	Case/GS/Career 2004	Case/GS/Career 2014
Inguinal femoral hernia	11.9	30
Antireflux	5.1	6.8
Colectomy	4.2	21.6
Gastrostomy	2.8	2.8
Gastric resection, partial	2.7	10.2
Enterolysis	2.6	3.5
Splenectomy for disease	1.4	1.3
Enterectomy	0.9	1.2
Common bile duct exploration	0.8	0.7
Antireflux (peds)	0.8	1.1
Total for the 10 most common procedures	33.2	79.2

Data represent the cumulative 5-year experience. GS, general surgery; peds, pediatric population.

DISCUSSION

In this paper, we compared the complex laparoscopic experience of general surgery and colon and rectal surgical residents. Our aim was to examine the volume of complex colon and rectal laparoscopic operations performed during general surgery residency, see whether this number meets the appropriate volume for proficiency, and determine whether a colon and rectal residency closes the volume gap in achieving that goal. We also

Table 5.
U.S. General Surgery Residents: Advanced Laparoscopic Experience in the Years 2010–2014

Training Year	Inguinal Femoral Herniorrhaphy	Partial Colectomy	Partial Gastrectomy
2009–2010	20.4	17.2	7.6
2010–2011	23.3	18.2	7.9
2011–2012	26.3	18.8	9.4
2012–2013	28.2	19.7	9.4
2013–2014	30	21.6	10.2

Data are average cases per resident per career.

Table 6.
U.S. Colon and Rectal Surgery Resident Laparoscopic Experience

Training Year	Colon and Rectal Residents	Laparoscopic Cases/Resident (Average)
2003–2004	67	30
2009–2010	82	70.6
2010–2011	87	73.7
2011–2012	87	72.4
2012–2013	90	78.6
2013–2014	91	81.9

looked at the overall number of basic and advanced laparoscopic cases that occurred during general surgery training, as an indicator of exposure and skill acquisition in this surgical modality. Data were obtained from the ACGME and the American Society of Colon and Rectal Surgeons (ASCRS). Currently, both the ACGME and ASCRS databases report average cases per year for graduating residents.

In 2004, there were no minimum requirements for performing complex laparoscopic procedures for either training program. In 2014, general surgery residents were required to perform 25 advanced laparoscopic operations, which include a large pool of options that can count toward their requirement, including thoracoscopy. In 2012, colon and rectal surgical residents were required to perform 50 laparoscopies (with a 3-year grace period to achieve this new requirement), but this requirement does not specify parameters, such as the number of right or left colectomies, or rectal resections.

For general surgery residents, the average number of laparoscopic cases is increasing each year. This increase in volume is likely to correlate with increased proficiency. Basic skills are now measured by the Fundamentals of Laparoscopic Surgery (FLS) testing required since July 1, 2009, for board eligibility. In addition, a small study has shown a correlation between FLS scores and global assessment scores in operating room performance.[9] In 2004, the average number of complex laparoscopies (for the 10 most common procedures) was 33.2 per residency career. In 2014, it was 79.2 (**Table 4**). Furthermore, the types of cases have changed. Laparoscopic colectomy is now the second most common advanced procedure performed by the general surgery residents (**Table 5**). For colon and rectal surgery residents, the number of laparoscopic colectomies exceeds those performed during general surgery training, but the average volume has remained stable. Currently, there is not an equivalent to FLS testing for complex laparoscopy.

The question for surgical educators remains the correlation of the volume of cases with proficiency in the operating room. How should readiness to operate be assessed?

Currently, 80% of graduating residents proceed to fellowship for additional training. This number may correlate with a lack of confidence in skills after surgical residency.[2,5] In addition, the pass rate for the American Board of Surgery certifying examination has been steadily declining, which may be another hallmark of lack of preparedness. A survey reported that 42.7% of program directors for advanced laparoscopic fellowships said incoming trainees could not perform 30 min of a major procedure independently at the beginning of their fellowships.[10]

Objective measures such as outcomes can provide insight into proficiency. Laparoscopic cholecystectomy is considered a basic laparoscopic skill and is the most commonly

Table 7.
Comparison of General Surgery Resident Laparoscopic Colectomy Experience, Cumulative Residency, and Chief Year With Colon and Rectal Resident Experience

Training Year	Average Total Laparoscopic Colorectal Resection/(GS) residency career	Average (GS) chief year	Average CR Resident Laparoscopic Resection
2009–2010	17.2	8.7	70.6
2010–2011	18.2	9.0	73.7
2011–2012	18.8	9.3	72.4
2012–2013	19.7	9.6	78.9
2013–2014	21.6	10.6	81.9

GS, general surgery.

performed laparoscopic procedure in residency training. Schwartz et al[13] examined whether senior residents acting as teaching assistants results in an adverse complication rate for their patients compared to surgical attendings working with junior residents. They found that complications occurred at similar rates in surgeries with teaching assistant residents and surgical attending faculty.

Gorgon et al[7] looked to see whether resident involvement in laparoscopic colorectal surgery negatively impacts outcomes and increases cost. The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database was used to query information on all patients who underwent laparoscopic colorectal surgery between 2005 and 2010. Residents were involved in 4,836 cases; in 2,148 cases, residents were not involved. Overall morbidity, mortality, and surgical and nonsurgical complications were comparable between the 2 groups. Operative time was longer in the resident group by 23 min.

Davis et al[6] similarly used the ACS-NSQIP database to evaluate surgical outcomes with resident participation in a variety of laparoscopic procedures of both basic and complex skill levels. They found that although operative times were longer, there was no statistically significant difference in outcomes.

Overall, resident participation in complex laparoscopic surgical cases does not increase complication rates. However, these studies do not assess autonomy or proficiency.

Mackenzie et al[9] evaluated the reliance of trainees on instructor input and developed and validated a risk-prediction score for laparoscopic colorectal surgical training cases. The risk prediction score is a set of patient and surgical factors that increase the chances of unplanned conversion from laparoscopy to an open procedure. A score of >6 (high risk of conversion) had higher level of instructor input, higher level of complications, longer hospital stay, higher rate of reoperation, and higher mortality rate. Trainees also had a lower global assessment score of proficiency on cases with a high risk-prediction score.

Miskovic et al[9] analyzed the length of the learning curve in laparoscopic colorectal surgery via analysis of multiple datasets. Outcomes included unplanned conversion to laparotomy, operative time, postoperative complications, and 30-day mortality. Results showed a learning curve of 152 cases was necessary to avoid conversion to open cases. Risks for unplanned conversion to laparotomy were significantly higher in male patients and in patients with high body mass index and those who underwent pelvic resection and depended on the experience of the surgeon, as determined by case volume. This learning curve is notably higher than reported in earlier publications.

Clearly, the volume of cases correlates with the ability to perform laparoscopic colorectal surgery. General surgery residents are showing an increase in the number of complex laparoscopic colorectal resections that they perform each year (**Table 7**), but they are still most likely not to meet the number for proficiency. Does a colorectal fellowship close this gap?

A survey designed by the Young Surgeons Committee of the ASCRS was sent to graduates of the ABCRS programs who completed their training from 2004 to 2009. They reported on their level of comfort, both at the end of general surgery training and at the end of colorectal residency training.[14] The survey found that after general surgery training, 16.4% were very comfortable with laparoscopic right colectomy, 9% were very comfortable with left colectomy, and 17.3% had not observed a laparoscopic colon resection during their training. As colorectal residents, 79.6% were very comfortable with right colectomy after performing more than 10 procedures. After performing 30 left colectomies 80% were very comfortable with hand-assisted laparoscopic resection, and 100% were very comfortable with straight laparoscopic resection.[11] Although this was a qualitative study, with a subjective end point (self-reported comfort level), it addresses the possibility that it would be appropriate to standardize a specific case requirement for right and left laparoscopic colectomies, because they require different skills. This is further supported by a study from Tekkis et al., which noted a different volume of cases needed to overcome the laparoscopic learning curve for right versus left colectomies.[15]

As noted, simulated experiences, such as the manual skills portion of the FLS test, are now necessary for eligibility for board certification. Therefore, it is important to address the role of simulation in advanced training for laparoscopic surgery. Given the low volume of advanced laparoscopic colon resections performed in general surgical residency, will simulation help close the gap? Unfortunately, there are few publications on simulation in advanced laparoscopy training. Beyer-Berjot et al[1] reviewed the existing literature on simulation in advanced laparoscopic training. Trends showed improvement in using the simulators themselves. There was minimal evidence showing improvement in actual operative capabilities.

CONCLUSION

Overall, this study showed significant disparity in case volume between general surgery and colon and rectal

surgery residents. At this time, general surgery residents are not graduating with enough volume of colorectal cases to complete the necessary learning curve. Given that there are 91 colon and rectal residents and 1,105 general surgery residents in the United States, the low volume of advanced laparoscopic cases for generally surgery residents is not a result of colorectal residents taking these cases. Rather, it represents a structural difference in training between the 2 programs. At this time, additional training is needed after general surgery to complete the learning curve.

Proficiency in advance laparoscopic colorectal surgery is likely to require additional assessment tools, such as validated global assessment scores for each operation. Moreover, different skills are used in right and left colectomies and pelvic dissections, making it reasonable to have a specific requirement for the types of resection. Information regarding the number of laparoscopic colorectal procedures and their outcomes after graduation would also give some indication of success from the training program itself. Practicing surgeons, especially new graduates deficient in case volume require additional proctoring and appropriate patient selection until the learning curve is completed.

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