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Original Article

Comparing Colonoscopy Quality Indicators between Surgeons and Gastroenterologists in A Rural Healthcare System

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ABSTRACT

Background: There is a significant shortage of physicians providing colonoscopies, especially in underserved and rural areas. Surgeons are increasingly filling this role by providing endoscopy services including colonoscopy in these areas. As a result, there has been discussion regarding the quality of colonoscopies performed by different provider specialties, specifically for non-gastroenterologists. The purpose of this study was to compare colonoscopy quality measures between gastroenterologists and surgeons in a rural central New York healthcare system.

Methods: All colonoscopies performed by 23 endoscopists, 14 surgeons and 9 gastroenterologists, within a rural healthcare network in 2017 were included as samples within this study, totaling 6265 colonoscopies. These included all diagnostic, screening, and surveillance colonoscopies. Quality metrics including withdrawal times and adenoma detection rates were calculated for all providers and the two groups were statistically analyzed and compared using chi-squared testing.

Results: 3113 colonoscopies were performed by surgeons (average of 222 per provider) and 3159 were performed by gastroenterologists (average of 351 per provider). Adenoma detection rates for surgeons and gastroenterologists were essentially the same at 31.38% and 31.82%, respectively ($p=0.6882$). Withdrawal times were slightly longer for surgeons at 13.19 minutes versus 11.02 minutes for gastroenterologists, though this difference was not statistically significant (0.2985).

Conclusions: Our results show that surgeons are not inferior to gastroenterologists in performing colonoscopies using the quality metrics of adenoma detection rates and withdrawal times. With the ongoing shortage of endoscopists, surgeons may be able to alleviate some of the burden without reduction in quality.

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Introduction

Colorectal cancer (CRC) is the second most common cancer and the third leading cause of cancer-related death in the United States [1]. Since the mid-1980s, CRC incidence has been decreasing in both men and women overall, especially in the decade between 2000 and 2010 [1]. For example, in those over age 65, the annual percent decline increased from

3.6% from 2001 to 2008 to 7.2% from 2008 to 2010 [1]. In those under age 50, however, incidence rates have slightly been increasing, with 11% of new cases being discovered in this demographic in 2020 [2].

Colonoscopy remains the gold standard for CRC screening, allowing for both detection and removal of lesions of the colon and rectum. The decline in incidence of CRC in the elderly has been attributed to the

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widespread usage of colonoscopy screening, which increased from 19% in 2000 to 55% in 2010 among adults aged 50 to 75 [1]. With the increase in screening, the quality of screening has also been standardized. Adenoma detection rate (ADR) has become the primary quality indicator, which functions as an aggregate of other quality measures including intubation rates of the cecum, withdrawal times, and quality of bowel preparations. There are thus standard guidelines for all of the aforementioned quality measures in order to maximize ADR and ultimately reduce both the incidence and prevalence of CRC.

Although this is encouraging, it needs to be noted that there is a significant shortage of physicians providing colonoscopy screening and surveillance, especially in underserved and rural areas. It has been shown that individual use of CRC screening increases as screening capacity (i.e., the number of endoscopists) in an area increases [3]. In addition, increased density of primary care physicians and gastroenterologists in a given region is inversely proportional to the number of late-stage CRC diagnoses [4]. In the early 2000s, it was estimated that about two-thirds of colonoscopies were performed by gastroenterologists while general surgeons performed the majority of the remainder [5]. Due to a lack of both of these specialists in certain areas, there has been a push to have primary care providers perform colonoscopy screening, especially targeting training of family medicine resident physicians [6]. In South Carolina, for example, there have been increases of 65% and 212% in colonoscopies performed by internists and family physicians, respectively, from 2001 to 2010 [7].

With concerns of access to colonoscopy services and as a result more non-gastroenterologists performing these procedures, discussion has increased regarding the quality of these procedures amongst different provider specialties. The purpose of this study was to compare colonoscopy quality measures between gastroenterologists and surgeons in a rural central New York healthcare system.

Methods

All colonoscopies performed by 23 endoscopists, 14 surgeons and 9 gastroenterologists, within our healthcare network between 1/1/2017 and 12/31/2017 were included as samples within this study. These included all diagnostic colonoscopies (workup for anemia, abdominal symptoms, etc.), standard screening colonoscopies per age and family history guidelines for CRC, and surveillance colonoscopies (including patients who have had prior polypectomies and colon and rectal resections for CRC). Emergent colonoscopies, such as those for significant bleeding, retrieval of foreign bodies, etc., were not included. In our healthcare network, colonoscopy referrals are channeled through a single pathway to a scheduling office in an "open access" system. In general, these referrals are from primary care providers and have not been seen in surgery or gastrointestinal specialty clinics prior. There is no initial triage before being assigned to an endoscopist based on availability or specialty and thus assignments are random. For example, a patient with ulcerative colitis or Crohn's disease is not preferentially assigned to a gastroenterologist. Likewise, a patient with a prior colon resection is not preferentially assigned to a surgeon. All colonoscopies were subjected to the same quality standards, including bowel preparation scores, withdrawal times, and adenoma detection rates.

The Boston Bowel Preparation Scale (BBPS) is used to assess bowel preparation quality within our healthcare network. All patients undergoing a colonoscopy are instructed to take a bowel prep the evening prior to the colonoscopy. The BBPS scale then assigns a value of 0 (unacceptable) to 3 (excellent) in each of three areas of the colon: right, transverse, and left. The rating is done after all cleansing measures have been used. To be considered "good", the prep must score a minimum of 2 in each section, totaling 6. A total score of <4 is considered "horrible" and all others are "unsatisfactory". The preps are scored at the completion of each procedure and the values for each segment are entered into a database. Reports are generated from this data to show the percentage of "good", "horrible", and "unsatisfactory" preps for each provider.

Withdrawal times were extracted from the electronic medical record system which allows certain points of the procedure to be recorded by nursing staff. The times for "at cecum" and "completion" (when the scope is out) are recorded for each colonoscopy and the difference between the two is the withdrawal time. "At cecum" in the medical record system was also the most proximal possible end point recorded in colonoscopies in which there was no cecum (e.g., a patient who had a prior ileocecectomy or a right colectomy). From this data, an average withdrawal time was calculated for each endoscopist.

Adenoma detection rates were derived from the final pathology reports for the colonoscopies. Based on a given pathologist's terminology, either "adenoma" or "serrated" was used to describe any pre-malignant lesion. Any colonoscopy with ≥ 1 adenoma was considered as positive. All other colonoscopies were "negative". The ADR was then calculated as the number of positive colonoscopies/total colonoscopies performed, expressed as a percentage for each endoscopist.

The averages for number of colonoscopies performed, positive colonoscopies, withdrawal times, and adenoma detection rates were then calculated for both surgeons and gastroenterologists. Comparison of withdrawal time between surgeons and gastroenterologists was carried out using the t-test adjusted for clustering by physician. Comparison of ADR was conducted using the Rao-Scott Chi-square test adjusted for clustering by physician a p-value of < 0.05 was considered statistically significant. All analyses were carried out using SAS 9.4.

All nine gastroenterologists are fellowship-trained and board certified in gastroenterology. All 14 surgeons are board certified in general surgery and had ample training with endoscopy during their residencies. Two of the surgeons are also fellowship trained in colorectal surgery and received further endoscopy training in their fellowships. Three other surgeons are fellowship trained in minimally invasive surgery and also received further endoscopy training in their fellowships.

International review board approval was obtained during the study period when it was deemed necessary to report patient demographics.

Results

Between 1/1/2017 and 12/31/2017, 6265 colonoscopy procedures were performed at our healthcare system by 14 surgeons and 9 gastroenterologists. A total of 3110 were performed by surgeons while

3155 were performed by gastroenterologists. Overall 88.7% of all colonoscopies performed were graded as “good” based on the BBPS.

Patient demographics are included in (Table 1). The average age for patients with colonoscopies performed by surgeons was 60.6 years and

60.2 for patients with colonoscopies performed by gastroenterologists. Forty-seven (47.0) percent of the patients in the surgeon group were male and forty-eight (48.3) percent in the gastroenterologist group were male.

Table 1: Patient characteristics of colonoscopies performed.

	Female (%)	Male (%)	Average Age	Age Range	Total
Surgeon colonoscopies	1647 (53)	1463 (47)	60.6	16-97	3110
Gastroenterologist colonoscopies	1630 (52)	1525 (48)	60.2	18-98	3155

The number of colonoscopies performed by each surgeon is listed in (Table 2). Also included in this table are the number of positive colonoscopies, adenoma detection rates, and withdrawal times, and the average for each of these measures. The number of colonoscopies performed ranged from 22 to 585 with average being 222. Successful

intubation of cecum was documented in 91.64% of colonoscopies. The number of positive colonoscopies ranged from 6 to 224 with the average being 70. The adenoma detection rate ranged from 17% to 39% with average being 31.4%. The withdrawal times ranged from 9.18 minutes to 41.37 minutes with the average being 13.2 minutes.

Table 2: Surgeon and gastroenterologist ADR and withdrawal times.

Surgeon	Colonoscopies performed	Positive colonoscopies	ADR (%)	Average Withdrawal time (min)
1	215	75	35	15.38
2	298	99	33	11.72
3	127	37	29	14.96
4	115	38	33	15.28
5	82	20	24	13.99
6	387	119	31	13.73
7	35	6	17	11.71
8	70	27	39	41.37
9	585	224	38	12.61
10	142	34	24	11.45
11	343	87	25	9.18
12	135	49	36	24.98
13	554	155	28	9.35
14	22	6	27	13.85
Total	3110	976		
Average	222.14	69.71	32	13.19

Gastroenterologist	Colonoscopies performed	Positive colonoscopies	ADR (%)	Withdrawal time (min)
1	95	22	23	7.91
2	128	29	23	11.72
3	402	113	28	8.09
4	487	208	43	20.58
5	204	47	23	11.13
6	263	60	23	8.82
7	439	109	25	10.25
8	462	135	29	8.28
9	675	282	42	9.66
Total	3155	1005		
Average	350.55	111.67	34	11.02

The number of colonoscopies performed by each gastroenterologist is listed in (Table 2) along with the number of positive colonoscopies, adenoma detection rates, and withdrawal times. The average for each measure is also listed in (Table 3). The number of colonoscopies performed ranged from 95 to 675 with average being 351. Successful intubation of cecum was documented in 89.80% of colonoscopies. The number of positive colonoscopies ranged from 22 to 282 with the

average being 112. The adenoma detection rate ranged from 23% to 43% with average being 31.9%. The withdrawal times ranged from 7.91 minutes to 20.45 minutes with the average being 11.0 minutes.

Comparisons for adenoma detection rates and withdrawal times for surgeons versus gastroenterologists are listed in (Table 3). The adenoma detection rates for surgeons and gastroenterologists were essentially the

same at 31.38% and 31.85%, respectively. There was no statistically significant difference between adenoma rates for surgeons versus gastroenterologists ($p=0.6882$). Withdrawal times were slightly longer

for surgeons at 13.19 minutes versus 11.02 minutes for gastroenterologists. However, this difference again was not statistically different with a P-value of 0.2985.

Table 3: Results of analysis of ADR and withdrawal times.

Overall ADR for Surgeons	31.38 (95% CI 27.80 – 34.96)
Overall ADR for Gastroenterologists	31.85 (95% CI 25.23 – 38.47)
Mean WT for Surgeons	13.19 (Min 9.18 – Max 41.37)
Mean WT for Gastroenterologists	11.02 (Min 7.91 – Max 20.58)
Median WT for Surgeons (25 th and 75 th percentile range)	10 (7,15)
Median WT for Gastroenterologists (25 th and 75 th percentile range)	9 (6, 13)

Discussion

Colonoscopy remains the gold standard for CRC screening allowing for both the detection and removal of polyps. With the shortage in colonoscopy screening, however, it has been questioned whether the quality of screening will be compromised should non-gastroenterologists such as surgeons perform more colonoscopies. Jiang *et al.* report that surgeons were half as likely as gastroenterologists to remove polyps [8]. Furthermore, Rabeneck *et al.* report that after a negative colonoscopy, those who have had their procedures performed by a gastroenterologist are less likely to develop CRC [9]. Sapci *et al.* report a 31% ADR for gastroenterologists versus 25.3% for colorectal surgeons in study consisting of over 15,000 colonoscopies [10]. A systematic review performed by Mazurek *et al.* found an association of lower adenoma detection rates and cecal intubations in colonoscopies performed by surgeons compared to gastroenterologists [11]. Kozbial *et al.*, however, report no significant difference in ADR between gastroenterologists and surgeons with an overall ADR of 20.5% in a study including over 59,000 colonoscopies [12].

Our study shows no significant difference between the quality metrics of colonoscopy performance comparing surgeons to gastroenterologists within our rural central New York healthcare system. Adenoma detection rates were essentially equal for both groups at about 31.6% and not statistically different. Gastroenterologists, however, had slightly shorter withdrawal times at 11.02 minutes versus 13.19 minutes for surgeons, yet achieving the same adenoma detection rates. This may be a reflection of the fact that gastroenterologists in our system performed an average of 351 colonoscopies while surgeons performed an average of 222 colonoscopies. Thus, more proficiency may come with increased volume. Nonetheless, the difference in withdrawal times was not statistically significant. It should also be noted that surgeons had similar ADRs despite performing fewer colonoscopies on average. This is in contrast to the argument raised that gastroenterologists should be the primary performers of screening colonoscopies as they typically perform more colonoscopies in both training and in practice.

Our study, however, has limitations. Firstly, our sample size is small with only 23 endoscopists (14 surgeons and nine gastroenterologists) performing colonoscopies over a single year. There was also significant variance in the amount of colonoscopies performed by the surgeons; one surgeon performed only 22 colonoscopies and another performed only 35. The surgeon who performed 35 colonoscopies also had a lower ADR than the other surgeons, though the reason for these colonoscopies

(screening vs diagnostic) is unknown. It is unclear whether the ADR for this surgeon would change with higher volume. It also possible that there may have been statistically significant differences in adenoma detection rates and withdrawal times had we had a larger sample size with several thousand more colonoscopies as some of the aforementioned papers.

Secondly, our study includes all purpose colonoscopies performed and not just screening colonoscopies. This is highlighted in (Table 1) as shown by the age of our patients that ranged from 19-99. Our sample includes patients with prior resections for CRC and other pathologies such as inflammatory bowel disease. Unfortunately, these cannot be excluded from our database. Some of the aforementioned papers included only screening colonoscopies. Thus, it may be argued that our results are not completely applicable to strictly screening for CRC when looking at ADR and withdrawal times. This would especially be true as withdrawal times would be shorter in patients with prior resections. On the other hand, it can be argued that these performance quality indicators can be applicable to all categories of colonoscopies for the sake of comparing surgeons and gastroenterologists if both are equally performing colonoscopies for the same cohort of patients.

We also do not have data on complication rates (perforation, post-polypectomy syndrome, readmissions, etc.). When comparing two different specialties performing the same procedure, this may be a future area of investigation to deem the safety of the providers performing these procedures as a comparative measure beyond just adenoma detection rates and withdrawal times.

Lastly, our data does not take into account multiple polyps that may have been detected during a single colonoscopy. Perhaps it is possible that certain providers detect more polyps per colonoscopy on average. The adenoma detection rate does not take this into account as a “positive” colonoscopy is a colonoscopy with at least one polyp detected. Even though the adenoma detection rate is considered the gold standard, this may represent another quality metric that can be used to gauge colonoscopy screening quality and may be a further metric by which surgeons and gastroenterologists can be compared.

Conclusion

Our results show that surgeons are not inferior to gastroenterologists in performing colonoscopy using the quality metrics of adenoma detection rates and withdrawal times. With the ongoing shortage of endoscopists,

surgeons may be able to assist in reducing the burden in many areas without reduction in quality.

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