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Polyp Detection Rate Correlates Strongly with Adenoma Detection Rate in Trainee Endoscopists

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Abstract

Background—The adenoma detection rate (ADR) is a widely accepted quality benchmark for screening colonoscopy but can be burdensome to calculate. Previous studies have shown good correlation between polyp detection rate (PDR) and ADR, but this has not been validated in trainees. Additionally, the correlation between PDR and detection rates for sessile serrated polyps (SSPDR) and advanced neoplasia (ANDR) is not well studied.

Aims—We investigated the relationship between PDR and ADR, SSPDR, and ANDR in trainees.

Methods—We examined 1600 outpatient colonoscopies performed by 24 trainees at a VA hospital from 2014 to 2017. Variables collected included patient demographics, year of fellowship, colonoscopy indication, and endoscopic and histologic findings. We calculated the overall ratios of PDR to ADR, SSPDR, and ANDR to assess the correlation between measured and calculated ADR, SSPDR, and ANDR, which is equivalent to the correlation between PDR and measured ADR, SSPDR, and ANDR.

Results—The overall PDR, ADR, SSPDR, and ANDR were 72%, 52%, 2%, and 14%. PDR (48%) was highest in the left colon, while ADR (32%) and ANDR (7%) were highest in the right colon ($p < 0.001$ for all). The overall ADR/PDR, SSPDR/PDR, and ANDR/PDR ratios were 0.73, 0.03, and 0.20. Correlation between PDR and ADR was highly positive overall ($r = 0.87$, $p < 0.0001$) and stronger in the right ($r = 0.91$) and transverse ($r = 0.94$) colon than the left colon ($r = 0.80$). Correlation between PDR and overall SSPDR and ANDR were not statistically significant.

Conclusions—PDR can serve as a surrogate measure of ADR to monitor colonoscopy quality in gastroenterology fellowship.

Keywords

Colorectal cancer screening; Quality metric; Quality improvement; Gastroenterology fellow

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Author's contribution SN: study design, data collection and interpretation, drafted and approved manuscript; **AKS:** study design, data collection and interpretation, approved manuscript; **JP:** study design, data collection, approved manuscript; **PSL:** study design, data collection and interpretation, drafted and approved manuscript.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest.

Introduction

Colorectal cancer (CRC) is the third most common malignancy diagnosed in the US for both men and women [1]. Observational studies have shown that screening colonoscopy reduces CRC incidence and mortality [2, 3]. One of the most widely accepted quality measures for colonoscopy is the adenoma detection rate (ADR) [4], and studies have shown an inverse relationship between ADR and the risk of interval CRC [5, 6].

However, ADR can be challenging and laborious to calculate, because it often requires manually inputting pathology results. Previous studies have shown that the polyp detection rate (PDR), which is more easily calculated, correlates well with ADR [7–9]. A calculated ADR can be derived by multiplying the PDR by the adenoma-to-polyp detection rate quotient (APDRQ), a constant conversion factor or ratio.

PDR and ADR vary among endoscopists with different levels of experience [10]. To our knowledge, the correlation between PDR and ADR has not been specifically evaluated in trainees. Given the importance of monitoring quality and performance during training and the lack of time for tracking pathology results, a validated simple surrogate measure of ADR would be especially valuable for fellowship programs. Furthermore, it remains unclear whether PDR correlates with other clinically important endoscopic outcomes, such as the sessile serrated polyp detection rate (SSPDR) and the advanced neoplasia detection rate (ANDR). To address these questions, we assessed the relationship between PDR and ADR, SSPDR, and ANDR in colonoscopies performed by trainee endoscopists.

Methods

We conducted a retrospective study of outpatient colonoscopies performed at the Manhattan VA Medical Center between September 2014 and December 2017. The study was approved by the VA New York Harbor Health Care System Institutional Review Board.

Only procedures performed by a gastroenterology fellow and with adequate bowel preparation (Boston Bowel Preparation Scale score ≥ 2 in all segments or qualitatively described as adequate, good, or excellent) were included. Procedures without documentation of cecal intubation were excluded. Each procedure was performed by one fellow who was supervised by one attending physician. Our study included 24 general gastroenterology fellows and six attending physicians. We manually extracted data on patient demographics (age, sex, race/ethnicity), colonoscopy indication, endoscopic and histologic findings (polyps, adenomas, sessile serrated polyps (SSPs), and advanced neoplasia), and endoscopist year of training. Advanced neoplasia was defined as any adenoma ≥ 10 mm in size or with villous histology or high-grade dysplasia or any SSP ≥ 10 mm in size or with dysplasia. We recorded endoscopic findings by colonic segment in the right colon (cecum to hepatic flexure), transverse colon, and left colon (splenic flexure to rectum).

We calculated PDR, ADR, SSPDR, ANDR, as well the ratios for ADR/PDR, SSPDR/PDR, and ANDR/PDR. Values were calculated overall, by colonic segment or site, and by year of training. Lesion detection rates by site were compared using the Chi-squared test. For each trainee endoscopist, we measured the individual PDR, ADR, SSPDR, and ANDR. We then

multiplied the measured PDR of each trainee by one of the three ratios to generate the corresponding calculated ADR, SSPDR, and ANDR. The correlation between the measured and calculated ADR, SSPDR, and ANDR was assessed using the Pearson correlation coefficient across all 24 trainees. Since PDR is perfectly correlated with calculated ADR, SSPDR, and ANDR (PDR × constant ratio = calculated ADR/SSPDR/ANDR), the correlation between a measured and calculated detection rate is mathematically equivalent to the correlation between PDR and the measured detection rate. In other words, the correlation between measured and calculated ADR is equivalent to the correlation between PDR and measured ADR. The same applies for SSPDR and ANDR. Since diagnostic procedures are often excluded from ADR calculations, we performed a sensitivity analysis that included only screening and surveillance examinations. Statistical significance was defined as $p < 0.05$. Analysis was performed using GraphPad Prism Version 7 (GraphPad Software, San Diego, CA) and Stata 16 (StataCorp, College Station, TX).

Results

We included a total of 1600 procedures that were performed by 24 general gastroenterology fellows. Patient demographics, endoscopist status, and colonoscopy findings are given in Table 1. Ninety-four percent of patients were men and the mean age was 64 years. The patient population was racially/ethnically diverse, with 45% black, 30% white, and 20% Hispanic. Surveillance (50%) and screening (32%) were the most common procedural indications.

Overall PDR, ADR, SSPDR, and ANDR were 72%, 52%, 2%, and 14%. Table 2 shows the lesion detection rates for all procedures by site. PDR was highest in the left colon, followed by the right colon and transverse colon. In contrast, ADR and ANDR were higher in the right colon than in the transverse colon and left colon. There was no difference in SSPDR by site.

The ADR/PDR, SSPDR/PDR, and ANDR/PDR ratios for the entire colon were 0.73, 0.03, and 0.20 (Table 3). The ADR/PDR and ANDR/PDR ratios decreased from the right to the left colon, and the same general pattern was observed for each year of training. The low number of SSPs precluded interpretation of the trend in the SSPDR/PDR ratio by site or year of training.

The correlation between the measured and calculated ADR (measured ADR and PDR) was 0.87 for the entire colon, 0.91 in the right colon, 0.94 in the transverse colon, and 0.80 in the left colon ($p < 0.0001$ for all, Table 4). There was a low positive correlation between measured and calculated ANDR (measured ANDR and PDR) in the left colon (0.43, $p = 0.04$). No other correlations were statistically significant. In the sensitivity analysis of only screening and surveillance examinations, all measured correlations were similar in magnitude to the overall analysis (Table 4).

Discussion

In this single-center study of gastroenterology fellows, we found that PDR was highly correlated with overall ADR, and the correlation was stronger in the proximal (right and

transverse) than distal (left) colon. However, PDR was not strongly correlated with overall SSPDR or ANDR. Lesion detection rates varied by colonic site but were similar across years of training. These results suggest PDR may be a simple and useful surrogate measure of ADR for gastroenterology trainees.

We found that ADR and ANDR were highest in the right colon, whereas PDR was highest in the left colon. A higher ADR and ANDR in the right colon may seem counterintuitive, since missed polyps are more common in the right colon and the protective effect of colonoscopy against CRC is lower in the proximal colon than the distal colon [2, 11]. However, because most patients in our study had undergone a prior colonoscopy, it is possible that previously missed lesions contributed to a higher detection rate in the right colon. The findings may also simply reflect the distribution of adenomas and advanced neoplasia in an older population, as a proximal shift in CRC distribution has been shown with increasing age [12]. Higher left-sided PDR can be explained by the higher prevalence of hyperplastic polyps in the sigmoid colon and rectum.

While it has been previously reported that ADR and PDR increase with each additional year of fellowship [10], we observed similar detection rates for all lesions by year of training. Ratios of detection rates were also similar, although there was an increase in the right colon ANDR/PDR ratio from first-year to third-year fellows. The overall consistency in lesion detection by year of training suggests that with adequate attending supervision, even inexperienced trainees can perform high-quality colonoscopy.

Our overall ADR to PDR ratio (0.73), or APDRQ, was higher than what has been reported in other US-based studies. Francis et al. and Boroff et al. calculated the APDRQ for all-indication colonoscopies to be 0.64 and 0.65, respectively [7, 8]. More recently, a meta-analysis of 25 studies from nine countries including all-indication colonoscopies reported a summary APDRQ of 0.69 [9]. The higher APDRQ in our study may be explained by our patient population, which was 94% male and 45% black. Data from a national endoscopic database have shown that men have a higher prevalence of large polyps than women and blacks have the highest prevalence of large polyps of any racial/ethnic group [13]. These demographic characteristics may have increased the proportion of adenomatous polyps in our study population. We also found in our study that the APDRQ decreased from the right to left colon. This is likely due to a higher proportion of hyperplastic polyps in the left colon.

PDR was highly correlated with ADR overall, and the greater degree of correlation observed in the proximal versus distal colon reflects the higher proportion of adenomatous polyps in the proximal colon. These findings are consistent with that of Boroff et al. [8], although our PDR to ADR correlation in the left colon was substantially higher than theirs (0.80 vs. 0.59). While our results suggest PDR can still be used to estimate left-sided ADR, the high prevalence of hyperplastic polyps in the left colon makes the PDR a less reliable surrogate for the ADR than in the proximal colon.

There was no statistically significant correlation between PDR and SSPDR or ANDR overall, although there was a low correlation between PDR and left-sided ANDR. Few studies in the literature have assessed whether ADR correlates with the detection rates of

SSPs or advanced adenomas. Similar to our results, Sanaka et al. [14] found that SSPDR is low and there was no correlation with ADR. Kahi et al. [15] did observe a correlation between ADR and proximal SSPDR; however, their definition of adenoma included advanced adenomas and adenocarcinomas and their definition of SSPs included hyperplastic polyps. Finally, Gohel et al. [16] also did not find a statistically significant correlation between PDR and advanced adenoma detection rate, and the correlation they calculated was consistent with our correlation between PDR and ANDR (0.32 vs. 0.36). Therefore, the majority of evidence to date does not support the use of PDR as a surrogate measure for SSPDR or ANDR.

The strengths of this study include its large sample size and focus on gastroenterology trainees, for whom the appropriateness of using PDR as a quality indicator has not been evaluated. Some limitations should also be acknowledged. First, this is a single-center VA study, and the results have not been externally validated in a gender-balanced population. However, our overall results and trends are consistent with previous studies that have mainly focused on attending gastroenterologists in non-VA hospitals. This suggests our findings should be broadly applicable to trainees at other institutions. Second, we did not have data on which procedures required hands-on assistance from an attending physician and the nature of the assistance. Procedures in which attending physicians primarily performed the withdrawal should ideally be excluded from the study, but this rarely occurred at our facility. Third, given the low number of SSPs found in the study, it is possible that we may have been underpowered to detect a true correlation between PDR and SSPDR. A larger study with a greater number of SSPs may be needed to definitively examine this relationship.

In conclusion, our study provides evidence that PDR is highly correlated with ADR in colonoscopies performed by gastroenterology trainees, particularly in the proximal colon. Furthermore, our overall APDRQ of 0.73 was largely consistent across all years of fellowship. While external validation is required, these results suggest PDR may be a simple and reliable surrogate measure for colonoscopy quality among gastroenterology trainees.

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Table 1

Patient characteristics, trainee status, and endoscopic findings (n = 1600)

Patient demographics	Frequency (%)
Sex	
Male	1506 (94.1)
Female	94 (5.9)
Age (mean ± SD)	64 ± 10.5
Ethnicity	
White	481 (30.1)
Black	713 (44.6)
Hispanic	312 (19.5)
Asian	14 (0.9)
Other	80 (5.0)
Colonoscopy indication	
Screening	511 (32.0)
Surveillance	794 (49.7)
Diagnostic	295 (18.5)
Number of cases by fellow year	
Year 1	543 (33.9)
Year 2	711 (44.4)
Year 3	346 (21.6)
Endoscopic findings	
Polyps	1147 (71.7)
Adenomas	839 (52.4)
Sessile serrated polyps	38 (2.4)
Advanced neoplasia *	225 (14.1)

* Advanced neoplasia: any adenoma ≥ 10 mm in size, with villous component, or with high-grade dysplasia OR any sessile serrated polyp ≥ 10 mm in size or with dysplasia

Table 2

PDR, ADR, SSPDR, and ANDR by site

All colonoscopies	Total colon	Right colon	Transverse colon	Left colon	*P* value*
PDR	0.72	0.40	0.32	0.48	< 0.001
ADR	0.52	0.32	0.24	0.24	< 0.001
SSPDR	0.02	0.01	0.01	0.01	0.064
ANDR	0.14	0.07	0.04	0.05	< 0.001

* Chi-squared test

PDR polyp detection rate, *ADR* adenoma detection rate, *SSPDR* sessile serrated polyp detection rate, *ANDR* advanced neoplasia detection rate

Table 3

Ratio of ADR, SSPDR, and ANDR to PDR by site and year of training

	Total colon	Right colon	Transverse colon	Left colon
All colonoscopies				
ADR/PDR	0.73	0.80	0.74	0.50
SSPDR/PDR	0.03	0.03	0.02	0.02
ANDR/PDR	0.20	0.18	0.12	0.11
First-year fellow				
ADR/PDR	0.75	0.81	0.73	0.50
SSPDR/PDR	0.02	0.03	0.01	0
ANDR/PDR	0.16	0.16	0.08	0.10
Second-year fellow				
ADR/PDR	0.74	0.79	0.77	0.52
SSPDR/PDR	0.04	0.02	0.02	0.03
ANDR/PDR	0.21	0.18	0.14	0.13
Third-year fellow				
ADR/PDR	0.68	0.79	0.69	0.47
SSPDR/PDR	0.03	0.02	0.05	0.01
ANDR/PDR	0.21	0.25	0.11	0.10

ADR adenoma detection rate, *PDR* polyp detection rate, *SSPDR* sessile serrated polyp detection rate, *ANDR* advanced neoplasia detection rate

Table 4

Linear association between measured and calculated ADR, SSPDR, and ANDR

Site	Pearson correlation coefficient	
	All colonoscopies (*n* = 1600)	**Screening and surveillance colonoscopies (*n* = 1305)**
ADR		
Total colon	0.87**	0.84**
Right colon	0.91**	0.91**
Transverse colon	0.94**	0.92**
Left colon	0.80**	0.78**
SSPDR		
Total colon	0.37	0.40
Right colon	0.38	0.31
Transverse colon	− 0.06	− 0.12
Left colon	0.28	0.27
ANDR		
Total colon	0.36	0.36
Right colon	0.20	0.15
Transverse colon	0.33	0.39
Left colon	0.43*	0.39

* $p < 0.05$

** $p < 0.0001$

ADR adenoma detection rate, *SSPDR* sessile serrated polyp detection rate, *ANDR* advanced neoplasia detection rate