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Proximal Serrated Polyp Detection Rate Correlates with Adenoma Detection Rate and is Impacted by Mean Withdrawal Time: A Retrospective Study

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Abstract

Background: Given the implicated role of proximal serrated polyps (PSP) in the development of interval colon cancer, it is important to investigate if proximal serrated polyp detection rate (PSPDR) correlates with adenoma detection rate (ADR) and the factors that are associated with higher detection rates.

Methods: We performed a retrospective review of medical records of average-risk patients who underwent a screening colonoscopy at a tertiary care academic center. A total of 851 screening colonoscopies were analyzed.

Results: Gastroenterologists (n=22) performed the 851 colonoscopies. In univariable logistic regression, endsocopists with a mean WT ≥11 minutes had a higher odds of detecting a PSP compared to endoscopists with a mean withdrawal time WT <11 minutes (p<0.001; OR 5.3; 95% CI 2.6-10.8). Odds of PSP detection were greater in males than females (p=0.01; OR 2.2; 95% CI 1.2-4.1). The multivariable regression analyses confirmed that PSPDR was higher for endoscopists with mean WT ≥11 minutes (p<0.001). In addition, there was a significant correlation between ADR and PSPDR among endoscopists who performed at least 50 colonoscopies during the study period (r=0.89, p=0.04).

Conclusions: We concluded that there is a strong correlation between PSPDR and ADR and that a mean WT ≥11 minutes is an independent predictor of higher PSPDR.

Keywords: Serrated polyp detection rate; Adenoma detection rate; Withdrawal time

Abbreviations:

ADR: Adenoma Detection Rate; BMI: Body Mass Index; CIMP: CpG Island Methylator Phenotype; CI: Confidence Interval; CRC: Colorectal Cancer; PSP: Proximal Serrated Polyp; PSPDR: Proximal Serrated Polyp Detection Rate; SD: Standard Deviation; WT: Withdrawal Time

Background

Colorectal cancer (CRC) remains one of the most prevalent cancers in the United States. It is the third most commonly diagnosed cancer and second leading cause of cancer death affecting men and women in the US [1]. According to the American Cancer Society, approximately 142,820 new cases of CRC were diagnosed in 2013. The lifetime risk is 1 in 20 people; however, this varies depending on personal and family risk factors [1,2]. In the last 20 years, the mortality from CRC has decreased, largely in part due to the advent of screening and advancement in medical oncology leading to more than one million current CRC survivors in the US [1,3-5]. Colonoscopy has been established as an effective screening tool for CRC. US guidelines recommend screening average-risk individuals starting at the age of 50 and surveillance colonoscopies are then implemented based on colonoscopy findings [1,4,6,7]. In view of the important role of colonoscopy as a preferred screening tool for CRC, quality indicators emerged to measure endoscopists' performance during colonoscopy. The key quality indicator is the adenoma detection rate (ADR) that has been shown to be an independent predictor of the risk of interval CRC after screening colonoscopy [8-11]. Current recommendations for goal ADR are 25% in men and 15% in women [9]. Several factors affect the ADR which include endoscopist's skills, polyp size, type, location, withdrawal time, and quality of bowel preparation [12].

Despite the positive impact of screening campaigns on mortality from CRC, recent studies suggest that colonoscopy may have a greater protective effect for distal over proximal colon cancer as interval cancers after screening colonoscopy have been reported at a higher rate in the proximal colon [13-18]. Multiple factors including missed proximal serrated polyps (PSP) have been implicated as possible causes for this discrepancy [16,19].

Advanced serrated polyps that become severely dysplastic and eventually malignant stem from the CpG island methylator phenotype (CIMP) pathway which is responsible for approximately 18% of colon cancers and 4% of rectal cancers [20]. Serrated polyps include hyperplastic polyps, sessile serrated adenoma, and traditional serrated adenomas [19,21]. Detection rate of serrated polyps is generally lower

than ADR which can be due to many factors including morphology, low prevalence, and quality of bowel preparation [16,19,20,22]. Given the implicated role of PSP in the development of interval proximal colon cancer, serrated polyp detection rate has been suggested as an additional quality measure for colonoscopy [12,23].

The aim of our study is to investigate if PSP detection rate (PSPDR) correlates with ADR and the factors that are associated with higher detection rates.

Methods

This study was approved by the Institutional Review Board (protocol number: 2012H0171) at The Ohio State University—Wexner Medical Center. Furthermore, all authors had access to the study data and have reviewed and approved the final manuscript.

Cohort

A retrospective analysis of consecutive, average-risk patients for CRC who were referred for screening colonoscopies over a three-month period in 2012. Information was obtained from the electronic medical record (Epic®) at The Ohio State University-Wexner Medical Center.

A data collection form was developed to record demographic and clinical data including gender, race, height, weight, tobacco use, aspirin use, presence of diabetes, withdrawal time (WT), quality of bowel preparation, total number of polyps, and polyp characteristics including location, type, and size.

Twenty two gastroenterologists performed the procedures. All the endoscopists were at least five years post-training during the study period except for two who were within two years post-training. All colonoscopies were performed with Olympus H180. Bowel preparation was categorized into adequate (excellent, very good, or good) and inadequate (fair).

Histologic details of the polyps collected included adenoma and serrated polyps. PSP was defined as serrated polyps (hyperplastic, sessile serrated adenoma or traditional serrated adenoma) occurring proximal to the splenic flexure.

Patients were excluded if they had a poor bowel preparation, if the quality of the bowel preparation was not recorded or if the cecum was not intubated. WT was recorded independently by nursing staff on a routine basis.

Statistics

PSPDR was calculated as the number of screening colonoscopies detecting at least one PSP divided by the total number of screening colonoscopies. ADR was calculated likewise.

The mean WT was calculated for each endoscopist using procedures that did not require endoscopic intervention. Then a median split was performed at 11 minutes, with each endoscopist categorized as mean WT <11 minutes or ≥11 minutes.

Patient and procedural characteristics were compared between procedures performed by endoscopists with mean WT <11 minutes versus ≥11 minutes using t-tests for continuous variables and chi-square tests for categorical variables.

Univariable logistic regression models were fit to PSP and adenoma detection. Separate multivariable logistic regression for PSP and adenoma detection included the variables gender, bowel preparation quality (adequate vs. inadequate), race, smoking status, age, aspirin use, mean WT (<11 minutes vs. ≥11 minutes), and diabetes. Body mass index (BMI) was not included in either of the multivariable models due to missing values.

To determine the correlation between PSPDR and ADR, individual physician rates were calculated for endoscopists who performed at least 50 colonoscopies during the study period. Pearson's correlation coefficient was then calculated across the physician-specific detection rates.

All tests were evaluated at the type I error rate of 0.05. All analyses were performed using SAS/STAT software, version 9.3 (Cary, NC).

Results

A total of 851 average-risk patients for CRC who underwent screening colonoscopy during the study period met inclusion criteria. A comparison of patient and procedural characteristics between endoscopists with mean WT ≥11 versus <11 is shown in Table 1.

There was no difference between the two groups in respect to age, gender, BMI, history of smoking, history of diabetes, aspirin use, or adequate bowel preparation.

The overall PSPDR for the cohort was 6.2%. In univariable logistic regression, endoscopists with a mean WT ≥11 minutes had a higher odds of detecting a PSP compared to endoscopists with a mean WT <11 minutes (p<0.001; OR 5.3; 95% CI 2.6-10.8) (Table 2).

Odds of PSP detection was greater in males than females (p=0.01; OR 2.2; 95% CI 1.2-3.9). The other variables were not associated with PSPDR.

Patient Characteristics	Mean WT <11 minutes (n=452)	Mean WT ≥11 minutes (n=399)	p-value
Age	57 (8)	58 (8)	0.52
Sex, Female	243 (54%)	214 (54%)	0.97
BMI	29 (7)[1]	28 (6)[2]	0.16
Race			0.38
White	362 (80%)	306 (77%)	
Black	45 (10%)	39 (10%)	
Asian	8 (2%)	7 (2%)	
Other	37 (8%)	47 (12%)	
Smoker	179 (40%)	137 (34%)	0.11
Aspirin Use	158 (35%)	126 (32%)	0.3
Diabetes	73 (16%)	52 (13%)	0.2
Procedural Characteristics			
Adequate Preparation	378 (84%)	339 (85%)	0.59

Table 1: Patient and procedural characteristics, mean (SD) or n (%). [1]n=323, [2]n=288 , WT: Withdrawal time.

Variable	Odds Ratio (95% CI)	p-value
Endoscopist Mean WT ≥11 minutes	5.3 (2.6, 10.8)	<0.001
Male vs. Female	2.2 (1.2, 3.9)	0.01
Prep quality, Adequate vs. Fair	0.70 (0.35, 1.4)	0.3
Race		0.74
Black vs. White	0.97 (0.37, 2.5)	
Asian vs. White	2.4 (0.51, 10.8)	
Other vs. White	0.97 (0.37, 2.5)	
Smoker vs. non-smoker	1.3 (0.75, 2.3)	0.33
BMI, normal=18.5 - 24.9		0.15
Underweight (<18.5) vs. normal	0.75 (0.04, 14.9)	
Overweight (25-29.9) vs. normal	2.6 (1.1, 6.6)	
Obese (>30) vs. normal	1.5 (0.57, 4.1)	
Age, 5 year increase	1.1 (0.89, 1.3)	0.51
Aspirin Use	0.94 (0.52, 1.7)	0.84
Diabetes	1.0 (0.48, 2.3)	0.93

Table 2: Proximal serrated polyp detection rate: univariable logistic regression. BMI: Body Mass Index; WT: Withdrawal time.

Variable	Odds Ratio (95% CI)	p-value
Endoscopist Mean WT ≥11 minutes vs. <11 minutes	5.5 (2.7, 11.2)	<0.001
Male vs. Female	2.2 (1.2, 4.1)	0.01
Prep, Adequate vs. Fair	0.70 (0.34, 1.4)	0.33
Race		0.64
Black vs. White	0.98 (0.36, 2.6)	
Asian vs. White	2.7 (0.54, 13.2)	
Other vs. White	0.81 (0.30, 2.2)	
Smoker vs. non-smoker	1.3 (0.72, 2.4)	0.38
Age, 5 year increase	1.0 (0.98, 1.1)	0.43
Aspirin Use	0.76 (0.39, 1.5)	0.41
Diabetes	0.93 (0.40, 2.2)	0.87

Table 3: Proximal serrated polyp detection rate: multivariable logistic regression. WT: Withdrawal time.

In the multivariable logistic regression model, endoscopists with a mean WT ≥11 minutes continued to have higher odds of PSP detection compared to endoscopists with a mean WT <11 minutes (p<0.001; OR 5.5; 95% CI 2.7-11.2) (Table 3). Also, odds of PSP detection continued to be greater in males than females (p=0.01; OR 2.2; 95% CI 1.2-4.1

The overall ADR for the cohort was 25.3%. In univariable logistic regression, endoscopists with a mean WT ≥11 minutes had higher odds of adenoma detection (p<0.001; OR 2.3; 95% CI 1.7-3.2), along with males (p<0.001; OR 1.8; 95% CI 1.3-2.5), older patients (p=0.003; OR for 5 year increase 1.2; 95% CI 1.1-1.3), and aspirin use (p=0.04; OR 1.4; 1.0-1.9). In the multivariable logistic regression model, all of these variables remained significantly associated with higher adenoma detection except for aspirin use (Table 4).

Variable	Odds Ratio (95% CI)	p-value
Endoscopist Mean WT ≥11 minutes vs. <11 minutes	2.4 (1.8, 3.4)	<0.001
Male vs. Female	1.8 (1.3, 2.5)	<0.001
Prep, Adequate vs. Fair	0.69 (0.45, 1.1)	0.09
Race		0.84
Black vs. White	0.96 (0.55, 1.7)	
Asian vs. White	1.0 (0.30, 3.4)	
Other vs. White	0.77 (0.44, 1.3)	
Smoker vs. non-smoker	1.0 (0.74, 1.5)	0.82
Age, 5 year increase	1.2 (1.1, 1.3)	0.01
Aspirin Use	1.1 (0.76, 1.6)	0.63
Diabetes	1.2 (0.77, 1.9)	0.42

Table 4: Adenoma detection rate: multivariable logistic regression. WT: Withdrawal time.

There was a significant correlation between the ADR and PSPDR among endoscopists who performed at least 50 colonoscopies during the study period (r=0.89, p=0.04, n=5).

Discussion

Adenomas have been recognized as pre-cancerous lesions for several years and ADR has been shown to be an independent predictor of the risk of interval CRC after screening colonoscopy [10,11]. However, it is only recently that proximal serrated polyps have been implicated as one of the factors associated with the development of interval colon cancers [13,16,21,24,25]. This is concerning given data showing significant variation among endoscopists in respect to PSPDR [23,26]. In view of these findings, there have been recent guidelines from the Multi Society Task Force as well as recommendations from an expert panel stressing the importance of recognizing these lesions during screening colonoscopy and setting an optimal surveillance interval [27,28].

Our study included a large number of average-risk screening colonoscopies. All the endoscopists were at least five years post-training during the study period except for two gastroenterologists who were within two years post-training. All the endoscopists had performed more than 500 colonoscopies in our system by the beginning of the study period.

The overall PSPDR was 6.2% which aligns with existing literature and the suggested PSPDR benchmark of 4.5% [12,23]. Furthermore, PSPDR and ADR among males and females indicated a higher detection rate in males; a finding that correlates with existing literature and further supports suggested benchmarks [9,12]. Moreover, a recommended ADR of 25% is comparable to our findings of 25.3% [9].

IJspeert et al. reported a moderate correlation between PSPDR and ADR [29]. 24.9% of the included patients were high risk patients for CRC. On the other hand, Occhipinti et al. reported a weak correlation between proximal serrated lesions and ADR [30]. 74% of the patients included in this study had alarm symptoms or other symptoms as an indication for colonoscopy. Sanaka et al. showed a poor correlation between sessile serrated polyp detection rate and ADR [31]. Although this study included only average risk patients for CRC, it included non-gastroenterolgist and non-colorectal surgeon endoscopists and had a relatively low proximal sessile serrated polyp detection rate of 1.4% compared to 6.2% in our study. In benchmark analyses, ADR is calculated based on colonoscopies performed on average risk patients for CRC. We used the same method in our analysis and showed a strong correlation between PSPDR and ADR ($r=0.89$, $p=0.04$) when the procedures are performed by endoscopists with comparable training.

Recent studies have explored the relationship between PSPDR and WT [32-35]. In concordance with previous studies, our study supports this relationship by showing that endoscopists with a mean WT ≥11 minutes had three times higher odds of detecting at least one PSP compared to endoscopists with mean WT <11 minutes.

There were some limitations in this study. All the procedures were performed in a single academic center which could have affected the external validity of the study. Due to its retrospective design, there were missing data for BMI that prevented us from including this variable in the multivariable models [12,29]. Another possible limitation is observer bias. As the understanding of serrated polyps and its importance in the development of CRC grows, endoscopists may introduce variation by observer bias for which some endoscopists may actively seek this already difficult to find polyp more than others [19,26,36]. However as this study was retrospective over a relatively short period of time, the observer effect by which individuals alter their behavior to increase productivity is at best minimal.

Conclusion

In conclusion, due to the variation we reported in PSPDR among endoscopists, and the strong correlation between PSPDR and ADR, PSPDR can be used interchangeably with ADR as a quality measure for colonoscopy when benchmarking large number of procedures. In addition, our study showed that a mean WT ≥11 minutes is an independent predictor of higher PSPDR and ADR. A large prospective study is needed to prove the reliability of our findings. Until then, endoscopists performing screening colonoscopies need to be aware of the implication of PSPs in CRC and the importance of a careful exam for optimal detection of these polyps.

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