Mean Polyp per Patient Is an Accurate and Readily Obtainable Surrogate for Adenoma Detection Rate: Results from an Opportunistic Screening Colonoscopy Program

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ABSTRACT

BACKGROUND

The incidence of colorectal cancer is rising in several developing countries. In the absence of integrated endoscopy and pathology databases, adenoma detection rate (ADR), as a validated quality indicator of screening colonoscopy, is generally difficult to obtain in practice. We aimed to measure the correlation of polyp-related indicators with ADR in order to identify the most accurate surrogate(s) of ADR in routine practice.

METHODS

We retrospectively reviewed the endoscopic and histopathological findings of patients who underwent colonoscopy at a tertiary gastrointestinal clinic. The overall ADR and advanced-ADR were calculated using patient-level data. The Pearson's correlation coefficient (r) was applied to measure the strength of the correlation between the quality metrics obtained by endoscopists.

RESULTS

A total of 713 asymptomatic adults aged 50 and older who underwent their first-time screening colonoscopy were included in this study. The ADR and advanced-ADR were 33.00% (95% CI: 29.52-36.54) and 13.18% (95% CI: 10.79-15.90), respectively. We observed good correlations between polyp detection rate (PDR) and ADR (r=0.93), and mean number of polyp per patient (MPP) and ADR (r=0.88) throughout the colon. There was a positive, yet insignificant correlation between advanced ADRs and non-advanced ADRs (r=0.42, *p*=0.35).

CONCLUSION

MPP is strongly correlated with ADR, and can be considered as a reliable and readily obtainable proxy for ADR in opportunistic screening colonoscopy programs.

KEYWORDS
Screening colonoscopy; Colonic polyps; Colon cancers; MPP; ADR

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INTRODUCTION

The incidence of colorectal cancer (CRC) is rising in several developing countries leading to a predictable increase in the global burden

of CRC over the next two decades.[1,2] This observation necessitates an urgent action for implementing preventive strategies in areas with increasing CRC incidence rates.

Colonoscopy is shown to reduce the incidence and mortality of CRC in western countries.[3] In developing countries including Iran with the rapidly rising costs of healthcare, it is necessary to apply the most cost-effective preventive strategy for CRC.

Colonoscopy is a costly procedure that should be done with an acceptable quality in order to prevent repeat colonoscopy due to incomplete procedures.[4-6] However the quality of colonoscopy varies by practice, which can largely affect its effectiveness, and as such, attempts to measure and enhance the quality of colonoscopy have been made.[7] The preferred endpoints for validation of the quality of colonoscopy are the CRC incidence and mortality. However, the adenoma detection rate (ADR) during screening colonoscopy has recently been extensively used as the best established metric for the quality assessment of screening colonoscopy.[6,8] The US Multi-Society Task Force on CRC has recommended a minimum ADR of 15% for women and 25% for men in screening colonoscopy.[9,10]

The established metric of ADR, however requires automated fashion for data-linkage or manual review of colonoscopy and pathology reports.[6] Indeed, in many settings it is a challenge to obtain ADRs because of the absence of endoscopy and pathology database integration. Therefore some investigators have proposed polyp detection rate (PDR) and mean number of polyps per patient (MPP) as more feasible quality indicators to be used in practice for screening colonoscopy.[6,7,11-13] In this study, for the first time in the region, we aimed to measure ADR, evaluate its correlation with polyp-related indicators, and identify the most accurate surrogate(s) of the ADR in routine practice.

MATERIALS AND METHODS

Patients and procedures

We retrospectively reviewed the colonoscopy database and pathology reports of individuals who underwent screening colonoscopy at Masoud clinic, Tehran, Iran. Asymptomatic individuals aged ≥50 years who scheduled for first-time screening colonoscopy between 1 June 2007 and 30 March 2013, were included in the study. Thirteen endoscopists performed 713 colonoscopy under conscious sedation using high-definition colonoscopes (Olympus CF-H180AL). Symptomatic patients and those with a personal history of CRC or familial pattern of the disease (i.e. CRC in the first degree relatives, heredity non-polyposis CRC, or familial adenomatous polyposis) were excluded. Two experienced gastrointestinal pathologists evaluated the histological features of colorectal lesions. The study was approved by the Institutional Review Board of Digestive Disease Research Institute, Tehran University of Medical Sciences.

Measures

We collected the individuals' demographic data, quality of bowel preparation, and the rate of successful cecal insertion. Also clinical and pathological features of polyps (i.e. number, size, site, type, and grade of dysplasia) were retrieved.

Colorectal lesions were histopathologically categorized as hyperplastic, serrated, tubular, tubular-villous, villous, or cancer.[14] Polyps with features of tubular, tubular-villous, villous, or serrated adenoma were defined as adenoma. Advanced adenomas included adenomas ≥10 mm in diameter, or adenomas with villous or tubular-villous histology, or adenomas with high-grade dysplasia. We classified colonic segments as proximal (i.e., transverse colon, hepatic flexure, ascending colon, and cecum), and distal colon (i.e., rectum, sigmoid, descending, and splenic flexure).

Polyp detection rate (PDR) was defined as the proportion of procedures in which at least one polyp was detected over the total number of colonoscopies. Similarly, adenoma detection rate (ADR), and advanced ADR were calculated as the proportion of procedures in which at least one adenoma or advanced adenoma was detected over the total number of colonoscopies, respectively. Mean numbers of polyps per patient (MPP) and mean numbers of adenomas per patient (MAP) were defined as the

total number of polyps or adenomas detected divided by the total number of colonoscopies performed, respectively.

Statistical analysis

Continuous data are presented as means (SD), and 95% confidence interval (CI). Categorical variables are reported as number and proportions with 95% CIs. The overall PDR, ADR, and advanced ADR were calculated using patient-level data. Endoscopist-level data were generated by calculating the mean of the quality metrics (e.g., PDR, ADR) for each endoscopist who performed 10 or more colonoscopies (7 out of 13). To explore the correlation of ADR with PDR and MPP, simple linear regression test was used reporting coefficients of determination (R^2).

The Pearson's correlation coefficient (r), which is equal to the square roots of R^2, was applied to show the strength of the correlation between the quality metrics generated by endoscopists. The least squares line for the mean and the observed ADR, PDR, and MPP was separately obtained and plotted for the proximal, distal, and the entire colon. Two-tailed p value of less than 0.05 was considered as statistically significant. Statistical analyses were performed using Stata/MP software, version 11. Plots were developed in R, version 2.13.1.

RESULTS

Demographics and quality indicators

A total of 713 asymptomatic average-risk adults aged 50 and older were included in this study. The mean age of the participants was 61.68 ± 8.40 years, and 53% of them were male (n=380). The quality of colon preparation was fair to excellent in 449 (62.97%) procedures. Cecal reach was reported in 590 (82.75%) colonoscopies. Overall, 521 polyps (in 259 individuals) were retrieved during screening colonoscopy. The overall PDR was 36.33% (95% CI: 32.79-40.00). Adenomas and advanced adenomas were detected in 235 (33.00%; 95% CI: 29.52-36.54) and 94 (13.18%; 95% CI: 10.79-15.90) patients, respectively. The MPP and MAP were 0.73 (95% CI: 0.70-0.76) and 0.35 (95% CI: 0.30-0.40), respectively. Six patients (0.84%; 95% CI: 0.30-1.82) had cancer (table 1).

Table1: Detection rates of colonoscopic lesions per patient

	All (n=713)
Polyps, percentage (95% CI)	36.33 (32.79-40.00)
Adenomas, percentage (95% CI)	33.00 (29.52-36.54)
Non-advanced adenomas, percentage (95% CI)	17.25 (14.55-20.22)
Advanced adenomas, percentage (95% CI)	13.18 (10.79-15.90)
Cancer, percentage (95% CI)	0.84 (0.30-1.82)
Polyps per patients, mean (95% CI)	0.73 (0.70-0.76)
Adenomas per patients, mean (95% CI)	0.35 (0.30-0.40)

CI: confidence interval

Table 2: Correlations of the values of the quality measures in the entire colon MPP, mean polyps

	PDR	ADR	A-ADR	MPP	MAP
PDR	1	-	-	-	-
ADR	0.93	1	-	-	-
A-ADR	0.89	0.90	1	-	-
MPP	0.98	0.88	0.85	1	-
MAP	0.98	0.92	0.83	0.98	1

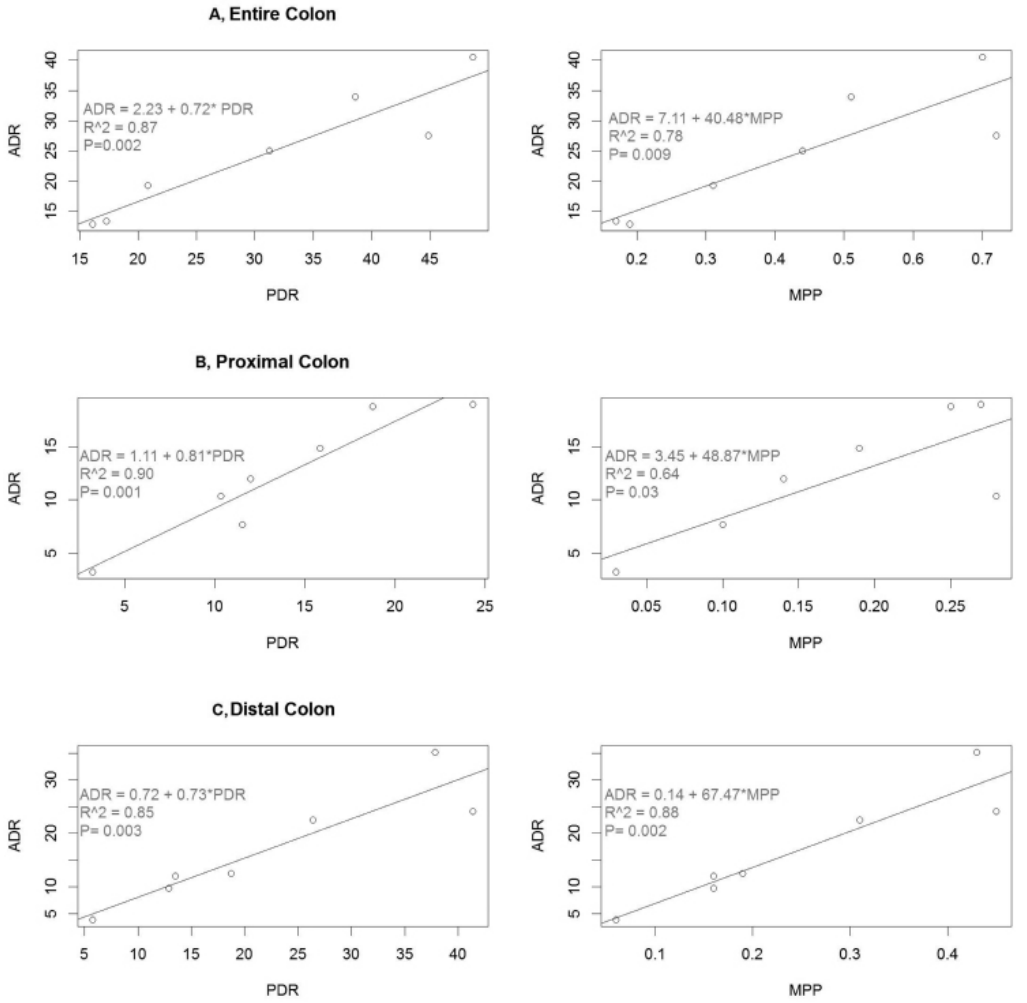
P's <0.05; PDR, polyp detection rate; ADR, adenoma detection rate; A-ADR, advanced-ADR;
per patient; MAP, mean adenomas per patient.

Correlation between quality indicators

The correlations between studied quality indicators are shown in table 2. We observed good correlations between PDR and ADR (r=0.93), and MPP and ADR (r=0.88) throughout the colon (table 2 and figure 1A). Similarly ADR, MPP, and PDR were strongly correlated with advanced ADR (r=0.90, r=0.85, and r=0.89, respectively) (table 2). We found strong correlations between ADR and PDR in both proximal (r=0.95, p=0.001) and distal colon (r=0.92, p=0.003). Likewise, the correlation between ADR and MPP was strong in proximal colon (r=0.80, p=0.03) and distal colon (r=0.94, p=0.002) (figure 1B and C). We observed a positive, yet insignificant correlation between advanced ADRs and non-advanced ADRs (r=0.42, p=0.35).

DISCUSSION

Adenoma detection rate (ADR) has been estab-



ADR: adenoma detection rate, PDR: polyp detection rate, MPP: mean polyps per patient.

Fig. 1: ADR as a function of PDR and MPP for entire colon (A), proximal colon (B), and distal colon (C)

lished as a widely accepted quality measure for colonoscopy quality, and strongly correlates with reduced rates of interval CRC.[15] In our study, the average-risk ADR of 33.00%, corresponding to the PDR value of 36.33%, is in line with previous reports from the screening settings.[6,7,16] More details on the quality of colonoscopies were discussed elsewhere.[17-18]

In practice, ADR may not be easily obtainable in the absence of an integrated endoscopy and pathology database. Therefore, development of more readily accessible surrogate(s) for ADR is desirable. PDR and MPP would be very immediate measures to monitor the quality of procedures. In our study, PDR and MPP were both strongly correlated with ADR, a finding that is consistent with those of others.[11-13,19,20] We, in agreement with Denis and colleagues,[19] suggest an additional benefit of using MPP over PDR as a surrogate for ADR, to monitor the quality of screening colonoscopies. The main advantage of the MPP is that it increases incrementally by rising polyp count that may serve as an incentive for specialists to find as many polyps as possible, whereas the PDR as a binary variable reaches the maximum value of 1, with detection of 1 polyp per patient. Thus, the MPP may serve as a

more readily available metric for ADR compared with the PDR, in routine practice.

A key issue is that the ADR correlation with MPP was not uniform throughout the colon in our series, and this variation should be noted before using the metric as surrogate of the ADR for the entire colon. Furthermore, the strong correlation of PDR and ADR (r=0.97) in proximal colon evident from our data and that of other studies[6,7,19] supports that the PDR and ADR should vary by colon segments, and that the lower correlation of the PDR and ADR in distal colon vs. proximal colon is mainly due to the removal of higher percentage of diminutive or hyperplastic polyps in distal segments.[6,7,19]

In our study the MPP was almost twice the MAP. One explanation for this finding would be the low rate of polyp retrieval during the procedure in particular for small polyps, which are not sent for pathological evaluation.

The existing data on correlation of colonoscopy metrics with advanced-ADR is controversial. An analysis of the US multi central endoscopic database including 14,341 screening colonoscopies, reported a good correlation of PDR and advanced ADR.[12] However, a recent report on 2167 average-risk patients from a single US center showed an overall poor correlation between PDR and advanced ADR.[7] In our series, both PDR and MPP had strong correlation with advanced ADR.

Knowledge on the correlation of the two subsets of the ADR (i.e., advanced and non-advanced) is limited. In line with the findings of a recent study by Greenspan and co-workers,[21] our results indicated a non-significant correlation between endoscopists' advanced-ADR and their non-advanced ADR. However there was an upward trend of advanced-ADR by increasing non-advanced ADR, which could reflect that the likelihood of finding advanced adenomas may increase simply by detecting more adenomas. Overall ADR, which includes advanced and non-advanced adenomas, is an established quality metric, whereas current guidelines have not clearly set a threshold value for advanced ADR in colonoscopy. In our opinion, the advanced ADR as a critical subset of the ADR could be treated as an independent quality measure in colonoscopy guidelines along with ADR.

Our study is one of the first of its type performed in a population with a rising CRC incidence. However we are also aware of the limitations of our study, which was based on a retrospective design and relatively a small sample size. More studies, however, are warranted to identify variations of the PDR and ADR among endoscopists addressing technical features of their performance in order to improve the quality of colonoscopy.

In summary, our adenoma and polyp detection rates are comparable to reports from western countries that have higher incidence of CRC, and are in line with the observed epidemiologic transition of CRC in Iran. MPP was strongly correlated with ADR, and can be considered a reliable and readily obtainable proxy for ADR in opportunistic screening colonoscopy programs.

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CONFLICT OF INTEREST

The authors declare no conflict of interest related to this work.

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