Editorial Commentary

Adenoma detection rate *vs.* adenoma per colonoscopy as quality indicators for colon cancer screening

Rizwan Ishtiaq[1], Laraib Zulfiqar[2], Manesh Kumar Gangwani[3], Muhammad Aziz[4]

[1]Academic Hospitalist, St. Francis Hospital, Hartford, CT, USA; [2]Department of Medicine, Quaid-e-Azam Medical College, Bahawalpur, Pakistan; [3]Hospital Medicine, University of Toledo, Toledo, OH, USA; [4]Department of Gastroenterology, University of Toledo, Toledo, OH, USA

Correspondence to: Muhammad Aziz, MD. Gastroenterology and Hepatology, The University of Toledo, 3000 Arlington Ave., Toledo, OH 43614, USA. Email: muhammad.aziz@utoledo.edu; marajani@hotmail.com.

Keywords: Adenoma detection rate (ADR); adenoma per colonoscopy (APC); quality; interval colon cancer

Received: 12 December 2022; Accepted: 22 March 2023; Published online: 28 April 2023.

doi: 10.21037/tgh-22-92

View this article at: https://dx.doi.org/10.21037/tgh-22-92

Introduction

Mortality by colorectal cancer (CRC) has declined significantly over the past few decades because of screening practices including colonoscopy, mainly due to the sensitive detection and removal of adenomas by colonoscopy (1). Interval colon cancer is the most alarming consequence of screening colonoscopy; its incidence is reported to be 0.5 to 1 per 1,000 patient-years (2,3).

Current US standards

Adenoma detection rate (ADR) is the percentage of patients with at least one histologically proven adenoma or carcinoma (3). ADR is a validated predictor of interval CRC and is a current surrogate marker of choice for endoscopy quality. Current minimum target detection rates are 30% for men and 20% for women (4). It has been reported in the literature that patients of endoscopists with ADR less than 20% have over 10 times greater risk of developing cancer because of the higher frequency of missed adenomas (2,3). Adenoma per colonoscopy (APC) is an additional quality indicator and is defined as the number of detected adenomas divided by the total number of screening colonoscopies (5). There have been very few studies that have discussed the association between ADR and APC (5). APC provides additional information and can extensively elaborate on the endoscopist's performance (5). In this editorial, we aim to compare ADR and APC in determining the quality and efficacy of colonoscopy. Improving quality indices for colonoscopy are inversely related to patient's post-procedure CRC risk (3).

ADR *vs.* APC

ADR is variable between various operators. It has also been discussed that ADR alone may not be optimal for assessing colonoscopy quality because it can potentially make an operator less inclined toward examining the remaining adenomas or polyps (6). This is known as the 'One and done' approach. In operators who are focused on using ADR as a quality indicator, it is very well possible that they may perform a quality examination until they find one adenoma and then unintentionally decrease the quality of the rest of the examination of the colonoscopy, which will indirectly affect the quality of the procedure without affecting ADR (7). Additionally, operator-based variability is also exhibited by differences in proximal and distal adenoma detection rate, and ADR metric by its calculable metric standard cannot account for these differences (8).

APC, defined as the number of adenomas detected during procedure, maybe a better-quality indicator than ADR. 95% of CRCs originate from colorectal adenomas (1). It cannot be predicted if every adenoma has an equal chance of progressing to CRC. It could also be possible that the only adenoma being examined has less chance of progressing to CRC. Considering APC as a quality

indicator, an operator will be inclined to examine all adenomas/polyps and remove as many adenomas as possible to maximize the histological examination, which will, in turn, increase procedural adenoma yield. Therefore, ADR will not be able to capture additional polyp removal beyond one as a quality metric, APC will be able to have an overall broader quality assessment.

Factors related to changes in ADR and APC

Some studies reported in the literature have discussed technical and endoscopist-related factors which can influence ADR. Technical factors include bowel preparation and withdrawal time (WT) (9-11). Endoscopist related factors include endoscopist years of practice, fatigue, workload, and timing of the colonoscopy, i.e., early morning *vs.* afternoon. Patient-related factors include age and sex. James *et al.* described age, gender, and endoscopist years of practice remained significantly associated with overall, distal, and proximal adenoma detection in multivariate analyses. While increasing age and male sex were associated with increased adenoma detection, increasing endoscopist years of practice was associated with decreased adenoma detection (8). Mehrotra *et al.* found that physicians with less than nine years of experience had a higher ADR than physicians with 25 to 51 years of experience (12). This can be explained by the fact that newer physicians have improved modalities and have a higher level of training. In another study by Jover *et al.*, older physicians had higher ADR than younger physicians (OR 1.06; 95% CI: 1.01–1.11) (13).

A study conducted by Sanaka *et al.* described that early morning colonoscopies have higher ADR than colonoscopies performed in the afternoon, mainly due to fatigue (14). It was a retrospective study investigating 2,087 incomplete colonoscopies (1,084 in the morning and 999 in the afternoon). A higher failure rate was observed in the colonoscopies performed in the afternoon (6.5% *vs.* 4.1%). Despite taking poor bowel preparations into the equation, the failure rate in the afternoon colonoscopies was higher (5.0% *vs.* 3.2%). A fatigued endoscopist may try to withdraw the colonoscope sooner compared to a non-fatigued endoscopist which can adversely affect ADR. A study by Lurix *et al.* showed that ADR is not affected by fatigue-related factors (15). The study compared ADR between the control group and a case group consisting of on-call duty or emergency procedures the night before screening colonoscopies. ADR was unaffected by overnight on-call duty. Undergoing emergency colonoscopy procedures the night before screening colonoscopy showed a significant decrease in ADR compared to the control group suggesting the effect of sleep deprivation on ADR (15). The effect of the timing of the day and workload on APC is unknown, and as per our knowledge, no study has reported this.

Considering technical factors, increasing WT is thought to increase ADR as it gives more time to examine the colon. The minimal recommended WT is 6 minutes for a normal colonoscopy (16). A prospective study by Harewood *et al.* found that WT and ADR remained stable while median CIT was lengthened as repetitive procedures progressed (17). Another prospective study by Adler *et al.* analyzed that WT within 6 to 11 minutes was unrelated to a reduced ADR (18). A study by Zhao *et al.* proved that increasing WT to 9 minutes is associated with increasing ADR (19). Compared to 6 minutes, nine minutes is easily adaptable per colonoscopy practices. WT of 9 minutes is suitable to give three minutes of WT in each segment of the colon (19). The study found that the benefit of prolonged WT is mostly confined to the proximal colon, which requires more careful inspection as this portion of the colon is associated with interval colon cancer most of the time (19). Prospective randomized controlled trials have also shown that the highest ADR and APC is achieved at nine minutes of WT (20). Another study evaluating the relationship between endoscopic WT and ADR found that compared to shorter WT, ADR significantly increased if the WT was increased ≥2 minutes in the right sided colon, ≥4 minutes in the proximal colon and ≥3 minutes in the left sided colon (21). Bowel preparation is another factor that can affect ADR. It is known that afternoon colonoscopies have poor bowel preparation, which can decrease ADR. In our understanding, if endoscopists have the same baseline status in terms of optimal working status and fatigue-related factors, WT and bowel preparation will affect ADR and APC in a similar fashion.

There are various strategies discussed in the literature that can increase ADR. In a study conducted by Kamal *et al.* including 3,901 patients, it was concluded that a second exam of the right colon increased ADR (22). In another study focusing on water immersion and air/CO_2 insufflation, higher ADR was noted in the group that used water techniques (23). The use of these low-cost techniques and measures will improve the adenoma detection rate, which will, in turn lead to decreasing incidence of interval colon cancer.

APC and correlation with ADR

All factors mentioned above affecting ADR will indirectly affect APC. No study has mentioned the correlation between APC and ADR directly linked to the detection of CRC. In a study by Wang *et al.*, younger endoscopists and endoscopists with a longer WT were found to have a higher APC (5). The study also found an excellent correlation between APC and ADR (r=0.97, P<0.001). Patient-related factors leading to high APC included older age and male patients (5). Park *et al.* discovered that APC was significantly correlated with ADR (r=0.82, P<0.001) (7). This shows that the strength of APC in detecting adenomas is indirectly linked to ADR. Any measures which can increase ADR will also lead to an increase in APC and decrease the incidence of interval colon cancer which is reported to be 0.5 to 1 per 1,000 patient years (2,3). Studies are needed in this regard. A study evaluating 80,915 screening colonoscopies of 60 endoscopists showed that despite high ADC and APC correlation, almost 48% of endoscopists with the lowest APC had higher ADR; however, no endoscopist with high APC had a lower ADR (5). In our understanding, although increasing ADR and APC will directly increase the chances of detecting CRC, APC is a better indicator because examining all adenomas removed during the procedure will maximize the chances of detecting abnormal pathology rather than examining just one adenoma. In a data from the New Hampshire Colonoscopy Registry, it was found that mean APC is inversely associated with post colonoscopy colorectal cancers (PCCRC). They investigated a total of 9,023 colonoscopies with a follow-up of 6–60 months period after index and 82 CRCs diagnosed during the 6–60 months period (50 CRCs diagnosed during 6–36 months) after the index exam. The data demonstrated reduction in rate of PCCRC in exams performed by endoscopists with a higher APC. APC of 0.6 (HR =0.29) may offer more protection from PCCRC than 0.4 (HR =0.37) within first 3 years of an index exam. Metrics of this study provides objective evidence that APC may be a better-quality indicator than ADR minimizing the risk of PCCRC (24). In our opinion, the disadvantages of APC include increased procedural and withdrawal times however this should not discourage the endoscopists as all adenomas should be removed for histological examination. Another disadvantage could be the need for accurate accounting of number of adenomas compared to ADR where only one adenoma detection is required.

Role of artificial intelligence (AI) and other technologies

Various advances in aiding polyp detection have a role in ADR and can also increase APC and further define its role in quality improvement. In a meta-analysis conducted by Hassan *et al.* in which 5 randomized control trials comprising 4,353 patients were included, it was found that pooled ADR was significantly higher in the group that used AI compared to the control group [791/2,163 (36.6%) *vs.* 558/2,191 (25.2%); RR, 1.44; 95% confidence interval (CI): 1.27–1.62; P<0.01; I^2=42%] (25). APC was also higher in the group with AI compared to the control group [1,249/2,163 (0.58) *vs.* 779/2,191 (0.36); RR, 1.70; 95% CI: 1.53–1.89; P<0.01; I^2=33%]. Moreover, lesion detection was not impacted by size and morphology, which could be affected by the human eye. This indirectly shows that increasing recognition failure by colonoscopy operators can lead to an increased incidence of internal colon cancer, which could have been otherwise detected by AI. Hence, using AI will improve the quality of colonoscopies directly impacting ADR and APC. Most recently, a network meta-analysis compared AI with other endoscopic interventions like endocuff, endocap, dye-based chromoendoscopy, flexible spectral imaging color enhancement, full-spectrum endoscopy, narrow band imaging water exchange, and water immersion accessing ADR and APC yield (26). AI showed increased ADR and APC when compared with above mentioned endoscopic interventions. We suggest that using these modalities can increase APC too, which is a stronger metric to assess the efficacy of colonoscopies. As per our knowledge, no current study in the literature has shown a correlation between APC and interval CRC.

Conclusions

Both ADR and APC are useful valid tools to determine endoscopists' performance and remain correlated in outcome measures. APC can serve as a better representation of the entire colon and provide additional information about endoscopist performance, increasing overall detection rates and improving quality metrics. It can also be a better assessment tool used in clinical trials to increase homogeneity. It may potentially lead to increased costs due to increased sedation and WT, as well as increased costs related to biopsies and histopathology. Further studies with APC are needed to establish a

minimum target for endoscopists and to assess the impact of APC on interval cancer using longer follow-ups in comparison to ADR. We conclude that ADR may be satisfactory for quality capture for colonoscopy, APC can distinguish high performers beyond adequate ADR. With the availability of newer technologies, including enhanced vision and artificial intelligence, ADR may not be adequate to set enhanced quality metrics and improve detection rates.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Translational Gastroenterology and Hepatology* for the series "Colonoscopy: Updates and Prospects". The article has undergone external peer review.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://tgh.amegroups.com/article/view/10.21037/tgh-22-92/coif). The series "Colonoscopy: Updates and Prospects" was commissioned by the editorial office without any funding or sponsorship. MA served as the unpaid Guest Editor of the series and serves as an unpaid editorial board member of *Translational Gastroenterology and Hepatology* from September 2022 to August 2024. The authors have no other conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Zauber AG, Winawer SJ, O'Brien MJ, et al. Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. N Engl J Med 2012;366:687-96.
2. Kaminski MF, Regula J, Kraszewska E, et al. Quality indicators for colonoscopy and the risk of interval cancer. N Engl J Med 2010;362:1795-803.
3. Corley DA, Jensen CD, Marks AR, et al. Adenoma detection rate and risk of colorectal cancer and death. N Engl J Med 2014;370:1298-306.
4. Rex DK, Schoenfeld PS, Cohen J, et al. Quality indicators for colonoscopy. Gastrointest Endosc 2015;81:31-53.
5. Wang S, Kim AS, Church TR, et al. Adenomas per colonoscopy and adenoma per positive participant as quality indicators for screening colonoscopy. Endosc Int Open 2020;8:E1560-5.
6. Aniwan S, Orkoonsawat P, Viriyautsahakul V, et al. The Secondary Quality Indicator to Improve Prediction of Adenoma Miss Rate Apart from Adenoma Detection Rate. Am J Gastroenterol 2016;111:723-9.
7. Park SK, Kim HY, Lee CK, et al. Comparison of adenoma detection rate and adenoma per colonoscopy as a quality indicator of colonoscopy. Scand J Gastroenterol 2016;51:886-90.
8. James P, Hegagi M, Hegagi M, et al. Variable Endoscopist performance in proximal and distal adenoma detection during colonoscopy: a retrospective cohort study. BMC Gastroenterol 2018;18:73.
9. Jia H, Koo M, Hsieh YH, Tseng CW, Hu CT, Zhang L, Dong T, Pan Y, Leung FW. Factors Associated With Adenoma Detection in Propofol-sedated Patients. J Clin Gastroenterol 2019;53:523-9.
10. Park JH, Kim SJ, Hyun JH, et al. Correlation Between Bowel Preparation and the Adenoma Detection Rate in Screening Colonoscopy. Ann Coloproctol 2017;33:93-8.
11. Rex DK, Bond JH, Winawer S, et al. Quality in the technical performance of colonoscopy and the continuous quality improvement process for colonoscopy: recommendations of the U.S. Multi-Society Task Force on Colorectal Cancer. Am J Gastroenterol 2002;97:1296-308.
12. Mehrotra A, Morris M, Gourevitch RA, et al. Physician characteristics associated with higher adenoma detection rate. Gastrointest Endosc 2018;87:778-786.e5.
13. Jover R, Zapater P, Bujanda L, et al. Endoscopist characteristics that influence the quality of colonoscopy. Endoscopy 2016;48:241-7.

14. Sanaka MR, Shah N, Mullen KD, et al. Afternoon colonoscopies have higher failure rates than morning colonoscopies. Am J Gastroenterol 2006;101:2726-30.
15. Lurix E, Hernandez AV, Thoma M, et al. Adenoma detection rate is not influenced by full-day blocks, time, or modified queue position. Gastrointest Endosc 2012;75:827-34.
16. Rex DK, Petrini JL, Baron TH, et al. Quality indicators for colonoscopy. Gastrointest Endosc 2006;63:S16-28.
17. Harewood GC, Chrysostomou K, Himy N, et al. Impact of operator fatigue on endoscopy performance: implications for procedure scheduling. Dig Dis Sci 2009;54:1656-61.
18. Adler A, Wegscheider K, Lieberman D, et al. Factors determining the quality of screening colonoscopy: a prospective study on adenoma detection rates, from 12,134 examinations (Berlin colonoscopy project 3, BECOP-3). Gut 2013;62:236-41.
19. Zhao S, Yang X, Wang S, et al. Impact of 9-Minute Withdrawal Time on the Adenoma Detection Rate: A Multicenter Randomized Controlled Trial. Clin Gastroenterol Hepatol 2022;20:e168-81.
20. Coghlan E, Laferrere L, Zenon E, et al. Timed screening colonoscopy: a randomized trial of two colonoscopic withdrawal techniques. Surg Endosc 2020;34:1200-5.
21. Jung Y, Joo YE, Kim HG, et al. Relationship between the endoscopic withdrawal time and adenoma/polyp detection rate in individual colonic segments: a KASID multicenter study. Gastrointest Endosc 2019;89:523-30.
22. Kamal F, Khan MA, Lee-Smith W, et al. Second exam of right colon improves adenoma detection rate: Systematic review and meta-analysis of randomized controlled trials. Endosc Int Open 2022;10:E1391-8.
23. Aziz M, Sharma S, Fatima R, et al. How to increase proximal adenoma detection rate: a meta-analysis comparing water exchange, water immersion and air/CO(2) insufflation methods for colonoscopy. Ann Gastroenterol 2020;33:178-86.
24. Anderson J, Hisey W, Robinson C, et al. S545 Mean Adenomas Per Colonoscopy Is Inversely Associated With Post Colonoscopy Colorectal Cancers: Data From the New Hampshire Colonoscopy Registry Validating This Quality Measure. Am J Gastroenterol 2021;116:S249.
25. Hassan C, Spadaccini M, Iannone A, et al. Performance of artificial intelligence in colonoscopy for adenoma and polyp detection: a systematic review and meta-analysis. Gastrointest Endosc 2021;93:77-85.e6.
26. Aziz M, Haghbin H, Sayeh W, et al. Comparison of Artificial Intelligence With Other Interventions to Improve Adenoma Detection Rate for Colonoscopy: A Network Meta-analysis. J Clin Gastroenterol 2022. [Epub ahead of print]. doi: 10.1097/MCG.0000000000001813.

doi: 10.21037/tgh-22-92
Cite this article as: Ishtiaq R, Zulfiqar L, Gangwani MK, Aziz M. Adenoma detection rate *vs.* adenoma per colonoscopy as quality indicators for colon cancer screening. Transl Gastroenterol Hepatol 2023;8:24.