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Assessment of quality in screening colonoscopy for colorectal cancer

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Introduction: The effectiveness of screening colonoscopy in decreasing the incidence of colorectal cancer (CRC) is largely dependent on the detection of polyps and the quality of the procedure. Several key quality measures have been proposed to improve the effectiveness of screening colonoscopies.

Aim: To evaluate quality indicators of screening colonoscopy in a tertiary hospital.

Methods: All CRC screening colonoscopies performed between 2005 and 2009 in a single tertiary center were reviewed for internationally accepted quality measures.

Results: Of the 1545 individuals who underwent first-time screening colonoscopy 38% were male and 62% were female. The mean age of the patients was 60.4 years and the mean difference in ages was ± 10.3 years. Cecal intubation rate was 91% (1336), however ileocecal valve photo documentation was performed in only 81% (1248) colonoscopies. The quality of bowel preparation was classified as: good 76% (1171), reasonable 11% (174), and poor 13% (200). Polyp detection rate (PDR) was 33% (503). The prevalence of polyps ≥1 cm in size was 5% (82). PDR was significantly higher in men than in women (44% [260] vs 25% [243], $P = 0.0001$). Other factors significantly influencing PDR were quality of bowel preparation (odds ratio [OR]: 1.28, 95% confidence interval [CI]: 0.9–1.6) and age over 50 (OR: 1.9, 95% CI: 1.3–2.9). Left colonic polyps were associated with a risk ratio of 2.3 (95% CI: 1.8–2.9) of lesions in the other colonic segments compared to no polyps in the left colon. None of the colonoscopists reported withdrawal time.

Conclusion: Cecal intubation rate and quality of bowel preparation were suboptimal. The polyp detection rate compares favorably to accepted standards and its main determinants are male sex, age >50 years, quality of bowel preparation, and the presence of left colonic polyps.

Keywords: colorectal cancer, screening colonoscopy, quality indicators

Introduction

The incidence of colorectal cancer (CRC) is rising in Europe and it is estimated that every year more than 400,000 patients are newly diagnosed with CRC.[1] Most cancers grow relatively slowly over 10–15 years and the development of CRC is attributed to the adenoma–carcinoma sequence.[2] This window period allows for screening and prevention of CRC by endoscopic removal of polyps. Many experts and scientific societies advocate colonoscopy as the method of choice for screening and prevention of CRC.[3–5] Although there is good evidence for the positive impact in the reduction of CRC it is also recognized that its effectiveness is dependent on the quality of the procedure[6–8] which, unfortunately, is very variable in the clinical practice. A number of key quality indicators have been recommended. In 2002, quality indicators for colonoscopy were published by the American Society for Gastrointestinal

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Endoscopy/American College of Gastroenterology (ASGE/ACG) and further adjusted by Rex et al.[8,9] The key indicators proposed were: preprocedure (appropriate indication and use of surveillance intervals, informed consent); intraprocedure (documentation of quality of bowel preparation, cecal intubation rates with photodocumentation of cecal landmarks, adenoma detection rate, withdrawal time >6 minutes, adequate resection of polyps); postprocedure (measurement of incidence of perforation, post-polypectomy bleeding and nonoperative management of post-polypectomy bleeding). Lieberman was the lead author of the report of the Quality Assurance Task Group of the National Colorectal Cancer Roundtable that developed a reporting and data system for colonoscopy to assist endoscopists in monitoring quality indicators in their practice.[10] European guidelines for quality assurance in CRC screening and diagnosis have recently been published.[11] Most CRC screening programs now incorporate routine assessment of the quality of examinations as a way to improve screening colonoscopy clinical outcomes. The quality of colonoscopies cannot be measured or improved if reports do not include key quality indicators. The objectives of our study were (1) to determine if screening colonoscopy reports in our center included key quality indicators and (2) to measure the actual performance of our examinations when compared to accepted standards.

Methods

We retrospectively analyzed all colonoscopy reports of the examinations performed between 2005 and 2009 in our Gastroenterology Department which we coded in our database as screening colonoscopies for CRC. Only total colonoscopies (as intended) where included. All of the examinations were performed by board-certified specialists or fellows in training. A total of 1545 first-time screening colonoscopies were eligible for data analysis. Procedure-related quality indicators considered for analysis were: cecal intubation rate and photodocumentation of cecal landmarks (ileocecal valve, appendiceal orifice, or terminal ileum), quality of bowel preparation, and polyp detection rate. The quality of bowel preparation was subjectively classified at the time of the examination by each endoscopist as good, fair, or poor, so we adopted these three grades of bowel preparation. The polyp detection rate instead of adenoma detection rate was considered since we did not have pathology data for all of the examinations. Accordingly, polyps ≥10 mm were considered surrogate markers for advanced neoplasia.[12] We correlated polyp detection rate with sex and age (dichotomized as <50 vs ≥50 years old), quality of bowel preparation, and use of sedation. Statistical analysis was performed using Microsoft Excel (Microsoft Corp, Redmond, WA) and SAS software (v 9.1; SAS Institute, Inc, Cary, NC). Multivariate analysis was used to determine factors influencing the polyp detection rate. A value of $P < 0.05$ was considered significant.

Results

The patient demographics are shown in Table 1. A total of 1545 examinations corresponding to 1545 patients were made. The distribution according to gender was 62% female and 38% male. The mean age of the patients was 60.4 years and the mean difference in ages was ± 10.3 years. Seventy percent of the patients were between 50 and 70 years old. Cecal intubation was successful in 91% (1336) of the colonoscopies although documentation of either three of the landmarks considered was present in only 81% (1248). Incomplete colonoscopies accounted for 14% (209) of the examinations. The motives for incomplete colonoscopy were patient intolerance 40% (84), inadequate bowel preparation 35% (73), technical difficulties 18% (37), and obstructive lesion 0.5% (1). A second screening colonoscopy within the same year was performed on only 30% (62) of patients with incomplete colonoscopies, of which 40% had polyps.

The quality of bowel preparation was classified as: good 76% (1171), fair 11% (174), and poor 13% (200). There was no significant gender difference in the quality of bowel preparation. Sixty-seven percent (1046) of the colonoscopies were performed without sedation, 25% (392) under conscious sedation, and 7% (107) under deep sedation. Although there were more incomplete examinations due to intolerance in patients without sedation than in patients with

Table 1 Patient characteristics

Gender	**N (%)**
Male	587 (38)
Female	958 (62)
Age (years)	**Median**
Patients	60.4 (±10.3)
Male	64.9 (±9.8)
Female	60.1 (±10.5)
Age, stratified	**N (%)**
20–29	14 (0.9)
30–40	34 (2.2)
40–50	119 (7.7)
50–60	548 (35.5)
60–70	552 (35.7)
70–80	225 (14.6)
80–90	40 (2.6)
>90	3 (0.2)

conscious sedation (6% [64] vs 5% [19]), the difference was not significant ($P = 0.31$).

The overall polyp detection rate (PDR) was 33% (503). The prevalence of polyps ≥10 mm in size, a surrogate marker for advanced neoplasia, was 5% (82). The polyp distribution was as follows: left colon 74% (370), right colon 31% (153), and transverse colon 17% (86) patients. In 26% (98) of the patients with left colonic polyps, synchronous polyps in the transverse or right colon were also detected. The presence of left colonic polyps was associated with a risk ratio of 2.3 (95% confidence interval [CI]: 1.8–2.9) for lesions in other colonic segments compared to no polyps in the left colon. Male gender was a major risk factor for the presence of polyps. PDR was significantly higher in men than in women (44% [260] vs 25% [243], $P = 0.0001$) with an odds ratio [OR] of 2.3 (95% CI: 1.8–2.9). Men also had a significantly higher prevalence of polyps ≥1 cm (9% [50] vs 3% [32], $P = 0.002$) and multiple polyps (22% [126] vs 11% [105], $P = 0.0001$), compared to women. Polyps were more frequently detected in patients aged ≥50 years than in those <50 years (34% vs 20%, $P = 0.0004$). PDR was higher in patients with good bowel preparation compared to reasonable or poor bowel preparation (34% vs 28%, OR: 1.28, 95% CI: 0.9–1.6). Polyps where detected in 34% of colonoscopies with deep/conscious sedation compared to 32% in colonoscopies without sedation but this difference was not significant ($P = 0.38$). Colorectal cancer was found in 0.3% (five) patients (three men and two women, mean age 68 years). Of these, two (40%) had at least one synchronous polyp, both in the left colon.

Discussion

Colonoscopy has become accepted as a powerful screening tool for CRC prevention and early diagnosis since 2000, when two landmark articles[13,14] were published describing results of screening colonoscopy and its feasibility and ability to provide definitive insights into the types and locations of important advanced neoplastic lesions that would be missed with sigmoidoscopy. Although the efficacy of colonoscopy in reducing CRC incidence and mortality is well established, there are some major pitfalls. Firstly, the positive impact of colonoscopy is largely operator-dependent,[6,8,18] highlighting the importance of the quality of the procedure. Secondly, colonoscopy seems to provide more protection against distal rather than proximal colon cancer, as pointed out by Canadian case-control and cohort studies.[15–18] The relative ineffectiveness of screening colonoscopy in the prevention of proximal colon cancer might be explained by certain biological features of neoplasms at this level[19] but also by potentially correctable factors related to the quality of the examination. The importance of defining and establishing uniform quality benchmarks for screening colonoscopy as a way to overcome these pitfalls and assure the positive impact of this examination has been recognized. In our study we analyzed some of the key quality indicators for screening colonoscopies and compared them to the proposed standards by ASGE/ACG[8,9] as a first step to improve our practice.

Completion rates have been proposed as a quality metric because it is reasonable to assume that the effectiveness of colonoscopy is limited if the entire colon is not routinely examined. Cecal intubation is defined as passing the tip of the endoscope beyond the ileocecal valve lip. Photodocumentation is recommended and important from a medical-legal perspective. Our observed cecal intubation rate (91%) is suboptimal compared to the ASGE benchmark of 95%. Variations in cecal intubation rates are due to physician variables (skill including dexterity, training level), patient variables (age, gender, body mass index, past surgeries, tortuousity of the colon, pain threshold, and response to anesthesia), and the adequacy of bowel preparation.[20–22] In our study we found that there were two main factors which contributed to incomplete colonoscopies. Firstly, patient intolerance in 40% (84) was the major motive for an incomplete examination. Because of logistical restrictions the majority of the colonoscopies where performed without sedation (67%) and this may have contributed to a high incidence of patient intolerance. Secondly, there was a higher incidence than desirable of patients with poor bowel preparation (13%).

A major limitation of our study was the subjective assessment of bowel preparation. The perception of good, fair, or poor between our endoscopists is highly variable and only a few report the quality of preparation if it is poor. We considered such reports to be indicative of good bowel preparation. The ASGE guidelines recommend that documentation of bowel preparation should be done in every examination. Although there is no standardized system for this, an adequate preparation is one that allows the clear detection of lesions >5 mm. The percentage of examinations with poor bowel preparation should be less than 10%,[9] a benchmark which we did not achieve. This should warn us to give special attention to our implemented bowel preparation protocol. Recent studies have shown that split dose polyethylene glycol-electrolyte (PEG) is more effective than conventional bowel preparations[23] and that adherence to dietary instructions has a significant impact on the quality of bowel preparation.[24]

The adenoma detection rate (ADR) was developed as a quality indicator in 2002.[9] It has been validated as a powerful predictor of CRC risk after screening colonoscopy.[25] A recent study by Baxter (2009) found that patients colonoscoped by doctors with polypectomy rates of 25%–29% and ≥30% had 52% and 39% lower incidence rates, respectively, of subsequent proximal colon cancers compared with patients colonoscoped by doctors with polypectomy rates ≤10%.[26] The ASGE/ACG recommendations propose that adenomas should be detected in more than 25% of the asymptomatic male individuals (>50 years) and in more than 15% of the asymptomatic female individuals (>50 years) at first colonoscopy because prevalence rates of adenomas in colonoscopy screening studies have been consistently over 25% in men and 15% in women >50 years old.[14] The Bowel Cancer Screening Program (BCSP) in the UK requires an ADR of 35%.[27] ADR is cumbersome to calculate as it needs to be correlated with pathology data not readily available at the time of the procedure. There have been recent studies that show that PDR is a useful quality measure with a good correlation with the ADR. In a study by Williams et al, the PDRs by endoscopists correlated well with their ADRs (r_s) = 0.86, $P < 0.001$). To attain the established benchmark ADRs for men (25%) and women (15%), endoscopists needed PDRs of 40% and 30%, respectively. [28] In our study, we used the PDR as a surrogate marker of the ADR and we were able to fulfill the requirements of this recently defined benchmark (44% for men and 25% for women). Despite our suboptimal cecal intubation rate and quality of bowel preparation, does our good PDR mean that we are doing these fairly well? It is known that adenoma detection is dependent on many different variables. Firstly, the baseline demographic features of the population screened, such as male sex and age above 50 years and to a lesser extent family history of colorectal neoplasia, influence the ADR. Secondly, factors related to the technique of the examination – such as the speciality of the endoscopist (gastroenterologist vs non-gastroenterologist),[29,30] quality of bowel preparation, and withdrawal time – also influence the ADR. Withdrawal times are directly linked to ADRs, because a more careful inspection leads to a greater yield. Studies have demonstrated increased detection of significant neoplastic lesions in colonoscopic examinations where the withdrawal time is 6 minutes or more.[31] In our study, none of the endoscopists reported withdrawal times, which can be seen as a major limitation. However, nowadays it is recognized that endoscopists who meet the ADR benchmark are likely to have satisfactory withdrawal technique. Our results regarding gender, age, and quality of bowel preparation as influencing factors for PDR are in accordance with the published literature. We did not find a significant difference in PDR between examinations with sedation or without sedation.

Our study has several limitations, as already pointed out. Being a retrospective study, there was missing data regarding some of the most important quality indicators, such as withdrawal time, standardized description of the quality of bowel preparation, and the adenoma detection rate. The only clear quality indicator we documented was the cecal intubation rate. With this data, we acknowledge that the assessment of the quality of screening colonoscopies in our center is limited and it cannot be extrapolated nationwide. Nevertheless, it is the first study in our country where to date a national colonoscopy screening program for colorectal cancer has not been implemented. Our study provides crucial input for improving the quality of our examinations and highlights the need to implement the use and the systematic report of these quality benchmarks before establishing a screening program.

Conclusion

Although colonoscopy screening has been documented to confer a high degree of protection against CRC in clinical trials, its population-based field efficacy is dependent on a high-quality procedure. Several quality indicators have been validated and incorporated in screening programs worldwide. In our center some of these quality indicators are still suboptimal. In the future we should aim to improve the quality of our examinations. Future research should be directed at determining the best way to use these quality indicators for colonoscopy in a manner that results in improved patient care and outcome.

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Disclosure

The authors report no conflicts of interest in this work.

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