

Screening colonoscopy: should we focus more on technique and less on technology?

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Abstract

Several large studies have confirmed that high quality colonoscopic surveillance can improve outcomes with substantial reduction in colorectal cancer rates. In order to improve outcomes from screening colonoscopy and help detect adenomas, the emphasis has been mainly on improvements in technology like high-resolution scopes, computerized as well as dye-based chromoendoscopy and wide-angle endoscopes. In addition to the equipment and technological innovation in the equipment used, a number of other factors like experience of the endoscopist, optimal withdrawal techniques, position changes during colonoscopy and bowel preparation can all influence adenoma detection and thereby the quality of colonoscopic surveillance. In this review we will focus on recent studies investigating these aspects of colonoscopy and their impact on adenoma or polyp detection.

Introduction

Colorectal cancer is the second leading cause of death in the US and the UK. Screening colonoscopy with resection of detected polyps has reduced the subsequent risk for developing colorectal cancer as well as the risk of colorectal-cancer-related mortality [1,2]. This enthusiasm in screening colonoscopy has been tempered by some studies that have shown that colonoscopy performs poorly in reducing mortality from right-sided cancers [3,4]. However, several large studies have confirmed that high-quality colonoscopic surveillance can improve outcomes with a substantial reduction in colorectal cancer rates [5,6]. This has resulted in several national societies, including the British Society of Gastroenterology (BSG) and the American Gastroenterology Association (AGA), focusing on adenoma detection rate as a performance or quality indicator in colonoscopy. In order to improve outcomes from screening colonoscopy and help detect adenomas, the emphasis of late has been focused more on technology like high-resolution scopes, computerized as well as dye-based

chromoendoscopy and wide-angle endoscopes rather than technique.

In addition to the equipment and technological innovation in the equipment used, a number of other factors like experience of the endoscopist, optimal withdrawal techniques, position changes during colonoscopy and bowel preparation can all influence adenoma detection and thereby the quality of colonoscopic surveillance. In this review we will focus on recent studies investigating these aspects of colonoscopy and their impact on adenoma or polyp detection.

Techniques in colonoscopy

Unarguably, the main challenge in colonoscopy is to ensure adequate mucosal visualization at both insertion and withdrawal. Optimal bowel preparation, effective use of sedation, position change and ancillary maneuvers during the procedure and improved withdrawal technique, adequate distension of the bowel throughout examination are some of the basic steps that could

collectively improve the outcomes. The impacts of these techniques are discussed separately below.

Bowel preparation

Inadequate bowel preparation has been variably defined and can be thought of as preparation that results in an inability to visualize a polyp of 5 mm or larger [7]. Suboptimal mucosal visualization decreases adenoma detection. Studies suggest that up to one third of the colonoscopies performed are compromised by poor bowel preparation [8], which in most cases precludes any planned endoscopic therapy. This requires a repeat procedure or alternative investigations, thus delaying the diagnosis and wasting resources.

Two bowel cleansers are widely used, polyethylene-glycol and electrolyte lavage solution (PEG+ELS), and sodium picosulphate (NaP) with or without PEG. PEG+ELS has very minimal fluid and electrolyte shift between the intestinal cells, and is safer for the majority of the patient groups, but patient compliance and acceptability due to its large volume (4 liter solution) is poor.

Recent studies have suggested that a split dose regimen of either PEG+ELS or NaP solutions improves bowel preparation scores for colonoscopy over standard methods where bowel preparation is taken a day prior to colonoscopy (Table 1). A meta-analysis comparing NaP with PEG did not show any difference between the two but PEG-based solutions performed better for clinically important outcomes like quality of preparation of the proximal colon [9]. However, a recent meta-analysis of studies comparing split versus standard colonoscopy preparation strategies showed that 4 liter split-dose PEG

is better than other bowel preparation methods for colonoscopy [10]. A system side implementation of split dose preparation in a large US centre found significant improvements in adenoma detection rate compared to a historical control group prior to implementation of the split dose colonoscopy preparation [11]. Table 1 lists some of these studies and their outcomes.

Procedure-related aspects

Techniques such as changing the position of the patient to aid insertion and to improve adenoma detection rate on withdrawal are well known but perhaps not adhered to adequately by many colonoscopists. Withdrawal time and technique are widely believed to be quality indicators of colonoscopy, but have also been argued to be surrogates for other quality indicators. More recently, queue position (timing of colonoscopy in the day shift) has been considered as a cause for variation in adenoma detection among colonoscopists. Some studies have shown that as the day progresses, polyp detection rate deteriorates, presumably due to operator fatigue and time pressure, whereas some have found no difference (see table 2). This implies that perhaps the differences are operator dependent and not universal.

Heightened awareness of colonoscopists either by filming/video-recording, presence of observer or a trainee in the room seems to have a positive impact on the colonoscopy outcomes. Additional stressors such as being behind the schedule, staff pressures, case volume, and interruption during the list may have a negative impact. These issues highlight that there are complex and dynamic “behind the scene” activities that have a bearing on standards of colonoscopy performed.

Table 1. Recent studies on the role of split dose bowel preparation for colonoscopy

Author (year) ref	Study Design	Comments	Results
Flemming JA (2012) [27]	RCT	Split dose of NaP used	Favours Split dose regime NaP.
Seo EH (2012) [28]	Prospective observational study.	Split dose of PEG+ELS used	Favours Split dose regime PEG+ELS.
Enestvedt BK (2012) [10]	Meta-analysis	Split dose versus conventional	Split doses of PEG found superior

Abbreviations: PEG, polyethylene glycol; ELS, electrolyte lavage solution

Table 2. Recent studies on queue position and operator fatigue on adenoma detection

Author (year) ref	Study design	Details	Results
Lurix E (2012) [29]	Retrospective review	3085 procedures. ADR variation with queue positions.	ADR does not vary with queue position, full day blocks or timing.
Guruda S (2011) [30]	Retrospective review	4665 procedures. ADR variation with queue positions.	Half day blocks increase but full day blocks decrease ADR
Lee A (2011) [31]	Retrospective review	1083 procedures. PDR variation with queue positions.	4.6% reduction in PDR with each hour elapsed.
Long M (2010) [32]	Retrospective review	3421 procedures. ADR variation with queue positions.	ADR affected as time progresses in both half and full day blocks.

Abbreviations: ADR, adenoma detection rate; PDR, polyp detection rate

Queue position

To look at the effect of operator fatigue on adenoma detection rate, various studies have examined the timing of the endoscopy list and work patterns, such as effect of full day versus half day blocks and more recently three three-hour shifts compared with the standard two four-hour endoscopy lists. Table 2 lists recent studies and the effects of queue position and operator fatigue.

Position change, ancillary maneuvers, withdrawal time and technique

Improved adenoma detection with position change of patients in association with adequate luminal distension during withdrawal phase of colonoscopy is a well-established fact [12,13]. Withdrawal time and its effect on adenoma detection rate, by both experienced and trainee colonoscopists, however, has been controversial. Table 3 lists some of the recent studies looking at withdrawal time and adenoma detection rate.

A second pair of eyes

Conscientious colonoscopists take extra care not to miss pathology, but, even so, an extra pair of eyes may help improve adenoma detection rate. To this end, the effect of video recording of a procedure, and a “fellow

effect” (presence of trainee in the room) on adenoma detection rate has been studied. This newly recognized behavioral issue among colonoscopists is difficult to study yet important to address. Observation perhaps acts as a form of “peer review” and reduces the likelihood of “cutting corners”. Table 4 lists the recent studies looking at adenoma detection rate with video recording of the procedure or the presence of a trainee.

Retroflexion and retroversion

Retroflexion in the rectal ampulla combined with making a 180° rotation of the scope tip has been claimed to improve mucosal visualization and could therefore improve the detection of adenomas. Saad et al. found that in 1502 consecutive colonoscopies, rectal retroflexion was successful in 94%, but resulted in the detection of an additional seven polyps of which six were hyperplastic and one a 4 mm adenoma [14]. Attempts to retrovert the colonoscope at the caecum and ascending colon has had mixed results. The technical success was only 60% using standard pediatric colonoscopies but 95% using prototype instruments with an extra flexible tip [15]. Retroflexion in the right colon was not shown to improve adenoma detection over standard forward viewing in a study from Indiana [16].

Table 3. Recent studies on the effect of withdrawal time on adenoma detection

Author (year) ref	Study design	Comments	Results
Adler A (2012) [33]	Retrospective review	12134 Procedures. ADR variation with WT.	No correlation with 6 minutes WT and ADR but instead influenced by operator and instrument quality.
Lee RH (2011) [34]	RCT	110 video recordings reviewed for withdrawal technique. WT noted.	WT and technique differs between endoscopists having varying ADR. WT range 6.3-10.2 minutes.
Gromski MA (2011) [35]	Prospective observational study	First year trainees involved in recording their WT and ADR	WT >10 minutes had significantly higher ADR
Overholt BF (2010) [36]	Prospective multi-centred study	15955 procedures reviewed for WT	WT >6 minutes increases Polyp detection.

Abbreviations: ADR, adenoma detection rate; WT, withdrawal time

Table 4. Studies on trainee involvement or video recording and adenoma detection

Author (year) ref	Study design	Comments	Results
Buchner AM (2011) [37]	Retrospective review	2430 procedures. Trainees involvement & ADR noted	Increased detection of small adenomas noted with trainee present.
Eckardt AJ (2009) [38]	Prospective study	387 procedures. Trainee involvement & ADR noted.	No significant difference noted in ADR with or without trainee.
Rex DK (2011) [39]	Prospective video recording of colonoscopy skills	7 colonoscopists involved with/without informing about video recording	Mucosal visualization time and technique improved with awareness of video recording.
Madhoun MF (2012) [40]	Video recording of all colonoscopies	All colonoscopists were aware of the video recording	No significant increase in ADR, but increase in detection of hyperplastic polyps noted

Abbreviation: ADR, adenoma detection rate

Looking for polyps at insertion and withdrawal

Traditionally, endoscopists have limited scope for systematic inspection of the mucosal surface to detect adenomas during the withdrawal phase of the procedure. A recent randomized trial looked at the effect of including the insertion phase in the adenoma detection process and found that inspection during insertion had no additional benefit on adenoma detection rate [17]. However, another European RCT found that removal of polyps smaller than 10 mm only on the withdrawal phase resulted in a lower adenoma detection rate compared to removal of these polyps in both insertion and withdrawal phases [18].

Use of antispasmodics

The role of using antispasmodics (mainly hyoscine N-butylbromide) has been controversial. Two recent studies have provided conflicting results on the use of antispasmodics and adenoma detection rate. An RCT from the Netherlands found no difference in both the detection of adenomas and advanced adenomas with the use of hyoscine N-butylbromide [19]. An Australian RCT, however, found that the adjusted odds of detecting an adenoma were 1.6 fold in the group receiving hyoscine N-butylbromide [20]. However, the adenoma detection rate between the groups was not significantly different.

Operator experience and expertise

A landmark study from Poland showed that endoscopists with a greater than 20% adenoma detection rate had a significantly lower rate of interval colorectal cancer [5]. More recent data from North America has confirmed that endoscopists with a higher polypectomy rate also have lower rates on interval colorectal cancer [21,22]. Interestingly, several studies have also shown an inverse relationship between endoscopists who classed themselves as Gastroenterologists and interval colorectal cancer rates [21-23].

A study from the UK, however, showed that operator volume and accreditation as bowel cancer screeners, and not the endoscopist's specialty, determined adenoma detection rate [24]. Training and quality improvement would obviously have a role here and a group from the Mayo Clinic showed that an endoscopist quality improvement program resulted in an improved adenoma detection rate in those who were randomized to the training program compared to those who were not [25]. However, variable results have been reported by another systematic quality improvement program with five specific interventions designed to improve adenoma detection rate. In this study, no change in adenoma

detection rate was noted over a 3-year period, despite these planned systematic interventions [26].

Conclusions

Efforts to improve adenoma detection rate in screening colonoscopy require colonoscopists to focus as much on technique as technology. High standards of colonoscopy can be achieved by adhering to simple technical standards. Remembering to spend time on withdrawal with adequate luminal distention and position changes to aid adenoma detection are important measures.

The other issues to focus on include considering the use of split dose bowel preparation to improve mucosal visualization and thereby adenoma detection rate. Considering the issue of operator fatigue and reducing the time spent in a stretch in the endoscopy unit in individual circumstances could have a benefit, but this could well be operator dependent. Not all colonoscopists may find trainees fun and stimulating, but their presence could lend an extra pair of eyes to improve adenoma detection rate. It is also worth considering video recording the entire procedure to heighten awareness among colonoscopists. Retroflexion and retroversion have not been shown to improve adenoma detection rate and this issue needs further study. The jury's still out on the role of hyoscine N-butylbromide. Training and accreditation also probably play a role and emerging data seem to suggest that higher procedural volumes and quality improvement interventions could improve adenoma detection rate.

Abbreviations

ELS, electrolyte lavage solution; NaP, sodium picosulphate; PEG, polyethylene glycol; RCT, randomized controlled trial.

Disclosures

The authors declare that they have no disclosures.

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