Colonoscopy and Colorectal Cancer

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Abstract

Colonoscopy has a central role in the detection and prevention of colorectal cancer. This is based on the fact that most colorectal cancer develops from premalignant adenomatous or serrated polyps, which can be removed at colonoscopy and hence prevent the development of colorectal cancer. The success of colonoscopy in preventing bowel cancer is dependent on the quality of the colonoscopy performed. This review highlights the key performance indicators measuring quality of colonoscopy, including consent, indication, preparation, caecal intubation rates, polyp detection and removal, withdrawal time and complication rates, and sets minimum target recommendations for each of the key performance indicators.

Does colonoscopy prevent colorectal cancer?

The evidence for colonoscopy reducing the incidence of colorectal cancer (CRC) comes mostly via indirect evidence from a number of observational, cohort studies. While the National Polyp Study demonstrated a risk reduction in the development of CRC of 76 per cent to 90 per cent post polypectomy, other studies have shown a more modest risk reduction. In addition, more recent evidence suggests that in real world community practice, colonoscopy affords a greater level of protection against the development of cancers on the left side of the colon than the right side. The reason for this is not entirely clear, but could include patient factors (bowel prep and tumour biology), colonoscopist factors (technique, knowledge, personality and perceptual factors), system drivers and equipment factors. The more aggressive biology of right sided cancer might be a factor and a recent study has confirmed that a higher proportion of right sided cancers after recent colonoscopy are microsatellite unstable. However, low polypectomy rates and a high proportion of incomplete colonoscopies seem a common theme in many

of these studies, suggesting that the quality of colonoscopy is a more important factor. A recent German study has suggested that well performed colonoscopy does indeed protect patients from both left and right sided cancer.

Quality in colonoscopy

Overall high quality colonoscopy is dependent on a number of factors, including patient-related factors, operator-related factors, system-related factors and equipment. Operator factors include appropriate training and experience of the colonoscopist, proper risk assessment of the patient, complete examination to the caecum with adequate mucosal visualisation and bowel preparation, the ability to detect and remove polyps safely, adequate documentation, timely and appropriate management of adverse events, follow-up of histopathology and appropriate screening and surveillance intervals based on published guidelines. Therefore, in order to maintain a high level of performance and quality in the colonoscopy procedure, a number of working groups have proposed key performance indicators. Improving Colonoscopy Services in Australia was published by a quality working group tasked by the Australian Department of Health and Ageing to provide a reference guide for colonoscopy alongside the roll-out of the National Bowel Cancer Screening Program. Several other international societies have also recently published colonoscopy quality guidelines, including the American, Canadian and European societies.

The Australian National Health and Medical Research Council (NHMRC) 2005 guidelines identify four key performance areas that need to be monitored for quality assurance. These are:

1. Procedure: indication, consent, preparation, technique
2. Facility and equipment
3. Documentation and reporting systems and training
4. Certification and credentialing.

Here we aim to focus on the colonoscopy procedure and the key performance indicators (KPIs) within this domain that have been identified for quality assurance. Key areas for quality KPIs for the colonoscopy procedure include consent, indication, preparation, caecal intubation rates, polyp detection and removal, withdrawal time and complication rates.

Consent

Patients must provide informed consent to undergo any endoscopic procedure. The requirements for an adequate bowel preparation form part of the consent, along with a full explanation of the procedure, including any risks and potential complications, why it is indicated and any alternative investigation options. Patients must be given the opportunity to ask questions and receive advice. Provision of this information prior to colonoscopy helps to minimise withdrawal of consent on the day of procedure, and therefore reduces loss of facility time and other economic consequences. It is important that this information is given prior to the commencement of bowel preparation. While European colonoscopy guidelines state that patients should also have the opportunity to withdraw consent during the examination, this is less relevant in Australia where anaesthetic support is more commonly used and patients are often more deeply sedated.

Indication

The Australian Quality Working Group recommended that prior to colonoscopy, the colonoscopist should ensure that the indication for performing the colonoscopy is documented. The indications for asymptomatic patients should conform to the NHMRC guidelines and include a family history of CRC, personal history of CRC or polyps, colitis surveillance or a positive faecal blood test. The use of colonoscopy for screening asymptomatic patients is not supported by the Australian Government, though this is not the case in other countries including the United States. Symptomatic patients should have relevant symptoms documented on the colonoscopy report.

Preparation

Effective bowel preparation is obligatory for high quality colonoscopy. Good bowel preparation facilitates polyp detection and optimises caecal intubation. Conversely, poor preparation is associated with prolonged procedures and failure to detect disease. The data on the superiority of type of bowel prep is conflicting. While preparations containing sodium phosphate are lower volume and may be better tolerated, polyethylene glycol solutions have an improved safety profile and are favoured for use in the elderly and patients with other medical comorbidities. However, tolerability and quality of high volume PEG prep is improved by splitting the dose, with the aim of finishing bowel prep within hours of the colonoscopy start time. Several societies suggest the poor preparation should be present in less than 10% of studies, but poor preparation is probably more precisely defined by the requirement to repeat the examination.

Caecal intubation rates

Caecal intubation is defined as deep intubation into the caecum with the tip of the colonoscope being able to touch the appendiceal orifice. Caecal intubation demonstrates a complete examination of the colon, and is fundamental for CRC screening. The intubation of the caecum should ideally be documented by an image of the appendiceal orifice and/or terminal ileum if intubated. The Australian Quality Working Group sets an adjusted (i.e. includes studies with poor prep and obstructing cancer) caecal intubation rate of 90% for general patients and 95% for patients undergoing screening colonoscopy. This is comparable to the National Health Service (NHS) Bowel Cancer Screening Program with a recommended minimum, unadjusted caecal intubation rate of 90%. The US Multi-Society taskforce has set a minimum intubation rate of 95% for screening colonoscopy and 90% for symptomatic colonoscopy, whereas the Cancer Care Ontario Standards are a completion rate of 95%, though this is excludes cases with obstructing lesions and poor bowel preparation. Low colonoscopy volume, i.e. less than 200 procedures per annum, has been associated with lower caecal intubation rates for colonoscopists with less than five years’ experience. While the Australian Conjoint Committee
Withdrawal time

Withdrawal time is the time taken to remove the colonoscope from the maximal extent of insertion at the caecum to withdrawal from the anus. Longer withdrawal times are associated with increased adenoma detection.\textsuperscript{37,38} The Australian quality working group recommends that the mean colonoscopy withdrawal time from the caecum for each proceduralist should be six minutes or greater for procedures where there is no polypectomy performed.\textsuperscript{45} This recommendation is similar to European guidelines,\textsuperscript{17} which recommend a minimum withdrawal time of six minutes in at least 90% of purely diagnostic examinations, and the joint task force of the American College of Gastroenterology and American Society for Gastrointestinal Endoscopy recommends that average withdrawal time should exceed six minutes in normal colonoscopies in which no polypectomies or biopsies were performed, though notes that this withdrawal time should not be applied to individual cases.\textsuperscript{39} However, withdrawal time is likely to be a surrogate marker for adenoma detection rates and as such should not be relied upon as an independent marker of quality.\textsuperscript{40}

Polyp detection, removal and retrieval

The NHS Bowel Cancer Screening Program defines ‘adenoma detection rate’ (ADR) as “the number of colonoscopies at which one or more histologically confirmed adenomas is found, divided by the total number of colonoscopies performed”.\textsuperscript{17} It is the best validated KPI for colonoscopy, though the number of adenomas per colonoscopy is a less well studied, but potential alternative.\textsuperscript{41} Evidence of ADR variability between endoscopists has been demonstrated by studies comparing ADR between gastroenterologists in the same group. These studies report a three to six fold difference in ADR between endoscopists.\textsuperscript{37,42-44} Similarly, the detection of serrated polyps also differs between endoscopists.\textsuperscript{45,46} The degree of variation is higher than traditional adenomas, with one study reporting a 25% difference in proximal serrated polyp prevalence per colonoscopy between endoscopists.\textsuperscript{46}

A study by Kaminski et al demonstrated a significant increase in interval cancers in individual colonoscopists with an ADR below 20%.\textsuperscript{37} The European Society of Gastrointestinal Endoscopy guidelines recognise that there is a difference between populations in whom screening colonoscopy is performed (e.g. US, where suggested ADR are 15%/25% for women/men) and for colonoscopy populations enriched with patients with positive faecal occult blood testing, in whom the ADR should be nearer to 35%.\textsuperscript{17} The ESGE guidelines recommend that a minimum of 90% of resected polyps should be retrieved.\textsuperscript{17}

ADR measurement often requires manual calculation and is time consuming to generate in endoscopy units without electronic linking between endoscopy reporting systems and histopathology reports. In order to overcome difficulties in measurement of ADR, a recent suggestion of using polypectomy rates (PR) as a surrogate for ADR has been studied and validated.\textsuperscript{48,49} However, a study by Boroff et al warns that while the correlation with ADR is reliable in the right colon, it is not in the left colon.\textsuperscript{50} Therefore, while PR measurement cannot be recommended as an alternative to ADR measurement, for endoscopy units that have difficulty in measuring ADR, PR is a reasonable first step but should not reduce attempts to be able to measure adenoma detection rates. A number of newer technologies such as cap-assisted colonoscopy, chromoendoscopy, Third Eye Retroscope and electronic image enhancement techniques, such as narrow band imaging (NBI) have, been developed to enhance mucosal inspection and adenoma detection rates. The impact of these on adenoma detection has been modest compared with the potential improvements from removing individual variation among colonoscopists.\textsuperscript{4} Indeed, it seems clear that colonoscopy technique and individual characteristics are much more important than equipment.\textsuperscript{40}

The Australian Quality Working Group recommends the adenoma detection rate for each proceduralist is more than 20 per cent in patients over 50 years undertaking an initial colonoscopy.\textsuperscript{15} The Joint Advisory Group from the British Society of Endoscopy Guidelines suggests an adenoma detection rate of >10% for flexible sigmoidoscopy and colonoscopy.\textsuperscript{41} The American College of Gastroenterology/American Society for Gastrointestinal Endoscopy taskforce recommends ADR targets for individual endoscopists of identifying one or more adenomas in at least 25% of men and 15% of women aged 50 years and older, undergoing screening colonoscopy,\textsuperscript{33,38} whereas European guidelines recommend adenoma detection rates be recorded, but leave targets to the discretion of individual screening boards – presumably due to variation among recommendations for screening (allcomers or faecal blood positive enriched), surveillance and symptomatic populations.

Complications

There is some evidence to suggest that an increased volume of colonoscopy performed by colonoscopists results in fewer complications.\textsuperscript{52-54} As a result, the UK NHS Bowel Screening Program suggests a lifetime experience of 1000 colonoscopies and an annual number of 150 colonoscopies prior to being certified to perform bowel cancer screening program colonoscopy.\textsuperscript{55}

The two most feared complications of colonoscopy are perforation and bleeding (usually post polypectomy). However, a missed cancer or advanced polyp is likely to be the biggest overall risk for the patient. Perforation in screening colonoscopy approximates 1/1000 and could be used as a useful indicator of colonoscopy safety in large colonoscopy units or in national screening programs.\textsuperscript{56} This increases to around 1/500 post polypectomy,\textsuperscript{46} but it is likely that not all post polypectomy perforations are recognised clinically. The rates are higher when resecting larger polyps.\textsuperscript{57} For screening populations enriched with positive faecal blood, the likelihood of adenomas and advanced adenomas is increased and the overall colonoscopy complication
rate is likely to be higher than with screening colonoscopy populations. This needs to be considered when applying historical complication rates in enriched colonoscopy populations. The requirement for surgery has reduced with the ability to close perforations with endoscopic clips (particularly post polypectomy).

The British Joint Advisory Committee and the Australian Quality Working Group guidelines state colonoscopy perforation rates should be <1:1000 whereas Rex et al suggest perforation rates greater than one in 500 for all colonoscopies or one in 1000 for screening colonoscopies require evaluation of practice.

Post polypectomy bleeding is defined as rectal blood loss following a colonoscopy that requires a blood transfusion that may occur up to two weeks post polypectomy. Bleeding is affected by many factors, including the definition of bleeding, use of antiplatelet and anti-thrombotic medication, lesion characteristics, colonoscopist volume and different diathermy settings. Due to this wide range of variables that impact on post polypectomy bleeding, there is a large range of reported incidence in the literature, with rates ranging from 1:10 to 1:300 colonoscopies.

Rex et al suggested post-polypectomy bleeding rates should be less than 1% and the Joint Advisory Group on GI Endoscopy from the British Society of Gastroenterology recommends post polypectomy bleeding requiring transfusion should be <1:100 (for >1cm polyps). The Australian Quality Working Group recommends post-polypectomy bleeding should be less than one in 100 patients who have had a polypectomy, whereas the European Society of Gastrointestinal Endoscopy recommends that less than 5% of post-polypectomy bleeding should require surgical intervention.

Colonoscopy has the most validated set of quality indicators of all endoscopic procedures. Many national and international societies have developed specific KPIs similar to those suggested in this article. Many of these quality indicators are deliverable from electronic reporting systems, so should be measured by colonoscopists and endoscopy units and be required by accreditation bodies.

Table 1: Recommendations

<table>
<thead>
<tr>
<th>Colonoscopy quality indicator</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>Consent</td>
<td>Suitable information should be provided to patients prior to the commencement of bowel preparation for colonoscopy.</td>
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<tr>
<td>Indication</td>
<td>The indication for screening colonoscopy in asymptomatic patients should conform to the NHMRC guidelines. Symptomatic patients should have the relevant symptoms documented on the colonoscopy report.</td>
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<tr>
<td>Preparation</td>
<td>Less than 10% of patients should require repeat procedure due to poor bowel preparation.</td>
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<td>Caecal intubation rates</td>
<td>Unadjusted rates for caecal intubation should be ≥90% for symptomatic and ≥95% for screening patients. Photo documentation of the appendiceal orifice +/- terminal ileum should be performed to confirm a complete examination.</td>
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<tr>
<td>Polyp detection, removal and retrieval</td>
<td>Adenoma detection rate for each proceduralist of &gt;20% in patients over 50 years of age undertaking an initial colonoscopy.</td>
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<tr>
<td>Complications</td>
<td>Perforation rates post colonoscopy should be &lt;1/1000. This is more relevant for population programs and large endoscopy units rather than individual colonoscopists.</td>
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References


40. Chen SC, Rex DK. Endoscopist can be more powerful than age and male gender in predicting adena detection at colonoscopy. Am J Gastroenterol. 2007 Apr;102(4):858-61.


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