How to Negotiate Difficult Colonoscopy to Optimize Cecal Intubation Rate

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ABSTRACT

Colonoscopy is the current standard method for evaluating colon. Cecal intubation rate is an important indicator of colonoscopy quality. In up to 10–20% colonoscopies, cecal intubation may be considered difficult. There are several consequences of low cecal intubation rate: it limits the efficacy of colonoscopy, increasing risk of complications and cost, and missing in detecting adenoma colorectal or other abnormal mucosa lesion. Failure to intubate the cecal can be a result of: (1) patients factors (female, older, diverticular disease, history of abdominal surgery, low body mass index, history of constipation, laxative use); (2) endoscopist factors (prior experience, the specific techniques and instrument used; (3) or some combination thereof.

In an effort to solve these problems endoscopist should increase their technical manoeuvres (minimizing inflation and looping, using water–aided method, appropriate use of positional changes and abdominal pressure) and use various accessories methods (inserting a biopsy forceps through the biopsy channel, pediatric colonoscopy, variable stiffness colonoscopy).

***Keywords**: cecal intubation rate, difficult colonoscopy, colonoscopy quality, water–aided colonoscopy*

ABSTRAK

Kolonoskopi merupakan metode standar untuk mengevaluasi sistem kolon. Angka intubasi sekal merupakan indikator penting yang mencerminkan kualitas kolonoskopi. Sekitar 10-20% prosedur kolonoskopi dikategorikan sulit. Ada beberapa konsekuensi sebagai akibat rendahnya angka pencapaian sekal, yaitu efikasi kolonoskopi rendah, meningkatnya risiko komplikasi dan biaya, serta kehilangan kesempatan dalam menemukan adenoma kolorektal atau lesi abnormal lainnya. Kegagalan mencapai sekal dapat disebabkan oleh karena: (1) faktor pasien (perempuan, usia lanjut, penyakit divertikula, riwayat operasi abdomen, indeks massa tubuh rendah, riwayat konstipasi, penggunaan pencahar); (2) faktor endoskopist (pengalaman, kemampuan teknis dan alat yang digunakan); (3) gabungan dari kedua faktor tersebut.

Dalam upaya untuk mengatasi persoalan tersebut endoskopist perlu meningkatkan kemampuan teknis (minimalisasi inflasi dan loop, menggunakan metode air, perubahan posisi pasien dan tekanan abdomen), dan memanfaatkan beberapa macam asesori (memasukkan forsep biopsi ke dalam skop, menggunakan kolonoskopi pediatri dan kolonoskopi yang lebih kaku).

***Kata kunci**: angka intubasi sekal, prosedur kolonoskopi yang sulit, kualitas kolonoskopi, kolonoskopi metode air*

INTRODUCTION

Colonoscopy has been used around the world for evaluating gastrointestinal symptomatic patients, post-cancer resection surveillance, post-polypectomy surveillance, evaluation of positive screening tests and in the USA, Germany, and Poland, as well as for screening of average-risk colorectal cancer.[1] Reaching

the cecal but missing in detecting abnormal mucosa, especially colon adenoma is meaningless. Colonoscopy has been considered by many to be the gold standard for colorectal cancer screening; therefore, adenoma detection rate has also been used for quality indicator in colonoscopy procedure. According to the United States Multi-society Task Force on Colorectal Cancer (USMTF) standard, adenoma detection rates is > 25% for male and > 15% for female.[2] USMTF recommends different benchmark for screening and symptomatic population of respectively 95% and 90%[2] and it is similar with the recommendation by European Society of Gastrointestinal Endoscopy (ESGE) commission guideline, which also regards 90% cecal intubation rate as acceptable rate but excludes cases with obstructive cancer requiring surgery.[3]

Cecal intubation rate is an important indicator of colonoscopy quality. Cecal intubation is defined as a deep intubation into the cecum with the tip of the endoscope being able to touch the appendiceal orifice. Cecal intubation is required to visualize of the mucosa of entire large intestine and distal terminal ileum.[3] There are several consequences of low cecal intubation rate, which include limitation of colonoscopy efficacy, increased risk of complications and cost, and missed detection of colorectal adenoma or other abnormal mucosa lesions. The aim of this manuscript is to describe factors that influence difficult colonoscopy and how to solve this problem.

HOW BIG IS THE PROBLEM?

In clinical practice a wide range of cecal intubation rates have been reported among different studies. In a multicenter study in the USA, only 55% of 69 endoscopists that performed 17,868 colonoscopies achieved a cecal intubation rate of over 90% and 9% of them the rate was less than 80%.[4] Bowles et al reported a prospective study of colonoscopy practice in the UK that involved 9,223 colonoscopies in 68 endoscopy units. They concluded that colonoscopy was often incomplete and did not achieve the target of 90%. Cecal intubation was recorded in 76.9% of procedures; however, the adjusted cecal intubation rate was only 56.9%.[5] Bayupurnama et al reported a study of 244 diagnostic colonoscopies for unsedated patients and they concluded that the intubation rates was 82.66%.[6]

In up to 10–20% of colonoscopies, intubation of the cecal may be considered difficult.[7] There is no satisfactory definition for difficult colonoscopy procedure. Colonoscopy can be difficult for endoscopists due to prolonged procedure, difficult and uncomfortable procedure for patients because of pain or difficult in both areas. Perhaps a practical but qualitative definition is more acceptable, i.e. a procedure which makes endoscopist struggles or fails to reach the cecal.[7,8,9]

FACTORS THAT INFLUENCE DIFFICULT COLONOSCOPY

Cecal intubation failure can be a result of: (1) patients factors (female, older age, diverticular disease, history of abdominal surgery, low body mass index, history of constipation, laxative use; (2) endoscopist factors (prior experience, the specific techniques and instrument used; (3) or some combination thereof.[10] Bowles et al reported that the reasons for failing to reach the cecal included patient discomfort (34.7%), looping (29.7%), poor bowel preparation (19.6%), and severe abdominal pain (17.34 %).[5]

Saunders et al reported that performing colonoscopy in female is more difficult than in male patients.[11] Colonoscopy appears to be a technically more difficult procedure in female patients. The reason for this may be in part due to the inherently longer colon. There were significant differences between female and male in total colonic length, which was greater in female (155 cm vs. 145 cm; $p < 0.005$), transverse colon length (48 cm vs. 40 cm; $p < 0.0001$), the length of transverse colon reached the true pelvis (62% vs. 26%; $p < 0.001$).

CT colonography (CTC) confirms the anatomic factors predictive of incomplete colonoscopy. According Hanson et al, significant differences were found between the complete and incomplete optical colonoscopy group, respectively for total colorectal length (167 cm vs. 210 cm; $p < 0.0001$), sigmoid colon length (48.7 cm vs. 66.8 cm; $p < 0.0001$), transverse colon length (49.2 vs. 66.3 cm; $p < 0.0001$), and number of flexures (mean 9.6 vs. 11.9; $p < 0.0001$).[10]

Diverticular disease also increases the degree of difficulty. The colon with severe diverticulosis can be more spastic with luminal narrowing and therefore, fixation can be more difficult to achieve adequate preparation, more difficult to insufflate, and it is more challenging to find the lumen safely.[9] Older age is associated with incomplete colonoscopy. In older age, the length of the entire colon tends to be increased with age, resulting in increased redundancies and excess looping in the colon. Constipation may be associated with redundancy of the colon and inadequate colon preparation, both of which increase the degree of

difficult colonoscopy. It is well known that lower body mass index (BMI) is associated with prolonged cecal intubation time and associated pain possibly due to sharper angulation of the sigmoid colon and difficulty straightening the scope.[12] Colonoscopy is presumed to be more difficult when performed after prior surgeries due to the presence of adhesions and altered anatomy. Adhesions occur in more than 90% of patients undergoing major abdominal surgery and in 55–100% of the female patients undergoing pelvic surgery.[13]

During colonoscopy, looping of the colonoscope shaft is considered one of the biggest challenges of the procedure, at time hindering visualization of the entire colon. Looping increases procedure discomfort for patients which requires higher levels of anaesthetics, prolongs the duration of procedures, and increases the exposure time to anaesthesia and its associated risks. Looping causes pain since it stretches the mesentery. To escape the loop, endoscopist exerts forces by pushing, pulling, and twisting the shaft of colonoscopy, risking damage to mucosa or lining of the colon.[14]

According Hsu et al, of a total 5,352 colonoscopies, there were only 108 procedures that fail to reach the cecal. One of the most important factors affecting the success of colonoscopy is looping (58%).[12] Shah et al conducted a study to assess the frequency of loop formation and types of loop during colonoscopy confirmed by magnetic imaging colonoscopy. One hundred complete colonoscopies were performed and looping occurred in 91% with N-sigmoid looping (79%) and deep-tranverse looping (34%) being the most common.[15] Satisfactory bowel preparation is a fundamental part of colonoscopic examination and complete colonoscopic assessment is the intention of all colonoscopic undertaken. ESGE recommended that at least 90% of examinations should be rated as adequate bowel cleansing or better.[3] In a study conducted by Harewood et al, records of 113,272 colonoscopy procedures were analyzed on the correlation between bowel preparation and polyp detection. Nearly 25% of patients did not achieve adequate bowel preparation before their colonoscopy procedure.[16]

Hendry et al reported their study about the impact of poor bowel preparation on colonoscopy. A total 10,571 colonoscopies were assessed and poor bowel preparation was identified in 1,788 (16.9%) of these cases. The intubation rate was 67.5% in those with satisfactory preparation; while in patients with poor preparation, 36% of colonoscopies were complete. Incomplete examination was more likely found with poor preparation (OR = 3.76; 95% CI = 3.38–4.18; p = 0.0005).[17]

HOW TO SOLVE DIFFICULT COLONOSCOPY

Basic Insertion Technical and Experience

Cecal intubation rate is positively correlated with insertion technique and experiences of the endoscopist. Ekkelenkamp et al reported that endoscopist with better experience perform more colonoscopies and those with higher rate of cecal intubation use less sedation causing less discomfort and achieve better patient experience.[18]

Chung et al reported about learning curves for colonoscopy involving 3,243 colonoscopies procedures and 12 first-year gastroenterology fellows. Success rate was evaluated based on cecal completion rate (> 90%) and cecal intubation time (< 20 minutes). The overall success rate of reaching cecal in less than 20 minutes was 72.8% and the cecal intubation time was 9.34 ± 4.13 minutes. The skill of trainees when performing cecal intubation in < 20 minutes was reached > 90% after 200 procedures. A recent study of gastrointestinal trainees in Korea showed that success rate has significantly improved and reached the requisite standard competence > 90 % after 150 procedures.[19]

It is important for colonoscopists to pay attention of loops and to minimize looping formation by performing adequate colonoscopic techniques such as hooking, tourqueing, jiggling, pulling back, suctioning excess air and using water immersion during insertion.[9] When colonoscopy is withdrawn without loops, the cecal, hepatic flexure, splenic flexure, sigmoid-descending junction and rectosigmoid junction lie approximately; 70 cm, 50 cm, 40 cm, 30 cm and 15 cm from the anal verge, respectively.[8]

As the above-mentioned, majority of loops are N-sigmoid, transverse and alpha loop. Various techniques have been adopted to correct loop formation. For N-sigmoid looping, shortening the colonoscope and aspirating excessive air is often sufficient. For alpha loop and especially when the loop is large, pulling the colonoscope back slightly is necessary to make the loop smaller and eventually the distal end will be more responsive to rotating force. Rotate the colonoscope clockwise while pulling it back to straighten the sigmoid colon using right-turn shortening. Changing the patient's position and applying manual compression may be helpful to insert the colonoscope through sigmoid colon, splenic flexures and redundant transverse colon. Abdominal pressure appears to be widely used for limiting loop formation in the sigmoid and transverse colon. For sigmoid loops, pressure can be applied over the left

iliac fossa with the patient in either left lateral or supine position; however, the latter may be more favorable.[8,20] For redundant transverse colon, pressure is usually applied to the upper abdomen with patient in a supine position or may be applied over both upper abdomen and left fossa illiaca. Changing the patient's position from left to right lateral position made easy passing through the curve of splenic flexure.[20] Although colonoscopists used frequent abdominal compression, patient position change are effective in only 52% of attemps.[15]

Water Instillation

During the insertion phase of colonoscopy, at least partial lumen distension is required to allow adequate visualization in order to safely direct the instrument through the caecum. Several agents have been used for colonic luminal expansion: air, CO_2, water, helium, argon, nitrogen and xenon. The ideal agent for colonic luminal expansion would facilitate cecal intubation, provide excellent mucosa visualization, limit intra- and post-procedure pain, safe and inexpensive. Air has remained the most commonly used technique for luminal distension since the advance of colonoscopy in the late 1960s.[22] Most of the pain experienced during colonoscopy insertion is felt at the passage of sigmoid colon. Sigmoid colon is mobile and when the patient is in the left position, infused air would be collected in the sigmoid colon and it pulls the colon up to the right side of the body. Therefore, larger amount of air is necessary for keeping adequate view so that the endoscope can pass through sigmoid-descending junction and it stretches the mesentery, which causes pain for the patients.[23]

Insufflated air may lengthen the colon and exaggerate angulations at the flexure, making cecal intubation more difficult. There is a difference between air and water methods for luminal distension in colonoscopy as water produces local distension to facilitate passage. Due to gravity, the infused water enters the left colon, weigh down and straighten the sigmoid colon. The warmth of water minimizes spasm. Insertion through difficult diverticular segments and passage through sigmoid is enhanced. Spasm and discomfort are minimized and intubation cecal is improved. Water infusion with complete air suction from the rectum to descending colon as "Water Navigation Colonoscopy" is enhancing the proportion of patients who are able to complete colonoscopy without sedation.[23,24]

Luo et al reported a prospective, randomized, controlled trial (RCT) that was designed to compare conventional air colonoscopy (AC) and water exchange colonoscopy (WEC) that could increase cecal intubation rates in Asian (Chinese) patients with prior abdominal or pelvic surgery. A total of 110 patients (with the ratio of unsedated to sedated colonoscopy is about 3 : 1) were randomized to the WEC (n = 55) or AC (n = 55) group. WEC significantly increased cecal intubation rate (92.7 vs. 76.4%, p = 0.33); while maximal pain scores were 2.1 ± 1.8 for WEC and 4.6 ± 1.8 for AC (p < 0.001). They concluded that WEC method has significantly enhanced cecal intubation in potentially difficult colonoscopy for unsedated patients with prior abdominal or pelvic surgery. Moreover, a higher proportion of patients examined by WEC would willing to have a repeat unsedated colonoscopy (90.9% vs. 72.7%; p = 0.013).[25] Bayupurnama et al conducted similar study, i.e. the water method colonoscopy in routine unsedated colonoscopy examinations. It was a RCT of diagnostic cases in Indonesian patients. About 57 and 53 patients were randomized to the control or study method, respectively. The comparison of air- vs. water–aided method was revealed including mean discomfort score ± SD, 6.4 ± 2.4 vs. 4.1 ± 2.6 (p < 0.001), willingness to repeat colonoscopy: 62.7% vs. 83.7% (p = 0.024), cecal intubation time 12.7 ± 7.1 vs. 11.9 ± 5.5 minutes (p = 0.38) and cecal intubation rate: 89.5 % vs. 92.4 (p = 0.74).[26]

Colonoscopy procedure may be conducted with deep sedation, conscious/minimal sedation (midazolam is the most frequently prescribed drug) or without sedation. Nowadays the sedation of patients undergoing colonoscopy is a common practice in the United Kingdom and in the United States. In contrast, unsedated or on-demand sedation colonoscopy is a routine practice in other European and Eastern countries.[27] Conscious sedation technique does yield a calmative effect; however, it can result in over-sedation in up to 50% of all cases, potential for more complications, and increase procedural costs.[28] According to RCT studies comparing the water method vs. air insufflations for colonoscopy with minimal sedation, we conclude that cecal intubation rate is 94–100% vs. 94–100%, pain score (0–10) = 2.5-4.1 vs. 3.4–5.3, and willingness to repeat colonoscopy 93.50% vs. 80.6%.[27]

Data from literature has consistently reported that in unsedated patients, the use of the alternative techniques, such as warm water irrigation or carbon dioxide insufflations may allow a high quality and

well tolerated examination.[27] In unsedated patients, the water method has significantly improved cecal intubation rate from 76% to 97% and the proportion of patients who reported willingness for repeating procedure has also enhanced from 69% to 90%.[29]

Different Endoscope and Accessories

Pediatric colonoscopy was basically made for children. However, it has been proven to be valuable in adult, not only for passing strictures but also where either fixation due to diverticular disease, postoperative adhesions, or unavoidably painful looping made passage impossible because the narrow diameter and greater flexibility seemed to allow forward movement.[9]

Saifuddin et al studied about the usefulness of a pediatric colonoscope for colonoscopy in adults. They reported that pediatric colonoscope is suitable for routine colonoscopy procedure in adults. It is also useful in patients in whom colonoscopy with the adult colonoscope is unsuccessful in reaching the cecum, particularly in female with prior hysterectomy.[30] Similar result has also been reported by Marshall et al.[31] The cecum was intubated more frequently in pediatric colonoscope group than in standard colonoscope group (96.1% vs. 71.4%; $p < 0.001$). Pediatric colonoscope is helpful to encounter a fixed, angulated sigmoid colon that cannot be easily or safely traversed with the standard colonoscope.

Variable Stiffness Colonoscopy

The variable-stiffness colonoscopy (VSC), which can be incorporated into standard adult and pediatric colonoscope, has a stiffness control ring with dial setting that ranges from 0 – 3. The endoscopist can adjust the relative flexibility of the scope's insertion tube. Xie et al conducted a meta-analysis which studied (eight randomized controlled trials enrolling a total of 2,033 patients to compare the efficacy of variable-stiffness colonoscope (VSC) and standard adult colonoscope (SAC). They concluded that the use of VSC has significantly improved cecal intubation rate and reduced ancillary manoeuvres (abdominal pressure and position changes) made during the procedure. Cecal intubation time was similar for the two colonoscope types over all trials; while a shortened time with the use of the adult VSC was seen in subgroup analysis.[32]

A cap or hood attached to the colonoscope tip may improve insertion by keeping a distance between the instrument tip and colonic mucosa; thus, it avoids red-out and keeps the luminal direction in view.[1] In addition, the cap was found to be useful in rescuing failed procedures in a randomized controlled trial conducted by Lee et al. Cap-fitted colonoscopy was able to rescue 18/27 (66.7%) procedures vs. 4/19 (21.1%) with routine colonoscopy ($p < 0.001$).[33]

Sometime, colonoscopists face a difficult colonoscopy during passing through the splenic flexure. It is recommended to insert a biopsy forceps through the biopsy channel and positioning it about 10 cm back from the distal end. It will stiffen the colonoscope to some degree, so that it can be inserted more easily through the splenic flexure. This is the most effective method in combination with changing the patient position and applying manual compression.[20]

Adequate Bowel Preparation

ESGE recommends bowel preparation for colonoscopy as follows: (1) a low-fiber diet on the day preceding colonoscopy; (2) a split regimen of 4 litre of polyethylene glycol (PEG) solution (or a same day regimen in the case of afternoon colonoscopy) for routine bowel preparation. A split regimen (or a same day regimen in the case of afternoon colonoscopy) of 2 liter plus ascorbate or sodium picosulphate plus magnesium citrate may be valid alternatives, in particular for elective outpatient colonoscopy. In patients with renal failure, PEG is the only recommended preparation. The delay between the last dose of bowel preparation and colonoscopy should be minimized and no longer than 4 hours; (3) the ESGE advises against the routine use of sodium phosphate for bowel preparation because of safety concerns.[34]

CONCLUSION

Colonoscopy is considered by many to be the gold standard for colorectal cancer screening and detection for other abnormality of colon mucosa. It will be optimized when cecal intubation rate more than 90%. Although colonoscopy facilitates the diagnosis and treatment of colonic disease, there are some public health issues including the access, training, diagnostic accuracy, complications and additional health-care cost. Due to these reasons, colonoscopists have responsibilities to ensure that the procedure is appropriate, safe and performed in high quality. To solve the problems, colonoscopists should increase their technical manoeuvres, use various methods, and undergo self-assessment. For endoscopy training center, it is particularly important to conduct studies that evaluate the cecal intubation rate and if necessary, the center should re-evaluate the training program.

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