

Factors that Influence Cecal Intubation Rate in Unsedated Patients during Colonoscopy

Suharjo B Cahyono*, Putut Bayupurnama**, Neneng Ratnasari**
Catharina Triwikatmani**, Fahmi Indrarti**, Sutanto Maduseno**, Siti Nurdjanah**

* Department of Internal Medicine, Charitas Hospital, Palembang

** Division of Gastroentero-hepatology, Department of Internal Medicine
Faculty of Medicine, University of Gadjah Mada/Dr. Sardjito General Hospital, Jogjakarta

ABSTRACT

Background: Successful cecal intubation is a primary quality indicator in colonoscopies and the most important factor in detecting abnormal lesion in the colon. There are many factors that influence cecal intubation rate during colonoscopy procedure. The aim of this study is to evaluate the factors that influence cecal intubation rate in unsedated patients during colonoscopy.

Method: A retrospective study of colonoscopy performed at Sardjito General Hospital, Jogjakarta, from January 2012 to August 2013. Age, sex, bowel preparation, indication for colonoscopy, colonoscopist, and reasons of incomplete colonoscopy from 564 colonoscopy reports were recorded and analysed.

Results: Overall successful cecal intubation rate was 408 (72.34%). Causes of incomplete colonoscopy were patients discomfort or pain 41.66%, looping/redundant 28.85%, poor bowel preparation 18.59%, fixation/adhesion 6.41%, and bleeding risk 4.49%. Female was more unsuccessful in cecal intubation than male (31.50% vs. 24.05%; $p = 0.048$). The successful cecal intubation rates for gastroenterologists compared to gastroenterology (GI) fellows were 77.92% vs. 49.55%; $p < 0.001$, and poor bowel preparation was more difficult to reach cecal than good preparation (57.58% vs. 23.69%; $p < 0.001$). Multivariate logistic regression analysis demonstrated that female and poor bowel preparation were independently associated with lower cecal intubation rate, and gastroenterologists were independently associated less unsuccessful to reach cecal.

Conclusion: The overall successful cecal intubation rate was still below the set standard. Several identified factors that may predict lower of cecal intubation rate: the skill and experience of colonoscopists (GI fellows), poor bowel preparation and female.

Keywords: cecal intubation rate, colonoscopy, unsedated colonoscopy

ABSTRAK

Latar belakang: Keberhasilan mencapai sekum merupakan indikator kualitas utama pada prosedur kolonoskopi, dan keberhasilan ini merupakan faktor terpenting dalam mendeteksi lesi abnormal di kolon. Ada banyak faktor yang mempengaruhi angka keberhasilan intubasi sekum dalam prosedur kolonoskopi. Penelitian ini bertujuan untuk mengevaluasi faktor faktor yang mempengaruhi angka intubasi sekum pada pasien yang menjalani prosedur kolonoskopi tanpa pemberian sedasi.

Metode: Studi retrospektif terhadap hasil kolonoskopi dilakukan di Rumah Sakit Sardjito, Yogyakarta dari bulan Januari 2012 hingga Agustus 2013. Usia, jenis kelamin, kebersihan usus, indikasi kolonoskopi, kolonoskopist dan alasan kegagalan mencapai sekum dari 564 laporan kolonoskopi dicatat dan dianalisis.

Hasil: Angka keberhasilan mencapai sekum secara menyeluruh adalah 408 (72,34%). Penyebab kegagalan mencapai sekum adalah pasien mengeluh nyeri 41,66%; looping/redundant 28,85%; kebersihan usus yang buruk 18,59%; fiksasi/adhesi 6,41% dan risiko perdarahan 4,49%. Perempuan lebih sering gagal mencapai sekum dibandingkan laki-laki (31,50% vs. 24,05%; $p = 0,048$). Konsultan lebih sering mencapai sekum dibandingkan

peserta pendidikan konsultan (77,92% vs. 49,55%; $p < 0,001$) dan kebersihan usus yang buruk lebih sulit mencapai sekum dibandingkan usus yang bersih (57,58% vs. 23,69%; $p < 0,001$). Analisis regresi multivariat memperlihatkan bahwa perempuan dan kebersihan usus yang buruk merupakan faktor independen yang mempengaruhi kegagalan intubasi sekum, dan konsultan merupakan faktor independen yang mempengaruhi keberhasilan mencapai sekum.

Simpulan: Angka keberhasilan mencapai sekum secara keseluruhan masih berada dibawah standar yang ditetapkan. Faktor yang diprediksi berkaitan dengan pencapaian sekum adalah kurangnya ketrampilan dan pengalaman, kebersihan usus yang buruk dan jenis kelamin perempuan.

Kata kunci: angka intubasi sekum, kolonoskopi, kolonoskopi tanpa sedasi

INTRODUCTION

Colonoscopy is widely used for the diagnosis and treatment of colon disorders. Properly performed, colonoscopy is generally safe, accurate, and well tolerated by most patients. Visualization of the mucosa of the entire large intestine and distal terminal ileum is usually possible at colonoscopy.¹ A complete examination of the colon and rectum is fundamental to any colorectal cancer screening program. Failure to reach the cecum is expensive and inconvenient for the patients as a new attempt at colonoscopy or radiological examination is required. Success cecal intubation reflects a quality colonoscopy and regarded as quality indicators for colonoscopy. The US Multidisciplinary Task Force on Colorectal Cancer (USMTF) and The European Society of Gastrointestinal Endoscopy (ESGE) Commission guideline recommend to set minimum standard for cecal intubation rate is 90%, but excludes cases with obstructive cancer requiring surgery.^{2,3}

In fact, the success of reaching the cecal are varies widely from 42–95% depend on the experience of endoscopists. Nayyar et al reported cecal intubation rate was 42%, and Bayupurnama et al underwent 244 diagnostic colonoscopies to unsedated patients, from this study they concluded that intubation rates was 82.66%.^{4,5}

In up to 10–20% of colonoscopies, intubation of the cecal may be considered difficult. Colonoscopy can be difficult for the endoscopist because of the prolonged procedure, difficult for the patient because of pain, or both. A practical but qualitative definition is a procedure where the endoscopist struggles or fails to reach the cecal. Technical skill of the endoscopist and patients factors influence the success of cecum intubation.^{6,7} The aim of this study is to evaluate the factors that influence cecal intubation rate in unsedated patients during colonoscopy.

METHOD

A retrospective study of colonoscopy performed at Sardjito General Hospital, Jogjakarta, was conducted from January 2012 to August 2013. During 20 months period of retrospective study, there were 688 colonoscopy reports. One hundred and twenty four colonoscopy reports were excluded because of obstructive colorectal cancer and 564 colonoscopy reports were analyzed. Patients with colon obstruction and intended therapeutic colonoscopy were excluded. All the patients were conducted colonoscopy without sedation. Colonoscopies were conducted by two gastroenterologists and two gastroenterology (GI) fellows. The first and the second gastroenterologist have conducted colonoscopy since 2001 and 2004, and both of the GI fellows have conducted colonoscopy since 2009. Standard adult colonoscope (Fujinon EC-250WL5) was used.

Factors that influence cecal intubation such as age, gender, bowel preparation, indication for colonoscopy (constipation, chronic diarrhea, hematochezia, abdominal pain, screening/surveillance, change in bowel habit) and colonoscopist (gastroenterologist vs. GI fellow) were recorded and analysed. The reasons of incomplete colonoscopy were also recorded. Successful cecal intubation or complete colonoscopy is defined as deep intubation into the cecal with the tip of the colonoscopy being able to touch the appendiceal orifice.³ Incomplete colonoscopy is defined as unsuccessful procedure to reach into the cecal, but excluded the cases with obstruction. According to the Boston Bowel Preparation Scale (BBPS), the quality of bowel preparation is ranked into four categories: excellent, good, poor and inadequate.⁸ In this study the quality of bowel preparation was ranked into two categories; good and poor only. Products for colon cleansing can be classified into two groups; osmotic agents and stimulants. In this study we used sodium

phosphate or magnesium sulphate salt for colon cleansing.

Data were presented as frequencies and percentages. Chi-square test was used to compare the proportion data and $p < 0.05$ was considered significant. Multivariate logistic regression was used to assess the independent associations between patient-related or colonoscopists factors and cecal intubation rates.

RESULTS

A total of 688 colonoscopies were performed by four colonoscopists during the 20 months of study, and only 564 colonoscopies were analysed. The patients comprised of males and females were almost equal. There were four colonoscopists participated in this study (two gastroenterologist and two GI fellows). The gastroenterologists were more successful than GI fellows (Table 1).

Table 1. Characteristics data of the patients

Variables	Results
Age (years)	51.6 ± 15.0 (13 to 97)
Sex	
Male	291 (51.60%)
Female	273 (48.40%)
Number of colonoscopists	
Gastroenterologists	2
Gastroenterology fellows	2
Successful cecal intubation	
Gastroenterologist 1	246/291 (84.54%)
Gastroenterologist 2	107/162 (66.05%)
Gastroenterology fellow 1	35/63 (55.56%)
Gastroenterology fellow 2	20/48 (41.67%)

The causes of incomplete colonoscopy were patients discomfort or pain 65 (41.66%), looping/redundant 45 (28.85%), poor bowel preparation 29 (18.59%), fixation/adhesion 10 (6.41%) and bleeding risk 7 (4.49%) (Table 2). There were many factors influencing unsuccessful cecal intubation such as age, gender, operator (gastroenterologists vs GI fellows), bowel preparation, abdominal symptoms (constipation, chronic diarrhea, hematochezia, abdominal pain, screening and change in bowel habit). From these factors only female, GI fellow and poor bowel preparation were significantly correlated with unsuccessful cecal intubation, respectively ($p = 0.048$; $p < 0.001$; $p < 0.001$) (Table 3). There was no difference between successful cecal intubation rate and colonoscopy indications (Table 4). Multivariate logistic regression analysis demonstrated that female, poor bowel preparation and colonoscopists factors were independently associated with lower cecal intubation rate (Table 5).

Table 2. The causes of incomplete colonoscopies

Procedure situation	Number of patients n (%)
Total number of procedure	564
Successful cecal intubation	408 (72.34)
Incomplete colonoscopies	156 (27.66)
Causes of incomplete colonoscopies	
Pain	65 (41.66)
Looping/redundant	45 (28.85)
Poor bowel preparation	29 (18.59)
Fixation/adhesion	10 (6.41)
Bleeding risk	7 (4.49)

Table 3. Univariate analysis of factors that may influence the cecal intubation rates

Factors	Total patients	Incomplete colonoscopies patients n (%)	Successful cecal intubation patients n (%)	p
Sex				
Male	291	70 (24.05)	221 (75.95)	0.048
Female	273	86 (31.50)	187 (68.50)	
Age (years)				
< 60	390	107 (27.44)	283 (72.56)	0.859
> 60	174	49 (28.16)	125 (71.84)	
Colonoscopists				
Gastroenterologists	453	100 (22.08)	353 (77.92)	< 0.001
Fellows	111	56 (50.45)	55 (49.55)	
Bowel preparation				
Poor	66	38 (57.58)	28 (42.42)	< 0.001
Good	498	118 (23.69)	380 (76.31)	
Constipation				
No	486	131 (26.95)	355 (73.05)	0.350
Yes	78	25 (32.05)	53 (67.95)	
Chronic diarrhea				
No	441	124 (28.12)	317 (71.88)	0.645
Yes	123	32 (26.02)	91 (73.98)	
Hematochezia				
No	380	96 (25.26)	284 (74.74)	0.067
Yes	184	60 (32.61)	124 (67.39)	
Abdominal pain				
No	472	132 (27.97)	340 (72.03)	0.799
Yes	92	24 (26.09)	68 (73.91)	
Screening/surveillance				
No	525	150 (28.57)	375 (71.43)	0.076
Yes	39	6 (15.38)	33 (84.62)	
Change in bowel habit				
No	529	151 (28.54)	378 (71.46)	0.068
Yes	35	5 (14.29)	30 (85.71)	

Table 4. Colonoscopy indications and incomplete colonoscopies

Colonoscopy Indications	Total patients (n = 564)	Incomplete colonoscopies patients n (%)	Successful cecal intubation patients n (%)	p
Constipation	78	25 (32.05)	53 (67.95)	0.152
Chronic diarrhea	123	32 (26.02)	91 (73.98)	
Hematochezia	184	60 (32.61)	124 (67.39)	
Abdominal pain	92	24 (26.09)	68 (73.91)	
Screening/surveillance	39	6 (15.38)	33 (84.62)	
Change in bowel habit	35	5 (14.29)	30 (85.71)	

Table 5. Multivariate logistic analysis of the influence of patients and colonoscopists related factors on lower cecal intubation rate

Variables	Odds ratio (95% CI)	p
Female	1.874 (1.243–2.827)	0.003
Poor bowel preparation	4.579 (2.594–8.084)	0.000
Gastroenterology fellows	0.269 (0.169–0.429)	0.000

DISCUSSION

In this study successful cecal intubation rate were 72.34%, still under international standard (90%). There are now several reports of cecal intubation rates in a variety of clinical setting. In the UK, even lower cecal intubation rates (77%) were recorded among a group of colonoscopists comprising of gastroenterologists, training, surgeons and radiologists. In Canada the overall cecal intubation rate is 87% and in Australia 96%.⁷ Failure to intubate the cecal can be 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.^{5,9,10}

Chen-Ming Hsu et al reported multivariate logistic regression analysis demonstrating that patient age greater than 60 years, constipation, poor colon preparation and two-person colonoscopy procedure were independently associated with lower cecal intubation rate. Older age was previously associated with incomplete colonoscopy. The reasons were, first, the length of the entire colon tends to increase with age, resulting in increased redundancies and excess looping; second, older age means higher comorbid conditions, history of prior surgery and greater likelihood of diverticular disease and increased incidence of poor bowel preparation.¹¹ In our study cecal intubation rate was not influenced by age.

In this study, factors that influence cecal intubation rate were female, poor bowel preparation and GI fellow. Many studies showed that colonoscopy in female was more difficult than in male. A retrospective review of 2194 colonoscopies performed by a single experienced endoscopist showed that 31% of examinations in female were considered technically difficult compared

with 16% in male.¹² Saunders et al showed that total colonic length was greater in female (median, 155 cm) compared to male (median, 145 cm), $p = 0.005$, despite female's smaller stature ($p < 0.0001$).¹² Although there were no significant differences in rectum plus sigmoid, descending, or ascending plus cecum segmental lengths, female had longer transverse colons (female median length, 48 cm; male median length, 40 cm), $p < 0.0001$. There were no differences in mobility of the descending colon and transverse colon between male and female, but the transverse colon reached the true pelvis more often in female (62%) than in male (26%), $p < 0.001$. They concluded that colonoscopy appears to be a technically more difficult procedure in female. The reason for this may be due in part to an inherently longer colon.¹² Other study showed similar result that female had significantly longer colons than male (193.3 cm vs. 185.4 cm; $p = 0.002$).¹³

Adequate bowel preparation is essential before colonoscopy, allowing us to make a proper examination of the entire mucosa. Inversely, insufficient preparation reduces the quality of the procedure, increases the risk of complications, decreases the detection rate of adenoma or abnormal mucosa lesion, and extends the exploration and need to repeat procedure. ESGE recommends that the state bowel cleansing should be audited and propose the standard that at least 90% of screening examination should be rated as having adequate or better bowel cleansing.³ Our study showed that bowel cleansing was near the setting of standard, that was 88.30% classified as good and 11.70% as poor. Our study showed similar results with other study that poor bowel preparation influence cecal intubation. Butt et al reported that a total of 1261 colonoscopies were performed in the study period. The cecal intubation rates were 94%, 86% and 82% for good, satisfactory and poor bowel preparation respectively.¹⁴

Cecal intubation rate is positively correlated with insertion technical and colonoscopist's experience. Ekkelenkamp et al reported that better colonoscopist perform more colonoscopies and those colonoscopist with the higher rate of cecal intubation rate use less sedation, cause less discomfort and achieve a better

patient experience.¹⁵ Chung et al reported their study about learning curves for colonoscopy, involved 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 in reaching cecal in less than 20 minutes was 72.8% and the cecal intubation time was 9.34 ± 4.13 minutes. Trainees's skill at performing cecal intubation in < 20 minutes that reached > 90% after 200 procedures.¹⁶ A recent study of gastrointestinal trainees in Korea by Hong-Jun Park et al showed that success rate significantly improved and reached the requisite standard competence > 90 % after 150 procedures. Their study was about predictive factors affecting cecal intubation failure in colonoscopies trainees. Colonoscopy was successfully completed to the cecum in 1,720 (83.9%) patients. Success rates gradually increased as trainees performed more colonoscopies; the rate of success rate was 62% in the first 50 cases, and grew to 93% by the 250th case. Logistic regression analysis of factors affecting cecal intubation failure showed female, low body mass index (BMI) < 18.5 kg/m², poor bowel preparation, and past history of stomach surgery were more often associated with cecal intubation failure, particularly before the trainees achieved technical competence.¹⁷ Many countries are now introducing screening for colorectal cancer. The setting of a minimum annual number of screening colonoscopies is fundamental. The National Health Service (NHS) English Bowel Cancer Screening Program set requirements of a minimum annual number of 150 screening colonoscopies.³ Our study showed that the first gastroenterologist that conducted colonoscopies actively more than 10 years had successful cecal intubation rate of 84.54% compared to GI fellow (49.55%) that conducted colonoscopies less than 5 years.

During colonoscopy, looping of the colonoscopy shaft is considered one of the biggest challenges of the procedure. Looping increase pain and the discomfort for the patient, requiring higher levels of anaesthesia, and prolongs the duration of the procedure, increasing the exposure time to anaesthesia and its associated risks. Study by Hong-Jun Park of the 2,050 colonoscopies, cecal intubation rate failed in 330 (16.1%) cases. The most common anatomic site reached by the trainees during failed colonoscopies was the hepatic flexure (31.5%), followed by the transverse colon (17.9%), and sigmoid-descending junction (13.9%).¹⁷ Colonoscopy is presumed to be more difficult when performed after

surgery due to the presence of adhesions and altered anatomy.¹¹ Our study showed that adhesion or fixation influence cecal intubation rate, but we did not correlate with past history of surgery. The limitation of this study was using retrospective design, so we could not explore several factors that influence cecal intubation rate such as body mass index, in or out patients, past history of surgery, etc.

CONCLUSION

The overall successful cecal intubation rate and quality of bowel preparation were still below the set standard. Patients related factors identified to be associated with lower rate of cecal intubation included female and poor bowel preparation. One of the most important factors affecting the success of colonoscopy is the experience and technical skill of colonoscopist.

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Correspondence:

*Suharjo B Cahyono
Department of Internal Medicine
Charitas Hospital
Jl. Jend. Sudirman 1054 Palembang Indonesia
Phone: +62-274-553119 Facsimile: +62-274-553120
E-mail: jbsb.cahyono@yahoo.com*
