Cancer Screening and Prevention **2025** vol. 4(4) | 186–198
DOI: 10.14218/CSP.2025.00021

Systematic Review

Terminal Ileum Intubation and Biopsy in Routine Colonoscopy Practice – A Systematic Review of Current Evidence

Jing Qiao[1#], Junyan Gao[1#], Xinxin Huang[1#], Lun Gu[1], Yihang Song[1], Tongchang Wang[1], Zhaoshen Li[1], Zixuan He[1,2], Shuling Wang[1,2] and Yu Bai[1,2*]

[1]*Department of Gastroenterology, Changhai Hospital, Naval Medical University, Shanghai, China;* [2]*Changhai Clinical Research Unit, Changhai Hospital, Naval Medical University, Shanghai, China*

Received: October 06, 2025 | **Revised:** October 22, 2025 | **Accepted:** November 28, 2025 | **Published online:** December 25, 2025

Abstract

Background and objectives: Terminal ileum intubation is an adjunct to colonoscopy that permits direct assessment of the terminal ileum. The histological examination of the ileal mucosa, which is acquired during terminal ileum intubation, may allow an accurate diagnosis. However, there is no absolute consensus on when ileoscopy and biopsy should be attempted. As a result, we aimed to evaluate whether terminal ileum intubation and biopsy should be performed routinely.

Methods: Systematic searches were performed in the PubMed, EMBASE, and Cochrane Library databases, as well as the Science Citation Index via the Web of Science platform. Reference lists from the identified papers were manually searched. Systematic searches were performed from January 1, 1971, to October 1, 2025. Studies reporting on terminal ileum intubation and biopsy during colonoscopy were included. Case reports, letters, reviews, and animal studies were excluded. The primary outcomes were the diagnostic yield of terminal ileum intubation and the rate of necessitating a change in management. Data were independently extracted by two reviewers and cross-verified by a third.

Results: Thirty-six observational studies were included. Crude aggregate diagnostic-yield proportions were 5.1% (122/2,383) in selected samples and 2.5% (871/35,339) in unselected samples. Among studies reporting management changes, the corresponding crude proportions were 2.0% (36/1,807) and 0.6% (139/24,285), respectively. Because of clinical heterogeneity, these proportions were summarized descriptively without between-group hypothesis testing. The crude diagnostic-yield proportions for inflammatory bowel disease, anemia, abdominal pain, chronic diarrhea, and other indications were 26.7%, 16.1%, 14.9%, 12.4%, and 3.2%, respectively; indication categories could overlap. The yield of ileal histopathology with a normal endoscopic appearance was low in both unselected and selected samples (3.5% and 2.4%, respectively).

Conclusions: Cecal intubation remains the standard marker of complete colonoscopy. Terminal ileum intubation may be considered selectively when clinically indicated or when additional documentation of examination extent is needed. Biopsy should be considered for abnormal terminal ileal mucosa or when clinical findings raise a high pretest probability of ileal disease.

Keywords: Ileoscopy; Colonoscopy; Endoscopy; Intubation; Ileum; Biopsy; Inflammatory bowel disease; Diagnostic yield.

***Correspondence to:** Yu Bai, Department of Gastroenterology, Changhai Hospital, Naval Medical University, 168 Changhai Road, Shanghai 200433, China. ORCID: https://orcid.org/0000-0002-7577-6001. Tel: +86-21-31161344, Fax: +86-21-55621735, E-mail: md.baiyu@foxmail.com

[#]These authors contributed equally to this work.

How to cite this article: Qiao J, Gao J, Huang X, Gu L, Song Y, Wang T, *et al*. Terminal Ileum Intubation and Biopsy in Routine Colonoscopy Practice – A Systematic Review of Current Evidence. *Cancer Screen Prev* 2025;4(4):186–198. doi: 10.14218/CSP.2025.00021.

Introduction

Since the first report of successful terminal ileum (TI) intubation by Nagasako in 1971,[1] there have been several reports describing the technical aspects, success rates, diagnostic yield, and biopsy outcomes in diseases involving the TI. TI intubation occurs during colonoscopy by many clinicians,[2–4] and it plays an important role in diagnosing diseases. The TI hosts many toxic substances and is lined by specialized lymphoid tissue of the immune system; thus,

© 2025 The Author(s). This article has been published under the terms of Creative Commons Attribution-Noncommercial 4.0 International License (CC BY-NC 4.0), which permits noncommercial unrestricted use, distribution, and reproduction in any medium, provided that the following statement is provided. "This article has been published in *Cancer Screening and Prevention* at https://doi.org/10.14218/CSP.2025.00021 and can also be viewed on the Journal's website at https://www.xiahepublishing.com/journal/csp".

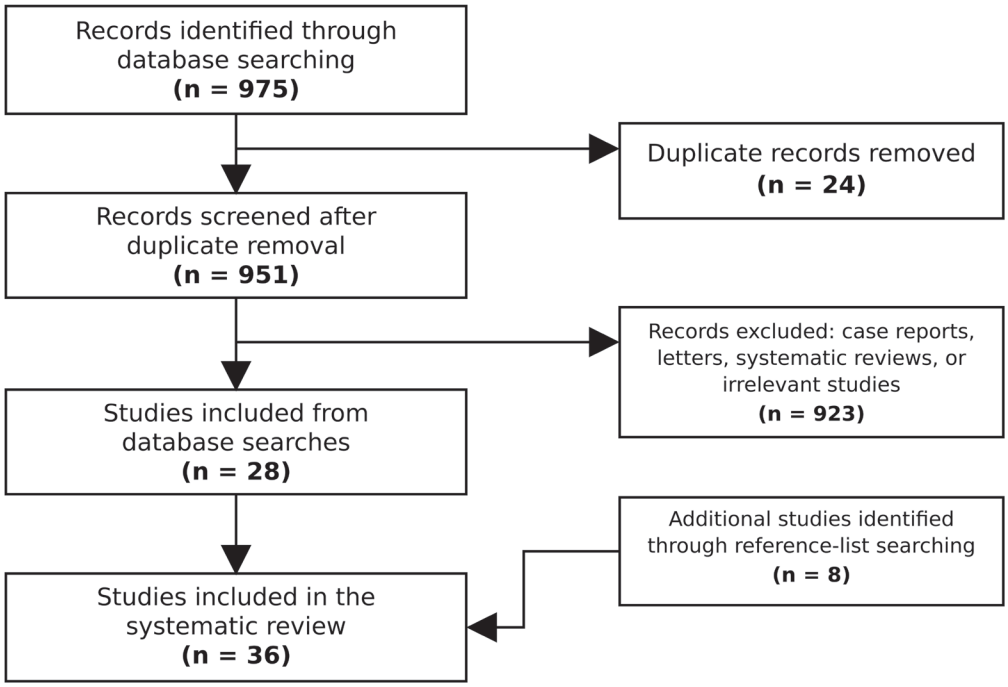

Fig. 1. Study-selection flow based on the available review records.

ileoscopy is usually performed to assess the state of the ileum or to diagnose or exclude diseases such as inflammatory bowel disease (IBD), infectious diseases, and parasitic diseases,[5–7] especially in the post-COVID-19 period, where the expanding gastrointestinal manifestations of COVID-19 infection are difficult to distinguish.[8–10] Furthermore, histological examination of ileal mucosa obtained during TI intubation may facilitate diagnosis in selected patients, and ileoscopy with biopsy can provide important diagnostic information for suspected small bowel inflammatory diseases, particularly Crohn's disease.[11,12] All of these factors make TI intubation an appealing diagnostic technique during colonoscopy.

However, there is no absolute consensus on when ileoscopy should be attempted. Some physicians believe that this approach is an important adjunct to colonoscopy and should be used in all cases if the circumstances allow it.[2,13] This may necessitate a change in management. Others believe that this treatment option is optional, depending on the indications and after considering the discomfort, time, yield, special techniques, and unnecessary risks.[14,15] It also remains controversial whether an ileal biopsy should be attempted in patients undergoing TI intubation. As a result, evaluation and biopsy of the TI are left to the discretion of endoscopists according to their clinical experiences, after considering the indications, patient tolerance, operating techniques, and other difficulties during the examination.

This study was designed to ascertain whether TI intubation is a useful procedure for all patients who undergo a colonoscopy. We also aimed to further evaluate which clinical indication is more warranted with a higher diagnostic yield. Third, we evaluated whether TI biopsy should be performed in every patient despite a normal endoscopic appearance.

Materials and methods

A systematic search was performed in PubMed from January 1, 1971, to October 1, 2025, using the search terms "terminal ileums OR terminal ileum intubation OR ileum", "intubations OR intubating OR catheterization OR intubate OR intubated OR intubation", "ileoscopy OR ileoscopies OR ileocolonoscopy", "yield OR diagnosis OR diagnose OR diagnosed OR diagnoses", and "biopsies OR pathology OR biopsy". Reference lists from the identified papers were further hand-searched to identify relevant studies. The EMBASE, Cochrane Library, and Science Citation Index were also searched for these topics. All four database searches were conducted on October 1, 2025. Database-specific search strings for EMBASE, the Cochrane Library, and the Science Citation Index and source-level retrieval counts were not retained. Manual searching covered reference lists of included studies and relevant reviews; the source article for each of the eight additional studies was not recorded.

The searches were restricted to English-language results. Articles were selected if the abstract contained a yield or biopsy of the TI in the form of published trials, other controlled or comparative studies, or case series. Three reviewers (SW, ZH, and XH) independently screened titles, abstracts, and full texts. Screening disagreements were resolved through discussion and consensus among the three reviewers. The review was not prospectively registered. Available study-selection counts are presented in Figure 1; database-specific retrieval counts and granular full-text exclusion reasons were not retained.

Inclusion and exclusion criteria: The studies included in this systematic review were those performed on TI intubation during colonoscopy and were not randomized controlled trials. Case reports, letters, systematic reviews, and studies on animals or cell lines were excluded. When there were duplicate studies, the study with the largest sample size was included.

Qualitative analysis and data extraction

LG and TW independently extracted the data using a standardized

extraction form. Discrepancies were resolved through discussion; if agreement could not be reached, YB adjudicated. LG, TW, and YS cross-verified the extracted data. No formal quality or risk-of-bias assessment was conducted. We used Review Manager 5.0.16 (Cochrane Collaboration, Oxford, UK) to summarize the details of the studies. The extracted data included the first author, publication year, country, inclusion criteria, age and sex of the patients, study design, indication for colonoscopy, and outcomes. The outcomes included the TI intubation rate, yield of TI intubation, yield of TI biopsy, diagnostic yield, and rate of necessitating a change in management.

The TI intubation rate was defined as the proportion of TI intubations relative to the total number of colonoscopies. The yield of TI intubation was defined as the ratio of the number of patients with abnormal TI findings after TI intubation to the total number of TI intubations. The yield of TI biopsy was defined as the ratio of the number of patients with TI histopathological findings through TI biopsy to the total number of TI biopsies. The diagnostic yield was defined as the ratio of the number of patients with endoscopic or histopathological findings that led to clinical intervention through TI intubation to the total number of TI intubations. The rate of need for a change in management was extracted as reported in each source study and was defined as the proportion of TI intubations leading to a new diagnosis, additional investigation, treatment initiation, imaging, or surgery. Outcomes not reported by a source study were treated as missing rather than zero. Patients with diarrhea, abdominal pain, weight loss, high C-reactive protein level, and hypoalbuminemia, along with previous negative stool testing for infection, were defined as having a high pretest probability of Crohn's disease.[16] Significant ileum histology was defined as histopathological findings from biopsy specimens of endoscopically normal-appearing ileal mucosa that necessitate a clinical intervention.

It was inappropriate to perform a meta-analysis due to the significant clinical heterogeneity of the studies. All included studies were prospective or retrospective observational studies; no randomized controlled trials were included. In addition, the methods of TI intubation and main outcome assessments varied.

Statistical analysis

Descriptive statistics were used to summarize study characteristics and crude aggregate proportions. Categorical variables are presented as percentages, and continuous variables are presented as reported by the source studies. Because of substantial clinical heterogeneity and overlapping indication categories, no inferential comparisons were performed across studies or indication groups.

Patient and public involvement statement

Patients or the public were not involved in the design, conduct, reporting, or dissemination plans of our research.

Results

The database searches identified 975 records in aggregate, and the available study-selection counts are shown in Figure 1. After 24 duplicates were removed, 951 records were screened. A total of 923 records were excluded and were collectively categorized in the retained records as case reports, letters, systematic reviews, or irrelevant studies; stage-specific exclusion reasons were not recorded. Twenty-eight studies were included from the database searches, and eight additional studies were identified by searching reference lists of included studies and relevant reviews. Finally, 36 studies were included.[3,5–7,14,17–47] Of these, 15 were prospective studies, and the remaining 21 were retrospective. We defined "selected research" as TI intubation performed to investigate the etiology of a certain group of patients with symptoms of underlying digestive diseases, while "unselected research" refers to TI intubation performed on all unscreened patients undergoing colonoscopy, without prior selection based on specific digestive symptoms under investigation.

The basic characteristics and diagnostic yield of the included studies are summarized in Table 1.[3,5–7,14,17–47] Eleven studies were from Europe, ten from the USA, eleven from Asia, two from Brazil, one from Australia, and one from Nigeria. The median number of TI-treated patients was 358. The success rate of TI intubation ranged from 30.9% to 100% among the prospective studies. The yield of TI intubation varied from 0.4% to 41%. The lowest incidence was reported in the study by Harewood *et al*.,[22] where only 17 abnormalities were found in 3,858 unselected patients who underwent TI assessment; the highest incidence was reported in the study by Geboes *et al*.,[5] where endoscopic lesions of the TI were found in 123 of 300 patients.

The yields of the TI biopsies were separated into three parts: biopsies obtained from endoscopically normal TIs, biopsies acquired from endoscopically abnormal TIs, and biopsies of unknown origin. Generally, routine biopsy of a normal macroscopic TI has a low diagnostic yield, ranging from 0% to 8.5%, while the yield of endoscopically abnormal TIs varies from 8.8% to 73.8%.

The diagnostic yield and rate of necessitating a change in management are summarized in Table 2.[3,5–7,14,17–28,30,32–46] A total of 33 studies reported diagnostic yield: 26 involved unselected samples and seven involved selected samples. The crude aggregate diagnostic-yield proportion was 2.6% (993/37,722), comprising 2.5% (871/35,339) in unselected samples and 5.1% (122/2,383) in selected samples. Management-change data were reported for 26,092 TI intubations; the crude descriptive proportions were 0.7% overall (175/26,092), 0.6% in unselected samples (139/24,285), and 2.0% in selected samples (36/1,807). Because the included studies were heterogeneous, no cross-study hypothesis testing was performed.

The indications for colonoscopies in patients with successful TI intubation are documented in Table 3,[3,5,6,19,21,23,24,26,28,31,32,35,36,38,40,43] with 24,077 indication occurrences in 16 studies, including 22,698 occurrences from 12 unselected-sample studies and 1,379 occurrences from four selected-sample studies. Individual patients could contribute to more than one indication. The crude diagnostic-yield proportions were 26.7% for known IBD, 16.1% for anemia, 14.9% for abdominal pain, 12.4% for chronic diarrhea, and 3.2% for other indications; these overlapping categories were not compared inferentially.

Melton *et al*.[31] screened asymptomatic patients for cancer—the "Other" group had the greatest proportion of abnormal ileoscopy findings (63%), but this did not explain the specific screening outcomes to be excluded. Table 3 descriptively shows the highest crude diagnostic-yield proportion for IBD (26.7%), followed by anemia (16.1%), abdominal pain (14.9%), diarrhea (12.4%), and other indications (3.2%). Because indication groups overlapped and patient-level de-duplication was not possible, no statistical comparisons were performed between indication groups or between selected and unselected samples.

It remains controversial whether biopsy via normal ileoscopy is suitable for clinical intervention, especially for patients with diarrhea. We assessed the yield of ileal histopathology with a normal endoscopic appearance, and the results are presented in Table 4.[3,5,18,19,21,25,26,29,32,34,35,45] Twelve studies were included; these consist-

Table 1. Basic characteristics of included studies in systematic review

Study (year)	Country	Sex (women, men)	Average years	Study design	Case selection	Patients (n)	Patients of TI intubation (n)	TI intubation rate
Borsch *et al*., 1984[17]	Germany		53.9	Prospective	Unselected	555	400	72.0%
Kundrotas *et al*., 1994[14]	USA	106, 164	Women 59, Men 61	Prospective	Unselected	270	213	78.9%
Zwas *et al*., 1995[6]	UK	–	–	Prospective	Unselected	144	138	95.8%
Geboes *et al*., 1998[5]	Belgium	Diarrhea (119, 138) Control (21, 22)	Diarrhea 35.8 (11–71) Control 47.6 (39–75)	Prospective	Diarrhea versus polyp surveillance (control)	300	Diarrhea 257, Control 43	100.0%
Bhasin *et al*., 2000[7]	India	–	–	Prospective	Unselected	66	57	86.4%
Shah *et al*., 2001[18]	USA	114, 54	51	Retrospective	Diarrhea	168	142	–
Yusoff IF, 2002[19]	Australia	621, 509	45	Retrospective	Diarrhea	1,131	508	–
Ansari *et al*., 2003[20]	UK	–	–	Prospective	Unselected	120	117	97.5%
Morini *et al*., 2003[21]	Italy	CNBD (56, 82) Control (56, 82)	–	Prospective	CNBD versus control	CNBD 156, Control 138	CNBD 138, Control 138	93.9%
Cherian *et al*., 2004[3]	UK	971, 733	60	Retrospective	Unselected	2,537	IBD 120, without IBD 1,584	–
Harewood *et al*., 2005[22]	USA	2,401, 1,457	–	Retrospective	Unselected	21,638	3,858	–
Yoong *et al*., 2006[23]	UK	–	–	Retrospective	Unselected	346	346	–
Iacopini *et al*., 2006[24]	Italy	336, 264	65	Prospective	Unselected	600	272	–
Powell *et al*., 2007[25]	UK	131, 101	52	Prospective	Unselected	232	232	–
McHugh *et al*., 2007[26]	USA	249, 165	37.6	Retrospective	Unselected	414	414	–
Kennedy *et al*., 2008[27]	USA	2,812, 3,596	63	Retrospective	Unselected	6,408	6,408	–
Jeong *et al*., 2008[28]	Republic of Korea	1,782, 2,139	45	Prospective	Unselected	3,921	3,417	87.1%
Melo *et al*., 2009[29]	Brazil	47, 64	51.6	Prospective	Macroscopically normal terminal ileum mucosa	111	111	–
Emami *et al*., 2009[30]	Iran	73, 55	63	Prospective	Unselected	128	93	72.7%
Melton *et al*., 2011[31]	USA	6,009, 3,776	46	Retrospective	Unselected	9,785	9,785	–
Sayilir *et al*., 2011[32]	Turkey	–	–	Retrospective	CNBD versus others	295	CNBD 135, others 160	–
Makkar *et al*., 2013[33]	USA	464, 225	48.3	Retrospective	CNBD	689	370	–
Wijewantha *et al*., 2014[34]	Sri Lanka	–	–	Retrospective	Unselected	764	764	–
Koksal *et al*., 2014[35]	Turkey	142, 155	42	Retrospective	Normal-appearing TI and with <5 aphthous ulcers	297	297	–

(continued)

Table 1. *(continued)*

Study (year)	Country	Sex (women, men)	Average years	Study design	Case selection	Patients (n)	Patients of TI intubation (n)	TI intubation rate
Velidedeoğlu *et al.*, 2015[36]	Turkey	24, 33	44.12 ± 11.42	Retrospective	Unselected	57	57	–
Akere *et al.*, 2017[37]	Nigeria	–	–	Prospective	Unselected	272	84	30.9%
Meral *et al.*, 2018[38]	Turkey	726, 584	55.79 ± 14.29	Prospective	Unselected	1,310	1,032	78.8%
Borsotti *et al.*, 2019[39]	Italy	–	–	Prospective	CNBD	504	492	97.6%
Mari *et al.*, 2020[40]	Israel	878, 922	–	Retrospective	Unselected	1,800	1,800	–
Leiman *et al.*, 2020[41]	USA	4,411, 3,388	58 (52–64)	Retrospective	Unselected	7,799	3,356	–
Wang *et al.*, 2020[42]	China	774, 901	49	Retrospective	Unselected	1,675	994	–
Rosevics *et al.*, 2021[43]	Brazil	2,181, 1,201	56.9 ± 13.1	Retrospective	Unselected	3,382	3,382	–
Alkhatib *et al.*, 2022[44]	USA	461, 547	51.7	Retrospective	Unselected	1,008	1,008	–
Vora *et al.*, 2024[45]	USA	185, 114	52	Retrospective	Macroscopically normal terminal ileum mucosa	299	299	–
Shu *et al.*, 2024[46]	China	4,004, 3,595	53	Retrospective	Unselected	7,599	7,599	–
Dąbkowski *et al.*, 2025[47]	Poland	169, 128	55.2	Retrospective	Unselected	297	297	–
TOTAL (crude)	–	–	–	–	–	77,215	50,917	65.9% (50,917/77,215)

Study (year)	Yield of TI intubation (%)	Yield of TI biopsy, by indication where available (%)		All cases (%)	Diagnostic yield†	Rate of necessitating a change in management‡	Note§
		Endoscopically normal TI (%)	Endoscopically abnormal TI (%)				
Borsch *et al.*, 1984[17]	–	–	–	5.0%	5.0%	–	1
Kundrotas *et al.*, 1994[14]	2.0%	Not biopsy	25.0%	–	0.5%	0.5%	2
Zwas *et al.*, 1995[6]	–	–	–	Asymptomatic 2.7%, Diarrhea 29%	Overall 7.2%, Asymptomatic 2.7%, Diarrhea 29%	2.9%	3
Geboes *et al.*, 1998[5]	Overall 41%, Diarrhea/ CD 47.8%, Control 0%	1.10%	–	Diarrhea/ CD 48.6%, Control 0	–	–	3
Bhasin *et al.*, 2000[7]	22.8%	–	–	–	22.8%	8.8%	1
Shah *et al.*, 2001[18]	–	2.4%	–	–	3.5%	1.4%	2
Yusoff *et al.*, 2002[19]	5.1%	0	–	–	5.1%	2.6%	1
Ansari *et al.*, 2003[20]	17.9%	–	–	2.6%	20.5%	–	3
Morini *et al.*, 2003[21]	CNBD 34.0%, Control 10.8%	CNBD 2.2 % Control 2.4%	CNBD 46.8% Control 13.3 %	–	CNBD 17.4%, Control 3.6%	–	2
Cherian *et al.*, 2004[3]	IBD 16.7%, without IBD 2.59%	Overall 1.5%, IBD 0, without IBD 1.7%	–	IBD 19%, without IBD 7.4%	4.1%	–	2

(continued)

DOI: 10.14218/CSP.2025.00021 | Volume 4 Issue 4, December 2025

Table 1. *(continued)*

Study (year)	Yield of TI intubation (%)	Yield of TI biopsy, by indication where available (%)		All cases (%)	Diagnostic yield[†]	Rate of necessitating a change in management[‡]	Note[§]
		Endoscopically normal TI (%)	Endoscopically abnormal TI (%)				
Harewood *et al*., 2005[22]	0.4%	–	–	–	0.4%	–	1
Yoong *et al*., 2006[23]	Abdominal mass 33.3%, Diarrhea 9.2	–	–	4.6%	4.6%	2.3%	2
Iacopini G, 2006[24]	5.5%	–	–	2.2%	2.2%	2.2%	2
Powell *et al*., 2007[25]	–	2.3%	–	–	2.2%	0.0%	2
McHugh *et al*., 2007[26]	19.3%	5.1%, significant histologic chronic inflammation 4.2%	73.8%, significant histologic chronic inflammation 67.5%	18.4%	18.4%	–	2
Kennedy *et al*., 2008[27]	1.0%	Not biopsy	32%	0.3%	0.3%	0.04%	2
Jeong *et al*., 2008[28]	Overall 3.7%	Not biopsy	Overall 8.8%, Right lower quadrant pain 1.8%, Diarrhea 0.4	–	0.3%	0.1%	2
Melo *et al*., 2009[29]	–	0.9%	–	–	–	–	2
Emami *et al*., 2009[30]	4.3%	–	–	–	4.3%	2.2%	1
Melton *et al*., 2011[31]	Overall 24.9%	Total 5.0%, CD 10.9%	Total 47.7%, CD 75.0%	–	–	–	–
Sayilir *et al*., 2011[32]	–	Overall 4.4 %, CNBD 5.9%, Other 3.1%	–	–	Overall 4.4 %, CNBD 5.9%, Other 3.1%	0.0%	2
Makkar *et al*., 2013[33]	–	–	–	5.1%	5.1%	1.6%	2
Wijewantha *et al*., 2014[34]	7.1%	3.8%	37.0%	6.2%	10.6%	6.2%	2
Koksal *et al*. 2014[35]	33.0%	8.5%	Overall 59.8%	25.3%	25.3%	–	2
Velidedeoğlu *et al*., 2015[36]	–	–	14%	14%	14%	1.8%	2
Akere *et al*., 2017[37]	2.4%	–	–	17.9%	17.9%	–	2
Meral *et al*., 2018[38]	Overall 6%, IBD 14.1% chronic diarrhea 12.1%	Not biopsy	62.9%	–	5.2%	–	2
Borsotti *et al*., 2019[39]	11.4%	–	–	10%	3%	3%	2
Mari *et al*., 2020[40]	12%	–	–	12%	12%	–	2
Leiman *et al*., 2020[41]	1.1%	–	50%	0.1%	0.0% (0/354)	–	2
Wang *et al*., 2020[42]	–	–	–	0.8%	0.8%	–	2
Rosevics *et al*., 2021[43]	5.3%	–	50.84%	2.7%	2.7%	0.9%	2
Alkhatib *et al*., 2022[44]	3.7%	Not biopsy	48.6%	–	1.8%	1.8%	2
Vora *et al*., 2024[45]	–	4.3%	–	4.3%	1.3%	1.3%	2
Shu *et al*., 2024[46]	2%	–	–	2.0%	0.1%	0.1%	2
Dąbkowski *et al*., 2025[47]	1.7%	–	–	1.7%	–	–	1

[†]Diagnostic yield: proportion of TI intubations with endoscopic or histopathological findings reported to lead to clinical intervention. [‡]Need for a change in management: a new diagnosis or additional investigation or treatment as reported by the source study; a dash indicates that the outcome was not reported, not zero. [§]Note: The "Diagnostic yield" and "Necessitate a change in management" result from macroscopic (1), microscopic (2), and unclear (3) abnormalities. CD, Crohn's disease; CNBD, chronic nonbloody diarrhea; IBD, inflammatory bowel disease; TI, terminal ileum.

Table 2. Diagnostic yield of terminal ileum intubation with or without biopsy

Study (year)	Patients of TI intubation (n)	Case selection	Diagnostic yield (%)	Necessitate a change in management (%)	Diagnostic yield (n)	Necessitate a change in management (n)	Note[†]
UNSELECTED							
Borsch *et al*., 1984[17]	400	Unselected	5.0%	–	20	–	1
Kundrotas *et al*., 1994[14]	213	Unselected	0.5%	0.5%	1	1	
Zwas *et al*., 1995[6]	138	Unselected	7.2%	2.9%	10	4	
Bhasin *et al*., 2000[7]	57	Unselected	22.8%	8.8%	13	5	
Ansari *et al*., 2003[20]	117	Unselected	20.5%	–	24	–	
Cherian *et al*., 2004[3]	1,704	Unselected	4.1%	–	70	–	
Harewood *et al*., 2005[22]	3,858	Unselected	0.4%	–	17	–	
Yoong *et al*., 2006[23]	346	Unselected	4.6%	2.3%	16	8	
Iacopini *et al*., 2006[24]	272	Unselected	2.2%	2.2%	6	6	
Powell *et al*., 2007[25]	232	Unselected	2.2%	0	5	0	
McHugh *et al*., 2007[26]	414	Unselected	18.4%	–	76	–	
Kennedy *et al*., 2008[27]	6,408	Unselected	0.3%	0.04%	22	3	
Jeong *et al*., 2008[28]	3,417	Unselected	0.3%	0.1%	11	3	
Emami *et al*., 2009[30]	93	Unselected	4.3%	2.2%	4	2	2
Wijewantha *et al*., 2014[34]	764	Unselected	10.6%	6.2%	81	47	
Koksal *et al*., 2014[35]	297	Normal-appearing TI and with <5 aphthous ulcers	25.3%	–	75	–	
Velidedeoğlu *et al*., 2015[36]	57	Unselected	14%	1.8%	8	1	
Akere *et al*., 2017[37]	84	Unselected	17.9%	–	15	–	
Meral *et al*., 2018[38]	1,032	Unselected	5.2%	–	54	–	
Mari *et al*., 2020[40]	1,800	Unselected	12%	–	216	–	
Leiman *et al*., 2020[41]	354	Unselected	0.0%	–	0	–	
Wang *et al*., 2020[42]	994	Unselected	0.8%	–	8	–	
Rosevics *et al*., 2021[43]	3,382	Unselected	2.7%	0.9%	90	30	
Alkhatib *et al*., 2022[44]	1,008	Unselected	1.8%	1.8%	18	18	
Vora *et al*., 2024[45]	299	Macroscopically normal terminal ileum mucosa	1.3%	1.3%	4	4	
Shu *et al*., 2024[46]	7,599	Unselected	0.1%	0.1%	7	7	
SUBTOTAL	35,339	–	2.5% (871/35,339)	0.6% (139/24,285)	871	139	
SELECTED							
Geboes *et al*., 1998[5]	300	Diarrhea/ CD versus polyp surveillance	5.0%	–	15	–	
Shah *et al*., 2001[18]	142	Diarrhea	3.5%	1.4%	5	2	
Yusoff *et al*., 2002[19]	508	Diarrhea	5.1%	2.6%	26	13	
Morini *et al*., 2003[21]	276	CNBD versus control	CNBD 17.4%, Control 3.6%	–	24, 5	–	

(continued)

Table 2. *(continued)*

Study (year)	Patients of TI intubation (n)	Case selection	Diagnostic yield (%)	Necessitate a change in management (%)	Diagnostic yield (n)	Necessitate a change in management (n)	Note[†]
Sayilir *et al*., 2011[32]	295	CNBD versus others	Overall 4.4 %, CNBD 5.9%, Other 3.1%	0.0%	Overall 13, CNBD 8, others 5	0	
Makkar *et al*., 2013[33]	370	CNBD	5.1%	1.6%	19	6	
Borsotti *et al*., 2019[39]	492	CNBD	3.0%	3.0%	15	15	
SUBTOTAL	2,383	–	5.1% (122/2,383)	2.0% (36/1,807)	122	36	
TOTAL	37,722	–	2.6% (993/37,722)	0.7% (175/26,092)	993	175	

[†]1:24.5% (98 patients) with normal investigation were of considerable clinical interest; 2: Normal ileum findings were also helpful in ruling out TI pathology in 78 other patients. CD, Crohn's disease; CNBD, chronic nonbloody diarrhea; TI, terminal ileum. A dash indicates that the outcome was not reported, not zero. Management-change aggregate proportions include only studies reporting that outcome. All aggregate percentages are crude descriptive proportions rather than meta-analytic estimates.

Table 3. Clinical indication occurrences and diagnostic yield

Study (year)	Diarrhea		Abdominal pain		IBD		Anemia		Others		Note[†]
	n	Diagnostic yield	n	Diagnostic yield	n	Diagnostic yield	n	Diagnostic yield	n	Diagnostic yield	
UNSELECTED											
Zwas *et al*., 1995[6]	28	8 (28.6%)	7	0	–	–	7	0	96	2 (2.1%)	1
Cherian *et al*., 2004[3]	–	–	–	–	120	20 (16.7%)	–	–	1,584	41 (2.6%)	1
Yoong *et al*., 2006[23]	119	11 (9.2%)	74	2 (2.7%)	33	5 (15.2%)	36	4 (11.1%)	65	6 (9.2%)	1
Iacopini *et al*., 2006[24]	–	–	31	0.0%	–	–	45	2 (4.4%)	196	4 (2.0%)	2
McHugh *et al*., 2007[26]	135	14 (10.4%)	23	1 (4.3%)	157	45 (28.7%)	62	9 (14.5%)	37	7 (18.9%)	2
Jeong *et al*., 2008[28]	1,058	58 (5.5%)	1,254	48 (3.8%)	–	–	82	2 (2.4%)	1,522	17 (1.1%)	1
Melton *et al*., 2011[31]	5,108	735 (14.4%)	3,629	758 (20.9%)	1,644	460 (27.9%)	502	156 (31.1%)	–	–	1
Koksal *et al*., 2014[35]	–	–	–	–	23	8 (34.8%)	44	17 (38.6%)	–	–	2
Velidedeoğlu *et al*., 2015[36]	19	6 (31.6%)	14	0.0%	–	–	–	–	24	2 (8.3%)	
Meral *et al*., 2018[38]	74	9 (12.2%)	89	4 (4.5%)	85	12 (14.1%)	252	8 (3.2%)	532	29 (5.5%)	1
Mari *et al*., 2020[40]	–	–	–	–	72	32 (44.4%)	161	25 (15.5%)	–	–	
Rosevics *et al*., 2021[43]	421	27 (6.4%)	486	21 (4.3%)	273	61 (22.3%)	278	13 (4.7%)	2,197	85 (3.9%)	
SUBTOTAL	6,962	868 (12.5%)	5,607	834 (14.9%)	2,407	643 (26.7%)	1,469	236 (16.1%)	6,253	193 (3.1%)	
Range	–	5.5–31.6%	–	0.0–20.9%	–	14.1–44.4%	–	3.2–38.6%	–	1.1–18.9%	

(continued)

Table 3. *(continued)*

Study (year)	Diarrhea		Abdominal pain		IBD		Anemia		Others		Note[†]
	n	Diagnostic yield	n	Diagnostic yield	n	Diagnostic yield	n	Diagnostic yield	n	Diagnostic yield	
SELECTED											
Geboes *et al*., 1998[5]	257	44 (17.1%)	–	–	–	–	–	–	43	0 (0.0%)	1
Yusoff *et al*., 2002[19]	508	26 (5.1%)	–	–	–	–	–	–	–	–	1
Morini *et al*., 2003[21]	138	47 (34.1%)	–	–	–	–	–	–	138	15 (10.9%)	1
Sayilir *et al*., 2011[32]	135	8 (5.9%)	–	–	–	–	–	–	160	5 (3.1%)	2
SUBTOTAL	1,038	125 (12.0%)	–	–	–	–	–	–	341	20 (5.9%)	
Range	–	5.1–17.1%	–	–	–	–	–	–	–	0.0–10.9%	
TOTAL	8,000	993 (12.4%)	5,607	834 (14.9%)	2,407	643 (26.7%)	1,469	236 (16.1%)	6,594	213 (3.2%)	

[†]The "Diagnostic yield" results from macroscopic (1), microscopic (2), and unclear (3) abnormalities. IBD, inflammatory bowel disease. Counts represent indication occurrences rather than unique patients; categories may overlap, and patient-level de-duplication was not possible.

Table 4. Yield of ileum histopathology with normal endoscopic appearance

Study (year)	Patients of TI intubation (n)	Case selection	Endoscopically normal (n)	Histopathology with normal ileum (n)	Significant ileum histology (%)
UNSELECTED[†]					
Cherian *et al*., 2004[3]	IBD 120, without IBD 1,584	Unselected	Overall 717, IBD 85, without IBD 632	Overall 11, IBD 0, without IBD 11	Overall 1.5%, IBD 0, without IBD 1.7%
Powell *et al*., 2007[25]	232	Unselected	216	5	2.3%
McHugh *et al*., 2007[26]	414	Unselected	334	17	5.1%
Melo *et al*., 2009[29]	111	Macroscopically normal terminal ileum mucosa	111	1	0.9%
Wijewantha *et al*., 2014[34]	764	Unselected	710	27	3.8%
Koksal *et al*., 2014[35]	297	Normal-appearing TI and with <5 aphthous ulcers	200	17	8.5%
Vora *et al*., 2024[45]	299	Macroscopically normal terminal ileum mucosa	299	13	4.3%
SUBTOTAL	3,821	–	2,587	91	3.5% (91/2,587)
SELECTED[†]					
Geboes *et al*., 1998[5]	300 (Diarrhea/ CD 257, Control 43)	Diarrhea /CD versus polyp surveillance (control)	177	2	1.1%
Shah *et al*., 2001[18]	142	Diarrhea	83	2	2.4%
Yusoff *et al*., 2002[19]	508	Diarrhea	158	0	0.0%
Morini *et al*., 2003[21]	CNBD138, Control138	CNBD versus control	214	5	2.3%
Sayilir *et al*., 2011[32]	295 (CNBD135, others160)	CNBD versus others	295	13	4.4%
SUBTOTAL	1,521	–	927	22	2.4% (22/927)
TOTAL	5,342	–	3,514	113	3.2% (113/3,514)

[†]In this table, "UNSELECTED" refers to an endoscopically normal appearance with no secondary screening based on specific symptoms within this subgroup. "SELECTED" refers to an endoscopically normal appearance with secondary screening based on specific symptoms. CD, Crohn's disease; CNBD, chronic nonbloody diarrhea; IBD, inflammatory bowel disease; TI, terminal ileum.

ed of seven studies involving unselected patients, and five studies involving patients with diarrhea. Of the 2,587 unselected patients who underwent ileoscopy, new information was added to 91 patients (3.5%) despite having normal endoscopic TI findings. Histological assessment of biopsies from selected samples revealed abnormal findings in 22 of 927 patients (2.4%), compared descriptively with 91 of 2,587 patients (3.5%) in unselected samples; no cross-study inferential comparison was performed.

Discussion

Cecal intubation, documented by visualization of cecal landmarks, is the standard marker of complete colonoscopy; TI intubation may provide additional information in selected cases. Colonoscopy completion is usually documented by endoscopic visualization and photography of cecal landmarks, with TI intubation serving as an optional adjunct.[44] Unfortunately, photographs of the cecum often fail to convincingly demonstrate classical cecal landmarks, and the use of video is inconvenient. TI intubation can provide additional confirmation of examination extent when cecal landmarks are difficult to document.[48] Incomplete colonoscopy can contribute to missed lesions, but this does not establish TI intubation as a routine requirement.[22,30] A recent study reported a case of a small bowel neuroendocrine tumor in the TI detected through colonoscopy with TI intubation during screening. Although the diagnostic yield for malignant tumors is low, this case illustrates a possible role for TI evaluation in selected patients.[49] For suspected small-bowel inflammatory disease, including Crohn's disease, ileoscopy and biopsy may contribute to diagnosis alongside clinical assessment and cross-sectional imaging.[50,51] TI endoscopy and biopsy may contribute to the differential diagnosis of disorders that mimic IBD but should be interpreted within the broader clinical context.[35]

There have been no randomized controlled trials focusing on the role of ileoscopy or biopsy, and the evidence in our report mainly consists of retrospective/prospective observational studies and a case-control series. Studies have reported variable success rates of TI intubation when attempted,[18,19] with a mean intubation time of approximately 3.4 minutes reported in one prospective study.[14] The reasons for unsuccessful intubation include technical difficulties, discomfort during the procedure, obstructive lesions, retained blood, poor bowel preparation, colonic redundancy, TI stricture, and inability to identify the ileal openings.[7,28] While there are few complications,[7] potential adverse events such as biopsy-associated bleeding and perforation should still be considered.[35] These features make TI intubation an appealing and applicable diagnostic method for colonoscopy.

Although several studies have described the yield of ileoscopy, it is still unclear whether TI intubation should be performed routinely in all patients. Some researchers believe that TI intubation should be a standard practice.[30] In several studies, ileoscopic findings revealing normal TI mucosa may also help to diagnose, differentiate, and rule out some mimicking diseases. In these cases, a normal TI or biopsy specimen helps to avoid further diagnostic studies and aids in making wise decisions for the next step of management.[14,30,35] Therefore, although the number of positive findings in unselected patients was low, normal TI intubation was also very helpful in clinical intervention. However, other researchers have suggested that TI intubation should not be performed for every patient due to the low yield.[5,23] In our descriptive summary, diagnostic-yield proportions were higher in selected than in unselected samples, particularly in studies of diarrhea, although no cross-study inferential comparison was performed.[5,18,19,21,32,33]

TI intubation has a high diagnostic yield when applied to specific clinical conditions, such as chronic nonbloody diarrhea and IBD.[5,6,18,21,39] It also plays an important role in the diagnosis of colonic tuberculosis, intestinal stricture, ileitis, and lymphoma.[52] Evidence from a single case is insufficient to recommend TI intubation broadly for upper gastrointestinal or nonspecific symptoms. A representative case reported by Amadu *et al*.[53] well illustrates this point: a 53-year-old woman presented with epigastric pain and showed no improvement after a course of proton pump inhibitors. Subsequent upper gastrointestinal endoscopy revealed persistent duodenal lesions. Ileoscopy performed concurrently demonstrated aphthous ulcers in the TI, and magnetic resonance imaging further indicated mild inflammation in the same region, ultimately leading to a diagnosis of duodenal Crohn's disease.[53] This case illustrates a possible complementary role for TI examination when proximal gastrointestinal findings are inconclusive but cannot establish routine practice.

Our findings in Table 2 demonstrated that routine TI intubation seldom provided diagnostic information, while its additional time cost substantially increased the workload on a national scale, impacted histopathological services,[23] and exacerbated patient discomfort. Taken together, these data support selective rather than routine TI intubation pending higher-quality comparative evidence.

For patients undergoing TI intubation, routine mucosal biopsy when the endoscopic appearance is normal is controversial. Yusoff *et al*.[19] verified that microscopic findings from normal ileoscopy in patients with chronic diarrhea did not contribute to their diagnosis. Nonetheless, Sayilir showed no significant difference in the yield of TI biopsies between patients who presented with chronic nonbloody diarrhea and those with other indications.[32] This finding is similar to our data—the yield of TI biopsy in unselected patients was 3.5%, and the percentage ranged from 0.9% to 8.5% in patients with a normal ileoscopy. The selected patients complaining of diarrhea had a subtotal yield of ileal histopathology with a normal endoscopic appearance of 2.4% (ranging from 0% to 4.4%). The low yield suggested little value in undertaking a biopsy in macroscopically normal TIs. However, some experts believe that a normal-appearing ileal mucosa may sometimes reveal significant pathological findings. Misra *et al*.[54] reported the diagnostic role of TI biopsies in patients with suspected intestinal tuberculosis. There have been cases of cytomegalovirus colitis and microsporidiosis diagnosed by biopsy of normal-appearing TIs.[35] Harewood and McHugh maintained that biopsies from normal-appearing mucosa in patients suspected of having Crohn's disease may yield histological abnormalities due to TI 'skipping' or intramural disease.[22,26] The results of a study by Samuel *et al*.[55] found that 10 of 24 (41.7%) patients with clinically active Crohn's disease who were assessed endoscopically demonstrated microscopic evidence of chronic inflammation. This finding suggests that TI biopsies may be useful in patients with Crohn's disease with a high pretest probability. It can also be argued that a normal TI biopsy result is useful in some cases to avoid subsequent or repeat ileoscopies. These findings support a targeted biopsy approach, particularly for abnormal mucosa or a high pretest probability of ileal disease, while effects on diagnostic accuracy, procedure time, and risk require further study.

Beyond its diagnostic role, ileoscopy may be useful in the postoperative management of Crohn's disease. For patients who have undergone ileocecal resection, endoscopic monitoring of the TI within six to twelve months after surgery is an established ap-

proach for assessing postoperative recurrence.[56] Endoscopic recurrence is commonly graded using the Rutgeerts score, which informs subsequent treatment decisions.[57] However, the timing of such monitoring endoscopy requires careful consideration. If patients experience postoperative infectious complications (such as surgical site infection, anastomotic leakage, or pneumonia) or have related high-risk factors (such as corticosteroid use, malnutrition, or perioperative blood transfusion),[58] the timing of endoscopy should be individualized according to clinical stability and treatment-related risks.

There are several limitations to our review. First, all included studies were observational and showed substantial clinical and methodological heterogeneity, including inconsistent definitions of diagnostic yield and management change. Second, no formal quality or risk-of-bias assessment was conducted. Third, database-specific search strings for three databases, source-level retrieval counts, granular full-text exclusion reasons, and the specific sources of the eight manually identified studies were not retained, limiting reproducibility and complete PRISMA reporting. Fourth, management-change outcomes were missing from many studies, and indication categories overlapped without patient-level de-duplication. Consequently, aggregate proportions are presented only as crude descriptive summaries; no meta-analysis, number-needed-to-test calculation, cross-study hypothesis testing, or quantitative publication-bias assessment was performed. Finally, the review was not prospectively registered, which may introduce reporting bias.

In summary, cecal intubation remains the standard marker of complete colonoscopy. TI intubation can be considered when clinically indicated or when additional documentation of examination extent is needed. The observational evidence summarized here does not support routine TI intubation in all patients or its use as a standalone quality indicator. Reported complications are uncommon, but TI-specific adverse-event evidence is limited. Targeted biopsy is most appropriate for abnormal terminal ileal mucosa or a high pretest probability of ileal disease, whereas routine biopsy of normal-appearing mucosa has a low diagnostic yield.

Conclusions

Cecal intubation is the standard marker of complete colonoscopy. TI intubation may be considered selectively when clinically indicated or when additional documentation of examination extent is needed; the current evidence does not support routine TI intubation in all patients or its use as a standalone quality indicator. Biopsy should be considered when terminal ileal mucosa is abnormal or when clinical findings indicate a high pretest probability of ileal disease.

Funding

This work was supported by the National Natural Science Foundation of China (82170567, 82100587, and 82300641), the Shanghai Sailing Program (No. 23YF1458700), the Chenguang Program of the Shanghai Education Development Foundation, and the Shanghai Municipal Education Commission (Grant No. 23CGA44).

Conflict of interest

Prof. Zhaoshen Li serves as Honorary Editor-in-Chief and Prof. Yu Bai serves as an Editorial Board Member of Cancer Screening and Prevention. Prof. Li and Prof. Bai were not involved in the editorial review or decision-making process for this article. The authors declare no other conflicts of interest.

Author contributions

Study conception and design (JQ, JG, XH, YB, ZL); literature search and study screening (SW, ZH, XH); data extraction (LG, TW); data verification (LG, TW, YS); resolution of screening disagreements by consensus (SW, ZH, XH); adjudication of unresolved data-extraction disagreements (YB); statistical analysis (JQ, JG, XH); analysis and interpretation of data (JQ, JG, XH, LG, TW); drafting of the manuscript (JQ, JG); critical revision of the manuscript for important intellectual content (YS, ZH, YB, SW, ZL); study supervision (YB, ZL). All authors have made substantial contributions to this work and have approved the final manuscript.

References

[1] Nagasako K, Yazawa C, Takemoto T. Biopsy of the terminal ileum. Gastrointest Endosc 1972;19(1):7–10. doi:10.1016/s0016-5107(72)73931-0, PMID:5053371.
[2] Lewis BS. Ileoscopy should be part of standard colonoscopy: a comparison of radiographic and endoscopic evaluation of the ileum. J Clin Gastroenterol 2000;31(2):103–104. doi:10.1097/00004836-200009000-00002, PMID:10993422.
[3] Cherian S, Singh P. Is routine ileoscopy useful? An observational study of procedure times, diagnostic yield, and learning curve. Am J Gastroenterol 2004;99(12):2324–2329. doi:10.1111/j.1572-0241.2004.40730.x, PMID:15571577.
[4] Sultan S, Mitchell RM. The importance of ileoscopy in patients with suspected small bowel disease. Eur J Gastroenterol Hepatol 2004;16(3):359. doi:10.1097/00042737-200403000-00018, PMID:15195903.
[5] Geboes K, Ectors N, D'Haens G, Rutgeerts P. Is ileoscopy with biopsy worthwhile in patients presenting with symptoms of inflammatory bowel disease? Am J Gastroenterol 1998;93(2):201–206. doi:10.1111/j.1572-0241.1998.00201.x, PMID:9468242.
[6] Zwas FR, Bonheim NA, Berken CA, Gray S. Diagnostic yield of routine ileoscopy. Am J Gastroenterol 1995;90(9):1441–1443. PMID:7661166.
[7] Bhasin DK, Goenka MK, Dhavan S, Dass K, Singh K. Diagnostic value of ileoscopy: a report from India. J Clin Gastroenterol 2000;31(2):144–146. doi:10.1097/00004836-200009000-00011, PMID:10993431.
[8] Huang K, Zhao X, Chen X, Gao Y, Yu J, Wu L. Analysis of Digestive Endoscopic Results During COVID-19. J Transl Int Med 2021;9(1):38–42. doi:10.2478/jtim-2021-0006, PMID:33850800.
[9] Weissman S, Belyayeva A, Sharma S, Aziz M, Elias S, Tabibian JH. SARS-CoV-2 and Acute Diverticulitis: the Expanding Gastrointestinal Manifestations of COVID-19 Infection. J Transl Int Med 2021;9(1):59–60. doi:10.2478/jtim-2021-0019, PMID:33850804.
[10] Friedel DM, Cappell MS. Diarrhea and Coronavirus Disease 2019 Infection. Gastroenterol Clin North Am 2023;52(1):59–75. doi:10.1016/j.gtc.2022.11.001, PMID:36813431.
[11] Kim DS, Ryu JE, Shin J, Koo HS, Lee S, Cho H, *et al*. Diagnostic Value of Ileal Lesions Found during Colonoscopy with Reference to Endoscopic Indications and Findings. J Clin Med 2024;13(4):1161. doi:10.3390/jcm13041161, PMID:38398473.
[12] Maaser C, Sturm A, Vavricka SR, Kucharzik T, Fiorino G, Annese V, *et al*. ECCO-ESGAR Guideline for Diagnostic Assessment in IBD Part 1: Initial diagnosis, monitoring of known IBD, detection of complications. J Crohns Colitis 2019;13(2):144–164. doi:10.1093/ecco-jcc/jjy113, PMID:30137275.
[13] Baillie J. Gastrointestinal endoscopy: basic principles and practice[J] Oxford, Boston: Butterworth Heinemann; 1992.
[14] Kundrotas LW, Clement DJ, Kubik CM, Robinson AB, Wolfe PA. A prospective evaluation of successful terminal ileum intubation during routine colonoscopy. Gastrointest Endosc 1994;40(5):544–546. doi:10.1016/s0016-5107(94)70249-7, PMID:7988815.
[15] Marshall JK, Hewak J, Farrow R, Wright C, Riddell RH, Somers S, *et*

al. Terminal ileal imaging with ileoscopy versus small-bowel meal with pneumocolon. J Clin Gastroenterol 1998;27(3):217–222. doi:10.1097/00004836-199810000-00008, PMID:9802449.
[16] Levesque BG, Cipriano LE, Chang SL, Lee KK, Owens DK, Garber AM. Cost effectiveness of alternative imaging strategies for the diagnosis of small-bowel Crohn's disease. Clin Gastroenterol Hepatol 2010;8(3):261–267.e4. doi:10.1016/j.cgh.2009.10.032, PMID: 19896559.
[17] Börsch G, Schmidt G. Endoscopy of the terminal ileum. Diagnostic yield in 400 consecutive examinations. Dis Colon Rectum 1985;28(7):499–501. doi:10.1007/BF02554095, PMID:4017810.
[18] Shah RJ, Fenoglio-Preiser C, Bleau BL, Giannella RA. Usefulness of colonoscopy with biopsy in the evaluation of patients with chronic diarrhea. Am J Gastroenterol 2001;96(4):1091–1095. doi:10.1111/j.1572-0241.2001.03745.x, PMID:11316152.
[19] Yusoff IF, Ormonde DG, Hoffman NE. Routine colonic mucosal biopsy and ileoscopy increases diagnostic yield in patients undergoing colonoscopy for diarrhea. J Gastroenterol Hepatol 2002;17(3):276–280. doi:10.1046/j.1440-1746.2002.02686.x, PMID:11982697.
[20] Ansari A, Soon SY, Saunders BP, Sanderson JD. A prospective study of the technical feasibility of ileoscopy at colonoscopy. Scand J Gastroenterol 2003;38(11):1184–1186. doi:10.1080/00365520310006018, PMID:14686723.
[21] Morini S, Lorenzetti R, Stella F, Martini MT, Hassan C, Zullo A. Retrograde ileoscopy in chronic nonbloody diarrhea: a prospective, case-control study. Am J Gastroenterol 2003;98(7):1512–1515. doi:10.1111/j.1572-0241.2003.07523.x, PMID:12873572.
[22] Harewood GC, Mattek NC, Holub JL, Peters D, Lieberman DA. Variation in practice of ileal intubation among diverse endoscopy settings: results from a national endoscopic database. Aliment Pharmacol Ther 2005;22(6):571–578. doi:10.1111/j.1365-2036.2005.02632.x, PMID: 16167974.
[23] Yoong KK, Heymann T. It is not worthwhile to perform ileoscopy on all patients. Surg Endosc 2006;20(5):809–811. doi:10.1007/s00464-005-0426-9, PMID:16432648.
[24] Iacopini G, Frontespezi S, Vitale MA, Villotti G, Bella A, d'Alba L, *et al*. Routine ileoscopy at colonoscopy: a prospective evaluation of learning curve and skill-keeping line. Gastrointest Endosc 2006;63(2):250–256. doi:10.1016/j.gie.2005.09.029, PMID:16427930.
[25] Powell N, Hayee BH, Yeoh DP, Rowbotham DS, Saxena V, McNair A. Terminal ileal photography or biopsy to verify total colonoscopy: does the endoscope agree with the microscope? Gastrointest Endosc 2007;66(2):320–325. doi:10.1016/j.gie.2007.02.039, PMID:17643707.
[26] McHugh JB, Appelman HD, McKenna BJ. The diagnostic value of endoscopic terminal ileum biopsies. Am J Gastroenterol 2007;102(5):1084–1089. doi:10.1111/j.1572-0241.2007.01194.x, PMID:17391315.
[27] Kennedy G, Larson D, Wolff B, Winter D, Petersen B, Larson M. Routine ileal intubation during screening colonoscopy: a useful maneuver? Surg Endosc 2008;22(12):2606–2608. doi:10.1007/s00464-008-9843-x, PMID:18347860.
[28] Jeong SH, Lee KJ, Kim YB, Kwon HC, Sin SJ, Chung JY. Diagnostic value of terminal ileum intubation during colonoscopy. J Gastroenterol Hepatol 2008;23(1):51–55. doi:10.1111/j.1440-1746.2007.05151.x, PMID:18171342.
[29] Melo MM, Cury PM, Ronchi LS, Gonçalves-Filho Fde A, Cunrath GS, Netinho JG. Terminal ileum of patients who underwent colonoscopy: endoscopic, histologic and clinical aspects. Arq Gastroenterol 2009;46(2):102–106. doi:10.1590/s0004-28032009000200005, PMID:19578609.
[30] Emami MH, Behbahan IS, Zade HD, Daneshgar H. New interpretation for diagnostic yield of ileoscopy: A prospective study and a brief review. J Res Med Sci 2009;14(3):157–163. PMID:21772877.
[31] Melton SD, Feagins LA, Saboorian MH, Genta RM. Ileal biopsy: Clinical indications, endoscopic and histopathologic findings in 10,000 patients. Dig Liver Dis 2011;43(3):199–203. doi:10.1016/j.dld.2010.08.004, PMID:20843753.
[32] Sayilir A, Kurt M, Kekilli M, Onal IK, Beyazit Y, Turhan N, *et al*. Diagnostic value of terminal ileum biopsy in chronic diarrhea with normal endoscopic appearance. J Dig Dis 2011;12(3):188–192. doi:10.1111/j.1751-2980.2011.00503.x, PMID:21615872.
[33] Makkar R, Lopez R, Shen B. Clinical utility of retrograde terminal ileum intubation in the evaluation of chronic non-bloody diarrhea. J Dig Dis 2013;14(10):536–542. doi:10.1111/1751-2980.12082, PMID:23777610.
[34] Wijewantha HS, de Silva AP, Niriella MA, Wijesinghe N, Waraketiya P, Kumarasena RS, *et al*. Usefulness of Routine Terminal Ileoscopy and Biopsy during Colonoscopy in a Tropical Setting: A Retrospective Record-Based Study. Gastroenterol Res Pract 2014;2014:343849. doi:10.1155/2014/343849, PMID:24550980.
[35] Koksal AR, Boga S, Alkim H, Ergun M, Bayram M, Sakiz D, *et al*. How does a biopsy of endoscopically normal terminal ileum contribute to the diagnosis? Which patients should undergo biopsy? Libyan J Med 2014;9(1):23441. doi:10.3402/ljm.v9.23441, PMID:24560378.
[36] Velidedeoğlu M, Enes Arıkan A, Kağan Zengin A. Diagnostic value of terminal ileum biopsies in patients with abnormal terminal ileum mucosal appearance. Ulus Cerrahi Derg 2015;31(3):152–156. doi:10.5152/UCD.2015.2756, PMID:26504419.
[37] Akere A, Otegbayo JA, Tejan EA. Terminal ileum intubation during colonoscopy: Should it be routinely performed on all patients? Trop J Med Res 2017;20:66–69. doi:10.4103/1119-0388.198125.
[38] Meral M, Bengi G, Kayahan H, Akarsu M, Soytürk M, Topalak Ö, *et al*. Is ileocecal valve intubation essential for routine colonoscopic examination? Eur J Gastroenterol Hepatol 2018;30(4):432–437. doi:10.1097/MEG.0000000000001065, PMID:29334518.
[39] Borsotti E, Barberio B, D'Incà R, Bonitta G, Cavallaro F, Pastorelli L, *et al*. Terminal ileum ileoscopy and histology in patients undergoing high-definition colonoscopy with virtual chromoendoscopy for chronic nonbloody diarrhea: A prospective, multicenter study. United European Gastroenterol J 2019;7(7):974–981. doi:10.1177/2050640619847417, PMID:31428422.
[40] Mari A, Khoury T, Mahamid M, Akram S, Kopelman Y, Abu Baker F. The Yield of Ileoscopy: Does Indication Matter? Isr Med Assoc J 2020;11(22):684–687. PMID:33249788.
[41] Leiman DA, Jawitz NG, Lin L, Wood RK, Gellad ZF. Terminal ileum intubation is not associated with colonoscopy quality measures. J Gastroenterol Hepatol 2020;35(9):1503–1508. doi:10.1111/jgh.14997, PMID:32003060.
[42] Wang W, Chen K, Xu Y, Zhou Y, Chen P. Routine ileal intubation in colonoscopy does not increase the polyp detection rate: a retrospective study. Z Gastroenterol 2020;58(10):955–959. doi:10.1055/a-1213-6701, PMID:33036049.
[43] Rosevics L, Ramos Júnior O. When Ileal Evaluation Is Not Mandatory during Colonoscopy. Arq Gastroenterol 2021;58(2):175–179. doi:10.1590/S0004-2803.202100000-30, PMID:34231662.
[44] Alkhatib AA, Kumar S. Clinical Yield of Ileal Intubation During Screening Colonoscopy. Cureus 2022;14(1):e20870. doi:10.7759/cureus.20870, PMID:35145777.
[45] Vora H, Ibrahim R, Chan J, Farraye FA, Hashash JG. Are biopsies from endoscopically normal terminal ileum necessary? Ann Gastroenterol 2024;37(6):695–698. doi:10.20524/aog.2024.0927, PMID:39568714.
[46] Shu S, Zhang C, Liu L, Shan J, Xiang T, Shu T, *et al*. Terminal ileal intubation is not necessary in routine colonoscopy: data from a large-scale retrospective study. BMC Gastroenterol 2024;24(1):432. doi:10.1186/s12876-024-03521-3, PMID:39592930.
[47] Dąbkowski K, Tryba M, Biesiada E, Konczanin K, Michalak M, Szczygłowska M, *et al*. Endoscopic assessment of terminal ileum in screening colonoscopy: is it worth the effort? Clin Endosc 2025;58(5):731–737. doi:10.5946/ce.2025.018, PMID:40675791.
[48] Rex DK, Petrini JL, Baron TH, Chak A, Cohen J, Deal SE, *et al*. Quality indicators for colonoscopy. Am J Gastroenterol 2006;101(4):873–885. doi:10.1111/j.1572-0241.2006.00673.x, PMID:16635231.
[49] Kahveci AS, Mubarak MF, Perveze I, Daglilar ES. Differential to Terminal Ileitis: Terminal Ileum Neuroendocrine Tumor Identified on Screening Colonoscopy. Ochsner J 2023;23(1):67–71. doi:10.31486/toj.22.0035, PMID:36936484.
[50] Tang SJ, Wu R. Ilececum: A Comprehensive Review. Can J Gastroenterol Hepatol 2019;2019:1451835. doi:10.1155/2019/1451835, PMID:30854348.
[51] Nehra AK, Sheedy SP, Wells ML, VanBuren WM, Hansel SL, Deepak

P, *et al*. Imaging Findings of Ileal Inflammation at Computed Tomography and Magnetic Resonance Enterography: What do They Mean When Ileoscopy and Biopsy are Negative? J Crohns Colitis 2020;14(4):455–464. doi:10.1093/ecco-jcc/jjz122, PMID:31960900.

[52] Neilson LJ, Bevan R, Panter S, Thomas-Gibson S, Rees CJ. Terminal ileal intubation and biopsy in routine colonoscopy practice. Expert Rev Gastroenterol Hepatol 2015;9(5):567–574. doi:10.1586/17474124.2015.1001744, PMID:25582839.

[53] Amadu M, Soldera J. Duodenal Crohn's disease: Case report and systematic review. World J Methodol 2024;14(1):88619. doi:10.5662/wjm.v14.i1.88619, PMID:38577197.

[54] Misra SP, Dwivedi M, Misra V. Ileoscopy in 39 hematochezia patients with normal colonoscopy. World J Gastroenterol 2006;12(19):3101–3104. doi:10.3748/wjg.v12.i19.3101, PMID:16718796.

[55] Samuel S, Bruining DH, Loftus EV Jr, Becker B, Fletcher JG, Mandrekar JN, *et al*. Endoscopic skipping of the distal terminal ileum in Crohn's disease can lead to negative results from ileocolonoscopy. Clin Gastroenterol Hepatol 2012;10(11):1253–1259. doi:10.1016/j.cgh.2012.03.026, PMID:22503995.

[56] Siham B, Amri F, Koulali H, Zazour A, Ismaili Z, Kharrasse G. Clinical-endoscopic correlation of postoperative recurrence in surgically treated Crohn's disease patients. J Crohns Colitis 2024;18(Suppl_1):i616. doi:10.1093/ecco-jcc/jjad212.0393.

[57] Barnes EL. Postoperative Crohn's disease management. Curr Opin Gastroenterol 2020;36(4):277–283. doi:10.1097/MOG.0000000000000638, PMID:32304384.

[58] Mowlah RK, Soldera J. Risk and management of post-operative infectious complications in inflammatory bowel disease: A systematic review. World J Gastrointest Surg 2023;15(11):2579–2595. doi:10.4240/wjgs.v15.i11.2579, PMID:38111772.