ORIGINAL PAPER

RJME Romanian Journal of Morphology & Embryology http://www.rjme.ro/

Is routine terminal ileum intubation justified during screening colonoscopy? Evidence from a regional screening program

VICTOR-MIHAI SACERDOŢIANU[1,2], ALEXANDRA-GEORGIANA BOCIOAGĂ[1,3], CARMEN-NICOLETA OANCEA[3,4], DUMITRU RĂDULESCU[5], MIRELA MARINELA FLORESCU[6], DAN NICOLAE FLORESCU[1,2], DAN IONUŢ GHEONEA[1,2]

[1] *Research Center of Gastroenterology and Hepatology, University of Medicine and Pharmacy of Craiova, Romania*

[2] *Department of Gastroenterology, University of Medicine and Pharmacy of Craiova, Romania*

[3] *Department of Biochemistry, University of Medicine and Pharmacy of Craiova, Romania*

[4] *Department of Community Projects, University of Medicine and Pharmacy of Craiova, Romania*

[5] *Department of Surgery, University of Medicine and Pharmacy of Craiova, Romania*

[6] *Department of Pathology, University of Medicine and Pharmacy of Craiova, Romania*

Abstract

Background/Aim: Although colonoscopy represents the cornerstone of colorectal cancer (CRC) screening, the incremental diagnostic yield of routine terminal ileum (TI) intubation remains insufficiently defined, particularly in fecal immunochemical test (FIT) positive patients. This study evaluated the feasibility, diagnostic performance, and clinical relevance of routine TI intubation in participants enrolled in a regional CRC screening program. *Patients, Materials and Methods*: We performed a retrospective analysis of individuals aged 50–74 years who underwent colonoscopy within a regional CRC screening program in South-West Romania between November 2020 and December 2023. Patients with successful TI intubation were compared with individuals in whom TI exploration was not performed. Demographic characteristics, bowel preparation quality, sedation parameters, comorbidities, procedural variables, and histopathological (HP) outcomes were assessed. *Results*: The analysis included 1512 complete colonoscopies, of which TI intubation was successfully achieved in 41.86% of procedures. Macroscopic TI abnormalities were identified in 1.74% of patients, including erosions, ulcerations, hyperemia, and nodular or atrophic changes. HP analysis showed findings suggestive of inflammatory bowel disease in 27.27%, celiac disease-related changes in 9.09%, and nonspecific inflammatory alterations in 63.64% of abnormal cases. Successful TI exploration was more commonly observed in patients receiving sedation and in those with better bowel preparation. No significant associations were observed regarding age, sex, or FIT values. *Conclusions*: Routine TI intubation demonstrated a relatively limited diagnostic yield in this screening population. Although clinically meaningful findings were uncommon, TI assessment may remain valuable in selected clinical settings. Further prospective studies are needed to establish its role in screening colonoscopy.

Keywords: colorectal cancer screening, screening colonoscopy, FIT-positive test, terminal ileum intubation.

Introduction

Colorectal cancer (CRC) programs are designed to detect cancer at early and localized stage in asymptomatic individuals and simultaneously to reduce disease burden through the identification and removal of precancerous lesions [1–4].

Beyond lesion detection, histopathological (HP) evaluation remains essential for understanding the biological behavior of colorectal neoplasia. Recent studies have demonstrated the relevance of proliferation markers and molecular pathways involved in tumor development and progression, supporting the role of comprehensive tissue assessment in CRC screening programs [5–7].

To achieve these goals, a complete colonoscopy is the technique applied to patients involved in a CRC program. Cecum evaluation is the endpoint of a full-length colon examination and is considered a key quality indicator of the procedure, while the role of terminal ileum (TI) intubation remains less clearly defined [8, 9].

Clear indications that a patient needs an ileal intubation colonoscopy include abdominal pain (right lower quadrant), diarrhea, hematochezia, unexplained iron-deficiency anemia, high suspicion of inflammatory bowel disease (IBD), tuberculosis or abnormal imaging [4, 8, 10–13].

During routine colonoscopy performed in the absence of a specific clinical indication, intubation of the ileocecal valve and inspection of the TI are not considered standard components of the examination. There are no recommendations whether TI intubation is mandatory in patients with a positive fecal immunochemical test (FIT) and usually an individualized medical decision will conclude [14]. In line with *European Society of Gastrointestinal Endoscopy* (ESGE) and *American Society for Gastrointestinal Endoscopy* (ASGE) recommendations, TI intubation has limited diagnostic value for colorectal neoplasia detection,

This is an open-access article distributed under the terms of a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License, which permits unrestricted use, adaptation, distribution and reproduction in any medium, non-commercially, provided the new creations are licensed under identical terms as the original work and the original work is properly cited.

being mainly reserved for confirming completeness of the examination in cases where cecal landmarks are not clearly visualized.

During TI intubation, specific abnormalities are not identified in most cases. Even when lesions are detected, they are predominantly nonspecific and rarely yield diagnostically meaningful information for a defined underlying condition [15, 16].

Aim

The objective of the study was to assess the frequency and diagnostic yield of TI exploration in patients enrolled in a regional CRC screening program.

Patients, Materials and Methods

The actual retrospective study was conducted between June 2024 and September 2024. The analyzed data was available on the register of the CRC screening program in the Southwestern Oltenia Region, Romania.

This register contains all reports of 1550 colonoscopies performed at a single center, Research Center of Gastroenterology and Hepatology (CCGH), University of Medicine and Pharmacy of Craiova, Romania, between November 2020 and December 2023, within the regional CRC screening initiative.

Inclusion criteria of our study contain patients with age between 50 and 74 years old, positive fecal immunochemical test (FIT) or high-risk patients with rectal bleeding and/or palpable rectal tumor on digital rectal examination, signed informed consent and in addition, a full detailed report. If biopsies or resection were required, HP data was also collected.

Exclusion criteria include the lack of intubation of the TI or incomplete data about ileal findings.

All procedures were performed by experienced gastroenterologists aided by endoscopy nurses in accordance with quality standards regarding colonoscopies. The equipment consisted of an Olympus EVIS X1 tower and two types of colonoscopes, CF HQ190 and CF H190.

Collected data contains gender, age, TI intubation findings, associated diseases, antiplatelets and anticoagulation status, quality of colon preparation – Boston Bowel Preparation Scale (BBPS), fit test value, sedation dose and withdrawal time.

The samples were processed using the usual technique of embedding in paraffin with 10% neutral buffered formalin and stained with the usual Hematoxylin and Eosin (H&E) stain and analyzed using a Nikon Eclipse Ei microscope. The images were realized using Lucia 5 software.

Statistical analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) and compared between groups using the independent-samples Student's *t*-test, while categorical variables were expressed as frequencies and percentages and compared using the χ^2 (*chi*-squared) test or Fisher's exact test, as appropriate. A two-tailed *p*-value <0.05 was considered statistically significant.

Results

A total of 51 437 enrolled in the CRC screening program and 45 049 individuals completed FIT and had valid results. Of these, 2825 (6.27%) tested positive and were referred for colonoscopy. An additional 88 individuals were classified as high-risk based on the risk assessment questionnaire and were referred directly for colonoscopy. Among eligible participants, 46.8% declined colonoscopy despite medical recommendation, indicating suboptimal adherence to the screening pathway (Figure 1).

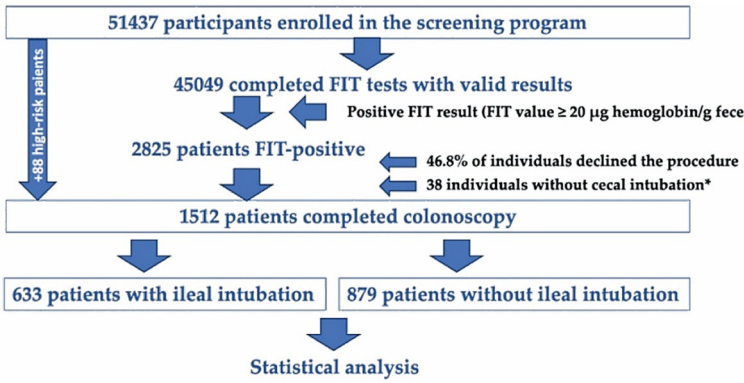

Figure 1 – ***Representative flowchart of patients enrolled on CRC screening program. *Cecal intubation was not achieved in 38 patients for various reasons, including stenotic lesions, poor tolerance of the procedure, and other technical or clinical limitations. CRC: Colorectal cancer; FIT: Fecal immunochemical test.***

Of the 1512 completed colonoscopies performed during the study period, in 58.13% of cases, ileal intubation was not assessed due to a not mandatory CRC screening condition and were included as the control group. A total of 633 (41.87%) patients with explored TI were included in our research as experimental group to quantify the real yield impact of the TI intubation on a CRC screening program (Table 1).

The results of the FIT tests demonstrated a slightly higher mean value in the group of those who also underwent TI exploration (222.45 *vs.* 213.04, p=0.6546) but without statistical significance, since the lesions that could cause occult bleeding were in both groups in the colon and not in the small intestine (Figure 2A; Table 2). Age was not a criterion regarding the choice of ileal intubation or not, so patients had a similar mean (Figure 2B; Table 2).

Table 1 – ***Mean and SD values of age, FIT test score, sedation dose and withdrawal time for patients included in our study***

Characteristic	Successful intubation	Unsuccessful intubation	*p*-value
Age [years]	62.75±6.90	62.74±6.74	0.984
FIT level	222.45±414.42	213.04±396.00	0.655
Propofol dose [mg]	209.15±101.79	200.08±105.96	0.090
Withdrawal time [min]	10.93±4.16	11.01±5.30	0.741

Data are presented as mean ± SD. FIT: Fecal immunochemical test; SD: Standard deviation.

Table 2 – ***Baseline demographic, clinical, and procedural characteristics according to TI intubation status***

Variable	Category	Ileal intubation Yes, *n*	Ileal intubation Yes, %	Ileal intubation No, *n*	Ileal intubation No, %	*p*-value
Comorbidities	No comorbidities	243	38.39	287	31.30	0.0077*
	Cardiac disease	194	30.65	297	32.39	
	Multiple comorbidities	135	21.33	204	22.25	
	Diabetes mellitus	50	7.90	108	11.78	
	Other comorbidities	0	0.00	6	0.65	
Antiplatelet	Yes	74	11.69	157	17.12	0.0040*
	No	559	88.31	760	82.88	
Anticoagulants	Yes	35	5.53	53	5.78	0.9221
	No	598	94.47	864	94.22	
Sedation	Yes	565	89.26	787	85.82	0.0557
	No	68	10.74	130	14.18	
Boston right	0 – No visibility	3	0.47	33	3.60	0.0*
	1	23	3.63	96	10.47	
	2	229	36.18	469	51.15	
	3	378	59.72	319	34.79	
Boston transverse	0 – No visibility	1	0.16	19	2.07	0.0*
	1	9	1.42	51	5.56	
	2	158	24.96	380	41.44	
	3	465	73.46	467	50.93	
Boston left	0	0.0	0.00	10	1.09	0.0*
	1	14	2.21	44	4.80	
	2	84	13.27	216	23.56	
	3	535	84.52	647	70.56	
Retroversion cecum	With retroversion	20	3.16	10	1.09	0.0*
	No retroversion	606	95.73	842	91.82	
	Not available	7	1.11	65	7.09	
Retroversion rectum	With retroversion	612	96.68	875	95.42	0.2685
	No retroversion	21	3.32	42	4.58	
Recommendation	Return for histopathology report	387	61.14	574	62.60	0.0010*
	Returns for FIT test in two years	180	28.44	203	22.14	
	Scheduled for endoscopic resection	52	8.21	84	9.16	
	Scheduled for surgery	2	0.32	1	0.11	
	Repeat colonoscopy due to inadequate bowel preparation	8	1.26	43	4.69	
	Scheduled for oncology consultation	3	0.47	9	0.98	
	Repeat colonoscopy due to incomplete examination	1	0.16	3	0.33	
Histopathological report	No cancer	391	61.77	564	61.50	0.9669
	CIS / suspected	95	15.01	142	15.49	
	Confirmed cancer	147	23.22	211	23.01	

*Statistically significant; CIS: Carcinoma *in situ*; FIT: Fecal immunochemical test; *n*: No. of cases; TI: Terminal ileum.

Most sedated patients (89.26%) underwent TI exploration, whereas among unsedated patients, only 10.74% underwent TI intubation (Table 2).

The dose of Propofol was higher in patients in whom the TI was explored, probably due to the prolonged insertion time, which, unfortunately, was not available in this study, as it was not a mandatory requirement in the CRC screening program (209.15 *vs.* 200.08, p=0.0899) (Figure 2C).

The withdrawal time was similar, respecting the *ESGE* standards in force of a minimum of seven minutes but with a target of nine minutes. In case the patient presents lesions that require detailed evaluation, resection or biopsy, the time was extended (Figure 2D).

The sex distribution showed a predominance of males both in the group of patients in whom the TI was explored (55.61% *vs.* 44.39%) and in the control group (52.99% *vs.* 47.01%) (Table 2).

Regarding anesthetic risk, the *American Society of Anesthesiologists* (ASA) classification was used in our study. Most patients were shown to be ASA class 2 in both patient groups.

The lowest number of patients who underwent TI intubation was observed among those with a higher-risk ASA, class 4 and 5, accounting 0.78% of total cases.

A total of 59.88% of patients in the study group had either cardiac disease, diabetes mellitus, or multiple comorbidities, whereas among patients in the control group, the percentage with these conditions was slightly higher, at 66.42%.

Macroscopic abnormalities of the TI were identified in 11 of the 633 (1.74%) patients who underwent successful

ileal intubation. The observed findings included erosions, ulcerations, mucosal hyperemia, and nodular or atrophic lesions. Of the 11 patients included in this subgroup, HP assessment revealed a heterogeneous distribution of mucosal abnormalities. Specifically, 27.27% of patients showed HP features consistent with IBD (Figure 3, A, A_1 and B). In addition, 9.09% of patients presented histological features consistent with celiac disease (Figure 4, A, A_1 and A_2). The rest of the patients, representing 63.64%, exhibited nonspecific inflammatory changes (Figure 5, A, A_1 and A_2). No tumors, including lymphomas, neuroendocrine tumors or gastrointestinal stromal tumors were observed.

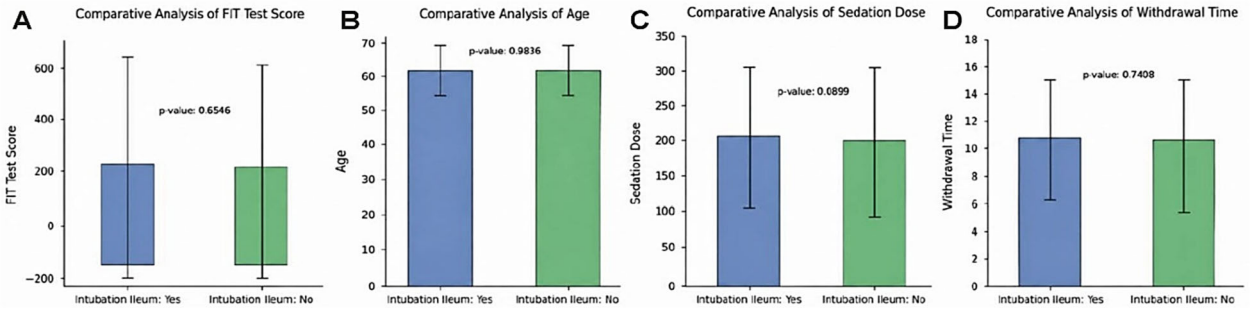

Figure 2 – ***(A) Comparative analysis of age according to TI intubation status; (B) Comparative analysis of FIT test scores according to TI intubation status; (C) Comparative analysis of Propofol sedation dose according to TI intubation status; (D) Comparative analysis of withdrawal time according to TI intubation status. FIT: Fecal immunochemical test; TI: Terminal ileum.***

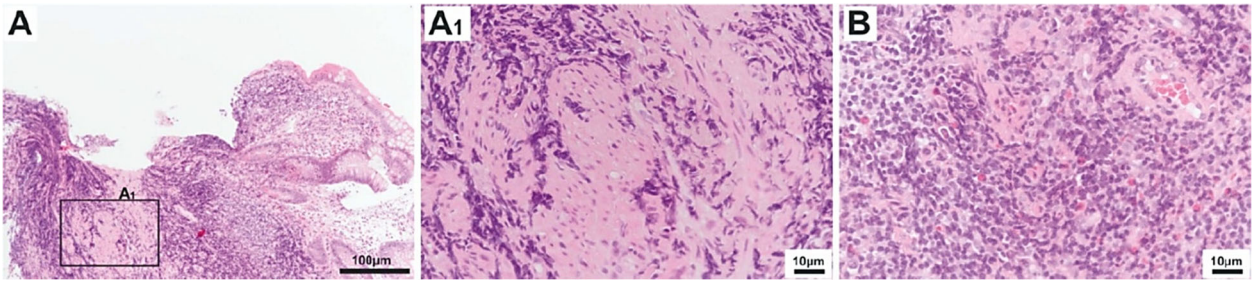

Figure 3 – ***Histological section of the intestinal mucosa showing atrophy of the villosities/crypts, ulceration and chronic inflammatory infiltrates with collagenous sclerosis through the thickness of the wall (A). Inflammation dissects the muscle layer of muscularis propria (A_1) and comprises mostly mononuclear cells (B). Crohn's disease. Hematoxylin and Eosin (H&E) staining. Scale bar: (A) 100 µm; (A_1 and B) 10 µm.***

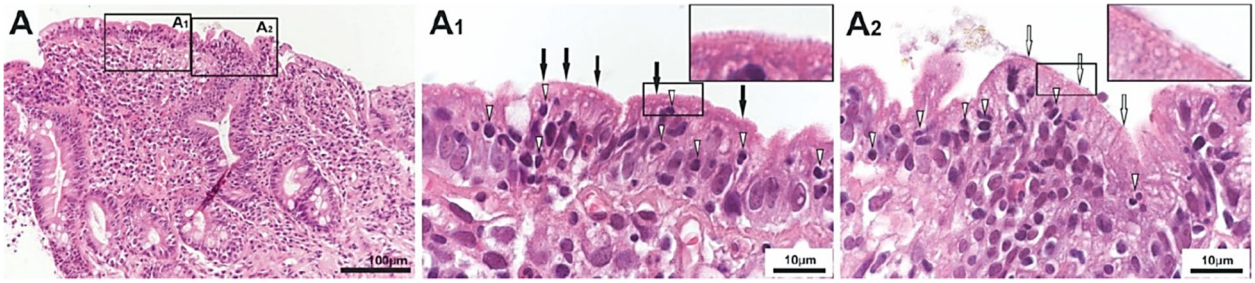

Figure 4 – ***Representative histological section of the intestinal mucosa showing dense chronic lymphoplasmacytic infiltrate in the lamina propria partial villous atrophy (A), increased intraepithelial lymphocytes (>30 per 100 enterocytes) (white arrowheads) with a relative preservation of the microvilli (black arrows and enlarged inset) (A_1), or increased intraepithelial lymphocytes (white arrowheads) and loss of microvilli (white arrows and enlarged inset) (A_2). Celiac disease. H&E staining. Scale bar: (A) 100 µm; (A_1 and A_2) 10 µm.***

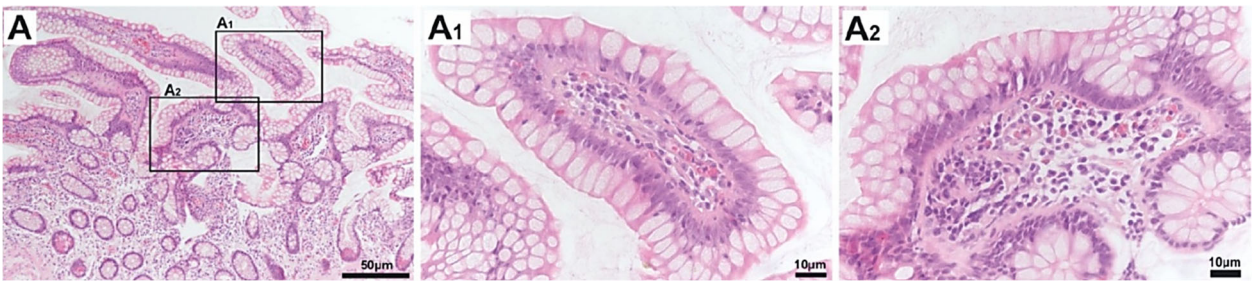

Figure 5 – ***Histological section of the intestinal mucosa showing preserved villosities and crypt architecture, with diffuse chronic inflammatory infiltrates within the lamina propria (A). Nonspecific inflammation, with plasma cells and lymphocytes underneath the covering epithelium, without intraepithelial migrated inflammatory cells (A_1 and A_2). H&E staining. Scale bar: (A) 50 µm; (A_1 and A_2) 10 µm.***

The mean age of patients in whom lesions was identified was 63.36±7.62 years, which was very similar to the mean age recorded among patients without lesions, namely 62.74±6.89 years. This difference was not statistically significant, as reflected by a *p*-value of 0.7922. Therefore, in the analyzed cohort, age did not appear to be significantly associated with the presence of lesions.

As noted earlier, patients receiving Propofol sedation during colonoscopy were more likely to undergo successful TI intubation than those examined without sedation.

Bowel preparation quality also appeared to play an important role in the successful intubation of the TI. Higher BBPS scores, reflecting better bowel cleansing, were associated with increased rates of successful TI intubation.

The mean length of TI explored during the procedure was 9.05±3.53 cm, indicating a relatively extensive evaluation of this intestinal segment. This is clinically relevant, as careful inspection and sampling of the TI can help detect subtle endoscopic or histological abnormalities, including findings suggestive of Crohn's disease or other forms of IBD, nonspecific inflammatory changes, and less commonly, histological features compatible with celiac disease.

Discussions

The diagnostic yield of routine ileal examination during colonoscopies performed outside screening settings varies considerably across different study populations, with detection rates reported between 0.4% to 67% [17].

While numerous studies have explored the diagnostic value of TI intubation in these contexts, limited data are available regarding its utility in routine colonoscopy, with recent studies suggesting a low diagnostic yield [12, 18, 19].

This uncertainty underscores the need for further evaluation of its role, especially among FIT-positive screening populations.

The characteristics of our cohort were patients' age and positive FIT test. This aspect can lead to different findings in TI in the general population who undergo a colonoscopy without a certain indication.

TI intubation was accomplished in 41.86% of complete colonoscopies in our study population. This finding closely resembles the rate reported by Alkhatib & Kumar (40.8%), whereas considerably lower rates were reported by Dąbkowski *et al.* (12.1%) and Harewood *et al.* (7.1%). Variations among studies may be related to heterogeneity in clinical practice, including endoscopist-related factors, procedural indications, and differences in policies regarding routine TI intubation during CRC screening colonoscopy [18–20].

In contrast to previous studies reporting that TI intubation was more frequently performed in younger individuals and that abnormal ileal findings occurred more commonly at younger ages, our results did not reveal significant age-related differences among patients with and without TI intubation or between those with and without lesions [9, 18, 19].

A slight male predominance was observed in both study groups, with a comparable sex distribution among patients with and without TI exploration. Previous studies evaluating TI intubation have reported inconsistent findings regarding sex-related differences, with some authors describing slightly higher TI assessment rates in female patients, whereas others found no significant differences between sexes. Overall, our findings support the notion that gender may not represent a major determinant of TI exploration during screening colonoscopy [19, 20].

Data suggest that most ileal findings on TI are ulcerations (92.7%) incidentally identified in asymptomatic individuals are typically not associated with significant HP abnormalities and tend to follow a favorable clinical course, with spontaneous resolution at follow-up colonoscopy (66.7–72.4%), suggesting a self-limited process and minimal clinical relevance in the absence of additional supportive findings [21].

In our study, TI inspection revealed macroscopic abnormalities in 11 of the 633 patients who underwent successful ileal intubation, resulting in a detection rate of 1.74%. This relatively low prevalence is consistent with previous studies evaluating the diagnostic yield of routine ileal intubation in patients undergoing screening or surveillance colonoscopic examinations. Alkhatib & Kumar reported mucosal abnormalities in 37 patients, representing 3.7% among the patients in whom TI intubation was successfully performed during screening colonoscopy [18]. Similarly, Meral *et al.* found endoscopically abnormal TI findings in 11 patients, corresponding to 3.3% of their screening cohort. HP abnormalities considered clinically relevant were infrequently observed, affecting only 1.9% of patients who underwent TI inspection during colonoscopy, regardless of the underlying indication [11].

In a surveillance colonoscopy population, Zwas *et al.* found abnormal HP findings in 2.7% of patients undergoing routine ileoscopy [22]. Compared with these studies, the frequency of macroscopic TI abnormalities in our cohort falls within the lower range of previously reported rates. By contrast, Kennedy *et al.*, in a large screening colonoscopy cohort of 6408 patients from the Mayo Clinic, reported markedly lower diagnostic yields, with endoscopic abnormalities detected in only 1% of patients and HP changes identified in only 0.3% of cases [23]. In our cohort, microscopic analysis of biopsies obtained from macroscopically abnormal TI mucosa revealed HP features consistent with IBD in 27.27% of cases and changes compatible with celiac disease in 9.09%. Most cases, representing 63.64%, showed nonspecific inflammatory changes. These findings indicate that although macroscopic ileal abnormalities were uncommon, a proportion of abnormal cases were associated with potentially clinically relevant diagnoses. Among patients with TI findings consistent with IBD, concomitant colonic involvement was identified in only one case.

The pattern of endoscopic abnormalities observed in our study, including erosions, ulcerations, hyperemia, and nodular or atrophic mucosal changes, is broadly comparable with previously published data. In the study by Alkhatib & Kumar, the abnormal endoscopic findings in the TI consisted of ulcerations in 35.14% of cases, nodular/granular mucosa in 24.32%, erosions in 16.22%, mucosal erythema in 18.92%, inflamed mucosa in 2.70%, and ileal polyps in 2.70%, based on a total of 37 identified lesions [18].

Differences between studies may reflect variation in patient selection, indication for colonoscopy, endoscopist practice patterns, definitions of abnormal ileal findings, and whether histological confirmation was systematically obtained. Importantly, although TI intubation may reveal mucosal abnormalities in a small proportion of patients,

the available literature suggests that clinically meaningful HP findings are uncommon in asymptomatic screening or surveillance populations.

The perception of colonoscopy as a painful and potentially embarrassing procedure may represent a significant barrier to patient attendance in screening programs, adherence to recommended surveillance, and early diagnostic assessment of colorectal symptoms [24, 25]. Successful TI exploration was observed more frequently in patients who underwent colonoscopy under Propofol sedation compared with those examined without sedation. This finding suggests that sedation may facilitate a more complete endoscopic examination by improving patient tolerance and procedural conditions, while also reducing the likelihood that endoscopists avoid additional exploration because of concerns regarding patient discomfort in unsedated procedures. In addition, in our study, Propofol administration tended to be higher in patients who underwent successful TI exploration, possibly reflecting more prolonged or technically demanding procedures. However, insertion time was not available for analysis because this parameter was not routinely collected within the CRC screening program. Previous studies have reported an association between deeper sedation and higher TI intubation rates, whereas in other study was observed that patients with pathological TI findings were more likely to receive lighter sedation. Collectively, these findings suggest that the association between sedation practices and TI exploration outcomes remains complex and warrants further investigation [4, 26].

The relatively extensive length of TI exploration observed in our cohort may have contributed to a more comprehensive assessment of this segment, potentially increasing the likelihood of identifying subtle endoscopic or HP abnormalities with potential clinical relevance.

Achieving a high-quality colonoscopy depends not only on safely reaching the cecum but also on adequate bowel preparation, meticulous inspection of the mucosa for the detection of all precancerous lesions, as well as their complete and curative resection [8, 27].

Bowel preparation quality also appeared to influence successful TI intubation in our cohort, as higher BBPS scores were associated with increased TI exploration rates. This observation is consistent with previous studies reporting a median Boston score of 8 among successfully examined patients and showing that better bowel preparation, particularly in the right colon, was associated with significantly higher TI intubation rates. Collectively, these findings support the importance of adequate bowel cleansing as a factor contributing to a more complete colonoscopic examination and potentially improving its diagnostic yield [18, 28].

The slightly higher prevalence of comorbidities among patients without TI exploration may reflect a tendency to limit procedural duration in individuals with increased clinical complexity, prioritizing essential diagnostic and therapeutic aspects of colonoscopy.

Given the consistently low prevalence of clinically relevant ileal findings reported in recent studies, routine ileal intubation during FIT-positive colonoscopy may not represent an efficient use of endoscopic resources. The inconsistency in reported rates of TI intubation probably reflects multiple contributing factors, such as variability in study cohorts, differences in endoscopist skill, the lack of formal guideline recommendations, the perceived limited clinical value of routine ileal inspection during screening colonoscopy, and time-related procedural considerations [12, 18].

Thus, while TI intubation can be considered a marker of complete and careful colonoscopic examination, its routine use in all patients should be balanced against procedure time, technical feasibility, and the relatively low likelihood of clinically significant findings in screening populations.

Conclusions

Our findings indicate that routine TI intubation has a relatively low diagnostic yield in a FIT-positive CRC screening population. Although macroscopic ileal abnormalities were occasionally identified, clinically relevant HP findings were uncommon and more than 50% were represented by inflammatory or nonspecific changes. These observations are consistent with previous studies reporting limited additional diagnostic benefit from routine TI assessment in screening settings. Nevertheless, ileal inspection may remain useful in selected clinical scenarios, particularly in patients with suspected IBD, chronic diarrhea, gastrointestinal bleeding, abnormal imaging, anemia, or other symptoms suggestive of small bowel pathology. Well-designed prospective studies are still required to clarify whether routine TI intubation provides meaningful clinical benefit in the setting of CRC screening.

Conflict of interests

The authors declare no conflict of interests.

Acknowledgments

This research was funded by the European Union from the European Social Fund, within the Human Capital Operational Program 2014–2020, financial contract number: POCU/756/4/9/136442. This study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Medicine and Pharmacy of Craiova, Romania (IRB No. 151/30.08.2023). Informed consent was obtained from all subjects involved in the study.

References

[1] US Preventive Services Task Force; Davidson KW, Barry MJ, Mangione CM, Cabana M, Caughey AB, Davis EM, Donahue KE, Doubeni CA, Krist AH, Kubik M, Li L, Ogedegbe G, Owens DK, Pbert L, Silverstein M, Stevermer J, Tseng CW, Wong JB. Screening for colorectal cancer: US Preventive Services Task Force Recommendation Statement. JAMA, 2021, 325(19): 1965–1977. https://doi.org/10.1001/jama.2021.6238 PMID: 34003218

[2] Wolf AMD, Fontham ETH, Church TR, Flowers CR, Guerra CE, LaMonte SJ, Etzioni R, McKenna MT, Oeffinger KC, Shih YT, Walter LC, Andrews KS, Brawley OW, Brooks D, Fedewa SA, Manassaram-Baptiste D, Siegel RL, Wender RC, Smith RA. Colorectal cancer screening for average-risk adults: 2018 Guideline update from the American Cancer Society. CA Cancer J Clin, 2018, 68(4):250–281. https://doi.org/10.3322/caac.21457 PMID: 29846947

[3] Qaseem A, Harrod CS, Crandall CJ, Wilt TJ; Clinical Guidelines Committee of the American College of Physicians; Balk EM, Cooney TG, Cross JT Jr, Fitterman N, Maroto M, Obley AJ, Tice J, Tufte JE, Shamliyan T, Yost J. Screening for colorectal cancer in asymptomatic average-risk adults: a guidance statement from the American College of Physicians (version 2). Ann Intern Med, 2023, 176(8):1092–1100. https://doi.org/10.7326/M23-0779 PMID: 37523709

[4] 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
[5] Niculescu ŞA, Grecu DC, Simionescu CE, Niculescu EC, Stepan MD, Stepan AE. Immunoexpression of Ki67, p53 and cyclin D1 in osteosarcomas. Rom J Morphol Embryol, 2021, 62(3):743–750. https://doi.org/10.47162/rjme.62.3.11 PMID: 35263402 PMCID: PMC9019677
[6] Şerban RE, Stepan MD, Florescu DN, Boldeanu MV, Florescu MM, Şerbănescu MS, Ionescu M, Streba L, Drăgoescu NAM, Christopher P, Obleagă VC, Constantin C, Vere CC. Expression of calcitonin gene-related peptide and calcitonin receptor-like receptor in colorectal adenocarcinoma. Int J Mol Sci, 2024, 25(8): 4461. https://doi.org/10.3390/ijms25084461 PMID: 38674047 PMCID: PMC11050384
[7] Şerban RE, Boldeanu MV, Florescu DN, Ionescu M, Şerbănescu MS, Boldeanu L, Florescu MM, Stepan MD, Obleagă VC, Constantin C, Popescu DM, Streba CT, Vere CC. Comparison between substance P and calcitonin gene-related peptide and their receptors in colorectal adenocarcinoma. J Clin Med, 2024, 13(18):5616. https://doi.org/10.3390/jcm13185616 PMID: 39337103 PMCID: PMC11432560
[8] Kaminski MF, Thomas-Gibson S, Bugajski M, Bretthauer M, Rees CJ, Dekker E, Hoff G, Jover R, Suchanek S, Ferlitsch M, Anderson J, Roesch T, Hultcranz R, Racz I, Kuipers EJ, Garborg K, East JE, Rupinski M, Seip B, Bennett C, Senore C, Minozzi S, Bisschops R, Domagk D, Valori R, Spada C, Hassan C, Dinis-Ribeiro M, Rutter MD. Performance measures for lower gastrointestinal endoscopy: a European Society of Gastrointestinal Endoscopy (ESGE) Quality Improvement Initiative. Endoscopy, 2017, 49(4):378–397. https://doi.org/10.1055/s-0043-103411 PMID: 28268235
[9] Rex DK, Schoenfeld PS, Cohen J, Pike IM, Adler DG, Fennerty MB, Lieb JG 2nd, Park WG, Rizk MK, Sawhney MS, Shaheen NJ, Wani S, Weinberg DS. Quality indicators for colonoscopy. Gastrointest Endosc, 2015, 81(1):31–53. https://doi.org/10.1016/j.gie.2014.07.058 PMID: 25480100
[10] 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. https://doi.org/10.1586/17474124.2015.1001744 PMID: 25582839
[11] Meral M, Bengi G, Kayahan H, Akarsu M, Soytürk M, Topalak Ö, Akpinar H, Sağol Ö. Is ileocecal valve intubation essential for routine colonoscopic examination? Eur J Gastroenterol Hepatol, 2018, 30(4):432–437. https://doi.org/10.1097/MEG.0000000000001065 PMID: 29334518
[12] Shu S, Zhang C, Liu L, Shan J, Xiang T, Shu T, Sun X. Terminal ileal intubation is not necessary in routine colonoscopy: data from a large-scale retrospective study. BMC Gastroenterol, 2024, 24(1):432. https://doi.org/10.1186/s12876-024-03521-3 PMID: 39592930 PMCID: PMC11600910
[13] Kim DS, Ryu JE, Shin J, Koo HS, Lee S, Cho H, Na J, Huh KC. Diagnostic value of ileal lesions found during colonoscopy with reference to endoscopic indications and findings. J Clin Med, 2024, 13(4):1161. https://doi.org/10.3390/jcm13041161 PMID: 38398473 PMCID: PMC10889396
[14] Alkhalidi N, Alrubaie A, Rezqallah RE, Kenber M. The value of terminal ileum intubation during colonoscopy. J Coloproctol, 2022, 42(1):59–62. https://doi.org/10.1055/s-0041-1739298
[15] Hoeck S, Tran TN. Insights into personal perceptions and experiences of colonoscopy after positive FIT in the Flemish Colorectal Cancer Screening Program. Gastrointest Disord, 2024, 6(1):49–63. https://doi.org/10.3390/gidisord6010004
[16] 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. https://doi.org/10.5152/UCD.2015.2756 PMID: 26504419 PMCID: PMC4605111
[17] 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 PMCID: PMC3129055
[18] Alkhatib AA, Kumar S. Clinical yield of ileal intubation during screening colonoscopy. Cureus, 2022, 14(1):e20870. https://doi.org/10.7759/cureus.20870 PMID: 35145777 PMCID: PMC8803374
[19] Dąbkowski K, Tryba M, Biesiada E, Konczanin K, Michalak M, Szczygłowska M, Safranow K, Starzyńska T. Endoscopic assessment of terminal ileum in screening colonoscopy: is it worth the effort? Clin Endosc, 2025, 58(5):731–737. https://doi.org/10.5946/ce.2025.018 PMID: 40675791 PMCID: PMC12489557
[20] 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. https://doi.org/10.1111/j.1365-2036.2005.02632.x PMID: 16167974
[21] Kim JH, Lee JY, Park YE, Lee JH, Park J, Kim TO, Moon W, Park SJ; Busan Ulsan Gyeongnam Intestinal Study Group Society (BIGS). Clinical course of terminal ileal ulcers observed incidentally during colonoscopy. Dig Dis Sci, 2021, 66(12): 4423–4428. https://doi.org/10.1007/s10620-020-06781-7 PMID: 33723699
[22] Zwas FR, Bonheim NA, Berken CA, Gray S. Diagnostic yield of routine ileoscopy. Am J Gastroenterol, 1995, 90(9):1441–1443. PMID: 7661166
[23] 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. https://doi.org/10.1007/s00464-008-9843-x PMID: 18347860
[24] Kerrison RS, Travis E, Dobson C, Whitaker KL, Rees CJ, Duffy SW, von Wagner C. Barriers and facilitators to colonoscopy following fecal immunochemical test screening for colorectal cancer: a key informant interview study. Patient Educ Couns, 2022, 105(6): 1652–1662. https://doi.org/10.1016/j.pec.2021.09.022 PMID: 34607734 PMCID: PMC9214549
[25] Bertels L, Lucassen P, van Asselt K, Dekker E, van Weert H, Knottnerus B. Motives for non-adherence to colonoscopy advice after a positive colorectal cancer screening test result: a qualitative study. Scand J Prim Health Care, 2020, 38(4):487–498. https://doi.org/10.1080/02813432.2020.1844391 PMID: 33185121 PMCID: PMC7781896
[26] Abu Baker F, Mari A, Aamarney K, Hakeem AR, Ovadia B, Kopelman Y. Propofol sedation in colonoscopy: from satisfied patients to improved quality indicators. Clin Exp Gastroenterol, 2019, 12:105–110. https://doi.org/10.2147/CEG.S186393 PMID: 30881077 PMCID: PMC6396664
[27] Keswani RN, Crockett SD, Calderwood AH. AGA clinical practice update on strategies to improve quality of screening and surveillance colonoscopy: expert review. Gastroenterology, 2021, 161(2):701–711. https://doi.org/10.1053/j.gastro.2021.05.041 PMID: 34334168
[28] Dinçer B, Ömeroğlu S. Contributions and outcomes of terminal ileum intubation in a surgical endoscopy unit: retrospective cohort study. Laparosc Endosc Surg Sci, 2024, 31(3):123–126. https://doi.org/10.14744/less.2024.57442

Corresponding author
Alexandra-Georgiana Bocioagă, Teaching Assistant, MD, PhD Student, Department of Biochemistry, University of Medicine and Pharmacy of Craiova, 2 Petru Rareş Street, 200349 Craiova, Dolj County, Romania; Phone +40760–416 165, e-mail: alexandra.bocioaga@umfcv.ro

Received: May 22, 2026 *Accepted: August 30, 2026*