

Original Article**New interpretation for diagnostic yield of ileoscopy:  
a prospective study and a brief review**

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**Abstract**

**BACKGROUND:** Lower digestive endoscopy is mostly limited to the cecum without any attempt to penetrate the ileum. One of the probable reasons is the expectation of a low diagnostic yield. This study aimed to examine the feasibility of ileoscopy during colonoscopy and its diagnostic yield.

**METHODS:** We prospectively studied 128 consecutive patients, who were referred to Poursina Hakim Research Institute for lower GI disorders evaluation over a four months period, from March to July 2003. We tried to do total colonoscopy and ileal intubation with special attention to the timing and success rate of colonoscopy in each landmark.

**RESULTS:** Out of 128 subjects, successful examination of cecum was done in 120 (93.6%). Out of 120 patients whose cecum was reached and studied, we intended to perform ileal intubation in 99 patients. Successful terminal ileal (TI) intubation was accomplished in 93(93.9 %) of the examinations. Abnormal findings were seen in 4 cases. Normal ileal findings were also helpful in ruling out TI pathology in 78 other patients with abdominal pain, weight loss, lower GI bleeding or colonic inflammation, which made ileoscopy clinically valuable in 82 of 95 normal ileal examinations (86.3%) in this study.

**CONCLUSIONS:** Ileoscopy is safe, fast and feasible, so we recommend it in all symptomatic cases since normal findings are also valuable in patients' clinical management. Considering normal findings, the routine ileoscopy had surprisingly higher diagnostic yield compared to the results of previous studies.

**KEYWORDS:** Ileal Intubation, Ileoscopy, Colonoscopy, Technique, Diagnostic Yield.

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Since the first report of successful intubation of the ileum,<sup>1</sup> there have been several descriptions of the technical aspects, success rate, diagnostic yield and utility of ileoscopy for inspection and for obtaining tissue samples in diseases involving the terminal ileum (TI).<sup>2-35</sup>

Intubation of the TI during colonoscopy is a technically demanding skill. Ileoscopy may aid in the diagnosis and staging of gastrointestinal disorders. This may change patient management and improve patient care.<sup>2</sup> However, lower digestive endoscopy is often limited to

the cecum without any attempt at penetrating the ileum<sup>3-5</sup> and it is not always taught to trainees. The probable reasons are perceived difficulty of ileal intubation, time constraints, and the expectation of a low diagnostic yield. This study aimed to examine the feasibility and diagnostic yield of ileoscopy at colonoscopy.

**Methods**

We prospectively studied 128 consecutive patients who were referred to Poursina Hakim Research Institute for lower gastrointestinal disorders evaluation over a four months pe-

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riod, from March to July 2003. All adult patients (> 18 y) referred during this period were included in the study. Patients on whom total colonoscopy and ileoscopy were not possible (due to obstruction by tumor or being high risk for perforation as in severe colitis) were excluded.

Ileoscopy was attempted with special attention to the timing and success rate of colonoscopy with respect to each landmark (rectum, sigmoid, splenic flexure, hepatic flexure, cecum and ileum). All procedures were performed by one experienced colonoscopist using Pentax EM 3300 processor and EC 3840 video-colonoscopy. After obtaining informed consent, bowel preparation was done by 36 hours of liquid diet plus two bags of the clean prep powder, each one dissolved in one liter of water and drunk by patients 16 hours and 8 hours before colonoscopy.

Two Bisacodyl tablets were taken TDS, starting 36 hours before the procedure.

Twenty five to 50 mg Pethidine hydrochloride (GERTO PHARMAZEUTIKA VIENNA, AUSTRIA) plus 1-3 mg Midazolam [(HYPNOZOL) DAROUPAKHSH, IRAN] were used as sedation in all cases. Colonoscopy was initiated on left lateral position and was done after a digital rectal examination (DRE). In each case, the total time was automatically recorded by the instrument but the divided time of reaching each landmark was recorded by an independent observer.

The cecum was identified by standard anatomical landmarks (the ileocecal valve, Mercedes Benz sign and the appendiceal orifice sign) and once identified, the time taken to pass successfully from the cecum into the ileum was recorded in seconds. Ileocecal valve was intubated by our modified method described previously.<sup>6</sup> Ileal intubation was not decided in 21 patients because of either poor general condition, having the diagnosis of colon cancer or colon cancer screening being the only reason for total colonoscopy. The position of the patient during ileoscopy was recorded. In this study, no pharmacological medication

(such as Hyoscine-n-butyl bromide) was used to make ileoscopy easier.

## Results

In this study, 128 adult patients were included. The mean age was 63 years (Standard deviation = 8.36) and 73 patients (57%) were women. We tried our best to do total colonoscopy; Successful examination was done in rectum in all 128 cases (100%); sigmoid in 127 cases (99.2%); splenic flexure in 125 cases (97.6%); hepatic flexure in 124 cases (96.8%); and cecum in 120 cases (93.6%). Out of 120 patients whose cecum was reached and studied, we intended to do ileal intubation in 99 patients.

Successful TI intubation was accomplished in 93 out of 99 of examinations (93.9%). Abnormal findings were seen in 4 cases (One case of Crohn's ileitis with a completely normal colonoscopy but severe ileal involvement, and also a case of lymphoma with normal colon and two cases of backwash ileitis)

Normal ileal findings were also helpful in ruling out TI pathology in 78 other patients with abdominal pain, weight loss, lower GI bleeding or colonic inflammation, which made ileoscopy clinically valuable in 82 of 95 normal ileal examinations (86.3 percent) in this study.

The average time of colonoscopies was about 33 min (minimum 5 min and maximum 82 min), and the average time from cecum to TI was about 2 min with a range of 2-664 seconds (2 sec to 11 min and 4 seconds). The reasons for unsuccessful access to the cecum were: 3 patients with left sided and one with right sided tumor block; two patients with severe colitis making total colonoscopy dangerous and two cases due to loop formation.

## Discussion

It is shown that ileoscopy has high diagnostic yield when applied to specific clinical conditions, such as inflammatory bowel disease,<sup>7</sup> HIV seropositivity,<sup>3</sup> tuberculosis,<sup>8</sup> seronegative spondyloarthropathy<sup>9</sup> and chronic non bloody diarrhea.<sup>10,11</sup> It is also useful in diagnosis of lymphoma,<sup>12,13</sup> cytomegalovirus ileitis,<sup>14</sup>

intestinal stricture<sup>15</sup> and reactive arthritis,<sup>16</sup> as well as in ileal ulcerations due to typhoid fever<sup>17</sup> and in patients with hematochezia.<sup>18</sup> The highest yield reported is as high as 67% in those with HIV and diarrhea.<sup>3</sup> However, in asymptomatic patients or patients with cancer or polyps, ileoscopy appears to have a low yield.<sup>19,20</sup> The diagnostic yield of routine ileoscopy on unselected colonoscopies is controversial. Most prospective studies reported high diagnostic yield,<sup>3,10,11,19-23</sup> but other big retrospective studies showed that it should only be attempted when there is a clinical suspicion of ileal disease (Table 1).<sup>5,18,24</sup>

In our study, pathologic findings were 4.3% (4 out of 93), similar to other studies in unselected population (Table 2). Useful diagnostic information was gained by demonstration of Crohn's disease in one subject with a completely normal colonoscopy but severe ileal involvement, and also in a case of lymphoma with normal colon and in two cases of colitis with backwash ileitis. Normal ileal finding was also helpful in ruling out TI pathology in patients with abdominal pain, weight loss, lower GI bleeding or colonic inflammation, because in these patients the colonoscopy findings were inconclusive or extension of colonic lesion into the ileum where expected (78/93, 83.8%). Therefore, ileoscopy was clinically valuable in 82 of 93 ileal examinations in this study. It means that ileoscopy is necessary to conclude whether or not such a symptom is related to an organic lower gastrointestinal disorder. In other words, negative findings are as important as the positive findings to make an objective decision for the next step of management in a patient with the above mentioned symptoms. This point has not been noted in previous studies and suggests that although positive finding in unselected patient may be low, normal findings are very helpful in clinical decision making as well. It seems that from this point of view, ileoscopic diagnostic yield is not only high, but is more than what it has been previously suggested.

Documentation of colonoscopy completion is very important. Some studies showed that

failure to detect cancer in screening colonoscopy may be due to incomplete procedure.<sup>25, 26</sup> It has been also shown that ileoscopy is very helpful to prove completion of colonoscopy.<sup>12,22</sup>

These two important benefits (diagnostic yield and documentation of complete colonoscopy) make routine ileoscopy a logic extension of colonoscopy. The techniques for ileal intubation are previously described.<sup>27,28</sup> Chen and Khanduja described a simple method to facilitate ileoscopy. Briefly, the ileocecal valve (ICV) is identified and positioned inferiorly (6 o'clock position) by manipulating the colonoscope. The tip of the instrument is then advanced above and beyond the valve and slowly withdrawn with the tip flexed downward until the orifice of the TI is exposed; after that, the colonoscope is advanced forward to intubate the ileum.<sup>29</sup>

Other authors have suggested a similar technique with the valve in the 12 o'clock position.<sup>30</sup> Batres et al positioned ICV superiorly between 10 and 2 o'clock for pediatric colonoscopy. Also, they noted that over distention of the cecum might make the intubation more difficult. So it is important to minimize the air insufflations to relax the tension of the ileocecal valve.<sup>31</sup> Kessler et al suggested that short bending sections can negatively impact cecal insertion and TI intubation in pediatric colonoscopies.<sup>32</sup> Arora et al showed that ileoscopy rate was significantly lower in patients aged 80 years or older compared to younger patients (71.1% vs. 86.1%).<sup>33</sup> Another study showed that instillation of peppermint oil solution in the cecum helped to reduce required time for TI intubation during colonoscopy, but it did not affect the success rate of TI intubation.<sup>34</sup>

In general, four techniques are described for ileal intubation (for details see table II in the study of Ansari et al<sup>35</sup>). Different studies have shown different success rates for ileal intubation (71.1-100%).<sup>3,8,10,18,21,32-36</sup> However, no study compared success rates of the various techniques. Only Ansari et al, noted that positioning of the ICV around 6-7 o'clock and passage into the ileum by downward deflection

**Table 1.** Diagnostic yield of ileoscopy in previous studies.

Author, year	Time direction	Target population	Cases number	Diagnostic yield
Borsch G, et al. <b>1985</b>	Prospective	Unselected population	555	29.5 %
Kundrotas LW, et al. <b>1994</b>	Prospective	Unselected population	295	The terminal ileum was considered to be visually abnormal in 4 cases, but only 1 of these was abnormal in histologic examination
Zwas FR, et al. <b>1995</b>	Prospective	Unselected population	138	Positive diagnosis was 2.7% in asymptomatic patients, and 29% of patients complained of diarrhea (18% in non-HIV patients, 67% in HIV-positive patients)
Yusoff IF, et al. <b>2002</b>	Retrospective	Colonoscopies performed for diarrhea	1131	5%
Bhasin DK, et al. <b>2000</b>	Prospective	Unselected population	66	14.4%, after ileoscopy, the diagnosis was altered in 8.7% cases
Batres LA, et al. <b>2002</b>	Retrospective	Pediatric	84	Normal small bowel follow through examinations were seen in 65 patients of whom 20 had abnormal TI biopsies and 45 had normal TI biopsies
Ansari A, et al. <b>2003</b>	Prospective	Patients undergoing diagnostic colonoscopy	120	20.5%
Cherian S, et al. <b>2004</b>	Retrospective	Unselected population	2,537	The diagnostic yields of ileoscopy and ileal histology were 16.7% and 19% in patients with colonic inflammatory bowel disease respectively, and 2.69% and 7.4% in other patients.
Misra SP, et al. <b>2004</b>	Prospective	Patients with a clinical suspicion of colonic tuberculosis	50	8 %
Maroy B. <b>2005</b>	Prospective	Unselected population in community practice	510	1.5%
Harewood GC, et al. <b>2005</b>	Retrospective	Patients undergoing evaluation of either abdominal pain/bloating, anemia or diarrhea with normal endoscopic findings at colonoscopy	3858 of 21 638	0.4%
Yoong KKY, et al. <b>2006</b>	Retrospective	Unselected population	346 of 2149	4.6%
Iacopini G et al <b>2006</b>	Prospective	Unselected population	1344	(5.5%)

**Table 2.** Indications for colonoscopy.

Indication*	n
Abdominal pain	43
Constipation	45
Diarrhea	32
Gross and occult rectal bleeding	45
Anemia	7
Family history of colorectal cancer	4
Follow up of colon cancer	20
History of colon polyp	14
Follow up of IBD	6
Other	8

\* Some patients had more than one indication

**Table 3.** Duration of ileal intubation in previous studies

Author, year	Time
Cherian S, et al. 2004	2.5 v 1.5 minutes
Ansari A, et al. 2003	55 s
Bhasin DK, et al. 2000	3.3 +/- 2.5 minutes
Kessler WR, et al. 2005	A:33.2 ± 43.8 s- B:40.8 ± 70.8s
Kundrotas LW 1994	3.4 minutes; range = 30 s-10 minutes
Maroy B 2005	1.25 min (IC95% = 1.1-1.4) (min = 0.1, max = 11 min),

with anti-clockwise torque appears to be the most effective technique in practice.<sup>35</sup>

According to our experience, a more convenient method is to start by pull-back technique with ileocecal valve locating somewhere between 9-12 o'clock in most cases; although in a few cases one may need to use other techniques to reach the highest possible success rate for ileal intubation.<sup>6</sup>

Batres et al in a retrospective study of pediatric colonoscopies reported success rate of 21.5% for TI intubation from 1994 to 1996 and 65.6% during 1999 to 2000. They suggested that this dramatic improvement in the success rate of TI intubation could be the result of using new endoscopes that were smaller and more flexible with improved video images. Increased experience in performing pediatric colonoscopies and changes in the staff may have been also partly responsible for this im-

provement.<sup>31</sup> Furthermore, Iacopini et al study showed that ileoscopy can be difficult when the ileocecal valve is thin lipped or single bulged, and can be easy when it has a volcanic morphology.<sup>37</sup>

A large study in which 21638 patients underwent complete colonoscopy for evaluation of either abdominal pain/bloating, anemia or diarrhea with normal colon findings showed significant practice variation in the rates of TI evaluation and declining trends for TI intubation with advancing patient age. They showed that ileal intubation rates in academic centers are higher than community and veterans affairs medical centers. However, among those patients in whom intubation was intended, successful TI assessment was achieved in 94.1%; while in those patients in whom intubation was not intended, intubation was only performed in 6.9%.<sup>5</sup> Success rate in our study was about 94% which is among the highest success rates reported so far.

Time to insert the colonoscope and the total procedure time of colonoscopy are important for several reasons including patient scheduling, endoscopy room staffing, physician and technical reimbursement, sedation requirements, and risk of sedation-related complications. In a study, prolonged insertion time to cecum was associated with inadequate bowel cleansing, advanced age, and constipation as the indication for the procedure for cecal intubation.<sup>38</sup> No study evaluated factors affecting ileal intubation time. But, the time for ileal intubation is reported 11 minutes in difficult cases and the mean time for ileal intubation was 55s to 3.5 min (table 3).<sup>18, 21, 22, 32, 35, 36</sup>

## Conclusions

In conclusion ileoscopy is safe and fast with a high diagnostic yield, so we recommend it in all symptomatic cases since normal findings are also valuable in patients' clinical management. Considering the normal findings, the routine ileoscopy in symptomatic cases had surprisingly higher diagnostic yield compared to the results of previous studies.

## Conflict of Interest

Authors have no conflict of interests.

## Authors' Contribution

MHE did the design of study. He performed all colonoscopies and ileoscopies. He had direct observation on data gathering, writing article and its edition. ISB took part in data gathering and data analysis. He wrote the manuscript and he did its submission. HD had great contribution in design, case finding and final review. HDZ had contribution in design, case finding and final review. All authors have read and approved the content of the manuscript.

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