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Immediate Unprepped Hydroflush Colonoscopy for Severe Lower GI Bleeding: A Feasibility Study

Aparna Repaka, MD, Matthew R. Atkinson, MD, Ashley L. Faulx, MD, Gerard A. Isenberg, MD, MBA, Gregory S. Cooper, MD, Amitabh Chak, MD, and Richard C. K. Wong, MBBS
Division of Gastroenterology and Liver Disease, Digestive Health Institute, University Hospitals Case Medical Center and Case Western Reserve University, Cleveland, Ohio, USA

Abstract

Background—Urgent colonoscopy is not always the preferred initial intervention in severe lower GI bleeding due to the need for a large volume of oral bowel preparation, the time required for administering the preparation, and concern regarding adequate visualization.

Objective—To evaluate feasibility, safety, and outcomes of immediate unprepped hydroflush colonoscopy for severe lower gastrointestinal bleeding.

Design—Prospective feasibility study of immediate colonoscopy after tap-water enema without oral bowel preparation, aided by water jet pumps and mechanical suction devices in patients admitted to the intensive care unit with a primary diagnosis of severe lower gastrointestinal bleeding

Setting—Tertiary referral center

Main outcome measurements—Primary outcome measurement was the percentage of colonoscopies where the preparation permitted satisfactory evaluation of the entire length of the colon suspected to contain the source of bleeding. Secondary outcome measurements were visualization of a definite source of bleeding, length of hospital and ICU stays, re-bleeding rates, and transfusion requirements.

Results—Thirteen procedures were performed in 12 patients. Complete colonoscopy to the cecum was performed in 9/13 patients (69.2 %). However, endoscopic visualization was felt to be adequate to definitively or presumptively identify the source of bleeding in all procedures, with no colonoscopy repeated due to inadequate preparation. A definite source of bleeding was identified in 5/13 procedures (38.5%). Median length of ICU stay was 1.5 days and hospital stay was 4.3 days. Recurrent bleeding during the same hospitalization, requiring repeat endoscopy, surgery or angiotherapy was seen in 3/12 patients (25%).

Limitations—Uncontrolled feasibility study of selected patients.

Corresponding author and reprint requests: Richard C.K.Wong, MBBS. richard.wong@uhhospitals.org.

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Conclusion—Immediate unprepped hydroflush colonoscopy in patients with severe lower GI bleeding is feasible with the hydroflush technique.

Introduction

Acute lower gastrointestinal bleeding (LGIB) is traditionally defined as bleeding distal to the ligament of Treitz, that is of recent onset, and that may result in instability of vital signs, anemia, and/or the need for blood transfusion. LGIB accounts for up to one-quarter to one-third of all hospitalizations with gastrointestinal bleeding¹ and has an estimated mortality rate of 3.6%². The costs of managing LGIB are substantial. The estimated cost of diverticular bleeding alone, the most common source of LGIB, was \$1.3 billion dollars in the United States in 2001³. Severe acute LGIB is a relatively rare, but life-threatening condition, with an annual incidence of 20-30 per 100,000 persons². It is in this particular group of very high-risk patients that rapid diagnosis and potential therapy is most important as they are at high-risk for recurrent or continued bleeding, need for surgery, angiography, morbidity and mortality.

Urgent colonoscopy, variably defined as colonoscopy performed within 6-24 hours of admission in the setting of severe LGIB, is safe, and associated with lower rates of re-bleeding, need for surgery in patients with severe bleeding⁴, and a reduction in length of hospital stay^{5,6}, thereby decreasing cost of care as compared with emergency angiography and elective colonoscopy⁷. In studies utilizing urgent colonoscopy for management of LGIB, a definite source of bleeding was identified in 8-34%⁸⁻¹¹, with earlier endoscopy associated with significantly more diagnostic and therapeutic interventions¹⁰. However, urgent colonoscopy requires the rapid oral administration of a large volume (median 5.5L, range 4-14L) of a polyethylene glycol-based purgative solution over 3-4 hours, with NG tube placement required in upto 50% of patients^{4,9,12}. These factors are often barriers to timely colonoscopy. In clinical practice, angiography, which is diagnostic and potentially therapeutic, is often preferred over colonoscopy for patients with severe bleeding¹³, due to concern of inadequate endoscopic visualization during active bleeding, as well as time saved by avoiding oral bowel preparation. Furthermore, due to the delay between resuscitation and endoscopic intervention, bleeding often subsides spontaneously, and information such as definitive etiology and accurate localization of bleeding, which may be useful for further management are not obtained.

Unprepped colonoscopy could decrease time from resuscitation to procedure in patients with severe LGIB, but has not been widely studied or utilized due to concerns of poor visualization, increased complications, and lack of proven benefit. In patients with severe LGIB, the cathartic action of blood decreases residual stool volume, potentially eliminating the need for a large amount of oral purgative preparation. Moreover, the advent of endoscopic water-jet irrigators and mechanical suction devices has revolutionized the ease with which visualization can be improved during colonoscopy. The impact of this technology on the management of LGIB has not been well studied. We hypothesized that by utilizing this technology and with only tap-water enemas, adequate endoscopic visualization can be achieved in patients with severe LGIB, without the need for oral preparation. This approach could potentially decrease time to colonoscopy, improve diagnostic yield, patient

outcomes, and physician preference for colonoscopy over angiotherapy as a front-line intervention in patients with severe LGIB. We present the results of a prospective feasibility study of immediate unprepped hydroflush colonoscopy in patients presenting with severe LGIB.

Methods

This study was approved by the Institutional Review Board for Human Investigation at our institution, and fulfilled all criteria for clinical research as set forth in the Declaration of Helsinki¹⁴. All patients gave written informed consent. The study was designed as a prospective feasibility study of immediate colonoscopy after tap-water enema alone, without oral bowel preparation in patients admitted to the ICU with a primary diagnosis of severe acute LGIB. Informed consent was obtained from patients who agreed to participate in the study.

Hydroflush colonoscopy

All patients received standard resuscitative measures including administration of intravenous crystalloid fluids, blood and blood products, as needed. Patients on warfarin for anticoagulation had reversal with FFP, with goal INR of ≤ 1.5 . After adequate resuscitation, patients received three 1 liter tap-water enemas, which were administered sequentially, 20 minutes apart, by an ICU nurse, followed by immediate colonoscopy without oral bowel preparation. EGD was performed before colonoscopy if there was high clinical suspicion of upper GI bleeding, history of peptic ulcer disease, or history of previous upper GI bleeding.

The term “hydroflush technique” was coined to describe our colonoscopy technique using a combination of the standard colonoscope, a water-jet pump irrigation (EIP2 irrigation pump, ERBE-USA Marietta, GA) and a mechanical endoscope suction device (BioVac direct suction device, US Endoscopy, Mentor, OH) (Figure 1a-d. Large volumes of water were used to lavage the colon with the irrigation pump at the highest flow rates (500 ml/min). The Biovac suction device bypasses the endoscopic suction, and umbilical cord increasing the effective suction power delivered to the end of the endoscopes channel. This technique was used to perform additional cleansing of the colon during the procedure, and maximize the endoscopic visualization, in the absence of an oral preparation. Colonoscopy was performed by one of five study investigators (four attendings and one advanced endoscopy fellow) and an advanced endoscopy fellow.

Active bleeding was treated by injection of dilute epinephrine (1:10,000) followed by endoclip and/or thermal-contact therapy of underlying vessel. Nonbleeding stigmata of recent hemorrhage were treated by endoclip and/or thermal-contact devices (heat probe or multipolar electrocoagulation). All identified bleeding sites were endoscopically tattooed with a sterile suspension of carbon particles (Spot, GI Supply, Camp Hill, PA).

Inclusion and Exclusion Criteria

Inclusion Criteria: Patients were included if they met both the following criteria a. Bloody bowel movement within the past 24 hours. b. Admission to the intensive care unit. They had to meet one of the following criteria. a. Blood transfusion of 2 units. b. Hematocrit decrease > 8% hematocrit from baseline. Finally patients' met one of the following criteria: a. History of syncope or pre-syncope b. Orthostatic vital signs (drop in systolic blood pressure of 20 mmHg or increase in pulse of 20 beats/minute from lying to standing) c. Resting pulse > 110 beats/minute. d. Systolic blood pressure < 100 mmHg Exclusion Criteria: Secondary gastrointestinal hemorrhage (bleeding that occurs in a patient hospitalized for another reason). b. Alternative source of hemodynamic instability (e.g., septic shock, cardiogenic shock). c. Clinical features making colonoscopy unsafe (e.g., suspected perforation or peritonitis, acute myocardial infarction, hypotension refractory to fluid resuscitation, or coagulopathy refractory to correction). d. Age under 18 years. e. Pregnancy

Definitions

Severe acute LGIB was defined as hematochezia requiring admission to the ICU with both hemodynamic instability and decrease in hematocrit. Re-bleeding was defined as maroon or red blood per rectum after a 24-hour period of no observed bleeding associated with a 5% drop in hematocrit or recurrence of hemodynamic instability. A definite source of bleeding was defined as a lesion with active bleeding, stigmata of recent bleeding such as non-bleeding visible vessel, adherent clot, or discrete lesions such tumor, colitis, angioectasia or ulcer. The finding of diverticulosis alone, without active bleeding and without stigmata of recent hemorrhage, and with no other source of bleeding in the colon, was considered a presumptive etiology of LGIB.

Data Collection

Demographic characteristics including age, gender, race, history of previous LGIB, non-steroidal anti-inflammatory and/or aspirin use, number of comorbidities, and anti-platelet and/or anti-coagulation use were obtained. Blood pressure, heart rate, hematocrit, platelets, and INR at admission were also recorded. Procedure characteristics documented were time from ICU admission to the procedure, duration of procedure (insertion, withdrawal, and total), endoscopic findings, endoscopic therapy, and immediate complications as recorded by the endoscopist. Hospitalization characteristics that were recorded included: length of hospital stay, length of ICU stay, whether or not cessation of bleeding was achieved, whether or not re-bleeding occurred after cessation of the index bleeding event, blood transfusion requirements, mortality, and need for further intervention after colonoscopy (surgery or angiography). For patients with re-bleeding, data on timing of re-bleeding, transfusion-requirements, and need for repeat diagnostic or therapeutic procedures were recorded.

Information pertaining to re-bleeding, readmission to the hospital with bleeding or other diagnoses, transfusions since discharge, and complications related to colonoscopy was obtained at 7 and 30 day follow-up which was performed through chart review and telephone questionnaire. In addition, on day 7, the patients were asked to report their

preference for 4-6 liters of an oral laxative solution or the 3 tap-water enemas if a repeat procedure was warranted.

Outcome Measurements

Primary outcome measurement was the percentage of colonoscopies where the preparation permitted satisfactory evaluation of the length of the colon suspected to contain the source of bleeding. Secondary outcome measurements were diagnostic yield, including the visualization of a definite source of bleeding, length of hospital and ICU stays, re-bleeding rates, transfusion requirements, and patient satisfaction.

Results

Between April 2010 and May 2011, 12 patients with severe acute LGIB who were admitted to the ICU were enrolled in the study. A total of 13 unprepped hydroflush colonoscopies were performed, with one patient requiring a second colonoscopy for re-bleeding. All of the patients enrolled in the study tolerated the tap water enemas. Median patient age was 75 years (range 52-84 years). Women comprised 75% of the enrolled patient population, and 83.3% patients were African American. Average number of comorbidities was 5.33. Thirty-three percent (4/12) patients had a prior history of LGIB. Two out of the twelve patients (16.7%) were chronically anticoagulated with warfarin, 8/12 patients (66.7%) were on aspirin or NSAIDS, and one patient was on both aspirin and clopidogrel. Mean of the lowest hematocrit during hospitalization was 24%, with an average drop in hematocrit of 11.1% (range 6-17.2%).

Median time from ICU admission to colonoscopy was 7.6 hrs (range 1.6-18 hrs). Median time from hospitalization to colonoscopy was 8 hrs (range 6-20 hrs). Average duration of colonoscopy was 38.7 minutes, with an average of 11.1 minutes for insertion. A definite source of bleeding was identified in 5/13 procedures (38.5%) with diverticular bleeding being the presumed etiology in the rest. Four of the five patients (80%) with active bleeding or stigmata of recent bleeding had successful endoscopic hemostasis and one patient required additional angiotherapy. Of the 5 cases where a definite source of bleeding was seen, two patients had rectal ulcers, two had diverticular bleeds, and one had acute diverticulitis (Figures 2a-b, 3a-b). Endoscopic visualization was adequate to definitively or presumptively identify the source of bleeding in all procedures, with no colonoscopy repeated due to inadequate visualization. Colonoscopy was performed to the cecum in 9/13 patients (69.2%). Of the 4 patients who had an incomplete colonoscopy, a definite source of bleeding was identified in 3 patients. The fourth patient had a presumptive source (rectal ulcer without stigmata). The primary purpose of these procedures was for management of GI bleeding, and not to screen or survey for colorectal neoplasia. Hence, none of the incomplete colonoscopies were repeated. No procedure-related complications occurred (Table 1).

Cessation of bleeding, either spontaneous, or with endoscopic therapy was seen in 9/12 patients (75%). Recurrent bleeding during the same hospitalization, requiring repeat endoscopy, angiotherapy or surgery was seen in 3/12 patients (25%). One patient was managed with repeat endoscopy, one with angiotherapy, and one required both angiotherapy and surgery. Median length of ICU stay was 1.5 days (36.5 hours, range 3-163 hours) and

hospital stay was 4.3 days (103 hours, range 40-330 hours). Average transfusion requirement was 6.7 units of packed red blood cells (range 2-20 units). Five patients (41.7%) required less than 5 units, another 5 patients (41.7%) required 5-10 units, and 2 patients (16.7%) required >10 units of transfusion. None of the patients experienced re-bleeding within 7 days of discharge.

At 30 days from hospital discharge, one patient died of unrelated causes, one patient was lost to follow-up, and none of the others experienced recurrence of bleeding (Table 2). All the patients interviewed at 7 days expressed a preference for tap-water enemas over a rapid oral bowel purge.

Discussion

Urgent colonoscopy improves diagnostic yield^{4, 9, 10, 15}, reduces length of hospital stay^{5, 6} and possibly decreases cost of care⁷. Outcomes such as rates of re-bleeding and need for surgery were shown to be improved in a prospective study with a historical control arm,⁴ but not reproduced in subsequent randomized control studies^{9, 11}. Overall, the benefits of urgent colonoscopy for severe lower GI bleeding are not as well proven as urgent upper endoscopy for upper GI bleeding. In routine clinical practice, angiography is often preferred over colonoscopy in these patients¹³, probably due to concern of inadequate endoscopic visualization and time saved by avoiding oral bowel preparation. This study demonstrates the feasibility of urgent unprepped colonoscopy in patients with severe LGIB, admitted to the ICU, using the hydroflush technique. Our study uniquely shows the impact of recently introduced endoscopic technology such as power water jet irrigation pumps and mechanical suction devices in the management of lower GI bleeding. Thirteen procedures were performed successfully with none repeated due to inadequate endoscopic visualization of source of bleeding. The average time to maximal insertion point and time for complete procedure were relatively short, at 11.1 and 38.7 minutes, respectively, even with the use of adjunctive technologies such as water-jet irrigation pumps and mechanical suction devices. Our sample size accrued over a year was small as hemodynamically significant severe acute LGIB, requiring ICU admission is a relatively rare etiology. In addition, not every endoscopist at our institution participated in the study; only 5 designated study investigators performed the colonoscopy, which did limit enrollment of some patients.

Cecal intubation was achieved in 69% (9/13) of the procedures. In the remainder (4/13), the presence of stool hindered completion of colonoscopy, but the cathartic action of the blood along with the enemas permitted advancement of the scope, visualization through the length of the colon containing the source of bleeding as well as the colon distal to it. This was more often the case when the bleeding source was in the left colon (Figure 3a, b). A definite source of bleeding was identified in 3 of the above patients, and a presumptive source (rectal ulcer without stigmata) in one patient. The incomplete colonoscopy and presence of stool obscuring the proximal colon did not interfere with clinical management. In fact, it proved to be an advantage as this type of distinction of the site of bleeding is not possible after oral bowel preparation. This approach could be useful to help localize the particular segment of colon that is bleeding in patients with diverticular hemorrhage and pan-diverticulosis, and to assist surgeons in making decisions regarding whether to perform partial (segmental)

colectomy or subtotal colectomy, if surgery is needed. As opposed to conventional colonoscopy, where reaching the cecum would be the expectation, in this study, the intent was to identify and treat the etiology of bleeding. Once the bleeding site had been identified, the endoscopist was not required to advance the endoscope any further. Hence none of the incomplete colonoscopies were repeated. By avoiding rapid, large volume oral bowel preparation, nasogastric tube placement, and reducing the time between resuscitation and intervention, this approach would remove barriers to colonoscopy and could become the preferred initial method for management of severe, acute LGIB for patients in the ICU. Not surprisingly, the vast majority of the patients in our study expressed a strong preference for undergoing colonoscopy without an oral bowel preparation.

A diagnosis of the etiology of bleeding (definite and presumptive sources) was made in 100% of patients in this study. A definite source of bleeding, defined as active bleeding or stigmata of recent bleeding, was identified in nearly 39%. Diagnostic yield, definite and presumptive sources of bleeding are variably defined in recent studies, making it difficult to draw comparisons. A more objective measure may be the percentage of patients who underwent endoscopic therapy, which, in this study is about 39%. The above measurements are higher than those seen in recent studies using the urgent colonoscopy approach with rapid purge^{4, 8-11, 16}, though our study involved only a small number of selected patients. Rate of early re-bleeding in this study was 25%, which is comparable to recent randomized controlled trials^{9, 11}. All cases of re-bleeding occurred in patients where a definite source of bleeding was not identified at initial colonoscopy, which may indicate the importance of identifying and treating the source of LGIB. There were no procedure related complications or deaths, demonstrating the safety of this approach.

Urgent colonoscopy is usually performed within 24-48 hours of admission, and time to procedure in recent studies has varied between 7.2 hours to 25 hours of admission. The average time to procedure from ICU admission in this study was 7.6 hours, with a range of 1.6-18 hours. In most cases, we were able to perform the procedure within 2 hours after patients were resuscitated, and in one case, performed within two hours of ICU admission. The wide variability in time to procedure not only represented times required for resuscitating patients and optimizing comorbidities, but also represented logistical and systematic barriers. We did see room for improvement in this approach. Greater involvement of emergency room physicians and ICU physicians in this care path could reduce time to GI consultation, and decrease the time to colonoscopy. Seven patients (58.3%) required over 5 units of blood transfusion, reflecting the severity of bleeding in this patient population. The lack of a control arm and small patient numbers makes it difficult to draw conclusions regarding the effect of this approach on transfusion requirements as well as overall hospitalization and ICU stays.

In conclusion, immediate unprepped hydroflush colonoscopy is feasible in the initial management of patients presenting with severe, acute lower GI bleeding who are admitted to the ICU. With the use of endoscopic water-jet irrigators and mechanical suction devices, immediate colonoscopy can be done after tap-water enema administration completely avoiding oral bowel preparation in this group of patients. This approach may reduce time to procedure, improve diagnostic yield, enhance ability to localize the site of bleeding, and

increase the rate of endoscopic therapy for severe LGIB. Larger, prospective controlled studies are necessary to measure change in outcomes such as length of hospitalization, transfusion requirements, and re-bleeding rates. This approach may also improve physician and patient preference for colonoscopy as the initial intervention in patients admitted to the ICU with severe acute lower GI bleeding.

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Acronyms

LGIB	lower gastrointestinal bleeding
EGD	Esophago-gastro duodenoscopy
ICU	Intensive Care Unit
NSAIDS	Nonsteroidal anti-inflammatory drugs

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Figure 1a.
Accessory mechanical suction device, with a Y-port adaptor and pinch clamp, suction valve, and biopsy valve.

Figure 1b.
Suction devices' biopsy valve and suction valve attached to the endoscope.

Figure 1c.

Y-port extension tubing, with orange tag attached to endoscopes suction barb, with other end connected to tubing from a suction canister (not shown). Also seen is extension tubing from water pump.

Figure 1d.
Water jet pump.

Figure 2a.
Actively bleeding rectal ulcer, pre-treatment

Figure 2b.
Bleeding rectal ulcer after treatment with endoclips

Figure 3a.
Demarcation zone between brown stool (proximally) and blood adherent to mucosa (distally) in the descending colon

Figure 3b.
Actively bleeding diverticulum in sigmoid colon

Table 1**Procedural outcomes (n=13)**

Procedure time (mean)(mins)		
	Insertion	11.1
	Total	38.7
Cecal Intubation (%)		69.2(9/13)
Definite bleeding source (%)		38.5(5/13)
Successful hemostasis (%)		80(4/5)
Etiology (n)		
	Diverticular	9
	Rectal ulcer	3
	Diverticulitis	1
Complications (%)		0
Preparation satisfactory for evaluation of bleeding site (%)		100
Repeat colonoscopy recommended (%)		0

Table 2

Hospitalization characteristics

Time to procedure (median)(hrs)	
From ICU admission	7.6
Hospital Stay (median)(days)	4.3
ICU Stay (median)(days)	1.5
Cessation of bleeding (%)	75(9/12)
Rate of re-bleeding (%)	25(3/12)
Need for repeat endoscopy(%)	8.3(1/12)
Need for Surgery (%)	8.3(1/12)
Need for Angiography (%)	16.7(2/12)
PRBC Transfusion units (mean)	6.7