Nasogastric Aspiration and Lavage in Emergency Department Patients with Hematochezia or Melena Without Hematemesis

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Abstract

Objectives: The utility of nasogastric aspiration and lavage in the emergency management of patients with melena or hematochezia without hematemesis is controversial. This evidence-based emergency medicine review evaluates the following question: does nasogastric aspiration and lavage in patients with melena or hematochezia and no hematemesis differentiate an upper from lower source of gastrointestinal (GI) bleeding?

Methods: MEDLINE, EMBASE, the Cochrane Library, and other databases were searched. Studies were selected for inclusion in the review if the authors had performed nasogastric aspiration (with or without lavage) in all patients with hematochezia or melena and performed esophagogastroduodenal endoscopy (EGD) in all patients. Studies were excluded if they enrolled patients with history of esophageal varices or included patients with hematemesis or coffee ground emesis (unless the data for patients without hematemesis or coffee ground emesis could be separated out). The outcome was identifying upper GI hemorrhage (active bleeding or high-risk lesions potentially responsible for hemorrhage) and the rate of complications associated with the nasogastric tube insertion. Quality of the included studies was assessed using standard criteria for diagnostic accuracy studies.

Results: Three retrospective studies met our inclusion and exclusion criteria. The prevalence of an upper GI source for patients with melena or hematochezia without hematemesis was 32% to 74%. According to the included studies, the diagnostic performance of the nasogastric aspiration and lavage for predicting upper GI bleeding is poor. The sensitivity of this test ranged from 42% to 84%, the specificity from 54% to 91%, and negative likelihood ratios from 0.62 to 0.20. Only one study reported the rate complications associated with nasogastric aspiration and lavage (1.6%).

Conclusions: Nasogastric aspiration, with or without lavage, has a low sensitivity and poor negative likelihood ratio, which limits its utility in ruling out an upper GI source of bleeding in patients with melena or hematochezia without hematemesis.

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Key words: gastrointestinal hemorrhage, melena, hematochezia, nasogastric aspiration

CLINICAL SCENARIO

A 75-year-old African American male with the chief complaint of bright red blood per rectum is brought to your emergency department (ED) via ambulance. The paramedics state that they observed a toilet bowl filled with red blood without clots. The patient appeared to the paramedics in no acute distress, with initial vital signs of blood pressure (BP) 160/95 mm Hg, pulse rate (PR) 90 beats/min, and respiratory rate (RR) 18 breaths/min. At triage the patient is alert and oriented and appears in no acute distress. The blood appears mixed with stool during three episodes. The patient denies hematemesis or any associated abdominal pain. He denies previous episodes of similar bleeding and has no history of esophageal varices, chronic liver disease, gastritis, gastroesophageal reflux, gastric or duodenal ulcers, hemorrhoids, colonic diverticuli, or gastrointestinal (GI) cancers. He is not taking warfarin, aspirin, clopidogrel, heparin, or any other blood-thinning agent. He denies recent ingestion of steroids or

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nonsteroidal anti-inflammatory drugs. He does not smoke, drink alcohol, or take illicit drugs. Medical history is positive only for hypertension.

The patient is placed in a monitored bed, two large-bore intravenous lines are started, and blood work is sent for serum lactate level, complete blood count, routine chemistry panel, coagulation profile, and type and screen. Physical examination discloses a healthy elder gentleman in no acute distress. Vital signs include temperature 98.6°F, BP 158/95 mm Hg, PR 90 beats/min, RR 18 breaths/min, and room air oxygen saturation 100%. No orthostatic BP or pulse changes are noted. Physical examination is unremarkable. The digital rectal examination has maroon-color stool and is grossly guaiac positive. No hemorrhoids, masses, or fistulae are noted. Initial hemoglobin and hematocrit are 12 g/dL and 34%, respectively. Serum lactate level is 2.5 mmol/L.

You request consultation with gastroenterology and surgery. The surgical resident requests a nasogastric tube to be placed for lavage, as ''I need to know if the source of bleeding is upper or lower.'' In addition, ''if an upper GI bleed is found, a lavage will tell me the extent of bleeding.'' After a single unsuccessful attempt to place the nasogastric tube, the patient refuses subsequent attempts. He states, ''That was barbaric. Don't come near me again with that tube!'' After your shift, discontent with imposing discomfort to your patient by trying to insert the nasogastric tube, you decide to examine the evidence behind using nasogastric aspiration and lavage in patients with melena or hematochezia without hematemesis.

INTRODUCTION

Since the first reported insertion of a nasogastric tube by Hunter in 1790 to feed a paralyzed patient,[1] its use has become routine, including an ever-expanding role in both therapeutic and diagnostic procedures. The consultant's suggestion to insert a nasogastric tube in the presented case is not an unusual request for localizing the source of GI bleeding (upper vs. lower).[2–4] The argument supporting this practice is to direct further diagnosis or treatment strategy (e.g., choice of upper or lower endoscopy, starting proton pump inhibitors). Some investigators have also suggested that the ability to clear the bloody or ''coffee ground'' aspirate with lavage might have prognostic value.[5] On the other hand, others have argued that in common practice, the majority of the patients with melena or hematochezia without hematemesis undergo both upper and lower endoscopy anyway, irrespective of the findings of nasogastric lavage.

Our patient voices valid concerns about the pain associated with nasogastric tube insertion. This procedure has been described by patients as one of the most painful of routine ED procedures.[6] The use of preprocedural nebulized lidocaine[7,8] has only been somewhat successful at alleviating the pain of nasogastric tube insertion. Complications with this procedure, although rare, include epistaxis, pneumothorax, hydrothorax, empyema, mediastinitis, pneumonia, esophageal perforation, and vocal cord paralysis.[9–11]

For an uncomfortable and painful procedure to be used routinely by emergency physicians the procedure must yield diagnostic or therapeutic benefits, and the advantages should outweigh the risks and complications. Our objective was to answer the following research question through an evidence-based literature review: in patients with hematochezia or melena without hematemesis, does nasogastric aspiration and lavage differentiate an upper from lower source of GI bleeding sufficiently to justify its routine use?

METHODS

Criteria

To answer the question posed by the clinical scenario, our formulated question is as follows: what is the utility of nasogastric aspiration and lavage in identifying upper GI sources of bleeding in ED patients with hematochezia/melena without hematemesis?

For the purpose of this review, we translated our research questions into a set of predefined selection criteria for relevant studies. In defining the target population, we intended to study ED patients with melena (black tarry stool) or hematochezia (bloody or maroon-colored stool), without hematemesis (vomiting bright red blood or coffee ground material).

We chose nasogastric aspiration (with or without a lavage) as the intervention. The nasogastric tube is a stomach tube placed through the nose and aspirated for blood, followed by slow lavage of room temperature water or saline. Diagnostic value of this intervention or test mostly relies on visualization of gross blood or coffee ground aspirate (to rule in the upper GI bleeding) or visualization of bile (to rule out upper GI bleeding). Upper GI bleeding refers to hemorrhage originating proximal to the ligament of Treitz. Inability to clear the stomach contents after determining the upper GI bleeding as the source of melena or hematochezia is generally interpreted as evidence of continuous bleeding.

The primary outcome was the operating characteristics (sensitivity, specificity, predictive values, and likelihood ratios) of nasogastric aspiration and lavage for identifying an upper GI source for the hemorrhage. The secondary outcome was the rate of complications associated with the procedure, including hemorrhage, aspiration, esophageal perforation, hemo- or pneumothorax, etc.

We considered esophagogastroduodenal endoscopy (EGD) as the reference standard test for identifying the source of bleeding. EGD can either visualize active bleeding or identify high-risk lesions likely to be responsible for the bleeding (e.g., visible vessel in an ulcer, a mass, a clot, or inflamed endothelium). Other acceptable alternatives include colonoscopy, radio nucleide scanning, arteriography, or surgery when the lower GI source for the bleeding was successfully identified. Keeping the details of our research questions in mind, our criteria for selecting the studies were as follows:

Participants. Participants included ED patients presenting with melena or hematochezia without hematemesis. We included studies that specifically stated they

excluded patients with known esophageal varices or those suspected of variceal bleeding because nasogastric tube insertion is felt by some to be relatively contraindicated. We also excluded studies with patients who had hematemesis or coffee ground emesis, because an upper GI source for the bleeding is already evident.

Intervention/test. Nasogastric tube was inserted with aspiration (with or without lavage).

Outcome. The primary outcome measure was the operating characteristics of nasogastric aspiration in identifying upper GI bleeding in the target population.

Target study design. The diagnosis arm included the following: cross-sectional studies that enrolled patients who received both nasogastric aspiration and lavage and the reference standard.

Search

We searched the MEDLINE database from 1966 to November 2008, and EMBASE from 1980 to November 2008. We also scanned the databases of the Cochrane Library through 2008,[12] Emergency Medical Abstracts from 1977 through November 2008,[13] and online resources including BestBETS.[14] We reviewed the bibliographies of the eligible trials for citations of additional eligible studies. Our MEDLINE and EMBASE search strategies are presented in Data Supplement S1 (available as supporting information in the online version of this paper).

These searches yielded 969 studies, which were then further reduced according to the algorithm given in Figure 1. We identified four observational studies that met our selection criteria.[15–18] We excluded one study[16] because the results of the reference standard test (EGD) was not reported in patients with negative nasogastric aspirates. Also, 18% of patients with positive nasogastric aspirates did not receive EGD.[16] One study[15] included patients with hematemesis, but after contacting the authors, we were able to separate out patients without hematemesis.

After the exclusions, we based our review on three studies.[15,17,18] We did not find any systematic reviews or meta-analyses on this subject. All three studies included in our review had retrospective designs. The descriptions of the included studies are summarized in Table 1.

We used the published standard criteria for reporting of diagnostic accuracy studies (STARD)[19] to evaluate the quality of the studies selected for this review. We specifically focused on sampling, design, test measurement, blinding of operators, reference standard, and estimate of diagnostic accuracy. The results of the quality assessment of the included studies are summarized in Table 2.

All studies were performed in a retrospective manner. Blinding was only obtained in one study[18] via blinding of data abstractors. The choice of reference standard varied in each of the three included studies. Aljebreen et al.[15] used EGD evidence of a high-risk lesion as their reference standard. This study defined a high-risk lesion as visualization of an active bleeding vessel, oozing vessel, or a visible vessel. Cappell[17] considered active bleeding, stigmata of recent bleeding, or obvious significant lesion on EGD as evidence of upper GI bleeding. Finally, Witting et al.[18] used a combination of information obtained from reviewing the hospital discharge summary, EGD, radionucleotide scans, angiography, or surgery as the reference standard. Although the reference standards used in these studies are different, they all reasonably support the presence of an upper GI source for the bleeding.

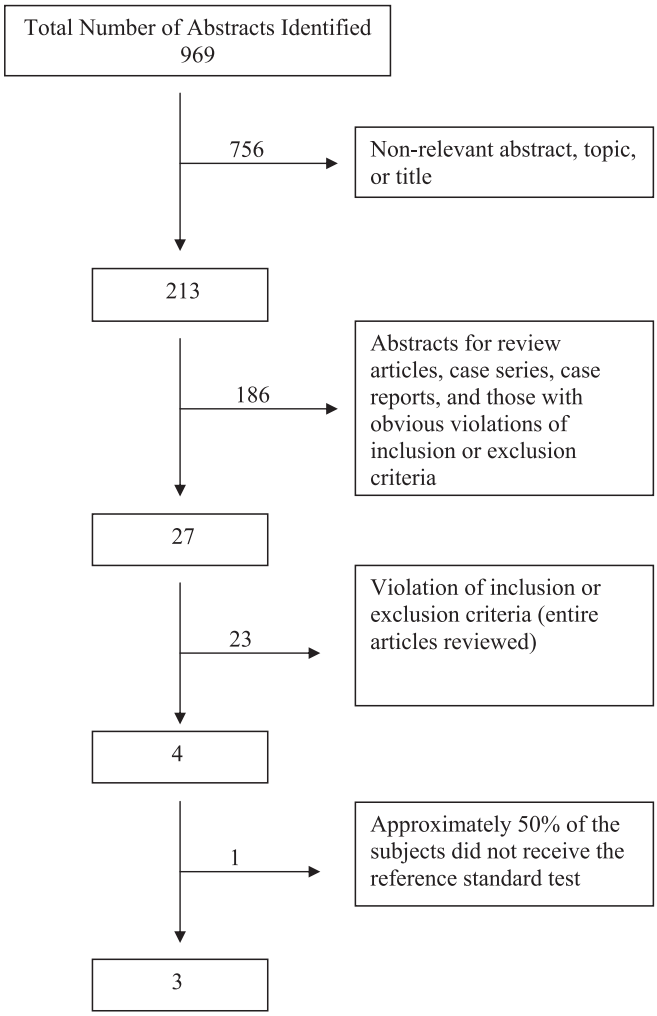

Figure 1. The process of selecting studies suitable for inclusion in the final review.

The estimate of diagnostic accuracy was presented as sensitivity and specificity in all three studies. Unfortunately, the retrospective design of the three included studies subjects them to various biases. These biases originate from missing data, unequal distribution of patients in the study groups, clinical heterogeneity of groups, and other flaws inherent to retrospective reviews.[20]

RESULTS

The included studies reported a very wide range for prevalence of an upper GI source for patients with melena or hematochezia without hematemesis. The rate of upper GI bleeding in the selected population was

Table 1
Description of Studies Included in the Review

Study	Population	Test Interpretation	Reference Standard
Aljebreen et al., 2004[15]	• Inclusion: patients with hematemesis, melena, or hematochezia who received both NGA and EGD (data obtained from a Canadian registry). • Exclusion: those who did not undergo NGA. • n = 526 enrolled patients; 232 had only melena or hematochezia as their presenting complaint (no hematemesis).* • Age (mean ± SD): 66 ± 16. • Sex: 62% male.	• Positive: coffee ground or bright red blood. • Negative: clear or bile-stained aspirate.	EGD
Cappell, 2005[17]	• Inclusion: patients with myocardial infarction who developed hematemesis, melena, bright red blood in stool, and patients with positive fecal occult blood test with either severe anemia (hematocrit <30) or hypotension (only data for patients with melena or hematochezia without hematemesis were analyzed: 66/125). • Exclusion: 1) NGA for other reasons; 2) age < 21 years; 3) orogastric tubes, 4) nonmonitored setting (CCU, ICU, or ED); 5) NGA for fecal occult blood without other criteria. • n = 66. • Age (mean and SD): 73 ±10. • Sex: 66% male.	• Positive: visualization of red blood or coffee ground aspirate. • Negative: clear (nonbloody) aspirate.	EGD
Witting et al., 2004[18]	• Inclusion: patients with bloody, dark, or black stools; admission through the ED; confirmatory testing within 3 days; age >17 years; and absence of hematemesis. • Exclusion: presence of ostomy, obvious anorectal source, admission for GI bleeding within previous month. • n = 235. • Age: 69% less than 50 years of age. • Sex: unable to extract data.	• Results coded in six categories: clearly negative, somewhat negative, questionably positive (flecks of blood, 30 mL), mildly positive (coffee ground or bright red blood, 30–450 mL), moderately positive (coffee ground >450 mL, or difficulty clearing), strongly positive (bright red blood >450 mL with difficulty clearing).	Hospital course and results of EGD, radionucleotide scans, angiography, and surgery.

CCU = cardiac care unit; EGD = esophagogastroduodenoscopy; GI = gastrointestinal; ICU = intensive care unit; NGA = nasogastric aspiration.
*Only patients with melena or hematochezia were included in the review (data provided in the article or by the authors after contacting them).

32% (95% confidence interval [CI] = 26% to 38%) for the study by Aljebreen et al.,[15] 74% (95% CI = 62% to 83%) in the study by Cappell,[17] and 50% (95% CI = 43% to 56%) in the study by Witting et al.[18] This wide range could originate from the differences in patient populations and also is likely to be due to selection bias in subject enrollment. It should also be noted that the study by Cappell[17] only enrolled patients with myocardial infarction who were experiencing melena or hematochezia. Patients with a myocardial infarction are a higher risk than the general population for upper GI bleeding because of higher rates of aspirin use. Thirty-four percent of the enrolled patients were on daily aspirin, and another one-third were on heparin or warfarin.[17] Additionally, this study only included patients from a monitored setting, which consisted of patients from the ED, intensive care unit, and cardiac care units and was not specific to ED patients alone.[17]

According to the included studies, the diagnostic performance of the nasogastric aspiration and lavage for predicting upper GI bleeding is fairly poor (Table 3). The sensitivity of this test ranged from 42% to 84%, and the specificity from 54% to 91%. Among the included studies, Cappell[17] reported the highest sensitivity, and the study by Witting et al.,[18] the highest specificity (Figure 2). An extra source of interstudy

Table 2
Quality Assessment of the Included Studies

	Aljebreen et al., 2004[15]	Cappell, 2005[17]	Witting et al., 2004[18]
Sampling	Consecutive sample	Convenience sample	Convenience sample
Design	Retrospective registry	Retrospective	Retrospective
Test measurement	Identifying coffee ground, bloody, clear/bile, or other	Identifying coffee ground, bright red blood, or clear	Identifying NGA color based on six classifications: clearly negative, somewhat negative, questionably positive (flecks of blood: at least 30 mL), mildly positive (coffee ground or bright red blood, 30–450 mL), moderately positive (coffee ground >450 ml, or difficulty clearing), strongly positive (bright red blood >450 ml with difficulty clearing)
Blinding of operators	Not blinded	Not blinded	Data abstractors were blinded to specific aims of the study and test measurement. The results of the reference standard test were obtained at different times to prevent influence
Reference standard	EGD for identifying high-risk lesions (active bleeding vessel, oozing vessel, or visible vessel)	EGD (active bleeding, stigmata of recent bleeding, or obvious significant lesion)	Hospital discharge summary, hospital course, endoscopy, radionucleotide scans, angiography, or surgery
Estimate of diagnostic accuracy	Sensitivity/specificity, and NPV/PPV	Sensitivity and specificity (for overall subjects, not specified for melena or hematochezia)	Sensitivity/specificity and NPV/PPV
Method of quantifying uncertainty	95% CI	95% CI	95% CI, LR

EGD = esophagogastroduodenoscopy; GI = gastrointestinal; LR = likelihood ratios; NGA = nasogastric aspiration; NPV = negative predictive value; PPV = positive predictive value.

Table 3
Operating Characteristics of Nasogastric Aspiration and Lavage in Diagnosing Upper GI Hemorrhage in Patients With Hematochezia or Melena Without Hematemesis

	Sensitivity, % (95% CI)	Specificity, % (95% CI)	PPV, % (95% CI)	NPV, % (95% CI)	LR+	LR–
Aljebreen et al., 2004[15]*	68 (57–78)	54 (45–61)	41 (33–50)	78 (69–85)	1.44	0.61
Cappell, 2005[17]	84 (70–93)	82 (57–96)	93 (81–98)	64 (43–80)	4.74	0.2
Witting, et al., 2004[18]	42 (32–51)	91 (83–95)	81 (69–90)	61 (53–68)	4.44	0.65

GI = gastrointestinal; LR+ = likelihood ratio of a positive test; LR– = likelihood ratio of a negative test; NPV = negative predictive value; PPV = positive predictive value.
*Information obtained by contacting authors.

variability may have resulted from their varying definitions of a positive endoscopy, which include a wide range of definitions, from a visibly bleeding vessel, to only an ulcer that was assumed to be the source of upper GI hemorrhage.

It must be noted that the likelihood ratios presented in Table 3 for Witting et al.[18] are different from the ones presented in the original article because we used different definitions for calculating the likelihood ratios. In our calculations, we used a more conservative approach to account for cases that did not undergo nasogastric aspiration. We considered the test results false negative if the EGD reported a positive upper GI source or as false positive if the EGD was negative. However, in the original article,[18] the authors used a different method for calculating the likelihood ratios and still counted the aborted cases (patients who did not have nasogastric aspiration) in their calculations by using a 3×2 table. This method yielded a negative likelihood ratio of 0.6 and a positive likelihood ratio of 11.0 (compared to 0.7 and 4.4, respectively, by our conservative method [Table 3]).

Finally, only one study reported the complications associated with nasogastric aspiration and lavage. One patient reportedly had gastric erosions resulting from suctioning, and another experienced epistaxis.[17]

APPLYING THE EVIDENCE

Nasogastric tube insertion is a common procedure performed in the ED around the world and is frequently requested by the consulting services for cases similar

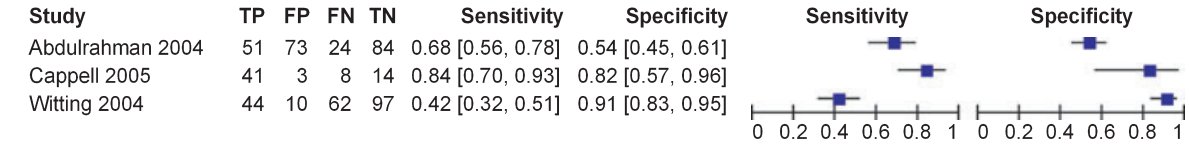

Figure 2. Summary of the results of the included studies representing the operating characteristics of nasogastric aspiration in identifying upper GI hemorrhage in patients with hematochezia or melena without hematemesis.*For each trial, the square corresponds to the observed sensitivity or specificity, and the horizontal line defines the 95% CI. FN = false negative; FP = false positive; GI = gastrointestinal; TN = true negative; TP = true positive.

to the patient in our scenario. Nasogastric aspiration and lavage is a diagnostic test often taken for granted in its safety and comfort to the patient. This procedure has been associated with a multitude of serious complications as discussed earlier.[9–11] Pillai et al.[21] found complication rates from nasogastric tube placement varying from 0.3% to 0.8%. Considering the frequency in which nasogastric tube insertion occurs worldwide, the number of complications is not insignificant. In addition, this test has been rated among the most painful and uncomfortable ED procedures.[6] Because the procedure is not completely benign and does cause marked discomfort to the patient, we must consider whether the use of this procedure is justified in patients presenting with melena or hematochezia without hematemesis.

Nasogastric aspiration and lavage is used as a potential screening test in the ED to differentiate upper from lower GI hemorrhage. For a screening test to be useful, it should have the characteristics of a high sensitivity, low negative predictive value, and low negative likelihood ratio. The included studies found that nasogastric aspiration and lavage carry a low sensitivity (42% to 84%), a high negative predictive value (61% to 78%), and a relatively poor negative likelihood ratio (0.65 to 0.2).

Given these heterogeneous results from our studies, the value of nasogastric aspiration and lavage is far from certain. From the operating characteristics of nasogastric aspiration and lavage it appears that all sensitivities are below 90%, and negative likelihood ratios are greater than 0.2, resulting in a negative predictive value of less than 78%; it is unlikely that a negative nasogastric aspiration and lavage should change the clinical management of patients with melena or hematochezia without hematemesis.

An aspirate positive for fresh blood or coffee ground materials is also not conclusive for a diagnosis of upper GI bleeding. It only increases the odds of an upper GI source by a factor of 1.44 to 4.74 times (positive likelihood, Table 3). The heterogeneity of the operating characteristics may be related to the criteria used to define a positive or negative aspirate. A false-negative aspirate could be caused by an inadequate lavage volume or inability to identify bile in the lavage fluid. A false-positive result could result from an overzealous definition of ''bright red blood'' in lavage, return of just flecks of blood, or just ''coffee grounds.''

The heterogeneity of diagnostic characteristics among these studies is related to variations in the study populations. Variation in disease prevalence is well known to affect predictive values, but may also affect sensitivity. Study populations with high disease prevalence tend to have patients with a more severe form of the disease. In this case, subjects with more active lesions are more likely to be correctly identified, inflating the sensitivity (spectrum bias).[22] We see this effect between our three trials, with the study by Cappell,[17] with the highest disease prevalence (74%), having a significantly higher sensitivity (84%) than the other two studies.

Now consider our clinical scenario of an elder gentleman who presents with hematochezia without hematemesis. He appears by vital signs and initial blood work to be hemodynamically stable. Our surgery consultant requested a nasogastric aspiration and lavage to differentiate an upper from lower GI source of bleeding. By examining the evidence, we can conclude that a negative nasogastric aspiration and lavage does not possess an adequate sensitivity or an acceptable negative likelihood to comfortably rule out an upper GI bleed. The question remains: is the nasogastric aspiration still worthwhile if gross blood or coffee grounds are found? This would seem to depend upon a discussion between the emergency physician and the gastroenterologist as to the value of emergent or delayed endoscopy in such a patient; there seem to be diverging opinions on this topic.[23–25] If the gastroenterologist plans on performing an emergent EGD if the nasogastric aspirate reveals gross blood or coffee ground material, placing a nasogastric tube might be worthwhile, at least by expediting the patient work-up. If the nasogastric aspirate is not going to prompt emergent EGD for a stable patient with a suspected upper GI bleeding, then the need for nasogastric tube is obviated. A negative or positive nasogastric aspirate and lavage will not change the diagnostic pathway for such a patient. The patient can then simply be managed with a nonemergent upper and lower endoscopy, without subjecting him or her to a nasogastric tube.

CONCLUSIONS

Nasogastric aspiration and lavage has a low sensitivity and relatively poor negative likelihood ratio to be useful in ruling out an upper gastrointestinal source in patients with melena or hematochezia without hematemesis. This test cannot be used to obviate or delay upper endoscopy in such patients, and therefore it does not change the management. A coordinated plan by emergency physician and the gastroenterologist as to whether nasogastric aspiration changes the timing of endoscopy should also be taken into consideration before nasogastric tube insertion.

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Supporting Information

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Data Supplement S1. Search strategies.

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