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Laparotomy and intraoperative enteroscopy for obscure gastrointestinal bleeding before and after the era of video capsule endoscopy and deep enteroscopy: A tertiary center experience

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ABSTRACT

Background: To evaluate roles of intraoperative endoscopy (IOE) in management of severe obscure GI bleeding (OGIB) before vs. after introduction of video capsule endoscopy (VCE) and deep enteroscopy (DE).

Methods: We retrospectively reviewed prospectively collected data of patients undergoing IOE for severe OGIB in a tertiary referral center.

Results: 52 patients had laparotomy/IOE for OGIB, 11 pre and 41 post VCE/DE eras. In the pre VCE/DE era, 36.4% (4/11) had preoperative presumptive diagnoses while in the post VCE/DE era presumptive diagnoses were made in 48.8% (20/41) ($p = 0.18$). Preoperative evaluation led to correct diagnoses in 18.2% (2/11) in the pre and 51.2% (21/41) in the post VCE/DE era ($p = 0.09$). Vascular lesions and ulcers were the most common diagnoses, but rebleeding was common. No rebleeding was found among patients with tumors, Meckel's diverticulum, and aortoenteric fistula.

Conclusions: Presumptive diagnoses in the post VCE/DE era were usually accurate. If VCE or DE are negative, the probability of negative IOE is high. Patients with tumors and Meckel's diverticulum were the best candidates for IOE.

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1. Introduction

Although obscure gastrointestinal bleeding (OGIB) accounts for only about 5% of gastrointestinal hemorrhage, it is a clinically significant and potentially expensive medical problem that often results in multiple blood transfusions, frequent hospitalizations, and repetitive diagnostic evaluations.¹

In the past, the standard evaluation for patients with OGIB was limited to esophagoduodenoscopy (EGD), push enteroscopy, colonoscopy, and radiologic studies of the small bowel (e.g. tagged RBC

scan, technetium-99 m scan, angiography, and small bowel computerized tomography [CT]). However, these tests are unable to completely examine the small bowel despite 75% of OGIB cases originating from the small bowel.^{2–4} Moreover, even with standard push enteroscopy, only 50–100 cm of small bowel can be visualized beyond ligament of Treitz.⁴ Therefore, in the past intraoperative enteroscopy (IOE) was required for complete small bowel evaluation and treatment in patients with severe recurrent OGIB.^{5–8}

Since their introduction, video capsule endoscopy (VCE) and deep enteroscopy (DE) have proven to be superior to other conventional tests for diagnosis of OGIB.^{9–13} Additionally, simultaneous tissue diagnosis by biopsies and treatment can be delivered during DE. These advances have resulted in more accurate diagnosis and significant improvement in the management of patients with OGIB.

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Table of abbreviations used

AGA	American Gastroenterology Association
ASA	American Society of Anesthesiologists
AVM	arteriovenous malformation
CT	Computerized tomography
CURE: DDRC	Center for Ulcer Research and Education: Digestive Diseases Research Center
DBE	Double balloon enteroscopy
DE	Deep enteroscopy
EGD	Esophagogastroduo denoscopy
GI	Gastrointestinal
GISTS	Gastrointestinal stromal tumors
INR	International normalized ratio
IOE	Intraoperative enteroscopy
MRI	Magnetic resonance imaging
NSAIDS	non-steroidal anti-inflammatory drugs
PRBC	Packed red blood cell
SBE	Single balloon enteroscopy
SE	Spiral endoscopy
VCE	Video capsule endoscopy

We aim to evaluate the roles of intraoperative endoscopy (IOE) in management of severe obscure GI bleeding (OGIB) in the eras before and after the introduction of VCE/DE. We compared the outcomes such as rebleeding in the two eras. Our hypothesis was that with the introduction of VCE/DE, accurate preoperative diagnosis could be achieved more frequently than before and clinical outcomes would improve after surgery.

2. Material and methods

We retrospectively analyzed prospectively collected data of patients diagnosed with severe OGIB undergoing exploratory laparotomy with or without IOE at Ronald Reagan UCLA Medical Center from 1990 to 2013. The study protocol was approved by the hospital Institutional Review Board (IRB). We utilized a 2007 American Gastroenterology Association (AGA) management guideline that defined OGIB as persistent gastrointestinal bleeding with no obvious etiology after EGD, colonoscopy, and other radiologic evaluations.¹⁴ OGIB was further subdivided into overt OGIB and occult OGIB according to the presence or absence of visible blood in the stool or melena. Baseline characteristics including age, gender, ethnicity, co-morbidities, baseline laboratory results (e.g. initial hemoglobin, platelet, international normalized ratio = INR), medications, the American Society of Anesthesiologists (ASA) classification, and quantity of blood transfusions during the same admission of the surgery were also recorded. Center for Ulcer Research and Education (CURE) prognostic scores were calculated for each patient.¹⁵ At our institution, VCE and DE were introduced in 2001. Therefore, study patients were categorized into pre VCE/DE era group if they were evaluated for IOE before 2001 and as post VCE/DE era group if they were evaluated in or after 2001. In order to reduce discrepancies in classification of arteriovenous malformations (AVM), angiodysplasia, and vascular ectasia, these diagnoses were labeled as “vascular lesions.” This diagnosis excluded small bowel varices.

2.1. Preoperative diagnoses

Findings from EGD, colonoscopy, push enteroscopy, radiologic

evaluations, double balloon enteroscopy (DBE), single balloon enteroscopy (SBE), and spiral enteroscopy (SE) of all patients were recorded. The preoperative findings were reviewed and subsequently categorized into three groups according to the strength of evidence for preoperative diagnosis. If no specific lesion was found as the source of bleeding, they were classified as “non-diagnostic”. If preoperative tests provided localization of the bleeding site without identifying a lesion, the results were classified as “localization” but not etiologic. Finally, lesions which were thought to be causative based upon location, stigmata of hemorrhage, and clinical evidence were classified as “presumptive diagnosis”.

2.2. Operative and IOE diagnoses

During the laparotomy, the stomach, small bowel, colon, and mesentery were mobilized, inspected, and palpated for transmural, serosal, or mass lesions. If no culprit lesion was found, an IOE was then collaboratively performed by the gastroenterologist and surgeons. Based upon the preoperative localization of the bleeding site and the presumptive diagnosis, the entry site of IOE was determined. Per-oral, enterotomy, or per-anal enteroscopies were performed when proximal, middle, or distal part of small bowel were the suspected locations respectively and no lesion was found on inspection at laparotomy. Transillumination was also utilized to assist identification of vascular and other lesions. Inspection of the gastrointestinal mucosa and lumen with IOE was primarily done during advancement of the enteroscope to minimize false positive results from trauma during small bowel manipulation and withdrawal.

A definitive diagnosis was made during IOE when lesions were identified with active bleeding or other major stigmata of recent hemorrhage (e.g. visible vessel or adherent clot). An ulcer in the diverticulum upon opening it and confirmed by surgical pathology was classified as a Meckel's diverticulum hemorrhage. The diagnosis of “vascular lesions” including angiodysplasia, arteriovenous malformations or angiomas was made by visual inspection without biopsies. Furthermore, we diagnosed patients with vascular lesions as the cause of OGIB when 1) active bleeding was present during IOE from or near the lesions, in the absence of other findings, 2) multiple or extensive lesions were found in the absence of other gastrointestinal lesions, 3) a vascular lesion was found on IOE at the same location identified by preoperative evaluation, such as capsule endoscopy, and/or 4) a large lesion (e.g. > 5–10 mm) was found with a visible vessel or adherent clot or spontaneous bleeding with mild water jet irrigation.

2.3. Follow-up and rebleeding

Follow up information was obtained from prospectively collected data from the CURE: Digestive Diseases Research Center (DDRC) database. Rebleeding was defined as: 1) recurrence of hematochezia or melena, or 2) recurrence of iron deficiency anemia, with fecal occult positive stools, with 3) a decrease in hemoglobin from baseline of ≥ 2 g and/or RBC transfusion of 1 or more units of blood and overt bleeding or fecal occult positive blood tests. Significant complications and postoperative adverse events including those related to the operation or co-morbidities were assessed.

2.4. Data and statistical analyses

Demographic and laboratory characteristics, diagnostic yield, number of patients with preoperative presumptive diagnosis and/or localization, and final diagnoses were compared between the pre and post VCE/DE eras. The rebleeding rates for patients with

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