EDITORIAL

Red dichromatic imaging in acute GI bleeding: Does it make a difference?

Where a new invention promises to be useful, it ought to be tried.

—Thomas Jefferson

Acute GI bleeding is one of the most common reasons for hospitalization and accounts for 530,855 hospital admissions annually in the United States and >$300,000,000 in total expenditure.[1] The causes include upper and lower GI sources. Active bleeding is seen in 10% of patients with upper GI bleeding[2] and in 21% of those with severe lower GI bleeding.[3]

Endoscopic evaluation is highly successful in identifying the bleeding source/site when active bleeding is present. The finding of active bleeding demonstrated by spurting during endoscopy portends a higher risk of rebleeding if it is not treated successfully.[4] Oozing from upper GI lesions is likely associated with less risk of recurrent bleeding, as suggested by recent studies.[5] Endoscopic treatment is highly effective in reducing the risk of rebleeding.[2,6]

Various highly effective endoscopic treatment modalities are available and can be grouped to cautery-based therapy (argon plasma coagulation, monopolar electrocautery, bipolar electrocautery), mechanical therapy (endoscopic clips that are either through or over the endoscope, band ligation devices), injection therapy, and hemostatic powder-based therapy.[7]

All therapies except for epinephrine injection and powder-based therapy work better with precise identification of the bleeding point. Unfortunately, the ability to pinpoint the exact bleeding point can be challenging in some patients with active bleeding and may be more challenging for less experienced endoscopists. This difficulty is frequently related to blood pooling that prevents adequate visualization. Therefore, therapy such as epinephrine injection is first delivered to stop or slow the bleeding and allow better identification of the bleeding point before additional therapy is targeted. The use of a therapeutic endoscope with a large suction channel and a clear cap attached to the endoscope, coupled with jet lavage, can also help. At times, therapy is applied to the suspected site of bleeding with the hope of controlling and preventing further bleeding. This nonselective approach can be associated with the need for repeated application of cautery, with an increased risk of perforation or failed treatment. Recurrent bleeding/continued bleeding is more frequent when therapy is not precise and is associated with the need for additional interventions, such as repeated EGD, angiography-guided vascular embolization, or surgery, with increased patient morbidity and mortality.

Red dichromatic imaging (RDI) is a novel type of enhanced endoscopic imaging that can assist with the identification of deeper blood vessels or bleeding points. RDI is constructed by the use of 3 wavelengths of light (green. 540 nm; amber, 600 nm; and red, 630 nm). Hemoglobin tends to absorb different wavelengths differently, leading to the observation of different colors depending on hemoglobin concentration. In 2020, RDI was embedded in commercially available endoscopic systems in Asia and Europe (EVIS X1, Olympus Co, Tokyo, Japan). Bleeding points tend to have a higher hemoglobin concentration compared with dilute blood in the surrounding pool and are better identified by the mode 1 setting. Modes 2 and 3 are helpful in better visualizing deep and superficial vessels. Limited published data suggest that this technology can help identify and treat vessels during peroral endoscopic myotomy and endoscopic submucosal dissection to reduce the risk of bleeding.[8,9] Recent case reports have highlighted the value of RDI in the setting of active colon diverticular bleeding[10] and hemostasis of gastric ulcer bleeding.[11] In one study, sclerotherapy of esophageal varices was faster when RDI was used for guidance.[12]

RDI may have a role in the treatment of patients with active acute GI bleeding when the bleeding point is not visible despite the use of available additional methods, or when treatment that does not require precise identification of the bleeding point, such as hemostatic powder–based therapy, is not available or successful.

In this issue of *Gastrointestinal Endoscopy*, Hirai et al[13] report on the use of RDI (mode 1) compared

0016-5107/$36.00
https://doi.org/10.1016/j.gie.2021.11.036

with standard white-light endoscopy in the identification of the bleeding point in patients with a variety of oozing and spurting upper and lower GI lesions. A total of 8 endoscopists participated in the study. Four were experienced, and 4 were trainee endoscopists. Both groups received training in <10 cases. Endoscopists reviewed collected video images of 64 cases seen over 1 year. Most cases were bleeding peptic ulcers. Only 3 patients with colonic diverticular bleeding were reviewed. Regions of interest at the bleeding point and surrounding blood were evaluated with white light and RDI by use of a calculated color difference score and a subjective visibility score. Neither of these measures has been previously validated in bleeding lesions. The scores for both measures appeared to correlate well. Interobserver agreement was lower for trainees than for experts, likely because of the varying levels of expertise for trainees. RDI was significantly superior to white light in identifying bleeding points when used by both experienced and trainee endoscopists. Endoscopic treatment was successful in all patients. The authors concluded that RDI allowed better visualization of bleeding points compared with white light by both expert and trainee endoscopists. No data were provided in reference to the impact of RDI on therapy success, procedure duration, or patient outcome.

RDI may have a role in the treatment of patients with active acute GI bleeding when the bleeding point is not visible despite the use of available additional methods, or when treatment that does not require precise identification of the bleeding point, such as hemostatic powder–based therapy, is not available or successful. The endoscopes used in this study were prototype endoscopes that allowed easy switching between white light and RDI with the push of a button. Newer commercially available endoscopy systems in Asia and Europe (EVIS X1) have RDI embedded, with the ability to switch from white light to RDI as needed during the procedure. These processors are not yet available in the United States. Unfortunately, as mentioned by the authors, the retrospective nature of this study, the lack of endoscopist blinding (a challenging process with endoscopic studies), the post hoc analysis of images, and the small number of patients with lower GI bleeding make it difficult to enable firm conclusions to be reached about the benefit of using RDI in acute active GI bleeding. In addition, the following questions should be answered before a wider use of this technology is advocated: Will better identification of the bleeding point lead to shorter procedure times and significantly improve treatment results and rebleeding rates? Will the use of RDI reduce the risk of adverse events resulting from the repeated application of cautery, especially in the duodenum or colon?

Randomized prospective studies with larger numbers of patients (especially with lower GI bleeding) are needed. In the meantime, endoscopy units with access to this technology may benefit from its availability in the performance of submucosal interventions by identifying and avoiding deep vessels and when precise identification of a bleeding point during procedures is needed.

DISCLOSURE

Both authors disclosed no financial relationships.

Abdul Hamid M. Al-Sabban, MBBS
Division of Gastroenterology
Ochsner Baton Rouge Medical Center
Baton Rouge, Louisiana, USA
Firas H. Al-Kawas, MD, MASGE
Division of Gastroenterology
Inova Health System
Falls Church, Virginia, USA

Abbreviation: RDI, red dichromatic imaging.

REFERENCES

1. Peery AF, Crockett SD, Murphy CC, et al. Burden and cost of gastrointestinal, liver, and pancreatic diseases in the United States: update 2021. Gastroenterology. Epub 2021 Oct 19.
2. Kovacs TOG, Jensen D. Endoscopic therapy of severe ulcer bleeding. Gastrointest Endosc Clin N Am 2011;21:681-96.
3. Jensen DM, Machicado GA, Jutabha R, et al. Urgent colonoscopy for the diagnosis and treatment of severe diverticular hemorrhage. N Engl J Med 2000;342:78-82.
4. García-Iglesias P, Villoria A, Suarez A, et al. Meta-analysis: predictors of rebleeding after endoscopic treatment for bleeding peptic ulcer. Aliment Pharmacol Ther 2011;34:888-900.
5. Jensen DM, Eklund S, Persson T, et al. Reassessment of rebleeding risk of Forrest IB (oozing) peptic ulcer bleeding in a large international randomized trial. Am J Gastroenterol 2017;112:441-6.
6. Jensen DM, Ohning GV, Kovacs TOG, et al. Natural history of definitive diverticular hemorrhage based on stigmata of recent hemorrhage and colonoscopic Doppler blood flow monitoring for risk stratification and definitive hemostasis. Gastrointest Endosc 2016;83:416-23.
7. Mullady DK, Wang AY, et al. AGA clinical practice update on endoscopic therapies for non-variceal upper gastrointestinal bleeding: expert review. Gastroenterology 2020;159:1120-8.
8. Maehata T, Fujimoto A, Uraoka T, et al. Efficacy of a new image-enhancement technique for achieving hemostasis in endoscopic submucosal dissection. Gastrointest Endosc 2020;92:667-74.
9. Kv A, Ramchandani M, Inavolu P, et al. Red dichromatic imaging in peroral endoscopic myotomy: a novel image-enhancing technique. VideoGIE 2021;6:203-6.
10. Saino M, Aoyama T, Fukumoto A, et al. Tracking the target in colonic diverticular bleeding using red dichromatic imaging. Endoscopy 2021;53:E425-6.
11. Kubosawa Y, Mori H, Fujimoto A. Utility of dual red imaging for endoscopic hemostasis of gastric ulcer bleeding. Dig Dis 2020;38:352-4.
12. Furuichi Y, Abe M, Takeuchi H, et al. Red dichromatic imaging reduces endoscopic treatment time of esophageal varices by increasing bleeding point visibility (with video). Dig Endosc. Epub 2021 May 10.
13. Hirai Y, Fujimoto A, Matsutani N, et al. Evaluation of the visibility of bleeding points using red dichromatic imaging in endoscopic hemostasis for acute GI bleeding (with video). Gastrointest Endosc 2022;95:692-700.e3.