Endoscopic Vacuum Therapy for Duodenal Hemorrhage in Critically Ill Patients With COVID-19

Diogo T. H. de Moura, MD, MSc, PhD[1,2], Eduardo G. H. de Moura, MD, MSc, PhD[1,2], Bruno S. Hirsch, MD[1], Thomas R. McCarty, MD, MPH[3], Gustavo L. Rodela Silva, MD, MSc[2], Stéphanie I. Rizk, MD[2,4], Christopher C. Thompson, MD, PhD[3], Paulo M. Hoff, MD, PhD[2,5] and Ludhmila A. Hajjar, MD, PhD[2,4]

Am J Gastroenterol 2022;117:690–692. https://doi.org/10.14309/ajg.0000000000001643

COVID-19–related acute respiratory distress syndrome is associated with high mortality, often times necessitating use of extracorporeal membrane oxygenation (ECMO). Hemorrhage associated with the development of hyperfibrinolysis, platelet dysfunction, coagulopathy, endotheliitis, thrombocytopenia, and heparin use is a frequent complication among these patients (1,2). Additional factors which increase the occurrence of gastrointestinal bleeding among ECMO patients include an increased host inflammatory state, nonpulsatile blood flow, reduced gastrointestinal perfusion and motility, and changes in acid-base physiology. These alterations remain challenging to manage with bleeding typically refractory to conventional hemostatic therapies, including epinephrine injection, thermal, mechanical, and topical therapies (3).

Endoscopic vacuum therapy (EVT) has been previously studied for the management of transmural gastrointestinal defects. EVT-related mechanisms including macrodeformation, microdeformation, changes in perfusion, exudate control, and gastric and biliopancreatic secretions clearance promote healing and may also be adapted for the treatment of refractory hemorrhage (4,5). Therefore, we applied these principles of EVT in 3 patients with COVID-19 on ECMO support and diffuse duodenal hemorrhage refractory to conventional endoscopic hemostatic therapies.

A cost-effective modified EVT was used using a triple-lumen tube to allow for nutrition and drainage through a single tube through the nares. A modified sponge was manufactured on the aspiration lumen of the tube with gauze and antimicrobial incision drape, as previously described by our group (5). Then, the distal end of the feeding lumen was positioned in the proximal jejunum and the aspiration portion in the duodenum. Finally, the device was connected to a vacuum machine (−125 mm Hg).

All 3 patients presented with melena and anemia. A summary of patients' demographic, laboratory, clinical, and endoscopic findings is shown in Table 1. Initial esophagogastroduodenoscopy demonstrated duodenal villous atrophy associated with diffuse bleeding, including active ulcers and visible vessels. Previous conventional endoscopic hemostatic approaches were unsuccessful after several endoscopies (range, 2–6) for all patients. Therefore, a modified EVT was performed.

All patients were stable within few days (range, 4–6) after modified-EVT procedure, without melena, and the follow-up esophagogastroduodenoscopy demonstrated a completely healed mucosa with no signs of villous atrophy, ulcerations, or hemorrhage. One patient developed rebleeding 2 weeks after modified-EVT removal; however, repeat modified EVT resulted in no further bleeding episodes. Figure 1 highlights images of the initial endoscopic evaluation, conventional endoscopic treatment failure, and the final appearance after modified-EVT treatment.

At present, data on gastrointestinal bleeding among patients receiving ECMO support are lacking and given poor treatment success, necessitating effective approaches based on the underlying pathophysiology (3). As such, a modified-EVT approach may be increasingly considered based on our experience and underlying mechanism of action. It is important to acknowledge these data are based on a limited number of patients with larger studies required to validate these findings. However, this modified-EVT approach was associated with high technical and clinical success rates, allowed for early enteral nutrition, and a low rate of rebleeding.

This novel strategy may reduce the need for repeat endoscopy sessions, decrease associated healthcare costs, and improve outcomes and quality of life for patients with diffuse duodenal hemorrhage with severe inflammatory response associated with COVID-19 on ECMO.

CONFLICTS OF INTEREST

Guarantor of the article: Diogo T. H. de Moura, MD, MSc, PhD.

Specific author contributions: D.T.H.M.: study concept and design, acquisition of data, interpretation of data, and drafting and critical revision of the article. E.G.H.M.: study concept and design, acquisition of data, interpretation of data, and drafting and critical revision of the article. B.S.H.: acquisition of data, interpretation of data, and drafting and critical revision of the article. T.R.M.: interpretation of data, drafting and critical revision of the article. G.L.R.S.: interpretation of data, drafting and critical revision of the article. S.I.R.: interpretation of data, drafting and critical revision of the article. C.C.T.: interpretation of data, drafting and critical revision of the article. P.M.H.: interpretation of data, drafting and critical revision of the article. L.A.H.: interpretation of data, drafting and critical revision of the article.

Financial support: None to report.

Potential competing interests: None to report.

Ethical concerns: This study was approved by the ethics committee of our institution (Hospital Vila Nova Star—IDOR, São Paulo, SP, Brazil). All patients provided written informed consent.

REFERENCES

1. Yamada S, Ogawa H, Asakura H. Etiology and management of bleeding during ECMO in a COVID-19 patient. J Atheroscler Thromb 2021;28:402–3.
2. Asakura H, Ogawa H. Overcoming bleeding events related to extracorporeal membrane oxygenation in COVID-19. Lancet Respir Med 2020;8:e87-e88.
3. Amata M, Martucci G, Granata A, et al. The role of endoscopy as non-invasive procedure to manage gastrointestinal complications during extracorporeal membrane oxygenation. Perfusion 2020;35:786–94.
4. de Moura DTH, de Moura BFBH, Manfredi MA, et al. Role of endoscopic vacuum therapy in the management of gastrointestinal transmural defects. World J Gastrointest Endosc 2019;1:329–44.
5. de Moura DTH, Hirsch BS, do Monte Junior ES, et al. Cost-effective modified endoscopic vacuum therapy for the treatment of gastrointestinal transmural defects: step-by-step process of

Table 1. Demographic, clinical, laboratory, and endoscopic features of patients with COVID-19 on ECMO support with diffuse GI bleeding

Variables	Patient 1	Patient 2	Patient 3
Gender	Male	Male	Male
Age	33	55	64
Comorbidities	Obesity class I	Obesity class I	Hypertension and overweight
Interval between onset of COVID-19 symptoms and GI bleeding	55	44	47
Interval between onset of ECMO and GI bleeding	30	6	25
Anticoagulant therapy	Yes	Yes	Yes
Multidrug resistance infection (source)	Yes (respiratory)	Yes (respiratory)	Yes (respiratory)
Vasopressors at onset of bleeding	Yes	Yes	No
Renal replacement therapy at onset of bleeding	Yes	No	No
Presentation of GI bleeding	Melena	Melena	Melena
Number of EGDs before EVT	6	4	2
Endoscopic findings	Active oozing from ulcerations and visible vessels in the duodenum	Severe duodenal villous atrophy associated with a small duodenal ulcer with active oozing bleeding	Diffuse blunting of the duodenal villi and active oozing
Endoscopic therapies before EVT	Hemoclips, hemospray, and epinephrine injection	Hemoclips and hemospray	Hemoclips, hemospray, and epinephrine injection
Pre-EVT Hb (g/dL)	8.2	8.4	8.6
Blood transfusion requirements 7 d before EVT	4	3	7
Blood transfusion requirements 7 d after onset of EVT	2	0	1
Enteral feeding at onset of bleeding	Yes	Yes	Yes
Restart of enteral diet (d)	5	4	6
Pre-EVT INR	1.2	1.0	1.2
Post-EVT INR	1.2	1.0	1.3
Pre-EVT platelets (/mcL)	113,000	71,00	79,000
Post-EVT platelets (/mcL)	260,000	62,00	73,000
Pre-EVT high-sensitivity CRP (mg/dL)	0.53	0.61	0.21
Post-EVT high-sensitivity CRP (mg/dL)	0.82	1.0	0.63
Pre-EVT D-dimer (ng/mL)	1,749	2,193	3,868
Post-EVT D-dimer (ng/mL)	1,076	2,386	4,153
Pre-EVT procalcitonin (ng/mL)	0.90	0.42	0.15
Post-EVT procalcitonin (ng/mL)	0.50	1.02	0.31
Days of EVT until cessation of GI bleeding	6	4	6
Duodenal rebleeding after EVT cessation	Yes (after 14 d—successfully treated with EVT again)	No	No
Adverse events related to EVT	None	None	None
Days on mechanical ventilation	43	56	88
Days on ECMO	31	52	86

Table 1. (*continued*)

Variables	Patient 1	Patient 2	Patient 3
Other sources of bleeding during hospitalization	Cerebral intraparenchymal hemorrhage and epistaxis	Alveolar hemorrhage, cerebral intraparenchymal hemorrhage, and urinary bleeding	Alveolar hemorrhage and epistaxis
Death related to GI bleeding	No	No	No
Death	No (discharged after 115 d of hospitalization)	Yes (multiple organ dysfunction syndrome)	Yes (alveolar hemorrhage)

CPR, C-reactive protein; ECMO, extracorporeal membrane oxygenation; EGD, esophagogastroduodenoscopy; EVT, endoscopic vacuum therapy; GI, gastrointestinal; Hb, hemoglobin; INR, international normalized ratio.

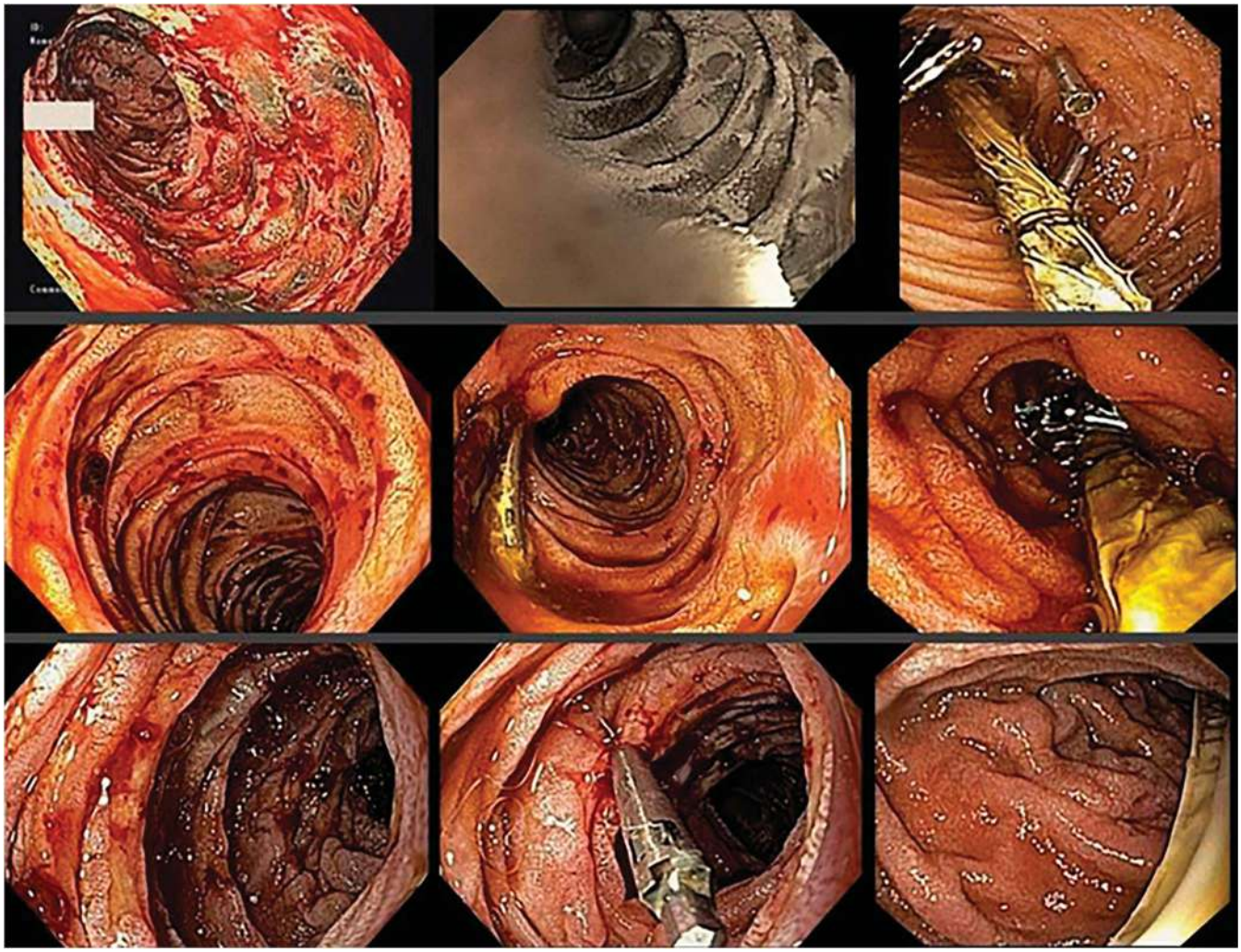

Figure 1. Endoscopic images demonstrating successful treatment with a modified-EVT approach.

manufacturing and its advantages. VideoGIE 2021;6:523–8.

[1]Gastroenterology Department, Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil; [2]FOR Instituto D´Or de Pesquisa e Ensino (IDOR), São Paulo, Brazil; [3]Division of Gastroenterology, Hepatology, and Endoscopy—Harvard Medical School, Brigham and Women's Hospital, Boston, MA, USA; [4]Cardiology, Department of Cardiopneumology, Instituto do Coração, Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil; [5]Oncology Department, Instituto do Câncer de São Paulo da Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil.
Correspondence: Diogo T. H. de Moura, MD, MSc, PhD. E-mail: diogo.moura@hc.fm.usp.br.