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Video Capsule Endoscopy in a Pediatric Patient With Hematemesis While on Ventricular Assist Device Support

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ABSTRACT We report the first case of video capsule endoscopy usage to diagnose gastrointestinal bleeding in a pediatric patient on a ventricular assist device. The outcomes of this case are consistent with the findings of reports in adult patients, showing no patient complications, no pacemaker or ventricular assist device interactions, and successful identification of a gastrointestinal source of bleeding. Use of video capsule endoscopy in this patient changed the management plan and eliminated the need for further invasive investigations highlighting the potential utility of this diagnostic method in this patient population.

Key Words: mechanical circulatory support, gastrointestinal bleeding, cardiology, mechanical interference

INTRODUCTION

Ventricular assist devices (VADs) are used to bridge pediatric patients with heart failure to transplantation or as destination therapy. Management of patients on VAD remains challenging due to associated complications. Gastrointestinal (GI) bleeding is one of the significant complications, with approximately 13% of pediatric patients experiencing a bleed while on VAD support (1). Therefore, safe and effective methods are needed to diagnose the source of GI bleeding in this population.

Current investigations for GI bleeding include upper and lower endoscopy, which permits visualization of the GI tract and provides capacity for therapeutic intervention. However, these modalities have limitations requiring additional consideration in pediatric patients on VAD support. This includes increased bleeding due to anticoagulation, increased perforation risk, and the need for general anesthetic. Video capsule endoscopy (VCE) is a noninvasive tool that involves swallowing a pill camera that transmits multiple images per second from within the stomach and small intestine to identify of GI mucosal abnormalities. VCE has minimal associated complications, with the most common being capsule retention in 1.4% of cases, and no reported patient deaths (2). In adult patients with a VAD and other cardiac devices, such as a pacemaker, VCE has not been associated with device-related interference (3). The role of VCE in pediatric patients with VAD is not defined due to a lack of data and, therefore, we present a case of a pediatric patient on VAD support who presented with GI bleeding and was investigated with VCE.

CASE REPORT

A 16-year-old female presented to the emergency department with hematemesis. She was previously diagnosed with Shone's complex, pulmonary hypertension, and complete heart block requiring a pacemaker who had a HeartWare Ventricular Assist Device (HVAD) (Medtronic Inc, Minneapolis, MN). No hematochezia or epistaxis was reported. Physical exam was unremarkable for source of bleeding, and bloodwork revealed a hemoglobin drop to 76 g/L from 93 g/L. Past medical history indicated a 5-week episode of overt GI bleeding 2 years prior, with esophagogastroduodenoscopy and an upper airway scope unable to identify a bleeding source.

Upon admission, the patient was started on intravenous pantoprazole and received a blood transfusion. Pediatric gastroenterology and otolaryngology were consulted to formulate an investigation and management plan. Endoscopy was felt to be high risk due to her pulmonary hypertension, so VCE was chosen to investigate for GI bleeding after consideration regarding potential interference between the video capsule and the VAD and pacemaker. Initially, a dissolvable patency capsule was administered to assess for safe transit, which passed without retention. Subsequently on admission day 5, a PillCam 3 capsule (Given Imaging Ltd, Deluth, GA) was swallowed by the patient. The capsule remained in the stomach for the entire recording and capsule passage occurred within 24 hours with no device-related complications (Figure 1). The VCE images suggested the gastric antrum was the source of the bleeding. The patient remained stable, and conservative management with intravenous pantoprazole was continued. Since the patient showed clinical signs of improvement, no further studies were performed in search of other bleeding sources. At discharge, the patient was stable with a hemoglobin of 95 g/L and was prescribed 8 weeks of pantoprazole and 6 weeks of sucralfate.

DISCUSSION

In a typical adult patient with an overt GI bleed, the decision to use VCE as a diagnostic tool is based on several considerations including diagnostic yield, safety, cost, and limitations. Current guidelines from 2017 recommend VCE as a complementary test in patients with overt GI bleeding when endoscopy cannot localize a bleeding source (4). In overt GI bleeds with a negative endoscopic study, VCE demonstrates superior diagnostic yield and cost effectiveness compared with other radiographic studies including angiography and is therefore the recommended follow-up test in this setting. A major benefit of VCE is its safety profile. A recent systematic review

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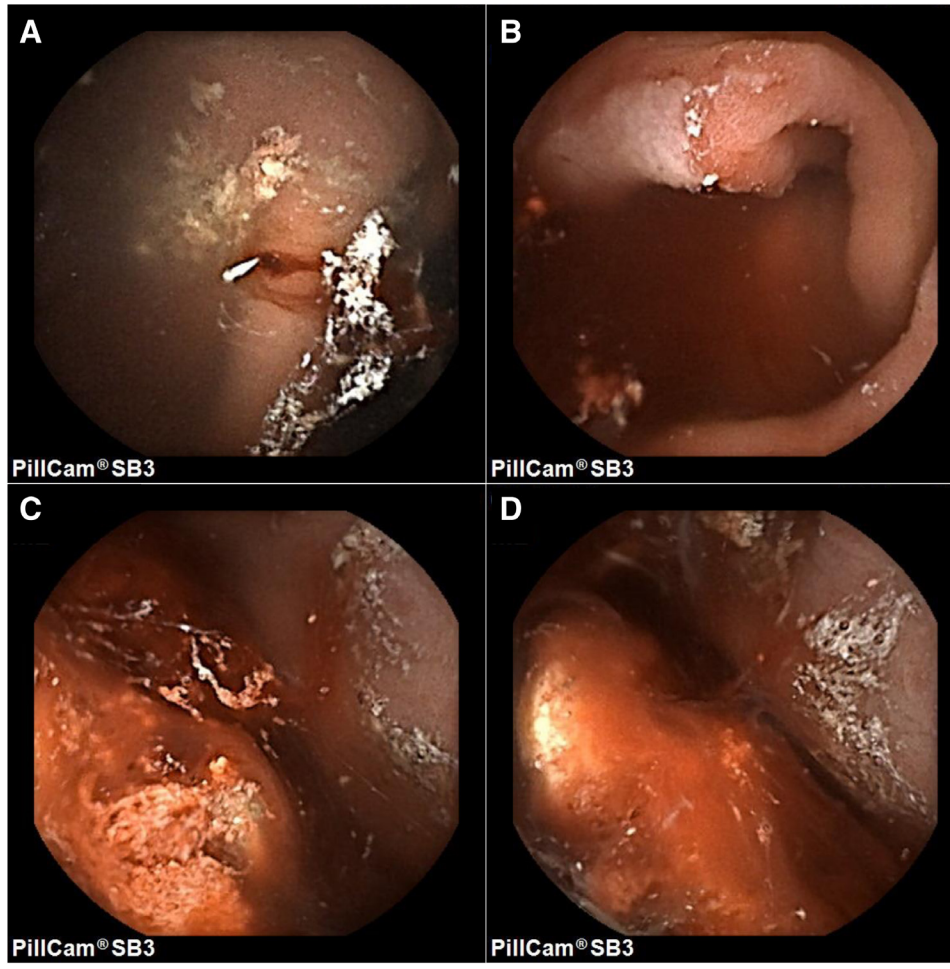

FIGURE 1. Video capsule endoscopy images captured in stomach over time. Active bleeding noted as capsule approaches antrum (A), with erosion and ulcerated mucosa (B). Later, early clot formation noted in antrum with some fresh blood still present (C and D).

of documented VCE adverse events from 2000 to 2019 reported that pooled rates of retention, swallow disorder, aspiration, technical failure, and procedural adverse events were less than 1% (5). Significant limitations of VCE include incomplete examination of the GI tract and inability for therapeutic intervention. Although VCE has an established role as a complementary test, recent reports suggest that VCE may be a reasonable first investigation option and demonstrate VCE first strategy to investigate GI bleeding is superior in identifying a bleeding source and significantly reduces the incidence of invasive procedures per patient compared with standard endoscopy (6,7). Ultimately, VCE is an acceptable secondary diagnostic option and a potential primary diagnostic option to assess for obscure GI bleeds in hemodynamically stable adult GI patients. The use of VCE in other patient populations is less clear and requires further study.

Our case illustrates the importance of VCE to assist in the diagnosis of GI bleeding in pediatric VAD patients. In adult VAD patients, VCE is safe and effective, with diagnostic yields up to 80% (8,9). The main diagnostic advantage of VCE is its ability to diagnose small bowel bleeding sources given the difficulty viewing this area with endoscopy. Compared with push enteroscopy, VCE demonstrates equal to superior efficacy in detecting small bowel bleeding sites, with a meta-analysis comparing the two modalities suggesting that VCE has a diagnostic yield of 63% compared with 26% in push enteroscopy (10).

The outcome of our case is consistent with the findings of previous adult studies with the ability to diagnosis a GI source of bleeding with no patient or cardiac device-related complications. The source of bleeding could have been identified with gastroscopy; however, VCE yielded the same diagnostic outcome while eliminating the need for anesthetic and potential bleeding and perforation associated with gastroscopy. In adult VAD patients with suspected GI bleeding, a VCE first strategy has resulted in fewer explorations and a similar diagnostic yield compared with push enteroscopy (11).

Despite the positive outcomes, our case also highlights a few common issues with VCE as an investigation choice in pediatric VAD patients. Concerns were raised over interactions between the capsule and cardiac devices. To date, no studies in adults have shown interference between video capsules and intracardiac devices (10), and cardiology agreed to proceed with VCE following consultation with adult and pediatric gastroenterology and the VAD team

Additionally, while VCE is a sensitive diagnostic tool, it cannot be used for therapeutic interventions. In high-risk patients finding, the source of bleeding and evaluating the response to conservative measures decreases the risk for the patient and leaves the option to pursue endoscopy if hemostasis cannot be achieved. Timing of investigation of acute GI bleed also influences the translation to therapeutic management and patient outcomes. Upper endoscopy is recommended to be done within 24 hours of an acute upper GI bleed for optimal mortality

benefit, with no added mortality benefit of doing so sooner (12,13). Optimal timing of VCE is comparable: performing VCE within 24 hours of presentation yields greater diagnostic accuracy and translates to a higher therapeutic intervention rate, both of which decrease with each passing day (14). In our case, VCE was performed 5 days after initial presentation, primarily due to the lack of familiarity with it and time taken for decision-making. Ultimately, our case was not negatively impacted by a later capsule study. VCE still identified a bleeding source and treated with appropriate conservative management.

While VCE can be helpful, it may not provide complete assessment of the GI tract, as the recording typically ends in the small intestine, leaving the large intestine unexplored (15). In addition, as noted with our patient, the capsule may remain in the stomach for the recording period and fail to provide images of the small bowel. In our case, this was most likely related to reduced gastric motility. Completion rates can improve with longer capsule battery life, administration of gastric promotility agents (when safe) in cases where the capsule remains in the stomach for >1 hour, or with direct endoscopic placement of the capsule into the duodenum (16,17).

Our case demonstrates that VCE can be safely applied in a pediatric patient with a VAD, with a diagnostic yield that guided clinical management. Further studies on safety, efficacy, and complications in pediatric VAD patients are necessary to establish its role in the care of this patient population.

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The Research Ethics Board at our institution qualified this project as a Case Report and was thus exempt from ethical review. Written informed consent was obtained from the patient's parent to publish the case details and associated images presented in this case study.

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