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CASE REPORT

General Medicine

Novel technique for continuous pressure monitoring of esophageal balloon in balloon tamponade device for acute variceal bleed

Brian H. Torres-Gonzalez MD | **Thomas L. Powell MD** | **Jennifer Yee DO** | **Katherine M. Hunold MD**

Department of Emergency Medicine, The Ohio State University, Ohio, Columbus, USA

Correspondence
Katherine Hunold Buck, MD, The Ohio State University, Department of Emergency Medicine, Columbus, OH, USA.
Email: Katherine.Buck@osumc.edu

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Abstract

Acute variceal bleeding is a life-threatening emergency associated with high mortality. Balloon tamponade is required for refractory bleeding to allow stabilization for definitive therapy. Unfortunately, these devices are associated with iatrogenic complications such as esophageal necrosis and perforation. It is imperative to accurately measure the esophageal balloon pressure to limit these complications. We describe a novel technique for both initial and continuous pressure monitoring of the esophageal balloon.

KEYWORDS
balloon tamponade device, variceal bleed

1 | INTRODUCTION

Acute variceal bleeding is a life-threatening emergency and a major cause of mortality in patients with cirrhosis, causing up to 70% of upper gastrointestinal bleeding in this population.[1] Initial resuscitative medical therapy using both blood products and medications has improved outcomes significantly, lowering mortality to approximately 10%–20%.[2,3] However, for patients with refractory high volume variceal bleeding, balloon tamponade with a balloon tamponade device provides an alternative therapy to achieve temporary hemorrhagic control until patients are hemodynamically stable enough to undergo definitive sclerotherapy or banding treatment.[4] These devices are associated with significant iatrogenic complications, including esophageal necrosis and perforation.[5,6] Here, we describe a novel technique using a digital Compass Lumbar Puncture[7] (Medline, Northfield, IL) and a hand inflation pump, 3-way stopcock, and tubing from an intravenous pressure bag in order to provide consistent and accurate readings of the esophageal balloon pressure for a balloon tamponade device.

2 | CASE REPORT

A 39-year-old female with history of alcoholic cirrhosis presented via emergency medical services to a university-affiliated community emergency department (ED) for hematemesis. Initial systolic blood pressure was in the 50s and her examination was notable for a distended and tender abdomen with dried perioral blood. Our massive transfusion protocol was initiated and she was treated with intravenous octreotide infusion, ceftriaxone, and proton pump inhibitor. While obtaining additional intravenous access and arterial line for hemodynamic monitoring, the patient became unresponsive, prompting intubation for airway protection. In conjunction with discussions with our gastroenterology (GI) colleagues, the plan was established for endoscopy once patient was hemodynamically stabilized in the intensive care unit (ICU). The patient was still noted to have ongoing bleeding from the mouth and nose concerning for continued variceal bleeding. As such, the decision was made by the ED team to insert a Bard Blakemore tube. The device was placed successfully on first attempt with an endotracheal tube introducer device (bougie) inserted in a distal hole to guide initial

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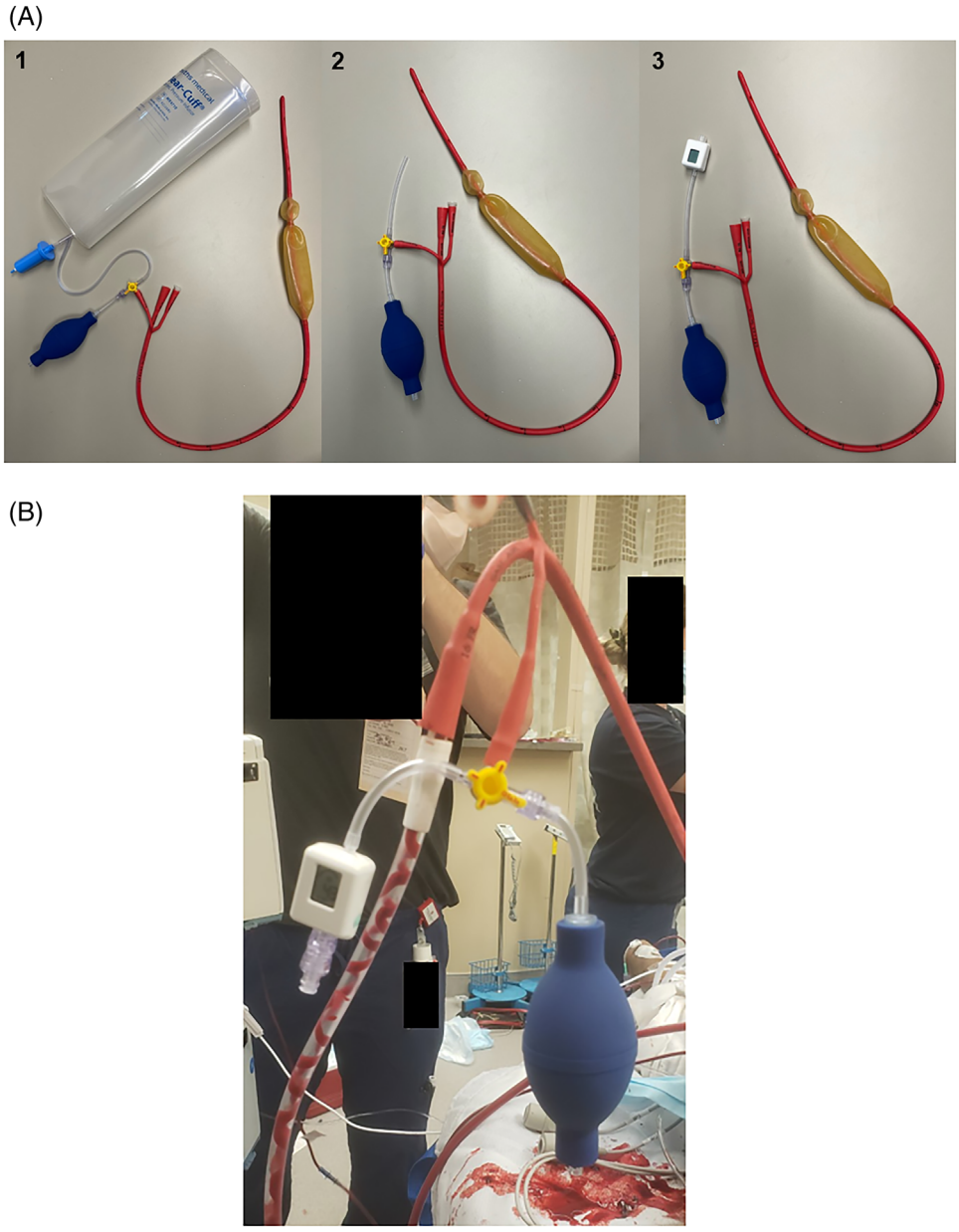

FIGURE 1 (A) Setup of continuous pressure monitoring using Compass in 3 steps: (1) attach Sengstaken–Blakemore (or equivalent) tube to pressure bag; (2) cut tubing to pressure bag; and (3) attach Compass. (B) Setup from (A) in use for our patient

placement within the esophagus. The gastric balloon was first inflated with 100 mL of air, and once gastric placement was confirmed in the stomach with x-ray, it was insufflated to a total volume of 250 mL of air to achieve gastric variceal tamponade. Constant traction was applied to the device using a 1 L normal saline bag acting as a 1 kg weight, which was hung with gauze over an intravenous pole. Once secured, the patient had >1 liter of blood immediately removed from the gastric suction port with ongoing bleeding from the nose and mouth, presumed to be esophageal in origin. Thus, the esophageal balloon was inflated to 35–40 mmHg, at which point, bleeding ceased. Owing to the lack of an available manometer, the esophageal balloon pressure was continually monitored by using a lumbar puncture Compass digital pressure monitor connected via a 3-way stopcock to the esophageal balloon port and a bulb inflation hand pump (Figure 1). The hand bulb allowed for incremental fine tuning of esophageal balloon pressures based on the Compass digital readings. After bleeding was controlled, the patient's vital signs began to stabilize. The patient was then transported to the ICU and the ICU team was instructed on proper care for the balloon tamponade device, as well as how to monitor the esophageal balloon pressure using the Compass.

The ED team was notified that the esophageal balloon had inadvertently been inflated to a pressure >199 mmHg for an unknown amount of time by ICU nursing staff approximately 30 minutes after arrival to the ICU. This was identified by the reading on the digital Compass

gauge. This was quickly corrected to a pressure between 35 and 40 mmHg. GI performed endoscopy 4 hours later, where an esophageal laceration with continued bleeding was identified. No intervention was completed by GI because of concern for a mucosal tear versus possible perforation. Computed tomography chest imaging by surgery determined there was no frank esophageal perforation, and their evaluation favored either a partial or contained perforation, if any perforation was present at all. At the time, patient was too hemodynamically unstable for a transjugular intrahepatic portosystemic shunt. The patient survived for 3 weeks with no evidence of esophageal perforation but continued critical illness; at that time, goals of care discussion was had with the family and ICU team, and the decision was ultimately made to transition patient to a code status of Do Not Resuscitate to reflect the family's wishes on behalf of the patient to not undergo chest compressions in the setting of cardiopulmonary arrest. The patient ultimately expired after family transitioned her to comfort care because of her clinical condition approximately 3 weeks later.

3 | DISCUSSION

The management of acute variceal bleeding consists of volume replacement, prophylactic antibiotics, and pharmacological therapies such as vasopressin and octreotide.[8] For cases refractory to this management, balloon tamponade is highly effective for controlling bleeding temporarily, with immediate control of hemorrhage in over 80% of patients.[9] Unfortunately, hemostasis is usually transient and associated with potentially lethal complications such as necrosis or perforation of the esophagus, resulting in mortality rates as high as 20%.[2] Therefore, balloon tamponade devices should be restricted only to patients with uncontrollable active bleeding for whom a more definitive therapy is planned within 24 hours of placement.[4,9] Of these complications, esophageal perforation is rare and potentially lethal. Perforation may occur secondary to malposition or overinflation of the esophageal balloon.[6] However, a manometer may be difficult to find and successfully attach in a high-pressure, time-limited situation. Here, we describe a novel technique using a Compass Lumbar Puncture digital pressure device to allow for a constant real-time monitoring of the esophageal balloon pressure. This, in combination with a 3-way stopcock and a hand bulb inflation pump as described, provided an easy method to monitor and accurately inflate the esophageal balloon to a pressure between 35 and 45 mmHg. It should be noted that these devices generally measure pressure in cm H2O, so to convert the reading to mmHg, multiply the reading by 0.735. It is important to confirm the unit of measurement the digital Compass reports to avoid an over- or underinflation issue. This device, or others like it, is easily found and accessible, especially in the ED as an adjunct to commercially available lumbar puncture kits. They have also been used for central venous[10] and abdominal pressure[11] measurements. Although unfortunately in our presented case the pressure was inadvertently increased to >199 mmHg, the continued monitoring of this device allowed for quick detection and correction of this issue, whereas the typical setup would not have detected this problem.

4 | CONCLUSION

Balloon tamponade devices placement are typically high-stress, high-resource usage events that require both prompt patient resuscitation and good communication skills for the overall resuscitation to have the greatest chance of success. The instantaneous continuous feedback provided by a digital monitoring device for a balloon tamponade device contributes positively to this endeavor. Once the decision to place a balloon tamponade device has been made, it is imperative that it is inserted and inflated properly to provide both tamponade of the varices as well as safe implementation of the device. As demonstrated here, digital manometry of a balloon tamponade can be accomplished using items readily found inside most EDs: the pressure ball and stopcock from a pressure intravenous bag cuff and the digital Compass from a lumbar puncture kit. This provides the advantage of real-time digital reading as well as the ability to inflate the device using the pressure ball. Ensuring proper pressure to create tamponade at the varices is of the utmost importance as the insertion of a balloon tamponade device may lead to a successful resuscitation free of iatrogenic injury.

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CONFLICTS OF INTEREST

No conflicts of interest to report.

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