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Case Report

Percutaneous catheter drainage of secondary abdominal compartment syndrome: A case report☆,☆☆

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ABSTRACT

Abdominal compartment syndrome can be a lethal entity when not treated in a timely fashion. Current standard of care involves emergent decompressive laparotomy by the surgical team. In this case, a 52-year-old male who developed abdominal compartment syndrome secondary to hemoperitoneum underwent emergent drain placement as decompressive laparotomy was not an optimal option for management. Little literature exists on the utility of drain placement or paracentesis for decompression in overall patient morbidity and mortality. However, when necessary, drain placement shows similar outcomes when compared to the standard of care. Interventional radiologists are uniquely positioned to provide drainage guided management for abdominal compartment syndrome in emergent settings.

Introduction

Abdominal compartment syndrome (ACS) is a vastly underrecognized and lethal entity [1–4].When left untreated, a patient may quickly go into multisystem organ failure, and ultimately, result in death. Diagnosis is made via bladder pressure measurements which represent intra-abdominal pressures. Any value greater than 12 mmHg is considered intra-abdominal hypertension. Furthermore, critically ill patients in whom intra-abdominal pressure measurements may not be possible, increases the need for providers to make a prompt clinical diagnosis. Gold standard treatment is decompressive laparotomy, however, the utility of paracentesis or catheter mediated therapy for decompression is not well represented in the literature. In emergent situations, interventional radiologists are uniquely situated with the ability to quickly decompress the abdomen with catheter placement. Here we present a case report of an acutely decompensating patient intraprocedurally who required emergent catheter directed decompression of ACS secondary to hemoperitoneum.

Case Report

A 52-year-old male with cirrhosis and history of variceal bleeding was emergently transferred from an outside hospital

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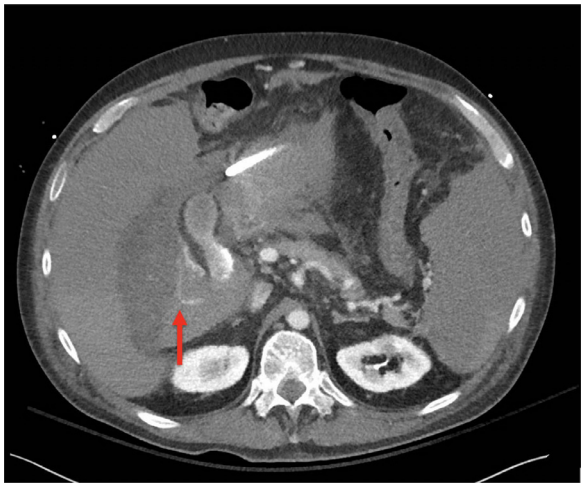

Fig. 1 – Computerized tomography of the abdomen and pelvis demonstrates active contrast extravasation from the perihepatic arteries. There is extensive hemoperitoneum visualized.

Fig. 2 – Ultrasound imaging showing an intra-abdominal drainage catheter during placement in the right upper quadrant fluid collection. An additional intra-abdominal catheter was placed with a total volume of 3 L of hemorrhagic fluid removed.

following significant distal esophageal bleed status post endoscopy, failed variceal banding, and subsequent unsuccessful TIPS procedure attempt. Prior to arrival, he had received 9 units of packed red blood cells, 2 units of fresh frozen plasma, and 1 unit of platelets. Upon transfer to the emergency department, he presented with a Blakemore tube in place, and was on Levophed for pressor support. Contrast-enhanced CT abdomen and pelvis showed active bleeding from the hepatic hilum and large volume hemoperitoneum (Fig. 1). Massive transfusion protocol was initiated, and the patient was stabilized prior to presenting to the interventional radiology suite for Transjugular Intrahepatic Portosystemic Shunt (TIPS) placement and embolization.

Hepatic angiogram showed normal course and caliber of the right and left hepatic arteries. Given CT angiogram findings, the decision was made to Gelfoam embolize the right hepatic artery. This was done successfully with a small volume of Gelfoam slurry. Attention was then turned to the TIPS portion of the procedure. After jugular access, during attempts at portal access, it was noted that the patient's vital signs were starting to change. The patient's oxygen saturation descended to 65%. He became tachycardic with heart rate in the 110 seconds as well as hypotensive. Fluoroscopic exam showed hypoinflated lungs despite adequate placement of the endotracheal tube. In the setting of known hemoperitoneum, abdominal exam was performed showing a distended and taut abdomen. Ultrasound performed in the interventional suite showed a large complex fluid collection. The clinical findings were suggestive of secondary ACS. Subsequently, two 8F intra-abdominal catheters were placed under sonographic guidance using trocar technique (Fig. 2). Three liters of hemorrhagic fluid was drained, and the patient clinically started to improve. The patient's vital signs improved. TIPS procedure was then completed successfully. One abdominal catheter was left in place for drainage, as the other had become dislodged. The patient then returned to the intensive care unit for further management and ultimately passed away due to significant blood loss.

Discussion

ACS is defined as an acutely elevated intra-abdominal pressure greater than or equal to 12 mmHg [1,3]. Many entities can lead to ACS such as: abdominal trauma, recent surgery, fluid resuscitation, hemorrhage, infection, pneumoperitoneum, and ischemia [5]. Primary symptoms include abdominal pain and distention. Secondary signs of ACS are: respiratory depression, decreased cardiac output, visceral ischemia due to decreased perfusion, and/or renal failure. When left untreated, this condition can be fatal. It becomes increasingly more important for overall prognosis that ACS be recognized early and be quickly treated. Current standard of care is decompressive laparotomy [2]. However, when a patient is sedated, it is difficult to differentiate clinical changes and what they may be secondary to. In this case report, we discuss the importance of understanding clinical findings and the role of interventional radiology in treatment.

As evidenced by our patient, it is of utmost importance to not only recognize signs of clinical deterioration but to also correctly identify what the underlying cause is. In a patient who previously underwent a failed TIPS procedure, and with active upper gastrointestinal bleeding, vital signs may change due to hypovolemia and inadequate fluid resuscitation. However, CT imaging obtained prior to procedure did show hemoperitoneum in the setting of active bleeding. Large volume hemoperitoneum is known to cause ACS secondary to compression of intra-abdominal contents leading to increased intra-abdominal pressure. This patient was not able to communicate pain. Hemodynamic instability was the first clinical indicator of any additional changes to the clinical picture.

Pathophysiology of ACS is complex. As intra-abdominal pressures rise, there is subsequent compression of the arterial in-flow and venous outflow, which can lead to ischemia. Compression of the circulatory vessels can lead to cardiac

dysfunction. Similarly, there is upward displacement of the diaphragm which can ultimately lead to hypoventilation, changes in respiratory rate, and hypoxia [5]. This underlying mechanistic change seen in the aforementioned organ systems can be applied to all systems of the body in relation to damage caused by ACS. As in our patient, the primary sign of any alteration in their clinical picture was initial changes in respiration despite being on a ventilator and sedated. Although this change in clinical picture could be secondary to hypovolemic and hemorrhagic shock, it did not entirely explain the patient's respiratory status change. Prompt bedside ultrasound and physical exam revealed significant hemoperitoneum.

Standard of care as determined by the World Society of ACS can be divided into 2 algorithms via the medical or surgical management pathway [6] based on patients clinical presentation. Medical management of ACS should be initiated upon recognition of elevated intra-abdominal pressures (Grade I C recommendation) [6]. This includes sedation, neuromuscular blockade, evacuating intraluminal contents, paracentesis, percutaneous drainage, avoiding excess fluid resuscitation, and organ support [6]. The ultimate goal is to alleviate pressures and go to the operating room for definitive management. Serial monitoring of intra-abdominal pressures is performed every 4 hours or continuously with a goal of pressures less than 15 mmHg [6]. Percutaneous drainage itself is recommended if elevated intra-abdominal pressures are secondary to space occupying substances within the abdominal cavity (Grade 2 C recommendation) [6]. A systematic review on catheter directed decompression for definitive management versus decompressive laparotomy has yet to be performed.

Likewise, there is limited literature on emergent intraoperative development of ACS. In our patient, the decision was made to promptly place 2 intra-abdominal catheters to alleviate the pressure. Immediately following this, the patient's respiratory rate, oxygenation, heart rate, and blood pressure improved. This displays the advantage of having the interventional radiology team available for definitive management of ACS secondary to abdominal cavity space occupying lesions/fluid collections. Catheter directed drainage of ACS has been advocated for due to its less invasive nature and rapid availability [7]. Decompressive laparotomy may leave patients with an open abdomen causing increased fluid losses, infection, fluid collections, fistula formation, hernias, or cosmetic concerns [1].

However, it is unclear how this affects long term morbidity and mortality of the patient population in interest. Cheatham et al performed a single center case control comparison of patients treated with catheter decompression versus decompressive laparotomy [7]. Definitive measurements on intra-abdominal pressure was measured. This study found that both, catheter drainage and laparotomy, were effective in decreasing abdominal pressure and improving overall abdominal perfusion [7]. The most striking finding is that 81% (n = 31) of patients were able to avoid laparotomy all together [7]. Additionally, those that did not drain at least 1 L of fluid or decrease abdominal pressure by at least 9 mmHg in the first 4 hours following decompression required subsequent laparotomy for definitive treatment [7]. Limited data has shown that there is reduced length of stay and improved survival to discharge when comparing percutaneous drainage and decompressive laparotomy [7,8].

With this study in mind, it is crucial to recognize that interventionalists play a vital role in catheter directed treatment of ACS. The future of medicine is geared towards minimally invasive management of patients to improve overall outcomes. Interventional radiologists are at the center of this discussion with their diverse training and ability to perform procedures under image guidance.

Conclusion

ACS can be difficult to recognize in intubated and sedated patients undergoing procedures. Secondary signs of ACS can be easily missed, pointing to the importance of prompt recognition and providing treatment. Standard of care is decompressive laparotomy. However, in select patients with intra-abdominal space occupying processes, the utility of abdominal catheter directed decompression is advantageous. This has yet to be thoroughly studied in a large sample size or random clinical trial. Although the patient did not survive due to the complex presentation and underlying comorbidities, their vital signs improved with drain placement for management of ACS. Therefore, in emergent settings, timely drain placement by the interventional radiology team should be considered.

Patient information

Patient information was de-identified and concealed to protect their identity.

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