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Severe intracranial and intra-abdominal hemorrhage: timing is everything

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CASE PRESENTATION

A pedestrian was struck by a motor vehicle traveling at high speed and was found to be in asystole requiring cardiopulmonary resuscitation, with return of spontaneous circulation in the field. Upon arrival in the emergency room, primary survey was notable for hypotension and Glasgow Coma Scale score of 3. Massive transfusion protocol was activated, and the patient was intubated. Secondary survey revealed depressed skull fracture and deformity of the left lower extremity. Extended focused assessment with sonography in trauma (eFAST) demonstrated absent right lung sliding, but no initial intra-abdominal free fluid, although views were limited due to body habitus. A right 28-French chest tube was placed, which returned only air. The patient was stabilized after transfusion of four units of packed red blood cells, four units of fresh frozen plasma, and one unit of platelets. CT with the institutional trauma protocol demonstrated a large holohemispheric right subdural hematoma with 19 mm midline shift and effacement of basal cisterns, along with diffuse subarachnoid hemorrhage (figure 1). In contrast to the negative intra-abdominal findings on eFAST earlier, the scan showed active extravasation in the right lower quadrant, which was concerning for mesenteric bleeding, grade 3 liver laceration with perihepatic hematoma, and grade 2 splenic laceration with perisplenic hematoma (figure 2). Additionally, multiple rib fractures, pulmonary contusions, and multiple extremity fractures were noted. Upon the completion of CT, the patient started to exhibit Cushing's triad, raising concern for brain herniation.

Figure 1 CT of the head revealing right subdural hematoma with midline shift.

What would you do?

A. Decompressive craniectomy followed by exploratory laparotomy
B. Emergency right-sided burr hole creation followed by exploratory laparotomy
C. Medical management of intracranial hypertension (intravenous mannitol or hypertonic saline) followed by exploratory laparotomy
D. Simultaneous decompressive craniectomy and exploratory laparotomy

What we did and why

Correct answer D. Simultaneous decompressive craniectomy and exploratory laparotomy

In a patient with polytrauma, the neurological examination can be confounded by ongoing hemorrhagic shock. Although circulatory support remains a key part in the primary resuscitation of patients in extremis, eFAST is an important adjunct in triage and management guidance. As demonstrated in this case, it is critical to understand the pitfalls and limitations of eFAST. First, technical and interpretive errors have been noted to be operator dependent. Second, eFAST has limited utility in the detection of small-volume intraperitoneal fluid, as the median volume of detection is 100 mL to 200 mL.[1] The sensitivity of eFAST has been reported to be variable in obese hemodynamically unstable patients with blunt abdominal trauma.[2] Therefore, eFAST findings which do not match the clinical picture should be repeated, or hemodynamics should prompt either a CT scan or operative exploration.

Given the CT findings, we initiated administration of mannitol and 23.4% hypertonic saline bolus while preparing for exploratory laparotomy. However, the patient developed hypertension, bradycardia, and widened pulse pressure, concerning for brain herniation. After discussing with our neurosurgery team, we decided to proceed with simultaneous exploratory laparotomy and decompressive craniectomy.

On laparotomy, there was a mesenteric vessel injury in the mid-small bowel with active bleeding. Adjacent ischemic small bowel was resected, and the bowel was left in discontinuity. The abdomen was packed and temporarily closed. Concurrently, the neurosurgery team performed a right hemicraniectomy and evacuation of subdural hematoma. There was extensive brain herniation from out of the dura

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Figure 2 Arterial extravasation from distal small bowel mesentery.

opening. The patient was transferred to surgical intensive care unit for further resuscitation and remained comatose off sedation, with fixed and dilated pupils, without corneal or gag reflex. A brain death examination could not be performed due to equivocal presence of cough reflex. In view of a non-survivable brain injury, further medical treatment was deemed ineffective. The patient was transitioned to comfort care and died.

Traumatic brain injury (TBI) resulting from high-energy injury mechanisms can often be associated with concomitant thoracoabdominal hemorrhage. Advanced Trauma Life Support advocates for definitive bleeding control and volume resuscitation as priorities in TBI to prevent secondary insults to the brain. However, in the case of impending brain herniation, performing sequential operations (ie, damage control laparotomy followed by decompressive craniectomy) may result in devastating neurological outcomes. Simultaneous multisystem surgery (SMS) is practiced in the military setting to manage blast-induced polytrauma but is less commonly performed in civilian trauma centers.[3] The World Society of Emergency Surgery consensus guidelines on TBI polytrauma patients recommend the implementation of SMS to improve outcomes for patients requiring hemorrhage control.[4] On an institutional level, it is important to develop protocols to promptly recognize the indications for SMS, facilitate dialogs between trauma providers and subspecialists, as well as provide staffing support for such treatment. Further studies are also needed to examine the resource utilization and benefits of SMS in civilian trauma centers to substantiate national guidelines.

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