Challenging Cases in Pediatric Trauma: Management of the Open Abdomen

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Introduction:
This case illustrates the difficulties associated with the diagnosis of intestinal injuries in the presence of blunt trauma, and the management of the open abdomen using temporary techniques.

Case Study:
A 11-year-old female was struck by a truck traveling at a high rate of speed while riding her bicycle without a helmet. On arrival her GCS was 8. Her pulse was 136 and blood pressure was 101/37. She was intubated and underwent CT scans of her head, neck, chest, abdomen, and pelvis. Multiple fractures were diagnosed which included the left humerus, femur, radius/ulna, distal tibia/fibula, and multiple vertebral fractures. Her left foot was pulseless and on arteriography, a single occlusion was revealed in the anterior tibial artery. Other injuries included significant pulmonary contusion, grade 3 splenic injury, pulseless and on arteriography, a single occlusion was revealed in the anterior tibial artery. Other injuries included significant pulmonary contusion, grade 3 splenic injury, and perforation with diffuse peritonitis. The test has proven quite effective in identifying solid organ injuries but is therefore of limited value in identifying pediatric patients who require exploration. CT scan of the abdomen and pelvis was negative. On day 5, she developed abdominal distention and hypotension. A repeat CT scan demonstrated extraluminal air and fluid collection in the left lower quadrant. During exploration a sigmoid colon perforation was identified in a segment with a degloving injury. Due to significant fluid overload abdominal closure was not feasible.

Over the ensuing 2 weeks, she underwent serial abdominal washouts, fluid restriction, and temporary abdominal closure utilizing a Wittmann patch. The abdomen was closed after 2 weeks with fascial and skin closure, secured with retainer sutures. The patient was extubated on day 29 and discharged to a rehabilitation facility in good condition.

Discussion:
Delay in Diagnosis of Blunt Bowel Injury in the Pediatric Population
Blunt bowel and mesenteric injuries (BBMI) represent a unique challenge to those who care for pediatric trauma patients. Most authors report an incidence of 10% (1–6). Despite the occurrence of these injuries, there remains legitimate concern regarding the consequences of “missed” injuries and delayed diagnosis. The diagnosis of BBMI in children is problematic for a number of reasons. BBMI are diagnosed 6 days after the initial trauma despite obtaining CT scans of the abdomen. These are quite common in poly injured, malnourished, and immunocompromised, as well as subjects with head trauma. The presence of blood in the peritoneum is not an indication for laparotomy in these patients. Similarly, intra-abdominal fluid identified by ultrasound is non-specific and therefore of limited value in identifying pediatric patients who require exploration. CT is currently the test of choice for children (and adults) who suffer blunt abdominal trauma. The test has proven quite effective in identifying solid organ injuries but is less reliable with injuries to the bowel and mesentery. In this patient, the injury was diagnosed 6 days after the initial trauma despite obtaining CT scans of the abdomen. This delay may have been due to the nonspecific findings on exam and imaging and could reflect the nature of a mesenteric injury that lead to evolving bowel ischemia and perforation with diffuse peritonitis.

Therefore, the decision to operate children with suspected blunt bowel or mesenteric injury should be based not on CT findings alone but on a clinical picture that includes serial physical examinations. Prompt treatment after diagnosis and a high index of suspicion are essential to minimize complications.

References:
5. The Open Abdomen: Management of the open abdomen presents numerous challenges in order to contain the significant loss of protein and fluid, loss of bowel function and loss of domain. These are quite common in poly injured, malnourished, and immunocompromised, as well as subjects with head trauma. BBMI are diagnosed 6 days after the initial trauma despite obtaining CT scans of the abdomen. These are quite common in poly injured, malnourished, and immunocompromised, as well as subjects with head trauma. The presence of blood in the peritoneum is not an indication for laparotomy in these patients. Similarly, intra-abdominal fluid identified by ultrasound is non-specific and therefore of limited value in identifying pediatric patients who require exploration. CT is currently the test of choice for children (and adults) who suffer blunt abdominal trauma. The test has proven quite effective in identifying solid organ injuries but is less reliable with injuries to the bowel and mesentery. In this patient, the injury was diagnosed 6 days after the initial trauma despite obtaining CT scans of the abdomen. This delay may have been due to the nonspecific findings on exam and imaging and could reflect the nature of a mesenteric injury that lead to evolving bowel ischemia and perforation with diffuse peritonitis.

Temporary closure methods we utilized in this case included the Barker vacuum pack, the ABthera (KGI, San Antonio, TX) and the Wittmann patch (Star Surgical Inc., Burlington, WI). The negative pressure dressings allowed active removal of fluid and reduction in bowel edema thus providing medial tension which helped minimize fascial retraction and loss of domain. Other advantages are its simplicity; it can be placed rapidly and allows quick access for re-entry, as well as sutures free. The Wittmann patch acts as an artificial butt that maintained domain and facilitated reapproximation of fascia. However, it lacked control of third space fluid and had the potential to adhere to abdominal viscera.

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