

# Challenging Cases in Pediatric Trauma: Management of the Open Abdomen

Firas Madbak MD

Lehigh Valley Health Network, Firas\_G.Madbak@lvhn.org

William D. Hardin Jr, MD, FACS, FAAP

Lehigh Valley Health Network, William.Hardin@lvhn.org

Follow this and additional works at: <https://scholarlyworks.lvhn.org/surgery>

 Part of the [Other Medical Specialties Commons](#), [Pediatrics Commons](#), [Surgery Commons](#), and the [Trauma Commons](#)

---

## Published In/Presented At

Madbak, F., & Hardin Jr, W. (2012). *Challenging cases in pediatric trauma: Management of the open abdomen*. Poster presentation.

This Poster is brought to you for free and open access by LVHN Scholarly Works. It has been accepted for inclusion in LVHN Scholarly Works by an authorized administrator. For more information, please contact [LibraryServices@lvhn.org](mailto:LibraryServices@lvhn.org).

# Challenging Cases in Pediatric Trauma: Management of the Open Abdomen

Firas Madbak, MD and William D. Hardin, Jr., MD, FACS, FAAP  
Lehigh Valley Health Network, Allentown, Pennsylvania

## 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 vertebrae. 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, and a widely displaced pelvis. No mass lesions or significant axonal injury were viewed on the CT of the head.

The child was initially treated with fluids, C-spine collar, and fracture stabilization. She underwent ORIF of the pelvic ring, left femur, and tibia-fibula fractures. A repeat CT scan of her 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 retention 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 Patient

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 rarity 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. Traditional methods of diagnosis include clinical examination, diagnostic peritoneal lavage, ultrasound, and computed tomography. All modalities have limitations in the pediatric patient. Clinical examination is often unreliable in children due to the high incidence of distracting injuries, especially head trauma. Additionally, the clinical exam is often difficult due to anxiety and variable ability to communicate. Diagnostic peritoneal lavage, used more commonly in the care of adult trauma victims, has little utility in pediatric trauma. Since most liver and spleen lacerations in children are managed nonoperatively,

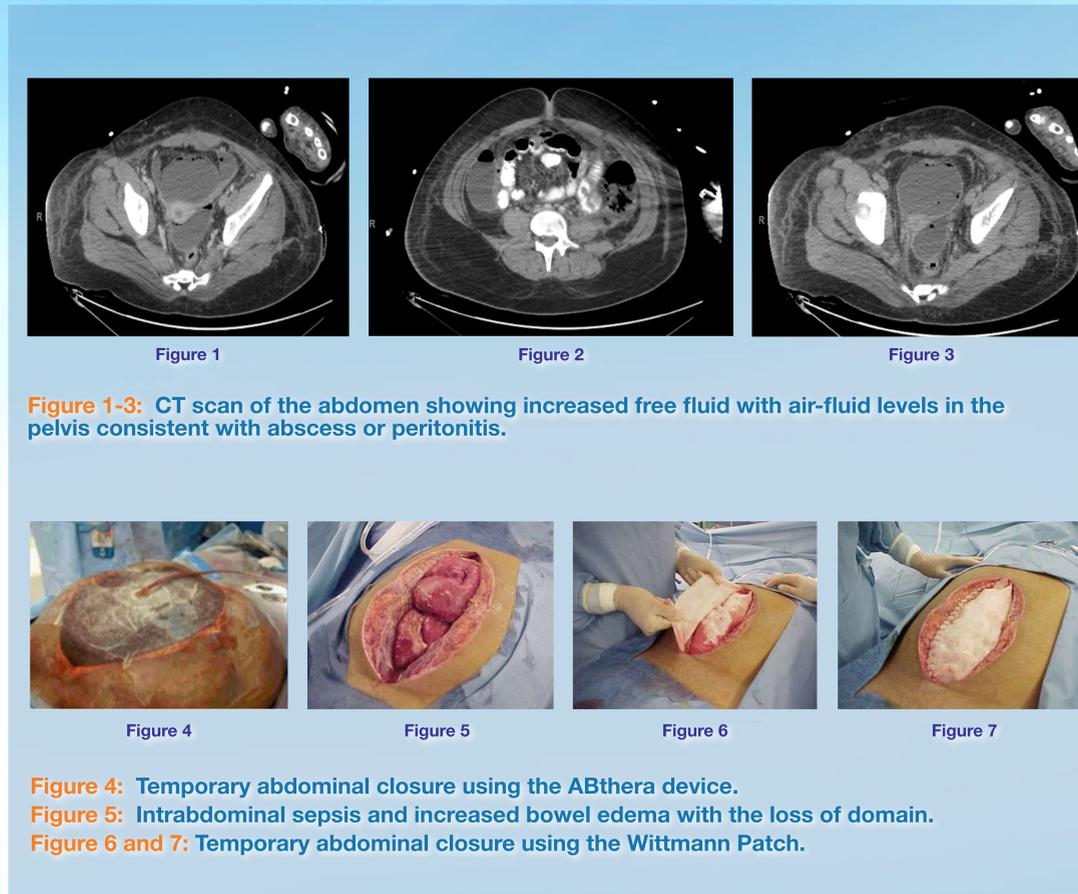


Figure 1-3: CT scan of the abdomen showing increased free fluid with air-fluid levels in the pelvis consistent with abscess or peritonitis.

Figure 4: Temporary abdominal closure using the ABthera device.

Figure 5: Intrabdominal sepsis and increased bowel edema with the loss of domain.

Figure 6 and 7: Temporary abdominal closure using the Wittmann Patch.

the presence of blood in the peritoneum is not an indication for laparotomy in these patients. Similarly, intra-abdominal fluid identified by ultrasound is nonspecific 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 explore 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.

## 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, septic patients, wound infections and intraabdominal abscesses. They are consequences of prolonged atmospheric exposure of abdominal viscera; intestinal ischemia from abdominal compartment syndrome and/or delayed resuscitation. Morbidity associated with wound complication from the open abdomen remains high (25%) and is associated with the timing and method of closure and fluid and transfusion volume. Aggressive fluid resuscitation often prevents early closure and hence leads to higher morbidity.

Temporary closure methods we utilized in this case included the Barker vacuum pack, the ABthera (KCI, 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 sutureless fixity. The Wittmann patch acts as an artificial burr 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.

## References:

1. Albanese C, Meza M, Gardner M, et al: Is computed tomography a useful adjunct to the clinical examination for the diagnosis of pediatric gastrointestinal perforation from blunt abdominal trauma in children? J Trauma 1996; 40:417-421
2. Albanese C, Meza M, Gardner M, et al: Is computed tomography a useful adjunct to the clinical examination for the diagnosis of pediatric gastrointestinal perforation from blunt abdominal trauma in children? J Trauma 1996; 40:417-421
3. Bensard D, Beaver B, Besner G, et al: Small bowel injury in children after blunt abdominal trauma: Is diagnostic delay important? J Trauma 1996; 41:476-483
4. Canty T Sr, Canty T Jr, Brown C: Injuries of the gastrointestinal tract from blunt trauma in children: A 12-year experience at a designated pediatric trauma center. J Trauma 1999; 46:234-240.
5. Tieu BH, Cho SD, Luem N et al. The use of the Wittmann Patch facilitates a high rate of fascial closure in severely injured trauma patients and critically ill emergency surgery patients. J Trauma. 2008 Oct;65(4):865-70.
6. Barker DE, Kaufman HJ, Smith LA, et al. Vacuum pack technique of temporary abdominal closure: a 7 year experience with 112 patients. J Trauma. 2000;48:201-207.
7. Miller PR, Meredith JW, Johnson JC, Chang MC. Prospective evaluation of vacuum-assisted fascial closure after open abdomen: planned ventral hernia rate is substantially reduced. Annals of Surgery. 2004 May; 239(5): 608-614. Study conducted using V.A.C.® Therapy System with V.A.C.® GranuFoam™ dressings.