Pediatric Abdominal Trauma
Making a Difficult Diagnosis

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Trauma injuries are a leading cause of death in the pediatric population, and abdominal trauma is not always apparent on initial workup. Here we present a case study with a review of the evaluation and management of several types of blunt abdominal trauma. Also provided are diagnosis and treatment algorithms and guidance on risk stratification.

A 5-year-old girl who was involved in a moderate-speed motor vehicle collision (MVC) is brought to the emergency department by EMS. She was a restrained backseat passenger in a booster seat, and there was moderate damage to the vehicle. The patient's mother was transferred to another hospital unconscious.

The child is crying but somewhat consolable. She has no obvious deformities or bruises. Her medical history is unknown. The patient continues to fuss, saying that it hurts everywhere and that she wants her mother.

Vital signs in the emergency department are as follows: blood pressure, 100/65 mm Hg; heart rate, 92 beats/min; respiratory rate, 28 breaths/min. Oxygen saturation is 98% on room air. The patient is crying, lying on a cart, alert, and oriented to place and person. Her pupils are equal, round, and reactive to light and accommodation, and extraocular movement is intact. Her mucous membranes are moist; and her head is normocephalic/atraumatic. Lungs are clear to auscultation bilaterally. Cardiovascular examination reveals regular rate and rhythm and no murmurs, rubs, or gallops. The abdomen is soft with mild voluntary guarding, although this is difficult to assess because of the child's crying. Bowel sounds are positive, and there are no bruises, palpable masses, or distension. On digital rectal exam, a guaiac stool test is negative and there is good rectal tone. The extremities are warm and dry, with +2 pulses and no obvious deformity or tenderness. Neurologic exam reveals a Glasgow Coma Scale (GCS) score of 15 and no focal deficits.

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INTRODUCTION

If this patient presented to your emergency department, what would you do? This article summarizes key points in the management of pediatric abdominal trauma patients, including diagnosis, common mechanisms of injury, risk factors, types of injuries to look for and how to identify them, and disposition. Because penetrating trauma accounts for only about 10% of pediatric abdominal trauma,[1,2] this article focuses primarily on blunt abdominal trauma and includes a brief discussion of penetrating trauma.

A solid foundation in pediatric abdominal trauma is essential for all emergency medicine physicians. Trauma is the leading cause of death in the pediatric population, and injuries to the abdomen are the third leading cause of pediatric trauma death, after injuries to the head and thorax.[1-3] Although relatively common, injuries to the abdomen are frequently missed and often fatal. In fact, the abdomen is the most common site of unrecognized fatal injury in pediatric trauma. Several confounding factors inherent to pediatric abdominal trauma account for this. Children often cannot adequately communicate their injuries to physicians, and they also are better able to compensate for significant injuries, which makes vital signs less helpful in identifying injuries early. Children can lose up to 45% of their total blood volume before showing any changes in blood pressure.[1,4]

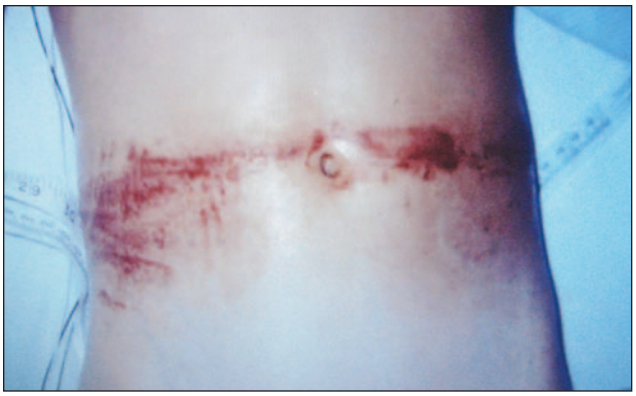


FIGURE 1. Abdominal bruising.

EPIDEMIOLOGY AND PATHOPHYSIOLOGY

In 2010, there were 146,953 cases of pediatric trauma (patients age < 20 years) reported to the American College of Surgeons' National Trauma Data Bank (NTDB).[2] Trauma occurs across all pediatric age-groups, but the incidence peaks in the teenage years (13 to 19 years) for all causes except falls. Males were approximately four times more likely than females to be injured as a result of firearms; otherwise, gender did not play a role in incidence or fatality from other mechanisms.[2]

Approximately 80% of pediatric trauma cases are the result of blunt trauma, and of these, MVCs account for more than 50% of blunt abdominal trauma injuries.[2] Motor vehicle collisions are the leading cause of mortality in children who die from trauma.[2] Injuries to the abdomen and thorax have two of the highest associated fatality rates. The majority of penetrating trauma cases are from gunshot wounds. Firearm injuries carry a case fatality rate of nearly 12%.[2]

It has been said time and again, but is especially true in relation to trauma, that children are not small adults. Children have much more pliable skeletal systems, which helps reduce their risk of fracture but in turn results in decreased protection of internal organs. This pertains particularly to the bladder, which has not yet settled into the pelvis and is at increased risk for trauma, especially secondary to use of lap belts. In addition, children have less fat and muscle to protect them. Less muscle mass, along with the loose attachments of the intestines, puts them at higher risk for deceleration injuries. Children also have a much smaller surface area over which to distribute the force of impact. All these factors contribute to a unique pattern of injury in children who present following abdominal trauma.

BLUNT ABDOMINAL TRAUMA

Evaluation

The presentation of children with abdominal trauma varies widely. There may be apparent trauma, a distended and bruised abdomen, mild abdominal pain, or, as observed in the case patient, no specific signs or symptoms except for being stunned by the incident. Each of these presentations can carry with it anything from a negative workup and no obvious internal injury to a visceral laceration and internal bleed. This variability in presentation is another confounding factor in identifying and treating children with abdominal trauma. As discussed earlier, initial physical exam findings and vital signs are not always reliable in pediatric trauma, and often children do not provide an accurate or complete history. Thus, it is important to gather further details from bystanders, EMS, and parents/guardians about the incident and mechanism of injury and to use this information to focus the exam and diagnosis.

History—Questions should focus on the mechanism of injury, damage to the vehicle (if MVC), speed (if MVC or pedestrian struck by motor vehicle), other fatalities at the scene, and whether restraints were properly in place (if MVC). In instances other than those involving a motor vehicle, it is key to ask about the position of the child on impact, height of a fall, surface landed on, what part of the child made the initial contact, number of blows the child received, what the child was doing during the accident (eg, if the child was riding a bike, suspicion for pancreatic injury or duodenal injury from handle bars is warranted), and whether any protective gear was worn.

Physical Examination—Physical exam signs in general are insensitive in pediatric trauma. Signs that may be found on the physical exam include abdominal bruising (Figure 1), distention (this is often unreliable, however, since the stomach fills with air as the child cries), abdominal tenderness, peritoneal signs such as a firm, rigid abdomen, back pain, nausea, vomiting, rectal bleeding, hematuria, hypotension (late finding), and tachycardia. The presence of abdominal wall hematoma is associated with a substantially increased risk of

intra-abdominal injury.[1,5] Tachycardia is often the earliest sign of shock in a pediatric trauma patient.

Nonaccidental trauma must be considered in the evaluation of pediatric trauma patients. In a retrospective study conducted over a 10-year period at a level 1 trauma center, 11% of pediatric abdominal trauma cases were the result of nonaccidental trauma.[6] Abuse victims and those with accidental trauma had an equal risk of solid organ injury, but abuse victims had an increased risk of hollow viscus injury. Compared with children injured by accidental trauma, children who had been abused tended to present later and to have multiple injuries, more severe injuries, and injuries that were not consistent with a specific mechanism.[6]

Approach to the Ambiguous Diagnosis

Given that the history is often unclear or absent and physical exam is frequently unreliable, how should the child with abdominal trauma be evaluated in the emergency department?

One common approach is to obtain a battery of laboratory tests and plain radiographs and to proceed to advanced imaging and consultation if results are abnormal. A complete blood count, chemistries, liver function tests, measurement of amylase and lipase, urinalysis, and/or radiographs of the chest, abdomen, and pelvis may be included. It should be noted, however, that the hemoglobin and hematocrit levels will very likely be normal initially, even in the setting of acute hemorrhage. Gross hematuria (and, some would argue, microscopic hematuria) is occasionally associated with renal injury, and elevated hepatic transaminase and lipase levels may suggest hepatic and pancreatic injury, respectively.[7] However, these laboratory tests all lack sufficient sensitivity and specificity to diagnose or exclude an intra-abdominal injury. As for plain films of the abdomen, other than the occasional radiograph demonstrating free subdiaphragmatic air, they rarely contribute useful information in the evaluation of blunt abdominal trauma. As is frequently taught, the most useful test in acute trauma is the blood type and crossmatch.

Another approach would be to perform CT of the abdomen and pelvis on all potentially injured children. This would identify most major intra-abdominal injuries, although CT may easily miss hollow viscus injuries, pancreatic injuries, mesenteric injuries, and diaphragmatic injuries. In addition, this approach would subject many children to the significant risks of intravenous contrast and radiation exposure.

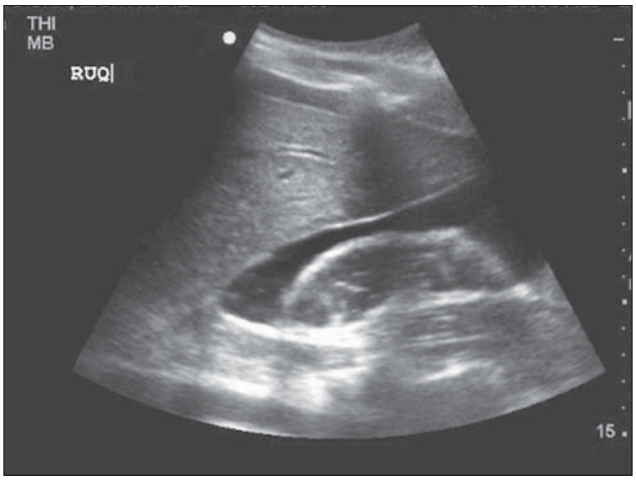
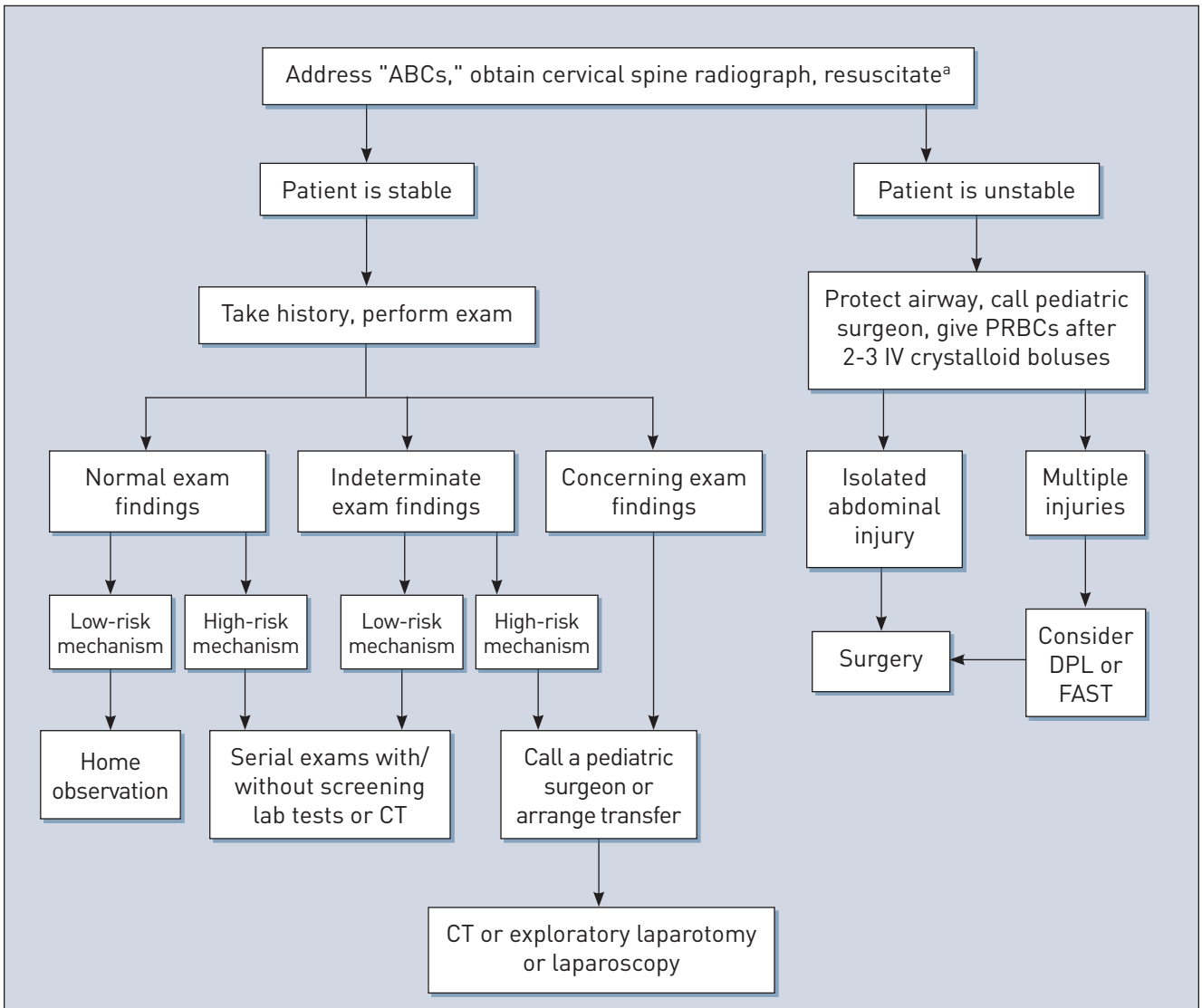


FIGURE 2. Free fluid in the right upper quadrant on FAST (focused assessment with sonography in trauma) scan.

The FAST (focused assessment with sonography in trauma) exam is also an option in the initial evaluation of trauma patients. This quick bedside study evaluating for the presence of free fluid (in the hepatorenal recess [Morison pouch], the splenorenal space, around the bladder, and in the pericardial space) does not use radiation and has proved to be highly sensitive in the detection of free fluid in both adult and pediatric patients (Figure 2). However, the FAST exam does little to evaluate or stage organ injuries and rarely dictates the management of these patients.[8-10] The rare exception is the multiply injured unstable patient, for whom a quick decision must be made either to initiate immediate celiotomy or to continue resuscitation and evaluation for extra-abdominal hemorrhage or severe brain or spinal injury.

The primary objective in managing pediatric abdominal trauma is to rapidly identify injuries that require intervention while minimizing harm or distress (eg, from needlesticks, catheters, radiation exposure, nontherapeutic surgery) to the child. Figure 3 suggests a practical approach to pediatric blunt abdominal trauma

FIGURE 3. Approach to Pediatric Blunt Abdominal Trauma



[a]See Figure 8.
"ABCs" = airway, breathing, circulation; CT = computed tomography; PRBC = packed red blood cell; IV = intravenous; DPL = diagnostic peritoneal lavage; FAST = focused assessment with sonography in trauma.

that integrates the history (mechanism of injury), physical exam, and ancillary studies.

SPECIFIC BLUNT TRAUMA INJURIES

The most common injuries associated with pediatric blunt abdominal trauma are solid organ injuries, and the most frequently injured organs are the liver (Figure 4), spleen (Figure 5), and kidney (Figure 6).[1,11,12] Injury to these organs should always be considered, especially when there is a significant mechanism of injury and focal findings on physical exam—right upper quadrant pain for liver and left upper quadrant pain for splenic injuries. The liver and spleen are at risk for contusion and laceration, which may lead to internal hemorrhage. In children, the capsules of both organs are thicker than in adults and thus may better contain the bleeding, hindering the ability to detect these injuries on physical exam. The greatest risk associated with liver and spleen injuries is hemorrhage. Hepatic hemorrhage carries a higher mortality than splenic hemorrhage.[3,13]

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FIGURE 4. CT showing liver laceration and shattered spleen from a 12-year-old child involved in a motor vehicle collision with lap belt injury.

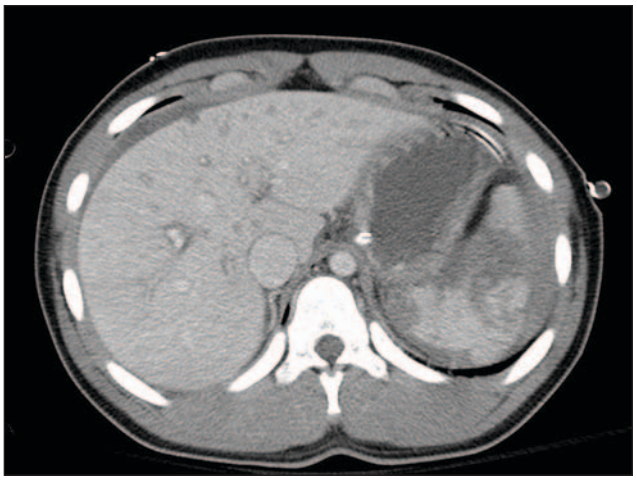


FIGURE 5. Splenic laceration.

Pancreatic Injury

This injury is commonly associated with handlebar accidents. It occurs when a child stops abruptly on a bike and the handlebars strike the upper abdomen. While pancreatic injury is uncommon, it must be considered, as patients with this injury may require operative management. CT and pancreatic laboratory testing (amylase and lipase) are useful in making this diagnosis.[11,14]

Seat Belt Syndrome

This is a constellation of injuries associated with motor vehicle restraints, especially two-point lap belts; these injuries include abdominal wall bruising, intra-abdominal visceral injury (most often small bowel), vertebral fracture, and spinal injury.[15-17] There are three mechanisms that result in seat belt syndrome: presubmarining, in which the belt is incorrectly placed over the abdomen rather than the legs; classic submarining, in which the occupant slides under the seatbelt; and jackknifing, in which the occupant flexes forward over the lap belt. Nearly three-quarters of children affected by seat belt syndrome were between ages 5 and 9 years,[18] an age range in which children tend to be too big for car seats and too small to sit in a regular unadapted seat. These children would benefit from a booster seat and are commonly injured due to lack of such adaptation. Children in SUVs and passenger cars are at greater risk than those in minivans.

Vertebral Fractures

These are often associated with abdominal trauma and can be associated with aortic injuries and ureteral injuries. With rapid deceleration and improperly placed seat belts and safety restraints, children are at increased risk for vertebral fractures such as Chance fracture, a bony fracture that travels posteriorly to anteriorly through the spinous process, pedicles, and vertebral body (Figure 7). This fracture often occurs in the thoracolumbar spine, and in many pediatric patients it is associated with intra-abdominal or aortic injuries. Patients with Chance fracture often complain of back pain and may or may not have bruising in the area of distribution of the seatbelt. In these patients, anteroposterior and lateral plain films of the thoracolumbar spine are usually sufficient. Occasionally, CT is needed to identify a fracture; if plain films are negative and clinical suspicion remains high, this modality is warranted.

Pelvic Fractures

These injuries are rare in the pediatric population, with an estimated incidence of one case per 100,000 per year.[19,20] However, they have a relatively high associated mortality; some studies report it as approaching 5%.[19,20] Children with pelvic fractures are less likely than adults to die from hemorrhage; rather they are more likely to die from associated central nervous sys-

FIGURE 6. Renal injury.

tem injuries.[19] Patients with an unstable pelvis or pelvic fractures should be thoroughly screened for vascular and genitourinary injuries. Angiography and genitourinary imaging, such as retrograde urethrography or cystography, should be considered.

CASE CONTINUATION

Laboratory tests ordered for the patient include measurement of amylase and lipase, urinalysis, liver function tests, and a complete blood count. Given the indeterminate findings on abdominal exam, CT of the abdomen and pelvis is performed. Lab results are within normal limits, and CT shows free fluid but no solid organ injury. What are the next steps in managing this case? What is the proper disposition?

MANAGEMENT STRATEGIES

Management of pediatric abdominal trauma hinges on clinical suspicion, serial exams, and history taking. In caring for a pediatric trauma patient, it is essential to stay calm and focused and to follow Advanced Trauma Life Support (ATLS) guidelines when conducting the primary and secondary surveys. As in adults, airway is the first priority. The leading cause of cardiac arrest in children is respiratory arrest, although in adults it is usually cardiac arrest that results in respiratory arrest. After the assessment of airway and breathing, circulation should be evaluated. If there is any suspicion for intra-abdominal trauma, early and aggressive fluid resuscitation with warmed

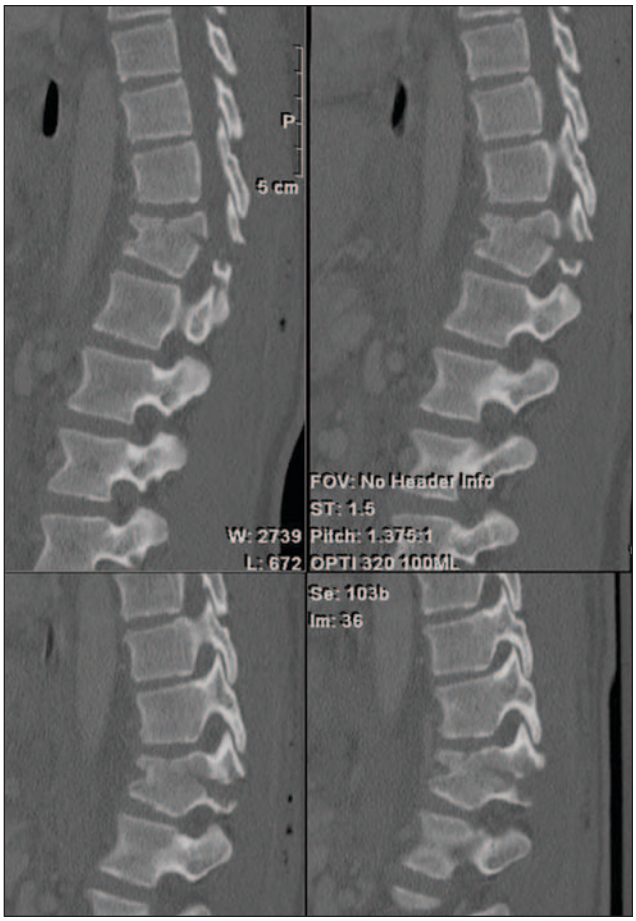
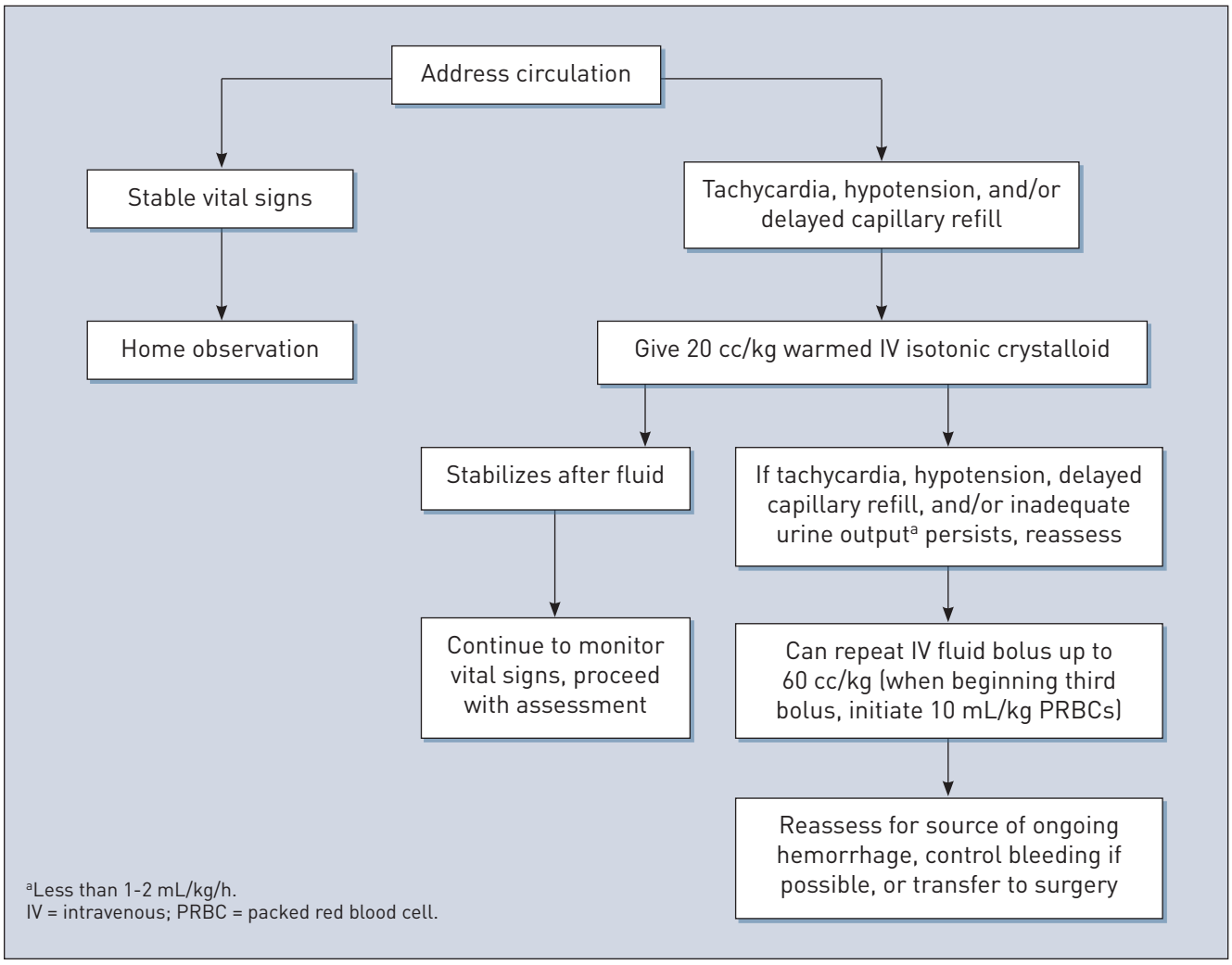


FIGURE 7. Chance fracture.

intravenous fluids (20 mL/kg of 0.9% normal saline IV fluid bolus) should be initiated. As described earlier, children with abdominal trauma do not show signs of shock until later; thus, early, quick action is warranted. Figure 8 provides a basic approach to fluid resuscitation in the pediatric trauma patient. After the "ABCs" (airway, breathing, and circulation) have been addressed, "D" (disability) and "E" (exposure) are the next concerns. A quick neurologic examination is needed (GCS, pupils, movement in all four extremities), followed by exposure of the patient. It is necessary to have the patient undressed to look for bruising and other obvious injuries. However, because of the large surface area exposed, strict temperature regulation is crucial, with particular attention to prevention of hypothermia.

After the primary survey has been completed, the ancillary tests mentioned above (chest or pelvic ra-

FIGURE 8. Fluid Administration in Pediatric Abdominal Trauma



[a]Less than 1-2 mL/kg/h.
IV = intravenous; PRBC = packed red blood cell.

diography, complete blood count, blood chemistries, liver function tests, measurement of amylase and lipase, and urinalysis) may be performed. If the results are suggestive of intra-abdominal hemorrhage or the patient becomes unstable, a pediatric surgeon should be immediately consulted. This discussion will help determine the need for immediate transfer, immediate operative intervention, or further evaluation. Many of the injuries mentioned above are managed conservatively with observation and supportive care in the hemodynamically stable patient. The patient in the case scenario may be placed into this latter category and would be appropriately managed with admission for serial abdominal exams, laboratory tests, and hemodynamic monitoring.

Solid Organ Injury

Splenic and liver injuries ideally should be managed nonoperatively.[12] Splenectomy in children carries a mortality of up to 50%, most commonly due to postsplenectomy infections. Children with known splenic injury should be followed with serial exams and serial hemoglobin/hematocrit measurements; serial liver function tests should be followed in liver injuries. In patients with splenic and hepatic injuries with high-grade but stable injuries, embolization with angiography is a possible alternative to exploratory laparotomy and resection. If the child remains hemodynamically unstable despite receiving adequate crystalloid and blood products, surgery is indicated. Between 90% and 98% of

pediatric patients with spleen injuries that are managed nonoperatively make a full recovery.[11]

As with liver and spleen injuries, pancreatic injuries are increasingly being managed without surgery. However, of all organ injuries, pancreatic injury is the most likely to fail nonoperative management, especially injuries grade 3 and higher that involve concomitant pancreatic duct injury.[11,21-23]

Chance Fractures

Chance fractures are usually managed medically. The fracture is reduced by placing the child in hyperextension and then applying a fiberglass body cast to immobilize the spine. If immobilization is not possible because of polytrauma or habitus, these fractures can be surgically repaired.[24]

Hollow Viscus Injuries

Small bowel is the most commonly injured hollow viscus in abdominal trauma. The jejunum is the most common site of small intestine involvement, with the area surrounding the ligament of Treitz being the most vulnerable because the fixation promotes shear stress tears.[25,26] Patients with hollow viscus injuries may have nonspecific exam findings ranging from no pain to peritonitis. In addition, physical exam findings may take up to 72 hours to manifest.[26,27] As previously mentioned, hollow viscus injuries are often missed on CT, thus creating a diagnostic dilemma. To complicate this further, morbidity and mortality increase when there is a delay in recognition and treatment. Often, patients with these injuries are admitted for serial exams and imaging. If hollow viscus injury is suspected, broad-spectrum antibiotics should be administered to cover aerobes and anaerobes.[28]

The classic circumstances associated with duodenal hematomas are bicycle accidents in which the handlebar provides pointed blunt force to the right upper quadrant; however, these injuries can also occur with abuse and in sporting events in which a forceful, concentrated blow to the right upper quadrant is sustained. Duodenal hematomas are often managed conservatively with bowel rest, nothing-by-mouth status, and nasogastric tube placement, but occasionally surgical drainage is required. Other less common bowel injuries include visceral tears and perforations; these most commonly occur at the ligament of Treitz or the ileocecal valve. Patients with these injuries often require surgical management, especially for tears grade 3 and higher. These patients are also at increased risk for pancreatic injuries, and careful evaluation, which may include ERCP (endoscopic retrograde cholangiopancreatography), should be performed to rule this out.[22]

Aortic Injuries

Traumatic aortic injury is rare, especially in children, with rates as low as 2.1% in pediatric trauma patients.[29] The thoracic aorta is the most common site for injury, and the most common type of injury is traumatic dissection.[30] Although uncommon, these injuries are associated with high morbidity and mortality.[30] The common approach to aortic injuries is medical management, with permissive hypotension and blood pressure control with β-blockers, until definitive therapy (open repair) can occur. Open repair requires single-lung ventilation, left heart bypass, and heparinization. While open repair has been the standard of care (as pediatric patients often outgrow grafts), trauma patients often have multiple injuries that make them unable to tolerate the open approach, and endovascular repair is evolving as a treatment strategy.[29,31,32]

Pelvic and Genitourinary Injuries

The pelvis must be included in the secondary survey of a pediatric abdominal trauma patient. While less common than solid organ injuries, pelvic injuries can result in significant morbidity and mortality. Pediatric patients are less likely than adults to suffer life-threatening exsanguinations from pelvic fractures and associated vascular injuries. Mortality from pelvic fractures in pediatric patients is more commonly associated with concomitant neurologic injuries, and massive hemorrhage in these patients is often from visceral injuries rather than vascular.[19,20] Therefore, children with pelvic fractures should have a thorough workup to look for associated injuries, rather than an assessment focused on the pelvic fracture itself. Pelvic fractures are mainly an indicator of multisystem trauma, as the pelvis in children is very pliable and requires a significant force to incur a fracture.[20,33] In fact, pelvic fractures in children are often managed nonoperatively with hip spica casts,

Table. Scoring System for Blunt Abdominal Trauma in Children[a]

Parameter	Score
Positive FAST exam	4
Abdominal pain	2
Peritoneal signs	2
Hemodynamic instability	2
AST >60 IU/L	2
ALT >25 IU/L	2
WBC count >9.5 x 10^9 g/L	1
LDH >330 IU/L	1
Lipase >30 IU/L	1
Creatinine >50 µg/L	1

[a]Score ≤7 has a negative predictive value of 97%.
FAST = focused assessment with sonography in trauma; AST = aspartate aminotransferase; ALT = alanine aminotransferase; WBC = white blood cell; LDH = lactate dehydrogenase.
Adapted from Karam et al.[45]

bed rest, slings, and non–weight bearing.[20,33] The medical literature suggests the one exception to nonoperative management is the older, more skeletally mature population with higher-grade, unstable pelvic fractures.[20,34]

Several types of pelvic injury in the pediatric population require special attention, including injuries to the bladder, testicles, kidneys, and urethra. Because the pelvis in pediatric patients is shallow, bladder rupture is more common in this population.[25] Evaluation and management of bladder rupture involves retrograde cystography.[35] Testicular rupture, although rare, also must be considered. It occurs in less than 1% of all trauma cases and is most commonly associated with sports-related injuries secondary to inadequate protective equipment and direct blunt force. However, if not recognized and treated, testicular rupture can result in infertility.[36] On exam, affected patients have a painful, swollen testicle. The diagnosis is usually made by a thorough physical exam and testicular ultrasound.[37] Management of these injuries historically has required surgical exploration, but more recent literature is suggesting success with conservative management.[38] Prompt diagnosis is needed to salvage the testicle, although the medical literature reports successful salvage rates up to 72 hours following the initial trauma.[36] Pediatric urogenital trauma is rare, occurring in less than 1% of trauma patients, and is very uncommon in patients without gross hematuria, difficulty voiding, or significant other trauma.[35]

Renal injuries are also fairly uncommon in pediatric trauma due to the protection provided by the rib cage.[39] The most common renal injuries encountered are lacerations and hematomas, and the majority of these are managed nonoperatively; this may involve mere observation or possibly percutaneous drainage of hematomas/urinomas.[40,41] Patients who are hemodynamically unstable or have persistent pain and renal laceration may require surgical exploration of possible retroperitoneal injury and possibly partial or total nephrectomy.[42]

Urethral injury is also a concern in the pediatric abdominal trauma patient. ATLS courses recommend examining the urethral meatus for blood as an indicator of urethral injury. However, traumatic urethral disruption in the pediatric population is relatively rare. Urethral injury should be investigated when blood is present, although this finding is not necessary for the diagnosis. In addition, urethral disruption should be considered in any pediatric patient with a pelvic fracture.[43] When urethral injury is suspected, retrograde urethrography should be performed and a catheter placed with the assistance of a urologist. Care for pediatric urethral injuries frequently is operative, and a pediatric urologist should be the primary decision-maker in management.[44] Delay in diagnosis and repair or inadequate repair increases the risk for impotence or incontinence.

Risk Stratification

In 2009, Karam et al[45] developed a scoring system to help physicians rule out intra-abdominal injury in pediatric patients with blunt abdominal trauma. Their study assessed more than 30 subjective and objective parameters, from lab values to mechanism, physical exam findings, and complaints. From this pool they isolated 10 findings that consistently predicted no intra-abdominal trauma. While their study included only 147 patients and their scoring system has not been validated, these parameters may serve as a guideline for approaching the pediatric patient with abdominal trauma. Accord-

ing to the study, a score of 7 or less has a negative predictive value of 97%. The score is obtained from the parameters listed in the Table.[45]

PENETRATING ABDOMINAL TRAUMA

Evaluation

Penetrating abdominal trauma constitutes a small subset of pediatric abdominal trauma and has its own subset of special considerations and injury patterns. In addition to a complete primary survey, a thorough secondary exam must be performed with attention to the entire abdominal cavity, which extends from the nipples to the pubic symphysis anteriorly and from the scapular tip to the iliac crests posteriorly. Careful examination of this area and the axillae and gluteal folds for entrance and exit wounds is essential. Additionally, information regarding the type of projectile and trajectory should be ascertained. Penetrating trauma from stab wounds is more likely to cause lacerations and injure the small bowel and liver. Because bullets have more kinetic energy and are more likely to ricochet within the abdominal cavity, gunshot wounds are more likely to cause visceral and vascular injury.[25]

FAST TRACK

Once abdominal injuries are stabilized, the next step is liberal consultation with, transfer to, or admission to a center with pediatric trauma expertise.

Management

While relatively uncommon, penetrating abdominal trauma accounts for approximately 10% to 20% of pediatric abdominal trauma admissions at trauma centers.[46] In the past, the management strategy for adult and pediatric penetrating abdominal trauma was exploratory laparotomy, as many diagnostic measures, such as CT and ultrasonography, often missed hollow viscus injuries, diaphragmatic rupture, retroperitoneal injuries, and other injuries associated with penetrating abdominal trauma. Current recommendations in adults, however, are leaning toward conservative management with broad-spectrum antibiotics to cover gram-negative bacteria and anaerobes and serial exams for the hemodynamically stable patient.[47,48] While no comparable guidelines have been established in pediatrics, studies such as those by Cigdem et al[49] and Moreno et al[47] suggest that conservative management may be a reasonable approach in select patients. Both of these case series were careful to exclude patients who where unstable or had signs of peritonitis. The data are still retrospective, with small numbers, and have not been reproduced. Thus, the decision not to operate on a penetrating abdominal trauma victim must be made by an experienced surgeon.

DISPOSITION

Fortunately, most children with abdominal trauma have no serious injuries and are discharged to the care of their parents. However, some pediatric abdominal trauma patients have serious injuries that warrant observation, while fewer require surgery, and some die from their injuries. Of 6,541 pediatric patients with abdominal injuries reported to the US National Trauma Database in 2011 who had an Abbreviated Injury Scale score of 3 or higher, 506 (7.74%) died.[2]

A careful and thoughtful history, physical exam, and evaluation for injuries are required to minimize morbidity and mortality in this population of patients. When identified, abdominal injuries should be stabilized. This should be followed by liberal consultation with, transfer to, or admission to a center with pediatric trauma expertise.

CONCLUSION

The young girl in the case was admitted for serial abdominal exams and hemoglobin measurements. She remained stable and was subsequently discharged to home 2 days after admission.

Pediatric abdominal trauma is a common and important issue for emergency physicians. Having an organized approach and a high suspicion for injury in spite of normal vital signs and exam findings is key. Because the injuries in pediatric abdominal trauma can be elusive and fatal, it is better to err on the side of caution in managing these patients. **EM**

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