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Retained Foreign Body

A 15-year-old male adolescent was brought to the ED by his father for evaluation of lacerations on the teenager's left forearm, which were caused by a shattered glass door. The accident happened approximately 45 minutes prior to the patient's arrival at the ED. The patient was up to date on all of his immunizations, including tetanus, and had no significant medical history.

On physical examination, the patient's vital signs were all normal. He was noted to have two lacerations on the volar aspect of the distal one-third of his left forearm. One laceration measured 2.5 cm, running diagonally on the forearm; the other laceration was approximately 2 cm, running horizontally on the forearm. The bleeding from both wound sites was easily controlled with pressure.

The emergency physician (EP) did not document a neurological examination of the left wrist and hand. He did, however, note that the patient had a 2+ radial pulse and good capillary refill. The EP irrigated the wounds thoroughly and sutured the two lacerations. There was no documentation on file of wound exploration or imaging studies. The patient returned 1 week after discharge from the ED for a wound check, and again 6 weeks later. On both occasions, he continued to complain of pain and decreased function of his left thumb and index finger.

Since the patient's condition did not improve, his father took him to an orthopedic surgeon. The orthopedist ordered a magnetic resonance imaging (MRI) study of the left forearm, which demonstrated a complete tear of one of the patient's flexor tendons. The orthopedist thought it was too late to repair the tendon and referred the patient to physical therapy. As the patient continued to complain of pain and decreased function of his left thumb, he consulted a second orthopedist, who decided to surgically explore the wound to determine the cause of the patient's continued pain and loss of thumb function. Surgical exploration revealed a piece of glass measuring 3.5 x 2 cm retained in the patient's forearm. The orthopedist removed the glass, irrigated the wound thoroughly, and closed the incision, after which the patient's thumb function improved considerably and his pain resolved.

The patient's family sued the EP and the hospital, arguing that the wound should have been explored and the glass removed on the initial ED visit. They further stated that if these steps were performed initially, the patient would not have required multiple imaging studies and surgery. At trial, the jury returned a defense verdict.

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Discussion

Approximately 11 million wounds are treated in US EDs each year.[1] Proper management of lacerations and wounds requires more than sutures or staples. The EP must also evaluate for associated injuries (eg, tendon laceration, vascular injury), and the possibility of a retained foreign body. It is also important to ensure the patient is up to date on his or her tetanus immunization.

As with most areas of medicine, a good history and physical examination are essential. The mechanism of injury will often be the first clue to the risk of a retained foreign body. For example, shattered glass or porcelain carries a much higher risk of retention compared to a laceration from a box cutter.

The age of the injury is also important in determining the best management approach and the risk of infection.

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In a study by Brancto,[1] wounds closed within 19 hours of injury had a 92% rate of healing without infection, compared to only 77% of those closed after 19 hours. In addition, determination of a patient's allergy status to anesthetics and antibiotics ensures safe and appropriate treatment.

On physical examination, the wound should be described in sufficient detail (eg, length, shape), and a distal neurovascular examination should be completed and documented. This involves testing the patient's motor strength, sensation, adequacy of pulses, and capillary refill. When examining the extremities, flexion and extension strength should also be assessed and documented.

After a wound is prepped and anesthetized, it should be explored. Often a patient may have excellent flexor or extensor strength on testing, but have a near-complete tendon laceration on visual inspection. Similarly, the wound should be explored for foreign bodies. It is important to identify and remove foreign bodies because of the associated increased risk of infection, pain, and delayed healing.[1] Occasionally, a wound may need to be extended to remove a foreign body.

Unfortunately, visual inspection of a wound, especially a deep one, is not highly sensitive. If a physician has a high index of suspicion for a retained foreign body but is unable to identify one on examination, imaging studies should be ordered. Conventional plain radiography, ultrasonography, computed tomography (CT), and MRI studies can all be used to identify foreign bodies. Each of these modalities has its unique advantages and disadvantages. A recent study by Pattamapaspong et al[2] compared the accuracy of radiography, CT, and MRI in detecting foreign bodies in the foot. In this study, researchers placed various types of foreign bodies, including fresh wood, dry wood, glass, porcelain, and plastic—all measuring 5 x 2 mm— in cadaver feet.[2] The overall sensitivity and specificity for foreign body detection was 29% and 100%, respectively, for radiographs; 63% and 98%, respectively, for CT; and 58% and 100%, respectively, for MRI.[2] Interestingly, CT was superior to MRI in identifying water-rich fresh wood.[2] A similar study by Aras et al[3] compared the sensitivity of plain radiographs, CT, and ultrasound in detecting foreign bodies in the face. The foreign bodies used in this study measured 1 x 1 x 1 cm and included metal, glass, wood, stone, acrylic, graphite, and polyoxybenzylmethylenglycolanhydride (ie, Bakelite).[3] In this study, ultrasound identified superficial foreign bodies with low radiopacity in body tissues more effectively than CT or plain radiographs.[3] In a review by Karabay[4] of traumatic wrist and hand injuries, ultrasound was considered the best modality to identify and locate both opaque and radiolucent foreign bodies in the soft tissue.

If a foreign body is identified but cannot be removed, consultation with a surgical service is required. Depending on the local referral pattern, this might be general surgery, plastic surgery, or hand surgery. Unless there is an acute nerve or vascular injury, patients rarely require immediate surgery. In most cases, the wound can be closed loosely until the surgeon can remove the foreign body in the operating room and/or with aid of fluoroscopy at a later time. Depending on the size, material, and location of the foreign body, the surgeon might even elect to simply observe.

The bottom-line lesson from this case: depending on the mechanism of injury, EPs must maintain a high index of suspicion for retained foreign bodies in traumatic wounds. In addition to wound exploration, imaging studies should be used in patients at high risk for a retained foreign body, such as those injured with broken glass or porcelain, but in whom no foreign body is found on wound exploration.

References

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Ruptured Esophagus

A 78-year-old man presented to the ED with symptoms of choking and chest discomfort. The patient stated that he had experienced a sudden onset of difficulty swallowing, along with chest pain, while he was eating dinner at a restaurant earlier that evening. The patient initially thought he had a piece of carrot stuck in his throat. He denied any previous history of similar symptoms. He complained of mild shortness of breath, but denied any drooling or vomiting. His medical history was significant for hypertension, which was controlled with medication. He denied tobacco or alcohol use and had no known drug allergies.

On physical examination, the patient's vital signs were: heart rate (HR), 106 beats/minute; blood pressure (BP), 144/82 mm Hg; respiratory rate, 22 breaths/minute, and temperature, 98.6°F. Oxygen saturation was 95% on room air. The patient's oropharynx appeared normal and without foreign body obstruction; his lungs were clear to auscultation bilaterally; and his HR was tachycardic but with a regular rhythm. Other than mild diaphoresis, the remainder of the physical examination was normal.

The EP ordered a complete blood count (CBC), a basic metabolic profile (BMP), and a portable chest X-ray, which the EP interpreted as normal. In addition, an intravenous (IV) saline lock was placed, and the patient was given morphine 4 mg IV and ondansetron 4 mg IV. He was also placed on 2 L of oxygen via nasal cannula. Since the patient continued to complain of chest pain and dysphagia, the EP consulted with a gastroenterologist; unfortunately, there was no documentation of this.

The EP admitted the patient to the floor with a diagnosis of esophageal obstruction, probably secondary to a piece of carrot. During the night, the patient's shortness of breath worsened, requiring an increase in supplemental oxygen. The next morning, the patient's HR increased to 120 beats/minute; his BP dropped to 96/50 mm Hg, and he developed a low-grade fever. He was transferred to the intensive care unit, where he was started on IV fluid resuscitation with normal saline and broad spectrum antibiotics. A CT scan of the chest was also ordered, which revealed an esophageal perforation. The patient was taken immediately to the operating room; surgery revealed a large esophageal perforation with evidence of mediastinitis and gross contamination of the left hemithorax. The patient died 2 days later.

The patient's family sued the EP for failure to diagnose and treat the esophageal perforation in a timely manner. The EP argued that the patient's symptoms were consistent with an obstruction, not esophageal perforation. The defendant also argued that the initial chest X-ray was normal. The case was resolved for $800,000 prior to going to trial.

Discussion

Esophageal perforation is a true medical emergency that requires timely diagnosis and management because morbidity and mortality are directly related to the time to treatment. Unfortunately, esophageal perforation can be a difficult diagnosis due to its relative rarity and variability in clinical presentation.

More than 50% of all esophageal perforations are iatrogenic, primarily as a complication of endoscopy.[1] Other causes of perforation include spontaneous perforation or Boerhaave syndrome (15%), foreign body (12%), trauma (9%), and malignancy (1%).[1] Anatomically, perforation tends to occur in the areas of the esophagus that are most narrow—eg, cricopharyngeus muscle, area of bronchoaortic constriction, and esophagogastric junction.[1]

Food impactions, not surprisingly, tend to occur in these same areas of the esophagus. In addition, there are structural esophageal abnormalities that increase the risk of food impaction, including diverticula, webs, rings, strictures, achalasia, and tumors.[2] Since food impaction can result in an esophageal perforation, there is a significant overlap in the initial presentation of these two conditions. However, in cases of perforation, signs and symptoms of shock predominate as time progresses due to esophageal contents leaking into the mediastinal and pleural spaces.

Patients with a food impaction will often complain of an acute onset of dysphagia, difficulty in handling secretions, choking, drooling, retrosternal fullness, regurgitation of undigested food, and wheezing.[2] Perforation can cause severe chest pain, tachypnea, dyspnea, fever, and shock.[2]

A chest X-ray is typically the initial imaging study for suspected esophageal perforation. Since most spontaneous perforations occur through the left posterolateral wall of the distal esophagus, a new left pleural effusion can frequently be seen on X-ray. Mediastinal emphysema is highly suspicious for perforation, but the condition takes time to develop; therefore, its absence on X-ray does not exclude perforation. In the setting of a normal chest X-ray and ongoing esophageal symptoms, further investigation is required, usually via CT scan or endoscopy. Computed tomography, because of its availability and speed, is usually the preferred study to confirm the diagnosis.

Once an esophageal perforation is confirmed or is highly suspected, the patient will require IV fluid resuscitation, IV broad-spectrum antibiotic treatment, and emergency surgical consultation. As previously stated, esophageal perforation is associated with a high mortality rate, and time is critical to successful management.

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