CASE STUDY

CE 2.0 ANCC Contact Hours

Blunt Chest Trauma

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ABSTRACT

Blunt chest trauma is associated with a wide range of injuries, many of which are life threatening. This article is a case study demonstrating a variety of traumatic chest injuries, including pathophysiology, diagnosis, and treatment. Literature on the diagnosis and treatment was reviewed, including both theoretical and research literature, from a variety of disciplines. The role of the advance practice nurse in trauma is also discussed as it relates to assessment, diagnosis, and treatment of patients with traumatic chest injuries.

Key Words

Aortic laceration, Blunt thoracic trauma, Cardiac contusion, Flail chest, Trauma nurse practitioner

A 62-year-old man presented to our level 1 trauma center after a high-speed single-vehicle collision. He was the restrained driver of a vehicle that rolled several times after hitting a patch of ice and was found approximately 50 yd from the highway. Upon arrival to the emergency department, his condition deteriorated such that his Glasgow Coma Score was 7, and he was subsequently intubated. He was hemodynamically stable upon arrival. However, during trauma resuscitation in the emergency department, the patient had a brief period of pulseless electrical activity. Cardiopulmonary resuscitation was initiated, and after 2 rounds of epinephrine, the patient returned to a normal sinus rhythm with a rate of 70. Diagnostic imaging revealed multiple traumatic chest injuries.

MULTIPLE RIB FRACTURES WITH FLAIL CHEST

Computed tomography (CT) scanning and 3-dimensional reconstruction films (Figure 1) of the chest revealed fractures of right ribs 1 to 4 and left ribs 1 to 9, with flail segments of the left 2 to 7 ribs. Flail chest occurs when 2 or more ribs are fractured in 2 or more locations[1] and can lead to chest wall instability and loss of thoracic volume, decreased lung volume, atelectasis, chest tightness, dyspnea, and chronic pain.[2] On physical examination, crepitus, subcutaneous emphysema, and asymmetrical chest wall expansion are common findings. Ribs 6 to 8 on the left were repaired with open reduction, internal fixation. Small randomized trials have suggested that surgical fixation of rib fractures improves intensive care unit length of stay, days of mechanical ventilation, long-term respiratory function, and decreases the incidence of chest infections.[3] Not all ribs can be plated, and patients not stable enough for surgical intervention will need alternative treatment modalities, which may include epidural anesthesia, physiotherapy, incentive spirometry, and noninvasive positive-pressure ventilation. The Eastern Association for the Surgery of Trauma recommends the use of epidural analgesia, which improves pain and pulmonary function compared with intravenous narcotics.[4] Long-term complications of flail chest include long-term pain and chest wall deformity if not plated. Ongoing management should be monitored with pulmonary function tests, chest radiographs, and should include pain management and incentive spirometry use.

PULMONARY CONTUSION

Pulmonary contusion is the most commonly identified injury in blunt thoracic trauma. If occurring in significant lung volume, it can cause respiratory failure and may require invasive ventilator support. On physical examination, the patient may have chest pain or shortness of breath. Management is largely pulmonary support, avoidance of fluid overload, and use of noninvasive ventilation with positive airway pressure. Patients, however, should not be fluid restricted, rather resuscitated with an isotonic crystalloid until there is adequate tissue perfusion. Long-term effects of pulmonary contusion include decreased functional residual capacity and fibrosis of the lung, causing dyspnea.[4]

PNEUMOHEMOTHORAX

A moderate left-side pneumohemothorax and right apical pneumothorax was identified. The left-side pneumohemothorax was treated with chest tube thoracotomy in the trauma bay. A pneumothorax is the presence of air in the pleural space. Advanced Trauma Life Support recommends tube thoracostomy for all traumatic pneumothoraces to avoid advancement into a life-threatening tension pneumothorax.[5] Pneumohemothoraces are

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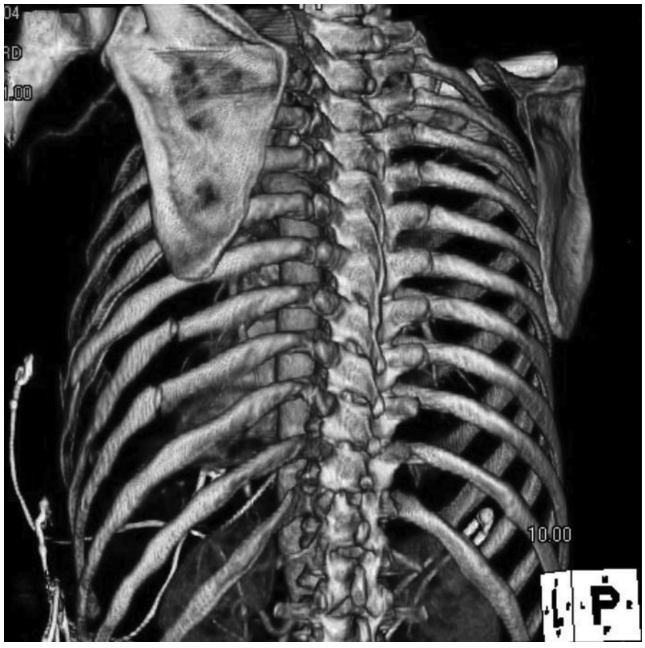

Figure 1. 3D reconstruction demonstrating multiple rib fractures.

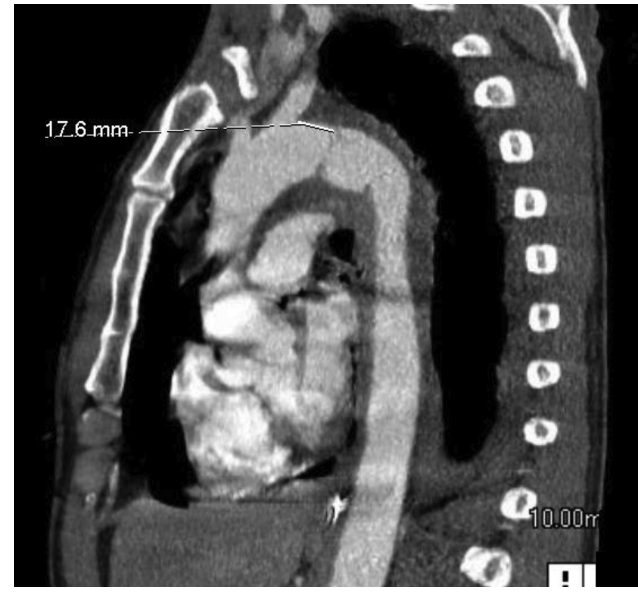

Figure 2. Blunt aortic injury demonstrated on CT.

diagnosed by chest radiograph, but diagnosis is limited if it is less than 400 to 500 mL. CT scanning of the chest is the gold standard for diagnosis. Hemothoraces should be drained with a chest tube regardless of the size to avoid complications such as retained hemothorax, fibrothorax, and empyema. Indications for open thoracotomy in the operating room include initial output of hemothorax drainage greater than 1500 mL, ongoing drainage greater than 200 mL/hr, or ongoing blood transfusions necessary to maintain hemodynamic stability. Retained hemothoraces are treated with video-assisted thoracotomy, ideally in the first 3 to 7 days to reduce the risk of infection.[6]

BLUNT AORTIC INJURY

Aortic laceration at the level of the aortic isthmus with associated mediastinal hematoma was discovered on CT scan (Figure 2). This was treated operatively with delayed endograft placement. Traumatic aortic injuries have a high mortality rate, with only an estimated 13% arriving at the hospital alive. Delayed repair of these injuries is reserved for those patients with major associated injuries and should be managed with adequate blood pressure control.[7] Chest radiograph is a useful screening tool for blunt aortic injury, which findings might include a widened mediastinum, obliteration of the aortic knob, or left mainstem bronchus deviation. CT of the chest is the gold standard for diagnosis, and CT angiography may aid in diagnosis if CT chest is indeterminate.[8]

CARDIAC CONTUSION

The patient had elevated troponins, peaking at 6.33 and pulseless electrical activity. A cardiac contusion is the bruising of the myocardium from rupture or hemorrhage of small vessels. It is diagnosed with 12-lead electrocardiogram (EKG) and cardiac biomarkers. If surgical intervention is not required, as in the case with valvular, septal, or free wall rupture, the management is largely supportive with treatment of arrhythmias.[9] An echocardiogram is indicated in those patients with persistent arrhythmias or hemodynamic instability. All patients with suspected blunt cardiac injury should receive an EKG. Blunt cardiac injury is ruled out if both EKG and troponin are negative.[8]

APN ROLE IN TRAUMA MANAGEMENT

Trauma nurse practitioners (TNPs) in our facility are involved with care of the trauma patient from arrival in the emergency department to follow-up in the trauma clinic. They respond to all Class 1 and Class 2 trauma activations and facilitate throughput of the patient from the trauma bay to diagnostic imaging and on to the intensive care unit. They perform procedures including chest tube insertion, central line insertion, arterial line insertion, and laceration repair, and act as a first assistant during trauma surgeries. All trauma laboratories and imaging are reviewed by the trauma nurse practitioners, and a plan of care is formulated in conjunction with the trauma surgeon. The TNP leads trauma rounds on all trauma patients twice weekly with other disciplines and rounds daily on both ICU and noncritical care patients. In our facility, TNPs independently run the trauma follow-up clinic for both former

hospitalized trauma patients and emergency department follow-up patients.

DISCUSSION

Motor vehicle collisions are responsible for 80% of cases of blunt chest trauma, which lead to a wide range of injuries.[10] In this case study, it is likely caused by a combination of direct transfer of energy from impact against the steering wheel and rapid deceleration. Assessment of the trauma patient with blunt chest injuries, as with all trauma patients, should occur in 2 phases. The first phase is assessing for and correcting life-threatening injuries, such as tension pneumothorax, airway obstruction, pericardial tamponade, and fatal arrhythmias. The secondary survey is then done to identify injuries that are not immediately life threatening. Early identification and management of blunt chest injuries is essential in caring for the trauma patient.

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