Tension Hydrothorax with Mediastinal Shifting: A Two-Case Report of the Emergency Decompression of a Rare and Potentially Lethal Respiratory Condition

Eric Vinck1*, Tim Peterson2, Ricardo Villarreal3, Luis Cabrera4 and Louis van den Eijnden4
1Department of General Surgery, El Bosque University, Colombia
2Department of General Surgery, Universitair Hospital Brussel, Belgium
3Department of Gastrointestinal Surgery, Nueva Granada Military University, Colombia
4Department of Medicine, Maastricht University Medical Center, Netherlands

Abstract

A Tension Hydrothorax is defined as a massive pleural effusion presenting with hemodynamic abnormalities secondary to mediastinal compression. In these patients the pleural volume increases the intrathoracic pressure to the point of compromising diastolic filling and cardiac output simulating a cardiac tamponade physiology. This is an uncommon yet potentially fatal medical emergency that if left untreated may lead to cardiac arrest. Therefore, patient stabilization takes priority over the need to determine effusion etiology. We present a two-case report of patients presenting with a tension hydrothorax managed in the emergency room with ultrasound-guided decompression thoracentesis and the other patient with a chest tube. Although these life-saving techniques appear simple, not having proper training is an independent factor for chest tube and thoracentesis complications. Thus courses and simulation training can benefit physicians to minimize potential complications when managing emergency conditions and pathologies such as a Tension hydrothorax.

Keywords: Tension hydrothorax; Massive; Pleural effusion; Chest tube

Background

A pleural effusion is the excessive pleural fluid within the pleural cavity defined as >15 cc and generally considered to be significant above 500 cc. Normal volume is approximately 0.1 ml/kg to 0.2 ml/kg, produced at 0.01 ml/kg/h from parietal capillaries and removed by parietal lymphatics at 0.28 ml/kg/h. When normal pleural physiology is impaired, pleural fluid accumulates; this happens through transudate mechanisms such as increased hydrostatic pressure seen in heart failure or decreased oncotic pressure seen in liver failure. Transudate effusions are more likely to be bilateral and chest tube management is usually not needed. Exudate mechanisms however occur through inflammatory processes such as pneumonia, obstructive processes as in neoplasms or trauma. Exudate effusions are usually unilateral and some may eventually need a chest tube. When massive, pleural effusion can cause significant pulmonary, cardiovascular and hemodynamic compromise secondary to mediastinal compression manifesting as tamponade physiology known as a tension hydrothorax. The exact incidence of this condition is unknown. This rare yet potentially fatal medical emergency, if unrecognized early may progress into cardiac arrest and prove fatal [1-10]. Although treatment with thoracentesis is the initial approach for pleural effusions, patient stabilization takes priority over determining effusion etiology in these patients because of the level of hemodynamic and respiratory insult. Therefore, a tension hydrothorax requires an emergency decompression either by thoracentesis or a chest tube depending on the clinical presentation, suspected etiology and physician preference and training. The criteria for placing a chest tube in massive pleural effusions include associated pneumothorax or hemothorax, respiratory and hemodynamic instability, and grade III-V parapneumonic effusions. There are no absolute contraindications for chest tube placement except refusal by the patient or adherence of the lung to the chest wall. History of pleurodesis may also suggest better results with thoracentesis. Relative contraindications include coagulopathies, loculations and large tumors masquerading as effusions. Here we report two cases of patients presenting with a tension hydrothorax, one managed with ultrasound-guided thoracentesis and another with a chest tube [11-19].
Case Presentation

Case 1: A 43-year-old male patient presents to the ER with a clinical picture of acute progressive respiratory difficulty during the last 4 days. On admission, there was severe dyspnea with significant use of accessory respiratory muscles, tachycardia (113 bpm), less than normal pulse oximeter (88% SaO2), blood pressure of (89/48 mmHg), absent right pulmonary breath sounds and dullness to percussion. Neither jugular ingurgitation nor muffled heart sounds were present. The patient's initial chest X-ray showed a massive unilateral right pleural effusion along with tracheal and mediastinal deviation to the opposite hemi-thorax (Figure 1). Considering the pleural fluid volume, respiratory insult and hemodynamic compromise, a chest tube was inserted using standard Royal College of Surgeons’ and ATLS recommendations; chest tube placed in the 5th intercostal space with anterior axillary line revealed a serosanguinous odorless fluid under pressure. The chest tube was connected to a pleural drainage system without suction and at 1400 cc immediate drainage the chest tube was clamped. Post-thoracostomy chest x-ray confirmed appropriate chest tube position as well as mediastinal and tracheal realignment. Immediately following drainage, the patient’s respiratory pattern, hemodynamics and adequate oxygenation was restored and attained (Figure 2). Pleural fluid analysis showed a malignant-exudate effusion, with a negative gram stain and bacterial culture. Follow-up chest x-ray showed a right lung mass not initially visible due to the effusion volume.

Case 2: A 29-year-old female patient with a clinical history of bilateral metastatic breast cancer treated with chemotherapy and radiotherapy presents to the ER with a clinical picture of 1 week consisting of severe dyspnea, left pleuritic pain and significant use of accessory respiratory muscles. On admission she had a blood pressure of (119/60 mmHg) heart rate of (122 bpm) a respiratory rate of (24 rpm) and O2 saturation of 87%. Physical exam revealed absent left breath sounds, dullness to percussion and jugular ingurgitation. Initial chest X-ray showed a massive left-sided pleural effusion with mediastinal compression and tracheal deviation to the opposite hemithorax (Figure 3). Emergency ultrasound-guided needle decompression revealed 3000 cc of an odorless serous-yellowish fluid under pressure. Post-thoracentesis chest X-ray showed a 25% pneumothorax secondary to needle decompression and the patient had a chest tube placed. Immediately following drainage, the patient’s respiratory pattern and hemodynamics were quickly restored. Post-chest tube X-ray showed tracheal and mediastinal realignment and a low placed chest tube with persistent pleural air. Pleural fluid analysis revealed a malignant-exudate effusion with negative gram-stains.

Discussion

Massive pleural effusions are defined as occupying >2/3 of the hemithorax and can be either malignant (67%) or non-malignant. 10% of pleural effusions are massive and 10% of patients with pleural carcinomas have massive effusions with complete hemithorax opacification. Up to 65% of cancer patients will have pleural effusions at one point during their ailment. When a pleural effusion is present in the context of malignancy, life-expectancy is 4 months. Non-malignant causes include trauma, chylothorax, pancreatitis, cirrhosis, TBC, parapneumonic effusions and other autoimmune diseases.
Physical exam will usually show reduced or absent breath sounds over the affected hemithorax and dyspnea; simple chest X-rays are usually sufficient to confirm increased pleural fluid. Large pleural effusions may be evacuated either by thoracentesis or by closed thoracostomy depending on the treating physician. One possible complication of thoracentesis is iatrogenic pneumothorax which can occur in about 20% to 39% of cases without the use of radiology; when performed using ultrasound-guided needle thoracentesis, pneumothorax rates are reduced to 2.5% to 13.9%; of which 30% to 50% require chest tubes [20-28]. Some pleural effusions will require chest tube placement with a complication rate of about 3% to 18%, the most common being malpositioning. Care must be taken when draining the pleural cavity to prevent re-expansion lung edema, a rare complication which can appear when pleural fluid or air in an atelectatic or trapped lung is evacuated too rapidly. Re-expansion lung edema has an incidence of 0.2%, therefore it is recommended not to exceed more than 1500 cc drainage within the first 24 hours. When more than 1100 cc of fluid is evacuated at tube or needle insertion, it increases the risk for developing a pneumothorax. Placement of chest tubes or needle decompression thoracentesis, simple yet high-risk and sometimes lifesaving invasive techniques, are usually performed by surgeons (chest tubes), pulmonologists (thoracentesis) and radiologists (thoracentesis), at teaching hospitals closed thoracostomies are performed mostly by surgery residents and to a minor degree by residents of other specialties [21-24]. Although placing a chest tube is considered to be a simple procedure, with insufficient expertise and training it can become life threatening. The literature shows that general surgery residents have a lower chest tube complication percentage than residents in other residency programs (7%), family and internal medicine (13%) emergency medicine (40%). Being a non-surgical trainee is thus an independent risk factor for chest tube placement complications. Courses such as the Specialty Skills in Cardiothoracic Surgery Course offered by the Royal College of Surgeons, ATLS training and other similar courses may greatly benefit physicians exposed to chest tube requiring pathologies. One study showed faster tube thoracostomy performances when practiced on simulation-embalmed cadavers. When performing image guided thoracentesis however; radiologists and radiology residents have the lowest pneumothorax rates of 0.5% to 1.8% in comparison to other specialties [23-34]. A Tension hydrothorax is a rare and potentially fatal medical emergency that can quickly lead to cardiac arrest, early suspicion and detection of this condition may prove lifesaving with the proper placement of a chest tube or needle decompression thoracentesis. Whether the patient receives treatment by thoracostomy or thoracentesis depends on physician expertise, equipment availability and the patient’s hemodynamic state. Both of our patients had a malignant tension hydrothorax and the decompression technique was chosen according to their individual hemodynamic and respiratory needs as well as the attending physician’s preference.

References


