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Traumatic tension chylothorax in a child: A case report

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ABSTRACT

Blunt trauma is the leading cause of death of children and adolescents in the United States. Potentially life-threatening injuries from blunt trauma to the chest must be identified and treated immediately. Clinician familiarity with the range of possible injuries assists in timely diagnosis and therapy. Chylothorax from injury to the thoracic duct is a rare consequence of blunt chest trauma. Tension chylothorax is exceptionally rare. We present a case of a 22-month old boy found to have a traumatic tension chylothorax during initial evaluation in the resuscitation bay after transfer from another facility. There have been no previous reports of a pediatric tension chylothorax after blunt trauma. Management consisted of drainage with tube thoracostomy, parenteral nutrition, and octreotide until the chyle leak resolved. Surgical ligation of the thoracic duct was not required.

Chylothorax, the accumulation of chyle in the pleural cavity after thoracic duct injury, from blunt trauma is rare. Tension chylothorax from blunt trauma is exceptionally rare. Of all cases of chylothorax, traumatic injury accounts for up to 54%, but the vast majority of these result from iatrogenic injury during surgery, not as result of nonsurgical blunt or penetrating trauma [1,2]. In a series of patients with chylothorax, only 3% were a result of nonsurgical trauma [2]. We present a case of a 22-month old boy found to have a traumatic tension chylothorax during initial evaluation in the resuscitation bay after transfer from another facility.

1. Case report

A 22-month old boy born at term with no significant medical history fell from a chair, two days prior to admission, landing on his right chest. The mother reported the patient was not in any significant distress immediately after the fall but did complain of right-sided pain. One day after the injury he developed a cough and intermittent shortness of breath that worsened later the same evening. Two days from injury the patient's mother found him minimally responsive and limp. He was then taken to the local emergency room where he presented with altered mental status and severe respiratory distress. A chest x-ray revealed complete opacification of the right lung. He was intubated and antibiotics were administered for possible pneumonia prior to urgent transfer to our facility.

On arrival to the resuscitation bay at our facility the patient was minimally responsive, cold (35.5 C) and mottled, tachycardic (155 BPM) and requiring the FiO_2 on the ventilator to be 100%. There were absent breath sounds on the right. There were no signs of trauma to his right chest. A chest x-ray confirmed the complete opacification of the right chest and revealed a mediastinal shift to the left (Fig. 1). A right sided tube thoracostomy was placed with immediate return of projectile, thin, odorless, and milky fluid upon entry into the pleural cavity. One liter of the fluid was drained initially, resulting in an immediate improvement in his vital signs and respiratory status. A repeat chest x-ray showed the pleural cavity to be drained and the lung expanded without pneumothorax (Fig. 2). The triglyceride content of the pleural fluid was 2500 mg/dL, confirming the diagnosis of a traumatic tension chylothorax. Additional studies revealed bilateral subluxation of the T12-L1 facets with interspinous ligamentous injury and multiple healed or healing fractures of the bilateral first ribs, left humerus, bilateral radii, left ulna, and left tibia.

Non-operative management of the chylothorax was initiated consisting of no oral intake and total parenteral nutrition (TPN). The chest tube drainage continued with over 90 ml/kg of output per day during the first several days of admission. He was extubated without complication on hospital day 1. In an attempt to decrease the volume of chyle, octreotide was administered on hospital day

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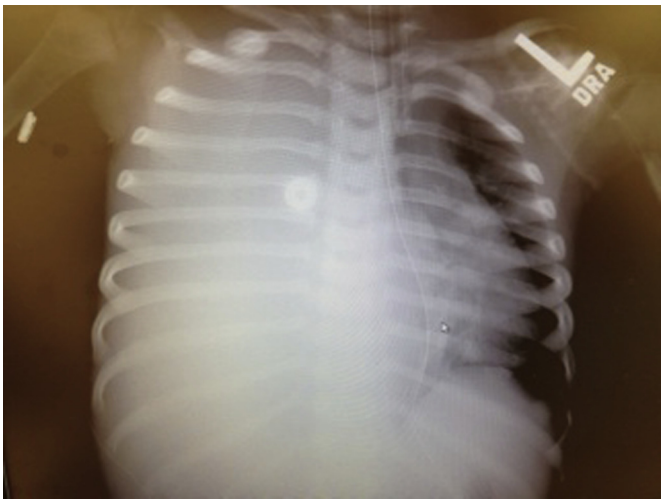

Fig. 1. Initial chest x-ray during trauma evaluation.

3 at a rate of 5.5 mcg/kg/hr and titrated to a high of 9 mcg/kg/hr during the admission. On hospital day 4, the effusion was still present on x-ray but the chest tube was draining poorly. To ensure accurate placement of a new chest tube and check for any unrecognized loculations a right VATS (video-assisted thoracic surgery) was performed that day. Intra-operatively, there was chyle noted within the pleural cavity, but the thoracic duct was not visualized and no obvious chyle leak was identified. There were no traumatic bony abnormalities noted. No loculated collections were noted and no pleurodesis was performed. The chest tube was placed under direct vision before concluding the operation. To help prevent immunosuppression, IVIG was administered intermittently during the admission for low levels of serum immunoglobulin that resulted from protein losses in the chyle.

On hospital day 17, a trial of enteral clear liquids was attempted after the pleural drainage had trended down to 30 ml/kg/day, but this was stopped on hospital day 20 after the drainage increased significantly. Over the next 10 days the drain output decreased to less than 1 ml/kg/day with a stable small effusion still present on x-ray. On hospital day 30, a solid low-fat diet was initiated without increase in the pleural effusion.

Fig. 2. Chest x-ray after tube thoracostomy.

During the hospitalization, child protective services performed an extensive investigation and concluded that there was general neglect without evidence of child abuse. On hospital day 37, the patient was discharged in good condition without a chest tube and on a low-fat diet. He was recovering well without any complaints at a clinic visit 2 weeks after discharge.

2. Discussion

Chylothorax is a result of injury or obstruction to the thoracic duct along its path through the posterior and superior mediastinum with subsequent drainage of chyle into one or both pleural cavities. The duct typically crosses the midline from the right to left posterior mediastinum at the level of the fifth thoracic vertebrae before it continues cephalad into the superior mediastinum. The chyle then drains into the venous system near the junction of the left subclavian and internal jugular veins. Whether the injury level is above or below the midline crossing of the thoracic duct typically dictates into which pleural cavity the chyle will drain [2].

The etiologies of a chylothorax can be divided into non-traumatic and traumatic, with traumatic accounting for up to 54% [1]. The traumatic causes can be further divided into surgical and non-surgical with only approximately 3% of traumatic etiologies resulting from non-surgical trauma. Non-surgical trauma includes penetrating or blunt trauma and marked increases in intra-thoracic pressure as seen in severe coughing or vomiting episodes [2]. Chylothorax is a known but rare complication of thoracic spine fracture or dislocation. This results from the thoracic duct's position directly anterior to the thoracic vertebrae. A review by Townshend et al., found 17 cases reported since 1952 [3]. Of those, there was only one pediatric case which involved a 14 year old boy [4]. Our patient sustained a subluxation of T12-L1 without any posterior rib fractures or other adjacent injuries, making vertebral injury a possible cause of the chylothorax. A traumatic tension chylothorax causing hemodynamic and respiratory compromise is exceedingly rare, mainly occurring after thoracic surgical procedures such as pneumonectomy and esophagectomy [5,6]. In one institution, chylothorax after esophagectomy occurred 1.5% of the time while 10% of those developed into a tension chylothorax [5]. There are few reports describing tension chylothorax from penetrating or blunt trauma [7,8], with no reports involving a pediatric patient. The only reports of a tension chylothorax in the pediatric population occurred post-operatively; one after a Fontan procedure and the other after a gastroschisis repair [9].

The management of a patient presenting to the trauma department should begin with following standard ATLS guidelines for rapid identification of the most life-threatening injuries. Our patient presented from another facility already intubated with a known right thoracic abnormality but there were no reports of a fluid collection or the possibility of fluid being under pressure. Initial chest x-ray in the trauma bay shortly after arrival revealed these concerning findings. In general, upon identification of any pleural contents under pressure a tube thoracostomy should be performed to decompress the contents and correct any hemodynamic or respiratory compromise, as seen in this patient. Given its rarity, a tension chylothorax would likely only be diagnosed after visualization and laboratory evaluation of the pleural contents, because in the setting of trauma, a hemothorax is much more commonly encountered. The standard laboratory evaluation for diagnosis of a pleural effusion typically includes cell count, pH, triglyceride, cholesterol, glucose, lactate dehydrogenase, protein, and microbiologic culture. In this patient, the suspicion for chylothorax was high enough that only a triglyceride level was ordered initially. A pleural fluid triglyceride content greater than 110 mg/dL

strongly suggests chylothorax, so given the triglyceride value of 2500 mg/dL, no other studies were subsequently ordered [10].

Once the patient is stabilized and the diagnosis of chylothorax is made, the management of chylothorax can begin. The patient presented above was managed with pleural drainage, total parenteral nutrition, and octreotide until the chylothorax resolved. Adequate pleural drainage is essential for treatment of an active thoracic duct leak. In the short term it helps to prevent respiratory compromise from fluid compression of the lung. Over time, the pleural apposition that the drainage creates assists in spontaneous closure of the leak by increasing the pressure around the leak, leading to a decrease in the flow through it. With ongoing drainage, close monitoring of the patient's electrolyte and nutritional status is required. Chyle contains significant amounts of protein, electrolytes, fat-soluble vitamins, and minerals. Hypoalbuminemia, zinc deficiency, and copper deficiency were persistent struggles in our patient that required albumin replacement and high levels of mineral replacement in the TPN. Chyle also contains high levels of lymphocytes and immunoglobulins. Depletion of these from the circulation with high volume chyle leakage can cause immunodeficiency, making the patient more susceptible to infection. Our patient developed high-grade temperatures during the admission that persisted over several days. IVIG was administered for low serum levels of immunoglobulin and broad-spectrum antibiotic coverage was initiated, but no source of infection was identified and the fever resolved, so the antibiotics were discontinued.

Limiting the flow of chyle through the thoracic duct assists in healing the injury. Dietary limitations with chylothorax revolve around removing long-chain triglycerides (LCT) from any enteral feedings or excluding an enteral diet completely. Chylomicrons transport LCTs from the intestines through the thoracic duct and into the venous circulation. By excluding LCTs from the diet, the volume of chyle is reduced, leading to decreased flow through the thoracic duct. Whether fasting with TPN supplementation decreases chyle flow more than an enteral diet without LCTs is unclear, but one small retrospective review did show faster healing with TPN only in children with congenital spontaneous chylothorax [11]. The benefit of octreotide, a somatostatin analog, in decreasing chyle flow through the thoracic duct has been poorly studied. A systematic review of case reports and series of pediatric patients with chylothorax that were treated with either octreotide or somatostatin concluded that there was a benefit, but the treatment regimens were not uniform and there were no controls [12].

Surgical treatment of chylothorax is generally indicated for prolonged drainage with conservative management or high-output drainage. There are currently no firm guidelines for the timing of an operation, but a retrospective review of patients with chylothorax after thoracic surgery found that an output of greater than 1 L per day predicted failure of conservative management [13]. Unfortunately it is difficult to extrapolate a persistent 1 L per day output to the pediatric population. In general, if surgical treatment of the injury is indicated, ligation of the thoracic duct is the operation of choice, through either an open or VATS approach. Thoracic duct ligation in the pediatric population has been shown to be safe and effective for chylothorax after cardiothoracic surgery in a small retrospective review of 20 patients [14]. Other less common modalities can also be used for treatment depending on local expertise, such as thoracic duct embolization or pleuroperitoneal shunt. In the case presented above, because the chest tube began functioning poorly in the presence of a persistent pleural effusion, the patient was taken for VATS exploration to assist in accurate placement of a new chest tube and check for any loculations. There was no obvious leak to repair at the time of operation, but even if there had been it was likely too early after the injury to abandon an attempt at conservative management given the lack of data regarding the long-term sequela of thoracic duct ligation in infants.

Lastly, child abuse should always be considered in any pediatric trauma where the story from the family is inconsistent or if common injury patterns for abuse are present. The child presented was diagnosed with several classic injuries associated with child abuse, namely multiple healed and healing long bone and rib fractures, bruising, and a spinal injury. Although, in this case, Child Protective Services could not prove child abuse, general neglect was suspected and the patient was placed in protective care. While rare, there have been reports of chylothorax as a result of child abuse [15–17], cautioning clinicians to be cognizant of the possibility before labeling a chylothorax idiopathic.

3. Conclusion

Chylothorax is a rare consequence of thoracic trauma. The immediate management of a pleural fluid collection causing physiologic derangements after trauma relies on rapid identification and drainage. Although blood is the most common finding on thoracostomy tube placement, chyle is a possibility that should be considered. Chylothorax management is primarily non-operative. Adequate drainage must be assured to accurately track daily output. Dietary adjustments and medications are aimed at limiting chyle flow to promote healing. Operative intervention is reserved for persistent or high output drainage. Interdisciplinary care teams are important to investigate cases where child abuse is a concern based on injury patterns, injury severity and shifting histories.

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