Tension Pneumomediastinum after Blunt Chest Injury Managed with Percutaneous Mediastinal Drain

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Background	Tension Pneumomediastinum is a life-threatening sequela of thoracic trauma that necessitates urgent intervention. This case presents a simple technique for pericardial drain placement that can be performed at the bedside.
Summary	A 73-year-old male with a past medical history of HIV and COPD presented after a motor vehicle crash with multiple left-sided rib fractures, pneumothorax, pneumomediastinum, and splenic rupture. On hospital day two, the patient developed tension physiology, which was relieved by percutaneous pericardial drain placement. A central venous catheter was placed into the pericardium, which was then connected to an underwater seal system. His hemodynamic status improved, and the patient was subsequently transferred to a long-term care facility after a hospital course prolonged by his comorbidities.
Conclusion	Tension Pneumomediastinum is a rare, life-threatening sequela of torso trauma that necessitates urgent intervention. Prompt recognition and relief of tension physiology, via any of a variety of techniques, is the priority.
Keywords	Tension Pneumomediastinum, blunt trauma, thoracic trauma, pneumomediastinum, percutaneous drain

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The authors have no conflicts of interest to disclose.

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Case Report

The patient, a 73-year-old male with a past medical history of HIV and COPD, presented after a motor vehicle crash in which he was the restrained driver without loss of consciousness. He sustained multiple left-sided rib fractures, hemopneumothorax, pneumomediastinum, and splenic laceration requiring angiographic embolization. A chest tube was placed to drain the left-sided hemopneumothorax (Figure 1). Although the patient initially presented hypertensive, he experienced intermittent bouts of hypotension, which were responsive to volume resuscitation. The patient was admitted to the surgical intensive care unit in respiratory failure requiring intubation with high FiO2. Crystalloid resuscitation was continued due to elevated stroke volume variation. A cortisol stimulation test was performed and was negative. A transthoracic echocardiogram was performed at the patient's bedside, and did not demonstrate evidence of pericardial fluid.

Figure 1. Admission Chest X ray demonstrating placement of left thoracostomy tube and pneumomediastinum.

On the morning of hospital day 2, the patient became hypertensive with desaturation. Patient was given a dose of metoprolol (Lopressor, Validus Pharmaceuticals LLC) and subsequently became hypotensive. Arterial blood gas revealed hypercarbia, and tidal volumes were increased. Fluid resuscitation was continued with marginal improvement; however, heart rate remained in the 50s, and multiple vasopressors were initiated. Repeat blood gas showed improvement, and the patient was determined to be stable for a repeat CT scan of the chest to evaluate for pulmonary embolism and a CT scan of the abdomen and pelvis to evaluate for persistent bleeding. While the scan did not demonstrate pulmonary embolism or evidence of bleeding, pneumomediastinum was again demonstrated (Figure 2). Excluding pulmonary embolism and hypovolemic shock, the decision to place a mediastinal drain was made. The subxiphoid region was palpated, and a large bore needle was inserted in the direction of the pericardium; a rush of air was heard upon insertion of the needle. Next, using the Seldinger technique, a triple lumen central venous catheter was placed for air release. The patient's blood pressure improved from SBP 90–100 to 120–130s. The patient was never tachycardic, thus his HR did not change. CXR at the bedside showed the catheter was near the root of the great vessels, and the catheter was then withdrawn to the mid-pericardium (Figure 3). There were no immediate complications. Bronchoscopy was performed to evaluate for tracheobronchial injury, and no injury was identified. The patient's two chest CTs were inspected thoroughly for any direct or indirect sign of esophageal injury and none was observed.

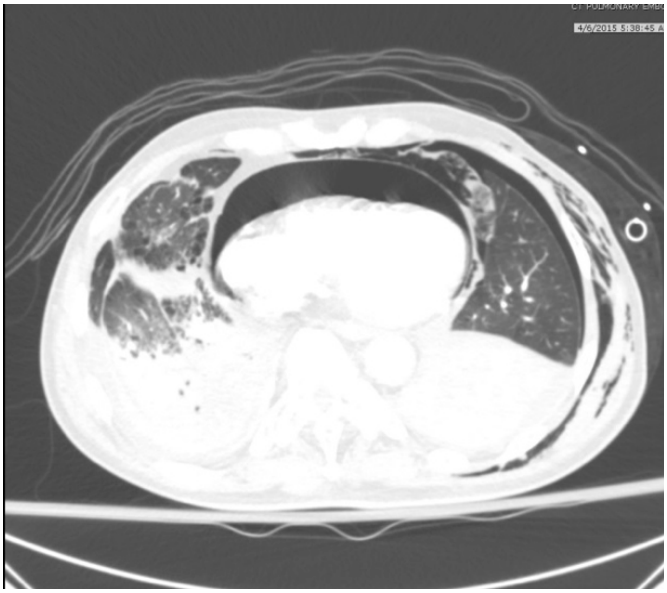

Figure 2. CT chest on postinjury day 2 demonstrating left pneumothorax and pneumomediastinum.

Patient's cardiovascular function improved following placement of the mediastinal drain, with subsequent imaging showing resolution of the pneumomediastinum. Patient's hypotension resolved, and he was weaned off of vasopressor support. The mediastinal and left pleural drains were removed relatively early in the patient's hospital course, which was prolonged by multiple infections secondary to the patient's known HIV status. He was eventually discharged from the hospital to an extended care facility.

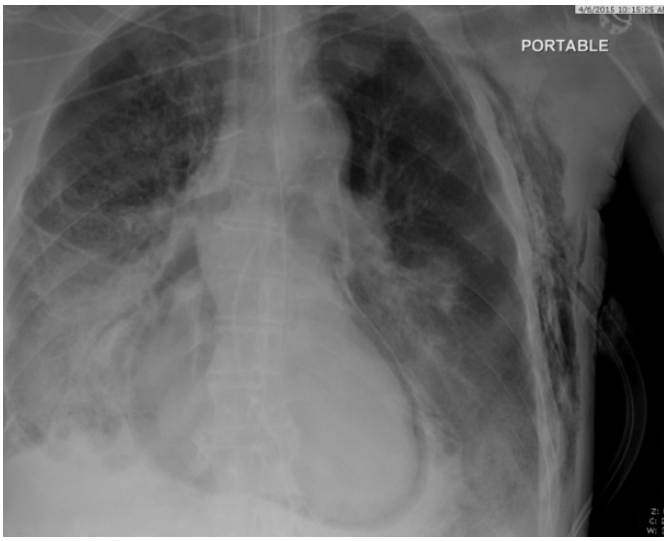

Figure 3. Chest X ray after placement of percutaneous drain.

Discussion

The phenomenon commonly referred to as pneumomediastinum consists of free air within the connective tissue of the mediastinum.[1] Pneumomediastinum can be a consequence of either blunt or penetrating thoracic trauma. The development of tension pneumomediastinum can be associated with injury to the tracheobronchial tree or esophagus, both of which can be life-threatening if primary repair of the injury is not addressed. These injuries, however, are rare findings in patients who survive to be seen in the hospital. One single-center study examining incidence of pneumomediastinum found a mean age of 40, in predominantly male (69.8 percent) trauma patients.[2] A large retrospective study found 5.2 percent (71/1364) of their trauma patients over an eight-year period had CT findings of pneumomediastinum. Of those patients, 5.8 percent (4/68) required surgical repair.[3] The diagnosis of tension pneumopericardium can be seen on CT as a "flattened heart sign," in which the anterior face of the heart is flattened, resulting in a decrease in the anterior-posterior diameter. The authors describing the flattened heart sign believe the sign to be diagnostic and predictive of a poor prognosis, though it may lead to early diagnosis and treatment.[4] This sign is again demonstrated in Figure 2. We believe our approach to be a relatively novel technique involving the percutaneous placement of a central venous catheter, which was then placed to water seal using a standard underwater seal system. To our knowledge, only four other authors have attempted a percutaneous catheter placement for relief of tension pneumomediastinum:

- The first case involved the placement of a pericardiocentesis catheter as a stabilizing measure before conversion to a pericardial window in the operating room.[5]
- The second case involved placement of a pigtail catheter via a subxiphoid approach; however, significant additional details were not provided.[6]
- In the third case, the catheter was attached to a Heimlich valve and the catheter was removed and re-inserted multiple times during the patient's hospital course.[7]
- The final case used needle decompression of the pericardium to stabilize the patient. Following stabilization, an 18 French triple-lumen catheter was placed, through which air could be aspirated as needed.[8]

In comparison with these cases, our catheter was placed to an underwater seal system, where it remained until resolution of the tension pneumomediastinum.

Conclusion

Tension pneumomediastinum is a rare, life-threatening sequela of torso trauma that necessitates urgent intervention. Prompt recognition and relief of tension physiology is the priority. Decompression of the mediastinum can be accomplished using a variety of techniques. After initial decompression, the patient needs to be evaluated for the source of the air, as further intervention to repair an aerodigestive injury may be necessary.

Lessons Learned

We believe our approach to be a relatively novel technique involving the percutaneous placement of a central venous catheter, which was then placed to water seal using a standard underwater seal system. To our knowledge, only four other authors have attempted a percutaneous catheter placement for relief of tension pneumomediastinum.

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