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CASE REPORT

Trauma

Tension pneumopericardium in blunt multi-system trauma in a resource limited setting

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Abstract

Pneumopericardium is defined as the presence of air within the pericardial sac. Pneumopericardium is a rare condition that may occur secondary to blunt trauma, penetrating trauma, pericardial infection with gas-forming organisms, or iatrogenically. Tension pneumopericardium is even less common and is defined as pneumopericardium that leads to hemodynamic instability. Despite its severity and a mortality rate of greater than 50%, the optimal management of tension pneumopericardium is unknown because of its rarity. We discuss the identification, stabilization, and management options of this potentially devastating traumatic injury in the setting of multisystem trauma in a resource-limited setting. There are no previous case reports we are aware of describing the management of this condition in resource-limited settings.

KEYWORDS
ATLS, blunt, pericardiocentesis, pneumopericardium, tension, thoracic, trauma

1 | CASE REPORT

A 68-year-old male presented to a critical access hospital via emergency medical services (EMS) after an accidental observed fall from a third-story balcony. The fall was estimated by bystanders to be 30 feet in height. The patient was initially unresponsive and with evidence of multisystem trauma on EMS arrival at the scene. He was not hypotensive or hemodynamically unstable in the field. He was, however, unresponsive with a Glasgow Coma Score (GCS) score of 3 and absent breath sounds in the bilateral lung fields. The patient was endotracheally intubated without the use of medications and underwent bilateral anterior needle thoracostomies of suspected bilateral large pneumothoraxes with 14gauge decompression needles before transport. He arrived at our local emergency department (ED), without in-house cardiology or surgical services, telemetry beds, or intensive care unit, hemodynamically stable but unresponsive with a GCS of 3T. His initial vital signs on arrival in the ED were noted as follows: a heart rate of 93 beats per minute, blood pressure of 110/81 mmHg, respiratory rate of 27 (breathing spontaneously at times over mask ventilation), and oxygen saturation of 100% via bag valve mask. Physical examination was noted for diminished breath sounds bilaterally with 14gauge needle decompression devices in place, epistaxis of the bilateral nares, multiple facial contusions, deformity of the left wrist, and significant edema in the region of the right proximal femur. After initial ED evaluation and stabilization, which included bilateral large-bore (28French) chest tube placement, left femoral central venous line placement, a focused assessment with sonography in trauma examination that was negative but limited by a large amount of subcutaneous air, and resuscitation via standard Advanced Trauma Life Support protocol, the patient underwent emergent computed tomography imaging of the head, cervical spine, chest, abdomen, and pelvis. Imaging was noted for a number of findings, including extensive facial and skull fractures, diffuse subarachnoid hemorrhage, interhemispheric subdural hemorrhage without midline shift or evidence of herniation,

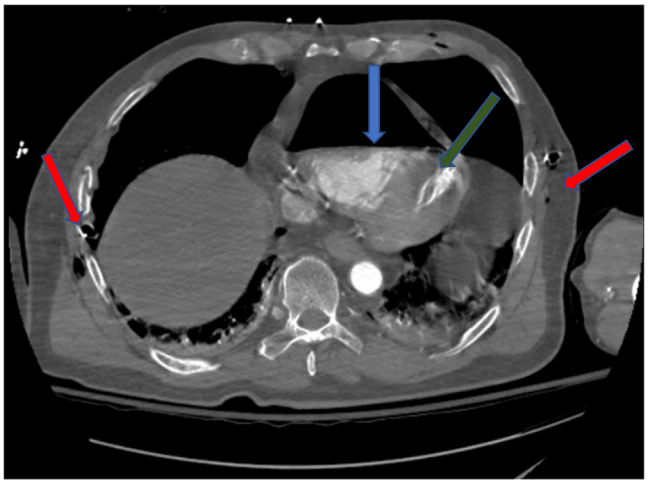

FIGURE 1 Transverse view of computed tomography of the chest at the level of lung bases with mediastinal window formatting. Pneumopericardium is present with compression of both right and left ventricle (blue arrow), pericardium visible outlining the air in the pericardial sac (green arrowhead), and 28French thoracostomy tubes seen entering the pleural cavity (red arrows).

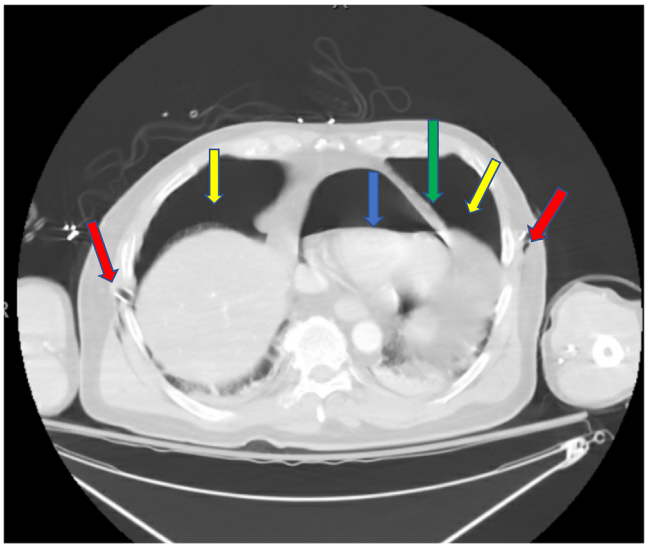

FIGURE 2 Transverse view of computed tomography of the chest at the level of lung bases with lung window formatting. Again, noted are pneumopericardium with compression of both right and left ventricle (blue arrow) and pericardium, (green arrow). Also seen are bilateral pneumothoraxes (yellow arrow) with chest tubes entering the pleural space (red arrows).

large bilateral pneumothoraxes with 28-French chest tubes positioned appropriately (Figures 1 and 2), pneumomediastinum, multiple bilateral rib fractures, and a large volume of air within the pericardial sac (Figures 1 and 2). There was significant compression and shift of the myocardium within the pericardial sac, consistent with tension physiology. Upon returning from radiology, the patient became hemodynamically unstable with a blood pressure of 43/30 mmHg, requiring pressor support with norepinephrine. Given his hemodynamic instability and lack of resolution via chest tube placement, the patient's tension pneumopericardium was managed via landmark-guided pericardiocentesis with 300 mL of air removed via needle aspiration with a 18gauge 3.5″ spinal needle with 60 mL syringe attached. No catheter was left in place. The patient's vital signs rapidly improved. He became hypertensive with a blood pressure of 153/117 mmHg and pressors were discontinued. The patient was subsequently successfully transferred to a level 1 trauma center via air transport. The patient unfortunately later expired on hospital day 2 at the referral center. His death was not believed to be related to his tension pneumopericardium.

2 | DISCUSSION

Tension pneumopericardium is a rare but important potential etiology of hemodynamic instability in trauma patients.[1] The entrance of air into the pericardial sac most commonly occurs from direct communication with the external environment, air tracking from ruptured alveoli, concomitant injuries to the esophagus or bronchial tree, or via congenital connection of the pleural and pericardial spaces.[1,2] The volume of air required to create tension pneumopericardium is thought to develop from a one-way valve effect.[1,3] This effect may occur in multisystem trauma patients because of the occurrence of the previously mentioned mechanisms in association with increased pleural pressures created by positive-pressure ventilation. Pneumopericardium is often self-limiting; however, in cases of tension pneumopericardium, definitive management generally involves undergoing a pericardial window.[4] This service is often unavailable in facilities without cardiac or thoracic surgery specialties available. Potential temporizing therapies include landmark-guided pericardiocentesis, ultrasound-guided pericardiocentesis, or thoracotomy. In general, ultrasound-guided pericardiocentesis is preferred over landmark-guided methods. Multiple studies and expert opinions have indicated decreased mortality and morbidity of pericardiocentesis with ultrasound guidance.[5] In the setting of extensive pneumopericardium and subcutaneous emphysema, ultrasound guidance may prove difficult. This may be due in part to the difficulty of discerning the air-filled pericardium from pulmonary tissue, as well as the acuity of the condition. Thoracotomy, although likely a more definitive approach, is difficult to advocate for in resource-limited settings owing to extended wait times and prolonged transports to definitive repair. We suggest that landmark-guided pericardiocentesis is a viable option for the treatment of tension pneumopericardium and may be the treatment of choice in resource-limited settings.

3 | CONCLUSIONS

Tension pneumopericardium is a rare but important etiology of hemodynamic instability in blunt trauma patients. Emergent treatment is indicated in the setting of hemodynamic instability related to pneumopericardium. A variety of techniques are available for management. In resource-limited settings, landmark-guided pericardiocentesis is indicated as a bridge to definitive care.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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