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## Case report

# Rapid onset mediastinal hematoma due to vertebral fracture and review of relevant literature



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## ABSTRACT

Patients with vertebral fractures are frequently encountered and those with thoracic and lumbar spine fractures are likely to have associated injuries. Detection of a widened mediastinum after trauma is very nonspecific and most of the time it is related to aortic injury or mediastinal hematoma. Vertebral or sternal fractures can also be the cause of mediastinal hematoma with or without aortic injury.

This report reviews an unusual case of rapid onset mediastinal hematoma due to vertebral fracture after a fall.

In the case, there was a mediastinal hematoma adjacent to a burst fracture of the T8 vertebral body. There was a rapid increase in identified hematoma during the emergency follow up and urgent erythrocyte transfusion was carried out.

We would like to raise awareness of this infrequent presentation of mediastinal hematoma, as it is insidious and possibly fatal. In the evaluation of mediastinal hematoma, the detection of osseous injuries is a requirement.

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## 1. Introduction

Detection of a widened mediastinum after trauma is very nonspecific. This situation typically refers to mediastinal hematoma and is usually due to aortic injury. A mediastinal hematoma is defined as presence of blood within the mediastinum as it dissects fascial planes. Traumatic etiologies that can contribute to a widened mediastinum, either in isolation or associated with an aortic injury, include vertebral or sternal fractures or a ruptured esophagus. Traumatic aortic injury is not the most common cause of mediastinal hematoma, but it is the most serious cause due to fatal results.<sup>1</sup> Still, it is very important to find the source of bleeding in patients with non-vascular injury.

## 2. Case

A 30-year-old man was admitted to emergency with complaints of back pain after falling from a height of 6 m onto his back. Physical examination revealed that there was tenderness on thoracic vertebrae with no crepitus or abnormal breath sounds. Thoracic vertebral fracture and posterior mediastinal hemorrhage was detected in computed tomography scan (Fig. 1 and 2). Spine imaging showed a burst fracture of the T8 vertebral body. Thoracic aortogram, performed to exclude the aortic injury, was normal. There was no other source of bleeding in cranial, thorax and abdomen tomography. Other laboratory tests, including electrocardiogram, electrolytes, CK myocardial band, and troponin-I level, were normal. Complete blood count revealed white blood cell and hematocrit levels of 13,000/dl and 41.2 mg/dl, respectively. Lack of vascular injury and location of bleeding being adjacent to the bone suggested that bleeding was due to thoracic 8th vertebral fracture. At the 4th hour of follow-up, there was a significant decrease at hematocrit level (34, 2 mg/dl) and 2 units of red blood cell (RBC) transfusions were given. Repeated computed tomography revealed an increase in posterior mediastinal hemorrhage (Fig. 3). The

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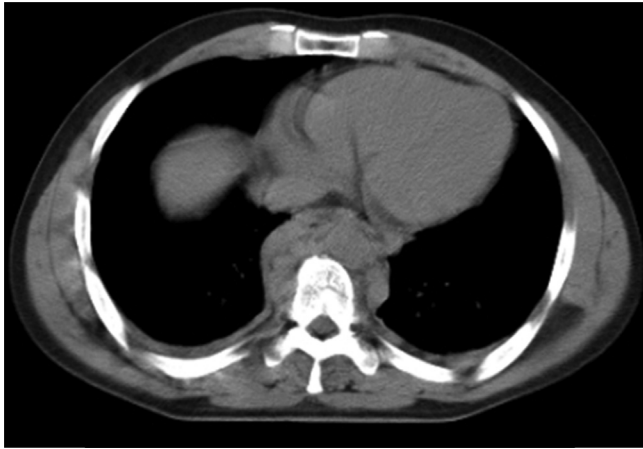


Fig. 1. Computed tomography scan illustrating Posterior Mediastinal Hematoma.

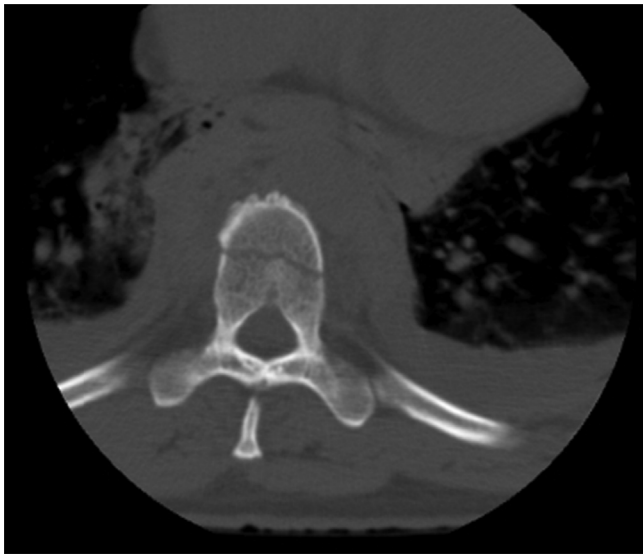


Fig. 2. Computed tomography scan illustrating thoracic vertebral fracture and the hemorrhage around the fracture.

patient was admitted to the intensive care unit and followed up for ten days. Although it was a large hematoma, the patient was managed conservatively without any intervention and his symptoms disappeared gradually. During this period, conservative non-surgical follow-up was performed and red blood cell (RBC) transfusions (2 units for first day, 2 units for second day) were given. Using a multidisciplinary approach, echocardiographies, chest X-rays, and standard laboratory tests (complete blood count, serum electrolytes, liver and kidney function tests) were performed. There was no progression of hematoma during the follow up of intensive care and ward.

### 3. Discussion

The etiology of mediastinal hematomas can be divided into traumatic and non-traumatic. The traumatic causes (which occur in the majority of patients) can be further subdivided into blunt chest trauma, penetrating chest trauma, and iatrogenic causes. In the case of blunt thoracic trauma, small venous injury is perhaps the most common cause of mediastinal hematoma. In addition, bleeding disorders and anticoagulant therapy can play a part. In the

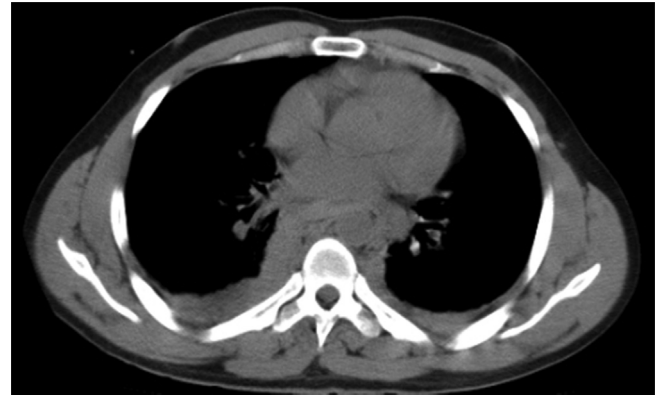


Fig. 3. Repeated Computed tomography scan illustrating the increased Posterior Mediastinal Hematoma, four hours after patient presentation.

case of penetrating trauma to the chest, such as gunshot wounds, several concomitant injuries are usually present; therefore, it is important to determine the entry and exit wounds as well as their relationship to the various mediastinal structures to establish the source of bleeding. Traumatic etiologies of mediastinal hematomas include traumatic aortic injury; mediastinal venous injury; misplacement of central catheters; and, rarely, sternal and spinal fractures.

Non-traumatic etiologies of mediastinal hematomas include non-traumatic aortic rupture, esophageal hemorrhage, and spontaneous [broken into 3 groups: secondary to underlying bleeding disorder; secondary to hemorrhage into mediastinal mass (preexisting mediastinal tumors, such as thymic, ectopic, thyroid, parathyroid masses, etc.); and other causes such as radiation vasculitis, infections, and rapid pressure elevation due to severe vomiting or Valsalva idiopathic, etc.].<sup>1</sup>

Theoretically, all organ pathologies adjacent to the mediastinum can be the cause of mediastinal hemorrhage and hematoma.

In mediastinal hematoma approach, it is very helpful to understand the mechanisms of vertebral trauma, involving forces and possible injury pattern. The thoracolumbar junction (T11 to L2) is considered a transitional zone between the highly fixed thoracic and relatively mobile lumbar regions. This distinction is important because the transitional zones sustain the greatest amount of stress during motion and are most vulnerable to injury. The most common levels for vertebral fracture are T11 to L2, particularly after a high-speed collision (thoracolumbar junction). This region is exposed to flexion mechanisms; correspondingly, mostly vertebral body fractures are seen in this region. Conversely, due to the stabilizing effect of ribcage, thoracic vertebrae have a relatively high stability. There are additional stabilizing effects via the near-vertical orientation of the articulating processes and the shingle-like oblique arrangement of the spinal processes. In this area a significant force is required for a fracture or dislocation to occur. In our case, there was a compression fracture on the 8th thoracic vertebra.

An injury to the spinal cord is likely to result in neural deficits. Spinal cord injury results in either complete or incomplete neural deficits (such as Brown-Séquard syndrome or anterior cord syndrome). Upon admission and during the follow up, there was no neurological deficit in our patient. In a study by Baldwin et al., conservative treatment of thoracolumbar spine fractures appeared safe.<sup>2</sup> In our case, conservative non-surgical follow-up was performed for the vertebral fracture. The tissue around the vertebrae was influenced by the vertebral fracture (instead of the spinal cord itself) and posterior mediastinal hematoma formation was seen.

Etiologically, mediastinal hematoma can be classified as traumatic (blunt, penetrant, or iatrogenic) or non-traumatic.<sup>3</sup> Vascular hemorrhage, especially venous vascular hemorrhage is the most common cause. Bone fractures very rarely cause mediastinal hematoma. Hematoma located in anterior mediastinum in contact with the posterior cortex of the sternum suggests sternal fracture,<sup>4</sup> while posterior mediastinal hematoma in contact with the anterior margin of the vertebral bodies suggests vertebral injury.<sup>5</sup> The use of coronal and sagittal reconstructed CT images can aid in the detection of fractures. In our patient, posterior mediastinal hematoma, located adjacent to 8th thoracic vertebral fracture, was detected by a tomography scan (Fig. 1 and 2).

Diagnosing mediastinal hematoma without histopathologic examination can be accomplished by using noninvasive techniques such as echocardiography, CT scanning, magnetic resonance imaging (MRI), and positron-emission tomography (PET) scanning. In our patient, repeated tomography and echocardiography were the bases of follow up.

Blood is supplied to vertebral column via segmental arteries that arise from the aorta. The arteria radicularis magna (ARM) (also known as the artery of Adamkiewicz) is the largest of the segmental arteries. Most commonly, the ARM rises to the level of T10 and generally enters into intervertebral foramen through a single intervertebral foramen between the levels of T9–T11.<sup>6</sup> In our case, mediastinal hematoma occurred more rapidly compared to the literature. Initially, increasing hemorrhage suggested that it was due to injury of a major artery, possibly the ARM. Because we were unsure of how the injury would progress, decompression surgery or selective angiography was planned in case it was needed. However, upon follow up, the hematoma remained stable and no invasive procedures were performed. In this situation, we speculate that the vertebral artery injury stabilized itself or the hematoma was due to venous hemorrhage.

Posterior mediastinal hematoma may be misdiagnosed as hemothorax, which is a condition that results from blood accumulation in pleural cavity. It results from a rupture of the serous membranes. Emergency physician should be aware of this distinction.

Spontaneous atraumatic mediastinal hematoma is a rare cause of a mediastinal mass. Anecdotal reports of coagulation abnormalities and neoplasms causing mediastinal hematomas have also been published.<sup>7,8</sup> The majority of mediastinal masses occur in the anterior mediastinum and therefore the hemorrhage due to mass can be expected in the anterior mediastinum. The most common causes are thymoma, lymphoma, and germ cell tumors.<sup>7,9</sup> In our case, there were no coagulation abnormalities or neoplasm.

There are some sporadic cases of traumatic mediastinal hematoma beyond great vessel and bone injury. Bürgueser et al. reported a spontaneous mediastinal hematoma as initial presentation of cystic adenoma of ectopic parathyroid<sup>10</sup> and McDermott et al. reported a mediastinal hematoma due to azygous vein rupture in blunt thoracic trauma.<sup>11</sup>

In literature review, the most common symptom of mediastinal hematoma was dyspnea or shortness of breath.<sup>1–4</sup> Other presenting symptoms included neck and chest wall ecchymosis, dysphagia, dysphonia, chest pain, tachycardia, and neck pain. In our case, the patient's major complaint at admission was back pain. During the emergency follow up, the patient complained of shortness of breath in addition to back pain.

Iatrogenic causes, including invasive procedures, transient increase in intra-thoracic pressure, and the Valsalva maneuver can cause mediastinal hematoma. In our patient, there was no invasive procedure or rapid intra-thoracic pressure-increasing procedure before the trauma.

The initial management of traumatic mediastinal hematoma is based on an emergent approach, including monitorization, close follow up, fluid resuscitation, and transfusion (if necessary). In our case, due to rapid deterioration, erythrocyte transfusion was carried out and the patient was followed in the intensive care unit.

#### 4. Conclusion

A multidisciplinary team approach should be used to manage these patients conservatively while carefully investigating the source of the hemorrhage. Mediastinal hematoma is an uncommon finding in vertebral trauma. We would like to raise an awareness of this infrequent presentation of mediastinal hematoma, as it is insidious and possibly fatal. While evaluating mediastinal hematoma, the detection of osseous injuries is a requirement.

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