

The Traumatic Vacuum Phenomenon at the Anterior Portion of the Spine: A Clue to Extensive Spinal Fracture

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Abstract A sixty-seven-year-old man complained back pain after falling from a ladder. On arrival, he had no neurological deficits in either leg. Emergency truncal computed tomography (CT) demonstrated multiple rib fractures with lung contusion and air density at the anterior portion of the 12th thoracic spine with fracture of the spinous process. Magnetic resonance imaging demonstrated an area of high intensity at the anterior portion of the 10 and 11th thoracic spine with the posterior portion of the 11 and 12th thoracic spine, suggesting extensive unstable lower thoracic fracture. The present case suggested that air density at the anterior portion of the spine on the CT might be an important clue that suggests the existence of rare extensive thoracic spinal fracture.

Keywords: vacuum phenomenon, extensive spinal fracture, computed tomography, diagnosis

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1. Introduction

The presence of incidental air density at joints or fracture sites is referred to as the vacuum phenomenon (VP). [1] The following mechanism is reported to underlie the formation of the VP. If an enclosed space is allowed to expand, the volume within the enclosed space will increase. In the setting of an expanding volume, the pressure within the space will fall. The solubility of the gas in the enclosed space will decrease as the pressure of the space decreases. Decreased solubility allows the gas to leave the solution. The combination of lower nitrogen solubility and the minimal metabolism of nitrogen by the body mainly accounts for the formation of the VP. The VP is observed at locations that experience a traumatic impact; thus, an analysis of the VP may be useful for elucidating the mechanism of injuries. [2] In the case of spinal trauma, the observation of the VP near the site of the avulsion of a nerve root or pneumorrhachis is observed on computed tomography (CT). [3,4] We herein report a case of traumatic VP at the anterior portion of the spine in a patient with extensive spinal fracture.

2. Case report

A sixty-seven-year-old man complained back pain after falling from a ladder. His past history included hypertension and benign prostatic hypertrophy. On arrival,

he was alert and his vital signs were stable, with the exception of hypertension. He had no neurological deficits in either leg. Emergency truncal CT demonstrated multiple rib fractures with lung contusion and air density at the anterior portion of the 12th thoracic spine with fracture of the spinous process (Figure 1). Magnetic resonance imaging, which was performed immediately after CT, demonstrated an area of high intensity at the anterior portion of the 10 and 11th thoracic spine with the posterior portion of the 11 and 12th thoracic spine, suggesting extensive unstable lower thoracic fracture (Figure 2). His trunk was stabilized in a 30-degree flexural position on a bed and surgical immobilization was performed on the 4th hospital day. His postoperative course was uneventful.

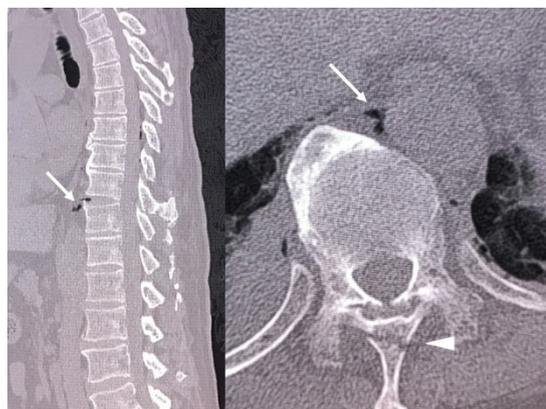


Figure 1. Computed tomography (CT) on arrival

CT demonstrates air density at the anterior portion of the 12th thoracic spine (arrow) with fracture of the spinous process (triangle). Left, sagittal view; Right, axial view.



Figure 2. Computed tomography (CT) and magnetic resonance image (MRI) on arrival

MRI demonstrates an area of high intensity in the anterior portion of the 10 and 11th thoracic spine with the posterior portion of the 11 and 12th thoracic spine. Left, sagittal CT view; Right, sagittal MRI view.

3. Discussion

This is the first case report to demonstrate traumatic VP at the anterior portion of spine in a patient with extensive thoracic spinal fracture.

Injury of the anterior longitudinal ligament or fracture in cases of diffuse idiopathic skeletal hyperostosis often complicate the treatment of extensive spinal fracture. [5] In such cases, the existence of hematoma at the anterior portion might suggest the possibility of extensive spinal fracture. Like the present case, the air density at the anterior portion of spine on the CT might suggest extensive thoracic spinal fracture because the extensive energy results in the expansion of the tissue and this action can lead to the formation the VP. Hyperextension injuries of the thoracolumbar spine are rare, but injuries of this type are unstable and often require surgical immobilization. [6,7,8] In addition, it is difficult to identify without MRI. Accordingly, the air density at the anterior portion of the spine on plain CT might be an important clue to suggest the existence of extensive thoracic spinal fracture.

4. Conclusion

The present case suggested that air density at the anterior portion of the spine on the CT might be an

important clue that suggests the existence of extensive thoracic spinal fracture.

Conflict of Interest

The authors declare no conflicts of interest in association with the present study.

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List of Abbreviations

CT: computed tomography
MRI: magnetic resonance image
VP: vacuum phenomenon.

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