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Case Report

Intercostal artery rupture associated with thoracic spinal hyperextension injury caused by a minor trauma: A case report

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ABSTRACT

Diffuse idiopathic skeletal hyperostosis is associated with hyperextension injury of the spine caused by a minor trauma and may often be diagnosed late, thus preventing effective treatment. To date, there have been no reported cases of segmental arterial injury associated with a hyperextension injury caused by a minor trauma in super-elderly patients with diffuse idiopathic skeletal hyperostosis. Herein, we present the findings and treatment provided for a 92-year-old woman with a right massive hemothorax and 12th thoracic vertebral fracture. The patient was diagnosed with diffuse idiopathic skeletal hyperostosis. Bleeding stopped naturally, and we successfully treated the patient using posterior fixation with percutaneous pedicle screws. At 6 months post-surgery, there was no complication, instrumentation failure, or correction loss, and she could walk independently using a cane. To our knowledge, this is the first report of intercostal artery rupture and massive hemothorax associated with diffuse idiopathic skeletal hyperostosis fracture caused by a minor trauma. It is notable that diffuse idiopathic skeletal hyperostosis following a minor trauma in such elderly patients may cause segmental arterial rupture associated with spinal burst fracture and hyperextension injury.

Introduction

Diffuse idiopathic skeletal hyperostosis (DISH) is a disease of unknown cause that induces systemic bone growth. Among the general population, it has a prevalence of 11%, which increases with age [1]. With spinal lesions, the intervertebral space fuses, and range of motion decreases [2]. Hyperextension injury associated with spinal fractures is rare [3] and is usually seen in patients with ankylosing spondylitis or DISH [3]. However, studies have reported on complications of greater vascular injury due to spinal hyperextension injury, usually caused by high-energy trauma, although reports on accompanying segmental arterial injuries are very rare [4]. To date, there has been no reported case of a segmental arterial injury associated with a hyperextension injury caused by a minor trauma in a super-elderly patient with DISH. Herein, we describe a thoracic spinal hyperextension injury in a super-elderly patient with DISH complicated by a segmental artery injury and massive hemothorax, caused by minor trauma.

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Patient information and clinical findings

A 92-year-old woman, (height 146 cm; weight 46.5 kg) experienced minor trauma by falling on her buttocks. Two days later, she experienced chest pain and dyspnea and was brought in an ambulance to the Department of Cardiology where she had previously presented for atrial fibrillation and had been prescribed direct oral anticoagulants (DOACs) to prevent cerebral infarction. On arrival at the emergency room, her blood pressure was 92/60 mmHg, heart rate was 118 bpm, SpO_2 was 90% (mask 5 L), and hemoglobin (Hb) was 8.8 g/dL.

Diagnostic assessment

Computed tomography (CT) revealed a right massive hemothorax and 12th thoracic (T12) vertebral fracture (Fig. 1), and the cardiologist consulted by the Department of Orthopedic Surgery recommended DOAC discontinuation. The orthopedic surgeon diagnosed the patient with a T12 compression fracture that had no correlation with the massive hemothorax, and she was admitted to the Department of Cardiology for careful examination of the new massive hemothorax and anemia.

Therapeutic intervention

On the day after admission, the patient was examined to determine the correlation between the hemothorax and vertebral fracture. We diagnosed her with traumatic extra-pleural hemothorax and a T12 vertebral burst fracture (AO Classification-B3, N0, M2) with DISH (Fig. 1B). Enhanced CT indicated no enhancement on the peripheral side of the right 12th intercostal artery from the fracture site and no remarkable extravasation (Fig. 2). Based on signs of shock upon arrival and no enhancement of the intercostal artery, we determined that the massive hemothorax had been caused by rupture of the 12th intercostal artery at the fracture site. A radiologist also determined that the hemothorax was caused by an intercostal artery injury due to the T12 spinal fracture. A chest drainage tube was inserted, and 800 mL of bloody discharge was drained (Fig. 3). The bloody discharge did not obviously increase—there was an additional 100 mL of more dilute bloody discharge—and her Hb was 8.7 g/dL the next day, so it was thought that there was no active bleeding and hemostasis was obtained. Thus, spinal posterior fixation from T9 to L3 was performed without trans-arterial embolization (TAE) of the right 12th intercostal artery on third day after admission (Fig. 4). The operation time was 126 min, and intraoperative blood loss was 85 mL.

Follow-up and outcomes

The patient's DOAC was restarted on postoperative day (POD) 1, and there was no increase in chest drainage and no decrease in Hb on POD2. As no recurrence of the hemothorax due to DOAC was identified, the chest tube was removed. Gait training began with the use of a trunk orthosis on POD3, and there were no postoperative complications. She walked using a cane and had no correction loss or instrumentation failure 6 months post-operation. The patient consented for her data to be submitted for publication.

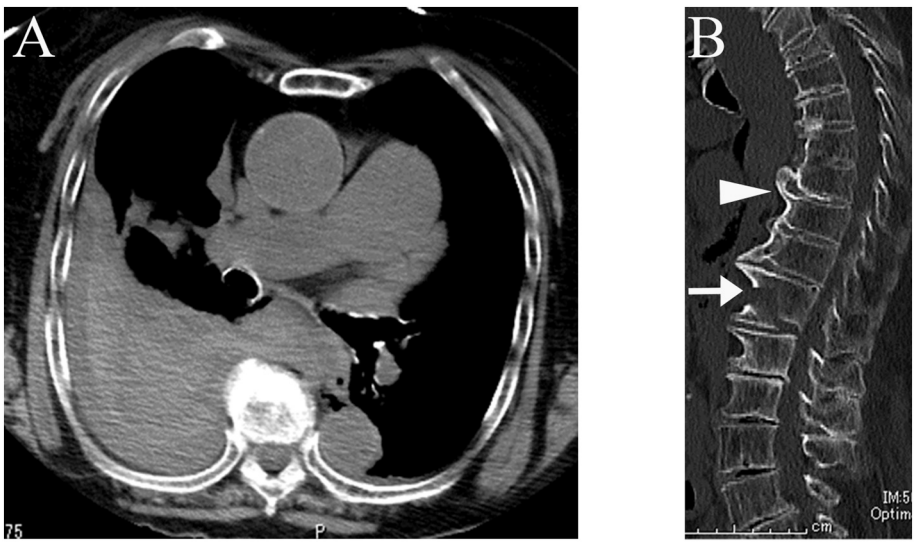

Fig. 1. Computed tomography shows a massive right hemothorax in the axial plane (A) and a 12th thoracic (T12) AO-B3 spinal fracture (arrow) and diffuse idiopathic skeletal hyperostosis (arrowhead) in the sagittal plane (B).

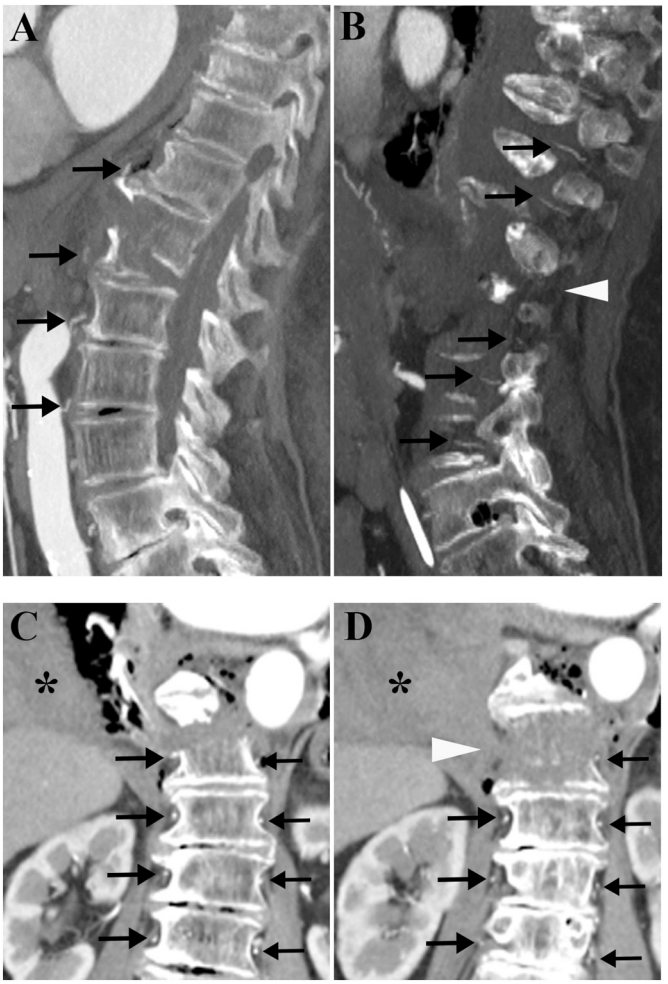

Fig. 2. Enhanced sagittal (A and B) and coronal (C and D) CT images. Enhanced arteries are identified by arrows, and arteries that are not enhanced are identified by arrowheads. Asterisks show right hemothorax (C and D).

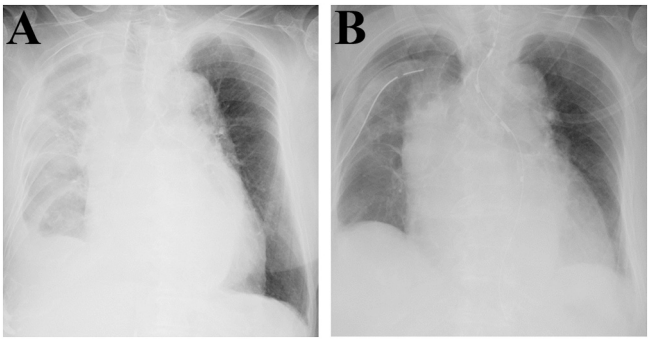

Fig. 3. A chest drainage tube was inserted in the right chest (B); 800 ml bloody discharge was drained, and improved X-ray permeability is noted compared to X-ray on admission (A).

Discussion

In this case, the minor trauma caused a thoracic AO-B3 vertebral burst fracture with 12th right intercostal artery rupture and a right extra-pleural hemothorax in a super-elderly patient with DISH. There was no re-bleeding from the injured artery during or post-operation, and the hospitalization course was good with no complications.

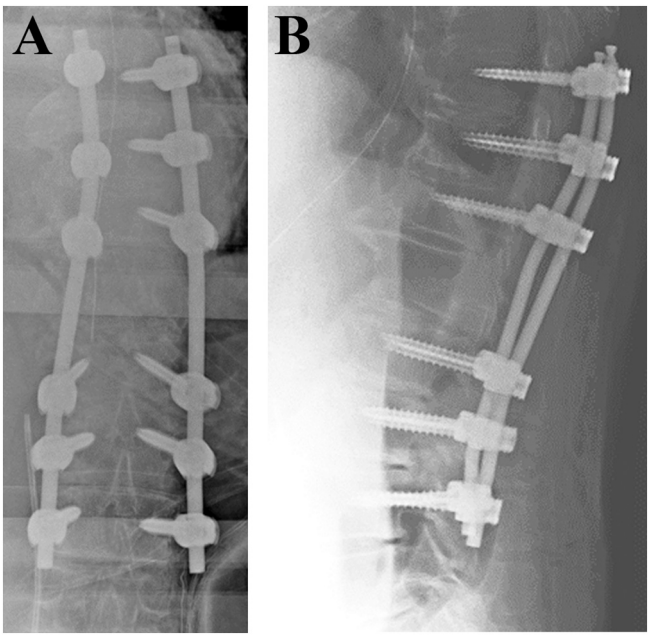

Fig. 4. Postoperative X-rays show good reduction of the T12 fracture and posterior fusion from T9 to L3.

Most thoracolumbar burst fractures are AO-A type flexion injuries with vertebral body collapse, and hyperextension injury is rare [5]. Moreover, vascular injuries are rarely associated with thoracolumbar burst fractures. Santoro et al. reported that among 357 thoracolumbar burst fractures, five (1.4%) were associated with vascular injuries in the aorta and its collateral branches [4]. According to them, 47 thoracolumbar burst fractures with vascular injuries had been previously reported, most caused by high-energy traumas. These included 43 aortic injuries, three segmental artery injuries (two lumbar arteries and one intercostal artery), and one phrenic artery injury. TAE was important [4], and 60% of spinal surgery patients with burst fractures and vascular injuries had died prior to vascular treatment [6]. Thus, TAE should be performed before spinal surgery when there is extravasation on enhanced CT or angiography, rapid decrease of Hb, hemorrhagic shock, and active bleeding. If the hemodynamics are stable and active bleeding is not suggested, as in this case, early spinal fusion may be performed.

DISH is defined as a systemic non-inflammatory disorder characterized by calcification or ossification along the anterolateral aspects of at least four contiguous vertebral levels [7], and the important clinical features are functional spinal ankylosis, poor bone quality, advanced patient age, and presence of comorbidities, which easily cause burst fracture with hyperextension injury by minor trauma [3]. Patients with ankylosing spondylitis or severe arthrosis including DISH are particularly exposed to traumatic aortic rupture due to tenacious adhesions between the aorta and anterior longitudinal ligament commonly found in these pathologies [4]. Even pre-existing vascular conditions, such as atherosclerosis, can promote aortic damage [8]. Spinal trauma that involves excessive traction or distortion of the aorta, probably thickened and less elastic, may cause tearing or breakage [4]. In this case, the minor trauma of falling on her buttocks caused a hyperextension injury of the DISH spine, and the right 12th intercostal artery, which lost essential elasticity owing to adhesions to the surrounding soft tissue, might have been ruptured by traction of the hyperextension injury.

DISH spinal fracture is likely related to delayed diagnosis. Okada et al. reported that among 285 thoracolumbar DISH fractures, 115 (40%) had a delayed diagnosis, of which 60% (68/115) were owing to a doctor's delay and 45% (51/68) were owing to an orthopedic surgeon's delay [9]. Delayed diagnosis is the main factor in neurological deterioration and CT multi-planar reconstruction (MPR) or magnetic resonance imaging (MRI) should be used to avoid it [10]. In our case, the doctor's diagnosis was delayed although CT-MPR was performed before consultation with an orthopedic surgeon. Fortunately, this patient did not present with neurological deterioration. Correct diagnosis of DISH and AO-B3 type spinal fractures is important. Moreover, as the number of super-elderly people has increased in recent years, that of extension injury fractures associated with DISH will increase. Thus, to avoid preventable complications of DISH hyperextension injury, enhanced CT should be performed along with MRI.

Conclusion

This case of AO-B3 thoracic vertebra fracture with DISH complicated by intercostal arterial rupture and hemothorax highlights how an artery near a spinal fracture site might be ruptured in DISH even if the injury is minor, especially in patients with hyperextension injuries. Therefore, the presence of bleeding should be confirmed on admission preoperatively to avoid preventable complications.

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Declaration of competing interest

None.

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