

Case Reports

Endovascular Aortic Repair for Thoracic Aortic Compression Resulting From Chance Fracture of the Thoracic Spine

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Abstract

Blunt aortic injury is a serious condition with a high mortality rate. Although rare, blunt aortic injury associated with spinal fracture has also been reported, and appropriate management of aortic disease is key to a good outcome. This report is a case of a 78-year-old man who was found to have a transverse fracture (Chance fracture) in the ninth thoracic vertebra, with a sharp bone fragment compressing the thoracic aorta. Early spinal surgery was needed; however, there was concern about the possibility of bleeding from the aorta and surrounding small arteries associated with the bone fragment during spinal surgery. Therefore, thoracic endovascular aortic repair was performed before spinal surgery. The next day after thoracic endovascular aortic repair, posterior spinal instrumentation was performed, and the postoperative course was uneventful. Because aortic injury associated with vertebral fracture can lead to massive bleeding and spinal cord injury, endovascular repair before spinal surgery is reasonable.

Keywords: Thoracic aorta; thoracic vertebrae; spinal fracture; blunt injury, endovascular procedure

Introduction

Blunt aortic injury (BAI) associated with thoracolumbar spine fracture has been reported in several cases and is often lethal, even when it occurs as low-energy trauma.^{1,2} Blunt aortic injury rarely occurs in transverse fracture of the thoracolumbar spine (Chance fracture), and an appropriate treatment strategy is essential for a good outcome. This is a report of a case of Chance fracture resulting from an anteriorly displaced bone fragment wherein the patient underwent thoracic endovascular aortic repair (TEVAR) before spinal surgery.

Case Report

A 78-year-old man was transported to the emergency department reporting back pain and injury after falling from a 2-meter-high stone wall during farming activity. He had a history of hypertension, type 2 diabetes mellitus, cervical osteoarthritis, and angina pectoris, the latter of which was treated with percutaneous coronary intervention. On arrival to the emergency department, the patient had clear consciousness, stable hemodynamic conditions, and calm respiratory status. Neurological abnormalities were not observed.

Blood test results revealed mild anemia, elevated D-dimer levels, and mild renal dysfunction. Chest radiography revealed opacity in the right lung field. Computed tomography revealed multiple fractures of the bilateral ribs, right

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hemothorax, and a transverse fracture of the ninth thoracic vertebra (AO Spine Thoracolumbar Spine Classification System type C, Chance fracture).³ An anteriorly displaced fracture fragment in close proximity to the distal descending aorta compressed the aorta (Fig. 1 and Fig. 2). There was no obvious extravasation around the distal descending aorta or the fracture fragment.

A right thoracic drain was immediately placed in the patient. The thoracic vertebral fracture was unstable and was considered an indication for early spinal surgery in terms of avoiding spinal cord injury and early ambulation. However, the fracture fragments were likely to cause direct aortic injury or arterial injury surrounding the aorta in relation to positional changes during spinal surgery. Therefore, it was decided to perform TEVAR before spinal surgery.

Surgery was performed under general anesthesia. Preoperative angiography revealed no obvious extravasation. A stent graft (Zenith Alpha ZTA-P-26-105-W1; Cook Medical) was deployed into the ninth thoracic vertebral segment of the thoracic aorta through the left femoral artery. Postoperative angiography confirmed the absence of endoleak.

After surgery, the patient was hemodynamically stable. The day after TEVAR, posterior spinal instrumentation was performed with the patient in the prone position under general anesthesia. The spinal surgery was completed without bleeding complications. The patient was discharged from the intensive care unit on the second day after TEVAR.

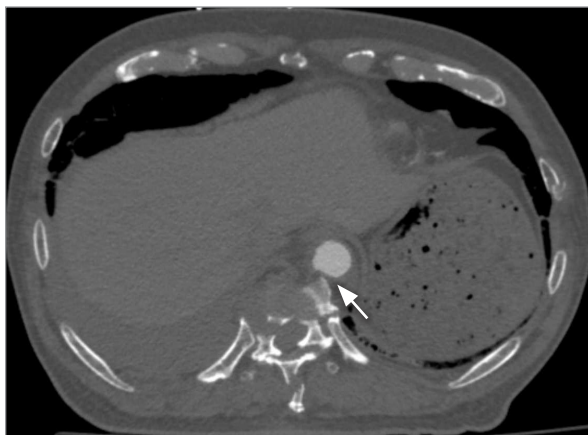


Fig. 1 Axial computed tomography demonstrates a sharp fracture fragment of the ninth thoracic vertebra in close proximity to and appearing to compress the descending aorta (arrow).

Abbreviations and Acronyms

BAI	blunt aortic injury
TEVAR	thoracic endovascular aortic repair

The patient had no complications and was discharged on walking alone with a cane. Postoperative computed tomography demonstrated no endoleak, and the aortic compression by the bone fragments was released by posterior fixation (Fig. 3). The patient consented to the publication of his data.



Fig. 2 Sagittal computed tomography reveals compression of the descending aorta by the ninth thoracic vertebra (arrow).

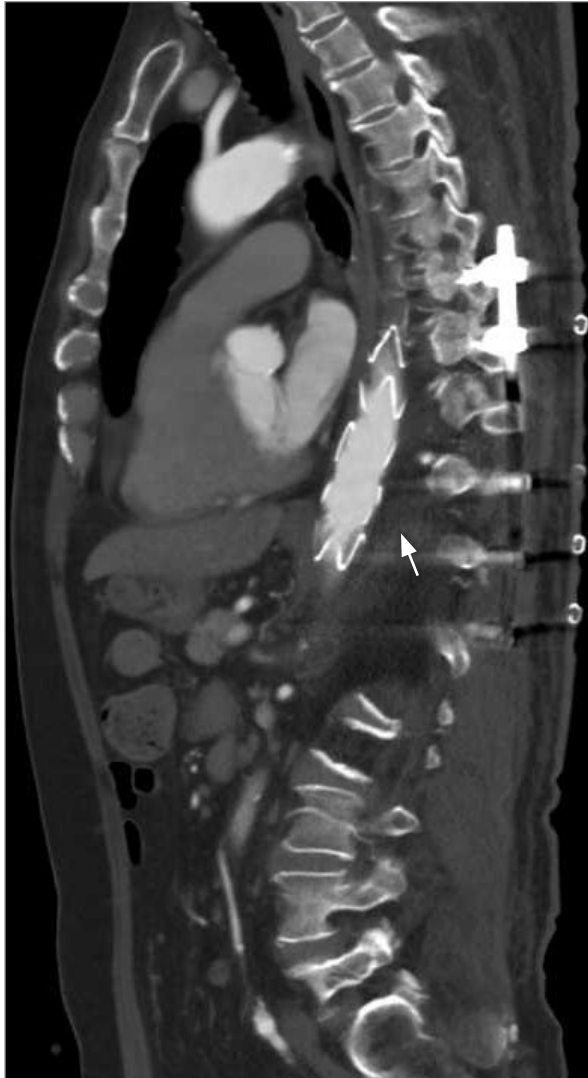


Fig. 3 Posttreatment computed tomography image revealed that the aorta in the area compressed by the thoracic vertebra (arrow) was protected and dilated by the stent graft.

Discussion

Blunt aortic injury is extremely lethal, with a mortality rate of 75% to 85% before transport to the hospital.⁴⁻⁶ Blunt aortic injury is usually caused by combined forces, including stretching, shearing, and torsion, associated with sudden deceleration of the aorta.⁴ More than 75% of cases are caused by high-energy trauma from automobile or motorcycle collisions.⁵ Although rare, BAI associated with thoracolumbar spine fracture can also occur⁷; such injuries have been reported to occur with low-energy trauma.^{1,2} Thoracolumbar spine fractures with aortic injury are most common in the 11th tho-

racic to second lumbar vertebrae, and the most common fracture type is type C of the AO Spine Thoracolumbar Spine Classification System.⁷ These fracture types are often unstable, and early spinal surgery is recommended. In the present case, the fracture type was classified as a Chance fracture among thoracolumbar spine fractures, which is a transverse fracture extending to the spinous process, vertebral arch, vertebral root, and vertebral body of the spine and is caused by tension from the sudden deceleration resulting from a collision or fall.⁸

Several cases of aortic injury associated with vertebral fractures have been reported, and the treatment of each aortic complication varies. A case reported by Cultrera et al⁶ is similar to this case in treatment strategy. In cases of thoracic vertebral fractures in which the bone fragments were in close proximity to the descending aorta, TEVAR was performed first, followed by posterior spinal instrumentation, considering the possibility of potential aortic injury. In a case of aortic compression caused by dislocated thoracic spine osteophytes, Adachi et al⁹ performed posterior spinal instrumentation with the placement of a resuscitation endovascular balloon occlusion of the aorta catheter and TEVAR on standby to prepare for secondary aortic injury by surgical manipulation. Injury to the abdominal aorta (which is anatomically difficult to treat endovascularly) caused by fracture fragments was also reported by Yoshioka et al.¹ They encountered a case of fall trauma with abdominal aortic injury resulting from a second lumbar bone fragment with retroperitoneal hemorrhage, and the patient underwent abdominal aortic replacement after the retroperitoneal hemorrhage was reduced with conservative treatment. According to a report by Santoro et al,⁷ the mortality rate was high in cases in which spinal injuries were treated before vascular complications. Therefore, vascular repair should be the first priority in treatment.

In addition to reports on aortic injuries associated with thoracolumbar spine fractures, there are also reports of surrounding arterial injuries, such as to the lumbar arteries or intercostal arteries,^{7,10} which can be fatal even when the vertebral fracture does not directly cause aortic injury. Although there was no obvious extravascular leakage in the present case, the possibility of aortic injury based on the compression of the bone fragment and the risk of injury to the surrounding arteries by free bone fragments was concerning. Regarding the treatment of common BAI of the thoracic aorta, treatment with stent grafts has been increasing every year and has improved outcomes compared with open surgery.⁵ In

addition, when multiple organ injuries are complicated, TEVAR is superior to open surgery for traumatic thoracic aortic injuries because it avoids cardiopulmonary bypass following high-dose heparin administration. In the present case, early intervention of the aortic lesion using TEVAR made it possible for the patient to more smoothly continue with rehabilitation and treatment of other diseases.

We encountered a case of aortic compression associated with a bone fragment of the thoracic vertebra wherein the fracture resulted from a fall accident. Thoracic endovascular aortic repair was performed before spinal surgery because of the risk of aortic injury related to positional changes and spinal surgical manipulation. This strategy resulted in a successful outcome. Aortic injury associated with vertebral fracture is a severe condition, and appropriate management of aortic complications is key to a good outcome.

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Conflict of Interest Disclosures: None

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