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Case Report

Initial experience with the treatment of concomitant aortic pseudoaneurysm and thoracolumbar spinal fracture: Case report

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ABSTRACT

One blunt abdominal aortic disruption (BAAD) and one blunt thoracic aortic injury (BTAI) case are presented. Both aortic injuries were combined with spinal fractures. In the BAAD case the aortic pseudoaneurysm manifested just above the lumbar fracture while in the BTAI case the aortic injury appeared several vertebras below the thoracal fracture site, suggesting different mechanisms in the aortic wall damage. In both cases the aortic wall first was sealed, successfully, by endovascularly-placed stents, meaning the risks of open aortic reconstructive surgery could be avoided. The adjacent crucial vessel's preservation, despite the stent covering the left subclavian artery and the left common carotid artery in one of the cases was verified by post-operative computed tomography angiography (CTA) examination. In second stage those spinal fractures which were deemed unstable were stabilized by the fixateur interne (a transpedicular screw-rod system). With this treatment sequence we wanted to avoid the unnecessary risk of a possible rupture of the unsealed aortic wall during positioning for the spinal procedure and during the spinal surgery. Both patients recovered from their aortic and spinal injuries.

Introduction

Blunt injury to the thorax or to the abdomen which causes aortic injury is not uncommon, although concomitant thoracolumbar spinal fractures and blunt aortic disruption are rare. These injuries together can occur mainly as a result of accidents in which the high energy is transferred to the patient's body at the moment of impact (i.e. motor vehicle collision, fall from heights or extreme sports). Low energy impact can also cause aortic laceration, however infrequently, when fractured vertebra damages the aortic wall. In these complicated cases diagnosis and treatment options (i.e. observation, open reconstructive surgery versus endovascular stenting of a potentially life threatening aortic dissection, pseudo-aneurysm or wall rupture) need full consideration. Furthermore, in consideration of a concurrent spinal fracture, the treatment method and, should surgery be necessary, choice among surgery types are also issues. Two cases and their successful solutions are presented in this article.

This case report was approved by our Institutional Review Board.

Case I

A 31 years old female fell from an extreme height due to a malfunctioning parachute. Whole body Computed Tomography

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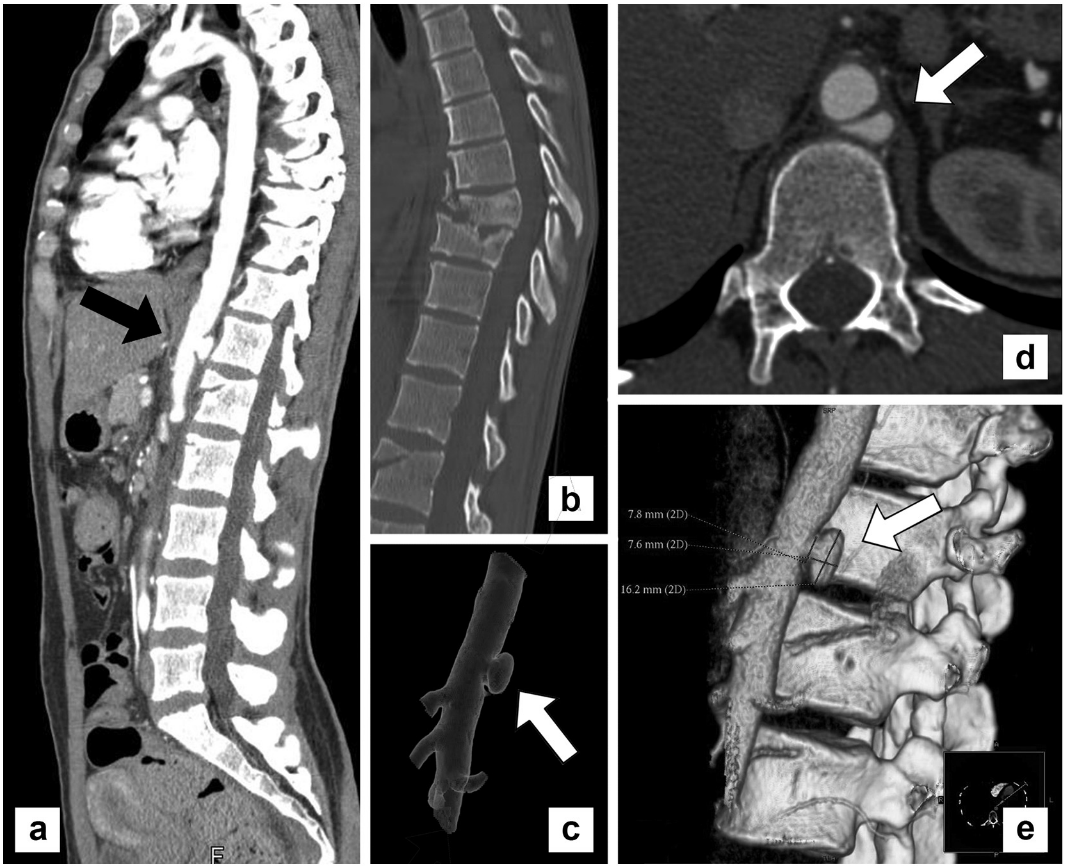

Fig. 1. Sagittal CT image shows the aortic wall damage, and the contrast agent leaving the lumen. Black arrow indicates the location (a). CT image presents Th8-9 and L1 vertebral fractures (b). 3D CT reconstruction image of the aorta highlights the vessel injury (c). Axial CT slice shows the same pathology (d). 3D CT reconstruction image demonstrates the aortic wall disruption and its location compared to the L1 fracture (e). White arrow points at the aortic lesion (c,d,e).

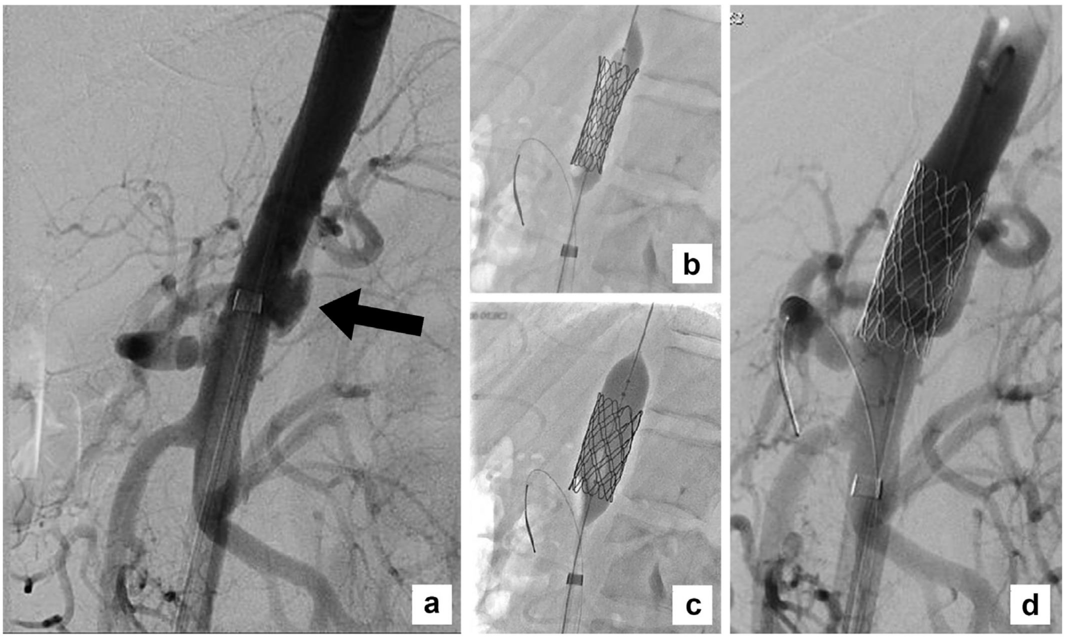

Fig. 2. Endovascular intraoperative images are presented. The black arrow indicates the site where contrast agent leaves the lumen of the aorta (a). Stenting is shown (b,c). After stenting the control image verifies the closed aortic wall with preserved celiac axis (d).

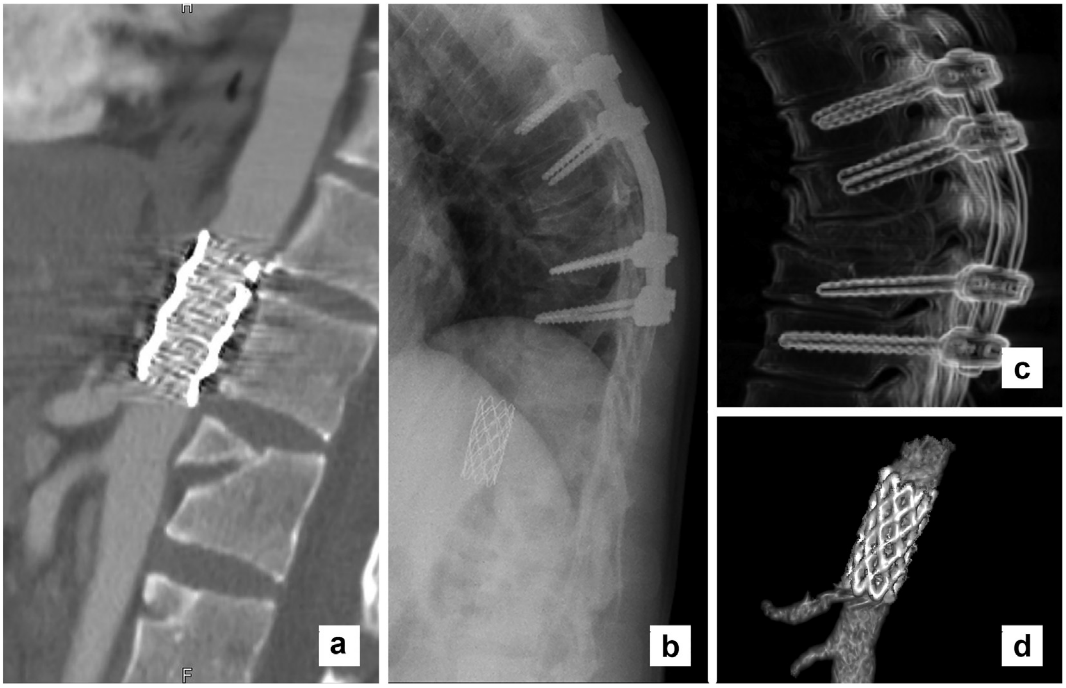

Fig. 3. Post-operative CT angiography shows the stent in the aorta with no contrast agent leakage and the filling of the celiac axis (a). A lateral X-ray image presents the aortic stent graft and the in-situ stabilized Th8-9 vertebral fractures (b). The spinal implants can be seen on the 3D CT reconstructed image (c). 3D image presents the stent graft-sealed aorta with the intact celiac axis (d).

(WBCT) scan showed multiple consecutive thoracal (Th8–9 AO B2 type) spinal fractures and lumbar (L1AO A1 type) fractures, with consecutive 8–11 rib fractures, a stable pelvic fracture, retroperitoneal hemorrhaging and bilateral hemo-pneumothorax. An arterial phase contrast agent left the lumen of the aorta at the level of Th12 vertebra tracing out a 9 × 16 × 16 mm pseudoaneurysm 8 mm above the celiac axis (grade III according to classification described by Azizzadeh et al.) [1] (Fig 1). There was no sign of perfusion perturbation below the level of the aortic injury and the patient hemodynamically remained stable. No neurological deficit could be detected, and the bilateral hemo-pneumothorax was drained. In commencing treatment, an invasive radiologist sealed the tear of the aortic wall with an endovascularly-placed stent graft (NuMmed CP 39 mm long, teflon-coated stent graft) without any adverse effect (Fig. 2). The stent graft did not overlap the celiac axis as it ended proximally to the vessel. The thoracal fracture was then stabilized by a transpedicular screw-rod system in situ (Th6-10 stabilization with Expedium system - DePuy Synthes Spine), and the dural sac was decompressed by a Th8 laminectomy (Fig. 3). Fracture-related hyperkyphosis was not corrected, and the post-operative period was uneventful. The patient recovered completely and gave birth to a healthy child three years ago.

Case II

A 32-year-old male automobile driver was injured in amotor vehicle collision (MVC). Because of decreasing oxygen saturation and tachypnea endotracheal intubation was performed and artificial ventilation was begun at the accident site in addition to a bilateral minithoracostomy. CT imaging verified Th1, Th3 AO A1 type and Th2 AO A2 type thoracal vertebral fractures associated with an aortic pseudoaneurysm in the arch (Fig. 4). Left-sided ribs 1 and 6, and multiple right-sided (1 − 10) rib fractures causing thorax instability and bilateral hemo-pneumothorax with lung contusions were also revealed. Additionally, L1 and 2 vertebral, right scapule, right acetabular and right trimalleolar fractures, intraperitoneal free air with some blood, right-sided sub- and epidural intracranial hemorrhages were identified. This patient became hemodynamically stable after bilateral intrapleural drainage, and a laparotomy was not necessary. After the repositioning of the femoral head the acetabular fracture was treated conservatively, and, due to the malleolar fracture, osteosynthesis was performed. Extension was provided for right inferior extremity. Additionally, the patient received a stent graft into the aorta via an endovascular procedure prior to spinal stabilization. The stent graft extending across the left subclavian artery caused no flow restriction and therefore no adverse effect. The serial thoracal vertebral fracture which included AO A2 type injury was stabilized by a C7-Th4 trandspedicular screw-rod construct (Expedium system - DePuy Synthes Spine) (Fig. 5). He also recovered completely from the major vessel injury and thoracal fracture.

Discussion

Traumatic blunt injuries to the aorta, usually referred to as blunt abdominal aortic disruption (BAAD) or blunt thoracic or traumatic aortic injury (BTAI) regardless the severely damaged part of the aorta (i.e. abdominal, arch, thoracal segment). BAAD or

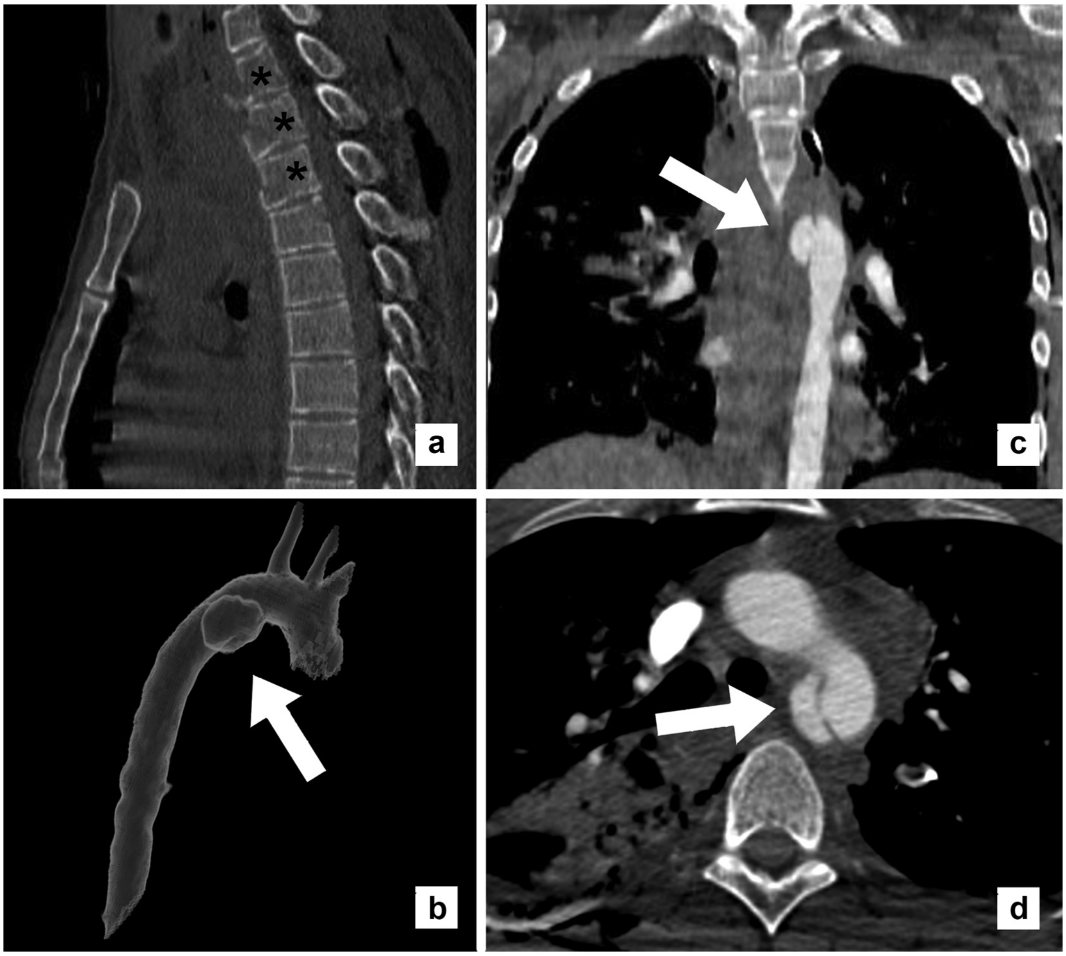

Fig. 4. Sagittal CT scan slice presents the fractured Th1-3 vertebras. Black asterisk marks the fractured vertebrae (a). 3D CT reconstruction image (b) and CT angiography images (c,d) demonstrate the aortic wall injury with leaking contrast agent. White arrow points at the aortic lesion.

BTAI, is the second most common cause of death after blunt head injury [2–4].

Traumatic aortic wall disruption is likely to occur in addition to injuries to other organs, including spinal column fractures. There are only a few articles which present concurrent aortic laceration and spinal fractures. Diagnostics of those patients who suffer from poly or multi trauma should involve, per modern trauma guidelines the entire spine, chest, abdomen, pelvis CT and, if clinical signs indicate, head CT as well [5]. In similar cases at our hospital we administer intravenous contrast agent for a more detailed screening of the major blood vessels to indicate possible leakages during the multiple phases. The mortality rate of untreated BAAD can be 90%, with a 85% mortality rate prior to hospital admission [4,6,7]. The feasibility of thoracic endovascular aortic repair (TEVAR) by insertion of an endoprosthesis (stent graft) and as an alternative method to open surgery is well established in literature of the past decade. RESCUE trial and other studies showed an eight to 9% mortality rate using stent grafts endovascularly compared to open reconstructive surgery, which could rise to a 35–45% mortality rate [3,8–11]. Furthermore, considering the usually numerous concurrent injuries or possible co-morbidities which may increase the complication rate of open procedures, or render it, due to the risks unacceptable (i.e. lung contusion in case of a thoracic descending aorta injury), endovascular treatment became more popular [4,12]. Advantages of TEVAR versus open surgery (avoidance of cardiopulmonary bypass surgery, significant systemic heparinisation, and a thoracotomy) result in the reduction of morbidity rate [3,4]. Handling the left subclavian artery to preserve its flow (if it is involved in the stenting site) is still disputed (fenestrated stent graft versus surgical revascularisation) [3,13]. In case of an associated vertebral fracture, the aortic wall should be repaired first to prevent a sudden aortic rupture which could result from turning the patient to a lateral or prone position for spinal surgery, or due to manipulation during spinal realignment.

In one of our cases the aortic injury manifested exactly above the L1 vertebra fracture at the niveau of Th12 vertebra. In the other case the aortic wall disruption took shape below the fractured vertebras (Th1-3) at the level of Th5 vertebra. These cases illustrate the possibility that the spinal fracture and aortic injury might occur adjacent to each other. They could be caused by the same effect of a blow to the body in an accident or could appear at separate sites, having been caused by the same impact but with different mechanisms. Both patients received endovascular stenting to avoid further aortic wall disruption, possible bleeding and/or death prior to spinal stabilization, resulting in no adverse effects.

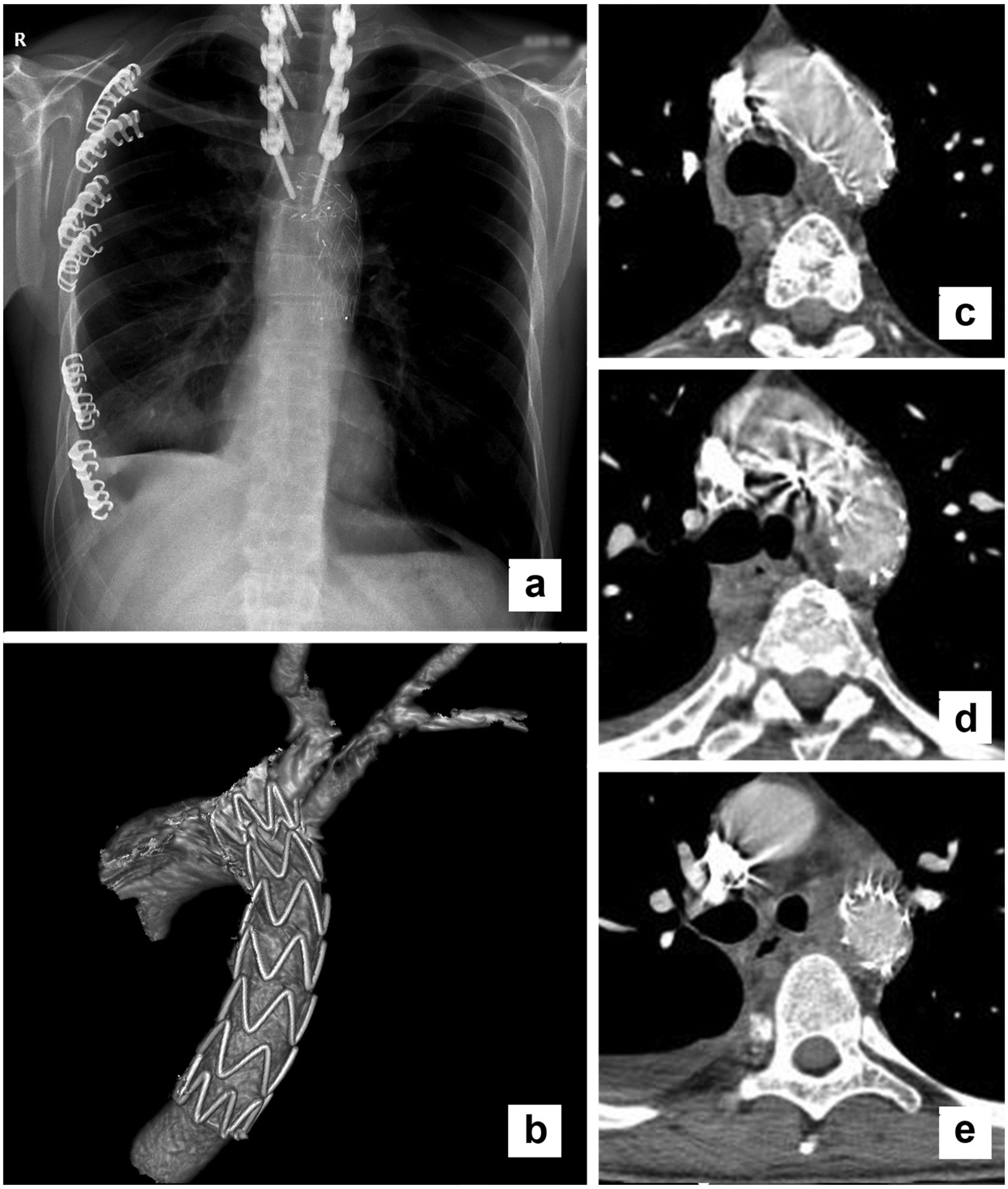

Fig. 5. Post-operative antero-posterior X-ray image shows the aortic stent graft, the spinal implant and the rib stabilizations (a). 3D CT reconstruction image demonstrates the stent graft in the aortic arch and the preserved left subclavian artery and left common carotid artery (b). Axial CT angiography slices present the stented and sealed aorta with no contrast agent leaking (c,d,e).

In this day and age many people choose extreme sports which can result in high energy crashes, and many more people drive on highways resulting in more MVC's, meaning the number of these combined injuries will probably increase.

Conclusions

The aforementioned cases were successfully treated in a level one trauma center, with no evidence of vascular side branch occlusion, hypopperfusion, endoleak, stent infolding or stent collapse.

In cases of high energy traumas when poly trauma or multi trauma is very likely the paramount importance of CT evaluation cannot be emphasized enough. Contrast enhanced WBCT scan is able to reveal blunt aortic injuries in combination with spinal fractures.

Endovascular reconstruction of traumatic aortic wall disruption involves less risk compared to open surgical procedures, and rational to be performed prior to any spinal reconstructive surgery.

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Conflict of interest

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Retrospective study

For this type of study formal consent is not required. "This article does not contain any studies with human participants performed by any of the authors."

This case report was approved by our Institutional Review Board.

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