Inframesocolic Abdominal Aortic Injury and Lumbar Vertebral Body Fracture Secondary to Hyperextension with Blunt Trauma

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Abstract
This case study describes an abdominal aortic injury and lumbar vertebral body fracture after blunt trauma. Abdominal aortic pseudoaneurysm is a rare complication of blunt abdominal trauma. Recent data reveal seven other reports in the literature. We describe a case of an inframesocolic abdominal aortic injury and lumbar vertebral body fracture from blunt trauma in a 16-year-old male after a hyperextension injury while body board surfing.

Key Words
Abdominal trauma · Biomechanics · Pseudoaneurysm · Vascular trauma

Case Report
A 16-year-old male was admitted to the hospital after a fall from a body board while surfing. He reported a forceful thoracic extension brought on by ocean waves, resulting in a tumble backwards. The patient was taken to a local hospital with complaints of back pain. An abdominal computerized tomography scan performed at the admitting institution revealed a periaortic hematoma at the T12 to L1 region. The patient was transferred to our level I trauma center for further evaluation and management.

Upon arrival, the patient complained solely of midline back pain. His vital signs were within normal limits and his admitting hemoglobin was 13.6 mg/dl, compared to 15.3 mg/dl at the transferring institution 6 h earlier. His physical examination was significant for reproducible pain upon palpation of the T12 and L1 spinous processes; he denied abdominal pain. An abdominal computerized tomographic angiogram was performed, revealing an abdominal aortic injury located between the superior mesenteric artery and the ostium of the right renal artery (Figure 1).

The patient remained hemodynamically normal and a repeat hemoglobin of 14.5 mg/dl was obtained on hospital day 1. Secondary to continued complaints of back pain, the patient underwent a directed computerized tomography scan of the lumbar spine, which revealed a fracture of the body of the L1 vertebrae and its right transverse process (Figure 2).

Over the following day, the patient’s back pain abated. With the resolved symptoms and continued hemodynamic normality, a period of observation ensued. A repeat computerized tomographic angiogram of the abdomen with reconstructed sagittal imaging was obtained on hospital day 5. This revealed a stable abdominal aortic pseudoaneurysm (Figures 3a, 3b).

The patient and family decided to return to his home state for further consultation and management. Upon discharge, the patient was tolerating a regular diet, had no further back pain, and was ambulating. Five-month followup via phone conversation found the patient to be in good health, with no episodes of abdominal or back pain. His physical activity remained limited, as recommended by his managing physicians, especially regarding contact sports. An abdominal computerized tomographic angiogram performed three months post-injury at a regional hospital revealed a significant reduction in the size of the pseudoaneurysm, per the report of the managing cardiothoracic and
vascular surgeon. Another abdominal computerized tomographic angiogram was scheduled at 6 months post-injury. No operative or endovascular interventions were planned at the time of followup.

Discussion

Injury to the abdominal aorta from blunt trauma is uncommon. It is so uncommon that a recent review article in the *New England Journal of Medicine* on “Blunt aortic injury” only reviewed the mechanisms, pathophysiology, diagnosis, and treatment of injuries to the thoracic aorta [1]. The rarity of this diagnosis is due in part to the protected position of the abdominal aorta and the high mortality of the injury when it occurs; therefore, patients who sustain this injury seldom reach the hospital still alive [2]. Raghavendran et al. [3] noted only seven reports of traumatic abdominal aortic pseudoaneurysm in the literature. Most blunt injuries will occur to the thoracic aorta and 79% of injuries to the abdominal aorta will result from penetrating trauma [4]. Cadaveric studies revealed a 2.8% incidence of abdominal aortic injury after blunt trauma [5]. Recent data suggest a 5% incidence of posttraumatic abdominal aortic pseudoaneurysm [6].

The mechanism of injury to the aorta relates to the biomechanical forces incurred. The abdominal aorta is tethered posteriorly by the spinal column and anteriorly by the peritoneum and abdominal viscera. The most frequent force observed in an injury to the abdominal aorta is compressive, associated with deceleration [7]. In this case, the injury was due to hyperextension. This mechanism likely involved a forceful extension beyond the point of maximal tensile strength of the aortic wall, resulting in a loss of integrity and a subsequent intimal tear. This tensile strain occurs where opposing forces of motion and fixation are exerted at the same points – the points of aortic fixation [8]. This is the first report to document hyperextension as a plausible mechanism for a blunt abdominal aortic injury.

Also in this case, the L1 vertebral body fracture is in direct proximity to the area of injury to the aorta. No visceral injury was noted in this patient. A fracture through the vertebral body of T12 or L1, known as a Chance fracture, is more commonly associated with a seat belt or hyperflexion mechanism of injury and hollow viscus injuries to the duodenum or pancreas [9]. Hyperextension associated with the impact from the tumble backwards was the likely mechanism of injury here. This case describes a novel means of vertebral body injury after blunt trauma – one that has not been reported previously in the literature.

Management options have expanded over time. Tucker et al. describe three cases of traumatic abdominal aortic pseudoaneurysm. Two were treated successfully with an endovascular approach, one with coils and thrombin injection into the pseudoaneurysm and one with a covered stent placement [10]. Open repair via aortorrhaphy, patch aortoplasty, or graft placement are standard. Halkos et al. in 2006 reported on the endovascular management of a blunt abdominal aortic injury. They suggested that concomitant visceral injury with peritoneal soilage would be an indication for endovascular repair [11]. Notably, they did not discuss extra-anatomic bypass as an alternative. Endovascular treatments are an option, but no long-term or comparison data exist to support an advantage over operative repair.