Screw in the Aorta: Minimally Invasive Graft Replacement for Chronic Aortic Erosion by Spinal Instrument

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Intra- and early post-operative aortic injury by pedicle screw is not a rare complication in orthopedic surgery, but aortic penetration by a screw head over a long time period is considered as an uncommon case. There are various surgical management options for thoracic aortic injury caused by malpositioned spinal instruments. We report a case of a patient who underwent minimally invasive graft replacement of the descending thoracic artery for pedicle screw penetration.

**Keywords:** minimally invasive surgery, intra-aortic pedicle screw

**Introduction**

Pedicle screw instrumentation has become increasingly popular during the past 20 yrs. Pedicle screws placed in the thoracic, lumbar, and sacral spine occasionally come in contact with major vessels. However, there are relatively few reports of complications caused by inappropriate screw placement resulting in either immediate or delayed major vessel injury. The management for thoracic aortic injury caused by malpositioned pedicle screw includes surgery and endovascular stent-graft insertion. We describe a case of pedicle screw penetration of the thoracic aorta and successful removal of the screw by minimally invasive graft-replacement.

**Case**

A 72-year-old woman was referred to our department with a 2-month history of back pain. She had a history of thoracic disc herniation and underwent anterior decompression and fusion using screw and rod via the extrapleural approach at T11-12 level 7 yrs before presentation. She was followed regularly in the orthopedic surgery department and the orthopedic surgeon suspected the screw penetration into the aorta.

On examination the patient appeared in good general condition, with a normal temperature, a blood pressure of 138/80 mmHg, a pulse of 66/min, and a respiratory rate of 20/min. She had a well-healed scar without evidence of infection. Laboratory test results were within normal limits. Chest radiograph showed a longitudinal rod secure to the spine with two pairs of pedicle screws at the T11/12 level (Fig. 1). Computed Tomography (CT) revealed a suspected penetration of the screw into the descending aorta (Fig. 2).

We performed left-sided thoracotomy at 8th intercostal space with 6-cm incision. Perpendicular access to the injured aorta was possible through the 8th intercostal space. Minimally invasive approach was carried out because we only needed the manipulation of short aortic segment. Exposure was obtained by using a soft tissue retractor. Cardiopulmonary bypass (CPB) was instituted by femoral cannulation. Intraoperative findings confirmed screw-head penetration into the aorta (Fig. 3). Aortic intima was missing around the penetrated screw-head and there was no pseudoaneurysm formation because of adhesion. After proximal and distal aortic cross clamping with Cygnet (Vitalitec...
Fig. 1 Chest radiograph showed a longitudinal rod secure to the spine with two pairs of pedicle screws (black arrow) at the T11/12 level.

Fig. 2 Computed Tomography (CT) revealed a suspected penetration of the screw into the descending aorta (black arrow).

International, inc, MA, USA), transverse aortotomy was performed at the level of screw tip penetration. A rod and two pairs of screws were removed. Oversewing of the defect in the aorta was impossible so the graft replacement of the descending aorta was performed using 18 × 9 mm InterGard® graft (InterVascular Inc, Nontivale, NJ, USA).

Postoperative course was uneventful and the patient’s back pain completely resolved. We consider the etiology of this case as attributable to an altered aortic position relative to the vertebral column due to change in blood pressure over time.

**Discussion**

Vascular trauma is a rare but well-recognized complication of spine surgery. Complications caused by malpositioning of the pedicle screws include hemorrhage, which may be immediately apparent or become manifest in the postoperative period, and pseudoaneurysms which manifest late. The etiology of screw misplacement and aortic perforation has been attributed to an altered spatial relationship of the spine to the aorta in patients undergoing spinal fixation.

Various surgical management techniques have been reported to treat aortic injuries caused by pedicle screws. Wagener reports on a patient with pedicle screw penetrating into the descending aorta, which was treated by open surgery (direct suture of the aorta with screw-tip cutting). Kakko describes two cases of pedicle screw perforation of the thoracic aorta. Surgical repair was performed for aorta lacerations (direct suture with screw-tip burring) and pseudoaneurysm (patch angioplasty).

Stent grafts have been previously used to treat aortic pseudoaneurysms and trauma with results comparable with open repair. Potential benefits of endovascular stent-graft insertion over surgical repair include: no thoracotomy, decreased major complications, decreased use of systemic coagulation, and less blood loss.

Bavare reports on a patient with aortic laceration caused by thoracic spinal hardware, who initially underwent open and endovascular repair. However, aortic replacement with hardware removal was performed for erosion of the aorta between the spinal hardware and the endovascular stent-graft 5 months later. The paper by Hu describes a case of percutaneous placement of a thoracic aortic stent-graft with surgical removal of a malpositioned screw.

Delayed aortic injuries after thoracic spinal instrumentation occur due to chronic irritation of the pulsating aortic wall against a metallic device. Surgical intervention or endovascular stent placement is necessary in order to prevent potential complications such as aortic perforation or pseudoaneurysm when malposition of a pedicle screw abuts the descending thoracic aorta.

In our patient, graft replacement of descending thoracic aorta and screw removal were performed in a minimally invasive way. Although endovascular stent-graft
Fig. 3  (A) Intraoperative findings confirmed screw-head penetration into the aorta (white arrow). (B) Postoperative 3D-CT showed the replaced graft.

insertion seems to be safer than operative repair, serious complication, such as aortic rupture due to stent erosion as Bavere described, might occur. In case of screw-tip penetration, removal of the screw tip is necessary to avoid the risk of tearing the stent graft fabric and recurrent bleeding.  

In conclusion, we present a case of minimally invasive graft replacement of the descending thoracic aorta for safe removal of a malpositioned pedicle screw. Minimally invasive procedure was possible by using the flexible aortic clamp.

Disclosure Statement

There is no conflict of interest.

References


