Delayed-iatrogenic injury of the thoracic aorta by an anterior spinal instrumentation

François Lavigne · E. Mascard · C. Laurian ·
J. Dubousset · P. Wicart

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Abstract We present a case of a 15-year-old girl who presented to us with an unusual low back pain. About 7 years ago, this patient had corrective surgery for her idiopathic left thoracolumbar scoliosis. Recent surgery revealed a laceration of the posterior wall of the thoracic aorta by an impending screw thread. This injury was repaired by the vascular surgeons and, subsequently, the patient had full recovery without any complications.

Keywords Anterior spinal fusion · Scoliosis · Iatrogenic · Injury · Aorta

Introduction

Iatrogenic aortic injury is a rare, but potentially catastrophic complication of spine surgery. Acute- and delayed-vascular complications caused by an impending implant have been reported [2, 6, 8–11, 13, 14, 17]. However, little is known about vascular injury after anterior instrumentation of scoliosis [2, 17]. We report a case of a thoracic aortic injury in a 15-year-old girl who presented 7 years after surgical correction of her idiopathic left convex thoracolumbar scoliosis.

Case report

A 15-year-old girl was treated in our department in June 1998 with the correction of an idiopathic thoracolumbar left convex scoliosis. The Cobb angle was 57° in the T11 to L3 vertebra (Fig. 1). The scoliosis was surgically corrected through an anterior approach. The vertebrae were reached from the left side and pedicle screws of the CD-Hopf system were inserted in the T10 to L3 vertebral bodies. The operation was uneventful and the curvature was reduced from 57° to 23° (Fig. 2). Postoperative recovery was also uneventful without any complications.

The patient made good progress and was followed yearly in our dedicated spine clinic. However, in March 2005, she complained of a left lumbar pain. Plain radiographs revealed neither migration of the implant, non-union of arthrodesis nor loss of scoliosis correction. Laboratory investigations reported an elevated sedimentation rate of 53 mm/h (normal, <10 mm/h). A computed tomography (CT) scan of the lumbar spine revealed a deep collection of fluid in the left psoas muscle. A CT-guided aspiration was performed confirming paralumbar haematoma resulting in the removal of 80 ml of blood (Fig. 3). Nevertheless, microbiological analyses were negative. An angiography was performed, but there was no evidence of extravasation of contrast medium or aortic pseudoaneurysm. Laparotomy was performed to drain the haematoma. The culture collection was positive for *Propionibacterium acnes*, indicating a possible late infection. Following surgery, a fistula developed on the left side and, a CT scan demonstrated a persistent deep collection despite surgery. Because of recurrent haematoma formation and persistence of infection, it was decided to remove the implants. The same thoracoretroperitoneal approach was used and a large deep seated psoas haematoma was evacuated. All the

F. Lavigne (✉) · E. Mascard · J. Dubousset · P. Wicart
Department of Paediatric Surgery, Saint Vincent de Paul
Hospital, 74-82 avenue Denfert Rochereau, 75014 Paris, France
e-mail: f.lavigne@voila.fr

C. Laurian
Department of Vascular Surgery, Saint Joseph Hospital,
75014 Paris, France

Fig. 1 Preoperative radiogram. The Cobb angle was 57°

Fig. 2 Postoperative radiogram. The Cobb angle was reduced to 23°

implants were removed except the screw from the body of T10 vertebrae. This was left in situ as there was sudden and uncontrollable haemorrhage. Postoperatively, the patient had CT scan of thorax and abdomen that revealed the T10 vertebral screw to be in contact with the posterior aortic wall. Prior to emergency vascular procedure, the patient had aortic angiography that revealed proximal occlusion of the left T10 intercostal artery and prominent thoracic

Fig. 3 Computed tomography taken 7 years after the initial surgery demonstrates a left retroperitoneal haematoma

collaterals around the artery of Adamkiewicz. Intraoperatively, the vascular surgeons noted a longitudinal laceration of the posterior wall of the thoracic aorta which was repaired with a synthetic patch of polytetrafluoroethylene (PTFE) and a 3–0 polypropylene suture. Postoperative recovery was uneventful without any complications. Although there was no intraoperative evidence of infection, the patient was prescribed amoxicillin for 3 months. At the final follow-up, the patient recovered fully without any complaints or further complications (Figs. 4, 5).

Discussion

Anterior procedures on the spine are often performed in the treatment of a wide variety of spinal disorders. Several studies demonstrated this approach to be safe and effective [5, 7, 12]. Grossfeld et al. [5] reported complications rate to be 7.5% in children after anterior spinal procedures. Anterior approaches are associated with a known risk of iatrogenic vascular injury [3, 5, 12, 15]. Most reports concern with venous injury during the mobilisation and retraction of major vessels. Incidence of iatrogenic major venous injury is generally low but quite variable, ranging from 2.4 to 18.4% of cases [1, 3, 4, 15, 16, 19]. Arterial injuries are extremely rare. Faciszewski et al. [3] reported only one aortic injury in a large retrospective series of 1,223 patients.

Delayed-aortic perforation by a surgical device is a rare but well-known complication. To our knowledge, 11 similar cases of iatrogenic aortic injury have been reported [2, 6, 8–11, 13, 14, 17]. Clinical symptoms are typically

Fig. 4 Computed tomography chest suggests that the device for the T10 vertebra may penetrate the thoracic aorta (TA)

Fig. 5 Postoperative CT chest shows the very anterior path of the involved screw

various, insidious and non-specific. Patients can present with acute bleeding, abdominal discomfort, dyspnoea, back pain, or low-grade fever. However, the injury could develop asymptotically and occur incidentally. Most aortic injuries reported in the literature were recognised within 18 months of the spine surgery. Nevertheless, Been

et al. [2] reported a thoracic aorta pseudoaneurysm caused by a pedicle screw, revealed 20 years after the correction of a scoliosis. Therefore, the treating surgeon should be highly suspicious of vascular complications if patients present with either early or late unusual symptoms following anterior spinal instrumentation.

Late aortic injury mostly occur due to chronic erosion of the arterial wall against the prominent implant and presents as delayed perforation [6, 9, 14, 17]. Rarely, it can occur due to direct penetration by the screw [10, 11]. In this case report, the patient presented with chronic erosion of the arterial wall against the screw thread which was misplaced. The screw was inserted too anterior and it was too long, leaving part of it protruding anteriorly. During thoracotomy, the posterior aortic wall was found to be lacerated. Matsuzaki et al. [11] reported similar observation of a device “driven into the aortic wall as if the latter were a nut for a bolt”. These findings explained that the injury was not recognised at the time of spinal instrumentation and the sudden haemorrhage when the involved screw was removed.

Postoperative vascular injuries require prompt diagnosis and early management, including surgical exploration, vascular repair, and removal of the devices if necessary. Direct repair of the thoracic aorta can be difficult because of the close relationship between the posterior wall of the aorta and the vertebral body. A partial circulatory assistance may be required to obtain haemostasis of the injured portion of the aorta. In patients with poor cardiac and/or pulmonary condition, endovascular graft placements provide a safe and effective alternative to achieve temporary haemostasis [2, 10, 13]. In the present case, endovascular grafting could not be used because of possible infection and the young age of the patient.

Vascular complications must be prevented by careful planning of surgical approach, and a rigorous selection of the device (design, insertion, direction and size of the screw). Predisposing factors, such as previous anterior spinal surgery, current or previous infection, segmentation anomaly and migration of the device should be identified before surgery [4]. Furthermore, the relationship of the spine to the aorta and anatomical changes induced by scoliosis should be anticipated. Sucato et al. [18] demonstrated that, in patient with thoracic idiopathic scoliosis, the aorta was positioned more laterally and posteriorly relative to the vertebral body presenting major challenges for safe placement of spinal device. Preoperative CT scan and magnetic resonance may be helpful in determining anatomical relationship and measurements of vertebral body width and depth. It may assist surgeons in planning where the spinal hardware should be placed and in choosing adequate screw length. During surgery, position of the aorta and of the screw tip may be confirmed by direct

palpation. Transverse diameter of the vertebral body should be carefully assessed with the use of callipers, to avoid protruding screw tip. Surgeon should watch out for AP fluoroscopy that may fail to confirm the position of the screw [8].

Furthermore, surgeon should pay attention to exposure and retraction-induced injuries, which are most probably underestimated. In the present case, the angiography acquired before the vascular procedure revealed an asymptomatic thrombosis of intercostal artery at T10. The thrombosis appeared to be related to surgical dissection or vessel mobilisation during correction of the spinal deformity. Fortunately, the artery of Adamkiewicz was supplied by collaterals arteries and no spinal cord ischaemic complication occurred.

Conclusion

In conclusion, iatrogenic aortic injury is a rare but life-threatening complication of anterior spinal procedures. Clinical symptoms are varied, insidious and difficult to diagnose. When performing anterior procedure, care should be taken with regard to surgical exposure and also a minimal distance between the implant and a major vessel should be maintained. Best treatment of this complication is prevention by a meticulous surgical technique and by a low-invasive instrumentation.

Conflict of interest statement None of the authors has any potential conflict of interest.

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