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Endovascular Management of Iliac Vein Compression Syndrome Due to Pedicle Screw Malposition After Posterior Lumbar Fusion Surgery

Spalteholz M[1*], Staab HH[2], Fuchs J[3], Moche M[3] and Gulow J[1]

[1]Department of Spine Surgery, Helios Park-Klinikum Leipzig, Germany

[2]Department of Vascular Surgery, Helios Park-Klinikum Leipzig, Germany

[3]Department of Interventional Radiology, Helios Park-Klinikum Leipzig, Germany

[*]**Corresponding author:** Spalteholz M, Department of Spine Surgery, Helios Park-Klinikum Leipzig, Germany, Tel: +49341864252298; E-mail: Matthias.Spalteholz@helios-gesundheit.de

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Abstract

There are very few case reports of common iliac vein compression syndrome caused by malpositioned pedicle screws. Nowadays endovascular solutions are recommended to examine and treat vascular injuries in these cases, due to less complication rates compared to open procedures. We present a case of a possible functionally May-Thurner syndrome due to a misplaced lumbar pedicle screw and a safe way to manage it.

Keywords: Pedicle screw malposition; Lumbar pedicle screw misplacement; Iliac vein compression syndrome; May-Thurner syndrome; Cockett syndrome

Introduction

Transpedicular screw fixation is a standard procedure in spine surgery, which is performed in an open, minimally-invasive or percutaneous fashion. The accuracy of pedicle screw stabilization is mandatory, not only to prevent neurovascular injury but also to provide sufficient biomechanical stability. Vascular problems without bleeding or haemodynamic changes due to posterior lumbar spine instrumentation can be under recognized in case of non-specific symptoms. Because there are only a few reports of iliac vein compression syndrome due to implant abutment after posterior spine surgery, there is no uniform recommendation how to deal with it. We present a case of possible functionally May-Thurner syndrome due to lumbar pedicle screw malposition and our way to manage it.

Case Presentation

A 78 year old man had to undergo posterior lumbar spine fusion surgery due to severe claudication caused by degenerative spondylolisthesis with central stenosis in the level L4/5. A few days after successful mobilization and pain release, he complained of new left sided leg pain and swelling. There was no neurological deficit observed. To exclude hardware problems,

we performed a CT scan of the lumbar spine. We detected a malposition of the left L5 pedicle screw with compression of the left common iliac vein, a vascular lesion with leakage was not seen. We discussed the case with our departments of interventional radiology and vascular surgery and decided for revision surgery. Our plan was to place a balloon catheter in the region of the screw tip, remove the screw, perform a venogram and in case of leakage inflate the balloon catheter and place a stent to seal up the lesion. In supine position a left common femoral vein access was performed to place a 8-French sheath. After insertion of the guide wire a balloon catheter (Bard, Atlas Gold 16 x 20 mm) was directly placed at the tip of the screw under fluoroscopy control. The catheter was fixed and the patient was positioned prone. After prepping and draping in a standard fashion we reopened the midline access to explore the left L5 pedicle screw. We performed a venogram, with no observable contrast extravasation. Afterwards we removed the pedicle screw and repeated the digital subtraction angiography. There was no visible contrast extravasation. A new L5 pedicle screw was placed in a standard free hand technique und the correct position was verified by intraoperative 3D imaging. The balloon catheter was inflated and no abutment was realized. We finished the instrumentation, closed the wound in a standard fashion and turned the patient supine. The final venogram after deflation of the balloon did not show contrast extravasation. Because a venous lesion was excluded, it was not necessary to place a covered stent. The patient recovered well with decreased left sided leg pain and regressive swelling (Figure 1-4).

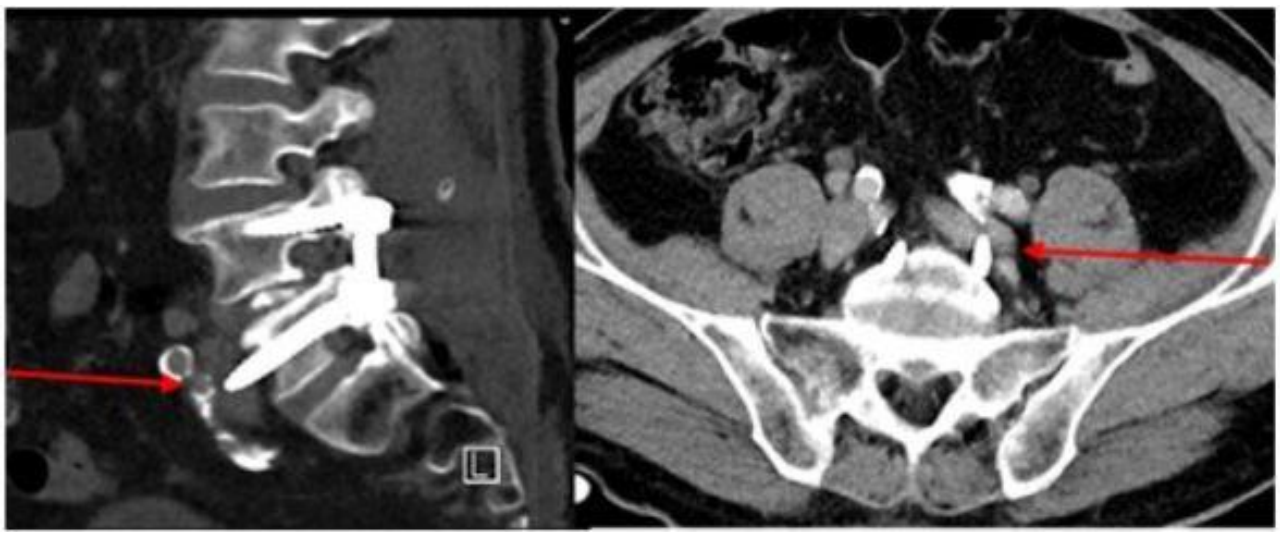

Figure 1: **(A):** Sagittal CT scan of the lumbar spine: The tip of the left L5 screw seems to be within the left common iliac vein (red arrow). No visible vascular lesion with leakage or haematoma; **(B):** Transversal CT scan of the lumbar spine: The tip of the left L5 screw seems to be within the left common iliac vein (red arrow). No visible vascular lesion with leakage or haematoma.

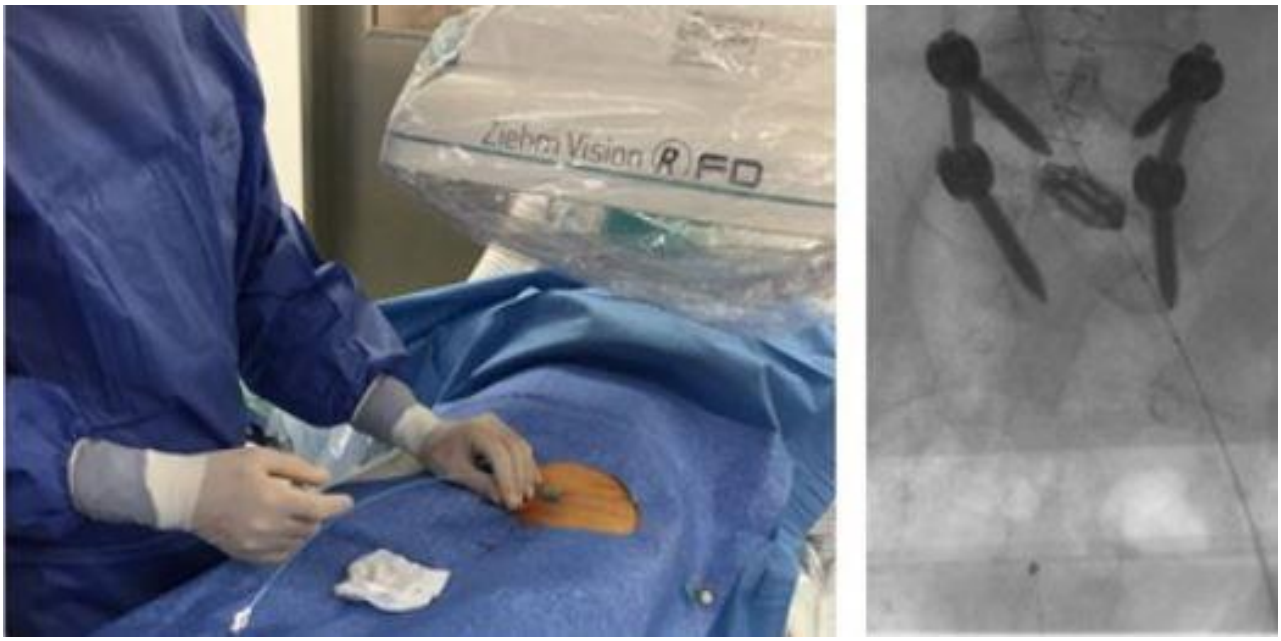

Figure 2: Patient in supine position. **(A):** Left common femoral vein access and placement of a balloon catheter via 8-French sheath; **(B):** X-ray visualization of the correct balloon position (the points mark the position of the balloon).

Figure 3: Patient in prone position, Digital Subtraction Angiography. **(A):** L5 Screw in situ (red arrow). Contrast filling of the left common iliac vein and ascending lumbar vein. No leakage; **(B):** L5 Screw removed. Contrast filling of the left common iliac vein and ascending lumbar vein. No leakage.

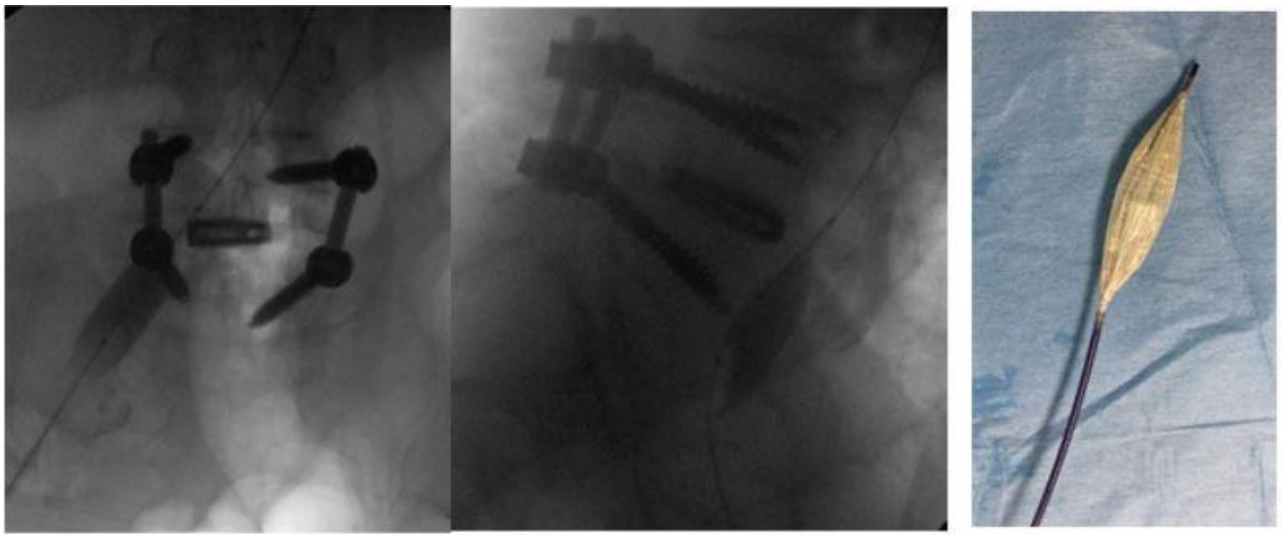

Figure 4: Patient in prone position. **(A):** Posterior anterior C-arm fluoroscopy: Inflation of the balloon catheter with no visible indentation by the screw tip; **(B):** Lateral C-arm fluoroscopy: Inflation of the balloon catheter with no visible indentation by the screw tip; **(C):** Balloon catheter (Bard, Atlas Gold 16 x 20 mm).

Discussion

The May-Thurner Syndrome (MTS), or Cockett`s syndrome, represents the compression of the left common iliac vein by the right common iliac artery against the lumbar spine, which can lead to chronic left-side venous obstructions symptoms like painful leg swelling and post-thrombotic syndrome [5,17]. It is supposed that 5% of all deep vein thrombosis are caused by MTS [11]. Regarding the literature, not only the compression per se, but additional factors must be responsible in thrombus formation [4]. A cohort of 50 probands without clinical or diagnostical thrombus signs demonstrated an average compression of the left iliac vein of 35% and 25% of the probands revealed a venous compression >50% [11]. There are very few case reports of left common iliac vein compression, presenting a possible May-Thurner syndrome, caused by malpositioned pedicle screws [16,29]. But this might be underestimated, because it might not be recognized, especially in delayed manifestation. Transpedicular screw fixation is a standard procedure in spine surgery, which is performed in an open, minimally-invasive or percutaneous fashion. Free-hand techniques using anatomical landmarks and intraoperative c-arm fluoroscopy as well as computed-tomography or fluoroscopy-based navigation systems are well established [1]. The intrapedicular screw position is mandatory to avoid bony destruction, neurovascular complications and ensure a safe anchorage. The accuracy of screw placement, especially in free-hand technique, depends on clinical experience. The reported malposition rates in older publications range from 5 to 41% [13,23]. Recent studies report misplacement rates up to 11,85% [2]. Medial and lateral perforation of the pedicle is more common than anterior wall perforations of the vertebral body [26]. Screw malposition less than to 2 mm of the medial wall is not associated with problems (‘safe zone’), but perforations more than 4 mm have high risk for neurological complications [12]. The reported incidence of anterior vertebral wall penetration is 2,8% which can lead to both visceral and vascular injury [8,20,27]. A systematic review of prospective in vivo studies demonstrated higher accuracy of pedicle screw placement using CT navigation than fluoroscopy-based or free-hand technique, with pedicle wall perforations of 2 mm in 7% using CT guided- navigation and in 19% using free-hand technique [9]. Pedicle screw malposition with vascular injury is a rare (<1%), but potentially devasting complication which can lead to hemorrhage with haemodynamic instability, thrombosis, arteriovenous fistulae or pseudoaneurysm formation.

Thoracic pedicle screw misplacement with contact to the thoracic aorta is reported in 0,29% and can cause severe complications intraoperatively and years later [7,21,24]. In a retrospective analysis of 680 thoracolumbar pedicle screws, Foxx et al. reported a contact with the great vessels in 33 cases (4,85%): aorta 4 cases, iliac artery 7 cases, iliac vein 22 cases. At mean follow up of 44 month none of the patients suffered from symptoms due to the vessel contact [7]. There is no consensus for screw removal in asymptomatic patients. Traditionally open surgery of severe vascular lesions included thoracotomy or laparotomy and direct repair, patch angioplasty or interposition grafting. These conditions are afflicted with high rates of spinal cord ischemia and pulmonary failure [10,18]. The reported rates of spinal cord ischemia in open thoracic aortic repair are up to 21% [6,28] and 2,5 to 3% in thoracic endovascular aortic repair [3,15]. The evolution and progression of endovascular techniques enable more treatment options and approaches with less morbidity [19]. Endovascular solutions are recommended in the treatment of vascular injury after pedicle screw malposition due to the less complication rates [14]. Currently, there are a few case reports dealing with endovascular management of screw related vascular injuries. Some authors removed the screws prior to deployment of a stent graft, some did it simultaneously, some performed the screw removal after endovascular stenting and others did not remove the screws [18,22,25]. We have decided to be prepared for a possible venous wall defect and placed the catheter prior to screw removal. In case of a leakage, the wall defect would have been covered and a stent graft can easily be placed. We think this is a safe procedure to control potentially problems.

Conclusion

Pedicle screw stabilization is a standard procedure in spine surgery with high accuracy of screw placement using navigation systems. The risk of vascular complications is rare but should not be underrated, especially because patients can present delayed symptoms. CT imaging cannot definitely exclude vascular lesions. In case of visible screw malposition with vascular compression syndrome, endovascular techniques are recommended to safely exclude and treat vascular injuries. To avoid and control possible venous laceration with severe bleeding, we recommend to place the balloon catheter prior to screw removal.

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