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CASE REPORT

Lumbar artery pseudoaneurysm: a rare case of delayed onset incomplete cauda equina syndrome following transforaminal lumbar interbody fusion

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Abstract

Background Cauda equina syndrome following transforaminal lumbar interbody fusion (TLIF) is very rare, and the causes implicated include inadequate decompression, retained disc fragments, epidural haematoma, gel foams, fat pad grafts, retained sponges, intradural masses and ischaemia of conus. This is a rare case report of pseudoaneurysm of dorsal branch of lumbar artery presenting with delayed onset incomplete cauda equina syndrome following TLIF.

Objective To describe the very rare case of lumbar artery pseudoaneurysm causing delayed onset incomplete cauda equina syndrome following TLIF and its management with endovascular embolisation.

Method An 80-year-old female presented with incomplete cauda equina syndrome on 14th post-operative day following TLIF. On evaluation, computed tomography (CT) scan and magnetic resonance imaging (MRI) revealed haematoma with heterogeneous signal intensity, which was pulsatile in ultrasonogram. Doppler and contrast-enhanced CT revealed pseudoaneurysm from posterior branch of left lumbar L4 artery, which was managed with endovascular embolisation.

Result After endovascular embolisation, the patient had immediate relief from radiating pain in left lower limb and regained full motor power and perianal sensation at the end of 3 weeks. Post-procedure ultrasonography done on the tenth day revealed complete resolution of the pseudoaneurysm.

Conclusion This case presentation shows the necessity of diagnosing epidural haematomas due to vascular aneurysm in patients with post-operative radiculopathy and neurodeficit and the effectiveness of endovascular embolisation in treating such a threatening condition.

Keywords Post-operative radiculopathy · Lumbar artery pseudoaneurysm · Cauda equina syndrome · Endovascular embolisation

Introduction

Transforaminal lumbar interbody fusion (TLIF) is a common procedure for many degenerative conditions of spine and has increased exponentially in the last two decades. The reported complication rate in TLIF ranges up to 36% [1] and includes dural tear, infection, neurological injury, screw misplacement, cage migration and retroperitoneal injuries. The incidence of post-operative cauda equina syndrome is cited as being very rare (0.08% to 0.2%), and the causes include inadequate decompression, retained disc fragments, epidural haematoma, gel foams, fat pad grafts, retained sponges and intradural masses [2]. We present a rare case of lumbar artery pseudoaneursym causing delayed onset incomplete cauda equina syndrome following TLIF.

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Case presentation

An 80-year-old female was admitted with a history of chronic low back pain with left lower limb radiculopathy associated with neurogenic claudication and limited ambulation for the past 4 years. Patient was on anti-platelet medication (Clopidogrel 150 mg once daily) for ischaemic heart disease. Imaging revealed degenerative spondylolisthesis at L3-4 and L4-5 levels with instability demonstrated in flexion/extension views (Fig. 1). Since the patient was on conservative management for adequate time with no alleviation of symptoms, surgical intervention was planned.

The patient underwent decompression with L3-4 posterolateral and L4-5 transforaminal lumbar interbody fusion (Fig. 2) after withholding anti-platelet medication for five days. Immediate post-operative period was uneventful with significant symptomatic improvement; VAS score improved to 3/10 from pre-operative score of 8/10. On the first post-operative day, the patient was ambulated and discharged on the sixth post-operative day. Two weeks later, the patient presented to the emergency department with acute onset radiating pain in left lower limb associated with perianal numbness for 48 h. Examination revealed weakness of left lower limb (MRC grade 3 power in L5 and S1 myotome), hypoesthesia at corresponding dermatomes, intact anal tone, but perianal hypoesthesia. There were no signs of infection at the surgical site.

Immediate MRI revealed paraspinal organised collection suggestive of haematoma measuring 7.2 × 5.9 cm, extending into posterior epidural space causing severe canal compromise. The presence of heterogeneous signal intensity (Fig. 3) within the collection prompted the radiologist to evaluate with ultrasonography. In Doppler study (Fig. 4), a well-defined anechoic pulsatile lesion with "Yin-yang sign" [3] and to-and-fro flow pattern was noticed deep within the haematoma. The Contrast-enhanced computed tomography (Fig. 5) confirmed the diagnosis of pseudoaneurysm from the posterior branch of left lumbar L4 artery. Emergency surgery was not feasible since the haematoma was pulsatile, and the patient had restarted anti-platelet medications. Patient underwent endovascular embolisation by an interventional radiologist.

Procedure of endovascular embolisation: Under local anaesthesia with fluoroscopic guidance, right common femoral artery (CFA) puncture was taken using modified Seldinger's technique. Super selective catheterisation of left L4 lumbar artery and contrast injection revealed pseudoaneurysm filling from branch of dorsal epidural arcade of dorsal spinal artery of left L4 lumbar artery (Fig. 6a). The pseudoaneurysm sac was embolised with liquid embolic agent (n-butyl cyanoacrylate) after confirming L4 artery as non-contributing to cord vascularity, and check angiogram revealed stasis of flow in left L4 lumbar artery with no evidence of filling of pseudoaneurysm (Fig. 6c). Good deposition of liquid embolic agent into pseudoaneurysm sac and feeding artery was verified with a post-procedure CT scan.

Fig. 1 Lateral view radiograph in flexion and extension showing dynamic instability

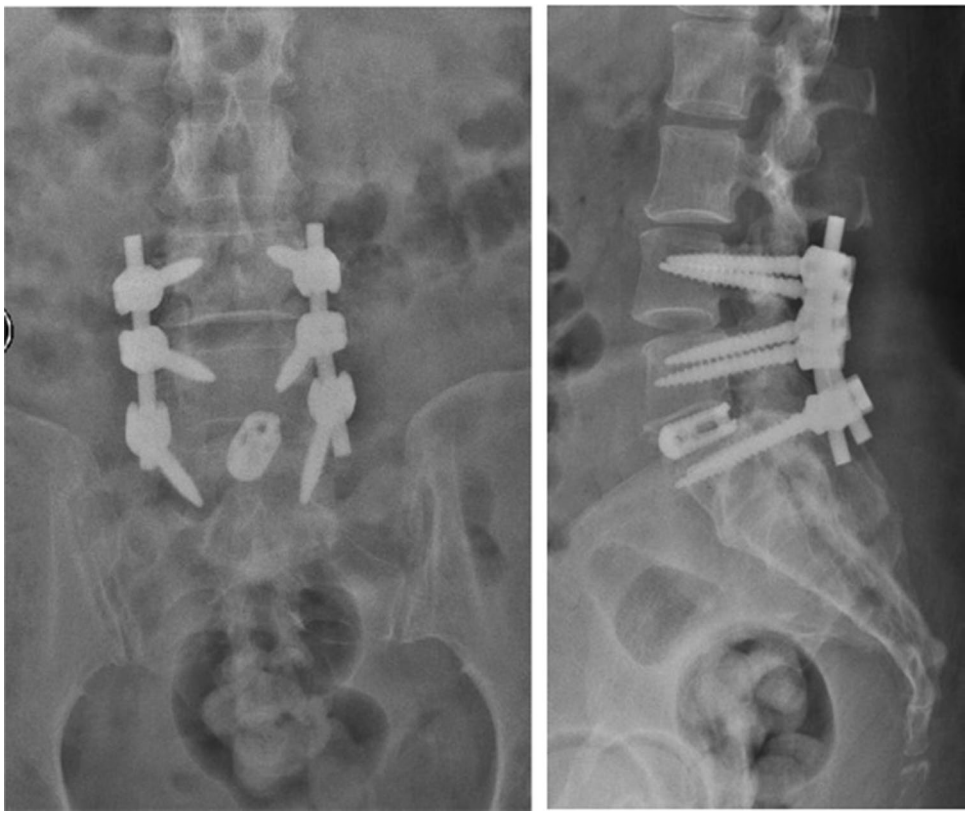

Fig. 2 Post-operative radiograph showing good position of implants

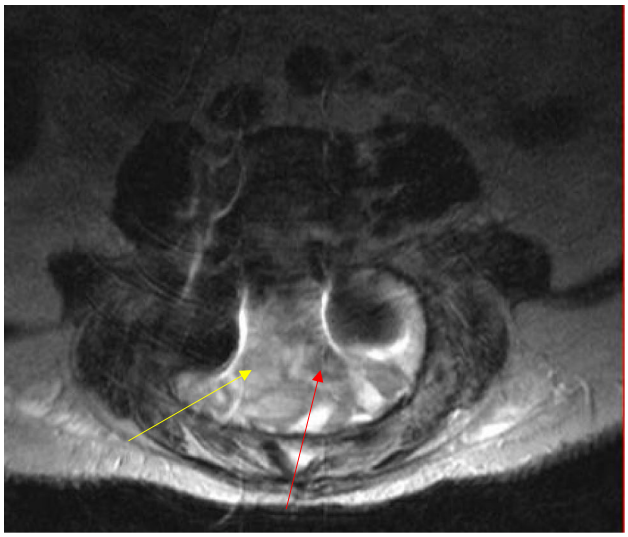

Fig. 3 T2-weighted axial cut in MRI showing haematoma with heterogeneous signal intensity (red arrow—hypo intense signal; yellow arrow—comparatively hyper-intense) and implant-related artefact

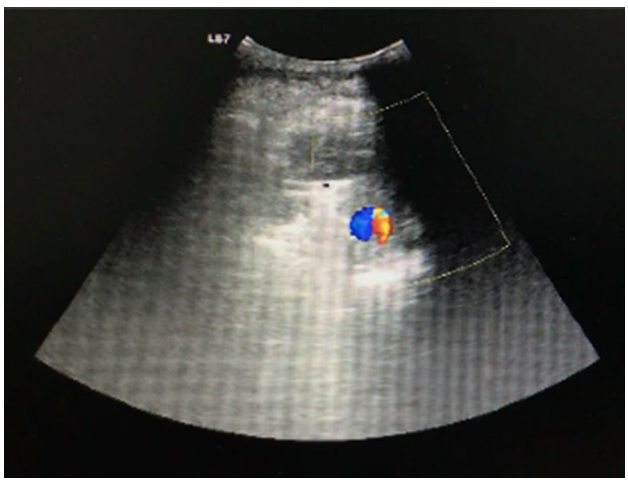

Fig. 4 USG Doppler revealing Yin-Yang sign

Post-procedure, the patient had immediate relief from radiating pain in left lower limb. By one week, there was gradual improvement in motor power, and regained full motor power, bowel and bladder function at the end of 3 weeks. Post-procedure ultrasonography (Fig. 7) done on the tenth day revealed complete resolution of the pseudoaneurysm.

Discussion

Post-operative cauda equina syndrome after lumbar spine surgery is very rare with an incidence of 0.08–0.2% [2] and can be of early or late onset. The causes implicated

Fig. 5 Axial section of arterial phase in contrast-enhanced CT showing the pseudoaneurysm (highlighted with an arrow)

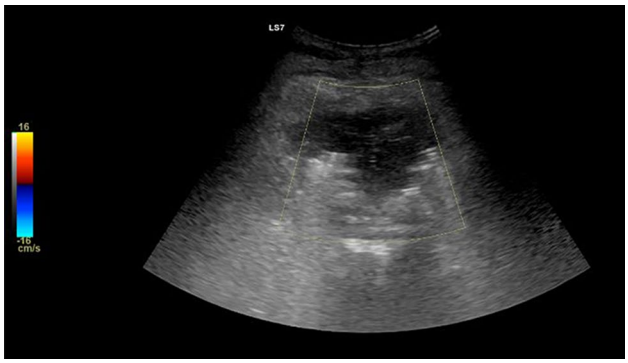

Fig. 7 USG at 10 days post-procedure showing resolution of pseudoaneurysm

in post-operative cauda equina syndrome include inadequate decompression, epidural haematoma, retained disc fragments, fat pad grafts, gel foams, retained sponges and ischaemia of conus or cauda equina. Radiculopathy occurring immediately after the surgery usually results from misplaced screws, excessive nerve/dura retraction, dorsal root ganglion(DRG) irritation, nerve injury during spondylolisthesis reduction, nerve anomaly, haematoma and infection, whereas epineural fibrosis, cage retropulsion, pseudomeningocele, bone growth in neuroforaminal space and pseudarthrosis present with late onset radiculopathy [4].

The vascular complications during spinal instrumentation have been reported in the literature and include retroperitoneal vascular injury and segmental artery injury [5]. Retroperitoneal vascular injury can cause haemodynamic instability and even death due to exsanguination, whereas segmental artery injury leads to acute intra-operative bleeding or present as radiculopathy due to psoas haematoma. Lumbar artery pseudoaneurysm is a rare condition and has been reported following blunt injury or gunshot injury of abdomen, renal surgery, aortic repair and lumbar instrumentation [6–9]. To our knowledge, there are some reports of post-operative lumbar artery pseudoaneurysm causing psoas haematoma and presenting as radiculopathy. However, pseudoaneurysm from dorsal branch of lumbar artery directly causing pressure symptoms on intraspinal neural structures has not been reported till now in the literature.

Lumbar arteries are four paired vessels with first three arising from dorsal aspect of abdominal aorta and the last pair from iliolumbar artery at the level of transverse process.

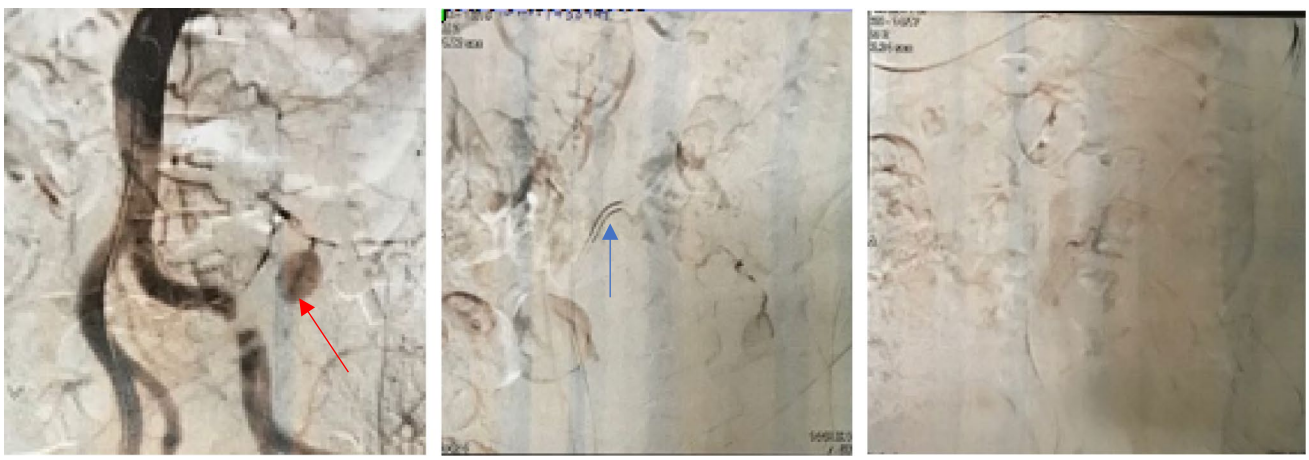

Fig. 6 **a** Endovascular angiogram showing pseudoaneurysm filling from branch of dorsal epidural arcade of dorsal spinal artery of left L4 lumbar artery, **b** endovascular catheter (blue arrow) in left L4 lumbar artery and **c** check angiogram revealing stasis of flow in left L4 lumbar artery with no evidence of filling of pseudoaneurysm

Table 1 When to suspect and how to approach a case of lumbar artery pseudoaneurysm causing post-operative neurodeficit

Findings suggestive of lumbar artery pseudoaneurysm	1. Heterogenous signal intensity in MR imaging 2. Yin-yang sign in ultrasonogram
Approach to a patient with lumbar artery pseudoaneurysm	Step 1: Confirm the diagnosis—contrast CT Step 2: Treatment—endovascular embolisation Step 3: Re-assessment—Doppler ultrasonography/MR imaging at short follow-up

A fifth pair may sometimes be present arising from median or lateral sacral artery or iliolumbar artery. These vessels course laterally along bodies of lumbar vertebra between adjacent transverse processes and then continue into abdominal wall dividing into anterior and posterior branches, which further branches into ganglionic, transverse, ascending and descending [10, 11]. While injury of lumbar artery per se is uncommon in surgeries done at the level of disc or inferior vertebral edges, the close relation of this vessel with lateral border of vertebral body and transverse process makes it vulnerable to injury during extensive lateral dissection and decortication of transverse process. In our patient, decortication of left L4 transverse process during preparation of L3-4 inter-transverse fusion bed might be the cause of injury. Hence, it is prudent to limit the lateral dissection and warrant meticulous handling of instruments around the transverse process. It is also reported that patients with bleeding tendencies, including those on anti-coagulant therapy and with connective tissue disorders, are at increased risk [12].

Pseudoaneurysm is defined as a breach in vessel wall with contained blood collection which is communicating with lumen of a ruptured vessel and is contained within adventitia or surrounding perivascular soft tissue, whereas true aneurysm is surrounded by all the layers of the vessel wall. In post-operative cases with metallic implants, evaluation with computed tomography and MRI is challenging because of implant-related artefacts. In our case, USG Doppler showed more classical flow dynamics and typical pattern. In ultrasonogram, grey-scale imaging revealed a well-defined thin-walled anechoic structure adjacent to artery which will mimic that of a collection or haematoma. Doppler showed the typical swirling motion called Yin-Yang sign and depicted the communication between the sac and feeding vessel as a to-and-fro motion [13]. CT with contrast disclosed arterial enhancement of the smooth-walled sac adjacent to the artery [14]. Conventional angiogram is the gold standard one because endovascular treatment can also be done simultaneously in a single setting. MRI will show signal void centre which is the lumen and peripheral heterogeneous signal areas which represent thrombus/haematoma and also show pulsation artefacts along phase encoding direction (Table 1). In our case scenario, we hypothesise that the segmental vessel might have been injured during lateral dissection, causing a false aneurysm secondary to intimal dissection. The surgical dissection around the neural foramen for decompression and TLIF cage insertion might have led to formation of a channel into the canal, facilitating gradual increase in size and intrusion of pseudoaneurysm into the canal which ultimately resulted in neural compression, causing incomplete cauda equina syndrome. This would probably explain the asymptomatic period following the index procedure.

Treatment decision in pseudoaneurysm depends on the location and size of pseudoaneurysm and presence of symptoms due to mass effect or expansion. Whereas small asymptomatic pseudoaneurysms in any other site can be managed conservatively, lumbar artery pseudoaneurysm whether small or large has to be treated immediately because of its tendency to expand and bleed. Endovascular embolisation has been advocated by several authors and has been effectively utilised in improving the haemodynamic status of patients [5]. Further, the complications associated with open exploration including severe blood loss, uncontrollable bleeding and difficulty in identifying the lesion are avoided. In our case, we avoided emergency surgical re-exploration which is advised in cases of incomplete cauda equina syndrome [15], because of the delayed presentation, timely diagnosis of pseudoaneurysm with imaging modalities and anti-platelet drug intake. Endovascular embolisation was done with the plan of withholding anti-platelet medicines, strict neurological monitoring and re-exploration in case of persistence or exacerbation of symptoms. However, embolisation itself had abated the symptoms obviating the need of open surgery.

Conclusion

This case report shows the importance of high index of suspicion with atypical MRI findings and appropriate use of Doppler ultrasonography in the diagnosis of lumbar artery pseudoaneurysm, and the effectiveness of endovascular embolisation in managing delayed onset incomplete cauda equina syndrome due to pulsatile haematoma in post-operative patients. The diagnosis of this rare case of post-operative neurodeficit may help in avoiding extensive revision surgery, especially in the elderly patients.

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Compliance with ethical standards

Conflict of interest All authors disclose that there is no conflict of interest.

Ethical approval Institutional review board approved this study with waiver of patient consent.

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