D J Med Sci 2026;12(2):111-116
doi: 10.5606/fng.btd.2026.227

Case Report

Vascular injury during far lateral disc herniation surgery and its endovascular management: A case report

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ABSTRACT

Vascular injury is a rare but potentially life-threatening complication of lumbar far lateral microdiscectomy. It requires early diagnosis and effective treatment. We hereby present a case of a 21-year-old male patient admitted to our clinic with complaints of low-back and left leg pain that had not resolved after three months despite medical treatments. Our intervention with far lateral L4-5 microdiscectomy under general anesthesia was intraoperatively complicated by sudden aberrant bleeding. Bleeding was controlled using hemostatic materials. The surgical intervention was discontinued, and an abdominal ultrasonography was performed while the patient was on the operating table. Upon suspicion of retroperitoneal hemorrhage, abdominal computed tomography (CT) and CT angiography were performed while the patient was intubated. The findings indicated the presence of a pseudoaneurysm at the left common iliac artery, which was treated with immediate endovascular stenting. In conclusion, early recognition of such vascular injuries and intervention by taking appropriate decisions after a multidisciplinary approach can prevent mortality and morbidity.

Keywords: Endovascular iliac stent, far lateral disc herniation, vascular injury.

Lumbar disc surgery from a posterior approach is a very common technique of neurosurgical practice.[1] Among the various surgical complications described to date, vascular injuries may result in a fatal outcome if not diagnosed and treated early. In fact, it has a mortality rate of up to 40%.[2-5] Though a more preferable and advantageous method, the paramedian approach to the far lateral disc herniation requires special attention for any potential complications, as it involves close surgical handling of the iliac artery and its branches.[6-8] We hereby present and discuss a case of a 21-year-old male patient who underwent surgery due to L4-5 extraforaminal disc herniation and developed left common iliac artery injury.

CASE REPORT

A 21-year-old male patient was admitted to our clinic with complaints of low-back and left-leg pain refractory to medical therapy for three months. Physical examination showed a muscle strength of 4/5 for the left leg extension, hypoesthesia in the left L4 dermatome area, and a positive Lasègue test at 45 degrees. The left patellar reflex was observed to be reduced to +2. Lumbar magnetic resonance imaging (MRI) showed far lateral disc herniation that compressed the extraforaminal L4 root at the L4-5 level, as shown in Figures 1a and 1b.

The patient was prepared for L4-5 far lateral microdiscectomy. A left paramedian approach was performed using a tubular retractor system.

Received: April 18, 2026
Accepted: June 24, 2026
Published online: August 23, 2026

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Cite this article as:
Ozbek MA, Oksuz NC, Başak AT. Vascular injury during far lateral disc herniation surgery and its endovascular management: A case report. D J Med Sci 2026;12(2):111-116. doi: 10.5606/fng.btd.2026.227.

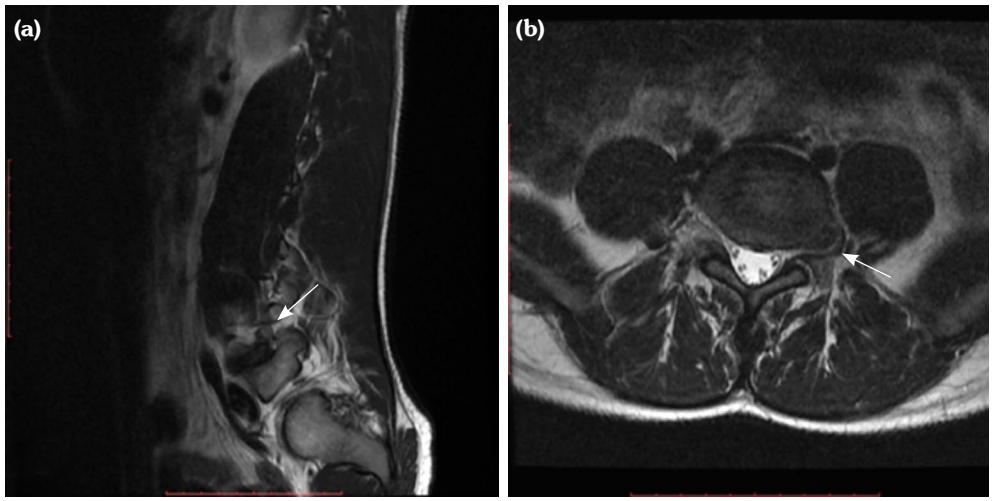

Figure 1. Preoperative MRI images. **(a)** Sagittal T2WI, disc herniation (arrow). **(b)** Axial T2WI disc herniation (arrow).
MRI, magnetic resonance imaging; T2WI, T2-weighted imaging.

Following the dissection of paraspinal muscles and exposure of the lateral facet and transverse processes, a microdiscectomy was carried out to remove the extruded disc material compressing the extraforaminal L4 root. Aberrant arterial bleeding occurred during microdiscectomy. Hemorrhagic output was diminished via oxidized regenerated cellulose, and surgical layers were quickly closed in an anatomically appropriate way. The patient was positioned supine, and an abdominal ultrasonography was performed. After detection of a volume increase within the left psoas muscle, the patient was taken to the computed tomography (CT) unit in intubated condition, where he underwent contrast-enhanced abdominal CT that indicated a hyperdense appearance (pseudoaneurysm) with lobulated contours and about a 25-mm diameter, adjacent to the left common iliac artery and approximately 3.5-4 cm distal to its bifurcation, as shown in Figures 2a and 2b. Between the contours of the psoas muscle and kidneys in the retroperitoneal area, marked bleeding was observed that started from the superior pole of the left kidney and extended to the pelvic level caudally adjacent to the

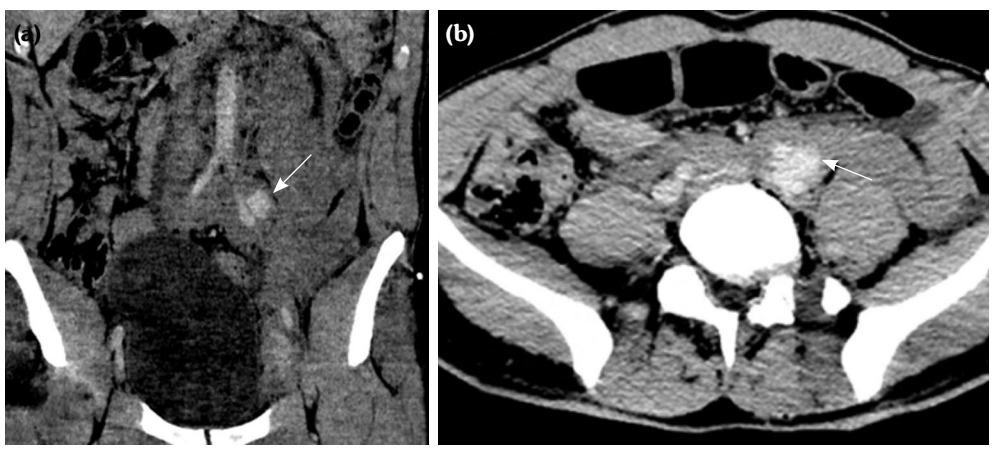

Figure 2. Abdominal CT angiography images. **(a)** Coronal, **(b)** Axial, pseudoaneurysm (arrows).
CT, computed tomography.

vascular structures. Upon recognition of a pseudoaneurysm, the patient was transferred to the catheterization laboratory after consultation with the interventional endovascular treatment unit. Meanwhile, the patient's blood pressure (systolic/diastolic) decreased to 60/30. The intervention was emergently initiated under general anesthesia, where bilateral introducer sheaths were advanced after access was established with venous needles from the right and left main femoral arteries via the groin under ultrasound guidance. Abdominal aortography and pelvic arteriography performed after accessing the abdominal aorta from the right side revealed massive active extravasation of the contrast material from a near 1-cm diameter defect at the posterior wall of the left common iliac artery, as shown in Figures 3a and 3b. Afterwards, a guidewire was advanced over the introducer sheath on the left, through which a 9-mm diameter and 5-cm long stent-graft (Gore® Viabahn® Endoprosthesis; W. L. Gore & Associates, Flagstaff, AZ, USA) was opened at the level of the common iliac artery. It was observed that the extravasation at the level of the common iliac artery disappeared and hemodynamic instability was resolved after the stent was implanted (Figure 3).

The patient was admitted to the intensive care unit while intubated. The patient's preoperative hemoglobin and hematocrit had been 14.9 g/dL and 42.5%, which were observed to decrease to 8.3 g/dL and 24.2% after the complication occurred, respectively. The patient received a total of three units of erythrocyte suspension, two units of fresh frozen plasma, and fluid replacement with crystalloids. He was also administered dopamine (at an infusion rate of 10 mcg/kg/min) and noradrenaline (at an infusion rate of 0.1 mcg/kg/min) infusions titrated to maintain a mean arterial pressure above 65 mmHg, the latter being continued for 12 h in the intensive care unit. The patient was extubated on the postoperative day 1 and transferred to the neurosurgery ward. The patient's postoperative period was uneventful, and he was discharged on the sixth postoperative day without any problems. Close follow-up during outpatient visits revealed complete resorption of the retroperitoneal hematoma at three months with an open and active stent, as shown in Figures 4a and 4b. The patient was maintained on antiplatelet therapy (acetylsalicylic acid 100 mg/day) during this period. A written informed consent was obtained from the patient.

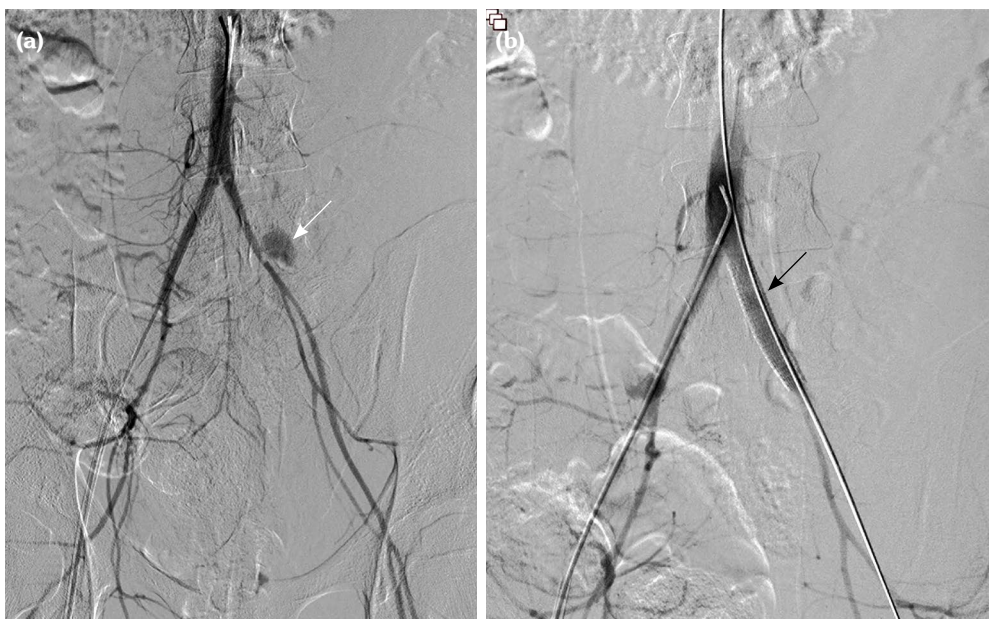

Figure 3. Endovascular angiography of iliac arteries. **(a)** Pseudoaneurysm of left iliac artery (arrow) **(b)** After treatment with stent (arrow).

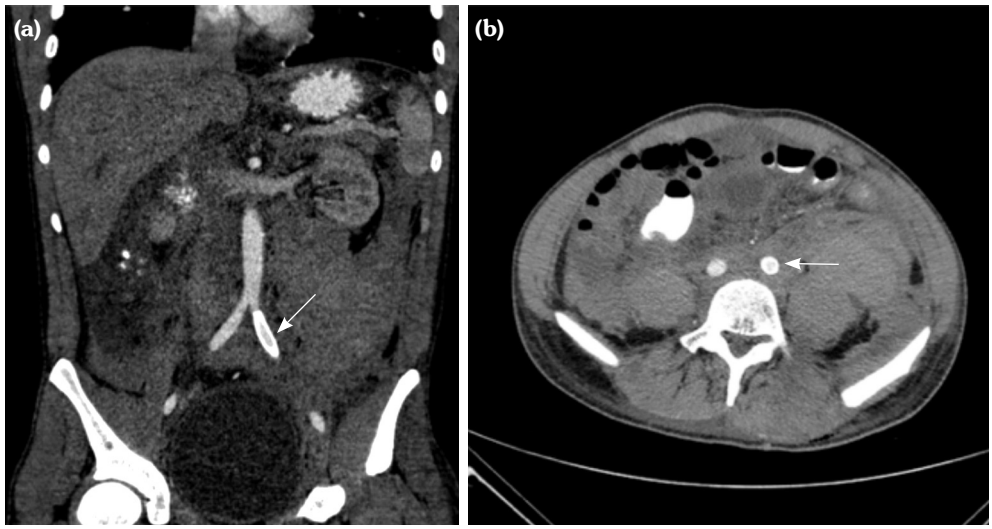

Figure 4. Postoperative third month control abdominal CT angiography. **(a)** Coronal. **(b)** Axial images.
CT, computed tomography.

DISCUSSION

Midline approaches remain inadequate for extraforaminal disc herniations, requiring substantial removal of the facet joint.[9,10] The far lateral approach provides better visualization of abnormalities without significantly disrupting the facet joint.[11,12] Although the overall incidence of major vascular injuries in lumbar disc surgery is estimated to be remarkably low (ranging from 0.01% to 0.14%), event rates increase in the far lateral approach.[13,14] Recent studies confirm that the far lateral approach carries a proportionally higher risk of such injuries compared to standard midline approaches due to its specific lateral trajectory and proximity to the retroperitoneal space.[15] Furthermore, these injuries may lead to a life-threatening complication.

Far lateral approaches direct the surgical trajectory laterally. This trajectory can inadvertently guide instruments closer to the great vessels. Anatomically, the bifurcation of the abdominal aorta into the common iliac arteries usually occurs at the L4 vertebral body level. Consequently, the left common iliac artery lies in intimate proximity to the anterior aspect of the L4-L5 disc space. Surgical instruments, such as pituitary rongeurs, can accidentally penetrate the anterior longitudinal ligament and annulus fibrosus. This penetration typically causes vascular injuries. Recent morphometric analyses emphasize that the L4-5 level poses the highest risk for left common iliac artery and vein lacerations due to their direct anterior adjacency.[16] Several factors predispose patients to these injuries. These include aggressive disc removal, degenerative anterior annulus defects, and anatomical vascular variations. Prior abdominal surgeries causing retroperitoneal adhesions also increase the risk. Furthermore, in far lateral approaches, the lateral absence of the posterior longitudinal ligament makes the anterior annulus more vulnerable to perforation. While L2-4 levels are mostly associated with abdominal aorta injuries, vascular injuries occurring at the L4-5 level usually involve the iliac artery.[17] The left common iliac artery is the most common site of such vascular injuries due to its more medial course and close adjacency to the L4-L5 intervertebral disc.[1,17-19]

To avoid such life-threatening complications, several preventive measures must be rigorously implemented. Preoperative planning is paramount; MRI and CT scans should be carefully evaluated not only for the disc pathology but also for the spatial relationship between the targeted disc space and anterior vascular structures. Intraoperatively, the depth of the surgical space should be continuously

monitored. Using depth-marked instruments, confirming the instrument tip position with lateral fluoroscopy, and avoiding the insertion of pituitary rongeurs deeper than 3 cm into the disc space are critical safety steps.

The clinical picture may manifest itself in the acute or chronic phase. In the acute phase, hypotension, shock, and tachycardia occur due to excessive bleeding.[20] In such cases, the anesthesiologist should be informed immediately, which provides early measures against hypotension and hypovolemic shock. In cases where vascular injury develops due to the elastic structure of the anterior annulus fibrosis and anterior longitudinal ligaments, it should be considered that more than half of such bleeding would leak to the retroperitoneal space rather than the surgical field, often masking the severity of the hemorrhage.[1,17]

If a major vascular injury is suspected during surgery, the incision should be closed quickly, and the patient should be placed in a supine position. Our case highlights the critical importance of a rapid emergency diagnostic workflow. Intraoperative ultrasonography can rapidly detect retroperitoneal fluid without moving the patient. However, it may not pinpoint the exact arterial defect. By seamlessly transitioning to emergency CT angiography, we quickly mapped the retroperitoneal hematoma. This allowed us to locate the pseudoaneurysm before irreversible shock ensued.

When comparing treatment modalities, open surgical repair often requires an emergency laparotomy in a hemodynamically unstable patient, which is historically associated with significant morbidity, higher blood loss, and mortality rates up to 10-65% depending on the vessel size and time of intervention. Conversely, endovascular treatment has become the current first-line therapeutic modality.[21] Current literature from the past five years strongly supports endovascular approaches, including stenting and resuscitative endovascular balloon occlusion, as the safest and most effective primary interventions for these iatrogenic injuries, offering rapid bleeding control.[22] The advantages of endovascular treatment include the short duration of anesthesia, rapid intervention, lower volume of blood loss in the procedure, and shorter hospital stay. The novelty of our report lies not in being the first of its kind, but in successfully demonstrating a multidisciplinary management algorithm from prompt intraoperative recognition to successful emergency endovascular stent placement in a hemodynamically unstable patient.

Nonetheless, this study has several limitations. The primary limitation of this study is its single-case design, which precludes broad generalizations regarding the superiority of a specific management protocol. Additionally, our follow-up period was limited to three months, necessitating further long-term vascular imaging to assess the extended durability and late-stage patency of the stent graft. Lastly, the emergency nature of the complication precluded pre-procedural vascular angiography prior to patient deterioration, although prompt intraoperative ultrasonography and subsequent CT angiography successfully mitigated this challenge.

In conclusion, iatrogenic vascular injury is a life-threatening complication during far lateral lumbar microdiscectomy due to comparable scarcity of anatomical landmarks and close proximity of the iliac arteries. To avoid such complications, the depth of the surgical space should be carefully evaluated and confirmed with X-ray, where necessary. The most important consideration in a vascular injury is early diagnosis and intervention. When such a complication occurs, early recognition of the injury and making appropriate decisions after a multidisciplinary approach can help the patient recover from this potentially fatal complication with minimal harm.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: A.T.B.: Idea/concept, control/supervision; M.A.Ö.: Design, analysis and/or interpretation, references and fundings; M.A.Ö., N.Ç.Ö.: Data collection and/or processing; N.Ç.Ö., A.T.B.: Literature review; M.A.Ö., A.T.B.: Writing the article, materials; A.T.B., N.Ç.Ö.: Critical review.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

AI Disclosure: The authors declare that artificial intelligence (AI) tools were not used, or were used solely for language editing, and had no role in data analysis, interpretation, or the formulation of conclusions. All scientific content, data interpretation, and conclusions are the sole responsibility of the authors. The authors further confirm that AI tools were not used to generate, fabricate, or 'hallucinate' references, and that all references have been carefully verified for accuracy.

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