Anterior Extrusion of Bone Graft after Posterior Lumbar Interbody Fusion with development Deep Vein Thrombosis: Case Report and Literature review

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Background: *Anterior bone graft extrusion is a very rare complication. Most patients with this type of extrusion are asymptomatic. Only few studies reported with the development of deep vein thrombosis (DVT) due to anterior bone graft extrusion and the detailed about the management.*
Propose: *The propose of this study is to report a patient with anterior bone graft extrusion with development of DVT without revision spinal surgery.*
Materials and Methods: *The authors demonstrated case by describing the patient's history, physical examination, imaging studies and treatment. We also reviewed and discussed related literatures.*
Results: *The patients with foraminal stenosis and disc extrusion of L4-S1 was performed posterior decompression and posterior lumbar interbody fusion of L4-S1. Postoperatively, the patient developed left thigh pain and swelling. The diagnosis of proximal DVT at left common iliac vein was confirmed by Doppler ultrasound and 3D CT angiography. The patient was treated with intervention; stent insertion at left common iliac vein, balloon dilatation, Inferior vena cava(IVC) filter, thrombectomy, injection of low molecular weight heparin. The patients showed an improvement in the clinical of radicular pain and thigh swelling.*
Conclusion: *Proximal DVT due to anterior bone graft extrusion is a very rare complication. The most important clinical symptoms are thigh swelling and pain. We must recognize patient's early symptoms and give an early diagnosis due to proximal DVT could be develop pulmonary thromboembolism and lead to death. Furthermore, the revision spinal surgery is more complex and associated with severe complications. This study described the management of DVT with nonsurgical approach, such as thrombectomy, common iliac vein stent, IVC filter insertion with an application of anticoagulants without going through revision spinal surgery.*

Keywords: *Deep vein thrombosis, posterior lumbar interbody fusion, complication, anterior bone graft extrusion*

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Introduction

Lumbar intervertebral graft extrusion is a complication that can occur during or after lumbar disc surgery. Anterior graft extrusion is less frequent but can be found after the surgery. The previous studies[1-5] reported the incidence of anterior graft extrusion is 0.6-0.8% and most patients are asymptomatic. A few case reports[1-5] described complication and management.

The main propose of this study was to report a case with anterior bone graft extrusion with development of proximal deep vein thrombosis (DVT) similar to previous reports[1-5]. But these patients had treatment with intervention; stent insertion at left common iliac vein, Inferior vena cava (IVC) filter insertion, thrombectomy, and anticoagulation without revision spinal surgery.

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Case report

A 72-year-old male came with right buttock pain radiating down to the right ankle and the right foot was dropped for 2 weeks. The patient had a history of hypertension and old CVA but he was denied history of previous venous thromboembolism and smoking. Physical examination showed decreased sensation of his right foot. The motor power of the right ankle dorsiflexion was grade III and right big toe dorsiflexion was grade IV, while others were grade V. His patellar reflex are 2+ on both sides. His body mass index (BMI) was 25.9 kg/m^2. Magnetic resonance imaging (MRI) studies demonstrated disc extrusion at L4-5 and L5-S1, with right

extraforaminal extension and severe right foraminal stenosis at L5-S1.

After Intubation, the patient was turned to prone position on the operative table. We performed a standard midline posterior approach, identified the bony landmark and level of pathology with intraoperative fluoroscope, insertion of pedicle screw at L4-S1 (Iliad®, Medyssey), confirmed the level and position of screw with fluoroscope, then performed posterior decompressive laminectomy L4-S1 with foraminotomy at right site of level L5-S1. The dura mater is exposed and delicately pushed back with a blunt retractor toward the midline but during traction the dura, an epidural vein was torn, we was controlled bleeding by using bipolar cauterization and packing gelatin-based sponges. After controlled bleeding, we performed open discectomy at L4-5 and L5-S1, removed disc material and irrigation disc space then used curettage to prepared vertebral endplate for fusion, insertion chip autogenous bone graft (1-2 ml per each level) between disc space and insertion titanium PLIF cage size width 11 mm, length 28 mm, 12 degrees lordotic angle (filled with autogenous bone graft and hydroxyapatite) at L4-5 and L5-S1 bilateral by manually. (Figure 1). Intraoperative blood loss was 2000mL. The patient reported an improvement in radicular symptoms after the surgery. On the postoperative day 1-16, he had no other complication, treated by routine postoperative care, rehabilitation program, and discharge to his home on day 13.

On the postoperative day 17, he complained about pain and swelling in the left thigh. His dorsalis pedis artery was palpable on both sides. A blood test for D-dimer was 3.79 µg/mL. The patient was immediately admission and received doppler ultrasound, 3-D computed tomography(CT) angiography and chest CT scanning. The result was acute DVT in left common iliac vein, external iliac vein, common femoral vein, superficial femoral vein and popliteal vein with thrombus in greater saphenous vein. No thrombosis was found in posterior tibial vein and there was no evidence of arterial stenosis or flow disturbance. Anterior bone graft extrusion was found at L4-5 level (Figure 2). Chest CT scanning revealed no evidence of pulmonary embolism. A vascular surgeon was consulted, and we decided to perform a stent insertion at left common iliac vein, balloon dilatation and IVC filter, thrombectomy at left common iliac, external iliac, common femoral and popliteal veins (Figure 3), low molecular weight heparin Enoxaparin 1mg/kg subcutaneously every 12 hours was started immediately and convert to oral warfarin for 3 months. His leg swelling was gradually disappeared in the next 2 weeks.

The 3-D CT angiography was obtained 6 weeks postoperatively and it demonstrated IVC filter insertion stated. The left common iliac, external iliac, common femoral, popliteal veins were decreased in size, but small trapped thrombus was still remained compared to the previous CT. The patient showed markedly improved conditions of left thigh swelling and edema. At the last follow-up (14 months postoperatively), the patient had no pain or swelling in his leg. The 3-D CT angiography showed the remaining anterior extrusion of bone graft, despite radiographic union. (Figure 4)

Discussion and Literature review

The PLIF procedure was pioneered in the 1940s by Ralph B. Cloward. The procedure was advocated because it allows posterior decompression of the neural elements while providing stabilization of the affected spinal motion segment. Based on the previous studies[6-7], the PLIF procedure can be technically difficult. The complications associated with PLIF included dural laceration, wound infection, postoperative radiculopathy, graft migration, pseudarthrosis, implant subsidence, epidural hemorrhage, vascular complication and bone graft donor–site morbidity. The intervertebral graft extrusion can occur frequently in the posterior direction. Anterior graft extrusion is found less frequently, but it may still occur after the procedure. Previous studies[1-5] reported an incidence of anterior graft extrusion between 0.6-0.8% and most patients show no clinical symptom. Some case reports[2-5] described complication and management of anterior graft extrusion. The potential risk factors of this type of graft extrusion include, but not limit to, the perforation of the annulus fibrosus and anterior longitudinal ligament, disc space violation, inadequate fixation, improper endplate preparation or graft placement. Graft migration can also occur in patients with osteomyelitis, discitis, or pseudarthrosis[3,4].

The incidence of DVT after spinal surgery is highly variable ranging from 0.3-31% from the previous studies[8-13]. Yang and colleagues8 reported 15.9% incidence in patients undergoing lumbar interbody fusion. The time to the onset of DVT after spinal surgery is variable from day 2 to 30 after surgery. It is the most common complication and a potentially lethal disease. The risks of DVT are multifactorial, such as advanced age, previous history of DVT, obesity, smoking, impaired mobility, high blood pressure, and high levels of serum D-dimer. In 2015 Wang TY et al.[11] reported an incidence of DVT within 30 days after lumbar surgery was 1.1% (15 from 1346 patients). Multivariate logistic regression determined that previous DVT, postoperative

urinary tract infection and creatinine level > 2.0 mg/dL were identified as risk factor for DVT.

In this study, the development of DVT may be caused by advanced age, history of hypertension, and postoperative impaired mobility, and the close proximity of the bone graft extrusion at L4-5 level to left common iliac vein. On the postoperative day 17, the patient complained about pain and swelling in the left thigh. It was not common clinical symptoms of DVT of lower extremities which presented by leg or calf edema and pain. The Doppler ultrasound and 3-D CT angiography was acute DVT in left common iliac, external iliac, common femoral, superficial femoral, and popliteal veins with thrombus in greater saphenous vein, it was corresponding with previously called "Proximal DVT". The proximal DVT is caused by mechanical obstruction of the left common iliac vein by the bone graft extrusion resulting in stasis rather than a primary hypercoagulable state[12,19]. In 2012, Nyamekye I and Merker L were reported a management strategies for proximal DVT. Anticoagulation alone has no significant thrombolytic activity and has not impact on prevention. They were recommended early thrombus removal for reduced post-thrombolytic syndrome, combined pharmocomechanical thrombolysis to enhance early thrombus removal.

In 2007, Yoshimoto H. et al.[2] reported a case of DVT after posterior lumbar interbody fusion(PLIF). The thrombosis was caused by migrated bone graft fragment from the interbody fusion site at L5/S1, which occluded the left common iliac vein at the bifurcation. The patient became symptomatic on the postoperative day 2 and underwent a revision surgery and an excision of the bone graft by a retroperitoneal approach. Puwar et al. was reported a case L3/4 spondylodiscitis treated with PLIF procedure. Intraoperative was found a cage migration in to Lt. pulmonary artery but the patient was asymptomatic. The author was compared this case report with previous studies in table 1.

The revision surgeries are more complicated and associated with a higher risk of complications. Nguyen HV. et al.[14] reported in a series of 14 patients, 8 of whom had pseudarthrosis or infection with cage migration. Of all patients, 57% of patients had vascular complications, and 1 patient died while undergoing a revision surgery using either transperitoneal or retroperitoneal approach. Fantini GA. et al.[15] reported a retrospective case series of 345 operations in 338 patients. The incidence of major vascular injury during anterior lumbar surgery is 2.9% (10 of 345 operations). Risk factors of such injury are previous osteomyelitis, discogenic infection, spondylolisthesis grade II, large anterior osteophyte, transitional lumbosacral vertebra, and anterior migration of interbody device. Allen and colleagues[16] also reported an incidence of vascular injury during anterior exposure of the spine is at 11% (54 of 480 patients) and the most common site of the injury is at L4-5 level (83%). Gumbs AA. et al.[17] reported in a retrospective case series of 218 patients whom had open anterior approach during spine procedure and 9 patients had revision procedures. The 5 of 9 patients of revision procedure also had complication. Early complications occurred in 4 patients (44%), and including dural tear, median nerve dysthesia, left common femoral nerve palsy, prolonged postoperative ileus and retrograde ejaculation. Late complications occurred in one patient and consisting of a DVT and urinary tract infection. Ralph J. Mobbs et al.[18] reported in a study of 227 patients who had approach-related complication of anterior lumbar interbody fusion. An intraoperative vascular injury requiring primary repair with suturing occurred in 15 patients (6.6%), 3 patients (1.3%) had incisional hernia requiring revision surgery, 7 patients (3.1%) had prolonged ileus (>7 days) managed conservatively, 4 patients had retrograde ejaculation, 15 patients (6.6%) had sympathetic, 5 patients (2.2%) had superficial wound infection treated with oral antibiotics, but there were no deep wound infections requiring reoperation or intravenous therapy. Dominique A. Rothenfluh et al.[9] reported access-related complications in anterior lumbar surgery in 31 patients over 60 years-old. The overall complication was 29% which included 4 vascular injuries and 1 pulmonary embolism. The vascular complication rate was 13 % (4 in 31 patients) with 2 cases of arterial and 2 cases of venous injuries requiring repair.

Because of the concerns over risks and complications from revision surgery reported in previous studies. We decided to treatment our patient without revision surgery. We reported a patient with anterior bone graft extrusion and the development of proximal DVT. The patient had treatment with intervention; stent insertion at left common iliac vein, IVC filter insertion, thrombectomy and anticoagulation without any risk of the revision spinal surgery.

Conclusion

Anterior bone graft extrusion could be result in proximal DVT by the compression of the left common iliac vein. Early detection, such as swelling and pain of the thigh region is important for preventing pulmonary thromboembolism, which occurs frequently in proximal DVT.

In patient with proximal DVT, Nonsurgical approach such as stent insertion, IVC filter insertion and thrombectomy with an application of anticoagulants, may be considered in such cases without going through revision spinal surgery

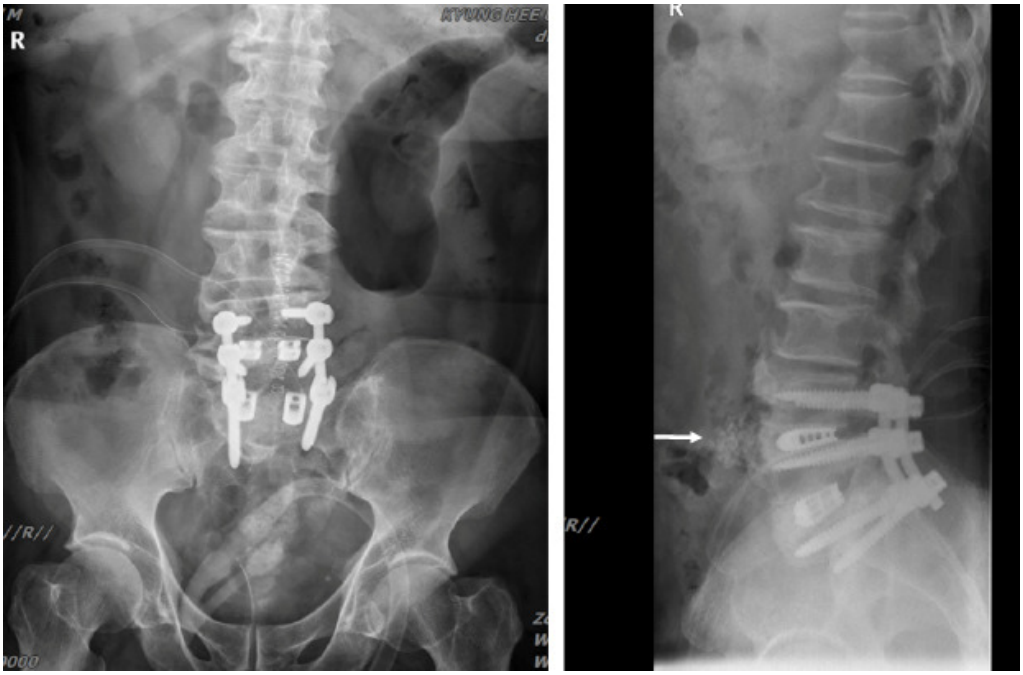

Fig.1 Anteroposterior (left) and lateral (right) radiographs taken immediately after PLIF surgery reveals proper placement of pedicle screws and intervertebral cage, but shows some bone graft anterior to L4-5 disc space (white arrow).

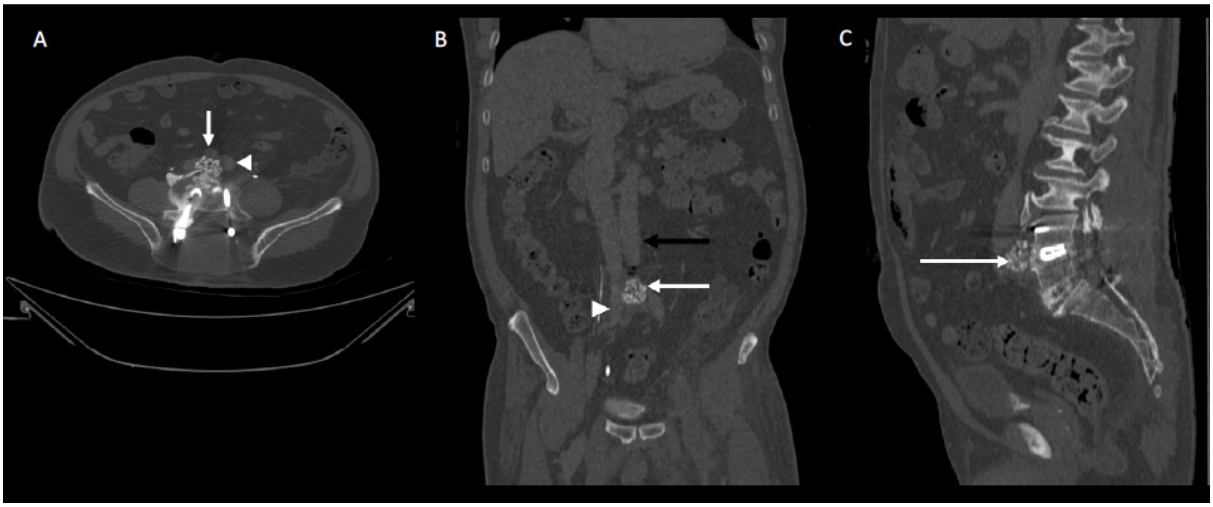

Fig.2 The 3-D computed tomography (CT) angiography at L4-5 on postoperative day 17

A. Axial view reveals anterior extrusion of bone graft at L4-5 disc space level with compression left common iliac vein (white arrow), but intact left common iliac artery (white arrow head).
B. Coronal view reveals anterior extrusion of bone graft with compression left common iliac vein (white arrow), but intact aorta (black arrow), and right common iliac vein (white arrow head)
C. Sagittal view reveals anterior extrusion of bone graft at L4-5 disc space level. (white arrow)

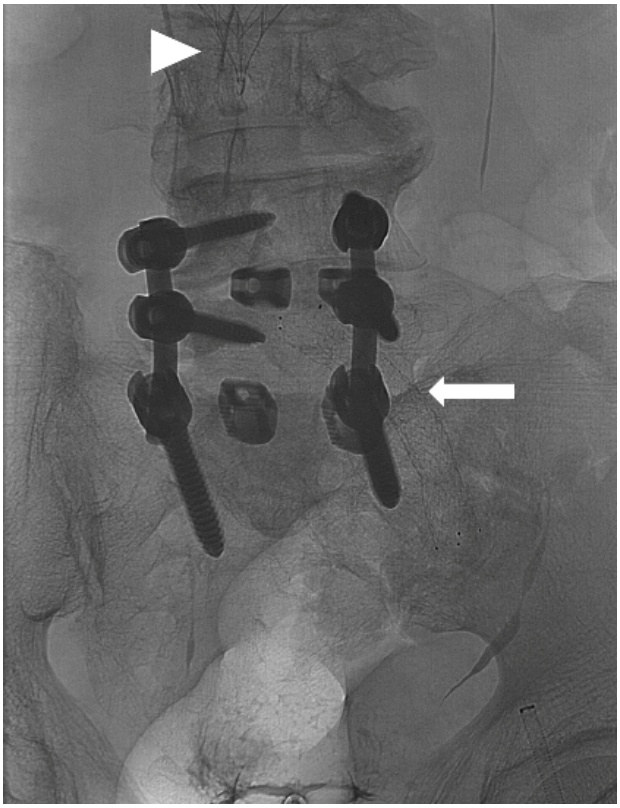

Fig.3 Insertion stent at left common iliac vein (white arrow) and IVC filter (white arrow head).

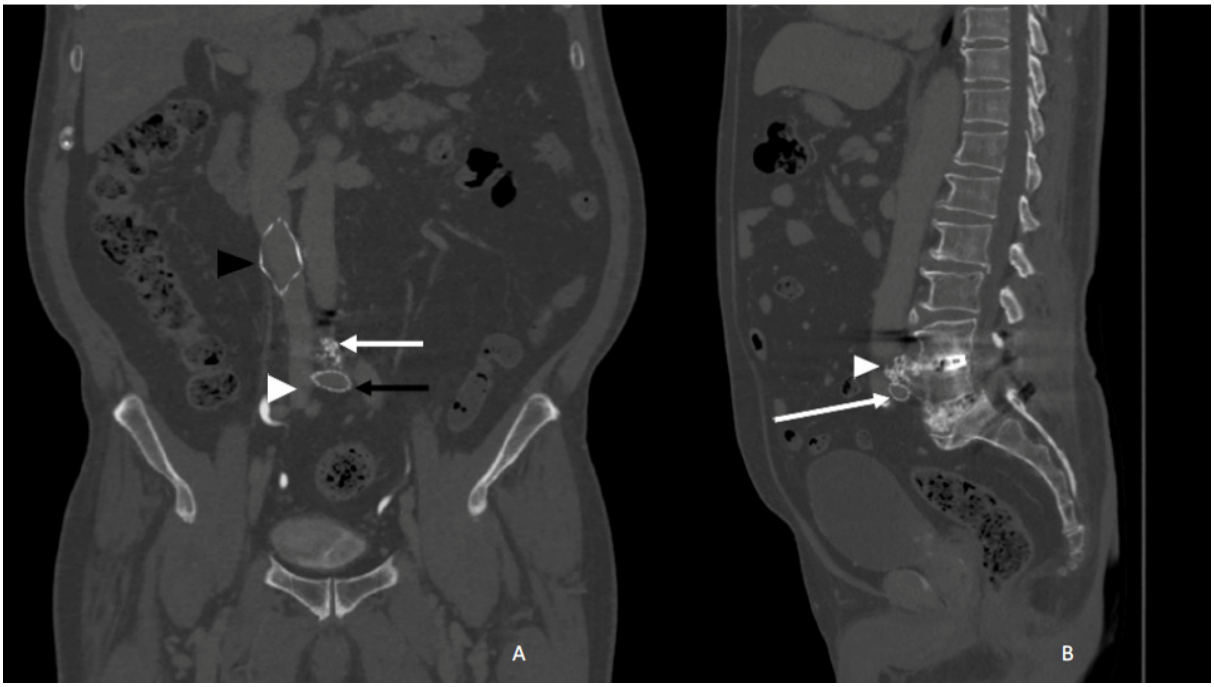

Fig.4 The 3-D computed tomography (CT) angiography obtained at 14 months postoperative

A. Coronal view reveal bone graft extrusion (white arrow), stent at left common iliac vein (black arrow), IVC filter (black arrow head) and intact right common iliac vein (white arrow head).
B. Sagittal view reveals the remaining of anterior extrusion of bone graft at L4-5 disc space (white arrow head) with stent at left commoniliac vein (white arrow), and radiographic union.

Author	Year	Preoperative Diagnosis	Index surgery	Level of extrusion	Compression site	Onset of conplication	Management
Bingo H	2002	NA	Lumbar Disc surgery	L4-L5 (n=12) L5-S1 (n=1)	Lt. common iliac artery (n=6) Pseudoaneurysm (n=4) AVF (n=1) Aortic bifurcation (n=1) IVC (n=1)	Immediate to 8 months	Dacron graft (n=4) Primary suture (n=4) Saphenous vein Graft (n=1) Resection&end to end anastomosis (n=4)
Yoshimoto H	2007	Isthmic spondylolisthesis L5-S1	PLIF	L5-S1	Lt. common iliac vein	Day 2	Excision
Pawar UM	2010	Spondylodiscitis L3-L4	TLIF	L3-L4	Lt. pulmonary artery	Intraoperative	Observe
This study	2016	Spinal stenosis L4-S1	PLIF	L4-L5	Lt common iliac vein	Day 17	Thrombectomy, stent, IVC filter, Anticoagulant drug

NA, not applicable; PLIF, posterior lumbar interbody fusion; TLIF, transforaminal lumbar interbody fusion
Table 1 Compared the details of this case with previous case reports.

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กรณีศึกษาผู้ป่วยหลอดเลือดดำที่ขาอุดตันเนื่องจากการกดทับของกระดูกภายหลังการผ่าตัด Posterior lumbar interbody fusion โดยวิธีไม่ต้องผ่าตัดซ้ำ

ธนิตา ปัญญาอมรวัฒน์, พบ, จองฮี ลี, คยุงชุง คัง, ซึงจุน ชิน, คีทัก คิม, วอนจู ชิน

วัตถุประสงค์: *ศึกษาผู้ป่วยหลอดเลือดดำที่ขาอุดตันเนื่องจากการกดทับของกระดูกภายหลังการผ่าตัด Posterior lumbar interbody fusion โดยวิธีไม่ต้องผ่าตัดซ้ำ*

ผลการศึกษา: *ผู้ป่วยชาย อายุ 72 ปี มีอาการของโรคโพรงกระดูกสันหลังตีบแคบและหมอนรองกระดูกระดับเอวเคลื่อน ทำการผ่าตัด Posterior decompression and posterior lumbar interbody fusion of L4-S1 หลังการผ่าตัดวันที่ 17 มีอาการของภาวะหลอดเลือดดำที่ขาซ้ายอุดตัน ตรวจ Doppler ultrasound และ 3D CT angiography พบการกดทับของ left common iliac vein เนื่องจากกระดูกที่มาจากการทำ posterior lumbar interbody fusion ได้รับการรักษาโดยการใส่stentที่ left common iliac vein, ทำ balloon dilatation,ใส่ Inferior vena cava (IVC) filter, thrombectomy และให้ยา intravenous low molecular weight heparin ภายหลังการรักษาอาการทุเลาลง โดยไม่ต้องใช้วิธีผ่าตัดซ้ำที่กระดูกสันหลัง*

สรุป: *ผู้ป่วยที่มีภาวะหลอดเลือดดำที่ขาอุดตัน เนื่องจากการกดทับของกระดูกภายหลังการผ่าตัด Posterior lumbar interbody fusion สามารถรักษาโดยการใส่ stent, IVC filter, thrombectomy และให้ยาสลายลิ่มเลือด โดยไม่ต้องรับการผ่าตัดซ้ำที่กระดูกสันหลังซึ่งเป็นการผ่าตัดที่มีความเสี่ยงสูง*