

Vertebrae Coronal Fracture following Oblique lateral Lumbar Interbody Fusion: Case Report

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Abstract

Objective: Oblique lateral lumbar interbody fusion (OLIF) surgery has been increasingly proposed a preferred minimally invasive approach for lumbar degenerative pathology. We aimed to report cases with vertebrae coronal fracture (VCF) following OLIF combined with anterolateral single-rod screw fixation (OLIF-AF).

Methods: A retrospective review was performed on all patients who underwent minimally invasive OLIF-AF surgery between October, 2017 and February, 2021. Patients with VCF were selected for further analysis.

RESULTS: Two patients (0.37%) out of 534 total patients (707 levels) were identified with VCF following OLIF-AF. Both patients presented with severe back pain and radiating to bilateral legs within 10 days after surgery. Both patients were osteoporosis and had improper lumbar motion at early stage postoperative. Managed with conservative treatment, the VCF healed and successful interbody fusion were achieved in both patients.

CONCLUSIONS: VCF following OLIF-AF surgery is a rare but anguished complication. The contributing factor may include osteoporosis, overweight and premature improper lumbar motion. Based on these fracture reports, we caution surgeons should repeatedly advise patients to limit lumbar movement at early stage postoperative, especially for osteoporosis patients.

Key words: vertebrae coronal fracture (vcf); oblique lateral lumbar interbody fusion (olif); anterolateral fixation; osteoporosis

Introduction

As a minimally invasive technique, the oblique lateral lumbar interbody fusion (OLIF) surgery has been recently popularized for patients with lumbar degenerative pathology [1-3]. With the increasing number of OLIF surgery being performed, the related known complications profile have been initially reported including cage subsidence, vascular and nerve injury, endplate violation, ureteral injury, ileus, peritoneal tear and so on [4-6].

As a serious complication, the vertebral coronal fracture (VCF), which was associated with severe pain, mobility disability and even reoperation, following lumbar interbody fusion surgery have been sporadically reported in the direct lateral approach, with the incidence of 0.6%-15.4%, which varied with different instrumentation usage [7-9]. However, to our knowledge, the VCF following OLIF surgery have not yet been mentioned in the previous literature. In this report, we were committed to present with 2 cases with the VCF among the total of 534 patients who underwent OLIF surgery combined with anterolateral fixation (OLIF-AF), which performed by a single senior surgeon between October, 2017 and February, 2021 in our institution.

Report of the case

Case I

A 76-year-old female visited our clinic with the complaint of chronic low back pain for 30 years and aggravated with right leg numbness for 4 months. A physical examination showed that numbness was found on the right posterior thigh and lateral calf, and ankle dorsal extensor muscle strength decreased. Dynamic instability was observed at X-ray (Figure 1a), and the MRI demonstrated that disc bulge causing spinal stenosis at L4-5 (Figure 1b). Prior to admission, she insisted on treating her tetter with corticosteroids more than 10 years, and the admission assessment revealed osteoporosis (T score=-2.7), and the body mass index (BMI) was 23.9 kg/m². After experienced failure conservative treatments for lumbar and leg pain, she finally underwent OLIF-AF surgery. Postoperative radiological examinations showed no endplate violation occurred intraoperatively and the disk space was clearly distracted (Figure 1c). Subsequently, the patient was discharged home on 2 days postoperatively with resolution of preoperative complaint.

Just 7 days postoperatively, following an unconscious excessive lumbar bending, a sharp pain was aroused in her lower back and radiated to bilateral legs. Emergency 3D-CT showed a coronal fracture of the L4 vertebrae, with the anterior half of the fractured vertebra slightly displaced upwards and forwards. The fracture line originated from the contact plane between the cage posterior upper edge and the vertebrae (Figure 1d). Treatment options were given and the patient chose conservative treatment including

analgesics, anti-osteoporosis, strict bed rest, and then began to gently walk under the brace after acute phase. Three months postoperatively, the pain was clearly relieved, and the 3D-CT examination revealed the osteotylus connection formation. The 3D-CT examination taken at 12 months postoperatively showed the vertebrae fracture healed and the successful fusion was also achieved (Figure 1e). The pain was mostly relieved, even so, anti-osteoporosis was recommended to be insisted on.



Figure 1. (a), preoperative dynamic X-ray radiographs revealed instability at L4-5; (b), preoperative MRI revealed spinal canal stenosis at L4-5; (c), 3D-CT taken at 1 day postoperative revealed good positioning of cage within the disc space without evidence of endplate violation or cage subsidence; (d), emergency 3D-CT (7 days postoperatively) revealed coronal fracture of the L4 vertebrae, with the cage counterclockwise rotation; (e), 3D-CT taken at 12 months postoperatively revealed the vertebrae fracture healed and the successful fusion was also achieved.

Case II

A 60-year-old female visited our clinic with the presence of repeated low back pain for 3 years, which aggravated with intermittent claudication for 6 months. She was neurological deficit on physical examination with numbness at the left lateral calf and instep, and the thumb dorsal extensor strength decreased. She also presented with some past medical histories included diabetes, hypertensive disease, and Cushing's syndrome more than 15 years. The admission assessment revealed severe osteoporosis (T score=-4.0), and normal BMI (23.1kg/m²). The radiological examinations showed a grade II degenerative spondylolisthesis of L4 (Figure 2a), and spinal canal stenosis at L4-5 level (Figure 2b). After failing non-operative management, she eventually underwent an uncomplicated OLIF-AF surgery. Postoperative radiological examination revealed the spondylolisthesis of L4 was certainly corrected without endplate violation (Figure 2c), and a clearly spinal canal expansion was achieved (Figure 2d). Routinely, the patient was discharged home on 2 days postoperatively with the pain relieved.

Exactly 10 days postoperatively, after undergoing a negligent lumbar bending and twisting, the patient immediately experienced severe pain in lower back, which meanwhile radiating to bilateral legs. Emergency 3D-CT examination confirmed that a non-displacement coronal fracture of the L5 vertebrae and cage subsided into the fractured vertebrae (Figure 2e). Refused re-operation, the patient chose conservative treatment included analgesics, anti-osteoporosis, strict bed rest, and then gradually softly walked under the brace after 6 weeks. Three months postoperatively, 3D-CT showed that the osteotylus connection formation and no visible progress in cage subsidence. The pain was distinctly relieved and the patients was allowed moderately walk under the brace protect. The 3D-CT examination taken at 12 months postoperatively showed the vertebrae fracture line disappeared (Figure 2f). Although the pain was almost relieved, anti-osteoporosis was still recommended to be insisted from now on.

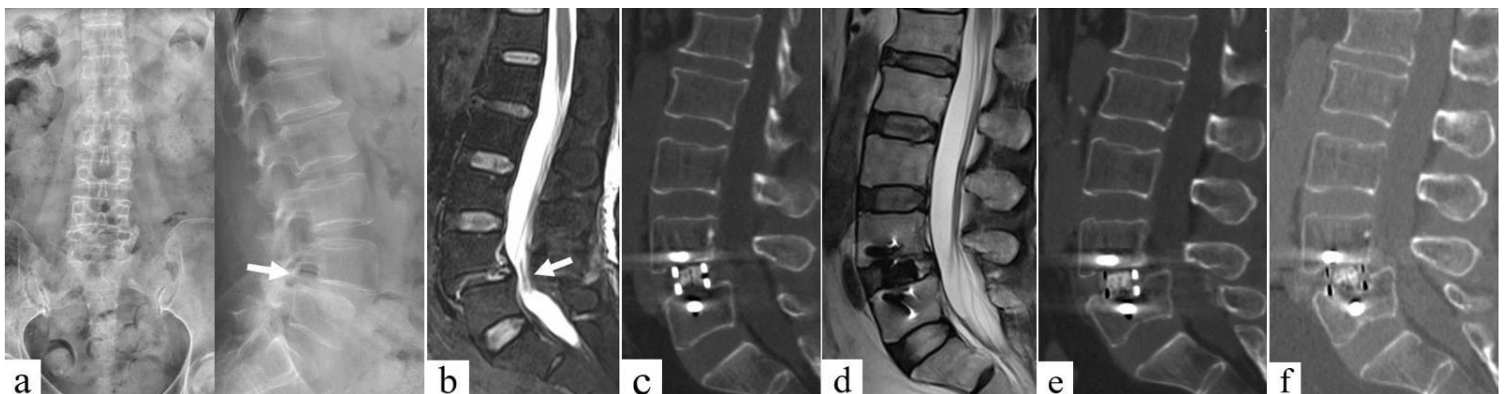


Figure 2: (a), preoperative X-ray radiographs revealed II° spondylolisthesis of L4; (b), preoperative MRI revealed spinal canal stenosis at L4-5; (c), 1 day postoperative 3D-CT revealed good positioning of cage within the disc space without evidence of endplate violation or cage subsidence; (d), 1 day postoperative MRI revealed clearly expansion of the spinal canal; (e), emergency 3D-CT (10 days postoperatively) revealed a non-displacement coronal fracture of the L5 vertebrae and cage subsided into the fractured vertebrae; (f), 12 months postoperatively, the 3D-CT revealed the vertebrae fracture healed and the successful fusion was also achieved.

Discussion

In our series of 534 patients with 707 levels who underwent OLIF-AF surgery, two patients experienced VCF at the operated level, with an extreme lower incidence which accounting for 0.4 % of total operated patients, or 0.3 % of total operated levels. This rate was almost agreement with the report of VCF following lateral lumbar interbody fusion (LLIF) surgery in previous large cohort. Rodgers et al. [7] reported the vertebrae fracture rate of 0.7 % among 600 patients who underwent LLIF surgery, and eventually caused reoperation. Subsequently, Tempel et al. [8] reported that among a total of 335 patients with 712 levels who underwent LLIF stand-alone surgery, 2 female suffered vertebrae fractures within 2 weeks postoperatively, with the incidence of 0.6% of patients, or 0.3 % of total operated levels. Additionally, in a small cohort, Dua et al. [9] reported a late vertebrae fracture with the incidence of 15.4 % in a group of 13 patients who underwent LLIF surgery with supplemental lateral plate and unilateral pedicle screw instrumentation.

Causes for VCF following lumbar interbody fusion surgery tends to be multifactorial. The intrinsic biomechanical properties of the construct may be a potential factor should be responsible for the VCF [8]. As shown in the biomechanical study performed by Fogel et al. [10], the construct of interbody cage combined with anterolateral instrumentation presented with a higher range of motion in the sagittal plane compared to that in the construct of interbody cage combined bilateral posterior pedicle screw instrumentation. In our study, both patients immediately suffered VCF following an inappropriate lumbar movement in sagittal plane. The emergency 3D-CT of the first fractured patient showed that the cage anterior lower edge was subsided into the L5 vertebrae, and the cage posterior upper edge was incised into the L4 vertebral body and then derived a fracture line in the coronal plane, which indicated that the cage may roll in the disc space and then cut the L4 vertebra. We speculated that the sufficient stability could not be provided by the anterolateral instrumentation during the lumbar spine excessively rotated in the sagittal plane, thus causing the cage rolled in the disc space and cut the vertebrae. Moreover, the cage anteroposterior diameter was also suspected as a factor affecting its stability in the disc space. A smaller anteroposterior diameter was not believed to provide sufficient drag torque to limit the cage rolled in the disc space [11]. The two fractured patients in our study were both implanted a cage with higher height (14mm) but narrow width (18mm), which more likely to lead to rolled in disc space and then cut the vertebrae.

Both patients discussed in this report were presented with osteoporosis, which caused by the additional medical comorbidities which associated with "corticosteroid overdose". Bone mineral density (BMD) was considered to be a vital factor affecting the fate of instrumentation in lumbar fusion surgery. Previous study have confirmed that the impaired BMD were associated with the implant subsidence, migration, and screw loosen, pulling out, even cleavage vertebrae [6, 12-14]. In our study, two patients presented with osteoporosis. The emergency 3D-CT showed that the relative location of the screw within the fractured vertebrae was clearly descended, and cross the fracture line. This result indicated that the osteoporotic condition was unable to resist screw cuts and then be the cause of coronal fracture. In addition, we noticed that the two fractured patients were female. This appearance was coincided with the report by Tempel et al. [8]. The sex specificity may be explained by that the curvature of lumbar lordosis increases more in females than in males and with age which may result in increased interfacial loading between the cage and endplate. Moreover, an increased incidence of osteoporosis in postmenopausal status in females compared to males also may responsible for this result [15-16].

Management of VCF after lumbar fusion surgery varied from conservative to extensive posterior bilateral pedicle screw instrumentation. However, some complication may arise during the reoperation. Tender et al. [11] reported a case of a deep wound infection following posterior revision for VCF. In our study, the two patients both chose the conservative treatment including analgesics, anti-osteoporosis and strict bed rest. Eventually, the fracture healed and successful fusion was achieved.

Conclusion

VCF following OLIF-AF surgery is a rare but anguished complication. The contributing factor may include osteoporosis, overweight and premature improper lumbar motion. Based on these fracture reports, we caution surgeons should repeatedly advise patients to limit lumbar movement at early stage postoperative, especially for osteoporosis patients.

Statements

Comprehensive agreement for academic use of information was obtained from the patients and no identifiable information of the participants was included in the manuscript.

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