

Acute rib fracture caused by preoperative positioning for direct lateral interbody fusion

A case report

Chang Hwa Hong, MD^a, Ki Jin Jung, MD^a, Jae Wan Soh, MD^a, Sung Hun Won, MD^b, Si John Hong, MD^a, Chang Hyun Kim, MD^a, Hong Seop Lee, MD^c, Soon Do Wang, MD^a, Won Seok Lee, MD^b, Woo Jong Kim, MD^{a,*}

Abstract

Rationale: Degenerative spondylolisthesis is defined as forward slippage of a vertebra with respect to the underlying vertebra and is associated with the induction of lumbar canal stenosis. The use of anterior column support for degenerative lumbar conditions has been well documented. Direct lateral interbody fusion (DLIF) gains access via a lateral approach through the retroperitoneal fat and psoas muscle. It avoids many of the access-related complications yet comes with its own risks and limitations. The location of the iliac wing precludes exposure of the L5–S1 disc space and may make L4–5 surgery difficult. Therefore, accurate preoperative patient positioning is essential.

Patient concerns: A 71-year-old female with a body mass index (BMI) of 39.2 kg/m² (height 155.9 cm, weight 79.5 kg) presented with lumbar pain radiating to the left lower limb. She complained of neurologic claudication with more than 100 m ambulation.

Diagnosis: Plain standing view on spine radiography revealed L4–5 spondylolisthesis and disc-space narrowing. Magnetic resonance imaging (MRI) revealed severe L4–5 bilateral foraminal stenosis. After the first surgery, simple rib cage radiography was performed to examine the source of her right-sided flank pain and it revealed acute fracture of the right ninth and tenth ribs.

Interventions: The patient was laterally positioned on the table in an extreme bending position. The intervertebral cage was inserted in the L4–5 disc space and disc height was restored. With respect to the rib fracture, treatment was conservative.

Outcomes: The patient's radiating pain was immediately relieved and her lower back pain disappeared at 3 months after surgery. The patient reported right-sided flank pain after the first surgery. Simple rib cage radiography was performed and revealed fracture of the right ninth and tenth ribs. Follow-up assessments conducted 2 months later revealed complete bony union.

Lessons: DLIF avoids many access-related complications. However, it is associated with other intraoperative complications, including injury to the lumbar nerve root and plexus. In addition, there are preoperative complications associated with improper patient placement on the table. In this case, the patient's obesity and strict positional requirements resulted in rib fracture. We suggest that surgeons consider this complication and exercise care in preoperative positioning.

Abbreviations: BMI = body mass index, CVA = costovertebral angle, DLIF = direct lateral inter-body fusion, MRI = magnetic resonance imaging.

Keywords: complication, degenerative spondylolisthesis, direct lateral interbody fusion, lateral position, rib fracture

Editor: N/A.

CHH and KJJ contributed equally to this study and should be considered co-first authors.

The authors have no conflicts of interest to disclose.

^a Department of Orthopaedic Surgery, Soonchunhyang University Hospital Cheonan, Dongam-gu, Cheonan, ^b Department of Orthopaedic Surgery, Soonchunhyang University Hospital Seoul, Yongsan-gu, ^c Department of Orthopaedic Surgery, Nowon Eulji Medical Center, Eulji University, Nowon-gu, Seoul, Korea.

* Correspondence: Woo Jong Kim, Department of Orthopaedic Surgery, Soonchunhyang University Hospital Cheonan, 31, Suncheonhyang 6-gil, Dongam-gu, Cheonan 31151, Korea (e-mail: kwj9383@hanmail.net).

Copyright © 2019 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and buildup the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

Medicine (2019) 98:8(e14700)

Received: 30 October 2018 / Received in final form: 24 January 2019 /

Accepted: 5 February 2019

<http://dx.doi.org/10.1097/MD.0000000000014700>

1. Introduction

Degenerative spondylolisthesis is defined as forward slippage of a vertebra with respect to the underlying vertebra and is associated with the induction of lumbar canal stenosis.^[1] The use of anterior column support for degenerative lumbar conditions has been well documented.^[2] Direct lateral interbody fusion (DLIF) gains access via a lateral approach through the retroperitoneal fat and psoas muscle.^[3] Direct lateral lumbar interbody fusion avoids many access-related complications but comes with its own set of risks and limitations. Complications include postoperative groin and thigh pain, as well as injury to the lumbar nerve root and plexus. Rare complications such as celiac trunk occlusion and bowel perforation may also occur.^[4–6] The location of the iliac wing contributes to the riskiness of this surgery, and precludes exposure of the L5–S1 disc space such that L4–5 surgery may be difficult. Therefore, accurate preoperative patient positioning is important. Patients are laid on the table in a bent lateral decubitus position for fluoroscopic imaging.^[3] In addition, obesity contributes to the development of surgical complications.^[7,8] Here, we present a case of acute rib

fracture caused by preoperative lateral positioning, which is rarely reported.

2. Case description

This case report was approved by the International Review Board of Soonchunhyang University Hospital (IRB No. 2018-10-026). The patient gave written informed consent for publication of this case report and accompanying images.

A 71-year-old female with a body mass index (BMI) of 39.2 kg/m² (height 155.9 cm, weight 79.5 kg) presented with lumbar pain radiating to the left lower limb. Her condition was unsuccessfully treated with conservative management for 6 months. She complained of neurologic claudication with more than 100 m ambulation. Her medical history showed rheumatoid arthritis, hypertension, and adrenal insufficiency.

Preoperative bone mineral density was measured and her lumbar T-score was 1.1, which is not indicative of osteoporosis. Radiographs of plain standing anteroposterior, lateral, flexion, and extension views revealed L4–5 spondylolisthesis and disc space narrowing (Fig. 1). Magnetic resonance imaging (MRI) revealed a L4–5 severe bilateral foraminal stenosis and root compression with mild ligament flavum hypertrophy (Fig. 2). We scheduled a 2-stage operation. The first surgery involved direct lateral lumbar interbody fusion for indirect decompression of the nerve root and the second involved posterior fixation to promote stability (Fig. 3).

In the first surgery, the patient was placed under general anesthesia and positioned laterally on the table with her right side down. To determine the precise positioning for a lateral approach, we measured the intervertebral disc space with fluoroscopy (Fig. 4). The initial measures indicated a narrow intervertebral space, so we adjusted her position until an optimal lateral approach was possible.

Immediately after surgery, the patient's radiating pain was relieved, but she presented with right-sided flank pain. The flank pain was aggravated by motion and deep breathing. Postoperative laboratory results were within the normal range and

costovertebral angle (CVA) tenderness was negative. We next assessed her rib cage using a simple radiograph, which revealed fracture of the ninth and tenth ribs (Fig. 5). We hypothesized that the acute fracture resulted from the preoperative lateral positioning and prescribed pain control medication. After 3 weeks, her flank pain was relieved and fracture union showed good progress after 2 months. She had no complications or recurrence of symptoms at the 6-month follow-up.

3. Discussion

There are various fusion techniques to address lumbar spinal instability. Each technique is associated with its own advantages and limitations. Lateral lumbar interbody fusion, including DLIF and extreme lateral lumbar interbody fusion, is a mini-open lateral, retroperitoneal, trans-psoas approach to the lumbar spine. It has an advantage over posterior and anterior approaches in that it avoids paravertebral soft tissue, visceral, and vascular injury.^[3,4]

A disadvantage associated with the lateral approach is potential injury to the lumbar nerve plexus, iliac vein, and urinary tract.^[9] In cases where the surgeon penetrates the retroperitoneal space, there is risk to the intraabdominal organs.^[10]

Spine surgeons should consider each of these risks and utilize intraoperative neurologic monitoring and frequent fluoroscopic imaging to lower their probability of occurrence. Since lateral lumbar interbody fusion involves minimal incision, frequent fluoroscopic imaging is not only beneficial for reducing surgical complications, it is also a helpful tool to accurately target the surgical site.

Once surgery begins, the patient's position is fixed; therefore, accurate preoperative positioning is critically important in lateral lumbar interbody fusion. In our case, the patient was positioned laterally on the table with the right side down. We subsequently adjusted her position based on fluoroscopic imaging to accurately access the intervertebral space. Due to the bony spur of the vertebral body and the compressed disc space, we bent her right

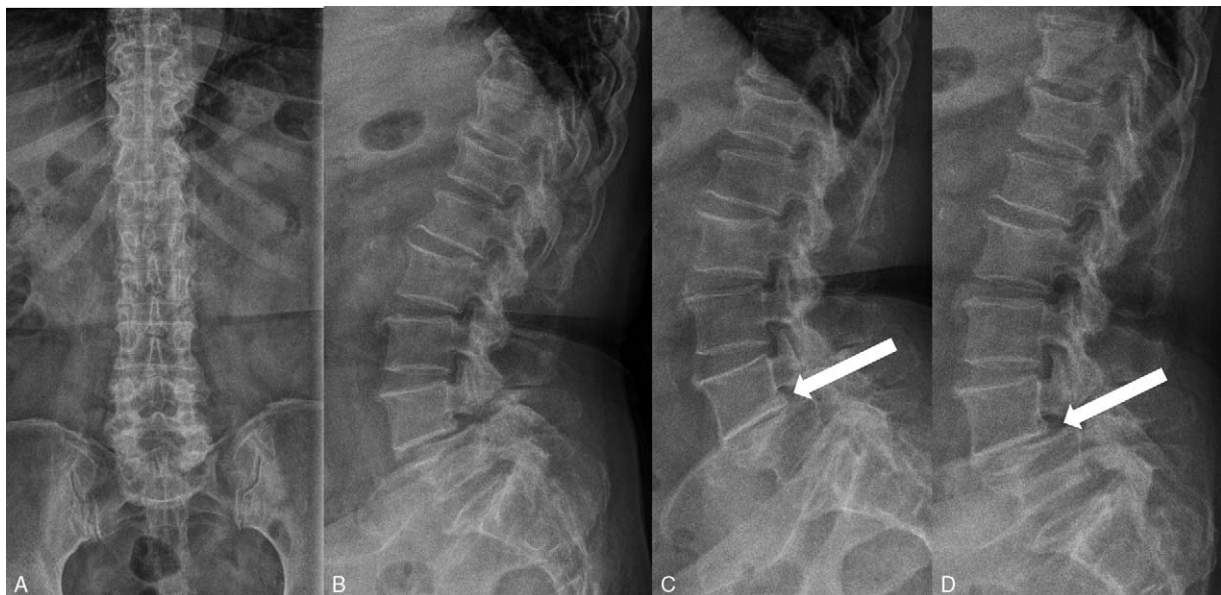


Figure 1. Preoperative plain anteroposterior (A), lateral (B), extension (C), flexion (D) radiograph views of the lumbar spine showing L4–5 spondylolisthesis and disc space narrowing (arrow).

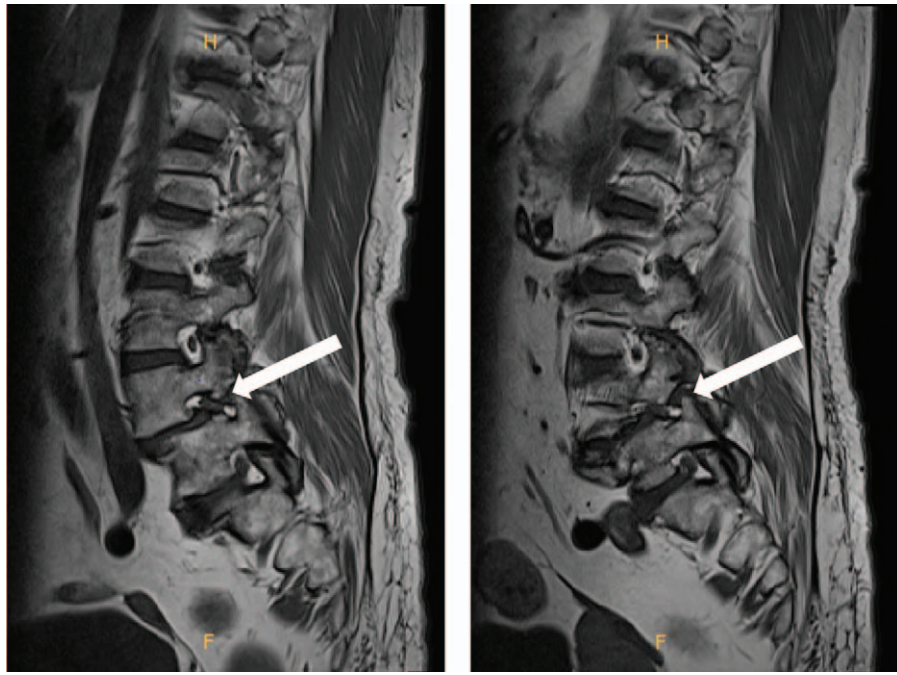


Figure 2. Preoperative T1-weighted magnetic resonance image of the lumbar spine showing L4–5 bilateral foraminal stenosis (arrow).

side and added a brace under her flank area to achieve an increased angle in the spinal column. We successfully achieved an accurate position for the lateral approach, but the excessive bending resulted in acute rib fracture. Before and after the operation, the patient had no trauma to the flank area, and the bone marrow density result of the patient was not osteoporosis

with lumbar spine T-score 1.1. Therefore, the authors thought that the rib fracture was caused by preoperative preparation.

While there have been many reports on the perioperative complications associated with lateral lumbar interbody fusion, this report presents a rare complication that resulted from preoperative positioning.



Figure 3. Postoperative plain anteroposterior (A), lateral (B) radiograph view of the lumbar spine showing L4–5 fusion.



Figure 4. Gross photograph of the right-sided down lateral position used for direct lateral interbody fusion: anteroposterior and posteroanterior views.

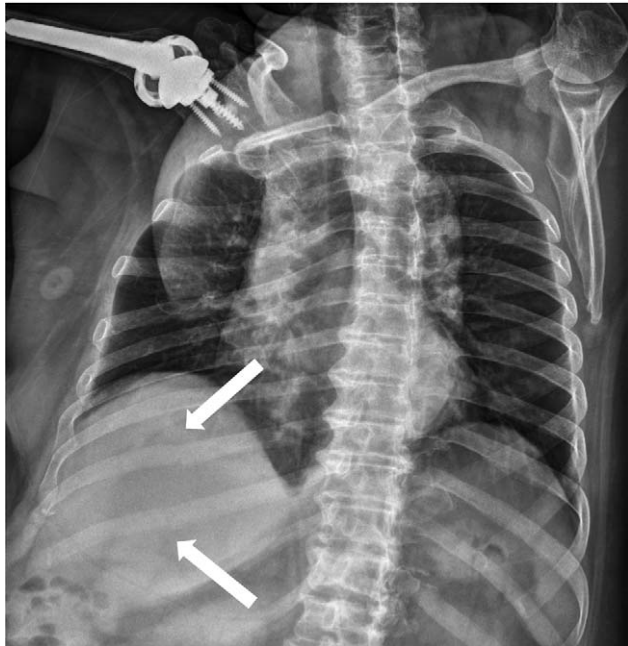


Figure 5. Plain radiograph of the rib cage showing right-sided fracture of the ninth and tenth ribs.

4. Conclusion

The lateral lumbar interbody fusion technique has become increasingly more common. However, spine surgeons should consider the associated advantages, disadvantages potential surgical complications. In addition, patients should receive information regarding the benefits and risks prior to surgery. Our case presented with a rare complication that, when present, should be discussed carefully with patients prior to surgery and considered by spine surgeons during the preoperative phase.

Acknowledgment

The authors thank the Soonchunhyang University Research Fund for support (20180017).

Author contributions

Conceptualization: Chang Hwa Hong, Hong Seop Lee, Woo Jong Kim.

Formal analysis: Jae Wan Soh.

Project administration: Si John Hong.

Software: Sung Hun Won.

Supervision: Ki Jin Jung, Sung Hun Won, Woo Jong Kim.

Visualization: Chang Hyun Kim, Won Seok Lee.

Writing – original draft: Soon DO Wang, Woo Jong Kim.

Writing – review & editing: Chang Hwa Hong, Woo Jong Kim.

Woo Jong Kim orcid: 0000-0002-4579-1008.

References

- [1] Guigui P, Ferrero E. Surgical treatment of degenerative spondylolisthesis. *Orthop Traumatol Surg Res* 2017;103:S11–s20.
- [2] Knight RQ, Schwaegler P, Hanscom D, et al. Direct lateral lumbar interbody fusion for degenerative conditions: early complication profile. *J Spinal Disord Tech* 2009;22:34–7.
- [3] Derman PB, Albert TJ. Interbody fusion techniques in the surgical management of degenerative lumbar spondylolisthesis. *Curr Rev Musculoskelet Med* 2017;10:530–8.
- [4] Balsano M, Carlucci S, Ose M, et al. A case report of a rare complication of bowel perforation in extreme lateral interbody fusion. *Eur Spine J* 2015;24(suppl 3):405–8.
- [5] Fomekong E, Pierrard J, Danse E, et al. An unusual case of ureteral perforation in minimally invasive pedicle screw instrumentation: case report and review of the literature. *World Neurosurg* 2018; 111:28–35.
- [6] Vasiliadis HS, Teuscher R, Kleinschmidt M, et al. Temporary liver and stomach necrosis after lateral approach for interbody fusion and deformity correction of lumbar spine: report of two cases and review of the literature. *Eur Spine J* 2016;25:257–66.
- [7] Rodgers WB, Cox CS, Gerber EJ. Early complications of extreme lateral interbody fusion in the obese. *J Spinal Disord Tech* 2010;23: 393–7.
- [8] Adogwa O, Farber SH, Fatemi P, et al. Do obese patients have worse outcomes after direct lateral interbody fusion compared to non-obese patients? *J Clin Neurosci* 2016;25:54–7.
- [9] Wang J, Zhou Y. Perioperative complications related to minimally invasive transforaminal lumbar fusion: evaluation of 204 operations on lumbar instability at single center. *Spine J* 2014;14: 2078–84.
- [10] Quillo-Olvera J, Lin GX, Jo HJ, et al. Complications on minimally invasive oblique lumbar interbody fusion at L2-L5 levels: a review of the literature and surgical strategies. *Ann Transl Med* 2018;6:101.