

Long Segment Fusion to L5 Vertebra and Sacral Vertebra in Degenerative Lumbar Spine

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– Abstract –

Study Design : A retrospective clinical study about problems in distal ends of long segment fusion to L5 and S1. Authors compared the incidence of fixation failure and analyzed the problematic cases.

Objectives : To verify the causes and associated conditions for high incidence of fixation failure in distal ends of long segment fusion.

Summary of Literature Review : In Degenerative lumbar diseases, degenerative kyphosis, degenerative scoliosis with revision surgery and multiple stenosis require long level fusion which is accompanied by various fixation problems extending to sacrum. Fusion to sacrum provides excellent correction of deformity. However, it results in the loss of movable segment and concentration of the force on lumbosacral region. Moreover it may foresee the problems of fixation or fusion and S-I joint problems. But long fusion to L5 leaving one movable segment below can result in early degenerative change of this segment.

Material and Methods : Among 65 patients given long level fusion involving more than 3 segment in National Medical Center from January 1991 to may 2000, 45 patients were selected and were followed for more than 2 years. First group (G1) involving L5 were 14 cases. Second group (G2) involving S1 were 31 cases. We evaluated loosening of implant- halo around screw, pull out screw, breakage of screw or rod, change of adjacent segment and pseudarthrosis by means of radiologic modality.

Results : Follow up radiologic findings showed 28.6% of loosening of implant on L5 in G1. G2 showed 41.9% of halo around screw in S1. Among cases with more than 4 level fusion, G1 showed 33.3% lower segment screw loosening and G2 showed 57.9%. In G2, group performed more than 3 level fusion showed 16.7% lower segment screw loosening. More than 4 level fusion showed higher loosening rate (57.9%) with the statistical segmental correlation ($P=0.023$). Lower end screw loosening occurred 16% in cases with interbody fusion and 55% in cases without interbody fusion and it showed statistical correlation ($P=0.047$). Also cases with deformity correction by posterior instrumentation showed higher loosening rate (60%) and showed 18.2% in situ fusion cases and it showed statistical correlation ($P=0.049$). In second case, sacral screw loosening occurred more frequently in patients of osteoporosis (54%), sagittal imbalance postoperatively (38%), correction loss (31%). Only 1 case of G1 showed an

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increased degenerative change between L5- S1.

Conclusion : In fusion to S1 in degenerative lumbar disease, factors such as long level fusion more than 4 segments by posterior instrumented correction, correction loss, sagittal imbalance and accompanied osteoporosis is related to high incidence sacral implant loosening- halo around screw, pull out screw, breakage of screw or rod. So if these kind of risk factor exist, it seems that the anteriorposterior interbody fusion is necessary. Postoperative L5- S1 degenerative change did not occur in follow up period in patient with well preserved sagittal balance postoperatively in this follow up periods.

Key Words : Degenerative lumbar disease, Long level fusion, Loosening of implant

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Table 1. Cause of long level fusion.

Cause	Case (%)
Multiple spinal stenosis	29 case (64.4)
Degenerative spinal kyphosis	20 case (44.4)
Spondylolisthesis	9 case (20)
Degenerative scoliosis	8 case (18)
Segmental Instability	6 case (13)

1991 1 2000 5
69 2 가 가 45
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14 1 , 31 2
48.2 14
115 61 (42 ~76)
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Table 2. Number of fusion segment

Level	Group I*	Group II†
3 level	11 (79%)	12 (39%)
4 level	2 (14%)	14 (45%)
5 level	1 (7%)	4 (13%)
6 level		1 (3%)

*Group I : Fusion to L5

†Group II : Fusion to S1

3 1 (33.3%)
19 11
(57.9%)
(p>0.05).
3
12 2 (16.7%)가
19 11 (57.9%)
(P<0.05).
가 11 2
(16%)가
20 11 (55%)
(p<0.05).
4 (28.6%)가
13 (41.9%)가 (Fig. 1, 2).
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(P<0.05).
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. 4 5 가 7 (54%),

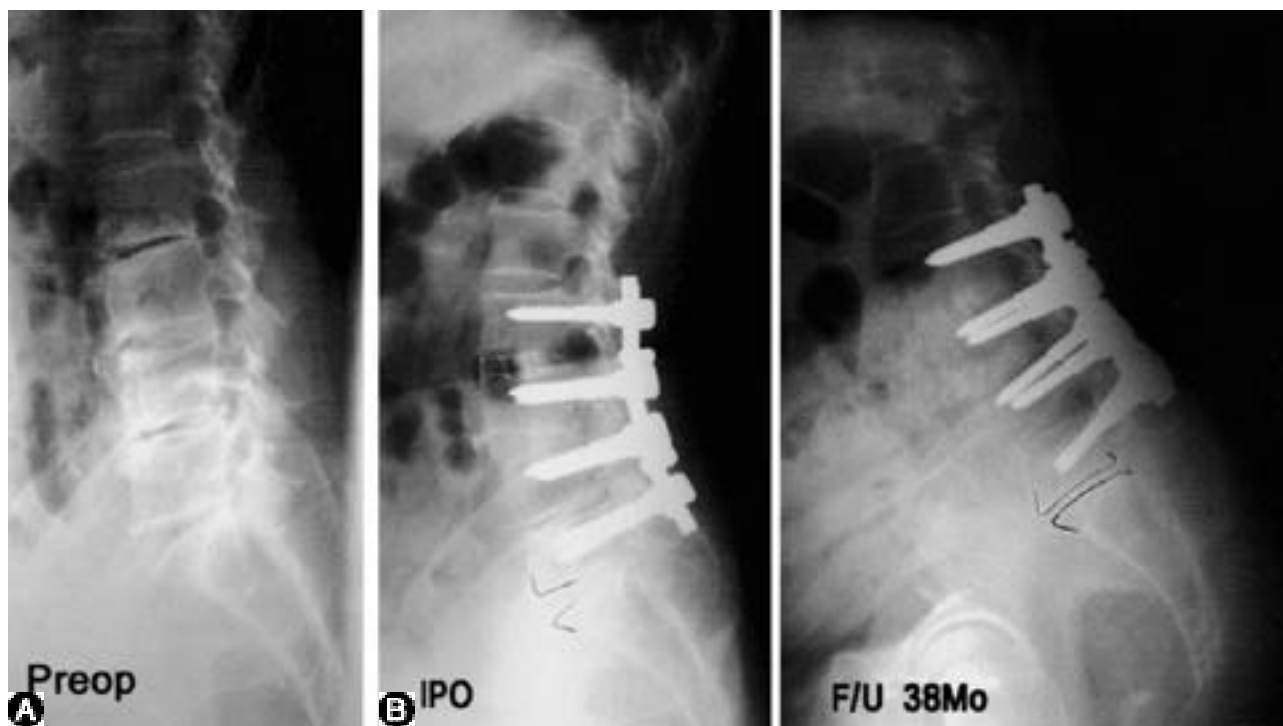
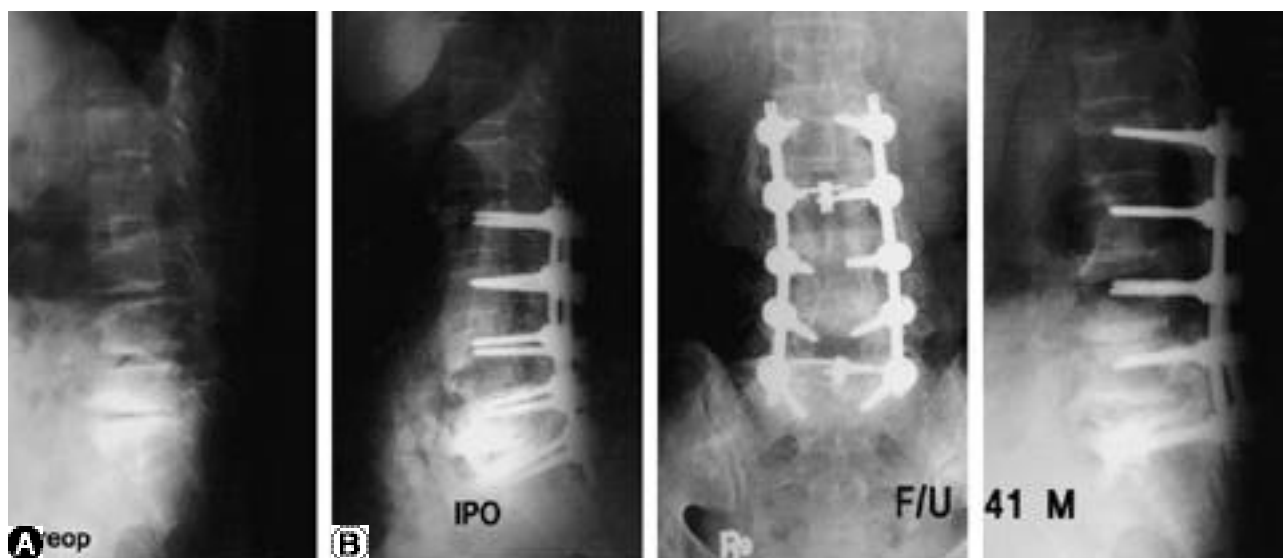


Fig. 1-A. Preoperative lateral side radiography of 67-year-old man shows degenerative lumbar kyphosis, and HNP L2-3-4-5.

B. Postoperative lateral side radiography with L2-5 posterolateral fusion with transpedicular screw and anterior interbody fusion.

Postoperative 38-months follow-up lateral side radiography of lumbar spine shows correction loss and aggravation of degenerative change L5-S1.

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Devlin ⁵⁾ C-D 27 12 offset hook

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가

가 ²⁰⁾ engagement 4

27)

2,3,6,7,10,16,22,25,26) 23,24) 7.7% 가 13.5% 가 5

가 5

가 ^{5,21)} Ogon ⁴⁾ 73%

가 , Devlin ⁵⁾ C-D가 , Leong ¹⁵⁾ Chopin block 126% , 120%

intersacral interiliac rod strut 가 ¹¹⁾ McKinley ¹⁷⁾

REFERENCES

- 1) Aota Y, Kumano K and Hirabayashi S : Postfusion instability at the adjacent segment after rigid pedicle screw fixation for degenerative lumbar spinal disorders. *J spinal Disord*, 8:464-473, 1995.
- 2) Blauth M, Tscherne H and Haas N : Therapeutic concept and results of operative treatment in acute trauma of the thoracic and lumbar spine: the Hanover experience. *Journal of Orthopaedic Trauma*. 1(3):240-252, 1987.
- 3) Camp JF, Caudle R, Ashman RD, et al : Immediate complication of Cotrel-Dubousset instrumentation to the sacro - pelvis: A clinical and biomechanical study. *Spine*, 15:932-941, 1990.
- 4) Dekutoski MB, Schendel M, Ogilvie JW, Olsewski JM, Wallace LJ and Lewis JL : Comparison of in vivo and in vitro adjacent segment motion after lumbar fusion. *Spine*,

- 19:1745-1751, 1994.
- 5) **Devlin VJ, Boachie-Adjei O, Bradford DS, Ogilvie JW and Transfeldt EE** : Treatment of adult spinal deformity with fusion to the fusion to the sacrum using CD instrumentation, *J spinal disord*, 1:1-14, 1991.
 - 6) **Dick W** : The fixateur interne as a versatile implant for spine surgery. *Spine*, 12:882-900, 1987.
 - 7) **Edwards CE** : Spinal screw fixation of the lumbar and sacral spine: early results treating the first 50 cases. In: *Proceedings of the 21st annual meeting of the Scoliosis Research Society*. *Orthop Trans*, 11:99, 1987.
 - 8) **Froning EC and Frohman B** : Motion of the lumbosacral spine after laminectomy and spine fusion: Correlations of motion with the result. *J Bone Joint Surg*, 50-A:897-918, 1968.
 - 9) **Herkowitz HN** : Lumbar spinal stenosis : Indications for arthrodesis and spinal instrumentation. *American Academy of Orthopaedic Surgeons Instructional Course Lectures*, 43:425-33, 1994.
 - 10) **Horowitch A, Peek RD, Thomas JC Jr, et al** : The Wiltse pedicle screw system. *Spine*. 14:461-467, 1989.
 - 11) **Horton WC, Holt RT and Muldowny DS** : Fusion of L5-S1 in adult scoliosis. *Controversy in spine care*, *Spine*, 21: 2522-2522, 1996.
 - 12) **Katz JN, Kioson SJ, Chang Lc, Levine SA, Fossel AAH and Liangh MH** : Seven to 10-year outcomes of decompressive surgery for degenerative lumbar spinal stenosis. *Spine*, 21:92-98, 1996.
 - 13) **Kim EH, Cho DY and Kim JH** : A clinical analysis of long segment fusion with pedicle screw in degenerative lumbar spine. *J Korean Spine Surg*, 6(3):388-396, 1999.
 - 14) **Lehmann TR, Yozzi JE, Weinstein JN, Reinartz SJ and Cilby H** : Long-term follow-up of lower lumbar fusion patients. *Spine*, 12:97-104, 1987.
 - 15) **Leong JC, Lu WW, Zheng Y, Zhn Q and Zhong S** : Comparison of the strengths of lumbosacral fixation achieved with techniques using one and two triangulated sacral screw. *Spine*, 23(21):2289-94, 1998.
 - 16) **Louis R** : Fusion of the lumbar and sacral spine by internal fixation with screw plates. *Clin Orthop*, 203:18-33, 1986.
 - 17) **McKinley TO, McLain RF, Yerby SA, Sharkey NA, Sarigul-Klijn N and Smith TS** : Characteristics of pedicle screw loading. Effect of surgical technique on intravertebral and intrapedicular bending moments. *Spine*, 24(1):18-24, 1999.
 - 18) **Nagata H, Schendel MJ, Transfeldt EE and Lewis JL** : The effects of immobilization of long segments of the spine on the adjacent and distal facet force and lumbosacral motion. *Spine*, 18:2471-2479, 1993.
 - 19) **Ogon M, Haid C, Krismer M, Sterzinger W and Bauer R** : Comparison between single-screw and triangulated, double screw fixation in anterior spine surgery. *Spine*, 21: 2728-2634, 1996.
 - 20) **Okuyama K, Sato K, Abe E, Inaba H, Shimada Y and Murai H** : Stability of transpedicle screwing on the osteoporotic spine: An in vitro study of the mechanical stability. *Spine*, 18:2240-2245, 1993.
 - 21) **Perra JH** : Techniques if instrumentation in long fusion to the sacrum. *Ortho Clin N Am*, 25:287-299, 1994.
 - 22) **Roy-Camille R, Saillant G and Mazel C** : Internal fixation of the lumbar spine with pedicle screw plating. *Clin Orthop*, 20:7-17, 1986.
 - 23) **Shin BJ, Kim KJ, Kim ST, Kim YI** : Survivorship analysis of pedicle screw fixation. *J Korean Spine Surg*, 6(3):355-361, 1999.
 - 24) **Shin BJ, Kim KJ, Cho YB, Kim YI** : Radiologic results of posterior lumbosacral fixation according to sacral fixation methods-single screw vs double screws. *J Korean Spine Surg*, 7(1):15-21, 2000.
 - 25) **Steffee AD, Biscup RS and Sitkowski DJ** : Segmental spine plates with pedicular screw fixation: a new internal fixation device for disorders of the lumbar and thoracolumbar spine. *Clin Orthop*, 203:45-53, 1986.
 - 26) **Steffee AD, Sitkowski DJ and Topham LS** : Total vertebral body and pedicle replacement. *Clin Orthop*, 203:203-208, 1986.
 - 27) **Whitecloud TS III, Butler JC, Cohen JL and Candello-ra PD** : Complications with the variable spinal plating system. *Spine*, 14:472-476, 1989.
 - 28) **Yang SW, Langrab NA and Lee CK** : Biomechanics of lumbosacral fusion in combined compression-torsion loads. *Spine*, 11:937-941, 1986.

