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Effect of Bone Cement Augmentation of Pedicular Screwing for Osteoporotic Lumbar Spine

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– Abstract –

Study Design : Eighteen patients undergoing bone cement augmentation of pedicular screwing for osteoporotic lumbar spine were reviewed retrospectively.

Objectives : To assess the effectiveness of bone cement augmentation of pedicular screwing for osteoporotic lumbar spine.

Summary of Literature Review : For the technical limit obtaining the dynamic stability in the bone-screw interface for osteoporotic lumbar spine, the additional device to enhance pedicular screw fixation strength needs.

Materials and Methods : We reviewed 18 cases undergoing pedicular screwing and fusion for the osteoporotic (Jikei grade I, II, III/III) lumbar spine from Feb. 2000 to Mar. 2001 with an average follow-up of 1.5 years. Mean age was 69.5 years with 6 male and 12 female. Inclusion criteria was 9 degenerative spinal stenosis, 5 spinal stenosis associated with compression fracture, 2 Kummel's disease, 1 spondylolisthesis and 1 internal disc disruption. We performed bone cement injection around the screws showing significantly low insertion torque, screw pullout or cut-up during surgery. We assessed the radiographic results of sagittal angle correction (SAC) of the fused segment and disc height restoration (DHR) on the preoperative, postoperative and last follow up lumbar lateral views. Clinical results were evaluated according to the Kumano's criteria.

Results : Mean sagittal angle at preoperative, postoperative and last follow-up was 11.6-21.6-19.6° with mean SAC gain 10° (p<0.05) and gain loss 2° (p>0.05). Mean disc height of each period was 33.3-49.8-43.5% with mean DHR gain 16.5% (p<0.05) and gain loss 6.3% (p>0.05). The clinical result was analyzed as 14 good, 3 fair and 1 poor. Fusion success was achieved in all. There were 2 perioperative complications of 1 superficial surgical site infection and 1 incomplete L4 root injury, and 6 complications during follow up of 3 compression fractures above fused segment, 1 screw pullout, 1 screw cut-up, and 1 bone cement extravasation into canal.

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Conclusions : The bone cement augmentation of pedicular screwing for osteoporotic lumbar spine can be an alternative to enhance screw fixation strength.

Key Words : Lumbar spine, Osteoporosis, Pedicular screwing, Bone cement augmentation

가 , pullout cut-up , 4 cc 6 cc 가 8 , 1.5 . 가 window (fragility) 7 corset 8 16 2. 9) 가 , Cobb 가 4 ° 가 20% Kumano ¹¹⁾ (good), (fair), (poor) . , cage 가 (radiolucent halo) , 가 1. 2000 2 2001 3 Jikei I, II, III/III 25 1 가 가 18 (12 , 6) , 1 61~ 2.2 1.5 . 70 12 , 71~80 5 , 81~90 1 69.5 (62~83) . 가 Jikei ¹³⁾ , 1 1 , 2 14 , 3 3 . 9 , 5 , Kummel 2 , 1 , 1 (Table 1). 가 cage- 가

Table 1. Indications of operation

Indication	No (%)
Degenerative spinal stenosis	9 (50)
Spinal stenosis with compression fracture	5 (27.8)
Kummel's disease	2 (11.1)
Spondylolisthesis	1 (5.55)
Internal disc disruption	1 (5.55)
Total	18 (100)

1.4), chi square-test

1. 1) (Table 2)

11.6 °; 21.6 °; 19.6 ° (p>0.05)

10 ° (p<0.05)

2.0 °

2) (Table 3)

33.3%, 49.8%, 43.5% (p<0.05)

6.3% (p>0.05)

20%

2. (Table 4)

14 (77.8%), 3 (16.7%), 1 (5.5%)

Table 2. Sagittal angle correction

	Pre-Op	Post-Op	Last F/U
Mean SA*	11.6°	21.6°	19.6°
SAC** Gain		(10°)	
SAC Loss			(2°)

SA*, sagittal angle; SAC**, sagittal angle correction

Table 3. Disc height restoration

	Pre-Op	Post-Op	Last F/U
Mean DHR*	33.3%	49.8%	43.5%
DHR Gain		(16.5%)	
DHR Loss			(6.3%)

DHR*, disc height restoration

1, 4

1 가

4

4 -6

3

1, 3

2

5

pullout cut-up

(Fig. 1)

pullout

pullout

cut-up 1

cut-up

cut-up

가

가

가

가

Table 4. Postoperative complications (N=18)

	perioperative	during F/U
Incomplete L4 root palsy	1	
Superficial SSI*	1	
Compression fracture above fused segment		3
Screw pullout		1
Screw cut-up		1
Bone cement extravasation into canal during revision		1
Total	2 (11.1%)	6 (33.3%)

SSI*, surgical site infection

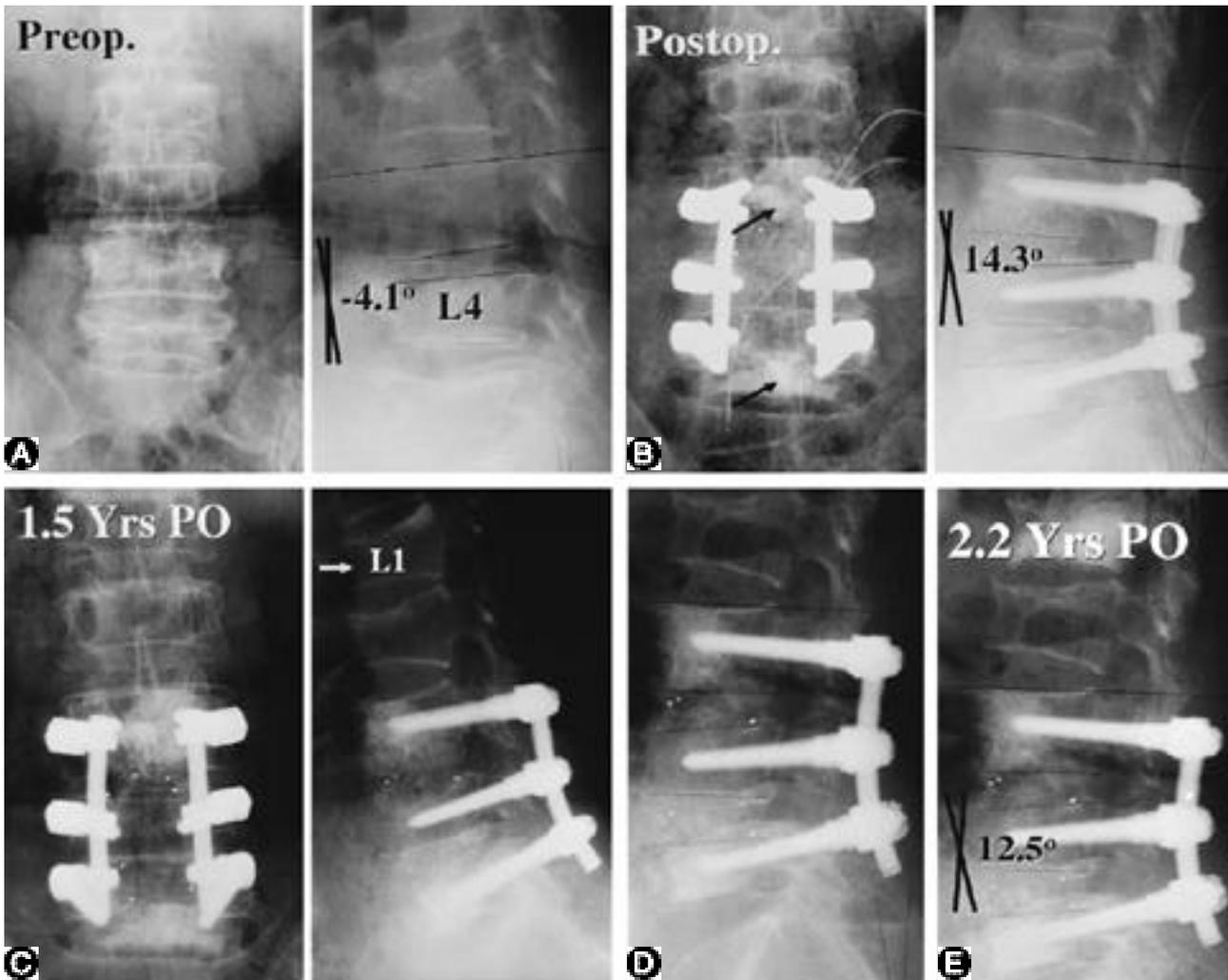


Fig. 1. A 66-year-old female with spinal stenosis at L3-4-5 associated with compression fracture of L4 and L5 bodies. Preoperative AP and lateral radiographs show Jikei grade II/III osteoporosis with -4.1° of local L3 to L5 kyphosis (A). Postoperative radiographs after L3-4-5 cage-PLIF and PMMA augmentation for Rt L3 and L5 screws (black arrows) show satisfactory correction of L3 to L5 sagittal angle to 14.3° (B). The 1.5-year follow-up examination shows L1 compression fracture (white arrow) from slipped down accident (C). Two weeks after fracture we performed percutaneous L1-vertebroplasty (D), and 2.2-year follow-up radiograph shows only a minor loss of the correction and no device-related problems (E).

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 load)
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 cut-up , 가 pullout
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 . Hu⁷⁾ pullout
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 - “fit” 3
 , Okuyama 12) 가 ,
 cage 가 ,
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 가
 cut-up 1 ,
 . Soshi 13) Zindrick 15)
 , Hu⁷⁾
 (exothermic)
 pullout 1
 pullout
 가 ,
 (integrity) . Soshi 13)
 pullout Jikei III ,
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 III 가 3 ,
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 (“teeter-totter” motion)
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REFERENCES

- 1) **Brantigan JW, Steffee AD, Lewis ML, Quinn LM and Persenaire JM** : Lumbar interbody fusion using the Brantigan I/F Cage for posterior lumbar interbody fusion and the variable pedicle screw placement system. *Spine*, 25: 1437-1446, 2000.
- 2) **Brantley AGU, Mayfield JK and Clark KR** : The effect of pedicle screw fit-An in vitro study. *Spine* 19:1752-1758, 1994.
- 3) **Coe JD, Warden KE, Herzig MA and McAfee PC** : Influence of bone mineral density on the fixation of thoracolumbar implants: A comparative study of transpedicular screws, laminar hooks and spinous process wires. *Spine*, 15:902-907, 1990.
- 4) **Grubb SA and Lipscomb HJ** : Results of lumbosacral fusion for degenerative disc disease with and without instrumentation-two to five year follow-up. *Spine*, 17:349-355, 1992.
- 5) **Halvorson TL, Kelley LA, Thomas KA, Whitecloud TS and Cook SD** : Effect of bone mineral density on pedicle screw fixation. *Spine*, 19:2415-2420, 1994.
- 6) **Hasegawa K, Takahashi HE and Uchiyama S et al** : An

- experimental study of a combination method using a pedicle screw and laminar hook for the osteoporotic spine. Spine, 22:958-963, 1997.*
- 7) **Hu SS** : *Internal fixation in the osteoporotic spine. Spine, 22:43S-48S, 1997.*
 - 8) **Kim EH, Lee KB and Cho DY** : *A comparison of flexible and rigid rods system in transpedicular screw fixation of degenerative lumbar spine. J Korean Orthop Assoc, 34: 103-110, 1999.*
 - 9) **Kim EH, Woo BC, Koh ES and Cho DY** : *The Change of Segmental Sagittal Angle in Low-grade Spondylolisthesis after Pedicular Screw Fixation with or without PLIF. J of Korean Orthop Assoc, 32:1098-1106, 1997.*
 - 10) **Kim KS, Kim Y, Kim ST, Koh JW and Choi YS** : *Surgical management of Extensive degenerative lumbar stenosis. J Korean Orthop Assoc, 27:488-501, 1992.*
 - 11) **Kumano K, Hirabayashi S, Ogawa Y and Aota Y** : *Pedicle Screws and Bone Mineral Density. Spine, 19:1157-1161, 1994.*
 - 12) **Okuyama K, Sato K, Abe E, Inaba H, Shimada Y and Murai H** : *Stability of transpedicle screwing for the osteoporotic spine-An in vitro study of the mechanical stability. Spine, 18:2240-2245, 1993.*
 - 13) **Soshi S, Shiba R, Kondo H and Murota K** : *An experimental study on transpedicular screw fixation in relation to osteoporosis of the lumbar spine. Spine, 16:1335-1341, 1991.*
 - 14) **Zdeblick TA, Kunz DN, Cooke ME and McCabe R** : *Pedicle screw pullout strength: Correlation with insertion torque. Spine, 18:1673-1676, 1993.*
 - 15) **Zindrick MR, Wiltse LL, Widell EH, Thomas JC, Woland WR, Field BT and Stencer CW** : *A biomechanical study of intrapeduncular screw fixation in the lumbar spine. Clin Orthop 203:99-112, 1986.*



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