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Revision Spine With Hartshill and Sublaminar Wiring in Operated Osteoporotic Fracture- A Case Note

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Abstract

Introduction: Osteoporotic vertebral compression fractures (OVCF) are one of the commonest fractures seen in day to day practise. We present a unique case of failure of pedicle screw instrumentation in OVCF revised by sublaminar wiring (SLW).

Case report: A 70 year old lady with old operated osteorporotic fracture with sagittal imbalance and implant loosening was revised with single spinal rectangular loop and sublaminar wires (SLW).

Conclusion: Pedicle screws constructs for short segment fixation are rigid and biomechanically superior with greatest pull out strength, which mainly depends on bone mineral density. But, sublaminar wires should be considered far more superior in severely osteoporotic bone.

Keywords: Bone density, Bone wires, Compression, Fractures, Osteoporosis, Pedical screws, Spinal fractures.

Introduction

Osteoporotic vertebral compression fractures (OVCF) are one of the commonest fractures seen in day to day practise. Indications for surgery include the presence of neurological symptoms, persisting pain and deformity. Various modalities of surgical treatment have been described in the form of anterior/ posterior instrumented fusion using pedicle screw instrumentation which is the most popular spinal instrumentation method today [7,20].

We present a unique case of failure of pedicle screw instrumentation in OVCF revised by sublaminar wiring (SLW). The patient was informed that her data would be submitted for publication and she has agreed.

Case report

A 70 year old lady came to the out patient department with complaints of back pain and difficulty to sit for prolonged hours. She was unable to stand independently and required support to walk. She had sustained L1 osteoporotic wedge compression fracture after a trivial fall a year back and was stabilised elsewhere with short segment pedicle screw instrumentation. Her mid back pain persisted (VAS 7/10, ODI- 74). On giving adequate conservative trial of medications her pain worsened which lead to crouching and inability to stand. On clinical and examination there was an angular kyphosis at the thoracolumbar junction which was tender. X-ray revealed gibbus deformity at L1. A thoraco lumbar facet pain block was tried for the patient due to the significant amount of pain, which provided her temporary relief for 3 months after which her pain recurred (VAS 8/10, ODI- 80). Her X-ray (Figure 1) showed partial backing out of screws and osteolysis around the threads in the vertebral body. Her CT scan (Figure 2) showed marginal lysis around the proximal pedicle screws suggestive of implant loosening. Her MRI (Figure 3) did not reveal any neural compression as was confirmed by a normal neurological examination, as the canal was decompressed by laminectomy at the index surgery. Her T score was -5.0. Due to significant kyphosis causing sagittal imbalance and implant loosening she was advised revision surgery in the form of implant removal and fixation with single spinal rectangular loop and sublaminar wires (SLW).

Surgical procedure

A midline skin incision extending from 3 levels above to 2 levels below L1 was taken. After midline exposure, para spinal muscles were elevated and retracted bilaterally from spinous processes, laminae; pars inter articularis up to the tip of transverse processes at the normal levels. This not only helped in the wide exposure of inter laminar area for wiring but also assisted in preparing a good fusion bed for bone grafting. Previous implants were removed.

Sublaminar wiring technique [17] Supra/inter spinous ligament and ligamentum flavum were excised, and a

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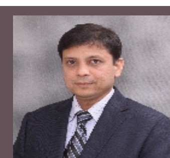
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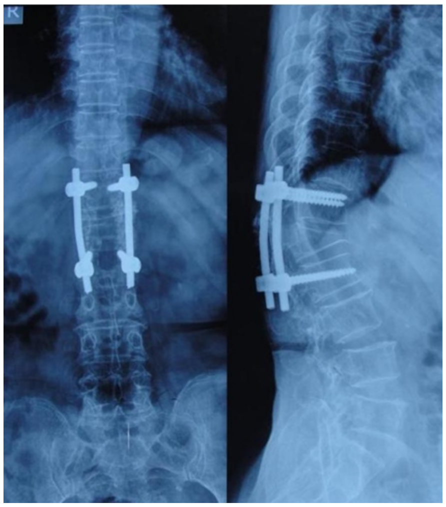

Figure 1: X-ray showed partial backing out of screws and osteolysis around the threads in the vertebral body

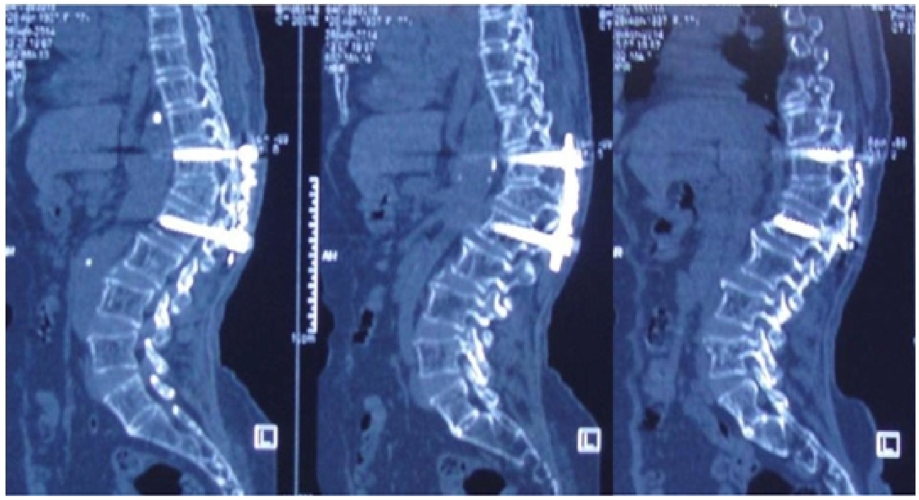

Figure 2: CT scan showed marginal lysis around the proximal pedicle screws suggestive of implant loosening.

sub laminar space was created at each level for passing wires. After exposing the sub laminar spaces, a double loop of 20 gauge "cold cured stainless steel wires" were inserted around the laminae of to be instrumented cephalad and caudal vertebral levels by insertion, advancement, roll through, and pull through technique (figure 4 and 5). The measured size loop rectangle is then adequately contoured for sagittal balance (figure 6). The wires are passed through the loop rectangle (figure 7) with cephalad wire always ending inside it, and caudal wire outside the loop rectangle at all levels, except for the terminal ones where the caudal wires end inside the loop rectangle, thus preventing the cephalad or caudal slippage of the loop rectangle . These wires were sequentially tightened clockwise starting at the ends of loop rectangle followed by inner wires. Tightening the wires in phases until final torque is reached, helps to correct the kyphotic deformity onto the contoured spinal loop rectangle. After final tightening, the extra length of wire is cut and buried on itself over the lamina. Finally, good graft bed preparation is done for posterior fusion (figure 8). Intraoperative blood loss was 300cc and surgical procedure was completed in 125 min. Vaccum drain was placed and the wound was closed in layers.

Post-operatively the patient was kept in HDU (high dependency unit) for monitoring and was shifted back to wards the next day. Vaccum drain was removed after 48 hours. no blood transfusions were required and the patient was hemodynamically stable. In-bed exercises and log rolling began in the HDU and the patient was ambulatory with orthotic support on day 3. The patient was discharged on Day 7 on oral analgesics with VAS 7 and ODI 74.

At 6 weeks, her VAS was 4 an ODI improved to 60. Wound had healed and she was self-ambulatory at home.

At 6 months, Her VAS reduced to 2, ODI was 46 and patient was doing outdoor ambulation.

After 1 yr patient had VAS 2/10 and ODI 20. She felt improvement in her saggital balance while walking and was easily able to sit and stand upright.

At 4 years the patient had no complaints but the X-ray revealed improved saggital balance breaking of the loop rod (figure 9)

Discussion

With the resurgence of third generation spinal implants, the utility of spinal loop rectangle and SLW was considered

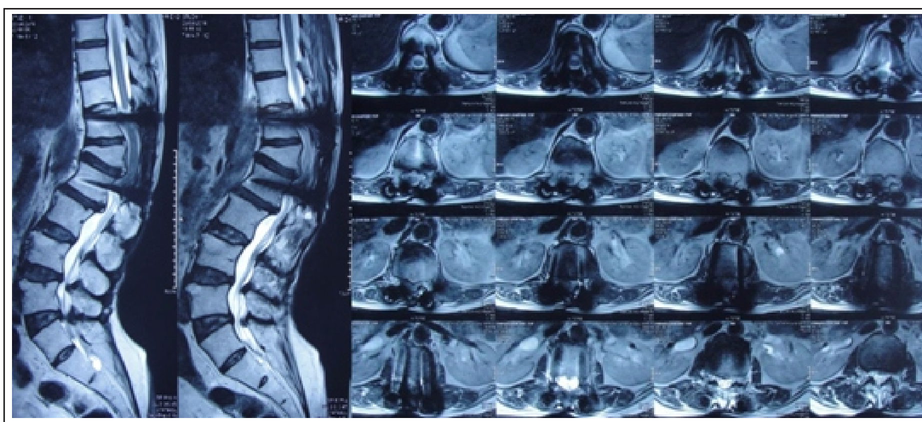

Figure 3: MRI did not reveal any neural compression

Figure 4: Sublaminar wiring technique

Figure 5: Sublaminar wiring technique

Figure 6: Sublaminar wiring technique

Figure 7: Sublaminar wiring technique

obsolete (19). The pedicle screws offer the strongest stabilization and better three-dimensional correction while treating degenerative spine and spinal deformity disorders [13,19]. The use of pedicle screw rod construct becomes a mandatory, especially when interbody fusion is planned in these disorders.

The pull-out strength of the pedicle screws depends on the bone mineral density of the pedicle and vertebral body which is low in elderly patients with OVCF. The pedicle screws and rod being rigid constructs are at an increased risk of failure by backing out due to anterior column collapse which occurs with osteoporotic vertebral compression fractures (OVCFs). This invariably occurs if the anterior column is not reconstructed [6,16]. Considering the age in whom the OVCFs predominantly occur, anterior approach surgeries are not the preferred one, due to the morbidity and mortality associated with it [2,5,8,10,14,18].

The newer techniques of augmented pedicle screw fixation require longer learning curves, involve additional costs to the patients, and are not without complications like failure by posterior displacement while still bound to PMMA [1] or because of detachment from the bone cement, rather than from the posterior displacement of the intact screw–cement mantle construct [11].

The spinal loop rectangle and SLW is a semirigid construct with "cold-cured" dual wires anchored to cortices of both laminae and tightened on to the contoured stainless steel dual rods. In an osteoporotic spine, the cortices of the laminae are much stronger compared to marrow within pedicles as well as vertebral body [3]. Spinal loop rectangle and SLW construct relies on the lamina for its hold, which is the strongest part of the osteoporotic vertebra.

Biomechanically, spinal loop rectangle and SLW construct only offers sagittal plane stability (by contoured dual rods) and rotational and/or translational stability (by cold cured dual SLWs, anchored on to the cortices of both laminae, and tightened on to dual rods). Being semirigid and poor in axial stability, this construct allows vertebral collapse to happen (in the absence of anterior column reconstruction) [12, 9]. This weakness in the construct is utilized to the surgeons advantage by converting antero-inferior dislodgement forces acting at the site of fracture into the forces of fracture union by controlled collapse. (figure 9)

A semi rigid, extra-cortical fracture stabilization by spinal loop rectangle and sublaminar wiring (SLW) is strong enough to hold the spine in normal alignment and also allows controlled axial, anterior column collapse [4].

Cadaveric spines instrumented with wire and cable display equivalent mechanical behavior, statically and under cyclic loading. The potential advantages of cable, however, must be balanced against

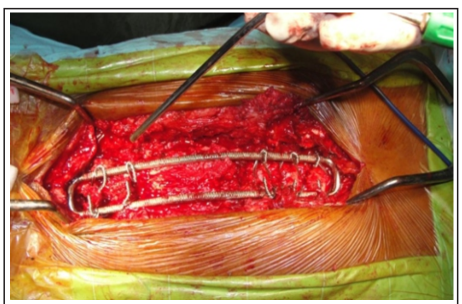

Figure 8: Good graft bed preparation is done for posterior fusion

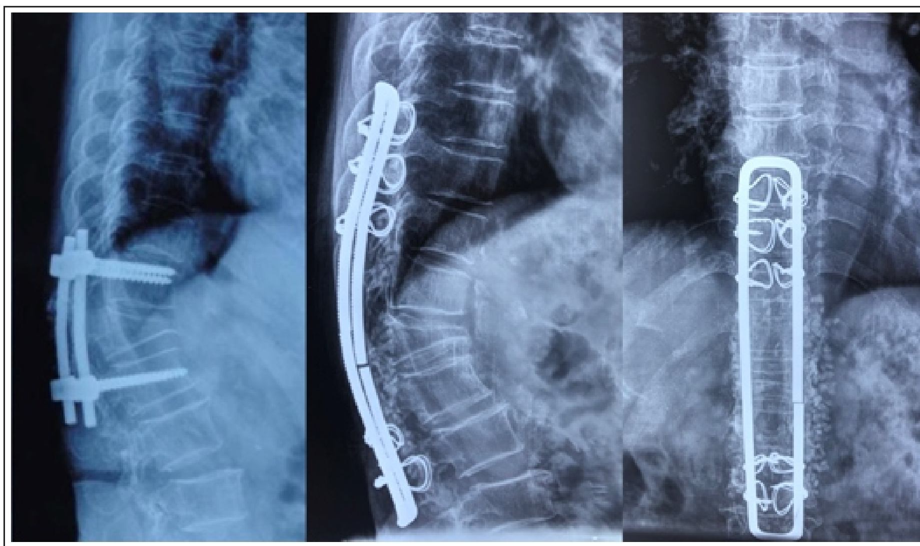

Figure 9: Xray revealed improved saggital balance breakaing of the loop rod

a substantial increase in cost relative to wire [15]. Locally made spinal loop rectangle and cold cured SLW is approximately one tenth of the price compared to imported third generation titanium implants (i.e. pedicle screws and rods).

The instrumentation procedure is easy to learn, user friendly, and safer technique. This requires lesser inventory, making it suitable for wider social applicability.

The wound complications related to the longer surgical exposure for extra bony anchor points in the spinal loop rectangle and SLW instrumentation is irrelevant in this patient of OVCF.

Conclusion

The major challenge in open surgical treatment in previously operated osteoporotic fracture is poor fixation in osteoporotic bone. Pedicle screws constructs for short segment fixation are rigid and biomechanically superior with greatest pull out strength, which mainly depends on bone mineral density. But, sublaminar wires should be considered far more superior in severely osteoporotic bone. Restoration of sagittal alignment and avoidance of extra correction can be managed by sublaminar wiring. They are very cost effective for patients from low socio-economic strata undergoing a revision spine surgery. The natural history of an OVCF healing (i.e. collapse) and semi rigid nature of this construct which allows controlled axial collapse to happen, both work in the favor of patient and surgeon's benefit.

References

1. *Bullmann V, Schmoelz W, Richter M, et al. Revision of cannulated and perforated cement-augmented pedicle screws: a biomechanical study in human cadavers. Spine 2010 ; 35 : E932–9.*
2. *Chang K-W, Chen Y-Y, Lin C-C, et al. Apical Lordosating Osteotomy and Minimal Segment Fixation for the Treatment of Thoracic or Thoracolumbar Osteoporotic Kyphosis. Spine 2005 : 1674–1681.*
3. *Coe JD, Warden KE, Herzig MA, et al. Influence of bone mineral density on the fixation of thoracolumbar implants. A comparative study of transpedicular screws, laminar hooks, and spinous process wires. Spine 1990 ; 15 : 902–907.*
4. *Cresswell TR, Marshall PD, Smith RB. Mechanical stability of the AO internal spinal fixation system compared with that of the Hartshill rectangle and sublaminar wiring in the management of unstable burst fractures of the thoracic and lumbar spine. Spine 1998 ; 23 : 111–115.*
5. *Faciszewski T, Winter RB, Lonstein JE, et al. The Surgical and Medical Perioperative Complications of Anterior Spinal Fusion Surgery in the Thoracic and Lumbar Spine in Adults. Spine 1995 : 1592–1599.*
6. *Glassman SD, Alegre GM. Adult spinal deformity in the osteoporotic spine: options and pitfalls. Instr Course Lect 2003 ; 52 : 579–588.*
7. *Hirabayashi S, Kumano K, Kuroki T. Cotrel-Dubousset pedicle screw system for various spinal disorders. Merits and problems. Spine 1991 ; 16 : 1298–1304.*
8. *Hodge WA, DeWald RL. Splenic injury complicating the anterior thoracoabdominal surgical approach for scoliosis. A report of two cases. The Journal of Bone & Joint Surgery 1983 : 396–397.*
9. *Luque ER. Interpeduncular segmental fixation. Clin OrthopRelat Res 1986 : 54–57.*
10. *McAfee PC. Complications of anterior approaches to the thoracolumbar spine. Emphasis on Kaneda instrumentation. Clin OrthopRelat Res 1994 : 110–119.*
11. *Mesfin A, Komanski CB, Jay Khanna A. Failure of Cement-Augmented Pedicle Screws in the Osteoporotic Spine. Geriatric Orthopaedic Surgery & Rehabilitation 2013 : 84–88.*
12. *Mohan AL, Das K. History of surgery for the correction of spinal deformity. Neurosurgical Focus 2003 : 1–5.*
13. *Moore DC, Maitra RS, Farjo LA, et al. Restoration of Pedicle Screw Fixation With an in Situ Setting Calcium Phosphate Cement. Spine 1997 : 1696–1705.*
14. *Nakai S, Zielke K. Chylothorax--a rare complication after anterior and posterior spinal correction. Report on six cases. Spine 1986 ; 11 : 830–833.*
15. *Parsons JR, Chokshi BV, Lee CK, et al. The biomechanical analysis of sublaminar wires and cables using luque segmental spinal instrumentation. Spine 1997 ; 22 : 267–273.*
16. *Patil S, Nene AM. Predictors of kyphotic deformity in osteoporotic vertebral compression fractures: a radiological study. Eur Spine J 2014 ; 23 : 2737–2742.*
17. *Patil SS, Bhojaraj SY, Nene AM. Safety and efficacy of spinal loop rectangle and sublaminar wires for osteoporotic vertebral compression fracture fixation. Asian J Neurosurg 2017 ; 12 : 436–440.*
18. *Weis JC, Betz RR, Clements DH 3rd, et al. Prevalence of perioperative complications after anterior spinal fusion for patients with idiopathic scoliosis. J Spinal Disord 1997 ; 10 : 371–375.*
19. *Wilber RG, Thompson GH, Shaffer JW, et al. Postoperative neurological deficits in segmental spinal instrumentation. A study using spinal cord monitoring. J Bone Joint Surg Am 1984 ; 66 : 1178–1187.*
20. *Yuan HA, Garfin SR, Dickman CA, et al. A Historical Cohort Study of Pedicle Screw Fixation in Thoracic, Lumbar, and Sacral Spinal Fusion. Spine 1994 : 2279S–2296S.*

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