



Avoiding Pedicle Subtraction Osteotomies with Hyperlordotic Anterior Cages.

A Case Report

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Introduction

JP is a 54-year-old male, who presented with a chief complaint of inability to stand up straight, and increasing low back pain, since being struck by a car 10 years ago. He had tried several courses of epidural injections and physical therapy without any improvement. His medical history is significant for hepatitis C and hypertension. The patient described the pain as a constant dull ache. 95% of his pain was lumbago, and 5% was radicular pain. Patient denied any radiation of pain beneath the knees. Pre operative examination revealed a severe sagittal imbalance with the plumb line falling 45 cm in front of his femoral heads. There was a fixed loss of lumbar lordosis, with no associated hip flexion contracture. Patient had a stopped forward gait, with significant flexion of the knees. His lower extremity neurological exam was normal. No examination findings consistent with myelopathy or radiculopathy were elicited.

Radiographic examination revealed a severe sagittal deformity. Lumbar Cobb angle was 10 degrees of kyphosis and a positive sagittal balance of 51cm. His pelvis was severely retroverted. Patient had a pelvic incidence of 64 degrees, a sacral slope of 24, and 40 degrees pelvic tilt. Deformity was fixed with no correction on supine extension films.

Procedure

Patient was taken to the operating room for staged anterior correction of deformity and posterior instrumentation and fusion. Anterior releases were carried out at L3/4, L4/5 and L5/S1. 20, 20 and 30 degree hyperlordotic cages were placed at L3/4, L4/5, and L5/S1 respectively. Anterior instrumentation was placed prevent kick out of the cages between the two stages. Screws were only placed through the inferior holes on the cages, to allow further correction during posterior component of procedure. To enhance fusion, the cages were packed with calcium phosphate soaked in autologous marrow aspirate.

On the second post operative day, posterior instrumentation from T3-Pelvis was conducted

with Smith-Peterson osteotomies at L1/2, L2/3, L3/4, and L4/5. Fusion was obtained with local decortication and BMP application.

Overall blood loss was 2000ml for anterior surgery and for 2000ml posterior surgery. Post-operatively the patient had normal neurological function. Radiographs post operatively revealed a positive sagittal balance of 2cm, and a lumbar Cobb angle of 65 degrees lordosis.

Discussion

Sagittal balance is assessed by drawing a vertical plumb line from middle of C7 vertebrae and assessing where it lies in relation the posterior superior corner of the S1 vertebral body. Neutral alignment is defined as the C7 plumb line intersecting the L5/S1 disc space. Positive sagittal balance is defined as the plumb line is anterior to S1 vertebrae. This occurs in conditions that lead to a loss of lumbar lordosis (such as degeneration)

Positive sagittal balance has been shown to be the radiographic parameter most closely linked with adverse health stats outcomes and severity of symptoms increases in a linear fashion with increasing positive sagittal balance.^{1,2}

It has been shown that restoring sagittal balance to within 5cm of neutral is associated with improved pain relief following adult spinal deformity surgery.³

Failure to correct sagittal balance is associated with an increased risk of junctional kyphosis and pseudoarthrosis of posterior fusion.³

Correction of sagittal plane deformities can be achieved with posterior based osteotomies, and or anterior and posterior fusion. Depending on the degree of correction desired at individual levels 2 main options are available to the operative surgeon.

The Smith-Peterson Osteotomy (SPO) is a resection of the posterior elements of the spinal column, by closing the wedge posteriorly the disc space opens anteriorly. This requires a compliant disc space. At each level a SPO can correct 10° of sagittal balance.⁴ In this case this would have required more than 8 SPO with the risk of not enough correction as the anterior column was fixed, and the disc space may not

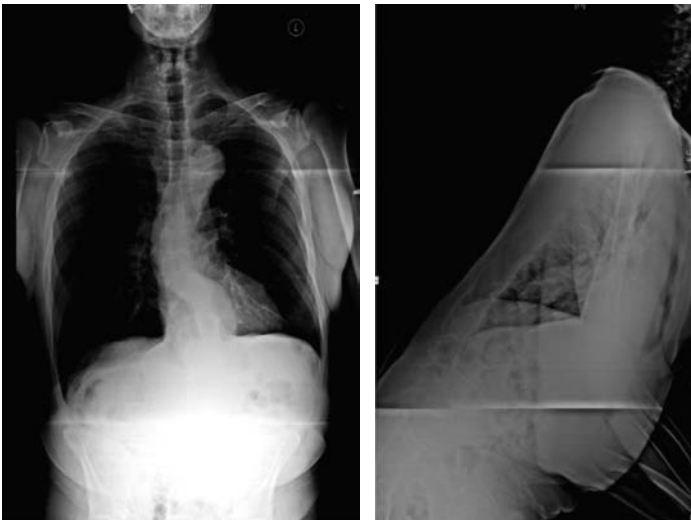


Figure 1. Pre operative radiographs. Note significant positive sagittal balance.

have opened up during correction. SPO's have also been associated with a loss of reduction over time.

The Pedicle subtraction Osteotomy (PSO) is a V shaped resection of the posterior elements and vertebral body. A PSO can correct 30° per level.^{5,6} Given the greater correction obtained with a PSO, several authors have suggested utilizing PSO's for corrections greater than 10cm of sagittal imbalance.^{4,5} However in this case to achieve enough correction this would have required doing two PSO's, typically one at L2 and the other one at L4. PSO's are associated with 8% rate of neurological compromise per level,⁶ and significantly higher blood loss when compared to a 3 level SPO (1.4 vs 2.6L).⁵

In this case the use of hyperlordotic anterior cages provided sufficient correction and stability, obviating the need for PSO's, and theoretically avoiding their increased complication rate. In total 75 degrees of sagittal plane correction was obtained with a combination of anterior cages and SPO's. It was felt that the majority of the correction was obtained with the initial anterior surgery and hyperlordotic cage insertion. The SPO's were carried out to ensure the relative hyper extension of the lumbar spine didn't impinge upon neural structures, and to allow fine tuning of the correction at the level and above the anterior fusion.

In summary we present the use of anterior hyperlordotic cages as an alternative to PSO's in severe sagittal imbalance where the deformity is rigid but not fixed.



Figure 2. Post operative radiographs. Note improved sagittal balance.

References

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