SOMATO PUBLICATIONS

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Case Report

The Impact of Sagittal Balance Correction and Bone Graft Volume in a Revision Surgery of a Repeatedly Operated Patient: A Case Report

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ABSTRACT

Background: Difficult spine cases involving multiple previous fusion surgeries pose a significant challenge to spine surgeons, particularly when combined with deformity correction. Surgical intervention must be comprehensive and tailored to avoid progression of degenerative processes and failure of previous surgeries. In this case, sagittal balance restoration was required, along with decompression and posterior revision fusion, emphasizing the need for greater bone graft volume to minimize the risk of fusion failure.

Case Presentation: The patient presented with severe back and leg pain secondary to the progression of degenerative spine processes, in addition to three previous fusion attempts which included L2-L5 posterior fusion, and two failed L5-S1 ALIF's, the second with sacrum collapse. Our diagnosis revealed a complex condition involving spinal stenosis, sagittal imbalance, and a twice-failed fusion. Surgery consisted of L1-S1 decompression and fusion revision from L2 to the sacrum, including instrumentation removal and replacement, additional decompression, removal of scar tissue, and deformity correction. We carried out a three-column osteotomy at L2 and reinforced the construct with a third rod. This allowed for a greater volume of bone graft to form. We used a new, unique cellular allograft fluid sourced from umbilical cord blood (BioBurst, Burst Biologics, Boise, Idaho) to promote early bone consolidation and greater graft volume at the level of the posterior joints and osteotomy. At 7 and 12-months, we checked clinically and with X-rays and found that the patient had significant resolution of preoperative symptoms. X-rays showed early fusion. At 18 and 26 months, there was no degradation of radiographic or clinical results.

Conclusions: Strategies for complex revision spine cases must address pathologies globally. In this case, sagittal balance restoration was needed to minimize the possibility of fusion failure. In addition, the instrumentation construct had to allow a greater volume of bone graft, and the allograft used was supplemented with a new cellular allograft fluid to enhance and accelerate fusion.

Abbreviations: ALIF: Anterior Lumbar Interbody Fusion; 3CO: Three Column Osteotomy

Background

Patients who have undergone multiple decompressive procedures and fusion surgeries pose a significant challenge to spine surgeons, particularly when combined with deformity correction [1,2]. The surgical intervention should be tailored to the specific pathologies and degenerative processes and/or the failure of previous surgeries [3]. The current popularity of minimally invasive surgery can contribute to a patient's reluctance to undergo an extensive surgery. However, in cases as complex as the one we illustrated, the surgical strategy must be aggressive; otherwise we could expose the patient to continued disability and further surgical interventions.

Case Presentation

A 64-year-old male presented with a long history of low back and leg pain with three previous fusion surgeries. He had undergone L2-

L5 fusion 5 years before, then an anterior lumbar interbody fusion (ALIF) without posterior instrumentation, to treat a degenerative disc disease at L5-S1 was performed in early 2015. This ALIF failed and was repeated several months later. Subsequently, the sacrum collapsed, and the patient remained symptomatic with the fractured pelvis. In addition, severe spinal stenosis was observed at L1-L2. Radiographs revealed that the patient had a significant sagittal imbalance (greater than 15 cm forward in sagittal vertical axis, and a greater than 30-degree pelvic incidence-to-lumbar lordosis mismatch) which would need to be addressed (Figure 1A and B). This required T9-Ilium posterior instrumented fusion with a three-column osteotomy (3CO) at L2.

The patient was incised from T9 to the ilium and the pedicle screws and rods were removed. New pedicle screws were placed at those levels except for L2. The L1-L2 was decompressed by laminectomy with scar removal off the dura down to L3 and continued down to S1. The facets at L1-L2 and L2-L3 were removed bilaterally. A wedge was cut from the inferior aspect of L2 all the way to the L1-L2 interspace. The inferior aspect of the L1 vertebral body was joined with the inferior aspect of the pedicle. A cage was placed to support the anterior column and act as a fulcrum. Bilateral temporary rods were placed and fluoroscopy showed 30-40 degrees of correction (lordosis).

BioBurst Fluid (Burst Biologics, Boise, Idaho) and allograft granules (in a 1 to 10 ratio, 1cc fluid to 10cc allograft) were mixed and placed both behind the spacer at L2 and postero-laterally from T9 to S1 to allow faster healing and promote greater bone volume. A tri-rod construct was completed to allow a greater extension at the fusion area.

At 7-months post-op, the patient reported a significant decrease of low back and leg pain (7.5/10 pre-op to 2.5/10 for back pain, 8/10 pre-op to 2/10 post-op for leg pain). At 12-months post-op symptom resolution was maintained. Radiographs at both 7 and 12-month follow-up show robust fusion consolidation and fusion mass volume (Figure 2 and 3). Subsequent follow-ups at 18 months and 26 months showed no deterioration in either fusion or clinical outcome.

Discussion and Conclusions

In this patient, sagittal balance restoration was needed with further decompression, and extensive posterior revision and re-fusion with removal of scar tissue, compromising biological environment for fusion consolidation.

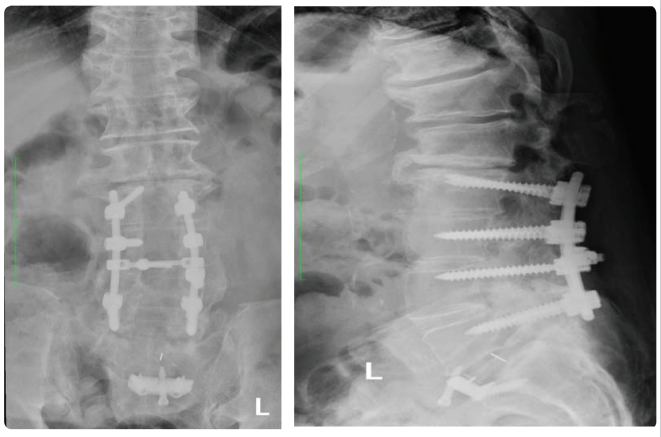

Figure 1A,B: AP and lateral radiographs of repeatedly operated patient with L1-2 stenosis, sagittal imbalance, and failed L5-S1 ALIF with sacrum collapse.

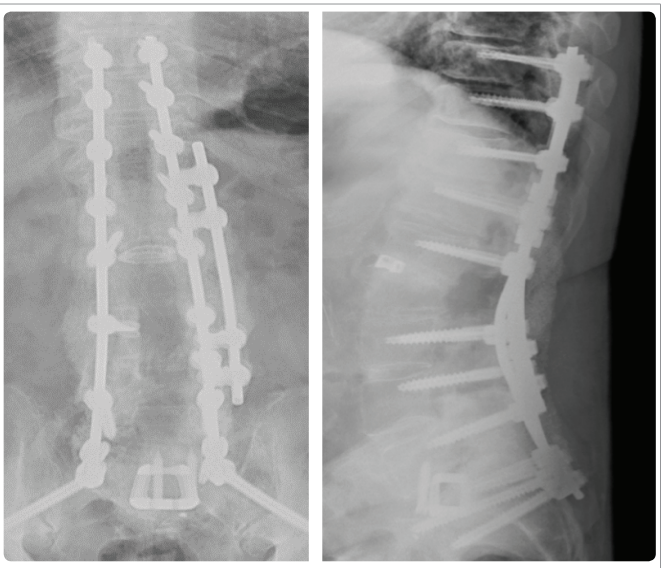

Figure 2A,B: 7-month post-op AP and lateral radiograph shows significant fusion consolidation at L2, site of 3CO, and at L2-S1 posterolateral grooves.

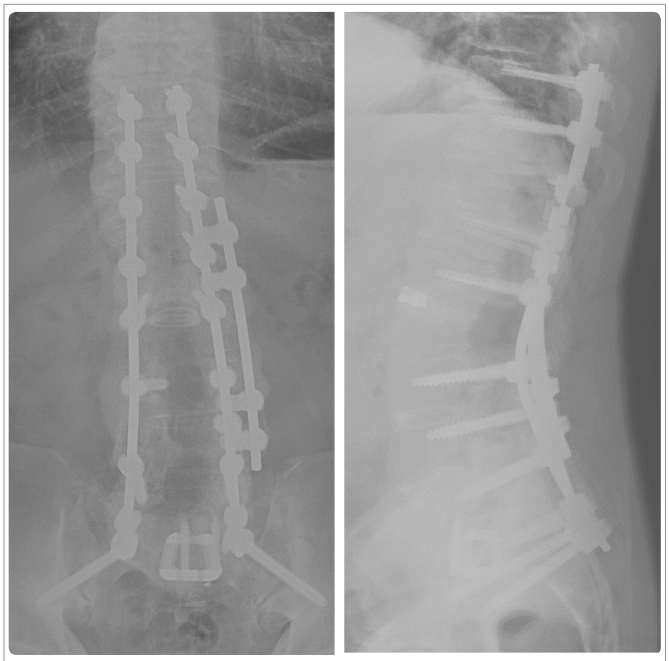

Figure 3A,B: 12-month post-op AP and lateral radiograph shows significant fusion consolidation.

The laminectomy, the three-column osteotomy and placement of the cage served to decompress the stenosis and correct the deformity of the spine. The three-rod construct then allowed for a greater volume of bone graft, placed in the posterior grooves. The allograft used was supplemented with a new cellular allograft fluid derived from umbilical cord blood (BioBurst Fluid, Burst Biologics, Boise, ID) to enhance and accelerate fusion, given the compromised nature of the bone graft site due to previous surgeries.

The BioBurst Fluid contains cytokines that have been extensively studied and found to play a critical role in vasculogenesis and angiogenesis (ANG1, VEGFa, VEGFb, FGF-1) [4-6]. Those cell functions are critical to the spinal fusion process by supporting bone growth, consolidation, and remodeling.

Strategies for complex revision spine cases must address pathologies globally rather than focus on correction of previous surgeries. Each aspect of the surgery must be optimized with the best technology available and the surgeon must use meticulous surgical technique to achieve the best possible outcome for these difficult patients.

Declarations

Ethics approval and consent to participate-not applicable, patient was not part of a study.

Consent for publication-Patient signed consent form for use of operative and outcome data as well as radiographs for publication.

Availability of data and material-operative report and office notes as well as radiographs are available upon reasonable request.

Authors Information

TM is a highly experienced neurosurgeon whose practice specializes in complex cases and spinal deformity. SC has 26 years of experience in clinical research, regulatory, and medical affairs.

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