Posterior Multilevel Decompression and Instrumented Fusion of the Lumbar Spine Treated with a Composite of Autologous Stem Cells (BMAC™) and Cancellous Allograft Matrix: A Report of 2 Cases

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Background
Autograft (Iliac Crest Bone Graft, ICBG) and Bone Morphogenetic Protein (BMP) with allograft are often used in lumbar spine fusions. The associated morbidity, lack of availability and time for harvesting of ICBG along with potential risk factors and cost of BMP has presented the need for a safe and effective alternative. Recently, attention has been focused on the use of autologous stem cells, harvested from the patient, isolated, concentrated and added to cancellous allograft, stem cell bone graft (SCBG). This new composite was compared with autograft, the "gold standard", in two patients to determine if it was equivalent to autograft alone.

Two patients presenting with low back pain that failed conservative treatment underwent posterior decompression and instrumented lumbar fusion. Patients were randomized to receive autograft alone on one side of the spine and concentrated autologous adult stem cells and cancellous allograft matrix on the contralateral side. These patients, currently 1 year post-op, are presented. (These patients are part of a 25 patient prospective study)

Case Study 1

A 52 Y/O male locomotive engineer suffered a work related injury when his train was struck by a truck. The patient presented with severe lumbosacral pain and right sacro-iliac pain that extended to his left thigh and calf. He had limited forward flexion with negative straight leg raise and normal motor function. There was diminished sensation in the lateral border of the left foot and reflexes were symmetric. The patient was diabetic and a non-smoker.

MRI showed moderate collapse at L4-L5 with disc protrusion and degenerative changes at three levels. Discography reproduced concordant pain at the three lower segments.

Failed conservative treatment included bed rest, physical therapy (PT), pain medication and cortisone injections.
Operative Procedure
The patient underwent a decompression and fusion from L3-S1 with bilateral pedicle screws and posterior rod fixation. He was randomized to receive autograft alone in the left lateral gutter and concentrated autologous stem cells with allograft in the right lateral gutter. (Fig.1-2).

Post-Operative Results
At a year post-op the patient was seeking medical retirement due to other injuries. (arthritic knee and abdominal diastasis) A CAT scan with reformatted views was performed 1 year post-op (Fig.3-4-5) showing solid lateral and facet fusions bilaterally.

Case Study 2
This 60 Y/O male presented with low back pain including left leg down to his calf. Physical exam showed lumbosacral tenderness, no motor or sensory changes and normal neurologic exam. He had failed conservative treatment and had an intrathecal pain pump. He was a non-smoker.

An MRI scan showed three level degenerative changes with disc collapse and facet arthropathy.

Operative Procedure
BMA (180 ml) was aspirated and processed as described on page 4. The patient underwent a 3 level decompression and instrumented pedicle screw fusion with PEEK interbody cages at each level. The patient was randomized to receive autograft in the left lateral gutter and left cages and concentrated autologous stem cells with allograft in the right lateral gutter and cages. (Fig.6-7)
Post-Operative Results
The patient did well and was back to work within four months. At four months post-op, he fell off a roof (work related) and herniated the L2-L3 disc. At one year, the CAT scan showed probable solid fusion at all three levels. (Fig.8-10) The lateral bone was inconclusive at L3-L4 and L4-L5 on the left. (autograft), inconclusive in the right facet at L3-L4 and L4-L5 (stem cell bone) and inconclusive in both cages at L5-S1 and the left cage at L3-L4. (autograft) Overall, it was felt that all three levels were solid. He is pending additional surgery at L2-L3.

Conclusion
In the above two patients, Bone Marrow Aspirate Concentrate (BMAC™) and cancellous allograft matrix appears equivalent to autograft in producing fusion of the Lumbar Spine. The author believes that this offers an effective alternative to autograft harvest and possibly Bone Morphogenic Protein (BMP).
Typical Bone Marrow Aspirate (BMA) Procedure
Bone marrow was aspirated from the right or left posterior iliac crest (Fig.11) through the lumbar incision using an 11 gauge, 5 side-hole (to maximize cell yield) Jamshidi needle. 120 ml of BMA was transferred (Fig.12) to the Bone Marrow Aspirate Concentrate (BMAC™) system (Harvest Technologies, Corp. Plymouth, MA). Following a 15 minute process, a final volume of 20 ml of BMAC (concentrated autologous adult stem cells) was recovered. The BMAC was then mixed (Fig.14) with packed allograft matrix (Spine Smith, Austin, TX) using the Graft Delivery Pack (Harvest Technologies Corp.) producing two bone "logs"(Fig.15). Laboratory cellular analysis of BMA and BMAC was performed at the Center for Blood Research, Boston, MA.

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