CASE REPORT
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ADULT STEM CELL TREATEMENT STRATEGY FOR JONES FRACTURE AND NONUNION OF THE PROXIMAL FIFTH METATARSAL

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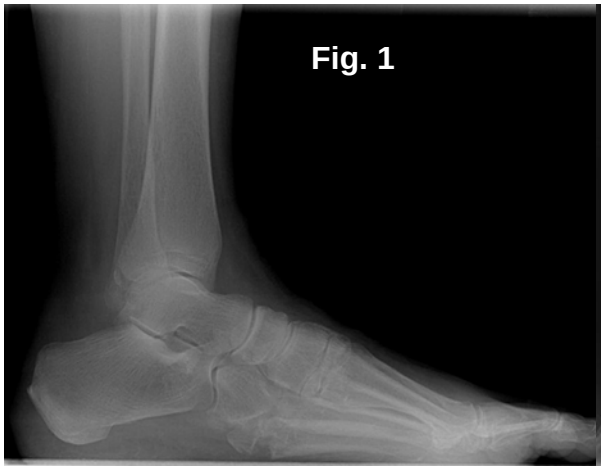
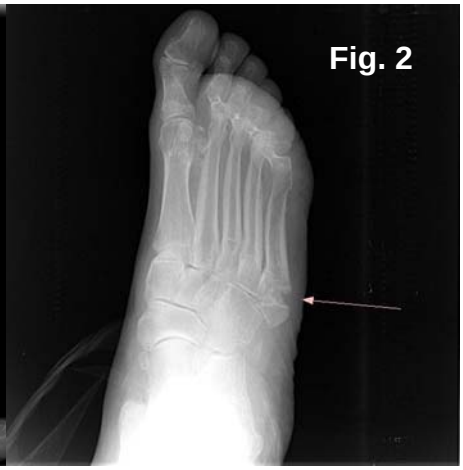
CASE HISTORY:





Twelve months prior to presentation, a 64 YO active Female sustained an inversion ankle sprain with a fracture of the fifth metatarsal that did not respond to conservative treatment (immobilization and orthotic). Upon x-ray examination (Figure 1, 2) there was a fracture gap of 9.17 mm. As the patient walked, the inferior aspect of the fracture site gapped open assisted by tension of the peroneus brevis muscle which brought the superior portion of the fracture in contact with bone at the corresponding aspect of the fifth metatarsal. The fracture margins had become sclerotic primarily on the proximal aspect of the fracture. Clinically there was pain associated with motion as well as mild edema and tenderness to the surrounding area. Gait was antalgic favoring the right leg.

Initial treatment was with casting. Six weeks post casting follow-up showed no improvement and the patient reported continued discomfort and pain. Re-casted for an additional six weeks produced no further improvement. Follow-up X-rays showed some fibrous tissue formation but a chronic nonunion Jones Fracture was diagnosed.

TREATMENT OPTIONS:

- Open surgical intervention, debridement, grafting with an autogenous graft (local bone from the calcaneous or tibia) and intramedullary fixation with a screw, followed by a period of 6 to as much as 10 weeks non weight bearing in a cast.
- Percutaneous injection of concentrated autologous stem cells from bone marrow aspirate.[1,2 ,3,4] This relatively new approach in treating nonunions appears to harness the patient's own biologic mechanism by delivering a concentration of stem cells locally which accelerates the division and migration of osteoprogenitor cells and resulting deposition of new bone.

TREATMENT PLAN:

Given the above treatment options, the patient elected for the less invasive injection of concentrated autologous stem cells. The surgical plan was to infiltrate BMAC percutaneously into the nonunion site (fibrous tissue matrix would act as a scaffold for the cells) and under the periosteum followed by 6 to 10 weeks of non-weight bearing in a cast.

MATERIALS AND METHODS:

Sixty milliliters of bone marrow was harvested from the posterior iliac crest from a single puncture with an 11 gauge jamshidi needle (with five lateral holes that allows for quicker aspiration of marrow). The marrow was first injected into a blood bag containing ACD-A anticoagulant. The marrow was then processed in the SmartPReP2 BMAC System (Harvest Technologies, Corp) which produced 10 mL of Bone Marrow

Aspirate Concentrate (BMAC) containing Adult Stem Cells, Growth Factors and other essential healing proteins[2].

An 18 gauge needle was used to percutaneously deliver 8 mL of BMAC directly into the nonunion; the fibrous tissue was "needled" while the stem cells were injected. The patient tolerated the bone marrow aspiration and the subsequent injection of her own stem cells very well. Following casting, the patient was instructed to return one week post-op.

RESULTS:

- At Week 2, follow-up some deposition of calcium formation could be seen
- At Week 4, X-rays (Figures 3, 4) showed solid bone formation and complete bridging of the fracture
- Patient reported no pain, nor need for any pain medication; no edema was seen and casting was removed
- At Week 6, patient was allowed full weight bearing and physical therapy was prescribed

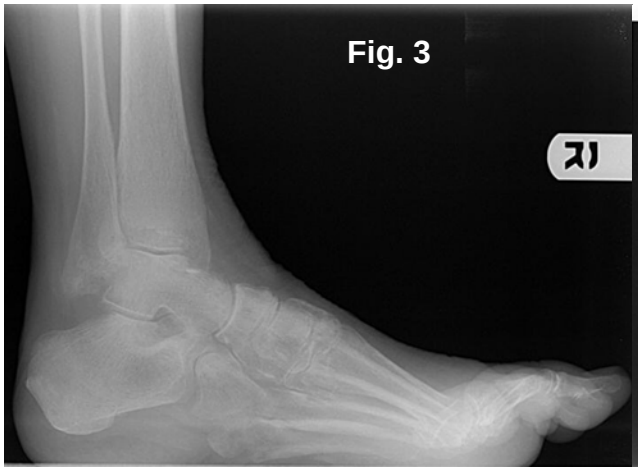


Fig. 3

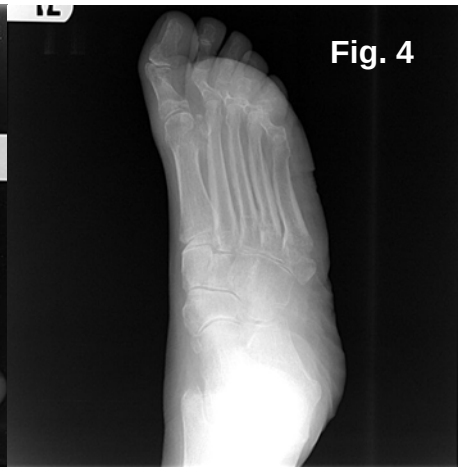


Fig. 4

- Length parameter, architecture and tuberocity of the base remained constant

DISCUSSION:

The relative ease of use and decrease of potential complications while expanding the patient population for the repair of a nonunion to those who may not be ideal surgical candidates due to comorbidities may make this a potential substitute for the current standard of care for nonunions. Bone formation was evident by Week 2 with solid bone noted throughout by Week 4 with obliteration of the previously sclerotic fracture margins. Weight bearing increased to full weight bearing by Week 6. There were no side effects noted and minimal postoperative discomfort. Other benefits included:

- Reduced expenses by avoiding use of implantable hardware and bone harvesting supplies
- Significant reduction in both operative time and pain/anesthesia management
- No pain associated with the harvest site post operatively
- Reduced concern for post harvest complications
- Less time to harvest bone marrow than an appropriate size autograft
- No need to retrieve surgical hardware at a later date
- Quicker return to normal activities than if an autograft with internal fixation had been employed

Most importantly, concentrated bone marrow injection is less complex than open surgery with significant reduction in operative time. This new treatment is also applicable to those patients with other comorbidities who may not be suitable candidates to undergo traditional bone grafting techniques due to health or poor soft tissue qualities.

CONCLUSION:

This new point-of-care technology provides the physician and patient with a less invasive biological approach in the treatment of nonunions and opens the door to reducing surgical morbidity and pain with accelerated healing and faster return to normal activity.

1. Hernigou, P, et al, Percutaneous Autologous Bone-Marrow Grafting for Nonunions: Surgical Technique, *Journal of Bone and Joint Surgery*, 2006; 88;322-327
2. Hernigou, P, et al, Percutaneous Autologous Bone-Marrow Grafting for Nonuions: Influence of the Number and Concentration of Progenitor Cells, *Journal of Bone and Joint Surgery,* 2005; 87-A;1430-1437
3. Lieberman JR, Commentary & Perspective on "Percutaneous Autologous Bone Marrow Grafting for Nonunions" by Hernigou P et al, *Journal of Bone and Joint Surgery,* 2005; 87-A; 1430-1437; e*JBJS, July 2005;*
4. Connolly, JF, et al, Development of an Osteogenic Bone-Marrow Preparation, *Journal of Bone and Joint Surgery*, June 1989; 684-691