Quantitative Assessment of Osteoprogenitor Stem Cells in Bone Marrow Aspirate from the Iliac Crest, Tibia and Calcaneus

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Introduction
It is well known that bone marrow aspirate (BMA) from the iliac crest (IC) contains mesenchymal stem cells as well as osteoprogenitor cells. In foot and ankle surgery, alternative harvest sites include the distal tibia (T) and calcaneus (C). There are no studies characterizing the quality of BMA obtained from these alternative sites and comparing them to that of the iliac crest. The goal of this study is to determine which location (IC,T,C) yields the highest number of osteoprogenitor cells.

Methods
A total of 40 patients were enrolled. Separate BMA specimens were harvested from the ipsilateral anterior iliac crest, medial distal tibia metaphysis and calcaneal body. The BMA was centrifuged to separate out a concentrate of bone marrow nucleated cells, plated, grown in cell culture and stained for alkaline phosphatase. Cells that stained positive for alkaline phosphatase, indicating active mesenchymal stem cells, were counted and recorded for quantity and concentration.

Results
Data from 37 patients was available for evaluation. Mesenchymal stem cells (of the osteoprogenitor line) were quantitatively evaluated and compared with respect to patient gender, age, tobacco use and diabetes. Marrow aspirate collected from the IC had a higher concentration of mesenchymal stem osteoprogenitor cells than either the distal tibia and calcaneus (p<0.0001). There was no statistical difference between the distal tibia and calcaneus (p=0.99).

Conclusion
Results of this study demonstrate BMA from the IC has the highest yield of mesenchymal osteoprogenitor stem cells amongst the three sites. Osteoprogenitor cell yield from the distal tibia and calcaneus are similar to one another.