STEM CELLS

Exposing gaps in our knowledge of stem cell therapy

Advances in stem cell therapy have captivated the medical community, but more research is required into the potential of mesenchymal stem cells (MSCs) in certain clinical applications. In the field of orthopedics, Cuomo *et al.* have shown that human bone marrow enriched with MSC is ineffective for healing critical-sized defects in a murine fracture model.

“Adult MSCs have been used in the past to successfully treat tibial non-unions and in other bone graft scenarios,” explains study investigator Jay Lieberman. “It is thought that increasing the number of stem cells placed in a bone repair site will enhance bone repair.” With this in mind, Cuomo and colleagues investigated the osteogenic potential of human bone marrow aspirate and MSC-enriched bone marrow aspirate compared with that of recombinant human bone

morphogenetic protein 2 (rhBMP2) in a nude rat femoral defect model. In the US, rhBMP2 has been approved for the treatment of open tibial fractures and spinal fusion, but it is expensive and requires optimization of the carrier.

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The researchers found no evidence of consistent bone repair in rats that received bone marrow, regardless of MSC concentration. After 12 weeks of treatment, the bone defects in all 10 of the rhBMP2-treated rats had healed completely compared with just 3 out of 44 rats in the bone marrow groups. The findings point to several gaps in our knowledge of the application of MSCs in

fracture repair. These include issues related to the variability of stem cell phenotypes and their potential for expansion, variations in MSC concentrations in marrow obtained from donors, and identification of an optimal carrier.

“We remain enthusiastic about the potential use of stem cells for a variety of clinical applications, and the successful use of MSCs in bone repair,” says Lieberman. “However, a better understanding of the role these stem cells have in bone repair is necessary to achieve consistent success in different clinical bone repair scenarios.”

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Original article Cuomo, A. V. *et al.* Mesenchymal stem cell concentration and bone repair: potential pitfalls from bench to bedside. *J. Bone Joint Surg. Am.* **91**, 1073–1083 (2009).