Vertebral body mesenchymal stem cell

Mesenchymal stem cells (MSCs) derived from whole bone marrow aspirate (BMA) and MSCs derived from density-gradient centrifugation were isolated from vertebral bodies and cultured under either hypoxic or normoxic conditions to evaluate their biological characteristics and HOX and TALE signature able to improve spinal surgery procedures.

SUMMARY OF BACKGROUND DATA: The use of spinal fusion procedures has increased over the last decades; however, failed fusion still remains an important problem. Clinician and researchers focused their attention on the therapeutic potential of bone marrow MSCs and several methods for their isolation and cultivation have been developed. However, the best source and techniques are still debated.

METHODS: MSCs morphology, surface markers, colony-forming-units, and three lineage differentiation through quantitative real-time PCR (qPCR) were evaluated. Additionally, gene expression analysis of HOX and TALE signatures during osteogenic differentiation were analyzed.

RESULTS: Our study showed that MSCs derived from whole BMA were successfully isolated and when cultured under hypoxic condition presented greater proliferation, larger colonies, and differentiated onto osteogenic and chondrogenic lineage with greater ability, while adipogenic differentiation was less efficient. Results also revealed that MSCs, differently isolated and cultured, expressed different level of HOX and TALE signatures and that HOXB8 were up-regulated with greater efficiency in MSCs derived from whole BMA under hypoxia.

This data indicated that hypoxic preconditioning of MSCs derived from whole BMA exhibited more suitable biological characteristics and different level of HOX and TALE gene activation. We, therefore, concluded that vertebral body MSCs derived from whole BMA may provide alternative sources of MSCs for tissue engineering applications for spine surgery [1)].

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Salamanna F, Cepollaro S, Contartese D, Giavaresi G, Brodano GB, Griffoni C, Gasbarrini A, Fini M. Biological Rationale for the Use of Vertebral Whole Bone Marrow in Spinal Surgery. Spine (Phila Pa 1976). 2018 Oct 15;43(20):1401-1410. doi: 10.1097/BRS.0000000000002626. PubMed PMID: 29547459.