PERIVASCULAR STEM CELLS DEMONSTRATE SIMILAR LEVEL OF STEMNESS, CHONDROGENIC ABILITY AND OSTEOARTHRITIS REPAIR POTENTIAL TO MESENCHYMAL STROMAL CELLS

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Introduction: Perivascular stem cells(PSCs) or pericytes have been of interests in the fields of orthopaedics and tissue engineering. PSCs are shown to have characteristics similar to mesenchymal stromal cells(MSCs), i.e., self-renewal, multipotentiality, and tissue repair. However, its performance against the more traditional Bone Marrow-derived MSCs(BM-MSC)has not been demonstrated. Hence, as study was conducted to:(i)Isolate, identify and characterise rat adipose-derived PSCs(AT-PSCs), peripheral blood-derived PSCs(PB-PSCs)and MSCs(PB-MSCs), and BM-MSCs; (ii)Determine their ability to undergo self-renewal, proliferation, and differentiation;(iii)Compare the chondrogenic potential of PSCs and MSCs in vitro and (iv) Explore the therapeutic efficacy of the PSCs and MSCs in rat anterior cruciate ligament transection(ACLT)osteoarthritis model.

Methodology: PSCs from AT and PB were isolated using magnetic-activated cell sorting(MACS)and defined as a population of CD146+CD31-CD45-. The MSCs were isolated from BM and PB using density gradient centrifugation and monolayer culture. The immunophenotyping of the isolated PSCs and MSCs were analysed by flow cytometry. Chondrogenic differentiation was confirmed via Safranin-O stain and GAG assay. PSCs and MSCs were injected intra-articular into rats after ACLT. After four and twelve weeks, rat knees were harvested for analysis. The gross morphology was assessed by modified ICRS/Brittberg scoring. Histological analysis used modified O'Driscoll scoring.

Results: PSCs and MSCs appeared as spindle-shaped or fibroblast-like morphology. PSCs expressed CD146(AT-PSCs 85.5%,PB-PSCs 75.5%), MSCs exhibited lower expression of CD146(BM-MSCs 6.2%,PB-MSCs 10.8%). Both expressed over 88% CD44 and CD90 and negative for CD31, CD34 and CD45. PSCs have similar ability to undergo self-renewal and tri-lineage differentiation to MSCs. Qualitative and quantitative analyses of the chondrogenic potential of PSCs and MSCs demonstrated similar levels of proteoglycan protein contents. Modified ICRS and O'Driscoll scores demonstrated significant PSCs and MSCs cartilage regeneration as compared to control groups.

Conclusion: Both PSCs and MSCs demonstrated comparable characteristics and chondrogenic potentials. These cells possess significant therapeutic effect on OA rat model and may be useful for clinical applications.