Adipose tissue-derived stem cells versus bone marrow-derived stem cells as an angiogenic therapy after ischemic limb injury in the adult male albino rat

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Abstract:

Background: Peripheral arterial disease (PAD) remains one of the leading causes of deformity worldwide. Among various therapeutic options for PAD, stem cell-based therapies hold some great promises. Nonetheless, the therapeutic efficacy faces the limitation of poor survival of donor cells. The aim of this work`: Isolation of the rat bone marrow MSCs (BM-MSCs) and adipose tissue MSCs (AD-MSCs) and assessing their growth kinetics and their role in improvement of angiogenesis after induction of acute hind limb ischemia through ligation of the femoral artery of the adult male albino rat. Material and Methods: The rat bone marrow and the adipose tissue were isolated from 10 male adult albino rats. They cultured and expanded through 6 passages. Acute lower limb ischemia was done by ligation of unilateral left sided femoral artery of an adult male albino rat. Both BM-MSCs and AD-MSCs, were injected immediately following ischemia in the semimembranosus muscle. BM-MSCs and AD-MSCs biological characteristics evaluated for cell therapy (morphology, flow cytometric analysis, colony-forming unit-fibroblast assay, proliferation capacity at passages 2, 4 and 6, population doubling time (PDT) and cell growth curves). Evaluation of muscle regeneration and angiogenesis was assessed through H&E staining of the tissue, Masson Trichrome to assess fibrosis, CD31 immunostaining for new blood vessel formation and electron microscopic examination for the cells ultrastructure. Results: BM-MSCs and AD-MSCs attached to the culture flask and displayed spindle-shaped morphology, more evident in AD-MSCs. Proliferation rate of AD-MSCs in the analyzed passages was more than BM-MSCs. The increase in the population doubling time (PDT) of both types of MSCs occurs with the increase in the number of passages. Light, electron microscopy and immunohistochemistry showed the better ability of AD-MSCs in improving the ischemic limb through their angiogenetic capacity than BM-MSCs. Conclusion: Rat AD- MSCs have growth kinetic advantages in the proliferative capacity, colony-forming unite fibroblast, population doubling time and angiogenic capacity when transplanted in a rat model of a hind limb ischemia more than that of BM-MSCs.

Keywords:

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