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Treatment of Full-Thickness Rotator Cuff Tendon Tear Using Umbilical Cord Blood-Derived Mesenchymal Stem Cells and Polydeoxyribonucleotides in a Rabbit Model

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Abstract : Objective: The aim of this study was to investigate regenerative effects of ultrasound (US)-guided injection with human umbilical cord blood-derived mesenchymal stem cells (UCB-MSCs) and/or polydeoxyribonucleotide (PDRN) injection in a chronic traumatic full-thickness rotator cuff tendon tear (FTRCTT) in a rabbit model. Material and Methods: Rabbits (n = 32) were allocated into 4 groups. After a 5-mm sized FTRCTT just proximal to the insertion site on the subscapularis tendon was created by excision, the wound was immediately covered by silicone tube to prevent natural healing. After 6 weeks, 4 injections (0.2 mL normal saline, G1; 0.2 mL PDRN, G2; 0.2 mL UCB-MSCs, G3; and 0.2 mL UCB-MSCs with 0.2ml PDRN, G4) were injected into FTRCTT under US guidance. We evaluated gross morphologic changes on all rabbits after sacrifice. Masson's trichrome, anti-type 1 collagen antibody, bromodeoxyuridine, proliferating cell nuclear antigen, vascular endothelial growth factor and platelet endothelial cell adhesion molecule stain were performed to evaluate histological changes. Motion analysis was also performed. Results: The gross morphologic mean tendon tear size in G3 and 4 was significantly smaller than that of G1 and 2 ($p < .05$). However, there were no significant differences in tendon tear size between G3 and 4. In G4, newly regenerated collagen type 1 fibers, proliferating cells activity, angiogenesis, walking distance, fast walking time, and mean walking speed were greater than in the other three groups on histological examination and motion analysis. Conclusion: Co-injection of UCB-MSCs and PDRN was more effective than UCB-MSCs injection alone in histological and motion analysis in a rabbit model of chronic traumatic FTRCTT. However, there was no significant difference in gross morphologic change of tendon tear between UCB-MSCs with/without PDRN injection. The results of this study regarding the combination of UCB-MSCs and PDRN are worth additional investigations.

Keywords : mesenchymal stem cell, umbilical cord, polydeoxyribonucleotides, shoulder, rotator cuff, ultrasonography, injections
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