Implantation of Culture-Expanded Autologous Bone-Marrow-Derived Mesenchymal Stromal Cells for Treatment of Early Stage Osteonecrosis of the Femoral Head

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INTRODUCTION: Since the introduction of core decompression (CD) with autologous bone marrow mononuclear cells (BM-MNCs) for the management of osteonecrosis of the femoral head (ONFH), some reports have demonstrated promising results. However, owing to the various outcomes of CD with BM-MNC due to the inadequate number of stem cells in BM-MNCs and the unclear ideal patient indication, treatment efficacy remains uncertain. This study aimed to evaluate the efficacy of CD with culture-expanded autologous bone marrow-derived mesenchymal stem cell (BM-MSC) implantation to prevent further collapse in pre-collapsed or early collapsed ONFH, especially large lesions in weight-bearing areas.
METHODS: A total of 18 patients (22 hips) with ONFH who underwent CD with culture-expanded BM-MSC implantation from September 2013 to July 2020 were retrospectively reviewed. The median age was 35.0 years (interquartile range [IQR], 28.5–42.0 years), and the median follow-up period was 4.0 years (IQR, 2.0–5.3 years). To obtain adequate BM-MSCs (Ossron®), 10 mL of bone marrow was aspirated and specially processed under Good Manufactured Practices. After culture and expansion, we performed CD with BM-MSC implantation at an average number of 1.06 × 108 MSCs. To evaluate radiographic and clinical outcomes, regular follow-up intervals were conducted. The Association Research Circulation Osseous (ARCO) classifications, the Japanese Investigation Committee classification and combined necrotic angle (CNA) were evaluated preoperatively and during the last follow-up. Clinical outcomes such as pain, discomfort or disability in the visual analogue scale (VAS) and Harris Hip Score (HHS) were evaluated. Radiographic failure was defined when the ARCO stage progressed to 3b and more. Clinical failure was defined when HHS was <80 or when total hip arthroplasty (THA) was performed.
RESULTS SECTION: The preoperative stage of ONFH was ARCO 2 in 14 hips and ARCO 3a in 8 hips. The ARCO staging was maintained in 7/14 hips (50%) in ARCO 2 and 4/8 hips (50%) in ARCO 3a. The radiographic failure rate of ARCO 2 and 3a was 14.3% and 50%, respectively. Furthermore, CNA decreased to more than 20° in six hips (four were ARCO 2 and two were ARCO 3a). Regarding clinical findings, no significant difference was noted in the VAS and HHS (P = 0.052 and P = 0.535, respectively). THA conversion was performed in four (18.1%) hips with intolerable pain.
DISCUSSION: CD with culture-expanded autologous BM-MSCs showed promising results in preventing radiographic progression and favourable clinical outcomes for the treatment of early stage ONFH.
SIGNIFICANCE/CLINICAL RELEVANCE: (1-2 sentences): Clinically, it is considered to be important because it shows the therapeutic effect of stem cells in ONFH.
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IMAGES:
Figure 1.

Figure 2.

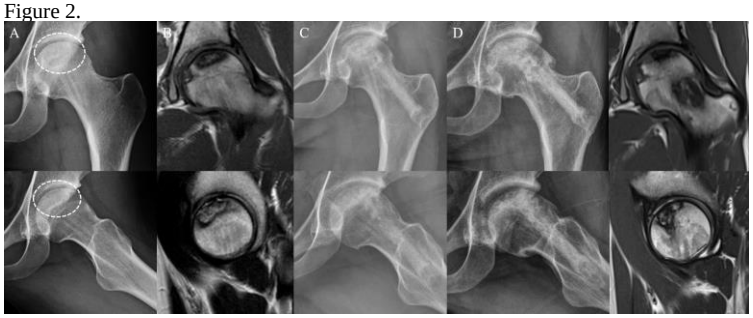

Figure 3.