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Cell culture media notably influence properties of human mesenchymal stroma/stem-like cells from different tissues

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Abstract

Background aims: Mesenchymal stroma/stem-like cells (MSCs) are a popular cell source and hold huge therapeutic promise for a broad range of possible clinical applications. However, to harness their full potential, current limitations in harvesting, expansion and characterization have to be overcome. These limitations are related to the heterogeneity of MSCs in general as well as to inconsistent experimental protocols. Here we aim to compare in vitro methods to facilitate comparison of MSCs generated from various tissues.

Methods: MSCs from 3 different tissues (bone marrow, dental pulp, adipose tissue), exemplified by cells from 3 randomly chosen donors per tissue, were systematically compared with respect to their in vitro properties after propagation in specific in-house standard media, as established in the individual laboratories, or in the same commercially available medium.

Results: Large differences were documented with respect to the expression of cell surface antigens, population doubling times, basal expression levels of 5 selected genes and osteogenic differentiation. The commercial medium reduced differences in these parameters with respect to individual human donors within tissue and between tissues. The extent, size and tetraspanin composition of extracellular vesicles were also affected.

Conclusions: The results clearly demonstrate the extreme heterogeneity of MSCs, which confirms the problem of reproducibility of results, even when harmonizing experimental conditions, and questions the significance of common parameters for MSCs from different tissues in vitro.

Anal Chem

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Microchip with Single-Cell Impedance Measurements for Monitoring Osteogenic Differentiation of Mesenchymal Stem Cells under Electrical Stimulation

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Abstract

Effective induction methods and *in situ* monitoring are essential for studying the mechanism of biological responses in stem cell differentiation. This article proposes an induction method incorporating electrical stimulation under an inhomogeneous field with single-cell impedance monitoring for studying osteogenic differentiation of mesenchymal stem cells (MSCs) using a microchip. The microchip contains an array of sextupole-electrode units for implementing a combination of controllable electrical stimulation and single-cell impedance measurements. MSCs are inducted to osteogenic differentiation under electrical stimulation using quadrupole electrodes and single-cell impedances are

monitored *in situ* using a pair of microelectrodes at each unit center. The proposed microchip adopts an array design to monitor a number of MSCs in parallel, which improves measurement throughput and facilitates to carry out statistic tests. We perform osteogenic differentiation of MSCs on the microchip with and without electrical stimulation meanwhile monitoring single-cell impedance in real time for 21 days. The recorded impedance results show the detailed characteristic change of MSCs at the single-cell level during osteogenic differentiation, which demonstrates a significant difference between the conditions with and without electrical stimulation. The cell morphology and various staining analyses are also used to validate osteogenesis and correlate with the impedance expression. Correlation analysis of the impedance measurement, cell morphology, and various staining assays proves the great acceleration effect of the proposed electrical stimulation on osteogenic differentiation of MSCs. The proposed impedance method can monitor the dynamic pro

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Adipose-derived mesenchymal stem cells promote the malignant phenotype of cervical cancer

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Free article

Abstract

Epidemiological studies indicate that obesity negatively affects the progression and treatment of cervical-uterine cancer. Recent evidence shows that a subpopulation of adipose-derived stem cells can alter cancer properties. In the present project, we described for the first time the impact of adipose-derived stem cells over the malignant behavior of cervical cancer cells. The transcriptome of cancer cells cultured in the presence of stem

cells was analyzed using RNA-seq. Changes in gene expression were validated using digital-PCR. Bioinformatics tools were used to identify the main transduction pathways disrupted in cancer cells due to the presence of stem cells. In vitro and in vivo assays were conducted to validate cellular and molecular processes altered in cervical cancer cells owing to stem cells. Our results show that the expression of 95 RNAs was altered in cancer cells as a result of adipose-derived stem cells. Experimental assays indicate that stem cells provoke an increment in migration, invasion, angiogenesis, and tumorigenesis of cancer cells; however, no alterations were found in proliferation. Bioinformatics and experimental analyses demonstrated that the NF-kappa B signaling pathway is enriched in cancer cells due to the influence of adipose-derived stem cells. Interestingly, the tumor cells shift their epithelial to a mesenchymal morphology, which was reflected by the increased expression of specific mesenchymal markers. In addition, stem cells also promote a stemness phenotype in the cervical cancer cells. In conclusion, our results suggest that adipose-derived stem cells induce cervical cancer cells to acquire malignant features where NF-kappa B plays a key role.