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Letter to the Editor:

Human adult stem cells from menstrual blood and endometrial tissue

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The article "Plasticity of human menstrual blood stem cells derived from the endometrium" by Lin *et al*. (2011), published in *Journal of Zhejiang University-SCIENCE B (Biomedicine & Biotechnology)*, described a newly identified mesenchymal-like stem cell (MSC) from human menstrual blood known as MenSC. Here we describe the latest findings in this area and clarify the difference between human adult stem cells from menstrual blood and endometrial tissue.

MenSCs express pluripotent markers such as octamer-binding transcription factor 4 (Oct-4), stage-specific embryonic antigen 4 (SSEA-4), Nanog, and c-kit, in addition to typical MSC surface markers including cluster of differentiation 9 (CD9), CD29, CD44, CD49f, CD90, CD105, and CD166 (Patel *et al*., 2008; Borlongan *et al*., 2010). MenSCs have the ability to differentiate into mesoderm tissues such as cartilage (40%–50%), adipose (60%–70%), and bone (45%), with the degree of differentiation similar to or better than bone marrow-derived MSCs. MenSCs also have the capacity to differentiate into neural and cardiac lineages (Patel *et al*., 2008). Our animal studies show that the human menstrual blood stem cells can repair several types of damaged cells in vivo (unpublished data).

Meng *et al*. (2007) and Murphy *et al*. (2008) described the cells from menstrual blood termed endometrial regenerative cells (ERCs) that express CD9, CD29, CD44, CD59, CD73, CD90, CD105, and Oct-4, but lack SSEA-4, Nanog, and c-kit. These cells have been demonstrated to differentiate into nine different cell lineages (cardiomyocytic, respiratory epithelial, neurocytic, myocytic, endothelial, pancreatic, hepatic, adipocytic, and osteogenic).

Another source of human adult stem cell from endometrial tissue called eMSC expresses similar MSC markers (Gargett and Masuda, 2010). Both MenSC and eMSC are negative for hematopoietic and endothelial markers such as CD34, CD38, CD45, and CD133 (Patel *et al*., 2008; Gargett and Masuda, 2010). Major differences between the cells include the invasive process required to retrieve the eMSC as well as the growth properties identified in vitro where eMSC but not MenSC requires growth factors and an extracellular matrix. Independent studies comparing eMSC to MenSC demonstrated 57 significant and differentially expressed genes (unpublished data).

Both MenSC and eMSC are similar to bone marrow-derived MSC; however, stromal-derived factor-1 (STRO-1), a marker used to prospectively isolate bone marrow-derived MSC (Gronthos *et al*., 2003), has not been found in cells from the endometrial tissue (Gargett and Masuda, 2010) or in MenSCs, although decidual cells are known to express STRO-1 (García-Pacheco *et al*., 2001).

MenSCs recapitulate pluripotency properties as an alternative adult stem cell source that circumvents ethical and logistical limitations of embryonic stem (ES) cells. Recent studies reveal great potential of

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MenSCs for treating stroke (Borlongan *et al*., 2010) and liver damage (unpublished data).

References

Borlongan, C.V., Kaneko, Y., Maki, M., Yu, S.J., Ali, M., Allickson, J.G., Sanberg, C.D., Kuzmin-Nichols, N., Sanberg, P.R., 2010. Menstrual blood cells display stem cell-like phenotypic markers and exert neuroprotection following transplantation in experimental stroke. *Stem Cells Dev.*, **19**(4):439-452. [doi:10.1089/scd.2009.0340]

García-Pacheco, J.M., Oliver, C., Kimatrai, M., Blanco, F.J., Olivares, E.G., 2001. Human decidual stromal cells express CD34 and STRO-1 and are related to bone marrow stromal precursors. *Mol. Hum. Reprod.*, **7**(12):1151-1157. [doi:10.1093/molehr/7.12.1151]

Gargett, C.E., Masuda, H., 2010. Adult stem cells in the endometrium. *Mol. Hum. Reprod.*, **16**(11):818-834. [doi:10.1093/molehr/gaq061]

Gronthos, S., Zannettino, A.C., Hay, S.J., Shi, S., Graves, S.E., Kortesidis, A., Simmons, P.J., 2003. Molecular and cellular characterisation of highly purified stromal stem cells derived from human bone marrow. *J. Cell Sci.*, **116**(9):1827-1835. [doi:10.1242/jcs.00369]

Lin, J., Xiang, D., Zhang, J.L., Allickson, J., Xiang, C., 2011. Plasticity of human menstrual blood stem cells derived from the endometrium. *J. Zhejiang Univ.-Sci. B (Biomed. & Biotechnol.)*, **12**(5):372-380. [doi:10.1631/jzus.B1100015]

Meng, X., Ichim, T.E., Zhong, J., Rogers, A., Yin, Z., Jackson, J., Wang, H., Ge, W., Bogin, V., Chan, K.W., *et al*., 2007. Endometrial regenerative cells: a novel stem cell population. *J. Transl. Med.*, **5**(1):57. [doi:10.1186/1479-5876-5-57]

Murphy, M.P., Wang, H., Patel, A.N., Kambhampati, S., Angle, N., Chan, K., Marleau, A.M., Pyszniak, A., Carrier, E., Ichim, T.E., *et al*., 2008. Allogeneic endometrial regenerative cells: an "Off the shelf solution" for critical limb ischemia? *J. Transl. Med.*, **6**:45. [doi:10.1186/1479-5876-6-45]

Patel, A.N., Park, E., Kuzman, M., Benetti, F., Silva, F.J., Allickson, J.G., 2008. Multipotent menstrual blood stromal stem cells: isolation, characterization, and differentiation. *Cell Transplant.*, **17**(3):303-311. [doi:10.3727/096368908784153922]

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