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Biology and Therapeutic Use of Domestic Animal Stem Cells

Markers of stemness in equine mesenchymal stem cells: a plea for uniformity

Catharina De Schauwer[a,*], Evelyne Meyer[b], Gerlinde R. Van de Walle[c], Ann Van Soom[a]

[a] *Department of Reproduction, Obstetrics and Herd Health, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium*
[b] *Department of Pharmacology, Biochemistry, and Toxicology, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium*
[c] *Department of Comparative Physiology and Biometrics, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium*

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Abstract

Mesenchymal stromal cells (MSC) are a very promising subpopulation of adult stem cells for cell-based regenerative therapies in veterinary medicine. Despite major progress in the knowledge on adult stem cells during recent years, a proper identification of MSC remains a challenge. In human medicine, the Mesenchymal and Tissue Stem Cell Committee of the International Society for Cellular Therapy (ISCT) recently proposed three criteria to define MSC. Firstly, cells must be plastic-adherent when maintained under standard culture conditions. Secondly, MSC must express CD73, CD90 and CD105, and lack expression of CD34, CD45, CD14 or CD11b, CD79α or CD19 and MHC class II antigens. Thirdly, MSC must be able to differentiate into osteoblasts, adipocytes and chondroblasts *in vitro*. Successful isolation and differentiation of equine MSC from different sources such as bone marrow, fat tissue, umbilical cord blood, Wharton's Jelly or peripheral blood has been widely reported. However, their unequivocal immunophenotyping is hampered by the lack of a single specific marker and the limited availability of monoclonal anti-horse antibodies, which are two major factors complicating successful research on equine MSC. Detection of gene expression on mRNA level is hereby a valuable alternative, although the need still exists to test several antibody clones in search for cross-reactivity. To date, commercial antibodies recognizing equine epitopes are only available for CD13, CD44 and MHC-II. Moreover, as the expression of certain adult stem cell markers may differ between species, it is mandatory to define a set of CD markers which can be uniformly applied for the identification of equine MSC.

Keywords: Horse; Mesenchymal stem cell; Cell surface markers; Characterization

Contents

* Corresponding author. Tel.: +32 [0] 9 264 75 61; fax: +32 [0] 9 264 77 97.
E-mail address: Catharina.Deschauwer@UGent.be (C. De Schauwer).

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1. Introduction

Athletic injuries are a common cause of wastage among competitive horses, associated with failure to return to a previous level of performance and with an increased risk of re-injury. Cell-based therapies using mesenchymal stem cells are being reported in equine medicine with increasing frequency in an attempt to improve the limited intrinsic capacity for complete self-repair of both cartilage and tendon after injury [1–3].

There are two broad categories of stem cells depending on the developmental stage from which they were obtained: embryonic stem cells (ESC) and adult stem cells [4] (Fig.1). In contrast to totipotent ESC, pluripotent ESC can only differentiate into all three somatic germ layers (meso-, endo- and ectoderm) and are derived from the inner cell mass of the blastocyst [5]. Adult stem cells are isolated from various adult tissues and are considered multipotent as they can only differentiate into organ-specific cell types of the germ layer

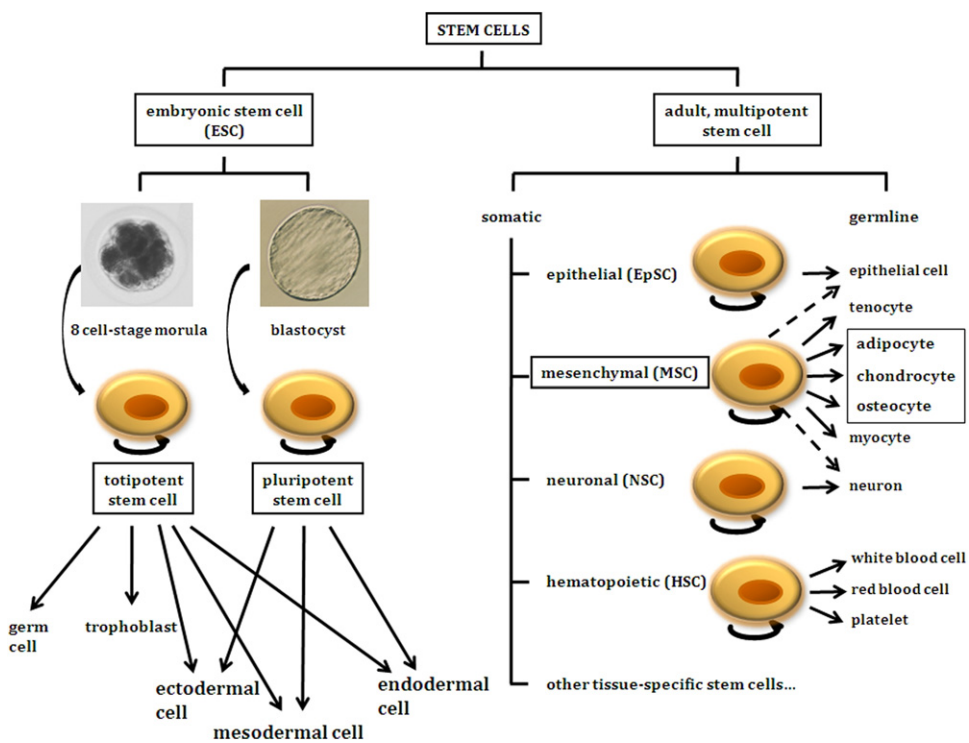

Fig. 1. Classification of stem cells. A schematic overview of embryonic stem cells (ESC) and adult stem cells, with emphasis on mesenchymal stromal cells (MSC) and their plasticity to differentiate into mesodermal and non-mesodermal lineages.