MINI-REVIEW

Mesenchymal stem cell based therapy for osteo-diseases

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Abstract

Stem cell therapy in recent years has gained much attention as the modern therapeutic approach to treat diseases. Mesenchymal stem cells (MSCs) are seen as the most reliable cells applied in therapy over other stem cells because of their versatility. Bone and cartilage diseases (osteo-diseases) are the major target of therapy using MSCs. In this perspective, we have statistically analyzed the data available on clinical trials registry databases regarding the mesenchymal stem cell based therapy for a number of mentioned diseases and paid attention towards the osteodiseases. We report that MSC therapy for osteo-diseases needs optimization in its standards to achieve acceptable results so that we can apply it in daily routine clinical practice.

Keywords: bone and cartilage diseases; cell based therapy; clinical trials; mesenchymal stem cells

Introduction

Stem cells are the specific cells having unlimited proliferation and differentiation capacities. Since their first discovery in 19th century (Reiser et al., 2005), these cells have been applied in cell-based therapeutic approaches in clinics (Brodie and Humes, 2005). From clinically applied stem cells, mesenchymal stem cells (MSCs) have been described as well-characterized stem cells that can be isolated from adult tissues (Jiang et al., 2002). Positive indications of their applications in various diseases have made them clinically promising (Bang et al., 2005, Garcia-Olmo et al., 2005, Kuo et al., 2008, Le Blanc et al., 2008, Nakamizo et al., 2005, Pisati et al., 2007). Many advantages in their application over the embryonic stem cells has made them potential candidates in regenerative medicine (Thomson et al., 1998). Other pluripotent stem cells, for example, induced pluripotent stem cells, are also mainly valuable for research purposes, and remain far from being applied in therapy (Nishikawa et al., 2008). MSCs were first isolated from the bone marrow of guinea-pig (Friedenstein et al., 1970). These cells were considered as bone marrow stem cells, which are very limited in number (Stenderup et al., 2003). MSCs have been isolated from almost all parts of the body, for example, skin (Toma et al., 2005), blood (Campagnoli et al., 2001), umbilical cord blood (Rosada et al., 2003), dentine (Perry et al., 2008), pancreas (Seeberger et al., 2011), adipose (Zuk et al., 2002), liver (Wenceslau et al., 2011), brain, heart, lungs, and kidneys (Salem and Thiemann, 2010).

Adipose tissue is the largest source of these stem cells as they can be isolated from the lipoasparate in daily routine liposuction (Yoo et al., 2009) and have limited oncogenicity (Vilalta et al., 2008). MSCs derived from different organs should have the following characteristics: self-renewal and differentiation ability to osteocyte, adipocyte and chondrocyte (Zuk et al., 2002); should express CD105, CD90, and CD73 antigens; and should not express CD11b, CD14, CD34, CD45, and HLA-DR1 (Ghannam et al., 2010). Clinical methodology (clinical trial) is the follow-up study of a disease treatment on humans under the supervision of expert scientists. Every clinical study has a strong experimental basis performed on animals. In this perspective, we will discuss clinical trials of osteo-