Comparison of cultured mesenchymal stem cells derived from bone marrow or peripheral blood of rats

Achmad F. Kamal¹, Diah Iskandriati², Ismail H. Dilogo¹, Nurjati C. Siregar³, Errol U. Hutagalung¹, Achmad A. Yusuf⁴, Silmi Mariya², Kurniadi Husodo¹

INTRODUCTION

Many studies have reported that mesenchymal stem cells (MSC) can accelerate healing of bone fracture [1, 2], massive bone defect [3-7], and fracture non-union [8]. MSC can be stimulated to differentiate into desired cells, into mechanically and structurally appropriate tissue, and show excellent integration into surrounding tissues [9-11].

MSC can be isolated from various sources, such as bone marrow [12, 13], periosteum and peripheral blood. Although reported as a reliable source of MSC, bone marrow in fact contains only a little amount of MSC (0.1-5 per 10⁶ cells from total nucleated cells in rat bone marrow). Therefore, a considerable amount of bone marrow aspirate is required [14-16]. In addition, it takes a considerably long time, about 3-4 weeks, until the stem cells cultured from bone marrow aspirate become confluent. Bone marrow aspiration also frequently causes trauma to the donor [15]. Therefore, other non-invasive methods of MSC isolation with the same or better potency compared to isolation from bone marrow need to be studied.

Isolation of MSC from peripheral blood is still a controversy [17, 18]. Previous studies show that not every isolation and culture of peripheral blood will able to produce MSC [19]. Drawbacks in isolation of MSC from peripheral blood include the limitations of the MSC to grow and proliferate in culture medium [19] and also difference in isolation methods and culture conditions [20, 21].

Isolation of MSC from peripheral blood covered the disadvantage found in isolation from bone marrow. Considerable amount of blood can be obtained from peripheral circulation and also the sampling technique is less traumatic than aspiration of bone marrow [19, 21]. In this study, we compared growth and potency of MSC cultured and isolated from bone marrow and those from peripheral blood of Sprague Dawley (SD) rats.

METHODS

Five male SD rats aged 8-12 weeks with average weight of 269 ± 15 g were prepared for harvesting of bone marrow and peripheral blood MSC. All procedures undertaken in this study have been approved by the Institutional Animal Care and Use Committee (IACUC) PT Bimana Indomedical Bogor (No R.03-11-IR) and ethical approval from Universitas Indonesia (No 131/PT02.FK/ETIK/2011).