

Comparing the Efficacy of Adipose-Derived vs. Bone Marrow-Derived Stem Cells in Combination with a Clinical-Grade Bone Graft Substitute in a Rat Model of Spinal Fusion

Benjamin D. Elder MD PhD; Christina Holmes PhD; Wataru Ishida MD; John Locke; Timothy F. Witham BS MD

[Institution]

Click To
Add Logo



Introduction

Adipose-derived stem cells (ADSCs) have been demonstrated to form vascularized bone in various animal and pre-clinical models. While bone marrow-derived stem cells (BMSCs) have been widely used in spinal fusion studies, adipose offers a number of advantages as an alternative clinical cell source, including a larger available tissue volume, higher stem cell concentration, and reduced donor site morbidity. In this study we compared the efficacy of ADSCs vs. BMSCs in achieving successful spinal fusion when combined with a clinical-grade bone graft substitute in a rat model.

Methods

ADSCs and BMSCs were isolated from the inguinal fat pads and long bones, respectively, of female Lewis rats (6-10 wk old) and cultured in vitro until passage 2 (P2) for subsequent transplantation. The frequency of colony forming unit fibroblast (CFU-F) colonies was also assessed in vitro for both ADSCs and BMSCs. Posterolateral spinal fusion surgery at L4-5 was performed on 36 female Lewis rats (6-10 wk old) divided into 3 experimental groups: [1] Vitoss (Stryker) clinical-grade bone graft substitute only (n=12); [2] Vitoss + 2.5×10^6 P2 ADSCs /side (n=12);

Results

ADSCs exhibited a faster proliferative rate and a higher frequency of CFU-F colonies in vitro than BMSCs. The mean fusion volume in the ADSC group was significantly larger than the BMSC and vitoss groups (44.3 mm³ vs. 27.6 and 30.0 mm³, respectively, p<0.01). The mean manual palpation score was the highest in the ADSC group compared with the BMSC and VO groups (1.5 versus 0.7 versus 0.8 p=0.03).

Conclusions

When combined with a bone graft substitute in a rat model, ADSCs yielded increased fusion mass volume and more robust fusion than BMSCs.

Learning Objectives

To discuss the outcomes of adipose-derived stem cells versus bone-marrow derived stem cells in a rat model

References