

# Co-transplantation of ES cells and bone marrow stromal cells for spinal cord injury suppresses tumor development

Ryosuke Matsuda<sup>1</sup>, Masahide Yoshikawa<sup>2</sup>, Hajime Kimura<sup>1</sup>, Yukiteru Ohji<sup>2</sup>, Hiroyuki Nakase<sup>1</sup>, Shigeaki Ishizaka<sup>2</sup>, Toshisuke Sakaki<sup>1</sup>

<sup>1</sup>Department of Neurosurgery, Nara Medical University, Nara, Japan; <sup>2</sup>Department of Parasitology, Nara Medical University, Nara, Japan

---

**Embryonic stem (ES) cells are a potential source for treatment of spinal cord injury (SCI). However, one of the main problems facing ES-based cell therapy is tumor formation. In this study, we examined whether co-transplantation of bone marrow stromal cells (BMSCs) with retinoic acid (RA)-treated ES cells prevented tumor formation in SCI mice. Mice transplanted with RA-treated ES cells alone developed tumors in the grafted site and behavioral improvement ceased after 4 weeks. In contrast, no development of tumors was observed in mice co-transplanted with BMSCs, which also showed sustained behavioral improvement. Further, we found attenuated mRNA expression of the undifferentiated markers Oct3/4, UTF1, Nanog, and Sox2 in RA-treated ES cells co-cultured with BMSCs *in vitro*. These results suggest that co-transplantation of ES cells and BMSCs is useful for preventing development of ES-derived tumors in ES-based cell therapy for SCI.**

**Keywords:** embryonic stem cell, bone marrow stromal cell, co-transplantation, NGF, tumor formation

*Cell Research* (2008) 18:s137. doi: 10.1038/cr.2008.227; published online 4 August 2008

---