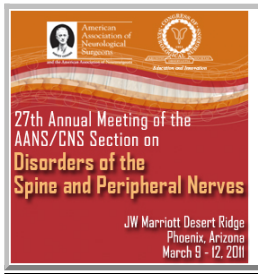

Attenuating Experimental Spinal Cord Injury by Hyperbaric Oxygen: Stimulating Production of Vasculoendothelial and Glial Cell Lines Derived Neurotrophic Growth Factors and Interleukin-10

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Introduction

The present study was to further examine the mechanisms underlying the beneficial effects of hyperbaric oxygen (HBO2) on experimental spinal cord injury (SCI).

Methods

Rats were divided into three major groups: (1) sham operation (laminectomy only); (2) laminectomy + SCI+ normobaric air (NBA; 21% O2 at 1 ATA); and (3) laminectomy + SCI + HBO2 (100% O2 at 2.5 ATA for 2 hours). Spinal cord injury was induced by compressing the spinal cord for 1 min with an aneurysm clip calibrated to a closing pressure of 55 g. HBO2 therapy was adopted immediately after SCI. Behavioral tests of hind limb motor function measured by Basso, Beattie, Bresnahan (BBB) locomotor scale was conducted at day 1 to 7 after SCI or sham operation. The triphenyltetrazolium chloride (TTC) staining and terminal deoxynucleotidyl transferase-mediated deoxyuridine triphosphate biotin nick end labeling assay (TUNEL) were also conducted after SCI to evaluate spinal cord infarction and apoptosis, respectively. Glial cell line-derived neurotrophic factor (GDNF) positive cells, vascular endothelial growth factor (VEGF) positive cells, and cytokines in the spinal cord were assayed at 4 hr after SCI or sham operation by immunofluorescence and commercial kits, respectively.

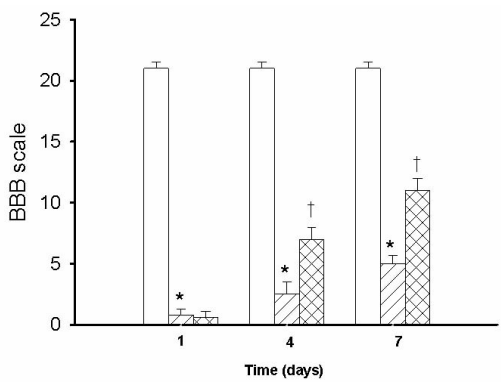
Results

It was found that HBO2 therapy significantly attenuated the SCI-induced hind limb dysfunction (Fig 1), spinal cord infarction (Fig 2) and apoptosis (Fig 3), and overproduction of spinal cord interleukin-1ß (IL-1ß) and tumor necrosis factor-a (TNF-a)(Fig 6). In contrast, the numbers of both GDNF-positive (Fig 5) and VEGF-positive (Fig 4) cells and production of spinal cord interleukin-10 (IL-10)(Fig 6) during SCI were all significantly increased by HBO2.

Conclusions

These data suggested that HBO2 may attenuate experimental SCI by stimulating production of GDNF, VEGF and interleukin-10.

Fig 1



(): sham-operated; (): NBA-treated SCI; (): HBO2-treated SCI. *p<0.01 vs. sham; †p<0.01 vs. SCI

Fig 2

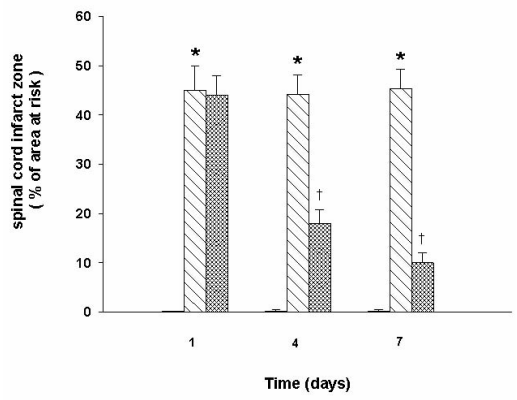


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Fig 3

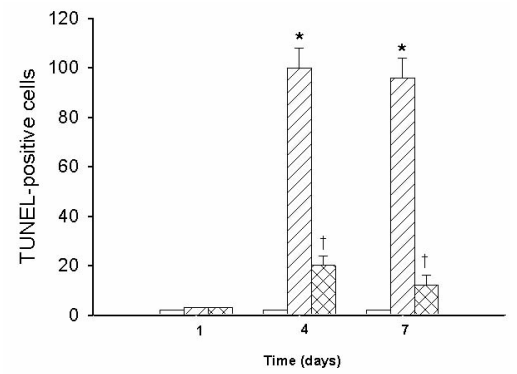

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Fig 4

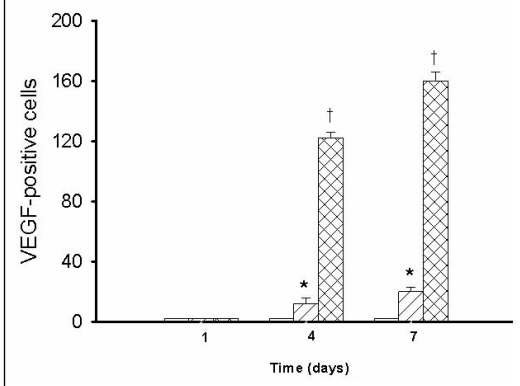


Fig 5

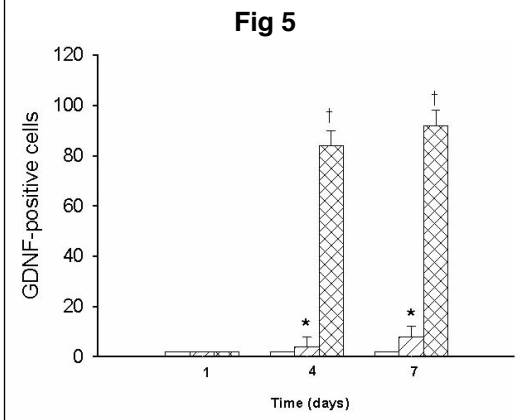
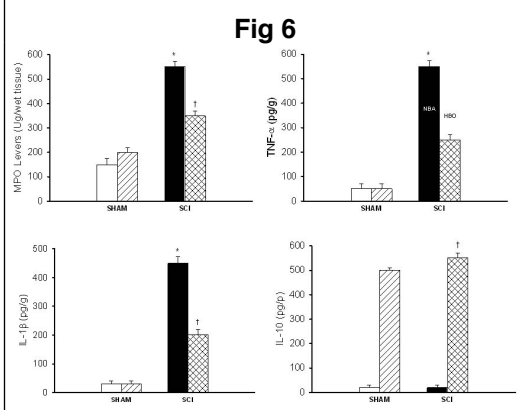


Fig 6



NBA+SCI (); *P<0.05 vs. sham; †P<0.01 vs. NBA+SCI

Fig 1

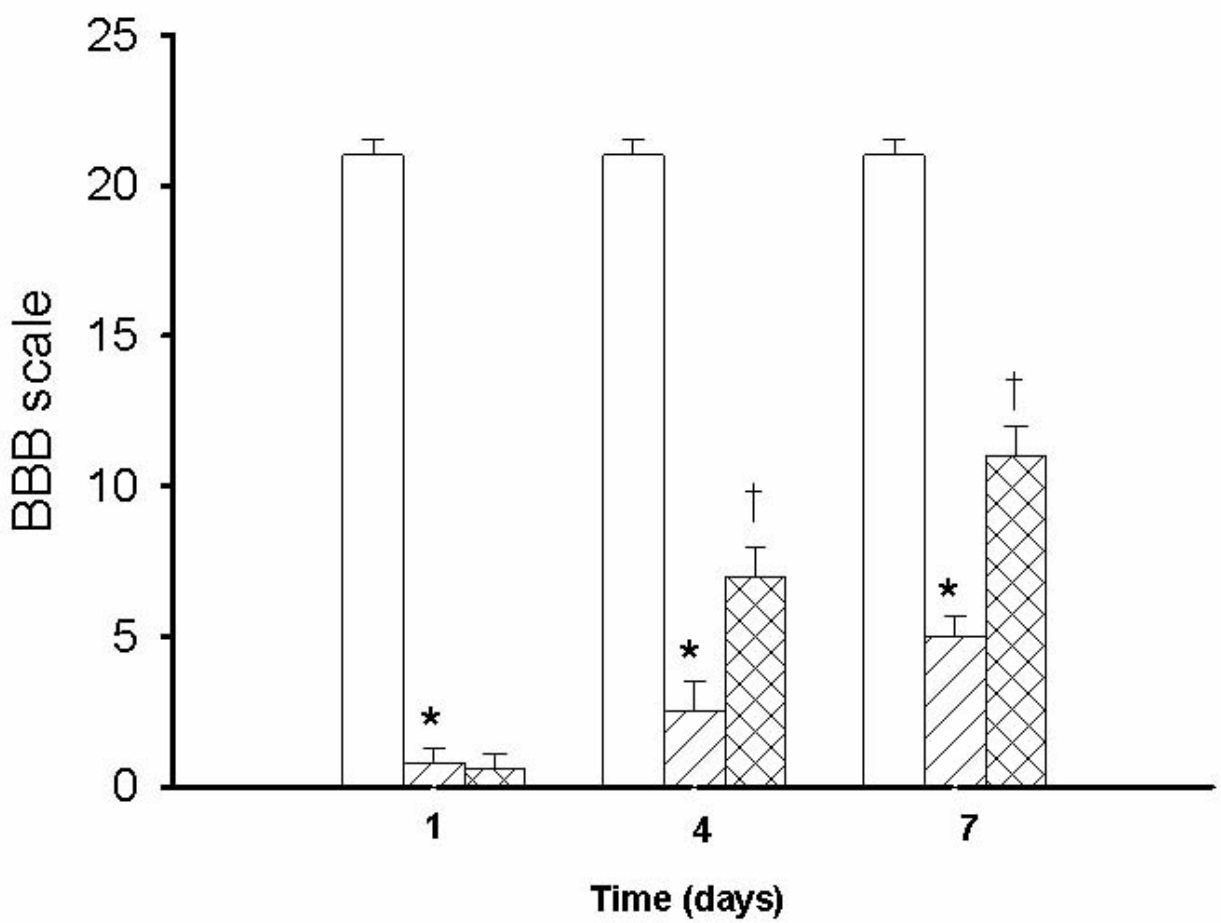


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Fig 2

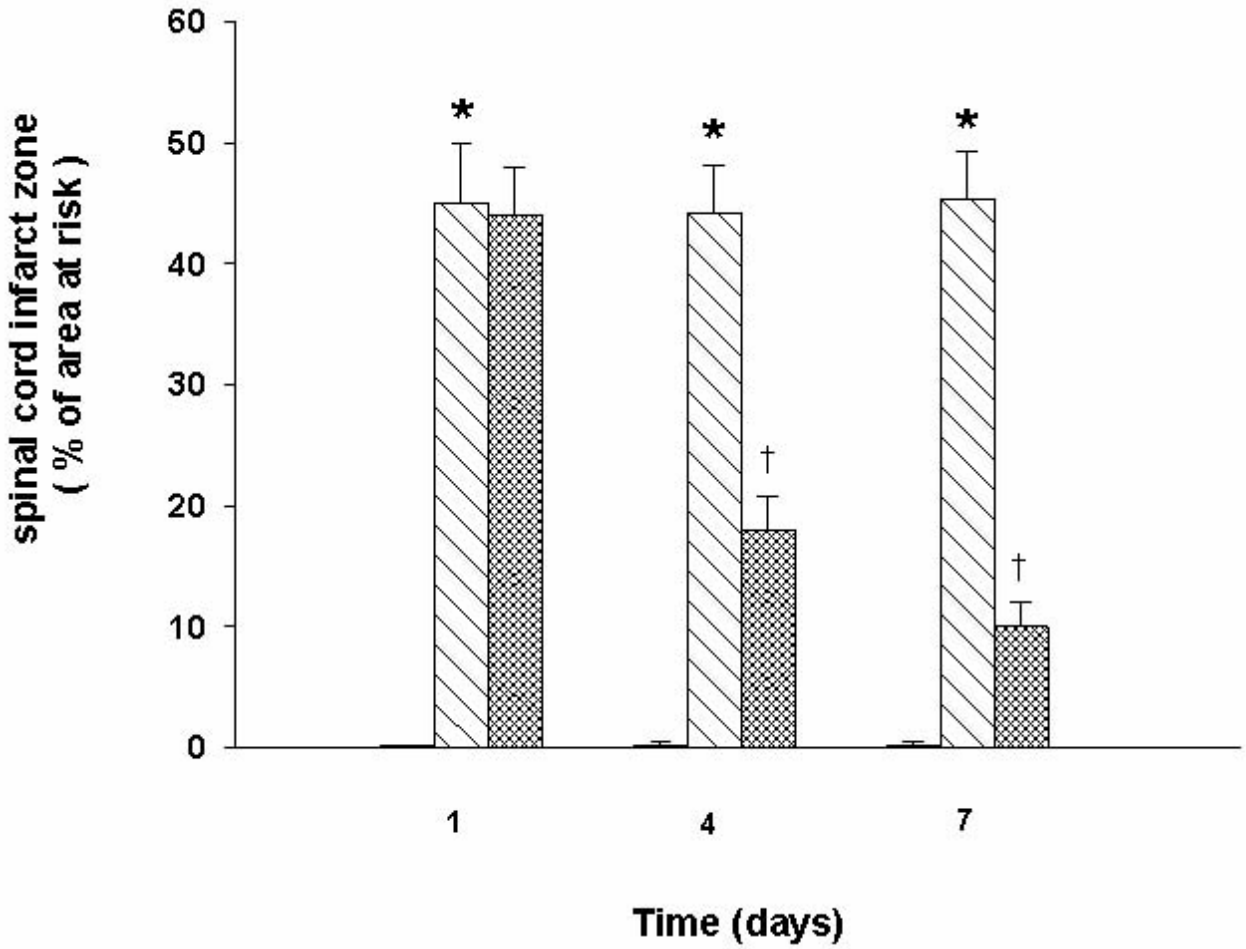

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Fig 3

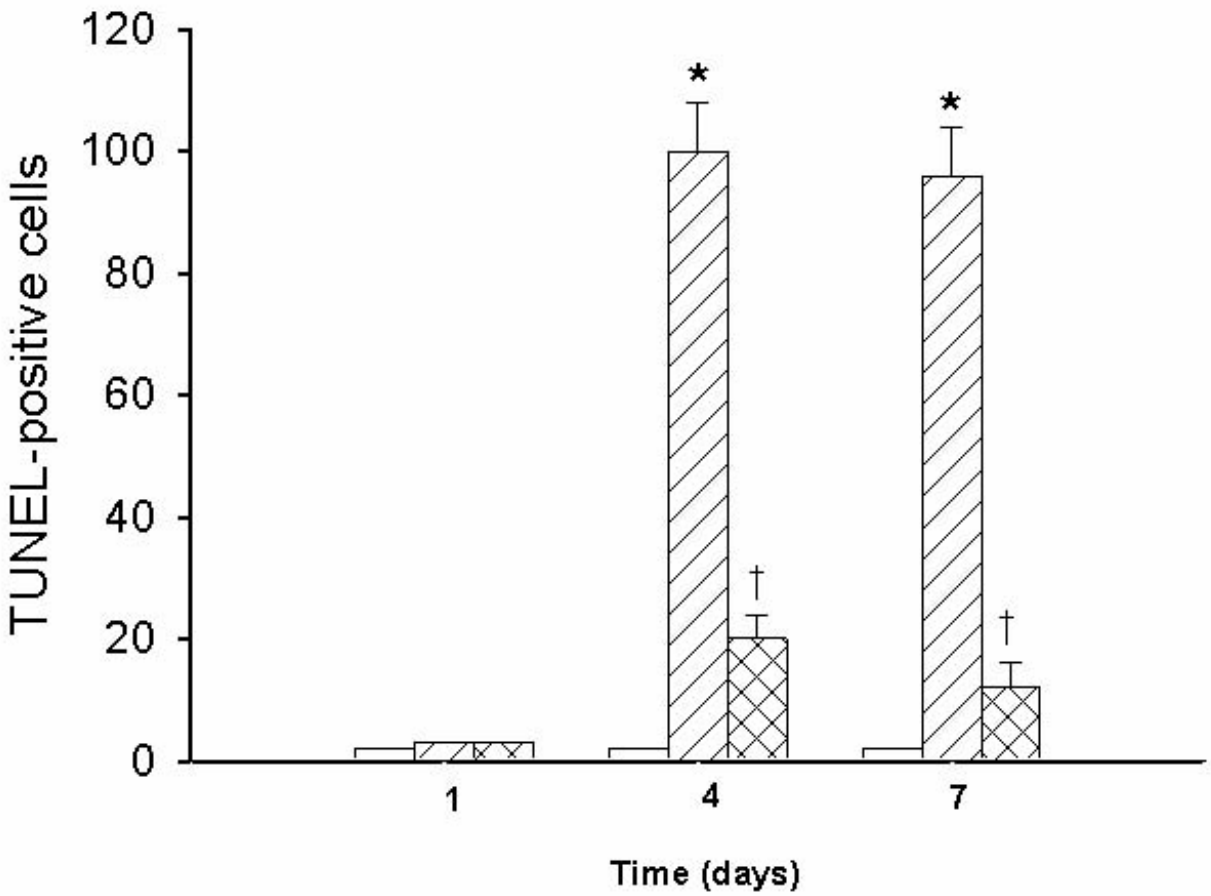

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Fig 4

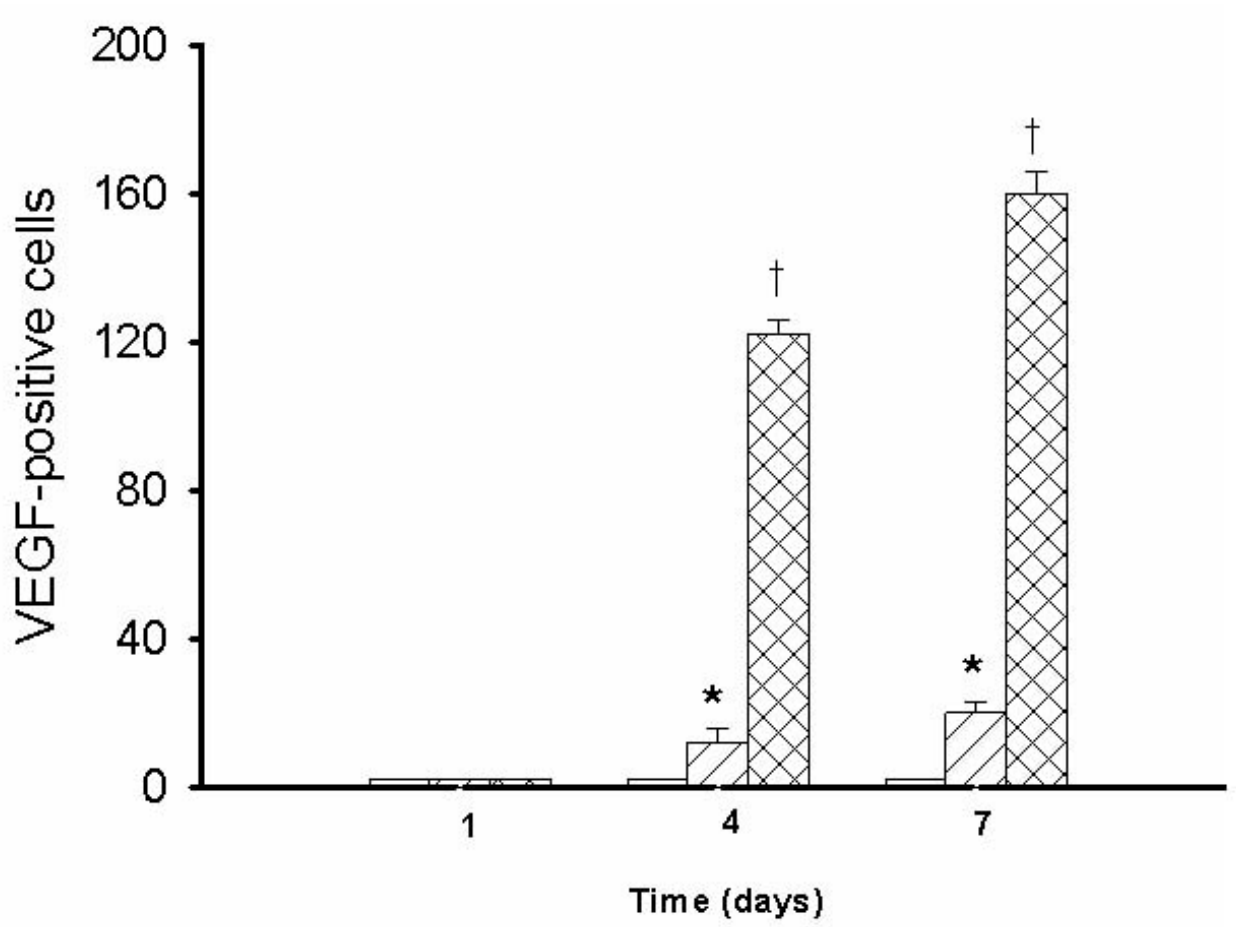


Fig 5

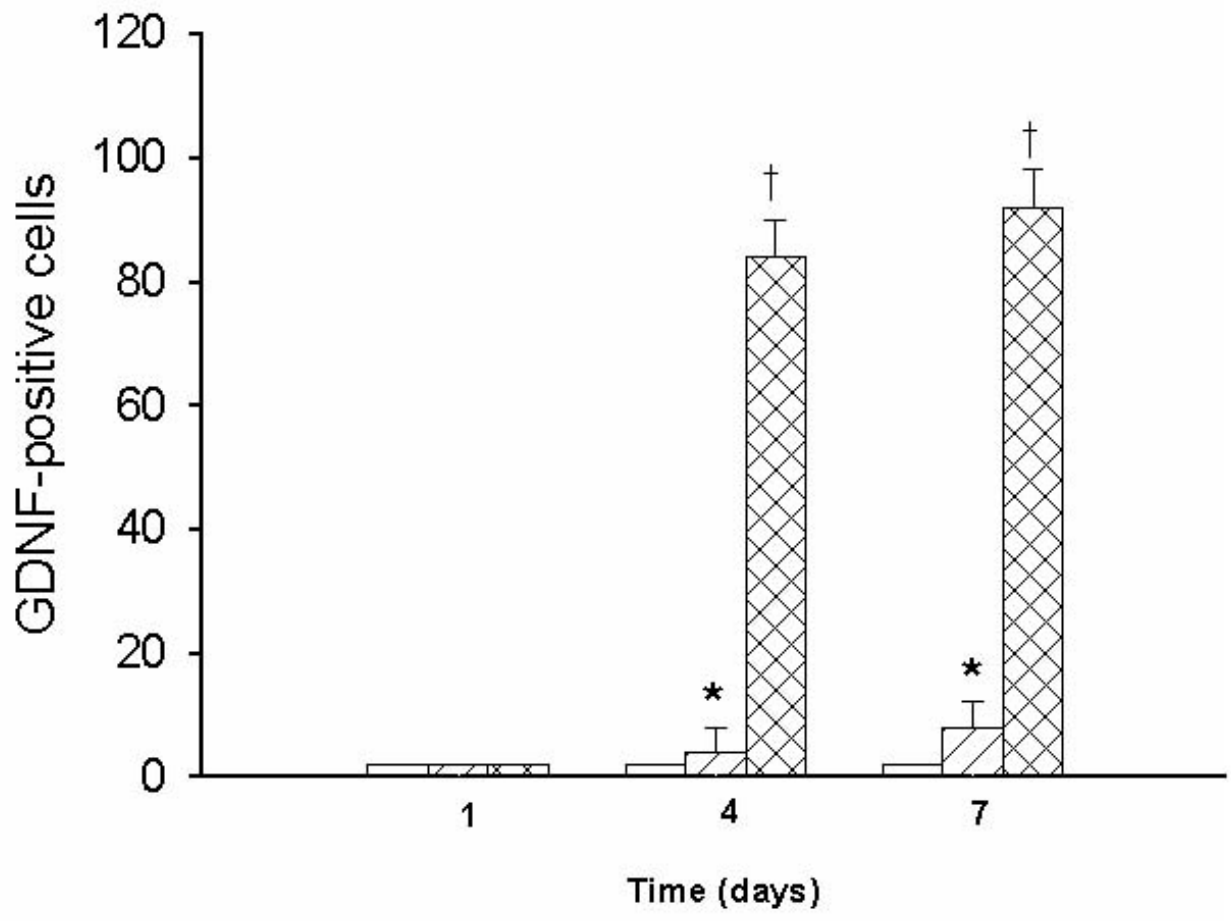
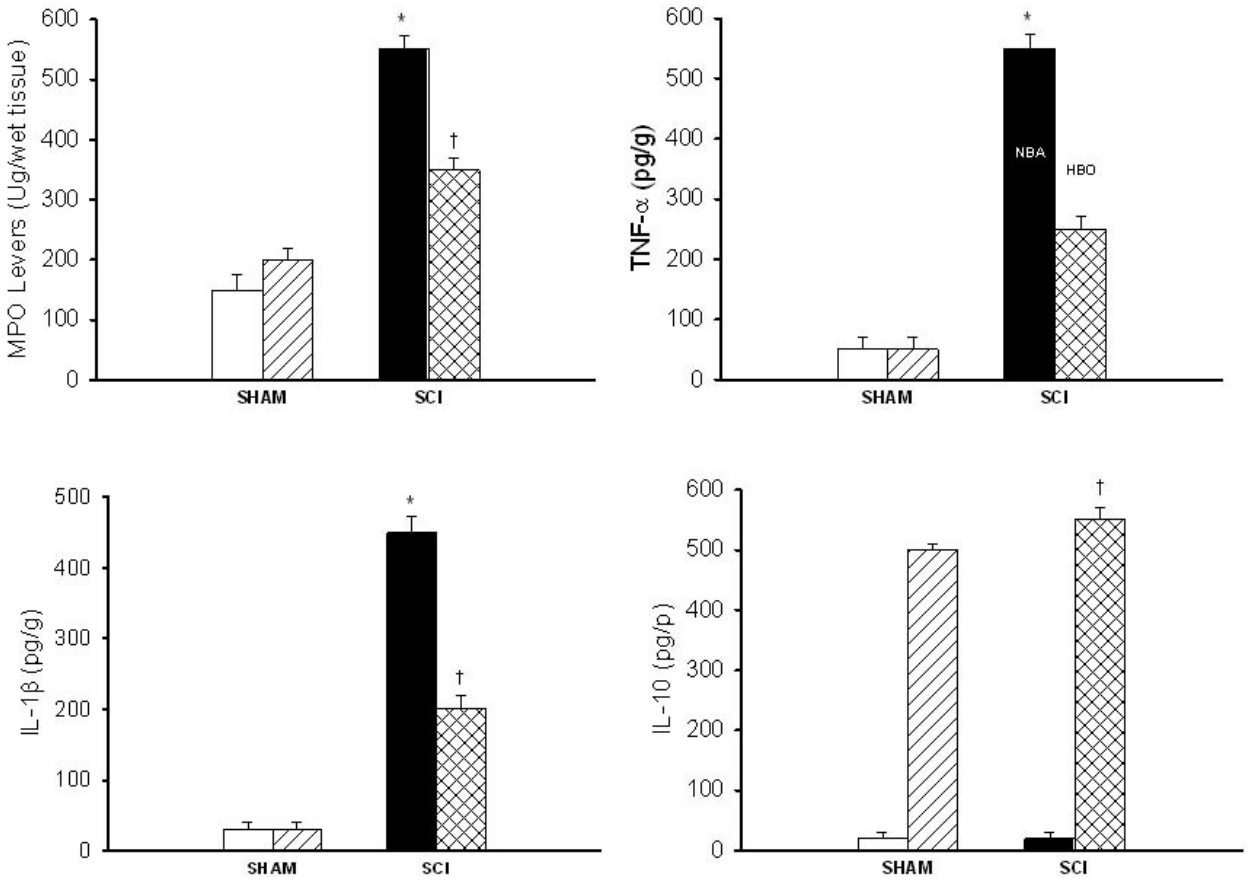


Fig 6



NBA+SCI (); *P<0.05 vs. sham; †P<0.01 vs. NBA+SCI