The effects of ozone therapy on inflammatory response associated with traumatic spinal cord injury in cutaneous wound healing in rats

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Introduction: At the cellular level, experimental spinal cord injury (SCI) provokes an inflammatory response, leading to delay in wound healing and low intensity of transforming growth factor-β1 (TGF-β1) in the dorsal wound-tissue specimens. Systemic application of ozone leads to delivery of super enriched oxygen at a cellular level and optimizes cell function via activating the red blood cell, immune-competent cells, the enzymatic antioxidants and radical scavengers at a cellular level. The aim of this study was to investigate the effects of ozone therapy on inflammatory response associated with SCI in cutaneous wound healing in rats.

Method: The rats were allocated to one of the three groups: Group T (trauma only, n=7): SCI was performed as described. The dorsal wound margins were apposed with a non-absorbable interrupted suture. Then, 4 mL of medical air was insufflated rectally during 1 min. via an 18G cannula once a day for 5 consecutive days. Group O (trauma+ozone, n=7): After trauma induction, instead of medical air, 4 mL of ozone (10mcg/mL) was insufflated. Group Control (no trauma, n=2): No treatment was applied. All rats were sacrificed at Day 14. Wound samples taken from the dorsum of the rats were evaluated histologically (as thickness of epithelium, thickness and regeneration of collagen fibers), immunohistochemically (expressions of TGF-β and VEGF), histomorphometrically (the number of blood vessels) and biochemically (hydroxyproline and hydroxyproline/protein levels). For statistical analysis, non-parametric ANOVA and Dunn’s test as a post-hoc were used (p<0.05).

Results: Histological evaluation of the tissue samples were revealed that vessel count was higher in ozone than in other groups (p<0.001 for each). Hydroxyproline levels in ozone group is approximately 1.8 times greater (p<0.05) when compared to others. Similarly, hydroxyproline to total protein ratios were 1.5 and 1.6 times greater (p<0.05) in ozone group when compared to others. Although, in histochemistry analyses revealed that collagenization in ozone group was lesser than in control group (p<0.001), it was significantly higher than in trauma group (p<0.001). Also, collagen organization was worse in trauma group than both ozone (p<0.05) and control (p<0.01). Although expression of TGF-β and VEGF was worse in ozone group than in control group (p<0.001; expressions of these growth factors was worse in trauma group then the others (p<0.001 for both groups).

Conclusion: Based on the results on the parameters evaluated in the study, ozone therapy reverses the inflammatory response associated with traumatic SCI, leads to better dorsal cutaneous wound healing via intensifying expressions of TGF-β and VEGF in rats.