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Hyperbaric oxygen therapy in the management of crush injuries: a randomized double-blind placebo-controlled clinical trial.

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Hyperbaric Oxygen (HBO) therapy is advocated for the treatment of severe trauma of the limbs in association with surgery because of its effects on peripheral oxygen transport, muscular ischemic necrosis, compartment syndrome, and infection prevention. However, no controlled human trial had been performed until now to specify the role of HBO in the management of crush injuries. Thirty-six patients with crush injuries were assigned in a blinded randomized fashion, within 24 hours after surgery, to treatment with HBO (session of 100% O₂ at 2.5 atmosphere absolute (ata) for 90 minutes, twice daily, over 6 days) or placebo (session of 21% O₂ at 1.1 ata for 90 minutes, twice daily, over 6 days). All the patients received the same standard therapies (anticoagulant, antibiotics, wound dressings).

Transcutaneous oxygen pressure (PtCO₂) measurements were done before (patient breathing normal air) and during treatment (HBO or placebo) at the first, fourth, eighth, and twelfth sessions. The two groups (HBO group, n = 18; placebo group, n = 18) were similar in terms of age; risk factors; number, type or location of vascular injuries, neurologic injuries, or fractures; and type, location, or timing of surgical procedures. Complete healing was obtained for 17 patients in the HBO group vs. 10 patients in the placebo group (p < 0.01). New surgical procedures (such as skin flaps and grafts, vascular surgery, or even amputation) were performed on one patient in the HBO group vs. six patients in the placebo group (p < 0.05). Analysis of groups of patients matched for age and severity of injury showed that in the subgroup of patients older than 40 with grade III soft-tissue injury, wound healing was obtained for seven patients (87.5%) in the HBO group vs. three patients (30%) in the placebo group (p < 0.05). No significant differences were found in the length of hospital stay and number of wound dressings between groups. For the patients with complete healing, the PtCO₂ values of the traumatized limb, measured in normal air, rose significantly between the first and the twelfth sessions (p < 0.001). No significant change in PtCO₂ value was found for the patients whose healing failed. The Bilateral Perfusion Index (BPI = PtCO₂ of the injured limb/PtCO₂ of the uninjured limb) at the

first session increased significantly from 1 ata air to 2.5 ata O₂ ($p < 0.05$). In patients with complete healing, the BPI was constantly greater than 0.9 to 2.5 ata O₂ during the following sessions, whereas the BPI in air progressively rose between the first and the twelfth sessions ($p < 0.05$), reaching normal values at the end of the treatment. In conclusion, this study shows the effectiveness of HBO in improving wound healing and reducing repetitive surgery. We believe that HBO is a useful adjunct in the management of severe (grade III) crush injuries of the limbs in patients more than 40 years old.
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