

# HBOT in the Treatment of Acute Blood Loss Anemia

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## Mechanisms of Action

The efficacy of hyperbaric therapy is based on an elevation of the partial pressure of oxygen (PO<sub>2</sub>), resulting in hyperoxygenation of perfused tissues.

Barometric pressure changes during HBO therapy are often expressed in multiples of atmospheres absolute (ATA). A change of one ATA is equivalent to 14.7 psi, 760 mm Hg, or 33 feet of seawater. Most HBO treatments are conducted between two and three ATA. When pressure is crucial to therapeutic effect, treatments can be performed at six ATA.

Hyperoxygenation of tissues is based on Henry's Law. As the PO<sub>2</sub> increases during compression, the amount of oxygen dissolved directly into the plasma increases. The increased PO<sub>2</sub> has a negligible impact on total hemoglobin oxygen content and the oxyhemoglobin dissociation curve remains unchanged.

At sea level in room air, there is 0.32 ml of oxygen dissolved in each 100 ml of whole blood (0.32 vol%). Unlike the hemoglobin saturation curve, the amount of oxygen dissolved in plasma is linearly related to the oxygen partial pressure. When breathing 100% oxygen, each additional atmosphere of pressure produces an additional 2.3 vol% oxygen dissolved in plasma. At three ATA, the maximum pressure using 100% oxygen, plasma contains 6.8 vol% oxygen. This elevated oxygen pressure increases the oxygen diffusion gradient and improves oxygen delivery to relatively ischemic tissues.

The cardiovascular effects of HBO therapy include a nominal reduction in cardiac

output and a generalized vasoconstriction. Systemic vascular resistance increases, but blood pressure changes very little because of a vagal-mediated bradycardia. While the vasoconstrictive effect may appear to add to cellular hypoxia, the increase in plasma oxygen content results in an overall gain in delivered oxygen.

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## ACUTE EXCEPTIONAL BLOOD LOSS ANEMIA

Hart GB, Lennon PA, Strauss MB: Hyperbaric oxygen in exceptional acute blood-loss anemia. *Journal of Hyperbaric Medicine* 1987;2(4):305-210.

Exceptional Blood Loss. Hyperbaric oxygen therapy may temporarily help to sustain life in cases of severe acute blood loss due to either exsanguination or hemolysis. Immediate transfusion is clearly the treatment of choice, but may not be possible for medical or religious reasons. The basic rationale for HBO therapy is that, at three ATA, enough oxygen is dissolved physically in plasma to support tissue metabolic functions until the red blood cells are restored. Hart reported improved survival in a small group of patients using this approach.

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*Anesteziol Reanimatol* 1989 Mar-Apr;(2):37-9

[The efficacy of hyperbaric oxygenation in experimental and hemorrhagic shock].  
[Article in Russian]

Sherman DM, Sennik VT, Sidenko VP

The efficacy of hyperbaric oxygenation (HBO, 2 atm, 1 h, altitude chamber "Irtys-MT") has been studied in acute experiments on 56 adult dogs with hemorrhagic and traumatic shock. It has been established that HBO has a marked therapeutic effect in hemorrhagic shock, especially in its early period, when almost all the animals are saved from death. In the late period of hemorrhagic shock and in the early period of traumatic shock HBO effect was manifested only in insignificant increase in the animals' survival and lifespan. In the late period of traumatic shock toxic effect of hyperbaric O<sub>2</sub> application was observed and the majority of animals died before the

end of HBO session.

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