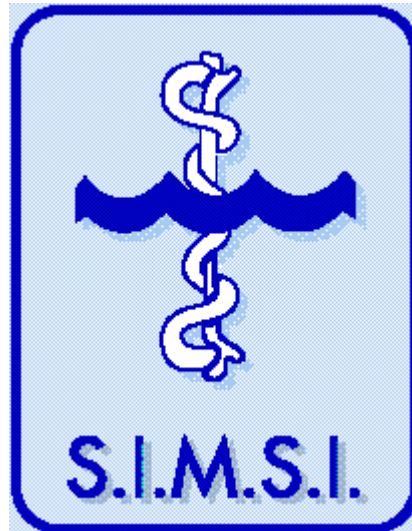


**SOCIETA' ITALIANA  
DI  
MEDICINA SUBACQUEA E IPERBARICA**



**RICERCA IN MEDLINE DEI LAVORI DI  
OSSIGENO TERAPIA IPERBARICA  
INDICIZZATI CON PAROLA CHIAVE DI IMPORTANZA RILEVANTE**

**2006  
PRIMO SEMESTRE**

a cura del  
**Dott. Francesco Ruocco**  
Servizio di Medicina Iperbarica e Subacquea  
Anestesia e Rianimazione del Dipartimento di Emergenza  
della Azienda Ospedaliera Universitaria di Careggi

Search "**Hyperbaric Oxygenation**"[MAJR] Limits: **Publication Date from 2006/01 to 2006/06**

**Search "Hyperbaric Oxygenation"[MAJR] Limits: Publication Date from 2006/01 to 2006/06**

1: Mediators Inflamm. 2006;2006(5):72620.

Exhaled nitric oxide is decreased by exposure to the hyperbaric oxygen therapy environment.

Puthuchery ZA, Liu J, Bennett M, Trytko B, Chow S, Thomas PS.

UNSW and Department of Respiratory Medicine, Faculty of Medicine, Prince of Wales Hospital, Randwick, NSW, Australia.

Exhaled nitric oxide (eNO) detects airway inflammation. Hyperbaric oxygen therapy (HBOT) is used for tissue hypoxia, but can cause lung damage. We measured eNO following inhalation of oxygen at different tensions and pressures. METHODS: Part 1, eNO was measured before and after HBOT. Part 2, normal subjects breathed 40% oxygen. RESULTS: Baseline eNO levels in patients prior to HBOT exposure were significantly higher than in normal subjects ( $P < .05$ ). After HBOT, eNO significantly decreased in patients ( $15.4 \pm 2.0$  versus  $4.4 \pm 0.5$  ppb,  $P < .001$ ), but not in normal subjects, after either 100% O<sub>2</sub> at increased pressure or 40% oxygen, 1 ATA. In an in vitro study, nitrate/nitrite release decreased after 90 minutes HBOT in airway epithelial (A549) cells. CONCLUSION: HBO exposure causes a fall in eNO. Inducible nitric oxide synthase (iNOS) may cause elevated eNO in patients secondary to inflammation, and inhibition of iNOS may be the mechanism of the reduction of eNO seen with HBOT.

PMID: 17392577 [PubMed - indexed for MEDLINE]

2: CJEM. 2006 May;8(3):147.

Comment on: CJEM. 2006 Jan;8(1):43-6.

Hyperbaric oxygen for carbon monoxide poisoning.

Amies DR.

Publication Types: Comment Letter

PMID: 17320007 [PubMed - indexed for MEDLINE]

3: CJEM. 2006 Jan;8(1):43-6.

Comment in: CJEM. 2006 May;8(3):147.

Should hyperbaric oxygen be used for carbon monoxide poisoning?

Silver S, Smith C, Worster A; The BEEM (Best Evidence in Emergency Medicine) Team.

Emergency Department, Hamilton Health Sciences McMaster University Medical Center, W. Hamilton, ON.

Publication Types: Review

PMID: 17175630 [PubMed - indexed for MEDLINE]

4: Technol Health Care. 2006;14(6):489-98.

Hyperbaric oxygen and lymphoid system function: a review supporting possible intervention in tissue transplantation.

Al-Waili NS, Butler GJ, Petrillo RL, Carrey Z, Hamilton RW.

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This review addresses the many ways that hyperbaric oxygen (HBO<sub>2</sub>) has been found to mitigate immune reactions, many of which are involved in rejection of allograft transplants, and thus offers a rationale for its possible use as an adjunct to help preserve and protect transplanted tissues. Rejection may involve both immunological reactions of the lymphoid system, or lymphoid-independent damage from trauma or other factors, including reperfusion injury. Lymphoid-induced damage involves cellular elements such as CD4 and macrophage cell types, as well as both proinflammatory and inhibitory cytokines. Cytokines such as TNFs and interleukins activate T-cells and macrophages, resulting in endothelial damage and its consequences. The immunosuppressive effects of HBO<sub>2</sub> include suppression of autoimmune symptoms, decreased production of IL-1 and CD4 cells, and increased percentage and absolute number of CD8 cells. HBO<sub>2</sub> normalizes cell-bound immunity and decreases the serum concentration of immune complexes. Studies have shown MHC class I expression to be altered when cultures were exposed to HBO<sub>2</sub>, so as to become undetectable by monoclonal antibodies or cytotoxic T lymphocytes. HBO<sub>2</sub> has been used in support of replanted rabbit ear grafts, spinal cord tissue transplants, dislocated young permanent teeth in children, replanting of fingers, free fibula reconstruction of segmental mandibular resections, autogenous free bone grafts, transplantations of the cornea, and liver transplants. In addition to its specific effects on the immune system, HBO<sub>2</sub> improves tissue oxygenation, reduces free radical damage during reperfusion, maintains marginally ischemic tissue, and accelerates wound healing. These properties make HBO<sub>2</sub> a promising intervention to be tested in transplantation recipients.

Publication Types: Review

PMID: 17148861 [PubMed - indexed for MEDLINE]

5: Scand J Plast Reconstr Surg Hand Surg. 2006;40(5):257-60.

Effect of hyperbaric oxygen on survival of composite grafts in rats.

Fodor L, Ramon Y, Meilik B, Carmi N, Shoshani O, Ullmann Y.

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Most treatment with hyperbaric oxygen (HBO) in plastic surgery is for wounds, burns, crush injuries, and infections. We aimed to find out if HBO increases the survival of composite grafts in rats. Twenty Sprague-Dawley rats were randomly assigned to two equal groups (treatment and control). A template 30 x 30 mm was placed on the skin and a composite graft taken from the upper back was harvested and then resutured to the fascia in situ. The treated group was placed in a hyperbaric chamber set at 202 kPa and 100% oxygen for 90 minutes daily for two weeks. Control animals were given no treatment. After death the mean surviving internal surface area of the graft was 372.5 (117.9) mm<sup>2</sup> in the control group and 561.3 (85.7) mm<sup>2</sup> in the experimental group (p=0.001). Treatment with HBO improved the surviving area of composite grafts in rats, and the beneficial effect was prominent only on the inner surface of the graft.

PMID: 17065113 [PubMed - indexed for MEDLINE]

6: *Aviakosm Ekolog Med.* 2006 Mar-Apr;40(2):42-6. [The mathematical model of the blood circulation and external respiration functional state during high-pressure oxygenation or hyperoxia] [Article in Russian]

Bukharov IB.

Based on the minimal energy uptake, the proposed mathematical model of blood circulation and external respiration functioning during high-pressure oxygenation or hyperoxia allows solution of the optimization task with restrictions dictated by adequate functioning of the two systems. Optimal levels of oxygen and carbon dioxide pressure in arterial and venous blood, minute blood volume and alveolar ventilation as a function of O<sub>2</sub> partial pressure in inspired gas mixture were determined. Calculations are compared with experimentally derived values.

Publication Types: Comparative Study English Abstract

PMID: 16999073 [PubMed - indexed for MEDLINE]

7: *Otolaryngol Pol.* 2006;60(3):401-5.

[Influence of hyperbaric oxygen on the view of chicken's inner ear damage after exposure to wide-band noise]

[Article in Polish]

Narozny W.

Katedra i Klinika Chorób Uszu, Nosa, Gardła i Krtani AM w Gdańsku. naroznyw@wp.pl

The aim of the study was to assess the influence of hyperbaric oxygen on regeneration processes which take place in the inner ear (basilar papilla - BP) of chicken after exposure to wide-band noise at the level 120 dB for 48 hours. We found, that hyperbaric oxygen applied once a day after exposure to the noise restricted the extensiveness and decreased the dynamics of hair cells injury. Quantitative and qualitative differences in histological changes which take place in chick basilar papilla after exposure to

hyperbaric oxygen and glucocorticoids may prove the presence of different their effectory points of acting.

Publication Types: English Abstract

PMID: 16989455 [PubMed - indexed for MEDLINE]

8: *Ann Emerg Med.* 2006 Sep;48(3):319-22. Epub 2006 Mar 20.

Treatment of severe carbon monoxide poisoning using a portable hyperbaric oxygen chamber.

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We report the first case of suspected carbon monoxide poisoning treated by hyperbaric oxygen therapy by using a portable hyperbaric stretcher. A 40-year-old British man in Kabul, Afghanistan, was found unresponsive in his apartment. Initial treatment consisted of oxygen by mask at a Combat Support Hospital for several hours, with minimal improvement. Operational security and risk prevented his immediate evacuation to the nearest fixed hyperbaric facilities. He was subsequently treated twice using an Emergency Evacuation Hyperbaric Stretcher, according to the US Navy Diving Manual treatment Table 9. The patient showed marked neurologic improvement after the first treatment and experienced near complete recovery before eventual evacuation. This case illustrates the practical use of portable chambers for the treatment of suspected cases of carbon monoxide poisoning in an austere environment.

Publication Types: Case Reports

PMID: 16934652 [PubMed - indexed for MEDLINE]

9: *B-ENT.* 2006;2(2):69-73.

Hyperbaric oxygen therapy after failure of conventional therapy for sudden deafness.

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PROBLEMS/OBJECTIVES: We investigated the effect of secondary hyperbaric oxygen therapy (HBO) for patients with idiopathic sudden sensorineural hearing loss after unsuccessful conventional treatment. METHODOLOGY: We retrospectively evaluated 3 groups: 100 patients without further treatment (group 1), 160 patients with secondary HBO at 1.5 ATA (group 2), and 56 patients with secondary HBO at 2.5 ATA (group 3). RESULTS: In group 1, a mean hearing gain (MHG) of 2.6 +/- 15 dB was found at the end of the follow-up period. After HBO, a MHG of 3.1 +/- 9 dB in group 2 and 19.7 +/- 23 dB in group 3 was achieved. The results in group 3 were statistically significant in comparison to group 1 (p < 0.007) and to group 2 (p < 0.009). With HBO after initial therapy failure, there is a significant correlation of MHG with time delay before HBO (p < 0.03). CONCLUSIONS: HBO at 2.5 ATA in patients with idiopathic sudden sensorineural hearing loss after unsuccessful

conventional treatment yields significant improvement of hearing. MHG is higher when time delay before HBO is shorter.

PMID: 16910290 [PubMed - indexed for MEDLINE]

10: Bosn J Basic Med Sci. 2006 May;6(2):21-4.

Hyperbaric oxygenation as a possible therapy of choice for infertility treatment.

Mitrović A, Nikolić B, Dragojević S, Brkić P, Ljubić A, Jovanović T.

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Endometrial sonographic and color doppler features can be used to predict the occurrence of pregnancy in natural or stimulated cycles. Implantation will usually only take place if the endometrium has reach a certain stage of vascularisation and development. The aim of this study was to evaluate endometrial development -- endometrial thickness and reflectivity , subendometrial, endometrial and uterine perfusion, after hyperbaric oxygenation, using transvaginal color doppler. During a three years period 32 women with unexplained infertility were entered into a randomised study. The patients were treated in multiplaced HAUX chamber at pressure of 2.3 ATA during 70 minutes, 7 days consecutively beginning with day 5th of menstrual cycle. The evaluation of effects of hyperbaric oxygen therapy was carried out by transvaginal color doppler sonography which was continuously used starting from 8th day of menstrual cycle until the ovulation in the cycles when the therapy was applied , one month before and one month after the therapy. Folliculometry in the cycles when hyperbaric oxygen therapy at 2.3 ATA was applied, indicated an excellent response of endometrium. Thickness of endometrium at the time of ovulation was 11.0 +/- 2.6 mm. Desirable quality of endometrium was significantly better in the cycle when HBO therapy had been applied ( $p < 0.001$ ). The doppler flowmetry of the uterine arteries indicated that the uterine blood vessel resistance was slightly higher than expected. Mapping of subendometrial blood vessels in the cycles covered by hyperbaric oxygen therapy showed the intensive capillary network of endometrium with low resistance  $R_i < 0.45$ . The oxygen used under higher pressure -- oxygen as a drug , may have an extraordinary significance for better outcome of pregnancy implantation by improving endometrial receptivity. If endometrial receptivity is conditioned by adequate vascularisation and oxygenation, then hyperbaric oxygen therapy is the treatment of choice.

PMID: 16879108 [PubMed - indexed for MEDLINE]

11: Undersea Hyperb Med. 2006 May-Jun;33(3):169-74.

Nitric oxide amplifies the excitatory to inhibitory neurotransmitter imbalance accelerating oxygen seizures.

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CNS O<sub>2</sub> toxicity is manifested most profoundly by generalized motor convulsions. The hypothesis was tested that HBO<sub>2</sub> triggers seizures by an excitatory to inhibitory neurotransmitter imbalance produced by neuronal nitric oxide (NO) activity. Anesthetized rats were exposed to 5 ATA HBO<sub>2</sub> for 75 min with or without prior inhibition of nNOS. Interstitial NO and amino acids: aspartate (Asp), glutamate (Glu) and gamma-aminobutyric acid (GABA) were determined in the striatum by microdialysis coupled with HPLC. Blood flow and EEG in the same striatal region were measured simultaneously. Rats treated with 7-NI showed no EEG spikes of O<sub>2</sub> toxicity, while seizure latency for untreated rats was 63 +/- 7 min. Significant increases in NO metabolites and blood flow were observed in control rats before seizures. HBO<sub>2</sub> did not change Glu significantly and increased Asp slightly whereas GABA decreased progressively by 37 +/- 7%. Pretreatment with 7-NI led to a significantly smaller decline in GABA. Overall, the simplified excitotoxicity index Glu/GABA increased significantly after 60 min of HBO<sub>2</sub> in control but fell in rats treated with 7-NI. We conclude that HBO<sub>2</sub>-stimulated neuronal NO production promotes an imbalance between glutamatergic and GABAergic synaptic function implicated in the genesis of oxygen-induced seizures.

Publication Types: Research Support, Non-U.S. Gov't Research Support, U.S. Gov't, Non-P.H.S.

PMID: 16869530 [PubMed - indexed for MEDLINE]

12: Exp Neurol. 2006 Oct;201(2):316-23. Epub 2006 Jun 30.

Neuroprotective effect of hyperbaric oxygen therapy monitored by MR-imaging after embolic stroke in rats.

Henninger N, Küppers-Tiedt L, Sicard KM, Günther A, Schneider D, Schwab S.

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The potential neuroprotective effects of hyperbaric oxygen (HBO) were tested in an embolic model of focal cerebral ischemia with partially spontaneous reperfusion. Rats ( $n = 10$ ) were subjected to embolic middle cerebral artery occlusion (MCAO) and diffusion weighted MRI (DWI) was performed at baseline, 1, 3, and 6 h after MCAO to determine the ADC viability threshold yielding the lesion volumes that best approximated the 2,3,5-triphenyltetrazolium chloride (TTC) infarct volumes at 24 h (experiment 1). For assessment of neuroprotective effects, rats were treated with 100% oxygen at 2.5 atmospheres absolute (ATA,  $n = 15$ ) or normobaric room air ( $n = 15$ ) for 60 min beginning 180 min after MCAO (experiment 2). DWI-, perfusion (PWI)- and T2-weighted MRI (T2WI) started within 0.5 h after MCAO and was continued 5 h, 24 h (PWI and T2WI only), and 168 h (T2WI only). Infarct volume was

calculated based on TTC-staining at 24 h (experiment 1) or 168 h (experiment 2) post-MCAO. ADC-lesion evolution was maximal between 3 and 6 h. In experiment 2, the relative regional cerebral blood volume (rCBV) of both groups showed similar incomplete spontaneous reperfusion in the ischemic core. HBO reduced infarct volume to 145.3 +/- 39.6 mm<sup>3</sup> vs. 202.5 +/- 58.3 mm<sup>3</sup> (control, P = 0.029). As shown by MRI and TTC, HBO treatment demonstrated significant neuroprotection at 5 h after embolic focal cerebral ischemia that lasted for 168 h. PMID: 16814772 [PubMed - indexed for MEDLINE]

13: Toxicology. 2006 Aug 15;225(2-3):138-41. Epub 2006 May 26.

Immediate oxygen therapy prevents brain cell injury in carbon monoxide poisoned rats without loss of consciousness.

Bunc M, Luzar B, Finderle Z, Suput D, Brvar M. Institute of Pathophysiology, School of Medicine, University of Ljubljana, Zaloska cesta 4, Slovenia. matjaz.bunc@kclj.si

In CO-poisoned patients without loss of consciousness no significant long-term functional differences in outcome have been shown in any hyperbaric versus normobaric oxygen studies. Since brain histology changes cannot be studied in CO-poisoned patients we evaluated the efficacy of normobaric and hyperbaric oxygen therapy in preventing brain cell injury in CO-poisoned animals without loss of consciousness. Wistar rats without loss of consciousness after exposure to 3000ppm of CO for 60min were exposed to ambient air (group 1), 100% oxygen at a pressure of 1bar (group 2) and 100% oxygen at a pressure of 3bar (group 3). The rats were sacrificed after two weeks, brain samples were stained with hematoxylin-eosin and a percentage of pyknotic cells in hippocampus was reported. Analyses of differences in percentage of pyknotic cells between different kinds of therapy showed that the percentage of pyknotic cells of the second group (2.3+/-1.2%) treated with normobaric oxygen and the third group (4.5+/-4.0%) treated with hyperbaric oxygen were similar, and both of them were significantly different, with a much lower percentage of pyknotic cells, from the first group left on ambient air (47.7+/-10.0%). In conclusion, immediate normobaric and hyperbaric oxygen therapy equally prevents hippocampal cell injury in CO-poisoned rats without loss of consciousness.

PMID: 16814444 [PubMed - indexed for MEDLINE]

14: J Wound Care. 2006 Jun;15(6):235-8.

A cost analysis of monoplace hyperbaric oxygen therapy with and without recirculation.

Treweek S, James PB.

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OBJECTIVE: Hyperbaric oxygen therapy is covered by the NHS under Specialist Services Definition Set 28. The indications and availability of the therapy have been influenced by educational failures,

perceived costs and, compared with drug studies, the small number of controlled trials. This study aimed to inform this debate by calculating the direct costs to the health service of hyperbaric oxygen therapy for inpatients using a single, one-person chamber. METHOD: The costs included in this cost analysis were: hyperbaric chambers, staff, oxygen, property and cleaning, miscellaneous and general overheads. All costs are for 2004. RESULTS: Lower and upper costs were calculated. Start-up costs range from pounds 64,800 to pounds 110,000 depending on the hardware selected. Annual costs, including 10-year amortisation of capital costs, range from pounds 40,069 to pounds 57,618 and per-treatment costs range from pounds 30 to pounds 41. Oxygen recirculation becomes cost effective after four to six years. CONCLUSION: Hyperbaric oxygen therapy is an inexpensive treatment that should be routinely available for conditions where evidence indicates that tissue hypoxia is a significant component of the injury or disease.

PMID: 16802558 [PubMed - indexed for MEDLINE]

15: Plast Reconstr Surg. 2006 Jun;117(7 Suppl):175S-190S; discussion 191S-192S.

Erratum in: Plast Reconstr Surg. 2006 Aug;118(2):62e. Friedman, H I F [corrected to Friedman, HI].

An evidence-based appraisal of the use of hyperbaric oxygen on flaps and grafts.

Friedman HI, Fitzmaurice M, Lefavre JF, Vecchiolla T, Clarke D.

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Hyperbaric oxygen has been advocated, both as an adjunctive or primary form of treatment, for a variety of disorders, including gas gangrene, osteoradionecrosis, and carbon monoxide poisoning. It has also been used to improve ischemic wounds before skin grafting and to support ischemic flaps. In this review, we analyze the available literature that investigates the use of hyperbaric oxygen for composite grafts, skin grafts, random flaps, distant flaps, and free flaps. An appraisal of the level of evidence for each of these uses of hyperbaric oxygen is offered. Although there are a significant amount of animal data supporting the application of hyperbaric oxygen for grafts and flaps, there is very little clinical information other than case reports and series to sustain its choice over other modalities of therapy. Multicenter prospective clinical studies are clearly needed comparing hyperbaric oxygen to other mechanical or pharmacologic interventions to improve wound healing for grafting or to support flap survival.

Publication Types: Review

PMID: 16799386 [PubMed - indexed for MEDLINE]

16: Physiol Res. 2007;56(3):369-73. Epub 2006 Jun 22.

Effect of combined therapy with hyperbaric oxygen and antioxidant on infarct volume after permanent focal cerebral ischemia.

Acka G, Sen A, Canakci Z, Yildiz S, Akin A, Uzun G, Cermik H, Yildirim I, Kokpinar S.

Department of Neurosurgery, Mersin University Medical Faculty, Mersin, Turkey.

The aim of the present study was to evaluate the efficiency of combination of hyperbaric oxygen (HBO) and an antioxidant on permanent focal cerebral ischemia. Male Wistar rats underwent permanent middle cerebral artery occlusion (MCAO). Then, animals were randomly assigned to one of four groups: the control group (n=9) received no treatment, HBO group (n=9) was treated for 90 min at 2.5 absolute atmosphere for 3 days, the U-74389G group (n=8) received single U-74389G injection (3 mg/kg), the HBO + U-74389G group (n=8) received both HBO and U-74389G treatments. Treatments were initiated within the first 10 min after MCAO. After 3 days, the infarct volumes in rat brains were measured. The infarct ratios were 25.6±6.5 % for the control group, 21.9±6.4 % for the HBO group, 15.7±5.7 % for U-74389G group and 12.5±3.8 % for HBO + U74389G group. The infarct volumes were significantly reduced in rats treated with U-74389G (p<0.05) and combination therapy (p<0.05). HBO failed to reduce infarct volume significantly. We concluded that 1) U-74389G is more beneficial than HBO on permanent MCAO in rats, and 2) a combined therapy failed to significantly improve infarct volume more than either single treatment.

PMID: 16792474 [PubMed - indexed for MEDLINE]

17: Otol Neurotol. 2006 Jun;27(4):478-83.

Negative effect of immediate hyperbaric oxygen therapy in acute acoustic trauma.

Cakir BO, Ercan I, Civelek S, Korpınar S, Toklu AS, Gedik O, Işık G, Sayin I, Turgut S.

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OBJECTIVE: The functional evaluation of the effect of the hyperbaric oxygen therapy (HBOT) onset time on cochlea by using distortion product otoacoustic emission. STUDY DESIGN: Animal study. METHODS: Twenty-four Wistar albino rats were divided into six groups and their right ears were directly exposed to a 110-dB sound pressure level (1-12 kHz) white noise for 25 minutes. The first group was considered the control group. HBOT was started at 1 hour postexposure for the second group, at 2 hours postexposure for the third group, at 6 hours postexposure for the fourth group, at 24 hours postexposure for the fifth group, and at 48 hours postexposure for the sixth group. Signal-to-noise ratios (SNRs) were recorded before the noise exposure; immediately after the noise exposure; and on the 3rd, 7th, and 10th day of postexposure.

RESULTS: SNRs at 6 to 8 kHz were significantly decreased after the acoustic trauma. The evaluation on the third day of postexposure showed that recovery begun in all groups except the group in which the HBOT was started at 1 hour postexposure. SNRs in the control group and HBOT groups were back to the preexposure levels at 10 days postexposure, except the 1- and 2-hour postexposure groups. However, in the group in which the HBOT was started at 1 hour postexposure, distortion product otoacoustic emissions were lost except at 4 kHz. The recovery of the SNRs in hyperbaric oxygen administration at 2 hours postexposure almost completed on the 10th day after noise exposure. CONCLUSION: Immediate HBOT in acoustic trauma treatment is not necessary; on the contrary, it has an adverse effect.

PMID: 16791038 [PubMed - indexed for MEDLINE]

18: Zhongguo Dang Dai Er Ke Za Zhi. 2006 Jun;8(3):216-20.

[Long-term effects of early hyperbaric oxygen therapy on neonatal rats with hypoxic-ischemic brain damage]

[Article in Chinese]

Liu MN, Zhuang SQ, Zhang HY, Qin ZY, Li XY.

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OBJECTIVE: The application and therapeutic effect of hyperbaric oxygen (HBO) in hypoxic-ischemic brain damage (HIBD) remains controversial. Previous studies have focused on the early pathological and biochemical outcomes and there is a lack of long-term functional evaluation. This study was designed to evaluate the long-term pathological and behavioral changes of early HBO therapy on neonatal rats with HIBD. METHODS: Postnatal 7 days (PD7) rat pups were randomly assigned into Control (n=18), HIBD (n=17) and HBO treatment groups (n=17). HIBD was induced by ligating the left common carotid, followed by 2 hrs hypoxia exposure in the HIBD and HBO treatment groups. The Control group was sham-operated and was not subjected to hypoxia exposure. The HBO therapy with 2 atmosphere absolutes began 0.5-1 hr after HIBD in the HIBD treatment group, once daily for 2 days. The spatial learning and memory ability were evaluated by the Morris water maze test at PD37 to PD41. The morphological and histological changes of the brain, including brain weight, survival neurons, AchE positive unit and NOS positive neurons in hippocampal CA1 region, were detected at PD42. RESULTS: The rats in the HIBD group displayed significant morphological and histological deficits, as well as severe spatial learning and memory disability. In the Morris water maze test, the mean escape latency were longer (56.35 ± 22.37 s vs 23.07 ± 16.28 s; P < 0.05) and the probe time and probe length were shorter in the HIBD group (29.29 ± 6.06 s vs 51.21 ± 4.59 s and 548 ± 92 cm vs 989 ± 101 cm; both P < 0.05) compared with the Control group. The left brain weight in the HIBD

group was lighter than that in the Control group (0.601 +/- 0.59 g vs 0.984 +/- 0.18 g; P < 0.05). The survival neurons in the hippocampal CA1 region were less (100 +/- 27/mm vs 183 +/- 8/mm; P < 0.05), as well as the AchE-positive unit and NOS-positive neurons (18.50 +/- 2.24% vs 27.50 +/- 2.18% and 19.25 +/- 4.33 vs 33.75 +/- 5.57 respectively; P < 0.05) after HIBD. Early HBO treatment improved the abilities of spatial learning and alleviated the morphological and histological damage. The mean escape latency (39.17 +/- 21.20 s) was shortened, the probe time (36.84 +/- 4.36 s) and the probe length (686 +/- 76 cm) were longer, and the brain weight (0.768 +/- 0.85 g), the survival neurons (133 +/- 25/mm) and the AchE-positive unit (21.94 +/- 2.73%) increased significantly compared with those of the HIBD group (P < 0.05). CONCLUSIONS: Early HBO treatment resulted in a protective effect against HIBD-induced long-term brain morphological and histological deficits and spatial learning and memory disability.

Publication Types: English Abstract  
PMID: 16787595 [PubMed - indexed for MEDLINE]

19: Clin Infect Dis. 2006 Jul 15;43(2):193-8. Epub 2006 Jun 12.

Comment on: Clin Infect Dis. 2006 Jul 15;43(2):188-92.

Counterpoint: hyperbaric oxygen for diabetic foot wounds is not effective.

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BACKGROUND: Diabetic foot ulceration is common, affecting 1.0%-4.1% of diabetic persons per year and up to 25% in a lifetime. Diabetic foot ulcers are multifactorial in origin, and many are slow to heal and/or are complicated by infection, frequently leading to amputation. Hyperbaric oxygen therapy has been suggested for numerous indications, and it is recognized by funding agencies for a smaller number including diabetic foot wounds. METHODS: I reviewed the literature about the history and practice of hyperbaric oxygen therapy and key issues relevant to efficacy, effectiveness, and cost-effectiveness. RESULTS: Although recognized for reimbursement by Medicare and major insurers, the evidence base for hyperbaric oxygen therapy for diabetic foot care remains weak. A systematic review for the Cochrane Collaboration concluded that hyperbaric oxygen therapy may have value in treating diabetic wounds, but the studies reviewed all had methodological weaknesses, and the positive effect of treatment was not seen in the single reviewed randomized trial to include a sham treatment arm. Hyperbaric oxygen therapy consumes very substantial resources--and has the potential to consume far more--that could be better spent on other aspects of management or prevention of diabetic foot ulceration. CONCLUSIONS: Hyperbaric oxygen therapy should not be offered for diabetic foot

wounds until large-scale, adequately blinded, controlled, and powered randomized studies have clearly demonstrated efficacy and cost effectiveness in the healing of ulcers and the prevention of major amputation.

Publication Types: Comment Lectures  
PMID: 16779746 [PubMed - indexed for MEDLINE]

20: Clin Infect Dis. 2006 Jul 15;43(2):188-92. Epub 2006 Jun 12.

Comment in: Clin Infect Dis. 2006 Jul 15;43(2):193-8.

Point: hyperbaric oxygen is beneficial for diabetic foot wounds.

Barnes RC.

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Publication Types: Lectures  
PMID: 16779745 [PubMed - indexed for MEDLINE]

21: Burns. 2006 Aug;32(5):650-2. Epub 2006 Jun 14. Hyperbaric oxygen as adjuvant therapy in the management of burns: can evidence guide clinical practice?

Wasiak J, Bennett M, Cleland HJ.

The Alfred Hospital, Victorian Adult Burns Unit, Commercial Road, Prahran, Melbourne 3183, Australia. J.Wasiak@alfred.org.au

Publication Types: Review  
PMID: 16777333 [PubMed - indexed for MEDLINE]

22: Anaesthesist. 2006 Jun;55(6):693-705.

[Hyperbaric oxygenation: characteristics of intensive care and emergency therapy]

[Article in German]

Wiese S, Beckers S, Siekmann U, Baltus T, Rossaint R, Schröder S.

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Hyperbaric oxygenation (HBO) is a decisive component of a comprehensive interdisciplinary intensive care therapy for numerous disorders, such as gas embolism, severe decompression illness or carbon monoxide (CO) intoxication. However, barochambers with 24 h accessibility are often not readily available, thus, requiring an interhospital transport of critically ill patients. In order to minimise additional risks, a skilled transportation team should be involved. Furthermore, the specific physical and physiological features of HBO require that the transportation personnel must be trained adequately. Specific characteristics of the interhospital transfer of HBO patients are described as well as adverse effects and their specific therapy.

Publication Types: English Abstract Review  
PMID: 16775732 [PubMed - indexed for MEDLINE]

23: *Ostomy Wound Manage.* 2006 May;52(5):14-6, 18, 20.

Hyperbaric oxygen therapy used to treat radiation injury: two case reports.

Yildiz S, Cimsit M, Ilgezdi S, Uzun G, Gumus T, Qyrdedi T, Dalci D.

Department of Underwater and Hyperbaric Medicine, Gülhane Military Medical Academy, Haydarpaşa Training Hospital, Istanbul, Turkey.

Publication Types: Case Reports Review

PMID: 16773750 [PubMed - indexed for MEDLINE]

24: *J Laryngol Otol.* 2006 Jun;120(6):446-9.

Does the slow compression technique of hyperbaric oxygen therapy decrease the incidence of middle-ear barotrauma?

Vahidova D, Sen P, Papesch M, Zein-Sanchez MP, Mueller PH.

Department of Otolaryngology & Head and Neck Surgery and the, London, UK.

OBJECTIVE: To note the incidence of middle-ear barotrauma following standard and slow compression during hyperbaric oxygen therapy (HBOT). The standards used were: (1) less than 40 per cent of the cohort should develop barotraumas, and (2) the incidence of barotrauma following the slow technique should be less than that caused by the standard technique. DESIGN: Prospective clinical audit. MATERIAL AND METHODS: Forty-two consecutive patients who received either standard compression or slow compression HBOT were included. Pre- and post-treatment otoscopy (graded according to a modified Teed's scale), tympanometry, audiometry and subjective ear complaints were compared between the groups and also compared with the set standard. RESULTS: Significantly less middle-ear barotrauma was noted when using the slow compression technique compared with the standard compression technique ( $p < 0.05$ ). The incidence of barotrauma when using standard compression failed to meet the set standard of less than 40 per cent. CONCLUSION: The slow compression method of HBOT proved to be both safe and superior to the standard compression technique.

PMID: 16772053 [PubMed - indexed for MEDLINE]

25: *Bratisl Lek Listy.* 2006;107(1-2):40.

The effect of hyperbaric oxygen therapy in treatment of leg ulcers.

Batora I, Batorova A, Zimanova J, Ulicna O, Gavornik P, Gaspar L.

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PMID: 16771137 [PubMed - indexed for MEDLINE]

26: *J Laryngol Otol.* 2006 Aug;120(8):665-9. Epub 2006 Jun 9.

Effectiveness of hyperbaric oxygen therapy in idiopathic sudden hearing loss.

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The aim of this study was to investigate the efficacy of hyperbaric oxygen (HBO) therapy in idiopathic sudden sensorineural hearing loss (ISSHL) by comparing hearing gain and improvement rate in patients who have been placed on both HBO and medical treatment (MT) (37 patients), and patients who have received MT only (17 patients). Both groups were compared with reference to pure tone average (PTA) and the number of patients who experienced hearing gain. Of 37 patients (40 ears) who received HBO + MT, 24 (60 per cent) experienced  $\geq 10$  decibels (dB) improvement in PTA compared to 13 (76.4 per cent) of 17 patients who were placed on MT only. Inter- or intra-group comparison of age stratification ( $< 50$  and  $\geq 50$  ages) did not produce significant differences in PTA and in the number of patients who experienced hearing gain. Although there are numerous studies showing efficacy of HBO therapy; this study did not reveal a trend in favour of HBO therapy.

Publication Types: Comparative Study

PMID: 16762093 [PubMed - indexed for MEDLINE]

27: *Anesteziol Reanimatol.* 2006 Mar-Apr;2(2):54-7.

[Psychoneurological disorders in acute intoxications by psychotropic drugs and their correction using hyperbaric oxygenation]

[Article in Russian]

Epifanova NM, Romasenko MV, Kukshina AA, Iakovlev AI, Zubareva OV.

The paper presents the results of a study of the clinical features of psychoneurological disorders in 178 patients with acute intoxications by various psychotropic drugs. Hyperbaric oxygenation showed positive changes in psychopathological syndromic kinesia. A sanogenetic rationale is provided for the method of choice in treating this category of patients.

Publication Types: English Abstract

PMID: 16758946 [PubMed - indexed for MEDLINE]

28: *Adv Ther.* 2006 Mar-Apr;23(2):332-41.

The effects of amifostine and dexamethasone on brain tissue lipid peroxidation during oxygen treatment of carbon monoxide-poisoned rats.

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The mechanisms of injury of, and methods of treating patients with, carbon monoxide (CO) poisoning are poorly understood. Besides the hypoxic degenerative effects of CO, reoxygenation injury may play an important role. Amifostine (Ami), which is most often used in radiotherapy for its tissue protective characteristics, may offer benefits. In this study, investigators evaluated the effectiveness of various treatments in a CO-poisoned rat model. A total of 36 Wistar rats were randomly assigned to 1 of 6 groups

(n=6 each), including control and poisoned groups exposed to CO at 2000 ppm (v/v) for 1 h, followed by various 1-h treatments: group C (control), group COair (ambient air), group CO-NBO (normobaric 100% oxygen), group CO-HBO (hyperbaric oxygen with 3 atmospheres absolute [3 ATA]), group CO-NBO-Ami (normobaric oxygen with intraperitoneal [i.p.] injection of amifostine 250 mg/kg body weight [bw]), and group CO-70O (70% O<sub>2</sub> and 5% CO<sub>2</sub> with dexamethasone 10 mg/kg bw, i.p.). Blood gas analysis, carboxyhemoglobin determination, brain tissue lipid peroxidation, and glutathione peroxidase (GSHPx), superoxide dismutase (SOD), lactate dehydrogenase (LDH), and creatine kinase (CK) activities were evaluated. Carboxyhemoglobin concentration in the air-treated group was 44+/-2%; it decreased to the control level with all oxygen treatments. Brain tissue GSH-Px and SOD measurements did not change. The activity of LDH in group CO-HBO and the activities of LDH and CK in group CO-70O were similar to those of group C. Lipid peroxides were high in ambient air and normobaric oxygen, but HBO, amifostine with oxygen, or 70% O<sub>2</sub> reduced these to control levels (P<.05).

PMID: 16751165 [PubMed - indexed for MEDLINE]

29: Brain Res. 2006 Jul 7;1098(1):126-8. Epub 2006 Jun 5.

Hyperbaric oxygen treatment decreases inflammation and mechanical hypersensitivity in an animal model of inflammatory pain.

Wilson HD, Wilson JR, Fuchs PN.

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Hyperbaric oxygen therapy has been used to treat a variety of ailments from carbon monoxide poisoning to fibromyalgia. The purpose of this experiment was to explore the effect of hyperbaric oxygen treatment on carrageenan-induced inflammation and pain in rats. Hyperbaric oxygen treatment significantly decreased inflammation and pain following carrageenan injection. Clinically hyperbaric oxygen may be used in situations where NSAIDs are contraindicated or in persistent cases of inflammation.

PMID: 16750177 [PubMed - indexed for MEDLINE]

30: Eur J Endocrinol. 2006 Jun;154(6):813-8.

Partial visual recovery from radiation-induced optic neuropathy after hyperbaric oxygen therapy in a patient with Cushing disease.

Boschetti M, De Lucchi M, Giusti M, Spena C, Corallo G, Goglia U, Ceresola E, Resmini E, Vera L, Minuto F, Ferone D.

Department of Endocrinological and Metabolic Sciences and Center of Excellence for Biomedical Research, University of Genoa and San Martino Hospital, Italy.

Here we describe the case of a 41-year-old woman with a history of Cushing disease who had previously

undergone unsuccessful neurosurgery, followed by stereotactic radiosurgery. More than 4 years after this treatment, she presented severe visual impairment, which started in the left eye and was documented by neuro-ophthalmic evaluation. Radiological assessment by contrast-enhanced magnetic resonance (MR) imaging initially suggested the diagnosis of glioma of the optic nerve and the patient started corticosteroid treatment (first with prednisone, 80 mg/day, followed by dexamethasone, 8 mg/day). Despite the therapy, vision in the left eye rapidly worsened until light was no longer perceptible; similar symptoms and signs also developed in the right eye, evolving to complete temporal hemianopsia. The clinical evidence was confirmed by the rapid progression of the MR picture, which showed homogeneous enhancement of the chiasm and optic nerves. On the basis of these findings, the original diagnosis of glioma was excluded, and radiation-induced optic neuropathy was diagnosed. As corticosteroids had proved inefficacious, hyperbaric oxygen (HBO) therapy was promptly instituted and vision steadily started to improve. This improvement was documented and confirmed by the progressive recovery of the visual field in the right eye and the changes in the sequential follow-up MR scanning. Optic neuropathy is an infrequent but dramatic complication of radiation therapy. Symptoms develop, on average, 12 months after treatment, and the onset may be acute and characterized by the progressive loss of vision in one or both eyes. HBO has already been used to treat this complication, but its efficacy is still controversial. Here, in addition to describing this particular case, which presented a significantly delayed radiation injury of the optic pathways, we provide a brief literature review and discuss some important points.

Publication Types: Case Reports Research Support, Non-U.S. Gov't

PMID: 16728540 [PubMed - indexed for MEDLINE]

31: Chin J Traumatol. 2006 Jun;9(3):168-74.

Effect of hyperbaric oxygen on cytochrome C, Bcl-2 and Bax expression after experimental traumatic brain injury in rats.

Liu Z, Jiao QF, You C, Che YJ, Su FZ.

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OBJECTIVE: To explore the effects of hyperbaric oxygen (HBO) treatment on the neuronal apoptosis at an earlier stage and the expressions of Cytochrome C (Cyt C), Bcl-2 (B-cell lymphoma-2 family) and Bax (Bcl-2 associated X protein) in rat brain tissues after traumatic brain injury (TBI). METHODS: Forty adult rats were divided into two groups, i.e., Group A (the rats with untreated TBI) and Group B (rats with HBO treatment after TBI). Sections of brain tissues of these two groups were then detected at 3, 6, 12, 24, 72 hours after TBI by immunohistochemistry and electronmicroscope, respectively. RESULTS: HBO treatment could up-regulate the expression of Bcl-2 within 72 hours, reduce the release of Cyt C from

mitochondria, attenuate the formation of dimeric Bax and alleviate the mitochondrial edema within 24 hours after TBI. CONCLUSIONS: HBO treatment can alleviate neuronal apoptosis after TBI by reducing the release of Cyt C and the dimers of Bax and up-regulating the expression of Bcl-2.

PMID: 16723075 [PubMed - indexed for MEDLINE]

32: Undersea Hyperb Med. 2006 Mar-Apr;33(2):89-94.

Proposing short-term observation units for the management of decompression illness.

Tempel R, Severance HW.

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Decompression illness (DCI) is a potentially life-threatening disease, often requiring hyperbaric oxygen therapy (HBO2) for symptom resolution. Once treated, current guidelines recommend an observation period of at least six hours for patients with neurological symptoms in case of relapse. Surveys have shown a symptom relapse rate as high as 38.5%, with half of those occurring in the first twenty-four hours. We propose that a short-term observation unit (OU) would be an ideal setting for these patients to be monitored. To evaluate this, we did a retrospective study of patients presenting with DCI at a major hyperbaric facility. One hundred and two consecutive patients were evaluated with DCI diagnosis and receiving HBO2. Forty-two (41.2%) patients had neurological sequelae; ten required more than one treatment for refractory symptoms or relapse. Thirty-eight of the forty-two patients received up to three treatments, which can be done within the time requirements of short-term observation. We conclude that OUs would provide a safe and efficient disposition for patients after receiving HBO2.

PMID: 16716058 [PubMed - indexed for MEDLINE]

33: Undersea Hyperb Med. 2006 Mar-Apr;33(2):85-8.

Monoplace hyperbaric chamber use of U.S. Navy Table 6: a 20-year experience.

Weaver LK.

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We report a 20-year experience at LDS Hospital, Salt Lake City, UT using the U.S. Navy Treatment Table 6 (TT6) in an oxygen-filled monoplace hyperbaric chamber (1985-2004). Air breathing was provided via a demand regulator fitted with a SCUBA mouthpiece while the patient wore a nose clip. Intubated patients were mechanically ventilated with a Sechrist 500A ventilator, with a modified circuit providing air, when specified. We treated 90 patients: 72 divers (decompression sickness [DCS] = 67, arterial gas embolism [AGE] = 5), 10 hospital-associated AGE, and 8 miscellaneous conditions. They received a total of 118 TT6 (9 TT6 in intubated patients). Ninety-four percent of the TT6 schedules were tolerated and completed. The intolerance rate

from two surveyed multiplace chambers was zero and 3% of 100 TT6 schedules each. Failure to complete the TT6 was due to oxygen toxicity (4) and claustrophobia (3). The U.S. Navy TT6 was well tolerated by patients with DCS or AGE treated in monoplace hyperbaric chambers, but tolerance may not be as high as when treated in the multiplace chamber.

Publication Types: Evaluation Studies

PMID: 16716057 [PubMed - indexed for MEDLINE]

34: Undersea Hyperb Med. 2006 Mar-Apr;33(2):81-3.

Platelet function in humans is not altered by hyperbaric oxygen therapy.

Thom SR, Fisher D, Stubbs JM.

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A pilot survey of platelet function was performed on 6 patients undergoing hyperbaric oxygen therapy (2.0 ATA O2 for 2 hours, 6 days/week) for prophylaxis against osteoradionecrosis. Blood was drawn immediately prior to and after the first, tenth and twentieth treatment for measurements of platelet aggregation, ATP release and expression of activated alphaIIb3 integrin. No significant differences were observed due to hyperbaric oxygen exposures.

Publication Types: Research Support, N.I.H., Extramural

PMID: 16716056 [PubMed - indexed for MEDLINE]

35: *Pediatr Emerg Care*. 2006 May;22(5):394.

Comment on: *Pediatr Emerg Care*. 2005 Jan;21(1):31-4.

Hyperbaric oxygen therapy for purpura fulminans-comment.

Tilelli JA, Farrell MM.

Publication Types: Comment Letter

PMID: 16714977 [PubMed - indexed for MEDLINE]

36: *J Oral Maxillofac Surg*. 2006 Jun;64(6):956-60.

The treatment of osteoradionecrosis of the mandible: the case for hyperbaric oxygen and bone graft reconstruction.

Peleg M, Lopez EA.

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PMID: 16713813 [PubMed - indexed for MEDLINE]

37: *Eur J Gastroenterol Hepatol*. 2006 Jun;18(6):685-8.

Hyperbaric oxygen as a treatment for malabsorption in a radiation-damaged short bowel.

Huddy JE, Patel P, Johnson MW, Hamilton-Farrell MR, Ede RJ, Sanderson JD.

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Radiation enteritis can be challenging to diagnose and treat. We report the case of a 44-year-old woman

who was diagnosed with a squamous cell carcinoma of the cervix in 1978 and treated with hysterectomy and post-operative radiotherapy. Over the next 20 years she required multiple intestinal operations resulting in short bowel syndrome. She became symptomatic of severe hypomagnesaemia which could not be corrected with oral supplementation and which required intravenous magnesium sulfate every 5-7 days for an 11-month period. However, following 25 sessions of hyperbaric oxygen therapy, she was able to discontinue intravenous magnesium and maintain her serum magnesium level with oral treatment. Her weight and stoma output improved. For over 4 years subsequent to this therapy she has not required further intravenous magnesium although has needed temporary nutritional support. Her case is complicated by vitamin A, B and D deficiencies.

Publication Types: Case Reports

PMID: 16702860 [PubMed - indexed for MEDLINE]

38: *Nephron Exp Nephrol.* 2006;104(1):e15-22. Epub 2006 May 11.

Hyperbaric oxygen treatment augments the efficacy of a losartan regime in an experimental nephrotic syndrome model.

Yilmaz MI, Korkmaz A, Kaya A, Sonmez A, Caglar K, Topal T, Eyiletan T, Yenicesu M, Acikel C, Oter S, Yaman H, Aktug H, Oguz Y, Vural A, Ikizler TA. Department of Nephrology, Gulhane School of Medicine, Etlik-Ankara, Turkey. mahmutiyilmaz@yahoo.com

**BACKGROUND/AIMS:** Proteinuria is associated with oxidant stress and inflammation. Hyperbaric oxygen (HBO) treatment has anti-inflammatory and anti-oxidant effects. The aim of the study was to investigate the benefits of HBO treatment on an experimental nephrotic syndrome model. **METHODS:** 50 male Sprague-Dawley rats weighing 255 +/- 39 g were housed. Forty rats were injected 6 mg/kg adriamycin into tail veins under anesthesia to induce nephrosis, while 10 rats were spared as sham control. After the stabilization of proteinuria at the sixth week, the rats were treated for 6 weeks by losartan (n = 10, 30 mg/kg/day), HBO (n = 10, 2.8 atmosphere absolute, 90 min/day), HBO + losartan (n = 10) and vehicle (n = 10). Protein carbonyl (PCO), superoxide dismutase (SOD) and glutathione peroxidase (GPx) were analyzed from tissue specimens. Biochemical markers were studied from venous samples and 24-hour urine was collected for proteinuria. The surviving animals at 12 weeks (vehicle group (n = 6), HBO (n = 6), losartan (n = 8), HBO + losartan (n = 10) were sacrificed. Glomerular sclerosis, tubulointerstitial and blood vessel changes were determined by semiquantitative scoring. **RESULTS:** The PCO levels increased (p < 0.001), and the GPx and SOD levels decreased (p < 0.001 for both) in the nephrotic rats. In losartan and HBO groups GPx levels increased (p = 0.001, p = 0.002 respectively), but PCO and SOD levels did not change. The combination of HBO with losartan significantly increased the GPx and SOD levels (p =

0.001 for both) and decreased PCO levels (p = 0.005). HBO but not losartan significantly reduced proteinuria (p < 0.001). The combination of HBO and losartan reduced proteinuria better than the single losartan regime (p < 0.001). The effect of the combination was also noticed on the histological examination of the kidneys. The activities, appetites, weight gains, and improvement of edema were better in the HBO combined with losartan regime. **CONCLUSIONS:** These results indicate that the addition of HBO therapy to a conventional regime, angiotensin receptor blockers, has significant benefits in the management of proteinuria. Future clinical studies are needed to elucidate the role of HBO and other antioxidant strategies in the treatment of proteinuria. Copyright 2006 S. Karger AG, Basel.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 16699289 [PubMed - indexed for MEDLINE]

39: *BMJ.* 2006 Aug 19;333(7564):374. Epub 2006 May 11.

Clinical effectiveness of treatment with hyperbaric oxygen for neonatal hypoxic-ischaemic encephalopathy: systematic review of Chinese literature.

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**OBJECTIVES:** To investigate the clinical effectiveness of treatment with hyperbaric oxygen for neonates with hypoxic-ischaemic encephalopathy. This treatment is frequently used in China but much less often in the West. **DATA SOURCES:** Western (Cochrane controlled trials register and database of systematic reviews, Medline, Embase, CINAHL, and HealthSTAR) and Chinese (China Hospital Digital Library, Chinese Medical Journal Network) databases and hand search of Chinese journals. No language restrictions. **REVIEW METHODS:** Randomised or quasi-randomised controlled trials of treatment with hyperbaric oxygen compared with "usual care" in term neonates with hypoxic-ischaemic encephalopathy. Outcomes included mortality and long term neurological sequelae. Standardised forms were used to extract and compare data. Criteria of York Centre for Reviews and Dissemination were used to assess quality. Analysis was mainly qualitative but included meta-analysis. **RESULTS:** 20 trials were found, mainly from Chinese sources. The reporting quality of trials was poor by Western (CONSORT) standards. Treatment with hyperbaric oxygen had better outcomes than the comparator in almost all trials. The odds ratios of the meta-analyses were 0.26 (95% confidence interval 0.14 to 0.46) for mortality and 0.41 (0.27 to 0.61) for neurological sequelae. **CONCLUSION:** Treatment with hyperbaric oxygen possibly reduces mortality and neurological sequelae in term neonates with hypoxic-ischaemic encephalopathy. Because of the poor quality of reporting in all trials and the possibility of publication bias, an adequately powered, high quality

randomised controlled trial is needed to investigate these findings. The Chinese medical literature may be a rich source of evidence to inform clinical practice and other systematic reviews.

Publication Types: Review

PMID: 16690641 [PubMed - indexed for MEDLINE]

40: *Int J Gynecol Cancer*. 2006 Mar-Apr;16(2):638-42.

Hyperbaric oxygen therapy for delayed radiation injuries in gynecological cancers.

Fink D, Chetty N, Lehm JP, Marsden DE, Hacker NF.

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Delayed radiation-induced injuries are difficult to treat. The treatment of delayed radiation injuries with hyperbaric oxygen therapy (HBOT) is reported in small case series and case reports. This study reports the experience of a single institution with HBOT in delayed radiation injuries in patients with gynecological cancers. At least 20 sessions of 100% oxygen inhalation at 2.4 Atmospheric Absolutes (ATA) for 90 min in a hyperbaric chamber were carried out. Of the 14 patients included in the study, 10 patients have healed or showed improvement of more than 50%, resulting in a success rate of 71%. Mean follow-up was 31.6 months (range 6-70 months). The adverse events were acceptable. HBOT should be considered for patients with delayed radiation injuries, not responding to other treatments.

PMID: 16681739 [PubMed - indexed for MEDLINE]

41: *Aviat Space Environ Med*. 2006 Apr;77(4):434-42; discussion 442-3.

Decision analysis in aerospace medicine: costs and benefits of a hyperbaric facility in space.

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INTRODUCTION: Assembly and maintenance of the International Space Station (ISS) requires an unprecedented number of spacewalks, which expose astronauts to the risk of decompression sickness (DCS). We illustrate the use of decision analysis to compare a hyperbaric oxygen (HBO) chamber to currently available therapy for DCS treatment on the ISS. METHODS: A decision-analytic model that simulates events over the lifespan of the ISS was constructed. Inputs to the model for probabilities, costs, and measures of morbidity and mortality were derived from a variety of sources, including a systematic literature review and an iterative consultation process with personnel at the Canadian Space Agency and the National Aeronautics and Space Administration (NASA). The decision model was analyzed using the methods of Monte-Carlo simulation and expected value calculation. Main outcome measures included the present value of costs and quality adjusted life years (QALYs), and the

cumulative probability of mission-related events over the life cycle of the ISS. Sensitivity analysis was performed. RESULTS: The HBO chamber strategy is associated with a mean cost of -12.5 million dollars (a net cost saving of 12.5 million dollars) with a 95% CI (-112.8 million dollars, 51.3 million dollars). An HBO chamber reduces the likelihood of a premature shuttle return and a premature Soyuz return by 8% and 3%, respectively. The result is sensitive to the lifespan of the ISS. CONCLUSIONS: At a 50 million dollars cost, an HBO chamber is likely, though not certain, to result in cost savings. Decision analysis is a useful tool for use in priority setting in aerospace medicine.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 16676656 [PubMed - indexed for MEDLINE]

42: *Ann Fr Anesth Reanim*. 2006 Sep;25(9):986-9. Epub 2006 May 3.

[Non pharmacological treatment of severe cutaneous infections: hyperbaric oxygen therapy, dressings and local treatments]

[Article in French]

de Vaumas C, Bronchard R, Montravers P.

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Beside conventional therapy, the management of necrotizing cellulitis and fasciitis is based on non-pharmacological treatments. Hyperbaric oxygen therapy and dressings are the most frequently used techniques. The usefulness of hyperbaric oxygen therapy is clearly demonstrated in experimental studies while the efficacy of this technique is poorly assessed in clinical practice. The French consensus conference has concluded to an adjuvant role of hyperbaric oxygen therapy combined to intensive care management, surgery and antibiotic therapy. Occlusive conventional dressings using humid or vaseline gauze dressings are largely used. Calcium alginate or silver coated dressings might be useful. In addition, vacuum-assisted closure therapy could be proposed in replacement of conventional dressings.

Publication Types: Comparative Study English Abstract

PMID: 16675193 [PubMed - indexed for MEDLINE]

43: *Acta Neurochir Suppl*. 2006;96:188-93.

Neuroprotective effect of hyperbaric oxygen in a rat model of subarachnoid hemorrhage.

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Acute brain ischemia after subarachnoid hemorrhage (SAH) induces oxidative stress in brain tissues. Up-regulated NADPH oxidase (NOX), a major enzymatic source of superoxide anion in the brain, may contribute to early brain injury after SAH. We

evaluated the effects of hyperbaric oxygen (HBO) on protein expression of gp91(phox) catalytic subunit of NOX, lipid peroxidation as a marker of oxidative stress, and on neurological and neuropathological outcomes after SAH. Twenty-nine male Sprague-Dawley rats (300 to 350 g) were randomly allocated to control (sham operation), SAH (endovascular perforation), and SAH treated with HBO groups (2.8 ATA for 2 hours, at 1 hour after SAH). Cerebral blood flow was measured using laser Doppler flowmetry. Rats were sacrificed after 24 hours and brain tissues collected for histology (Nissl staining and gp91 (phox) immunohistochemistry) and biochemistry. Mortality and neurological scores were evaluated. Neuronal injury associated with enhanced gp91 (phox) immunostaining was observed in the cerebral cortex after SAH. The lipid peroxidation product, malondialdehyde, accumulated in the ipsilateral cerebral cortex. HBO treatment reduced expression of NOX, diminished lipid peroxidation, and reduced neuronal damage. HBO caused a drop in mortality and ameliorated functional deficits. HBO-induced neuroprotection after SAH may involve down-regulation of NOX and a subsequent reduction in oxidative stress.  
PMID: 16671452 [PubMed - indexed for MEDLINE]

44: Am J Physiol Heart Circ Physiol. 2006 Oct;291(4):H1988-98. Epub 2006 Apr 28.  
Vascular reactivity and endothelial NOS activity in rat thoracic aorta during and after hyperbaric oxygen exposure.  
Hink J, Thom SR, Simonsen U, Rubin I, Jansen E.  
Hyperbaric Oxygen Treatment Unit (4092 Dept. of Anaesthesia, The Centre of Head and Orthopaedics, Copenhagen Univ. Hospital Rigshospitalet, 9 Blegdamsvej, DK 2100 Copenhagen OE, Denmark. hink@dadlnet.dk  
Accumulating evidence suggests that hyperbaric oxygen (HBO) stimulates neuronal nitric oxide (NO) synthase (NOS) activity, but the influence on endothelial NOS (eNOS) activity and vascular NO bioavailability remains unclear. We used a bioassay employing rat aortic rings to evaluate vascular NO bioavailability. HBO exposure to 2.8 atm absolute (ATA) in vitro decreased ACh relaxation. This effect remained unchanged, despite treatment with SOD-polyethylene glycol and catalase-polyethylene glycol, suggesting that the reduction in endothelium-derived NO bioavailability was independent of superoxide production. In vitro HBO induced contraction of resting aortic rings with and without endothelium, and these contractions were reduced by the NOS inhibitor N(omega)-nitro-L-arginine. In addition, in vitro HBO attenuated the vascular contraction produced by norepinephrine, and this effect was reversed by N(omega)-nitro-L-arginine, but not by endothelial denudation. These findings indicate stimulation of extraendothelial NO production during HBO exposure. A radiochemical assay was used to assess NOS activity in rat aortic endothelial cells. Catalytic activity of eNOS in cell homogenates was

not decreased by HBO, and in vivo HBO exposure to 2.8 ATA was without effect on eNOS activity and/or vascular NO bioavailability in vitro. We conclude that HBO reduces endothelium-derived NO bioavailability independent of superoxide production, and this effect seems to be unrelated to a decrease in eNOS catalytic activity. In addition, HBO increases the resting tone of rat aortic rings and attenuates the contractile response to norepinephrine by endothelium-independent mechanisms that involve extraendothelial NO production.

Publication Types: Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't  
PMID: 16648176 [PubMed - indexed for MEDLINE]

45: Wiad Lek. 2006;59(1-2):105-9.  
[Clinical aspects of hyperbaric oxygenation]  
[Article in Polish]

Szymańska B, Kawecki M, Knefel G.  
Oddziału Leczenia Oparzeń Centrum Leczenia Oparzeń w Siemianowicach Śląskich.  
Authors have presented methods of hyperbaric treatment used in the clinical settings. They have commented on the problem of oxygen toxicity, oxygen poisoning and indications and contraindications to hyperbaric oxygenation. In spite of side effects and possible complications, HBO can be a valuable method of treatment of many diseases. This method should be initiated in due time, after proper qualification of patients and by using the treatment protocol appropriate for every patient.  
Publication Types: English Abstract Review  
PMID: 16646303 [PubMed - indexed for MEDLINE]

46: Acta Trop. 2006 May;98(2):130-6. Epub 2006 Apr 25.  
Hyperbaric oxygen therapy reduces the size of Leishmania amazonensis-induced soft tissue lesions in mice.  
Arrais-Silva WW, Pinto EF, Rossi-Bergmann B, Giorgio S.  
Departamento de Parasitologia, Instituto de Biologia, Universidade Estadual de Campinas, Caixa Postal 6109, CEP 13083-970, Campinas, São Paulo, Brazil.  
In this study we determined whether exposing mice to hyperbaric oxygen (HBO) would alter various disease parameters of a susceptible mouse strain infected with Leishmania amazonensis. BALB/c mice exposed to HBO (100% O<sub>2</sub> at a pressure of 2.5 ATA, 1h before parasite inoculation and subsequently for 20 days) showed significant delay in lesion development and reduction in lesion parasite burdens compared with HBO-unexposed mice. Circulating levels of interferon gamma (IFN-gamma) and tumor necrosis factor (TNF-alpha) were significantly elevated in HBO-exposed as compared to HBO-unexposed mice. Concanavalin A-stimulated lymph nodes cultures from HBO-exposed mice released significantly more IFN-gamma and less interleukin 10 (IL-10) than cultures from HBO-unexposed mice, consistent with a skewed Th1 response. These results demonstrate, for the first

time, that HBO can play a pathogen control role during leishmaniasis. Further studies are needed to elucidate whether hyperoxia alone or increased atmospheric pressure alone can exert a similar effect.  
Publication Types: Research Support, Non-U.S. Gov't  
PMID: 16638602 [PubMed - indexed for MEDLINE]

47: Georgian Med News. 2006 Mar;(132):44-7.  
[Changes of immunological and cytogenetic indexes in lymphocytes of patients with bacterial endocarditis under the influence of laser therapy and a hyperbaric oxygen therapy]  
[Article in Russian]  
Kantariia IT, Megreladze II, Lapiashvili NN, Kanashvili MB.  
The purpose of the present work was the estimation of the therapeutic effect of the soft laser therapy and a hyperbaric oxygen therapy during their inclusion in a therapeutic complex for the treatment of bacterial endocarditis. 30 patients (II group) under our observation have passed the standard basic therapy, and for 45 patients (I group) of different age the intravenous laser and hyperbaric oxygenation were added into the therapeutic complex. The estimation was made by evaluation of immune status and cytogenetic markers before treatment. At the height of disease there was marked immune deficiency, basically at the expense of T-helpers, and also of the B- lymphocyte part. The phagocyte system efficiency indices were decreased. By the admission of patients in the clinic the number cells with aberrations of chromosomes was increased. After the treatment in the I group of patients there was absolute and relative elevation on the number of T-and B- lymphocytes, T-helpers, also the decrease of leukocytes, T-lymphocyte index, the increase of blast transformation lymphocytes level on mytogen FGA. The phagocytosis was activated, the balanced level of different Ig classes occurred. Number of cells with aberrations of chromosomes sharply decreased, basically at the expense of aneuploidic cells. Obtained results show, that laser therapy and hyperbaric oxygen therapy can be included in the therapeutic complex for the treatment of bacterial endocarditis.  
Publication Types: English Abstract  
PMID: 16636378 [PubMed - indexed for MEDLINE]

48: Acad Emerg Med. 2006 Jul;13(7):707-14. Epub 2006 Apr 24.  
Hyperbaric oxygen reduces acetaminophen toxicity and increases HIF-1alpha expression.  
Salhanick SD, Belikoff B, Orlow D, Holt D, Reenstra W, Buras JA.  
Program in Toxicology, Division of Emergency Medicine, Children's Hospital, Boston, MA, USA.  
OBJECTIVES: To investigate the effect of hyperbaric oxygen (HBO2) on acetaminophen (APAP)-induced hepatotoxicity. The authors further evaluated the effects of APAP poisoning and HBO2 on the expression and function of hypoxia-inducible

factor 1-alpha (HIF-1alpha) in an effort to further describe the mechanisms of APAP-induced hepatotoxicity. In vitro assays were performed to better understand the effects of HBO2 on HIF-1alpha function. METHODS: In vivo, four groups of C57BL/6 mice were treated as follows: APAP only, APAP followed by HBO2, HBO2 only, and untreated shams. Plasma alanine aminotransferase activity was measured, and hepatic HIF-1alpha induction was determined by Western blot. In vitro, cultured HEP G2 hepatocytes were exposed to HBO2, hypoxia (2.5% O2), or normoxia. HIF-1alpha DNA-binding and transcriptional activity were assessed. RESULTS: Alanine aminotransferase activity was reduced in the APAP+HBO2 group (2,606 IU/L +/- 4,080; vs. APAP: 6,743 +/- 3,397, p = 0.01 at 6 hours). APAP-only, HBO2-only, and APAP+HBO2 treatments all increased HIF-1alpha expression relative to shams (p = 0.02, p = 0.02, and p < 0.01, respectively). HBO2 increased HIF-1alpha DNA binding 5.7 (+/- 1.2)-fold relative to controls (p < 0.01); however, a parallel increase in HIF functional transcriptional activity did not occur. CONCLUSIONS: Hyperbaric oxygen reduced early APAP-induced hepatocellular injury. APAP poisoning increases HIF-1alpha protein levels and functional activity. HBO2 increases HIF-1alpha protein levels and DNA binding without a corresponding increase in transcriptional activity.  
Publication Types: Comparative Study  
Research Support, N.I.H., Extramural  
Research Support, Non-U.S. Gov't  
PMID: 16636360 [PubMed - indexed for MEDLINE]

49: Eur Arch Otorhinolaryngol. 2006 Jul;263(7):680-4. Epub 2006 Apr 22.  
Value of hyperbaric oxygen in bacterial and fungal malignant external otitis treatment.  
Narozny W, Kuczkowski J, Stankiewicz C, Kot J, Mikaszewski B, Przewozny T.  
ENT Department, Medical University of Gdansk, Debinki Str 7, bld 16, 80-211, Gdansk, Poland. naroznyw@wp.pl  
Malignant external otitis (MEO) is an invasive, morbidity, even mortality, mainly pseudomonas infection of the external auditory canal, frequently involving the base of the skull, multiple cranial nerve and the meninges. In many cases conventional therapy has been prolonged, intensive and relatively ineffective, especially in infections other than bacterial (mainly fungal). We presented theoretical principles of hyperbaric oxygen (HBO) treatment in MEO, our own experience and others' experience in applying this treatment method. We treated eight patients with MEO applying pharmacotherapy, topical management, surgery in one case and also adjunct HBO. In six patients, infection was caused by Pseudomonas aeruginosa, in one by Staphylococcus sp. and in one by Aspergillus sp. Complete recovery was achieved in seven patients. In the patient with MEO caused by Aspergillus sp., intracranial complications developed and the patient died. Our

experiences in employing HBO in bacterial-caused MEO have confirmed the role of HBO as a valuable, beneficial, supporting classical treatment method. Small number of patients with MEO, especially with non-bacterial infection, and unforeseen clinical course of disease make our experience difficult to objectivize.

PMID: 16633825 [PubMed - indexed for MEDLINE]

50: *Ann Emerg Med.* 2006 May;47(5):504; author reply 504-5.

Comment on: *Ann Emerg Med.* 2005 Nov;46(5):462-4.

Response to: To dive or not to dive? Use of hyperbaric oxygen therapy to prevent neurologic sequelae in patients acutely poisoned with carbon monoxide.

Matteucci MJ, Tanen DA.

Publication Types: Comment Letter

PMID: 16631992 [PubMed - indexed for MEDLINE]

51: *J Oral Maxillofac Surg.* 2006 May;64(5):819-22. Treatment of the irradiated patient with dental implants: the case against hyperbaric oxygen treatment.

Donoff RB.

Harvard School of Dental Medicine, Massachusetts General Hospital, Boston, 02115, USA. bruce\_donoff@hms.harvard.edu

Publication Types: Review

PMID: 16631491 [PubMed - indexed for MEDLINE]

52: *J Oral Maxillofac Surg.* 2006 May;64(5):812-8. Placement of dental implants in irradiated bone: the case for using hyperbaric oxygen.

Granström G.

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Publication Types: Review

PMID: 16631490 [PubMed - indexed for MEDLINE]

53: *Ann Acad Med Singapore.* 2006 Mar;35(3):151-7.

Hyperbaric oxygen therapy for radiation-induced optic neuropathy.

Levy RL, Miller NR.

The Wilmer Eye Institute, Johns Hopkins Hospital, Baltimore, Maryland 21287, USA.

**INTRODUCTION:** Radiation-induced optic neuropathy (RON) is an infrequent but devastating consequence of radiation exposure to the visual pathways, usually following months to years after the treatment of paranasal or intracranial tumours. Hyperbaric oxygen (HBO) therapy is one of several therapies that have been tried for this condition. The purpose of this review is to describe the clinical characteristics of RON, the rationale for the use of HBO in this condition, and the available clinical data on its safety and efficacy. **METHODS:** MEDLINE searches were performed on radiation optic neuropathy, hyperbaric oxygen therapy, and similar

terms, and selected references were reviewed. The results were combined with the experience at our own institution. **RESULTS:** RON typically follows a fulminant course with characteristic symptoms, examination findings, and imaging. The threshold for prior radiation exposure depends upon the delivery system used and patient characteristics. Therapy with anticoagulants or steroids has been unsuccessful. While there are case reports in the literature of successful treatment with HBO, therapy with HBO has to be initiated soon after the onset of vision loss, and even then yields variable results at best. **CONCLUSIONS:** There is still no consistently successful treatment for RON. HBO may be attempted in selected cases, but the prognosis for preservation of vision remains grim.

Publication Types: Review

PMID: 16625263 [PubMed - indexed for MEDLINE]

54: *Diabet Med.* 2006 Apr;23(4):360-6.

Effect of hyperbaric oxygen on cardiac neural regulation in diabetic individuals with foot complications.

Sun TB, Yang CC, Kuo TB.

Institute of Medical Sciences, Tzu Chi University, Hualien, Taiwan.

**AIMS:** There are relatively few effective methods to treat autonomic neuropathy in patients with diabetes mellitus. Our aim was to test the hypothesis that hyperbaric oxygen therapy may restore cardiac neural regulation dysfunction in diabetic individuals with foot complications. **METHODS:** We conducted a prospective randomized controlled study in patients with diabetic foot problems. Daily heart-rate variability analysis from 5-min electrocardiography was used to evaluate the temporal change of cardiac neural regulation. The experimental group consisted of 23 subjects exposed to hyperbaric oxygen therapy of 202.65 kPa for 90 min every Monday to Friday for 4 weeks (20 treatments). The control group consisted of 15 age-, sex- and disease-matched subjects who were not exposed to hyperbaric therapy. Patients with medical complications and failure of wound healing were excluded to eliminate possible confounding effects. **RESULTS:** There was no significant difference in baseline R-R interval (RR), variance, high-frequency power (HF), low-frequency power (LF), and LF/HF ratio between the two groups. In the hyperbaric oxygen group there were significant increases in changes of RR (82.7 +/- 16.02 ms); variance 0.88 +/- 0.12 ln(ms<sup>2</sup>); HF 1.06 +/- 0.18 ln(ms<sup>2</sup>); and LF 0.87 +/- 0.15 ln(ms<sup>2</sup>) after the treatment. Measurements of tissue oxygen demonstrated significant increases in local tissue oxygenation in the hyperbaric oxygen group (53.0 +/- 2.6 mmHg) compared with the control group (27.5 +/- 3.1 mmHg), P < 0.05. **CONCLUSION:** Hyperbaric oxygen therapy has a significant vagotonic effect, which is beneficial in improving cardiac neural regulation in patients with diabetic autonomic dysfunction.

Publication Types: Randomized Controlled Trial  
Research Support, Non-U.S. Gov't  
PMID: 16620263 [PubMed - indexed for MEDLINE]

55: Hawaii Med J. 2006 Feb;65(2):53-4.  
Medical school hotline.  
Smern RW, Farm F Jr.  
The Hyperbaric Treatment Center John A. Burns  
School of Medicine, USA.  
PMID: 16619862 [PubMed - indexed for MEDLINE]

56: Dig Dis Sci. 2006 Mar;51(3):480-7.  
Hyperbaric oxygen enhances the efficiency of 5-aminosalicylic acid in acetic acid-induced colitis in rats.  
Gorgulu S, Yagci G, Kaymakcioglu N, Ozkara M, Kurt B, Ozcan A, Kaya O, Sadir S, Tufan T.  
Department of General Surgery, Gulhane Military Medical Academy, 06018, Etlik, Ankara, Turkey.  
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The aim of this study was to assess the efficiency of hyperbaric oxygen alone and in combination with 5-aminosalicylic acid in the acetic acid-induced colitis model, a well-known experimental model of inflammatory bowel disease in rats. Rats were randomly divided into five groups. In the noncolitis control group, rats were given isotonic saline, while in the other groups rats were treated by intracolonic administration of 4% acetic acid. In group 2, the untreated control group, no additional therapy was applied. In groups 3, 4, and 5 hyperbaric oxygen, 5-aminosalicylic acid, and 5-aminosalicylic acid + hyperbaric oxygen therapies were applied, respectively. Administration of acetic acid caused an inflammatory response in all animals. Histopathologic score was significantly higher in group 2 than in any other group. 5-Aminosalicylic acid and hyperbaric oxygen significantly decreased the histopathologic score ( $P < 0.05$ ). Myeloperoxidase activity was also reduced significantly by 5-aminosalicylic acid ( $P < 0.05$ ) but not by hyperbaric oxygen. The most prominent ameliorative effect, however, was seen in group 5 and the histopathologic score and myeloperoxidase activity were significantly lower than in groups 3 ( $P < 0.05$ ) and 4 ( $P < 0.001$ ). Hydroxyproline level also increased significantly in group 5, but not in groups 3 and 4 ( $P < 0.001$ ). These findings indicate that hyperbaric oxygen therapy is effective in reducing the extent of colitis induced by acetic acid, although it is not as potent as 5-aminosalicylic acid. The combination of hyperbaric oxygen and 5-aminosalicylic acid, however, led to a much more prominent reduction in the severity of colitis. Hyperbaric oxygen may have a promising place in the treatment of inflammatory bowel disease.  
Publication Types: Comparative Study  
PMID: 16614956 [PubMed - indexed for MEDLINE]

57: Nurs N Z. 2006 Mar;12(2):17.  
The nursing role in oxygen treatment.  
Polley H.

PMID: 16610608 [PubMed - indexed for MEDLINE]

58: Nurs N Z. 2006 Mar;12(2):16.  
Treating wounds with oxygen.  
Polley H.  
Oxygen Therapy Clinic, Auckland.  
PMID: 16610607 [PubMed - indexed for MEDLINE]

59: ScientificWorldJournal. 2006 Apr 3;6:425-41.  
Effects of hyperbaric oxygen on inflammatory response to wound and trauma: possible mechanism of action.  
Al-Waili NS, Butler GJ.  
Life Support Technologies, Inc., Chronic Wound Treatment and Hyperbaric Medicine Center, The Mount Vernon Hospital, Mount Vernon, NY 10550, USA.  
There is growing interest in expanding the clinical applications for HBO2 (hyperbaric oxygen therapy) into new medical and surgical fields. The pathophysiology of response towards wounds, infection, trauma, or surgery involves various chemical mediators that include cytokines, prostaglandins (PGs), and nitric oxide (NO). The beneficial role played by HBO2 in wound healing, carbon monoxide poisoning, decompression sickness, and other indications is well documented. However, the exact mechanism of action is still poorly understood. This review addresses the effects of HBO2 on PGs, NO, and cytokines involved in wound pathophysiology and inflammation in particular. The results of this review indicate that HBO2 has important effects on the biology of cytokines and other mediators of inflammation. HBO2 causes cytokine down-regulation and growth factor up-regulation. HBO2 transiently suppresses stimulus-induced proinflammatory cytokine production and affects the liberation of TNF $\alpha$  (tumor necrosis factor alpha) and endothelins. VEGF (vascular endothelial growth factor) levels are significantly increased with HBO2, whereas the value of PGE2 and COX-2 mRNA are markedly reduced. The effect of HBO2 on NO production is not well established and more studies are required. In conclusion, cytokines, PGs, and NO may play a major role in the mechanism of action of HBO2 and further research could pave the way for new clinical applications for HBO2 to be established. It could be proposed that chronic wounds persist due to an uncontrolled pathological inflammatory response in the wound bed and that HBO2 enhances wound healing by damping pathological inflammation (anti-inflammatory effects); this hypothetical proposal remains to be substantiated with experimental results.

Publication Types: Review  
PMID: 16604253 [PubMed - indexed for MEDLINE]

60: Undersea Hyperb Med. 2006 Jan-Feb;33(1):33-43.  
A pilot study with long term follow up of hyperbaric oxygen pretreatment in patients with locally

advanced breast cancer undergoing neo-adjuvant chemotherapy.

Heys SD, Smith IC, Ross JA, Gilbert FJ, Brooks J, Semple S, Miller ID, Hutcheon A, Sarkar T, Eremin O.

Department of Surgery, University of Aberdeen, Scotland.

Work in an animal cancer model suggests that pretreatment with hyperbaric oxygen can improve tumor vascularity rendering chemotherapy more effective. Accordingly 32 subjects with locally advanced breast carcinoma (>5cm diameter) entered into a randomized clinical trial where a course was administered of six intravenous pulses of cyclophosphamide 1000mg/m<sup>2</sup> i.v., doxorubicin 50mg/m<sup>2</sup> i.v. and vincristine 1.5mg/m<sup>2</sup> i.v. In the case group this was preceded by ten, once daily, sessions of hyperbaric oxygen therapy (HBO<sub>2</sub>) administered either at 2.4 or 2.0 atmospheres absolute. Eleven out of 15 subjects tolerated a full course of HBO<sub>2</sub> and chemotherapy. All 17 control subjects tolerated a full course of chemotherapy. Tumor extravascular extracellular or edema fluid was reduced after HBO<sub>2</sub> but there was no reduction in tumor cell volume and no indication of increased vascularity on MRI. Clinical and pathological responses to chemotherapy were the same in both groups and there was no evidence of neovascularisation. Five year survival in those who tolerated the trial regime was 73% and did not differ between the groups. This mortality was cancer related.

Publication Types: Randomized Controlled Trial  
Research Support, Non-U.S. Gov't

PMID: 16602255 [PubMed - indexed for MEDLINE]

61: Undersea Hyperb Med. 2006 Jan-Feb;33(1):27-32.

A prospective, randomized clinical trial comparing two hyperbaric treatment protocols for carbon monoxide poisoning.

Hampson NB, Dunford RG, Ross DE, Wreford-Brown CE.

Center for Hyperbaric Medicine, Virginia Mason Medical Center 1100 Ninth Avenue Seattle, Washington 98101, USA.

INTRODUCTION: The optimal hyperbaric oxygen (HBO<sub>2</sub>) treatment protocol for acute carbon monoxide (CO) poisoning is unknown. This is indicated by one study that found 18 different protocols to treat CO poisoning by North American multiplace hyperbaric facilities. A pilot study was conducted to evaluate the feasibility of randomizing patients to different protocols and to determine whether any large differences in clinical outcome were present between the two most common protocols. METHODS: Adult patients with accidental CO poisoning resulting in transient loss of consciousness, presentation to the emergency department within 12 hours, primary language English, high school education, and residence within 100 miles of the hyperbaric facility were recruited.

Enrolled patients were randomized to one HBO<sub>2</sub> treatment at 2.4 atmospheres absolute (atm abs) pressure with 90 minutes of 100% oxygen breathing vs. treatment by the US Air Force CO protocol (3.0 atm abs maximum pressure). A neurocognitive screening test was performed immediately after hyperbaric treatment and repeated 14-21 days later. RESULTS: From 1995 to 2002, 30 patients age 21 to 88 years were randomized, 18 to treatment at 2.4 atm abs and 12 to 3.0 atm abs. Average carboxyhemoglobin level for the population was 24.8 +/- 8.8% (mean +/- SD). Delay to hyperbaric treatment averaged 313 +/- 129 minutes. Neither variable was different between treatment groups. Six patients had abnormal neurocognitive testing immediately following hyperbaric treatment, 4 in the 2.4 atm abs group (22%) and 2 in the 3.0 atm abs group (17%) (P=0.71). One patient in each group demonstrated abnormality on delayed testing (p=0.75). One in each group did not return for follow-up. CONCLUSIONS: It is feasible to randomize CO-poisoned patients to different hyperbaric treatment protocols. Determination of differences in efficacy between treatment protocols will require a large multicenter trial with the use of detailed neurocognitive testing.

Publication Types: Randomized Controlled Trial  
PMID: 16602254 [PubMed - indexed for MEDLINE]

62: Undersea Hyperb Med. 2006 Jan-Feb;33(1):17-25.

Wound oxygen levels during hyperbaric oxygen treatment in healing wounds.

Rollins MD, Gibson JJ, Hunt TK, Hopf HW.

Department of Anesthesia and Perioperative Care, University of California at San Francisco, San Francisco, CA, USA.

Hyperbaric oxygen (HBO<sub>2</sub>) increases wound oxygen delivery, but few data quantify wound oxygen levels over the course of healing. We characterized these changes during and after HBO<sub>2</sub> treatment in a rat wound model. The treatment group (n=7) received 2.0 ATA HBO<sub>2</sub>, 90 minutes BID for 15 days. Control rats (n=5) were only exposed to HBO<sub>2</sub> during measurement. On days 5, 10, and 15, wound pO<sub>2</sub> was measured before, during, and for an hour after HBO<sub>2</sub> treatment. Both the peak pO<sub>2</sub> and the pO<sub>2</sub> one hour after HBO<sub>2</sub> treatment were significantly greater than baseline on all days in both the treatment (p < .01) and control group (p < .05). The peak pO<sub>2</sub> during HBO<sub>2</sub> exposure and one hour after decreased significantly in the treatment group on day 15 compared to day 5 (p < .01, p < .05 respectively). No significant differences were found in pO<sub>2</sub> values between days within the control group. These results demonstrate that both the peak wound oxygen levels and duration of elevation change significantly throughout the course of HBO<sub>2</sub> treatment.

Publication Types: Research Support, N.I.H., Extramural  
Research Support, Non-U.S. Gov't  
PMID: 16602253 [PubMed - indexed for MEDLINE]

63: Undersea Hyperb Med. 2006 Jan-Feb;33(1):11-5. Hypoxemia with air breathing periods in U.S. NAVY Treatment Table 6.

Weaver LK, Churchill SK.

Hyperbaric Medicine, LDS Hospital, University of Utah School of Medicine, Salt Lake City, Utah, USA. Air breathing is used to lessen hyperbaric oxygen (HBO<sub>2</sub>) toxicity. Hypoxemia could occur during hyperbaric air breathing in patients with lung dysfunction, although this has not been previously reported. We report two cases of hypoxemia during air breathing with two patients treated with the US Navy Table 6. Patient 1 was an 11-year-old male with cerebral gas embolism (during cardiac transplantation), patient 2 was a 66-year-old female with cerebral gas embolism from a central venous catheter accident. Both were mechanically ventilated. We monitored arterial blood gas (ABG) during therapy. In both patients, ABG measurements showed hypoxia during the first air breathing period at 1.9 atm abs (192.5 kPa). If patients require > or = 40% inspired oxygen before HBO<sub>2</sub> therapy, oxygenation monitoring is advisable during air breathing periods, especially at lower chamber pressures (< or = 2.0 atm abs).

Publication Types: Case Reports

PMID: 16602252 [PubMed - indexed for MEDLINE]

64: Undersea Hyperb Med. 2006 Jan-Feb;33(1):1-4. The effect of hyperbaric oxygen on intraocular pressure.

Ersanli D, Akin T, Yildiz S, Akin A, Bilge AH, Uzun G.

Department of Ophthalmology, GMMMA Haydarpaşa Training Hospital, 81100, Kadikoy/Istanbul, Turkey. The effects of hyperoxia on intraocular pressure (IOP) have been studied in experiments on human beings and animals. The changes occurring in IOP in patients during routine HBO<sub>2</sub> therapy are unknown. In this study we investigated IOP changes arising during the HBO<sub>2</sub> therapy at 2.5 ATA. Fifty-six patients receiving HBO<sub>2</sub> therapy for various reasons were included in the study. Bilateral IOPs of patients measured with the Tono-pen XL (Medtronic, Solan, USA) tonometer before, during and after HBO<sub>2</sub> therapy. Average IOPs were 14.85 +/- 3.17 mmHg (range, 10-24), 13.00 +/- 2.97 mmHg (range, 9-21) and 14.74 +/- 3.12 mmHg (range, 10-22), respectively. IOP was reduced significantly during HBO<sub>2</sub> therapy and returned its pre- HBO<sub>2</sub> levels after therapy. Our data indicated a statistically significant decrease in IOPs during therapy at 2.5 ATA. This decrease was of minor physiological significance in these patients whose baseline IOP values were within the normal range.

PMID: 16602250 [PubMed - indexed for MEDLINE]

65: Injury. 2006 Apr;37 Suppl 1:S63-73. Epub 2006 Apr 11.

Electric stimulation and hyperbaric oxygen therapy in the treatment of nonunions.

Karamitros AE, Kalentzos VN, Soucacos PN.

1st Department of Orthopaedics, Athens University, Attikon Hospital, Haidari, Athens, Greece.

Up to 10% of the fractures occurring annually in the U.S. end up in non-union or delayed union. Classical treatment with osteosynthesis and bone grafting is not always successful. Alternatives in treatment have long ago been considered. This article presents current concepts in treatment with electrical stimulation and hyperbaric oxygen, the mechanisms of action, experimental and clinical evidence of their application.

Publication Types: Review

PMID: 16581073 [PubMed - indexed for MEDLINE]

66: Pediatr Transplant. 2006 Mar;10(2):234-9.

Hyperbaric oxygen therapy for hepatic artery thrombosis following liver transplantation: current concepts.

Grover I, Conley L, Alzate G, Lavine J, Van Hoesen K, Khanna A.

Hyperbaric Medicine Department, University of California San Diego, San Diego, CA 92103-8401, USA.

This article presents the case of an infant who underwent an orthotopic liver transplant and then developed hepatic artery thrombosis that was detected on routine post-operative right upper quadrant ultrasound. Alteplase (TPA) failed to open the artery, so the child received systemic heparin and hyperbaric oxygen (HBO) therapy. After six HBO treatments, the hepatic artery had recanalized and his liver function tests had returned to normal or near normal. There were no complications to the HBO therapy, and 1 yr after the transplant, the child's liver is functioning well. The present study discusses the beneficial effects of HBO therapy and the proposed mechanisms for its favorable results. In our patient, systemic heparin and HBO therapy prevented liver failure and need for retransplantation.

Publication Types: Case Reports

PMID: 16573613 [PubMed - indexed for MEDLINE]

67: Pediatr Transplant. 2006 Mar;10(2):145.

Hyperbaric oxygen therapy: a useful adjunct therapy in pediatric hepatic arterial thrombosis.

Soltys K, Mazariegos G.

Publication Types: Editorial

PMID: 16573597 [PubMed - indexed for MEDLINE]

68: Arch Phys Med Rehabil. 2006 Apr;87(4):592-3; author reply 593.

Comment on: Arch Phys Med Rehabil. 2004 Jul;85(7):1198-204.

Medicine that overlooks the evidence.

Harch PG.

Publication Types: Comment Letter Research Support, U.S. Gov't, P.H.S.

PMID: 16571403 [PubMed - indexed for MEDLINE]

69: Stroke. 2006 May;37(5):1314-8. Epub 2006 Mar 23.

Hyperbaric oxygen suppresses NADPH oxidase in a rat subarachnoid hemorrhage model.

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Department of Physiology and Pharmacology, Loma Linda University, Loma Linda, CA 92354, USA.

**BACKGROUND AND PURPOSE:** One of the major contributors to brain injury after subarachnoid hemorrhage (SAH) is oxidative stress, and 1 of the major enzymatic sources of superoxide anion production in the brain is NADPH oxidase. Therefore, we studied whether hyperbaric oxygen (HBO) suppresses neuronal NADPH oxidase in a rat model of SAH. **METHODS:** Eighty-three Sprague-Dawley male rats were assigned to sham, SAH, and SAH treated with HBO groups. SAH was induced by endovascular perforation. HBO (2.8 atmospheres absolute for 2 hours) was started at 1 hour after perforation. Rats were euthanized at 6 or 24 hours, and brains were collected for histology, biochemistry, and molecular biology studies including NADPH oxidase activity, gp91phox mRNA expression, and lipid peroxidation assays. Mortality and neurological scores were evaluated. **RESULTS:** We observed an increased neuronal immunoreactivity of gp91phox at 24 hours after SAH. The upregulation of gp91phox mRNA was associated with increased oxidative stress. HBO decreased NADPH oxidase expression, activity, and the level of oxidative stress at 24 hours after SAH. HBO reduced neuronal injury and improved functional performance throughout the observation period. **CONCLUSIONS:** HBO suppresses NADPH oxidase and oxidative stress in cerebral tissues at 24 hours after SAH.

**Publication Types:** Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't  
PMID: 16556878 [PubMed - indexed for MEDLINE]

70: Med Hypotheses. 2006;67(2):216-28. Epub 2006 Mar 22.

Hyperbaric oxygen therapy may improve symptoms in autistic children.

Rossignol DA, Rossignol LW.

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Autism is a neurodevelopmental disorder that currently affects as many as 1 out of 166 children in the United States. Recent research has discovered that some autistic individuals have decreased cerebral perfusion, evidence of neuroinflammation, and increased markers of oxidative stress. Multiple independent single photon emission computed tomography (SPECT) and positron emission tomography (PET) research studies have revealed hypoperfusion to several areas of the autistic brain, most notably the temporal regions and areas specifically related to language comprehension and auditory processing. Several studies show that diminished blood flow to these areas correlates with many of the clinical features associated with autism including repetitive, self-stimulatory and stereotypical behaviors, and impairments in

communication, sensory perception, and social interaction. Hyperbaric oxygen therapy (HBOT) has been used with clinical success in several cerebral hypoperfusion syndromes including cerebral palsy, fetal alcohol syndrome, closed head injury, and stroke. HBOT can compensate for decreased blood flow by increasing the oxygen content of plasma and body tissues and can even normalize oxygen levels in ischemic tissue. In addition, animal studies have shown that HBOT has potent anti-inflammatory effects and reduces oxidative stress. Furthermore, recent evidence demonstrates that HBOT mobilizes stem cells from human bone marrow, which may aid recovery in neurodegenerative diseases. Based upon these findings, it is hypothesized that HBOT will improve symptoms in autistic individuals. A retrospective case series is presented that supports this hypothesis.

**Publication Types:** Case Reports

PMID: 16554123 [PubMed - indexed for MEDLINE]

71: World J Gastroenterol. 2006 Mar 7;12(9):1421-5. Effects of hyperbaric oxygen and Pgg-glucan on ischemic colon anastomosis.

Guzel S, Sunamak O, AS A, Celik V, Ferahman M, Nuri MM, Gazioglu E, Atukeren P, Mutlu O.

Department of General Surgery, Cerrahpasa Faculty of Medicine, Istanbul, Turkey.

**AIM:** In colorectal surgery, anastomotic failure is still a problem in ischemia. Here, we analyzed the effects of hyperbaric oxygen and beta-glucan on colon anastomoses in ischemic condition. **METHODS:** Colonic resection and anastomosis in rectosigmoid region were done in forty Wistar-Albino rats of four groups of equal number. Colon mesentery was ligated to induce ischemia. The first group was the control group. The subjects of second group were treated with hyperbaric oxygen; the third group with glucan and the fourth group were treated with both. At the fourth day, rats were sacrificed, anastomotic segment was resected and burst pressures and hydroxyproline levels of anastomotic line were measured. **RESULTS:** The burst pressure difference of second and third groups from the control group were meaningful ( $P < 0.01$ ); the fourth group differed significantly from the control ( $P < 0.001$ ). There was no difference between the treated groups on burst pressure level ( $P > 0.05$ ). The hydroxyproline levels in all treated groups were different from the control group significantly ( $P < 0.001$ ). Hydroxyproline levels in the fourth group were higher than those of the second and the third groups ( $P < 0.001$ ). There were no significant differences between the second and the fourth groups in burst pressure and hydroxyproline levels ( $P > 0.05$ ). **CONCLUSION:** Hyperbaric oxygen and glucan improve healing in ischemic colon anastomoses by anti-microbial, immune stimulating properties and seem to act synergistically when combined together. PMID: 16552813 [PubMed - indexed for MEDLINE]

72: J Oral Maxillofac Surg. 2006 Apr;64(4):589-93.

Distraction osteogenesis in irradiated rabbit mandibles with adjunctive hyperbaric oxygen therapy.

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**PURPOSE:** The purpose of this study was to evaluate the effect of hyperbaric oxygen therapy on bone regeneration during distraction of irradiated rabbit mandibles. **MATERIALS AND METHODS:** Twenty New Zealand white rabbits were randomly subdivided into 4 groups. Group 1 served as control, group 2 received preoperative radiation therapy, group 3 received pre- and postoperative hyperbaric oxygen (HBO) therapy, and group 4 received preoperative radiation therapy and pre- and postoperative HBO therapy. All rabbits underwent a corticotomy of the left body of the mandible after placement of a distraction device. Distraction, at a rate of 1 mm/day and a rhythm of 1 turn/day, began after a 3-day latency period for 14 days. Thirty days after completion of the distraction protocol, the animals were euthanized, and histomorphometric and radiographic data of the distraction segments were obtained. **RESULTS:** Histomorphometric analysis of new bone fill was greatest in the non-irradiated groups compared to groups receiving radiation therapy, regardless of HBO therapy ( $P = .03$ ). Pre-corticotomy bone density measurements showed a significant increase in bone density over time ( $P = .0007$ ). This resulted in a significant relationship between HBO therapy, radiation therapy, and time ( $P = .0050$ ). **CONCLUSIONS:** The results of the study support the use of HBO therapy during distraction osteogenesis. Any additional therapeutic benefit of HBO therapy in irradiated bone would require additional investigation.

PMID: 16546637 [PubMed - indexed for MEDLINE]

73: Brain Res. 2006 Apr 21;1084(1):196-201. Epub 2006 Mar 20.

Extension of brain tolerance to hyperbaric O<sub>2</sub> by intermittent air breaks is related to the time of CBF increase.

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Intermittent air breaks during hyperbaric oxygen (HBO<sub>2</sub>) exposures protect against pulmonary and central nervous system (CNS) toxicity. The mechanisms of this beneficial effect from intermittency are not known. In this study, we examined if release of vasoconstriction during HBO<sub>2</sub> exposure indicates a threshold for toxic dose of HBO<sub>2</sub> and how it may be related to tolerance by intermittency. Awake rats instrumented for EEG and cerebral blood flow (CBF) measurement were exposed to 100% O<sub>2</sub> at 6 ATA (absolute pressure).

Air breaks of 3 or 10 min were given at different times after CBF increase. Following the air break, animals were exposed to 100% O<sub>2</sub> until seizure and total O<sub>2</sub> time was used to calculate benefit/toxicity. The most beneficial schedule was then used to assess the role of the multiple air breaks in extension of HBO<sub>2</sub> tolerance. A significant increase in seizure latency was observed in animals with a single 3- or 10 min air break given 5-10 min after CBF increase. No change in seizure latency was observed when air breaks were given beyond (>10 and <5 min) this window. The duration of total O<sub>2</sub> time to seizures was doubled with multiple 3 min air breaks, and quadrupled with 10 min air breaks compared with continuous HBO<sub>2</sub> exposures. With more time spent on O<sub>2</sub>, the duration of air breaks was not sufficient for recovery from O<sub>2</sub> toxicity and for CBF to return to baseline. Results show that an "optimal window" of HBO<sub>2</sub> exposure is required for benefits by intermittent exposure to air.

Publication Types: Comparative Study  
Research Support, U.S. Gov't, Non-P.H.S.  
PMID: 16546146 [PubMed - indexed for MEDLINE]

74: Clin Exp Nephrol. 2006 Mar;10(1):82-4.

Hyperbaric therapy for bilateral visual loss during hemodialysis.

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Bilateral vision loss during hemodialysis is a rare but devastating entity, with grim prognosis for sight. The etiologies are diverse but share ischemia as a common mechanism. This is a report of a patient with bilateral sight loss during hemodialysis, with early hyperbaric treatment and return of visual acuity to baseline. Hyperbaric treatment should be considered, where early administration is possible, for bilateral blindness during hemodialysis.

Publication Types: Case Reports  
PMID: 16544183 [PubMed - indexed for MEDLINE]

75: Curr Pain Headache Rep. 2006 Apr;10(2):95-100.

Hyperbaric oxygen therapy in chronic pain management.

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Chronic pain is one of the frequently encountered clinical problems that is difficult to cure. Hyperbaric oxygen (HBO) therapy has been reported in chronic pain syndromes with promising results. In this review, we focus on the effectiveness of HBO in fibromyalgia syndrome, complex regional pain syndrome, myofascial pain syndrome, migraine, and cluster headaches. HBO may be beneficial if appropriate patients are selected. HBO is a reliable method of treatment. However, physicians performing HBO must be aware of oxygen toxicity. Another problem regarding HBO is the scarcity of

centers administering it. Further research is required focusing on the optimal treatment protocol, the cost/benefit ratio, and the safety of HBO in chronic pain management.

Publication Types: Review

PMID: 16539861 [PubMed - indexed for MEDLINE]

76: *Optom Vis Sci.* 2006 Mar;83(3):195-8.

Hypermetropia-succeeded myopia after hyperbaric oxygen therapy.

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A 58-year-old man presented with a change in vision during hyperbaric oxygen (HBO) therapy. Subsequent follow-up visits showed a hypermetropic shift, which succeeded the myopic shift after each of two series of HBO treatments. The maximal refractive amplitude was 3.00 D (range -1.37 D to +1.62 D) in the right eye and 2.75 D (range -1.25 D to +1.50 D) in the left eye. Refraction stabilized after 1.5 years at +0.62 D and +0.50 D to pretreatment values in the right and left eye, respectively. The findings are discussed with regard to possible changes in the structure of the lens.

Publication Types: Case Reports

PMID: 16534462 [PubMed - indexed for MEDLINE]

77: *Brain Res Bull.* 2006 Mar 31;69(2):109-16. Epub 2005 Dec 15.

Involvement of the mitochondrial ATP-sensitive potassium channel in the neuroprotective effect of hyperbaric oxygenation after cerebral ischemia.

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In the present study, we investigated whether activation of mitochondrial ATP-sensitive potassium channel is involved in the neuroprotective effect offered by early hyperbaric oxygenation after cerebral ischemia. The selective mitochondrial ATP-sensitive potassium channel antagonist 5-hydroxydecanoate was infused intracerebroventricularly before hyperbaric oxygenation treatment initiated 3 h after middle cerebral artery occlusion for 90 min. Neurological status was evaluated and brains were removed for the measurement of infarct size and immunohistochemical evaluation of apoptosis 24 h after middle cerebral artery occlusion. Early hyperbaric oxygenation treatment improved neurologic deficits and reduced infarct volume, while these effects were reversed by the administration of 5-hydroxydecanoate. Furthermore, early hyperbaric oxygenation significantly decreased the number of apoptotic cells in the peri-infarct cortex 24 h after ischemic insult and this effect was also blocked by 5-

hydroxydecanoate. The present findings suggest that early hyperbaric oxygenation therapy prevents apoptosis and promotes neurologic functional recovery after focal cerebral ischemia, and the opening of mitochondrial ATP-sensitive potassium channel plays a role in this antiapoptotic effect of early hyperbaric oxygenation.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 16533658 [PubMed - indexed for MEDLINE]

78: *Rev Lat Am Enfermagem.* 2006 Jan-Feb;14(1):118-23. Epub 2006 Mar 8.

[Nursing activities in hyperbaric oxygen therapy]

[Article in Portuguese]

Lacerda EP, Sitnoveter EL, Alcantara LM, Leite JL, Trevizan MA, Mendes IA.

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The authors discuss nursing activities in hyperbaric oxygen therapy through an experience report developed at the Medical Clinical of the Naval Hospital Marcílio Dias. This article presents a brief history of the procedure, its therapeutic effects, indications, collateral effects and complications. The authors believe that efforts are needed to create awareness about nursing activities in this new role as a labor market alternative in this growing specialty area.

Publication Types: English Abstract

PMID: 16532248 [PubMed - indexed for MEDLINE]

79: *Zhongguo Dang Dai Er Ke Za Zhi.* 2006 Feb;8(1):33-7.

[Effect of hyperbaric oxygenation on neural stem cells and myelin in neonatal rats with hypoxic-ischemic brain damage]

[Article in Chinese]

Yu XH, Yang YJ, Wang X, Wang QH, Xie M, Qi BX, Liu CT, Wang XL, Jia YJ, Zhong L.

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OBJECTIVE: This study investigated the effect of hyperbaric oxygenation (HBO) on neural stem cells (NSCs) and myelin in neonatal rats following hypoxic-ischemic brain damage (HIBD) and aimed to explore the possible mechanism of the protective effect of HBO on HIBD. METHODS: Seven-day-old Sprague-Dawley rat pups were randomly assigned into 4 groups: Normal control, HIBD, hyperbaric air (HBA), and HBO groups (n=30 each). The HIBD model was produced by permanent occlusion of the left common carotid artery and 2 hrs hypoxemia exposure (8% O<sub>2</sub> at 37 degrees C). HBA and HBO treatment was administered (2 ATA, once daily for 7 days) in the HBA and HBO groups respectively 1 hr after HIBD. BrdU immunohistochemistry was used to detect the NSCs in the sub-ventricle zone (SVZ) of the lateral ventricle and the dentate gyrus (DG) of the hippocampus. The myelin damage was assessed by myelin basic protein (MBP) immunostaining. RESULTS: The BrdU-positive cells in the SVZ and

the DG of the ischemic hemisphere in the HIBD group were dramatically decreased compared with those of the Normal control group at 3 weeks post-HIBD ( $P < 0.01$ ). The HBO treatment resulted in an increase of BrdU-positive cells in the DG from  $153.7 \pm 37.0$  to  $193.7 \pm 38.8$  ( $P < 0.05$ ). The nestin expression in the HIBD and HBA groups was reduced compared with that in the Normal control group. There was no difference in the nestin expression between the HBO and the Normal control groups. Hypoxia-ischemia (HI) led to marked myelin damage at 1 week post-HIBD. HBO or HBA treatment alleviated the damage. CONCLUSIONS: The HBO treatment can result in the proliferation of BrdU-positive cells and alleviate the myelin damage following HIBD in neonatal rats, thereby offering neuroprotectivity against HI insults.

Publication Types: English Abstract  
PMID: 16522237 [PubMed - indexed for MEDLINE]

80: *Angiology*. 2006 Mar-Apr;57(2):139-44.  
Accelerated wound healing: multidisciplinary advances in the care of venous leg ulcers.  
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Lake District Hospital Wound Clinics, Lakeview, OR 97630, USA. Cbongil@aol.com  
The etiologies of venous leg ulcers have been well known for millennia, and yet there remains no simple solution to this very common problem. Achieving closure of venous leg ulcers is often a lengthy process that is further complicated by the presence of significant comorbidities. The authors present data on healing venous leg ulcers in a cohort of 231 patients, most of whom had 1 or more complicating factors. Our multidisciplinary and aggressive approach to healing venous leg ulcers is described and has resulted in an average healing time of 29 days, a significantly shorter duration of treatment than the reported average of 6 months.

Publication Types: Comparative Study  
PMID: 16518520 [PubMed - indexed for MEDLINE]

81: *J Pediatr Surg*. 2006 Mar;41(3):505-13.  
Cerebral oxygenation in major pediatric trauma: its relevance to trauma severity and outcome.  
Narotam PK, Burjonrappa SC, Raynor SC, Rao M, Taylon C.  
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INTRODUCTION: Trauma is the commonest cause of death in the pediatric population, which is prone to diffuse primary brain injury aggravated by secondary insults (eg, hypoxia, hypotension). Standard monitoring involves intracranial pressure (ICP) and cerebral perfusion pressure, which do not reflect true cerebral oxygenation (oxygen delivery [Do(2)]). We explore the merits of a brain tissue oxygen-directed critical care guide. METHODS: Sixteen patients with major trauma (Injury Severity Score, >16/Pediatric Trauma Score [PTS], <7) had partial pressure of brain tissue oxygen (Pbto(2)) monitor (Licox; Integra

Neurosciences, Plainsboro, NJ) placed under local anesthesia using twist-drill craniostomy and definitive management of associated injuries. Pbto(2) levels directed therapy intensity level (ventilator management, inotropes, blood transfusion, and others). Patient demographics, short-term physiological parameters, Pbto(2), ICP, Glasgow Coma Score, trauma scores, and outcomes were analyzed to identify the patients at risk for low Do(2). RESULTS: There were 10 males and 6 females (mean age, 14 years) sustaining motor vehicle accident (14), falls (1), and assault (1), with a mean Injury Severity Score of 36 (16-59); PTS, 3 (0-7); and Revised Trauma Score, 5.5 (4-11). Eleven patients (70%) had low Do(2) (Pbto(2), <20 mm Hg) on admission despite undergoing standard resuscitation affected by fraction of inspired oxygen, Pao(2), and cerebral perfusion pressure ( $P = .001$ ). Eubalic hyperoxia improved cerebral oxygenation in the low-Do(2) group ( $P = .044$ ). The Revised Trauma Score ( $r = 0.65$ ) showed moderate correlation with Pbto(2) and was a significant predictor for low Do(2) ( $P = .001$ ). In patients with Pbto(2) of less than 20 mm Hg, PTS correlated with cerebral oxygenation ( $r = 0.671$ ,  $P = .033$ ). The mean 2-hour Pbto(2) and the final Pbto(2) in survivors were significantly higher than deaths ( $21.6$  vs  $7.2$  mm Hg [ $P = .009$ ] and  $25$  vs  $11$  mm Hg [ $P = .01$ ]). Although 4 of 6 deaths were from uncontrolled high ICP, PTS and 2-hour low Do(2) were significant for roots for mortality. CONCLUSIONS: Pbto(2) monitoring allows for early recognition of low-Do(2) situations, enabling appropriate therapeutic intervention.

Publication Types: Clinical Trial  
PMID: 16516625 [PubMed - indexed for MEDLINE]

82: *J Hepatol*. 2006 Jul;45(1):28-34. Epub 2006 Feb 3.

Hyperbaric oxygen induces vascular endothelial growth factor and reduces liver injury in regenerating rat liver after partial hepatectomy.  
Ijichi H, Taketomi A, Yoshizumi T, Uchiyama H, Yonemura Y, Soejima Y, Shimada M, Maehara Y.  
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BACKGROUND/AIMS: The aim of this study was to investigate the effect and the mechanism of hyperbaric oxygen treatment on regenerating rat liver after partial hepatectomy (PH). METHODS: Wistar rats underwent a 70% PH, followed by treatment with hyperbaric oxygen starting 8 h after PH. The regenerated liver weight and serum parameters were compared. Proliferation of both hepatocytes and sinusoidal endothelial cell (SEC) was also monitored by evaluating the proliferating cell nuclear antigen (PCNA) labeling index. Furthermore, the hepatic adenosine triphosphate levels and vascular endothelial growth factor (VEGF) protein expression were analyzed at different times. RESULTS: Hyperbaric oxygen treatment significantly reduced the serum alanine aminotransferase levels at 24 h,

total bilirubin and total bile acid levels at 48 and 72 h, respectively. No significant differences in the hepatic adenosine triphosphate levels, the restitution of liver weight, or PCNA positive hepatocytes were observed between the two groups. The PCNA positive SEC, in contrast, was significantly increased in the hyperbaric oxygen group at 48h, furthermore, the hyperbaric oxygen treatment significantly increased the expression of VEGF protein in the regenerating liver at 24 and 48 h. CONCLUSIONS: Hyperbaric oxygen treatment can be considered as a therapeutic modality after massive PH. PMID: 16513203 [PubMed - indexed for MEDLINE]

83: J Neurosurg. 2006 Jan;104(1):170-1; author reply 171-2.

Comment on: J Neurosurg. 2004 Sep;101(3):435-44.

Hypoxia and traumatic brain injury.

Rockswold GL, Quickel RR, Rockswold SB.

Publication Types: Comment Letter

PMID: 16509162 [PubMed - indexed for MEDLINE]

84: Anaesth Intensive Care. 2006 Feb;34(1):61-7.

The performance and safety of a pleural drainage unit under hyperbaric conditions.

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The performance of a proprietary dry suction pleural drainage unit was measured under hyperbaric oxygenation conditions. The test pleural drainage unit was connected to pressure gauges that allowed the pressures created in the suction and collection chambers to be measured as well as the pleural drainage catheter pressures under varied suction regulator settings during compression, hyperbaric steady states and decompression. The maximum flow capacity of the unit was also measured under varying hyperbaric conditions. The Atrium Oasis Dry Suction 3600 Chest Drain brand was dramatically affected by pressure change. Nevertheless, based upon our testing, we believe it can be used safely in a hyperbaric environment provided that the following precautions are taken. Suction should not be applied during pressurization. Pressurization needs to be slow, 10 kpa/min or less. Suction is needed for air leaks of 4/min or more at pressure. At stable hyperbaric pressure, the level of suction delivered can be set by adjusting the suction regulator with reference to the conversion table we have determined. Suction must be applied during depressurization if there is an air leak of 5/min or greater coming from the patient, otherwise suction is not essential. As the features of many brands and models of proprietary drains are similar, we would expect other types could be hyperbaric compatible, but individual testing should be performed before acceptance.

Publication Types: Comparative Study Evaluation Studies

PMID: 16494152 [PubMed - indexed for MEDLINE]

85: Acta Cir Bras. 2006 Jan-Feb;21(1):52-7. Epub 2006 Feb 13.

[Hyperbaric oxygen therapy in rats submitted to hepatic veins ligation: mortality valuation and histological study of liver and spleen]

[Article in Portuguese]

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PURPOSE: To evaluate the effects of hyperbaric oxygen therapy in rats submitted to instantaneously hepatic vein obstruction. METHODS: 30 Holtzman adult male rats were utilised, distributed into two groups: 1) hepatic vein obstruction; 2) hepatic vein obstruction associated with hyperbaric oxygen therapy. General anaesthesia was utilized by a solution composed of ketamine chloride (40 mg/ml) and meperidine chloride (10 mg/ml) in a dose of 50/mg/weight, applied into the right gluteus muscle. The animals belonged to group 2 were submitted to hyperbaric oxygen therapy, 8 hours after the operations, in a 2,5 atmosphere, which lasts 120 minutes per day, in consecutive 20 days. The statistical analysis was made in relation to mortality and histological study of livers and spleens utilizing the Fisher test, and the results were considered statistically significant when  $p < 0.05$ . RESULTS: Occurred seven (46.67%) deaths between animals belonged to group 1 and no deaths in the animals belonged to group 2. The histological studies made in the livers and spleens of the animals belonged to group 1 showed many alterations in the following percentages: thrombosis of hepatic, portal and centerlobular veins in five (33.3%), very extensive necrosis of liver cells in seven (46.7%), and light in eight (53.3%), Kupffer cells developed and hypertrophied in 14 (93.3%), high congestion of the spleen purple in six (40.0%) and moderate and severe hemossiderinosis spleen in 14 (93.3%). The analysis of this parameters in the group 2 only showed light necrosis of liver cells, Kupffer cells light developed and hypertrophied, moderated congestion of the spleen purple and light hemossiderinosis spleen. All these parameters analysed showed significantly difference ( $p < 0.05$ ) between these two groups. CONCLUSIONS: It could be concluded that the hyperbaric oxygen therapy applied in rats, with instantaneously hepatic vein obstruction decreased their post-surgical mortality and their early deleterious effects in the liver and spleen.

Publication Types: English Abstract

PMID: 16491224 [PubMed - indexed for MEDLINE]

86: Zhonghua Nan Ke Xue. 2006 Jan;12(1):46-9.

[Effect of varicocelelectomy with hyperbaric oxygenation in treating infertile patients with varicocele]

[Article in Chinese]

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**OBJECTIVE:** To explore the therapeutic effects of combination of varicocelectomy with hyperbaric oxygenation (HBO) in treating infertile patients with varicocele. **METHODS:** Ninety-six patients were randomly divided into two groups: 40 patients in group A treated by varicocelectomy with HBO, and 56 in group B treated by solitary varicocelectomy. **RESULTS:** The sperm density, sperm motility, sperm vigor, normality, serum testosterone, the pregnant rate of patients spouses were improved respectively in both two groups ( $P < 0.01$  or  $P < 0.05$ ), and group A had better results than group B ( $P < 0.05$ ). LH, FSH in group A decreased significantly after the therapy. Group A had higher sperm penetration assay (SPA) percentages than group B ( $P < 0.05$ ), and the pregnant time of patient's spouses in group A was earlier than that in group B ( $P < 0.05$ ). **CONCLUSION:** Varicocelectomy with HBO can more effectively regulate reproductive hormone, improve semen quality, SPA index and pregnant rate than solitary varicocelectomy in treating infertile patients with varicocele and can markedly shorten the pregnant time.

Publication Types: English Abstract  
Randomized Controlled Trial  
PMID: 16483159 [PubMed - indexed for MEDLINE]

87: Brain Res. 2006 Mar 3;1076(1):231-7. Epub 2006 Feb 9.

Hyperbaric oxygen reduces basal lamina degradation after transient focal cerebral ischemia in rats.

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Hyperbaric oxygen (HBO) has been shown to preserve the integrity of the blood-brain barrier after cerebral ischemia. However, the underlying molecular mechanisms are currently unknown. We examined the effect of HBO on postischemic expression of the basal laminar component laminin-5 and on plasma matrix metalloproteinase-9 (MMP) levels. Wistar rats underwent occlusion of the middle cerebral artery (MCAO) for 2 h. With a delay of 45 min after filament introduction, animals breathed either 100% O<sub>2</sub> at 1.0 atmosphere absolute (ata; NBO) or at 3.0 ata (HBO) for 1 h in an HBO chamber. Laminin-5 expression was quantified on immunohistochemical sections after 24 h of reperfusion. Plasma MMP-9 levels were measured using gelatin zymography before MCAO as well as 0, 6 and 24 h after reperfusion. Immunohistochemistry 24 h after ischemia revealed a decrease of vascular laminin-5 staining in the ischemic striatum to 43 +/- 26% of the contralateral hemisphere in the NBO group which was significantly attenuated to 73 +/- 31% in the HBO group. Densitometric analysis of

zymography bands yielded significantly larger plasma MMP-9 levels in the NBO group compared to the HBO group 24 h after ischemia. In conclusion, HBO therapy attenuates ischemic degradation of cerebral microvascular laminin-5 and blocks postischemic plasma MMP-9 upregulation.

Publication Types: Comparative Study  
Research Support, Non-U.S. Gov't  
PMID: 16480689 [PubMed - indexed for MEDLINE]

88: J Nucl Cardiol. 2006 Jan-Feb;13(1):69-74.

Improvement of myocardial perfusion in coronary patients after intermittent hypobaric hypoxia.

del Pilar Valle M, García-Godos F, Woolcott OO, Marticorena JM, Rodríguez V, Gutiérrez I, Fernández-Dávila L, Contreras A, Valdivia L, Robles J, Marticorena EA.

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**BACKGROUND:** Persons living at high altitude (exposed to hypoxia) have a greater number of coronary and peripheral branches in the heart than persons living at sea level. In this study we investigated the effect of intermittent hypobaric hypoxia on myocardial perfusion in patients with coronary heart disease. **METHODS AND RESULTS:** We studied 6 male patients (aged >or=53 years) with severe stable coronary heart disease. All patients were born at sea level and lived in that environment. They underwent 14 sessions of exposure to intermittent hypobaric hypoxia (equivalent to a simulated altitude of 4200 m). Myocardial perfusion was assessed at baseline and after treatment with hypoxia by use of exercise perfusion imaging with technetium 99m sestamibi. After the sessions of hypoxia, myocardial perfusion was significantly improved. The summed stress score for hypoperfusion, in arbitrary units, decreased from 9.5+ to 4.5+ after treatment ( $P=.036$ ). There was no evidence of impairment of myocardial perfusion in any patient after treatment. **CONCLUSIONS:** Intermittent hypobaric hypoxia improved myocardial perfusion in patients with severe coronary heart disease. Though preliminary, our results suggest that exposure to intermittent hypobaric hypoxia could be an alternative for the management of patients with chronic coronary heart disease.

Publication Types: Clinical Trial  
Research Support, Non-U.S. Gov't  
PMID: 16464719 [PubMed - indexed for MEDLINE]

89: Plast Reconstr Surg. 2006 Feb;117(2):646-51; discussion 652-3.

Therapeutic outcome of hyperbaric oxygen and basic fibroblast growth factor on intractable skin ulcer in legs: preliminary report.

Nakada T, Saito Y, Chikenji M, Koda S, Higuchi M, Kawata K, Ishida S, Takahashi S, Kondo S, Kubota Y, Kubota I, Shimizu Y.

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**BACKGROUND:** Beneficial effects of hyperbaric oxygen on ischemic vascular diseases have been noted. Acceleration of wound healing with basic fibroblast growth factor has also been reported. The authors employed combination therapy of hyperbaric oxygen and basic fibroblast growth factor in patients with skin ulcer in legs refractory to conventional therapy. **METHODS:** Three men and four women were simultaneously treated with hyperbaric oxygen at 2 absolute atmospheric pressures for 90 minutes daily and spray treatment of basic fibroblast growth factor to the ulcer bed daily for an average of 2.6 months. Biopsy specimens obtained from ulcer tissues were divided into two pieces, one for histologic examination and the other for measuring fibrous protein. **RESULTS:** Ulcers were completely cured in five of seven patients. Two patients showed shrinkage of ulcer size. This combined therapy induced proliferation of connective tissue of the ulcer tissues, especially collagen and noncollagenous protein. **CONCLUSIONS:** Combined treatment with hyperbaric oxygen and basic fibroblast growth factor may be useful in patients with intractable skin ulcers in legs, and the shrinkage effect of this therapy is probably related to the proliferation of granulation tissues of the ulcer lesion.

PMID: 16462352 [PubMed - indexed for MEDLINE]

90: *Plast Reconstr Surg.* 2006 Feb;117(2):24e-28e. Managing pyoderma gangrenosum: a synergistic approach combining surgical débridement, vacuum-assisted closure, and hyperbaric oxygen therapy. Niezgodá JA, Cabigas EB, Allen HK, Simanonok JP, Kindwall EP, Krumenauer J. Center for Comprehensive Wound Care and Hyperbaric Oxygen Therapy, Aurora Health Care, St. Luke's Medical Center, Milwaukee, Wisconsin, USA. niezgodá@execpc.com

Publication Types: Case Reports

PMID: 16462310 [PubMed - indexed for MEDLINE]

91: *Brain Res.* 2006 Feb 23;1075(1):213-22. Epub 2006 Feb 3.

A comparison of hyperbaric oxygen versus hypoxic cerebral preconditioning in neonatal rats.

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The potency of hyperbaric preconditioning (HBO-PC) is uncertain compared to well-validated ischemic or hypoxic models and no studies have directly compared HBO-PC to hypoxic preconditioning (HPC). We subjected rat pups to unilateral carotid cauterization followed by 90 min (min) of hypoxia using 8% O<sub>2</sub>. Three HBO-PC regimens (maximum 2.5 atmospheres for 150 min) were compared to HPC (150 min of 8% O<sub>2</sub>) for changes in mortality and

brain weight. Preconditioning-induced oxidative stress was assessed using aconitase activity and manganese superoxide dismutase (MnSOD) transcript levels. Initial brain weight data revealed a large coefficient of variation and compelled an examination of the temperature sensitivity of the model that revealed a narrow optimal range of 35 to 37 degrees C of variability in brain injury and mortality. With rigorous temperature control, high dose HBO-PC and HPC showed comparable anatomic (mean hemispheric weight decrease: control 42%, HPC 25% (P=0.01), HBO-PC 26% (P=0.01) and mortality protection (control 14.7%, HPC 5.9% HBO-PC 5.7%, P=0.001). High dose HBO-PC, but not HPC, suppressed aconitase activity by 65% at 24 h after the preconditioning stimulus (P=0.001). In contrast, MnSOD mRNA increased 2.5-fold at 24 h after HPC (P=0.007) but not after high dose HBO-PC. Thus, when temperature variability is eliminated, HBO-PC and HPC elicit similar preconditioning efficacy in neonatal brain but invoke different defenses against oxidative stress.

Publication Types: Comparative Study  
Research Support, N.I.H., Extramural  
Research Support, Non-U.S. Gov't

PMID: 16458861 [PubMed - indexed for MEDLINE]

92: *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2006 Feb;101(2):144-9.

Hyperbaric oxygen results in an increase in rabbit calvarial critical sized defects.

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**OBJECTIVE:** This study was undertaken to evaluate whether the effects of hyperbaric oxygen (HBO) therapy could alter the critical size for spontaneous healing of a bone defect in the rabbit calvarial model. **STUDY DESIGN:** An animal trial of 12 weeks duration was conducted using 20 New Zealand white rabbits, which were randomly divided into 2 groups of 10 animals each. Calvarial defects were created in the parietal bones of each animal bilaterally. Defects were critical-sized, 15 mm on one side and supra-critical-sized, 18 mm on the contralateral side. Group 1 received a 90-min HBO treatment sessions at 2.4 absolute atmospheric pressure (ATA) per day for 20 consecutive days. Group 2 served as a control without any HBO treatment sessions. Five animals in each group were sacrificed at 6 and 12 weeks. Data analysis included qualitative assessment of the calvarial specimens, post-sacrifice radiographs, as well as histomorphometric analysis to compute the amount of regenerated bone within the defects. ANOVA and paired sample t test were used for statistical analysis. **RESULTS:** Both radiographic analysis and histomorphometric analysis demonstrated that HBO-treated animals had significantly more new bone within their defects compared with the control group (P < .001). There was no statistically significant difference between the percentage of new bone forming in the 15-mm and

18-mm HBO-treated defects. There was no difference between the 6-week and the 12-week HBO-treated groups. HBO is effective in enhancing the bony healing of full thickness critical sized as well as supra-critical-sized defects in the rabbit calvarial model. CONCLUSION: Bone regeneration was significantly greater in the HBO-treated animals regardless of the defect size. HBO may have increased the diameter of the rabbit critical-sized calvarial defect to more than 18 mm.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 16448913 [PubMed - indexed for MEDLINE]

93: *Liver Int.* 2006 Mar;26(2):248-53.

Effect of hyperbaric oxygen on cold storage of the liver in rats.

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BACKGROUND: The depletion of biochemical energy stores during prolonged cold storage is one of the most critical events of cold ischemia-reperfusion (CI/R) injury. The aim of this study was to evaluate the effect of hyperbaric oxygen (HBO) treatment on CI/R injury. METHODS: Livers were harvested from male Wistar rats and stored for 24 h at 4 degrees C in University of Wisconsin solution (Group 1). Others were additionally treated with HBO during the preservation period (Group 2). At the end of the 24 h cold preservation, the concentrations of hepatic enzymes and lipid peroxidation (LPO) in the effluent and the hepatic adenosine triphosphate (ATP) levels were measured. After preservation, the livers were reperfused for 90 min with an oxygenated Krebs-Henseleit bicarbonate buffer. Perfusate samples were obtained serially, and portal flow rates were also recorded. RESULTS: In group 2, aspartate aminotransferase (AST), lactate dehydrogenase (LDH), and LPO into the effluent at the end of preservation were decreased and the depletion of ATP was prevented ( $P < 0.05$ ). After reperfusion, the portal flow was significantly improved in group 2 ( $P < 0.05$ ). The time-dependent increase of alanine aminotransferase levels (ALT) observed in group 1 was suppressed significantly in group 2, and total bile production during 90 min of reperfusion was significantly greater in group 2 ( $P < 0.05$ ). The structure of the livers in group 2 was significantly well maintained, and the liver weight change ratio was significantly greater in group 1 ( $P < 0.05$ ). CONCLUSIONS: HBO treatment during cold storage seems to prevent hepatic ischemic injury and have protective effects against CI/R injury by attenuating the depletion of energy stores.

Publication Types: In Vitro

PMID: 16448464 [PubMed - indexed for MEDLINE]

94: *Basic Clin Pharmacol Toxicol.* 2006 Feb;98(2):150-4.

Investigation of the effect of hyperbaric oxygen on experimental cyclosporine nephrotoxicity.

Atasoyu EM, Yildiz S, Cimsit M, Cermik H, Qyrdedi T, Evrenkaya TR, Aktas S, Uzun G, Bilgi O, Gultepe M.

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Hyperbaric oxygen interacts with drugs which patients use concurrently with hyperbaric oxygen treatment, which may cause in potentiation or inhibition of both therapeutic and toxic effects. We examined the effect of hyperbaric oxygen therapy on experimental cyclosporine A nephrotoxicity. The study comprised four groups of rats: a control group, a cyclosporine A group (25 mg/kg/day intraperitoneally for four days), a hyperbaric oxygen group (60 min. every day for four days at 2.5 atmospheric pressure), and a cyclosporine A+hyperbaric oxygen group (CsA 25 mg/kg/day intraperitoneally for four days+hyperbaric oxygen for 60 min. every day for four days at 2.5 atmospheric pressure). Hyperbaric oxygen did not alter biochemical parameters. Cyclosporine A increased serum urea and serum creatinine levels and decreased creatinine clearance. In the cyclosporine A+hyperbaric oxygen group serum urea level increased more than in the cyclosporine A group. Cyclosporine A increased tubular epithelial cell apoptosis and necrosis score values. The numbers of apoptotic cells in proximal tubule epithelial cells in the cyclosporine A+hyperbaric oxygen group were significantly higher than those of the cyclosporine A group. We recommend that renal functions of the patients receiving cyclosporine A should be monitored during hyperbaric oxygen therapy.

PMID: 16445587 [PubMed - indexed for MEDLINE]

95: *J Wound Ostomy Continence Nurs.* 2006 Jan-Feb;33(1):21-5.

Is hyperbaric oxygen therapy effective for the management of chronic wounds?

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Publication Types: Review

PMID: 16444099 [PubMed - indexed for MEDLINE]

96: *Br J Dermatol.* 2006 Feb;154(2):251-5.

Livedoid vasculopathy: long-term follow-up results following hyperbaric oxygen therapy.

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BACKGROUND: Livedoid vasculopathy, also known as atrophie blanche, is a recurrent painful vasculopathy appearing mostly on the lower limbs. Treatment is challenging and relapses are frequent. OBJECTIVES: To analyse the long-term effect and

safety of hyperbaric oxygen (HBO) therapy in treating livedoid vasculopathy. METHODS: Twelve patients with active livedoid vasculopathy were included in this study. All patients underwent HBO therapy five times a week. Each week photographs were taken and the total dose of analgesics was recorded. Side-effects were documented and assessed. Recurrence was defined as the presence of skin ulceration. RESULTS: Of the eight patients who completed the treatment, resumption of ambulation and reduction of analgesics were achieved at an average of 4.9 HBO therapy sessions. Leg ulcers in all eight patients healed completely at a mean of 3.4 weeks (range 2-5 weeks). Six patients suffered relapses of ulceration and responded to additional HBO therapy. No significant side-effects were found. CONCLUSIONS: HBO is a relatively safe, fast and effective method to treat patients with livedoid vasculopathy.

Publication Types: Evaluation Studies  
PMID: 16433793 [PubMed - indexed for MEDLINE]

97: *Neuropathol Appl Neurobiol.* 2006 Feb;32(1):40-50.

Hyperbaric oxygen therapy reduces neuroinflammation and expression of matrix metalloproteinase-9 in the rat model of traumatic brain injury.

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The acute inflammatory response plays an important role in secondary brain damage after traumatic brain injury (TBI). Neutrophils provide the main source of matrix metalloproteinases (MMPs) which also play a deleterious role in TBI. Numerous preclinical studies have suggested that hyperbaric oxygen therapy (HBOT) may be beneficial in various noncerebral and cerebral inflammatory diseases. The goal of this study was to evaluate the effects of HBOT on inflammatory infiltration and the expression of MMPs in correlation with secondary cell death in the rat model of dynamic cortical deformation (DCD). Twenty animals underwent DCD with subsequent HBOT (2.8 ATA, two sessions of 45 min each); 10 animals: DCD and normobaric oxygenation (1 ATA), 10 animals: not treated after DCD. Cell death was evaluated by TUNEL. Neutrophils were revealed by myeloperoxidase staining. Immunohistochemical staining for MMP-2 and -9 and tissue inhibitors of MMP-1 (TIMP-1) and -2 was also performed and the results were quantitatively evaluated by image analysis. In the animals treated by HBOT, a significant decrease in the number of TUNEL-positive cells and neutrophilic inflammatory infiltration was seen in comparison with nontreated animals and those treated by normobaric oxygen. The expression of MMP-9 was also significantly lower in the treated group. Staining for MMP-2 and TIMP-2 did not change significantly. Our results demonstrate that HBOT decreased the extent of secondary cell

death and reactive neuroinflammation in the TBI model. The decline of MMP-9 expression after HBOT may also contribute to protection of brain tissue in the perilesional area. Further research should be centred on the evaluation of long-term functional and morphological results of HBOT.

PMID: 16409552 [PubMed - indexed for MEDLINE]

98: *Ann Nutr Metab.* 2006;50(3):173-6. Epub 2006 Jan 10.

Influence of vitamin C and E supplementation on oxidative stress induced by hyperbaric oxygen in healthy men.

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AIM: To investigate the effect of a 4-week vitamin C and E supplementation on oxidative stress induced by hyperbaric oxygen (HBO). METHODS: 19 healthy men were exposed to 3 sequential protocols, i.e. HBO (100% O<sub>2</sub>, 2.4 bar, 131 min) before (T1) and after 4 weeks of daily supplementation with 500 mg slow-release vitamin C and 272 IU vitamin E (T2). A normoatmospheric protocol (21% O<sub>2</sub>, 1.0 bar, 131 min) served as control treatment (nonexposed). Blood samples were taken before (B) and immediately after (A) treatment. Plasma levels of vitamin A, C, E, beta-carotene, reduced glutathione and malondialdehyde were measured by HPLC. Antioxidative capacity and lipid peroxides in plasma were analyzed by ELISA. RESULTS: HBO decreased vitamin C and antioxidative capacity (T1). At T1, Delta A - B of vitamin C and lipid peroxides was different from nonexposed. Vitamin supplementation increased plasma levels of vitamin C and E by 28 and 37%, respectively. Vitamin supplementation led to decreased concentrations of lipid peroxides and reduced glutathione. After supplementation, HBO decreased vitamin C and reduced glutathione. At T2, Delta A - B of vitamin C and lipid peroxides was significantly different from nonexposed. CONCLUSION: In humans, oxidative stress decreased plasma levels of vitamin C and antioxidative capacity and increased plasma lipid peroxides. Supplementation with vitamin C and E did not prevent these effects. Copyright 2006 S. Karger AG, Basel.

Publication Types: Randomized Controlled Trial  
Research Support, Non-U.S. Gov't  
PMID: 16407642 [PubMed - indexed for MEDLINE]

99: *Inhal Toxicol.* 2006 Mar;18(3):211-4.

Severe carbon monoxide poisoning treated by hyperbaric oxygen therapy--a case report.

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Carbon monoxide (CO) poisoning is an important cause of mortality and late neurological sequelae

such as memory loss, personality changes, psychosis, dementia, and so on. The benefits of hyperbaric oxygen (HBO) therapy are still discussed, but the majority of trials recommend it in severe cases with coma and/or hemodynamic instability, irrespective of carboxyhemoglobin (COHb) level, to prevent permanent neurological deficits. We present a 35-yr-old woman who underwent accidental CO poisoning. Although breathing 100% oxygen by mask during transfer to the hospital, she was in deep coma, hypotensive, cyanotic, and hypoxic (arterial pO<sub>2</sub> 7.41 kPa, HbO<sub>2</sub> 87.8%), with serum COHb 26.7% on hospital admission. Orotracheal intubation, mechanical ventilation, iv fluids, dobutamin, and norepinephrine were administered. COHb level decreased to 17.2% within 1 h. To prevent severe neurological sequelae, the patient was transferred as soon as possible to an HBO center 60 km distant to perform HBO therapy twice at 3.0 and once at 2.2 atm within 24 h. After the second HBO session, the patient regained consciousness, and respiratory failure and shock resolved. She was transferred to our hospital and discharged few weeks later with discrete paresis of peripheral nerves, discrete ischemic brain lesions on computed tomography (CT) scan, and moderately abnormal electroencephalogram (EEG) without cognitive disturbances. She was able to resume her daily activities. We conclude that in severe CO poisoning, normobaric oxygen therapy and resuscitation by fluids, inotropic agents, and catecholamines is essential for survival, but additional HBO therapy seems to prevent major neurological sequelae.

Publication Types: Case Reports

PMID: 16399663 [PubMed - indexed for MEDLINE]

100: J Foot Ankle Surg. 2006 Jan-Feb;45(1):58-9; author reply 59-60.

Comment on: J Foot Ankle Surg. 2005 Jul-Aug;44(4):276-80.

A retrospective study of patients with diabetes mellitus after partial foot amputation and hyperbaric oxygen treatment.

Armstrong DG, Lavery LA.

Publication Types: Comment Letter

PMID: 16399564 [PubMed - indexed for MEDLINE]

101: Radiother Oncol. 2006 Jan;78(1):91-4. Epub 2005 Dec 7.

Treatment of radiation proctitis with hyperbaric oxygen.

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**BACKGROUND AND PURPOSE:** Radiation proctitis is a potential complication following pelvic radiation therapy. There are no standard treatments and treatment outcomes are unpredictable. We report our experience with the use of hyperbaric oxygen treatment (HBOT) for radiation proctitis cases refractory to standard medical or laser therapy.

**PATIENTS AND METHODS:** During the period 2000-2004, 10 patients with radiation proctitis were treated with HBOT (three males and seven females; mean age of 65). The median follow-up period was 25 months (range 6-43 months). Patient symptoms were retrospectively scored prior to, and following HBOT, based on the LENT-SOMA scale. **RESULTS:** Prior to treatment, three patients had Grade 3 toxicity (i.e. requiring blood transfusions) and seven had Grade 2 toxicity with dominant symptoms of rectal pain and/or diarrhoea. HBOT was well tolerated and 9 of the 10 patients completed a full HBOT treatment program. Rectal bleeding completely stopped in four of nine symptomatic patients and improved in three others. Rectal pain completely remitted in three of five symptomatic patients. Diarrhea remitted completely in one of five patients and improved in three others. Of the 10 patients treated, only two did not respond to HBOT. **CONCLUSIONS:** Significant improvement of rectal bleeding, diarrhea and rectal pain is possible using HBOT. HBOT should be offered to patients who fail conventional treatments for radiation proctitis.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 16337705 [PubMed - indexed for MEDLINE]

102: J Biomed Sci. 2006 Jan;13(1):143-56. Epub 2005 Nov 22.

Hyperbaric oxygen induces VEGF expression through ERK, JNK and c-Jun/AP-1 activation in human umbilical vein endothelial cells.

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Hyperbaric oxygen (HBO) is increasingly used in a number of areas of medical practice, such as selected problem infections and wounds. The beneficial effects of HBO in treating ischemia-related wounds may be mediated by stimulating angiogenesis. We sought to investigate VEGF, the main angiogenic regulator, regulated by HBO in human umbilical vein endothelial cells (HUVECs). In this study, we found that VEGF was up regulated both at mRNA and protein levels in HUVECs treated with HBO dose- and time-dependently. Since there are several AP-1 sites in the VEGF promoter, and the c-Jun/AP-1 is activated through stress-activated protein kinase/c-Jun N-terminal kinase (SAPK/JNK) and extracellular signal regulated kinase (ERK), we further examined the c-Jun, JNK and ERK that might be involved in the VEGF induced by HBO. The VEGF mRNA induced by HBO was blocked by both PD98059 and SP600125, the ERK and JNK inhibitors respectively. HBO induced phospho-ERK and phospho-JNK expressions within 15 min. We further demonstrated that c-Jun phosphorylation was induced within 60 min of HBO treatment. HBO also induced the nuclear AP-1 binding ability within 30-60 min, but the AP-1 induction was blocked by treatment with either the ERK or JNK inhibitor. To verify that the VEGF

expression induced by HBO is through the AP-1 trans-activation and VEGF promoter, both the VEGF promoter and AP-1 driving luciferase activity were found increased by the cells treated with HBO. The c-Jun mRNA, which is also driven by AP-1, was also induced by HBO, and the induction of c-Jun was blocked by ERK and JNK inhibitors. We suggest that VEGF induced by HBO is through c-Jun/AP-1 activation, and through simultaneous activation of ERK and JNK pathways.

PMID: 16328781 [PubMed - indexed for MEDLINE]

103: *Toxicol Appl Pharmacol.* 2006 Jun 1;213(2):152-9. Epub 2005 Dec 1.

Hyperbaric oxygen reduces delayed immune-mediated neuropathology in experimental carbon monoxide toxicity.

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The goal of this investigation was to determine whether exposure to hyperbaric oxygen (HBO(2)) would ameliorate biochemical and functional brain abnormalities in an animal model of carbon monoxide (CO) poisoning. In this model, CO-mediated oxidative stress causes chemical alterations in myelin basic protein (MBP), which initiates an adaptive immunological response that leads to a functional deficit. CO-exposed rats do not show improvements in task performance in a radial maze. We found that HBO(2) given after CO poisoning will prevent this deficit, but not eliminate all of the CO-mediated biochemical alterations in MBP. MBP from HBO(2) treated CO-exposed rats is recognized normally by a battery of antibodies, but exhibits an abnormal charge pattern. Lymphocytes from HBO(2)-treated and control rats do not become activated when incubated with MBP, immunohistological evidence of microglial activation is not apparent, and functional deficits did not occur, unlike untreated CO-exposed rats. The results indicate that HBO(2) prevents immune-mediated delayed neurological dysfunction following CO poisoning.

Publication Types: Research Support, N.I.H., Extramural

PMID: 16325878 [PubMed - indexed for MEDLINE]

104: *Am J Physiol Heart Circ Physiol.* 2006 Apr;290(4):H1378-86. Epub 2005 Nov 18.

Stem cell mobilization by hyperbaric oxygen.

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We hypothesized that exposure to hyperbaric oxygen (HBO(2)) would mobilize stem/progenitor cells from the bone marrow by a nitric oxide (\*NO) -dependent mechanism. The population of CD34(+) cells in the peripheral circulation of humans doubled in response

to a single exposure to 2.0 atmospheres absolute (ATA) O(2) for 2 h. Over a course of 20 treatments, circulating CD34(+) cells increased eightfold, although the overall circulating white cell count was not significantly increased. The number of colony-forming cells (CFCs) increased from 16 +/- 2 to 26 +/- 3 CFCs/100,000 monocytes plated. Elevations in CFCs were entirely due to the CD34(+) subpopulation, but increased cell growth only occurred in samples obtained immediately posttreatment. A high proportion of progeny cells express receptors for vascular endothelial growth factor-2 and for stromal-derived growth factor. In mice, HBO(2) increased circulating stem cell factor by 50%, increased the number of circulating cells expressing stem cell antigen-1 and CD34 by 3.4-fold, and doubled the number of CFCs. Bone marrow \*NO concentration increased by 1,008 +/- 255 nM in association with HBO(2). Stem cell mobilization did not occur in knockout mice lacking genes for endothelial \*NO synthase. Moreover, pretreatment of wild-type mice with a \*NO synthase inhibitor prevented the HBO(2)-induced elevation in stem cell factor and circulating stem cells. We conclude that HBO(2) mobilizes stem/progenitor cells by stimulating \*NO synthesis.

Publication Types: Controlled Clinical Trial  
Research Support, N.I.H., Extramural

PMID: 16299259 [PubMed - indexed for MEDLINE]

105: *Int J Oral Maxillofac Surg.* 2006 Jan;35(1):79-87. Epub 2005 Sep 26.

The effect of irradiation and hyperbaric oxygenation (HBO) on extracellular matrix of the condylar cartilage after mandibular distraction osteogenesis in the rabbit.

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The effects of irradiation and hyperbaric oxygenation (HBO) on the extracellular matrix of condylar cartilage after mandibular distraction were evaluated. Unilateral distraction was performed on 19 rabbits. Five study groups were included: control, low- and high-dose irradiation, and low- and high-dose irradiation groups with HBO. Additionally, four temporomandibular joints (TMJ) were used as control material. The high-dose irradiated animals were given in the TMJ 22.4 Gy/4 fractions irradiation (equivalent to 50 Gy/25 fractions). Low-dose irradiation group received a 2.2 Gy dosage. Two groups were also given preoperatively HBO 18 x 2.5ATA x 90 min. After a two-week distraction period (14 mm lengthening) and four-week consolidation period the TMJs were removed. Proteoglycan (PG) distribution of the extracellular matrix was evaluated using safranin O staining and collagen I and II using immunohistochemistry. The organization of fibrillar network was studied by polarized light microscopy. On the operated side of

the control group and on the unoperated side in all, except for high-dose irradiated group, PG distribution and fibrillar network were normal appearing. In the irradiated groups, with or without HBO, the cartilaginous layer was partially or totally devoid of PG and the network structure was severely damaged. In conclusion, irradiation in conjunction with the pressure applied by distraction causes severe damage to extracellular matrix of condylar cartilage. PMID: 16188425 [PubMed - indexed for MEDLINE]

106: J Cereb Blood Flow Metab. 2006 May;26(5):666-74.

Hyperbaric oxygen preconditioning induces tolerance against spinal cord ischemia by upregulation of antioxidant enzymes in rabbits.

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The present study examined the hypothesis that spinal cord ischemic tolerance induced by hyperbaric oxygen (HBO) preconditioning is triggered by an initial oxidative stress and is associated with an increase of antioxidant enzyme activities as one effector of the neuroprotection. New Zealand White rabbits were subjected to HBO preconditioning, hyperbaric air (HBA) preconditioning, or sham pretreatment once daily for five consecutive days before spinal cord ischemia. Activities of catalase (CAT) and superoxide dismutase were increased in spinal cord tissue in the HBO group 24 h after the last pretreatment and reached a higher level after spinal cord ischemia for 20 mins followed by reperfusion for 24 or 48 h, in comparison with those in control and HBA groups. The spinal cord ischemic tolerance induced by HBO preconditioning was attenuated when a CAT inhibitor, 3-amino-1,2,4-triazole, 1 g/kg, was administered intraperitoneally 1 h before ischemia. In addition, administration of a free radical scavenger, dimethylthiourea, 500 mg/kg, intravenous, 1 h before each day's preconditioning, reversed the increase of the activities of both enzymes in spinal cord tissue. The results indicate that an initial oxidative stress, as a trigger to upregulate the antioxidant enzyme activities, plays an important role in the formation of the tolerance against spinal cord ischemia by HBO preconditioning.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 16136055 [PubMed - indexed for MEDLINE]

107: Physiol Res. 2006;55(1):25-31. Epub 2005 Aug 5.

Pulmonary protective effects of hyperbaric oxygen and N-acetylcysteine treatment in necrotizing pancreatitis.

Balkan A, Balkan M, Yasar M, Korkmaz A, Erdem O, Kiliç S, Kutsal O, Bilgic H.

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The purpose of this study is to analyze the protective effect of combining N-acetylcysteine (NAC) and hyperbaric oxygen (HBO) treatment in the lung tissue during acute pancreatitis. Sixty Sprague-Dawley male rats were randomly divided into five groups; Group I; Control group (n=12), Group II; pancreatitis group (n=12), Group III; pancreatitis + NAC treatment group (n=12), Group IV; pancreatitis + HBO treatment group (n=12), Group V; pancreatitis + HBO + NAC treatment group (n=12). HBO was applied postoperatively for 5 days, twice a day at 2.5 fold absolute atmospheric pressure for 90 min. Lung tissue was obtained for measuring malondialdehyde (MDA), superoxide dismutase (Cu/Zn-SOD) and glutathione peroxidase (GSH-Px) levels along with histopathological tissue examinations. This study showed that all three treated groups (HBO alone, NAC alone and combined HBO+NAC treatment) had pulmonary protective effects during acute necrotizing pancreatitis.

PMID: 16083313 [PubMed - indexed for MEDLINE]

108: Childs Nerv Syst. 2006 Jan;22(1):38-42. Epub 2005 May 5.

Hyperbaric oxygen therapy for the treatment of brain abscess in children.

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**INTRODUCTION:** The treatment of brain abscess remains a challenging topic usually involving a multimodal concept. **METHODS:** We report our experience with hyperbaric oxygen (HBO) therapy in five children presenting with brain abscesses between 1995 and 2002 at the Department of Neurosurgery, Graz. Mean age was 14.8 (range 11-17 years). All abscesses were located supratentorially. One child had a single abscess and one had multilocated abscesses. Two other patients presented with both subdural empyema and brain abscess, one of them showing an epidural empyema as well. In another child, the brain abscess was associated with meningoencephalitis and subdural empyema. In all of them the underlying condition was spread of infection from the paranasal sinuses, except for one, who was immunocompromised due to cytotoxic chemotherapy for acute lymphocytic leukaemia. **RESULTS:** One single brain abscess and one of the multiple abscesses were drained. All subdural/epidural empyemas were treated surgically. Antibiotics were administered intravenously for 13 to 22 days (mean 22 days). All patients underwent HBO therapy; the number of treatments ranged from 26 to 45 "dives" (mean 30). Treatments were given once daily at 2.2 atmosphere absolutes for 60 min at 12 m. During the hospital stay all improved their clinical condition, with continued regression of abnormalities on magnetic resonance imaging (MRI). In the following weeks, other interventions were performed to treat the origin of the infections. At 6 months

follow-up they were all in good clinical condition, either symptom free or with minor residual symptoms. MRI at this time showed no evidence of disease in three, a residual dural enhancement in one and a residual shrunken collection in the child with multilocated abscesses. No recurrence was observed during a mean follow-up of 21 months (range from 7 to 72 months). CONCLUSION: HBO therapy in children with brain abscesses seems to be safe and effective, even when they are associated with subdural or epidural empyemas. It provides a helpful adjuvant tool in the usual multimodal treatment of cerebral infections and may reduce the intravenous course of antibiotics and, consequently, the duration of hospitalization. Multidisciplinary management is recommended to optimize care for these critically ill children.

Publication Types: Clinical Trial Comparative Study

PMID: 15875200 [PubMed - indexed for MEDLINE]