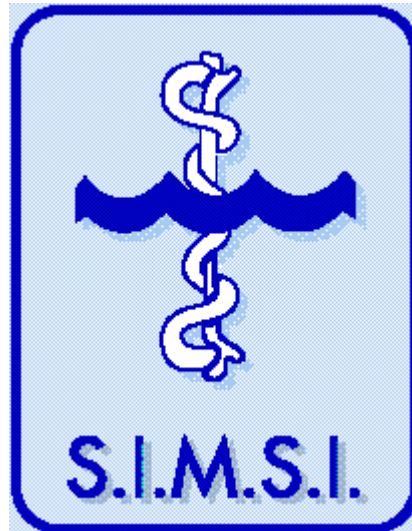


**SOCIETA' ITALIANA
DI
MEDICINA SUBACQUEA E IPERBARICA**



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

**2008
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 2008/01 to 2008/06**

Search "Hyperbaric Oxygenation"[MAJR] Limits: Publication Date from 2008/01 to 2008/06

1: Acta Neurochir Suppl. 2008;105:191-6.

Hyperbaric oxygen preconditioning protects against traumatic brain injury at high altitude.

Hu SL, Hu R, Li F, Liu Z, Xia YZ, Cui GY, Feng H.

Department of Neurosurgery, Southwest Hospital of the Third Military Medical University, Chongqing, PR China.

BACKGROUND: Recent studies have shown that preconditioning with hyperbaric oxygen (HBO) can reduce ischemic and hemorrhagic brain injury. We investigated effects of HBO preconditioning on traumatic brain injury (TBI) at high altitude and examined the role of matrix metalloproteinase-9 (MMP-9) in such protection. **METHODS:** Rats were randomly divided into 3 groups: HBO preconditioning group (HBOP; n = 13), high-altitude group (HA; n = 13), and high-altitude sham operation group (HASO; n = 13). All groups were subjected to head trauma by weight-drop device, except for HASO group. HBOP rats received 5 sessions of HBO preconditioning (2.5 ATA, 100% oxygen, 1 h daily) and then were kept in hypobaric chamber at 0.6 ATA (to simulate pressure at 4000m altitude) for 3 days before operation. HA rats received control pretreatment (1 ATA, room air, 1 h daily), then followed the same procedures as HBOP group. HASO rats were subjected to skull opening only without brain injury. Twenty-four hours after TBI, 7 rats from each group were examined for neurological function and brain water content; 6 rats from each group were killed for analysis by H&E staining and immunohistochemistry. **RESULTS:** Neurological outcome in HBOP group (0.71 +/- 0.49) was better than HA group (1.57 +/- 0.53; p < 0.05).

Preconditioning with HBO significantly reduced percentage of brain water content (86.24 +/- 0.52 vs. 84.60 +/- 0.37; p < 0.01). Brain morphology and structure seen by light microscopy was diminished in HA group, while fewer pathological injuries occurred in HBOP group. Compared to HA group, pretreatment with HBO significantly reduced the number of MMP-9-positive cells (92.25 +/- 8.85 vs. 74.42 +/- 6.27; p < 0.01). **CONCLUSIONS:** HBO preconditioning attenuates TBI in rats at high altitude. Decline in MMP-9 expression may contribute to HBO preconditioning-induced protection of brain tissue against TBI. **Publication Types:** Research Support, Non-U.S. Gov't
PMID: 19066108

2: Acta Neurochir Suppl. 2008;105:113-7.

Hyperbaric oxygen for experimental intracerebral hemorrhage.

Qin Z, Xi G, Keep RF, Silbergleit R, He Y, Hua Y.

Department of Neurosurgery, University of Michigan Medical School, Ann Arbor, MI 48109-2200, USA.

Acute brain edema formation contributes to brain injury after intracerebral hemorrhage (ICH). It has been reported that hyperbaric oxygen (HBO) is neuroprotective in cerebral ischemia, subarachnoid hemorrhage, and brain trauma. In this study, we investigated the effects of HBO on brain edema following ICH in rats. Male Sprague-Dawley rats received intracerebral infusion of autologous whole blood, thrombin, or ferrous iron. HBO (100% O₂, 3.0 ATA for 1 h) was initiated 1 h after intracerebral injection. Control rats were exposed to air at room pressure. Brains were sampled at 24 or 72 h for water content, ion measurement, and Western blot analysis. We found that 1 session of HBO reduced perihematoma brain edema (p < 0.05) 24 h after ICH. HBO also reduced heat shock protein-32 (HSP-32) levels (p < 0.05) in ipsilateral basal ganglia 24h after ICH. However, HBO failed to attenuate thrombin-induced brain

edema and exaggerated ferrous iron-induced brain edema (p < 0.05). Three sessions of HBO also failed to reduce brain edema 72h after ICH. In summary, HBO reduced early perihematomal brain edema and HSP-32 levels in brain. HBO-related brain protection does not occur through reduction in thrombin toxicity because HBO failed to attenuate thrombin-induced brain edema. Our results also indicate that HBO treatment after hematoma lysis for ICH may be harmful, since HBO amplifies iron-induced brain edema.

Publication Types: Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't
PMID: 19066094

3: Adv Gerontol. 2008;21(2):306-10. [Assessment of thrombocyte aggregation and coagulation haemostasis of elderly and senile patients with ischemic heart disease treated with application of non-drug therapy]

[Article in Russian]

Zakharova NO, Kurkina OV.

The main aim of the study is to estimate a state of thrombocytic and coagulation haemostasis of elderly and senile patients with ischemic heart disease through using a combination of magnitotherapy and hyperbaric oxygenation. 108 patients aged between 70 and 85 years are recruited so far. The range of diagnoses varies from ischemic heart disease, stable angina of II functional class. The studies indicators include thrombocytes aggregation and coagulation which are provided before and after treatment. It has been shown that the results are more positive when magnitotherapy and hyperbaric oxygenation are included in the treatment. That is effected in positive dynamic of thrombocytes spontaneous and induced aggregation, coagulation haemostasis indicators and fibrinolytic activity, which characterize improvement of cardiovascular system functioning.

Publication Types: English Abstract

PMID: 18942378

4: Acta Cir Bras. 2008;23 Suppl 1:72-6; discussion 76.

The role of hyperbaric oxygen therapy (hot) as an otoprotection agent against cisplatin ototoxicity.

Yassuda CC, Righetti AE, Cury MC, Hyppolito MA, Oliveira JA, Féres O. Ribeirao Preto Faculty of Medicine, University of São Paulo, Brazil.

PURPOSE: Hyperbaric oxygen therapy (HOT) consists of intermittent inhalations of 100% oxygen at a pressure higher than 1 atm. It is an important adjuvant therapy in pathological processes like soft tissue infections, radiation injury, gas gangrene, osteomyelitis and decompressive diseases. Cisplatin, a potent antineoplastic drug, widely used in cancer therapy is highly ototoxic causing bilateral, irreversible damage to the hearing of high frequency sounds (4-8 KHz). OBJECTIVE: This experimental study conducted at the Faculty of Medicine of Ribeirao Preto, University of Sao Paulo aims to evaluate Hyperbaric Oxygen Therapy as an otoprotection agent against drug toxicity. METHODS: Albino guinea pigs were divided into two groups: in Group A, 5 animals (10 cochlea) received cisplatin, i. p., 8.0 mg/kg/day during three days and afterwards were submitted to HOT; in Group B, 3 animals (6 cochlea) received cisplatin, i. p. 8.0 mg/kg/day during three days. Guinea pigs were evaluated by acoustic otoemissions (AOE) and scanning electron microscopy (SEM). RESULTS: Group B animals showed loss of auditory functions as measured by AOE and distorted outer hair cells by SEM. In Group A, outer hair cells shown by SEM images were mostly preserved. CONCLUSION: It is presumed that Hyperbaric Oxygen Therapy has a protector effect against cisplatin ototoxicity.

PMID: 18516452

5: Cerebrovasc Dis. 2008;26(4):447-8. Epub 2008 Sep 26.

Normalization of brain tissue lactate after hyperbaric oxygen therapy in a progressive stroke patient.

Lee JI, Wittsack HJ, Christaras A, Miese FR, Siebler M.

Department of Neurology, Heinrich Heine University, Düsseldorf, Germany.

Publication Types: Case Reports
PMID: 18818491

6: Turk J Pediatr. 2008 May-Jun;50(3):235-41.

Analysis of the features of acute carbon monoxide poisoning and hyperbaric oxygen therapy in children.

Yarar C, Yakut A, Akin A, Yildiz B, Dinleyici EC.

Department of Pediatrics, Osmangazi University Faculty of Medicine, Eskişehir, Turkey.

The aim of this study was to make a retrospective descriptive analysis of the features of children with acute carbon monoxide poisoning (COP). We evaluated 74 children (43 girls, 31 boys; age range 1 to 17.8 years) who were consecutively admitted to our emergency unit and hospitalized with accidental acute COP between June 2003 and June 2005. All patients received normobaric oxygen therapy until their carboxyhemoglobin (COHb) levels were decreased below 2% and their symptoms resolved. Thirty-eight of 74 patients (51.4%) also received hyperbaric oxygen (HBO) therapy as indicated by signs and symptoms or COHb levels. COHb levels were significantly higher and hospitalization period was longer in the children who had abnormal neurological findings ($p < 0.05$ for both). All patients showed complete recovery without neurological sequelae except one who had visual impairment at discharge, and antiepileptic therapy was started because of epilepsy after seven months. Acute COP is an important health problem in our country, especially in winter, because of poorly functioning heating systems. The clinical spectrum including neurological findings varies during childhood. We suggest that HBO therapy could be used safely in children.

PMID: 18773668

7: Hawaii Dent J. 2008 Mar-Apr;39(2):10-1.

Hyperbaric therapy outside of dentistry.

Sonson JS.

PMID: 18711875

8: Hepatogastroenterology. 2008 May-Jun;55(84):1014-9.

The effect of hyperbaric oxygen treatment on postoperative morbidity of left lobe donor in living donor adult liver transplantation.

Suehiro T, Shimura T, Okamura K, Okada T, Okada K, Hashimoto S, Mochida Y, Kuwano H, Saitoh S, Gotoh F.

Department of General Surgical Science, Graduate School of Medicine, Gunma University, Maebashi 371-8511, Japan.
tsuehiro@med.gunma-u.ac.jp

BACKGROUND/AIMS: In living donor liver transplantation (LDLT), donor safety has top priority, and donor morbidity should be minimized to zero. However, several corporal problems still remain. The effect of hyperbaric oxygenation treatment (HBO) was evaluated for donor morbidity in LDLT. METHODOLOGY: A total of 14 consecutive donors were studied. The donors into were divided into 2 groups as follows: HBO group ($n=7$), which started HBO 3 days after operation, and a control group ($n=7$). Patient's factors, graft volume, liver regeneration rate, liver function tests and postoperative complications were compared between the 2 groups. RESULTS: There was no significant difference between the groups in whole liver, graft and remnant liver volume. The incidence of wound numbness on POD 28 was 86% (6/7) in the control group and 29% (2/7) in the HBO group ($p < 0.05$). Postoperative hospital stay was 14.4 and 14.6 days in the control and HBO group, respectively ($p=NS$). On POD 14, AST value in the HBO group was significantly lower than in the control group ($p < 0.05$). PT% value in the HBO group was significantly higher than in the control group on POD 14 ($p < 0.05$). Total bilirubin level in the HBO group was significantly lower than in the control group on POD 14 and 28 ($p < 0.05$), and total bile acid value in the HBO group was significantly lower than the control group ($p < 0.05$) on POD 14. Albumin level in the HBO group was significantly

higher than the control group on POD 7, 10 and 28 ($p < 0.05$). Four weeks after the operation, the regeneration rate was significantly higher in the HBO group than in the control group ($p < 0.05$). CONCLUSIONS: Liver regeneration was promoted by HBO preserving a function in LDLT using left lobe graft. Hyperbaric oxygen therapy seems to be very useful to LDLT. Publication Types: Controlled Clinical Trial PMID: 18705320

9: Ren Fail. 2008;30(6):665.
Comment on: Ren Fail. 2008;30(2):233-7.
Clinical challenges in the treatment of hemodialysis patients with hyperbaric oxygen therapy. Yildiz S, Uzun G.
Publication Types: Comment Letter PMID: 18661418

10: Anesteziol Reanimatol. 2008 May-Jun; (3):49-53.
[Use of hyperbaric oxygenation as a component of intensive care in acute pancreatitis and its impact on homeostasis and intensity of oxidative stress]
[Article in Russian]
Lisagors IL.
Twenty-two patients diagnosed as having acute pancreatitis (AP) were examined to assess whether hyperbaric oxygen therapy (HBO) was an efficient and safe adjunct to the standardized treatment protocol in patients with AP. The impact of HBO on oxygenation in the splanchnic area, homeostasis, oxidative stress, and intraabdominal hypertension was evaluated. A treatment group consisted of 11 patients treated for 3 days (twice a day) using a monoplace chamber under pressures of 1.7-1.9 ATA. Patients ($n = 11$) in the control group were managed in accordance with the standardized treatment protocol. HBO improved oxygen delivery to the splanchnic area, positively affected homeostasis and induced no significant intraabdominal pressure changes. HBO demonstrated neither explicit prooxidative effect nor typical complications. Publication Types: Clinical Trial English Abstract

PMID: 18652173

11: Life Sci. 2008 Aug 15;83(7-8):236-41. Epub 2008 Jun 24.
Hyperbaric oxygen preconditioning promotes angiogenesis in rat liver after partial hepatectomy. Ren P, Kang Z, Gu G, Liu Y, Xu W, Tao H, Zhang JH, Sun X, Ji H. Department of Pharmacology, China Pharmaceutical University, Nanjing, 210009, PR China.
Hyperbaric oxygen preconditioning (HBO-PC) increases the level of HIF-1 α (hypoxia inducible factor-1 α) and its target gene VEGF (vascular endothelial growth factor) which is involved in angiogenesis. Liver regeneration is an angiogenesis-dependent process. We hypothesized that HIF-1 α and VEGF mediated the angiogenesis effect of HBO-PC on regenerating rat liver. Male Sprague Dawley rats received HBO-PC followed by 70% partial hepatectomy. Proliferation of hepatocytes and endothelial cells was evaluated by BrdU (bromodeoxyuridine) staining. Microvascular density was assessed by immunohistochemistry. mRNA expression of HIF-1 α was assessed by quantitative RT-PCR and protein levels of HIF-1 α and VEGF were assessed by western blot. HIF-1 α DNA-binding activity was determined with an ELISA-based kit. HBO-PC increased the proliferation index of endothelial cells and microvascular density at 48 h after partial hepatectomy. The protein level and DNA-binding activity of HIF-1 α and the protein level of VEGF were increased by HBO-PC before and after partial hepatectomy. Partial hepatectomy alone also increased proliferation index and the expressions of HIF-1 α and VEGF. Our results indicated that the angiogenesis effect of HBO-PC on liver after partial hepatectomy could be achieved by increased HIF-1 α activity and VEGF expression. However, the angiogenic effect of HBO-PC is moderate and HBO-PC failed to produce additional effect on the enhancement of HIF-1 α and VEGF induced by partial hepatectomy alone. Publication Types: Research Support, Non-U.S. Gov't PMID: 18644387

12: Acta Neurochir Suppl. 2008;101:145-9.

Effect of hyperbaric oxygen on patients with traumatic brain injury.

Lin JW, Tsai JT, Lee LM, Lin CM, Hung CC, Hung KS, Chen WY, Wei L, Ko CP, Su YK, Chiu WT.

Department of Neurosurgery, Taipei Medical University-Wan Fang Hospital, Taipei, Taiwan.

Hyperbaric oxygen therapy (HBOT) is the medical therapeutic use of oxygen at a higher atmospheric pressure. The United States Food and Drug Administration have approved several clinical applications for HBOT, but HBOT in traumatic brain injury (TBI) patients has still remained in controversial. The purpose of our study is to evaluate the benefit of HBOT on the prognosis of subacute TBI patients. We prospectively enrolled 44 patients with TBI from November 1, 2004 to October 31, 2005. The study group randomly included 22 patients who received HBOT after the patients' condition stabilization, and the other 22 corresponding condition patients were assigned into the matched control group who were not treated with HBOT. The clinical conditions of the patients were evaluated with the Glasgow Coma Scale (GCS) and Glasgow Outcome Scale (GOS) before and 3 to 6 months after HBOT. The GCS of the HBOT group was improved from 11.1 to 13.5 in average, and from 10.4 to 11.5 ($p < 0.05$) for control group. Among those patients with GOS = 4 before the HBOT, significant GOS improvement was observed in the HBOT group 6 months after HBOT. Based on this study, HBOT can provide some benefits for the subacute TBI patients with minimal adverse side effects.

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

PMID: 18642650

13: Undersea Hyperb Med. 2008 May-Jun;35(3):219-25.

Validation of hyperbaric oxygen treatment software for use with monoplace chambers.

Sechrist JR, Warriner RA 3rd, Weninger AE, Ong R.

Sechrist Industries, Inc., Anaheim, CA 98207, USA.

Hyperbaric oxygen (HBO2) therapy is increasingly used in the treatment of a wide variety of medical conditions. However, for monoplace chambers, there is some uncertainty when sufficiently high oxygen concentrations are attained, because most chambers are not instrumented to measure oxygen. To remedy this, Microsoft Excel-based software, HBO O2 Smart Guide, was developed to simulate the atmosphere of monoplace chambers during treatment. Based upon chamber dimensions, patient weight, oxygen purge rates, desired pressurization, and HBO2 time, the program calculates oxygen concentration, consumption and exposure for each treatment. Software testing was conducted using four different chambers instrumented with an oxygen analyzer. Two purge rate profiles were used: constant, and biphasic (a high initial purge rate was changed to a lower plateau rate when pressurization was reached). Comparison of measured and calculated times to reach 95% oxygen concentration within the chambers demonstrated the software was accurate within 1%. The HBO O2 Smart Guide enables optimum purge profiles to be simulated with resultant potential improvements in HBO2 treatment efficacy, calculation of effective oxygen exposures (actual time during prescribed treatment during which patient breathes $>$ or $=$ 95% oxygen) to enable more accurate comparison of treatment profiles and outcomes, and cost savings in oxygen usage. This software will enable clinicians to provide more consistent HBO2 treatments.

Publication Types: Validation Studies

PMID: 18619118

14: Undersea Hyperb Med. 2008 May-Jun;35(3):159-61.

Comment in: Undersea Hyperb Med. 2008 Nov-Dec;35(6):455-6; author reply 456.

Resolution of neurological DCI after long treatment delays.

Weisher DD.

St. Thomas Neurology, PLLC, P.O. Box 7307, Paragon Medical Building,

Suite 209, St. Thomas, U.S.V.I. 00801.

We report two interesting cases in which both divers sustained a very serious Type II decompression sickness. This involved substantial neurological impairment which was successfully treated despite having a delayed treatment time 12 hours or more. The treatment used hyperbaric oxygen recompression therapy with the addition of lidocaine i.v. drip. This first case was in November 2007 and the second was in December 2007 and both patients made excellent recoveries.

Publication Types: Case Reports
PMID: 18619110

15: Hepatogastroenterology. 2008 Mar-Apr;55(82-83):491-5.

Effect of hyperbaric oxygen therapy on patients with adhesive intestinal obstruction associated with abdominal surgery who have failed to respond to more than 7 days of conservative treatment.

Ambiru S, Furuyama N, Kimura F, Shimizu H, Yoshidome H, Miyazaki M, Ochiai T.

Surgical Center, Chiba University Hospital, 1-8-1 Inohana, Chuo-ku, Chiba 260-8677, Japan. ambirus@umin.ac.jp

BACKGROUND/AIMS: To investigate the effects of hyperbaric oxygen (HBO) therapy on patients with adhesive intestinal obstruction who have failed to respond to more than 7 days of conservative treatment.

METHODOLOGY: Six hundred eighty-five patients, who were admitted a total of 879 times for adhesive intestinal obstruction, were divided into groups according to the treatment and interval between the first day of the therapy and clinical symptoms of obstruction; tube decompression therapy within 7 days after appearance of clinical symptoms (Group I: n = 321), clinical symptoms that have persisted for less than 7 days before the start of HBO therapy (Group II: n = 498), and for more than 7 days (Group III: n = 60).

RESULTS: The overall resolution and mortality rates in the cases of adhesive intestinal obstruction were 79.8% and 2.2% in Group I, 85.9% and 1.4% in Group II, and

81.7% and 1.6% in Group III, respectively. Group II had significantly better resolution rates than Group I (odds ratio 1.6, $p < 0.02$). CONCLUSIONS: HBO therapy may be useful in management of adhesive intestinal obstruction associated with abdominal surgery, even in patients who fail to respond to other conservative treatments. HBO therapy may be a preferred option for treatment of patients for whom surgery should be avoided.

PMID: 18613394

16: Brain Res. 2008 Jul 30;1222:87-94. Epub 2008 May 18.

Therapeutic window of hyperbaric oxygen therapy for hypoxic-ischemic brain damage in newborn rats.

Wang XL, Zhao YS, Yang YJ, Xie M, Yu XH.

Division of Neonatology, Department of Pediatrics, Xiang Ya Hospital, Central South University, 87 Xiang Ya Road, Changsha, PR China.

Previous studies showed that hyperbaric oxygen (HBO) promoted cell proliferation in hypoxic-ischemic (HI) neonate rats. Neural stem cells (NSC) existed in the brain lifelong and can be activated. This study was undertaken to assess whether HBO treatment promoted the proliferation of NSC and repaired the brain damage regardless of when it is started, thus to explore the therapeutic window of HBO treatment. Seven-day-old Sprague-Dawley rats underwent left carotid ligation followed by 2 h of hypoxic stress (8% O₂) at 37 degrees C). Hyperbaric oxygen therapy was administered 3, 6, 12, 24, and 72 h after HI. 5-bromo-2'-deoxyuridine and 5-bromo-2'-deoxyuridine/nestin were detected by immunofluorescence and nestin was examined by western blot analysis 10 days after HI. T-maze forced alternation, the foot-fault test, and the radial arm maze were conducted at P 22 days (14 days after HI), P 30 days, and P 34 days. Thereafter, cerebral morphology was examined by Nissl-staining 28 days after HI. There were remarkable increases in the proliferation of neural stem cells in the HBO-treated group, 3, 6, 12, and 24 h after HI, as compared with the HIBD group. The HBO-treated

group, 3, 6, and 12 h after HI, performed better in the behavioral test and had less neural loss in the hippocampal CA1 region as compared with the HIBD group. The therapeutic window for effective HBO treatment could be delayed up to 12 h after HIBD, while the effect decreased 24 h after HI.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 18582850

17: Urology. 2009 Jan;73(1):205-8. Epub 2008 Jun 25.

Effects of hyperbaric oxygen therapy on tumor growth in murine model of PC-3 prostate cancer cell line.

Tang H, Sun Y, Xu C, Zhou T, Gao X, Wang L.

Department of Urology, Shanghai Changhai Hospital, Shanghai, China.

OBJECTIVES: To test the hypothesis that hyperbaric oxygen (HBO) has no effect on tumor growth in a murine model of indolent in vivo prostate cancer. HBO means breathing pure (100%) oxygen under increased atmospheric pressure. METHODS: Human prostate PC-3 cells were injected into 40 severe combined-immunodeficient mice. They were randomized to undergo 20 sessions of either HBO or normobaric air in standardized conditions and observed for 4 weeks before histologic assessment of any palpable tumors that had developed. The analysis of the developed PC-3 tumors included tumor volume, microvessel density, apoptosis-associated markers (ie, p53, p27), and the proliferative index (Ki-67). RESULTS: The exposure to HBO at 2 atm for 20 treatment sessions, which comprised a daily 90-minute session, 5 d/wk, had no effect on the prostate cancer volume ($P > .05$). No differences were observed in tumor microvessel density, proliferative index, or apoptosis markers compared with the non-HBO group ($P > .05$). CONCLUSIONS: HBO did not have a tumor stimulatory effect on prostate cancer and could potentially be used safely in conjunction with other therapeutic modalities.

PMID: 18579187

18: Neurosci Lett. 2008 Aug 22;441(2):224-8. Epub 2008 Jun 18.

Combination effects of normobaric hyperoxia and edaravone on focal cerebral ischemia-induced neuronal damage in mice.

Nonaka Y, Shimazawa M, Yoshimura S, Iwama T, Hara H.

Department of Biofunctional Evaluation, Molecular Pharmacology, Gifu Pharmaceutical University, 5-6-1 Mitahora-higashi, Gifu 502-8585, Japan.

We evaluated the potential neuroprotective effects of combination treatment with normobaric hyperoxia (NBO) and edaravone, a potent scavenger of hydroxyl radicals, on acute brain injuries after stroke. Mice subjected to 2-h filamental middle cerebral artery occlusion were treated with NBO (95% O₂, during the ischemia) alone, with edaravone (1.5 mg/kg, intravenously after the ischemia) alone, with both of these treatments (combination), or with vehicle. The histological and neurological score were assessed at 22-h after reperfusion. Infarct volume was significantly reduced in the combination group [36.3±6.7 mm³ (n=10) vs. vehicle: 65.5±5.9 mm³ (n=14) $P < 0.05$], but not in the two monotherapy-groups [NBO: 50.5±5.8 mm³ (n=14) and edaravone: 56.7±5.8 mm³ (n=10)]. The combination therapy reduced TUNEL-positive cells in the ischemic boundary zone both in cortex [6.0±1.4 × 10⁽²⁾/mm² (n=5) vs. vehicle: 18.9±2.4 × 10⁽²⁾/mm² (n=5), $P < 0.01$] and subcortex [11.6±1.5 × 10⁽²⁾/mm² (n=5) vs. vehicle: 22.5±2.1 × 10⁽²⁾/mm² (n=5), $P < 0.01$]. NBO and combination groups exhibited significantly reduced neurological deficit scores at 22-h after reperfusion (vs. vehicle, $P < 0.05$). Combination therapy with NBO plus edaravone prevented the neuronal damage after focal cerebral ischemia and reperfusion in mice, compared with monotherapy of NBO or edaravone.

PMID: 18577423

19: Respir Med. 2008 Aug;102(8):1145-7. Epub 2008 Jun 20.

Are pulmonary bleb and bullae a contraindication for hyperbaric oxygen treatment?

Toklu AS, Korpınar S, Erelel M, Uzun G, Yildiz S.

Department of Underwater and Hyperbaric Medicine, Istanbul University, Istanbul Faculty of Medicine, 34093 Fatih, Istanbul, Turkey. akin@toklu.net

BACKGROUND: Air cysts or blebs in the lungs may predispose pulmonary barotrauma (PBT) by causing air trapping when there is a change in environmental pressure. The changes in the environmental pressure are also seen during hyperbaric oxygen treatments (HBOT). **AIM:** The aim of this study was to determine how patients were evaluated for pulmonary blebs or bullae, and PBT prevalence in different HBOT centers. **METHODS:** HBOT centers were asked to participate in this study and a questionnaire was sent via e-mail. A total of 98 centers responded to our questionnaire. **RESULTS:** Sixty-five HBOT centers (66.3%) reported that they applied HBOT to the patients with air cysts in their lungs. X-ray was the most widely used screening method for patients with a history of a lung disease. The prevalence of PBT in these centers was calculated as 0.00045%. **CONCLUSIONS:** Our survey demonstrated that (1) a significant portion of the HBO centers accept patients with pulmonary bleb or bullae, (2) although insufficient, X-ray is the mostly used screening tool for patients with a history of pulmonary disease and (3) the prevalence of pulmonary barotrauma is very low in HBOT.

Publication Types: Multicenter Study

PMID: 18571913

20: Brain Res. 2008 Jul 24;1221:126-33. Epub 2008 May 11.

Neuroprotective effect of hyperbaric oxygen therapy in brain injury is mediated by preservation of mitochondrial membrane properties.

Palzur E, Zaaroor M, Vlodaysky E, Milman F, Soustiel JF.

Acute Brain Injury Research Laboratory, Faculty of Medicine, Technion Israel Institute of Technology, Haifa, Israel.

Recent experimental data have shown that hyperbaric oxygen therapy (HBOT) was associated increased Bcl-2 expression at the injury site that correlated with reduced apoptosis. We hypothesized that

HBOT mediated enhancement of Bcl-2 expression and increased intracellular oxygen bio-availability may both contribute to preserve mitochondrial integrity and reduce the activation of the mitochondrial pathway of apoptosis. For this purpose, a cortical lesion was created in the parietal cortex of Sprague-Dawley rats by dynamic cortical deformation (DCD) and outcome measures in non-treated animals were compared with that of HBOT treated rats. Morphological analysis showed a profound reduction in neuronal counts in the perilesional area and a marked rarefaction of the density of the axonal-dendritic network. In treated animals, however, there was a significant attenuation of the impact of DCD over perilesional neurons, characterized by significantly higher cell counts and denser axonal network. In mitochondria isolated from injured brain tissue, there was a profound loss of mitochondrial transmembrane potential ($\Delta\psi(M)$) that proved to be substantially reversed by HBOT. This finding correlated with a significant reduction of caspases 3 and 9 activation in HBOT treated animals but not of caspase 8, indicating a selective effect over the intrinsic pathway of apoptosis. All together, our results indicate that the neuroprotective effect of HBOT may represent the consequence of preserved mitochondrial integrity and subsequent inhibition of the mPTP and reduction of the mitochondrial pathway of apoptosis.

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

PMID: 18561900

21: Undersea Hyperb Med. 2008 Mar-Apr;35(2):152-6.

Clinical hyperbaric facility accreditation program's achieving accreditation "with distinction".

[No authors listed]

Publication Types: Directory

PMID: 18551795

22: Neurol Res. 2008 May;30(4):389-93.

Effect of large dose hyperbaric oxygenation therapy on prognosis and oxidative stress of acute permanent cerebral ischemic stroke in rats.

Xue L, Yu Q, Zhang H, Liu Y, Wang C, Wang Y.

Department of Hyperbaric Oxygenation, Beijing Tiantan Hospital, Capital Medical University, Beijing, China.

OBJECTIVE: To evaluate the therapeutic effect and the oxidative stress effect of 9 and 18 hour hyperbaric oxygenation therapy (HBOT) protocols on the earliest stage of acute permanent middle cerebral artery occlusion (MCAO) in rats. METHODS: The permanent MCAO model of rats was used. The animals were randomly divided into 9 and 18 hour HBOT groups, as well as a control group. MAIN OUTCOME MEASURES: (1) The Garcia neurological grading system was used to assess the therapeutic effect of hyperbaric oxygenation therapy; (2) the infarct volume was calculated with the 2,3,5-triphenyltetrazolium chloride (TTC) pathologic staining and NIH Image J software 24 and 120 hours after MCAO; (3) the level of reactive oxygen species determined by superoxide dismutase (SOD), malondialdehyde (MDA) and nitric oxide (NO) in ischemic brain tissue were separately examined at the 18, 48 and 120 hour post-ischemia time points using spectrophotometry. RESULTS: (1) There were significant improvements in the neurobehavioral outcome of the rats in the 9 and the 18 hour groups, as compared with rats from the control group ($p < 0.01$); (2) cerebral infarct volume decreased 63-64% in the rats of 9 hour group and 51-66% in the 18 hour group at the 24 and 120 hour time points, as compared with that of the control group; (3) the SOD levels of the 9 and 18 hour groups were remarkably lower than those of control group after both 18 and 48 hours ($p < 0.01$ and $p < 0.05$); (4) the MDA level of the 9 and 18 hour groups were both remarkably lower than the control groups, especially at 18 hours ($p < 0.05$). Meanwhile, the MDA level in the 9 hour group was remarkably lower than both the 18 hour group and the control group ($p < 0.01$ and $p < 0.05$); (5) the level of NO in both hyperbaric oxygenation therapy groups were remarkably higher than that of the control at 18 and 48 hour time points ($p < 0.01$). While

the level in 18 hour group was remarkably lower than that of 9 hour group at 18 hour time point ($p < 0.05$). At the 120 hour mark, the NO levels were basically the same in all the three groups.

CONCLUSIONS: (1) The two protocols of large dose hyperbaric oxygenation therapy are highly efficient in reducing infarct volume and improving neurobehavioral outcome in permanent MCAO rats within the earliest stages of stroke; (2) increased duration of hyperbaric oxygenation therapy does not appear to equate to improved outcomes; in fact, the longer duration may aggravate the oxidative stress in ischemic tissue.

PMID: 18544257

23: Brain Res. 2008 Jul 11;1219:8-18. Epub 2008 Apr 27.

Supplementation with a synthetic polyphenol limits oxidative stress and enhances neuronal cell viability in response to hypoxia-re-oxygenation injury.

Duong TT, Antao S, Ellis NA, Myers SJ, Witting PK.

Vascular Biology Group, ANZAC Research Institute, Concord Hospital, Concord, NSW 2139, Australia.

Oxidative stress is associated with the pathology of acute and chronic neurodegenerative disease. Cultured human neuronal cells exposed to experimental hypoxia-re-oxygenation (H/R) injury responded with an increased production of reactive oxygen species (ROS) and a significant decrease in intracellular ATP. Expression of genes encoding for hypoxia-inducible factor 1-alpha (HIF1-alpha), inducible haemoxygenase-1 (HO-1), glucose transporter-1 (Glut-1), the oxygen-sensor neuroglobin (Nb) and Cu,Zn-superoxide dismutase (SOD1), catalase (CAT) and glutathione peroxidase-1 (Gpx-1) increased significantly in response to the insult. Enhanced expression of HO-1, SOD1 and CAT correlated with an increase in the corresponding protein activity. Despite the cellular response to bolster antioxidant capacity, apoptosis and necrosis increased following H/R injury. In contrast, ROS

accumulation, the endogenous gene response and cell death was limited in neuronal cells pre-incubated with 50 or 100, but not 10 microM of the phenolic antioxidant 3,3',5,5'-tetra-*t*-butyl-biphenyl-4,4'-diol (BP) prior to H/R injury. These data indicate that the early endogenous gene response to H/R injury is unable to inhibit neuronal dysfunction and that increasing cellular antioxidant capacity with a synthetic polyphenol (>10 microM) is potentially neuro-protective.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 18538307

24: J Craniofac Surg. 2008 May;19(3):757-65.

Hyperbaric oxygen inhibits growth but not differentiation of normal and irradiated osteoblasts.

Wong AK, Schönmeyr BH, Soares MA, Li S, Mehrara BJ.

Division of Plastic and Reconstructive Surgery, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania, USA.

Hyperbaric oxygen (HBO) therapy is used in the treatment of osteoradionecrosis. Although HBO is thought to improve radiation-induced hypocellularity and bone tissue hypoxia, the precise effects of HBO on bone cells such as osteoblasts have not been described. In this study, our goal was to assess the effect of HBO on irradiated and nonirradiated primary osteoblast cultures and assess for changes in growth, apoptosis, cell cycle profile, differentiation, and gene expression. We found that daily HBO treatments caused a 24% decrease in cell growth after 9 days in culture. Hyperbaric oxygen negatively affects growth by inducing osteoblast apoptosis and cell cycle arrest. Hyperbaric oxygen leads to G1/S cell cycle arrest in unirradiated osteoblasts where as it causes G2/M arrest in cells that were previously irradiated with either 7 or 12 Gy of ionizing radiation. Although radiation was shown to have a dose-dependent inhibitory effect on early osteoblast differentiation as measured by alkaline phosphatase activity, HBO did not have a

significant effect on osteoblast differentiation.

Microarray analysis revealed that exposure to HBO leads to a differential expression of a variety of gene families including stress response pathways. In summary, although successive daily HBO treatments resulted in growth delay, osteoblast function as measured by the ability to produce alkaline phosphatase was not significantly affected. These data suggest that HBO does not have any positive effects on either normal or radiation-damaged osteoblasts in vitro.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 18520395

25: Int Urogynecol J Pelvic Floor Dysfunct. 2009 Jan;20(1):113-5. Epub 2008 May 29.

Necrotizing fasciitis following transobturator tape treated by extensive surgery and hyperbaric oxygen.

Flam F, Boijesen M, Lind F.

Department of Gynecology, Capio S:t Göran Hospital, S-112 81 Stockholm, Sweden.

folke.flam@gynekologkliniken.se

The transobturator sling procedure (TVT-O) was developed to minimize surgical risks involved in treating genuine stress incontinence. All data suggest that most risks associated with the retropubic route such as injuries to the bladder, intestines or vessels are practically obsolete with the obturator route. However, severe soft-tissue infections have been reported with this new technique. In this case report, necrotizing fasciitis (NF) developed shortly after a TVT-O procedure. This life-threatening complication required extensive debridements, a diverting colostomy, antibiotics, and eight sessions of hyperbaric oxygen (HBO) therapy. We emphasize the importance of a unified interdisciplinary clinical approach in severe NF with rapid progression and systemic toxemia. Primary, aggressive but tissue-saving debridements together with antibiotics are the cornerstones of therapy. HBO therapy can oxygenate infected hypoxic tissues to help marginally viable tissues survive,

reduce the inflammatory response, improve leukocyte bacterial oxidative killing capacity, and achieve infection control and healing.

Publication Types: Case Reports
PMID: 18509584

26: Tohoku J Exp Med. 2008 May;215(1):113-7.

Hyperbaric oxygen therapy decreases QT dispersion in diabetic patients. Kardesoglu E, Aparci M, Uzun G, Suleymanoglu S, Uz O, Onem Y, Ay H, Kucukardali Y, Ozkan S. Department of Cardiology, Gulhane Military Medical Academy, Haydarpasa Teaching Hospital, Istanbul, Turkey.

Diabetes mellitus is frequently associated with the malignant ventricular arrhythmias and sudden death. The QT dispersion is the difference between the longest and shortest QT interval calculated from the standard 12-lead electrocardiogram. The QT dispersion is suggested as an index of myocardial electrical activity. An increase in QT dispersion is associated with the malignant ventricular arrhythmias and sudden cardiac death. Diabetic patients receive hyperbaric oxygen (HBO) therapy for non-healing lower extremity ulcers. The aim of this study was to determine the effect of HBO therapy on QT dispersion in diabetic patients. Thirty diabetic patients (18 male and 12 female, 59.9 +/- 10 years), who were planning to undergo ten sessions of HBO therapy in two weeks for non-healing lower extremity ulcers, were consecutively enrolled into the study. The 12-lead resting electrocardiography recordings were taken before the first HBO therapy and after the 10th HBO-therapy session. QT intervals were measured on electrocardiogram. QT intervals were corrected for heart rate by using Bazett's formula (corrected QT [QTc] = QT/ radical R - R [seconds]). QTc dispersion was significantly decreased from 59.8 +/- 17.4 msec to 52.2 +/- 15.5 msec after ten sessions of HBO therapy (p < 0.05). However, maximum QTc, minimum QTc and mean QTc did not change significantly after HBO therapy. We have concluded that HBO

therapy may reduce the risk of malignant ventricular arrhythmia and sudden cardiac death in diabetic patients when applied repetitively.

PMID: 18509242

27: Int J Infect Dis. 2008 Sep;12(5):550-2. Epub 2008 May 27.

Fungal malignant otitis externa treated with hyperbaric oxygen.

Ling SS, Sader C.

Otolaryngology Department, Royal Perth Hospital, Wellington St, Perth, Western Australia 6009, Australia. shanus@iinet.net.au

OBJECTIVE: To report a case of Aspergillus flavus malignant otitis externa, successfully treated with antifungal agents, surgical debridement, and hyperbaric oxygen treatment. PATIENT: The case was a 77-year-old man with non-insulin dependent diabetes mellitus, who presented with otalgia and purulent otorrhea. Intervention was with surgical debridement, antifungal agents, and hyperbaric oxygen treatment. The main outcome measures were radiological and histological findings. CONCLUSIONS: A. flavus is a rare cause of malignant otitis externa. Aggressive treatment should include surgical debridement, with appropriate antifungal agents and hyperbaric oxygen therapy.

Publication Types: Case Reports

PMID: 18508401

28: Spinal Cord. 2008 Dec;46(12):824. Epub 2008 May 27.

Comment on: Spinal Cord. 2008 Mar;46(3):241-2.

Inappropriate suggestion of benefit from hyperbaric oxygen for spinal cord injury.

New P.

Publication Types: Comment Letter

PMID: 18504450

29: Int J Oral Maxillofac Surg. 2008 Jul;37(7):617-24. Epub 2008 May 23.

Impact of perioperative hyperbaric oxygen therapy on the quality of life of maxillofacial patients who undergo surgery in irradiated fields.

Harding SA, Hodder SC, Courtney DJ, Bryson PJ.

Hyperbaric Medical Centre, Derriford, Plymouth, Devon, UK. sharding.jb@googlemail.com
From 2001 to 2005, 66 patients referred for perioperative hyperbaric oxygen therapy (HBO2) for debridement of necrotic tissue or prevention of radionecrosis were assessed with quality of life measures, before and after completion of HBO2 and surgery. The Medical Outcomes Short Form 36 (SF-36) and Hospital Anxiety and Depression Scale (HADS) showed no significant changes. The European Organisation for Research and Treatment of Cancer Core (EORTC-C30) questionnaire showed significant improvement in pain, global health, and dyspnoea (p=0.011; p=0.027; p=0.008, respectively). The Head and Neck sub-module (H&N35) identified significant improvements in teeth, dry mouth and social contact (p=0.002; p=0.038; p=0.029, respectively). The University of Washington Scale (UW), showed significant changes in relation to chewing and shoulders (p=0.031; p=0.047). When sub-group analysis using 'osteoradionecrosis' and 'dental extraction or implants' was performed on the EORTC and UW data, variations in the patterns of significance were found. Adjunctive HBO2 should be considered for the treatment and prevention of some of the long-term complications of radiotherapy.
PMID: 18501562

30: Undersea Hyperb Med. 2008 Mar-Apr;35(2):113-29.

Hyperbaric oxygen induces endogenous neural stem cells to proliferate and differentiate in hypoxic-ischemic brain damage in neonatal rats.

Yang YJ, Wang XL, Yu XH, Wang X, Xie M, Liu CT.

Division of Neonatology, Department of Pediatrics, Xiang Ya Hospital, Central South University.

BACKGROUND AND PURPOSE: Studies suggest that after brain injury, hyperbaric oxygen (HBO2) is neuroprotective by stimulating cell proliferation. We examine whether HBO2 promotes neural stem cells (NSC) to proliferate and differentiate in neonatal hypoxic-ischemic (HI) rats. METHODS: Seven-

day-old rat pups were subjected to unilateral carotid artery ligation followed by 2 hours of hypoxia (8% O2). HBO2 was administered (2 ATA (atmospheres absolute), once daily for 7 days) within 3 hours after HI. The proliferating neural stem cells in the subventricular zone (SVZ) and dentate gyrus (DG) were dynamically examined by 5-bromo-2-deoxyuridine (BrdU)/nestin immunofluorescence. Nestin protein was detected by western blot analysis at various time points (from 6 hours to 14 days) after HI. The migrating NSC were examined by BrdU/doublecortin (DCX) immunofluorescence 7 and 14 days after HI. The phenotype of the newborn cells was identified by BrdU/beta-tubulin, BrdU/glia fibrillary acidic protein (GFAP) and BrdU/O4 (oligodendrocyte marker) immunofluorescence. Myelin basic protein (MBP) was examined by immunohistochemistry and pathological changes of the brain tissue were detected 28 days after HI. RESULTS: In neonatal HI rats treated with HBO2, the proliferation of endogenous NSC was observed in the SVZ and DG. Cell numbers peaked 7 days after HI and proliferating NSC migrated to the cerebral cortex at 14 d after HI. Twenty-eight days after HI, an increase in newly generated neurons, oligodendrocytes and MBP was observed in the HBO2 group compared to the untreated and HI-treated rats. CONCLUSIONS: This study suggests that HBO2 treatment may promote neurogenesis of the endogenous NSC in neonatal HI rats, contributing to repair of the injured brain.

Publication Types: Evaluation Studies Research Support, Non-U.S. Gov't
PMID: 18500076

31: Vojnosanit Pregl. 2008 Mar;65(3):235-8.

[Hyperbaric medicine--dilemmas regarding its possibilities]

[Article in Serbian]

Rabrenović M, Matunović R, Rabrenović V, Zoranović U.

Vojnomedicinska Akademija, Centar za hitnu pomoć, Beograd, Srbija.

Publication Types: Review
PMID: 18494272

32: Resuscitation. 2008 Aug;78(2):200-14. Epub 2008 May 16. Hyperbaric oxygen improves rate of return of spontaneous circulation after prolonged normothermic porcine cardiopulmonary arrest. Van Meter K, Sheps S, Kriedt F, Moises J, Barratt D, Murphy-Lavoie H, Harch PG, Bazan N. Section of Emergency Medicine, Department of Medicine, and Neuroscience Center of Excellence, LSU Health Sciences Center in New Orleans, LA, United States. scusimano@newsouth.net
AIM: This controlled, prospective, randomized porcine study tests the hypothesis that high-dose hyperbaric oxygen (HDHBO2) compared with normobaric oxygen (NBO2) or standard-dose hyperbaric oxygen (SDHBO2), improves return of sustained spontaneous circulation (ROSC) after a normothermic, normobaric, 25-min, non-intervened-upon cardiopulmonary arrest. The study incorporated a direct mechanical ventricular assist device (DMVAD) for open chest continuous cardiac compressions (OCCC) to assist advanced cardiac life support (ACLS). The experiment demonstrates a dose response to oxygen concentration in the breathing mix used in resuscitative ventilation. MATERIALS AND METHODS: Male pigs (average 30kg weight) underwent a 25-min, normothermic, non-intervened-upon cardiopulmonary arrest. Following arrest all animals were ventilated with 100% oxygen and were subjected to OCCC, incorporating DMVAD-aided ACLS. The animals so treated were randomized to be in one of three groups, with six animals in each group. The NBO2 group remained at 1.0 atmosphere absolute (ATA), while the SDHBO2 and HDHBO2 groups were initially placed at 1.9 and 4.0ATA, respectively. Uniform, but not American Heart Association (AHA) protocol, ACLS was maintained as needed over the ensuing 2h for all animals in all groups. At the end of 2h, the animals were euthanized. RESULTS: Continuously sustained ROSC (mean arterial pressure > or =50mmHg at all times), without the need of the pump assist over the 2-h resuscitation attempt that followed

the 25-min arrest, occurred in four out of six animals in the HDHBO2 group, and in none of the animals in the NBO2 or SBHBO2 groups ($p < 0.001$). CONCLUSIONS: Our results show significantly sustained ROSC using HDHBO2 to resuscitate swine after a 25-min, non-intervened-upon, normothermic cardiopulmonary arrest. These results could not be achieved using NBO2 or SDHBO2. Publication Types: Research Support, Non-U.S. Gov't PMID: 18486298

33: J Postgrad Med. 2008 Apr-Jun;54(2):140-3. Prevention of avascular necrosis in displaced talar neck fractures by hyperbaric oxygenation therapy: a dual case report. Mei-Dan O, Hetsroni I, Mann G, Melamed Y, Nyska M. Department of Orthopedics, Meir University Hospital, Sapir Medical Center, Kfar Saba, Israel. omer@extremegate.com
Talar neck fractures are a rare injury that account for less than 2% of all foot fractures. Displaced fractures are associated with an exceedingly high rate of avascular necrosis (AVN). The incidence of AVN following Hawkins Type 3 fractures of the talar neck may approach 100%, particularly if diagnosis and reduction are delayed. Severe cases may present as pain and disability of the ankle and the subtalar joints due to a talar dome collapse, resulting in degenerative changes that usually require hind foot arthrodesis. We present two cases of traumatic displaced talar neck fractures which were treated surgically more than 2 weeks following injury due to a delay in diagnosis. Both patients underwent hyperbaric oxygen therapy (HBOT) after the operation and neither resulted in AVN of the talus in a three-year follow-up. We suggest that this favorable result may be due to the beneficial effects of HBOT. Publication Types: Case Reports PMID: 18480532

34: Wound Repair Regen. 2008 May-Jun;16(3):321-30.

The use of hyperbaric oxygen therapy to treat chronic wounds: A review.

Thackham JA, McElwain DL, Long RJ. School of Mathematical Sciences, Queensland University of Technology, Brisbane, Australia. j.thackham@qut.edu.au

Chronic wounds, defined as those wounds which fail to proceed through an orderly process to produce anatomic and functional integrity, are a significant socioeconomic problem. A wound may fail to heal for a variety of reasons including the use of corticosteroids, formation of squamous cell carcinoma, persistent infection, unrelieved pressure, and underlying hypoxia within the wound bed. Hypoxia appears to inhibit the wound healing process by blocking fibroblast proliferation, collagen production, and capillary angiogenesis and to increase the risk of infection. Hyperbaric oxygen therapy (HBOT) has been shown to aid the healing of ulcerated wounds and demonstrated to reduce the risk of amputation in diabetic patients. However, the causal reasons for the response of the underlying biological processes of wound repair to HBOT, such as the up-regulation of angiogenesis and collagen synthesis are unclear and, consequently, current protocols remain empirical. Here we review chronic wound healing and the use of hyperbaric oxygen as an adjunctive treatment for nonhealing wounds. Databases including PubMed, ScienceDirect, Blackwell Synergy, and The Cochrane Library were searched for relevant phrases including HBOT, HBO/HBOT, wound healing, and chronic/nonhealing wounds/ulcers.

Publication Types: Research Support, Non-U.S. Gov't Review
PMID: 18471250

35: JOP. 2008 May 8;9(3):275-82. Hyperbaric oxygen therapy effects on tissue lesions in acute pancreatitis. Experimental study in rats.

Festugato M, Coelho CP, Fiedler G, Machado FP, Gonçalves MC, Bassani FR, Pierezan PH, Osvaldt AB, Rohde L.

Laboratory of Physiology, Center of Biological Sciences, University of

Caxias do Sul (UCS), Caxias do Sul, RS, Brazil.

OBJECTIVE: To study the effects of hyperbaric oxygen therapy on tissue lesions in an experimental model of acute pancreatitis induced by pancreatic duct ligation. ANIMALS: Forty-eight adult female Wistar rats were randomized into two groups (n=24): control group and hyperbaric oxygen therapy group. INTERVENTION: The second group was treated with a two-hour daily session of hyperbaric oxygen therapy at 2.5 ATA started 6 hours after pancreatic duct ligation. SETTING: The two groups were divided into 3 subgroups of 8 rats each undergoing euthanasia on days 1, 3, and 7 after the acute pancreatitis induction. MAIN OUTCOME MEASURES: The pancreas was evaluated according to the following histopathologic criteria: edema, hemorrhage, acinar necrosis and leukocyte infiltration. RESULTS: Hyperbaric oxygen therapy was efficient in significantly reducing acinar necrosis on the first day (P=0.049) and the foci of hemorrhage on the seventh day (P=0.050). The edema and leukocyte infiltration did not show the expected reduction. CONCLUSION: The utilization of a daily session of hyperbaric oxygen therapy at 2.5 ATA is efficient in reducing the hemorrhage and acinar necrosis but is not sufficient to reduce edema and leukocyte infiltration.

Publication Types: Evaluation Studies
PMID: 18469439

36: Med Hypotheses. 2008 Sep;71(3):470-1. Epub 2008 May 7.

Does hyperbaric oxygen therapy improve outcome in bacterial endophthalmitis?

Ayata A, Uzun G, Unal M, Yildiz S, Bilge AH.

Publication Types: Letter
PMID: 18467036

37: Croat Med J. 2008 Apr;49(2):224-32.

Influence of adjuvant hyperbaric oxygen therapy on short-term complications during surgical reconstruction of upper and lower extremity war injuries: retrospective cohort study.

Roje Z, Roje Z, Eterović D, Druzijanić N, Petrićević A, Roje T, Capkun V.

Division of Plastic Surgery and Burns, Department of Surgery, Split University Hospital Center, Soltanska 1, 21000 Split, Croatia. zdravko.roje@st.t-com.hr

AIM: To determine the effects of hyperbaric oxygen (HBO) therapy on short-term complications of complex war wounds to the upper and lower extremities in patients who were and those who were not treated according to North Atlantic Treaty Organization (NATO) emergency war surgery recommendations. METHOD: We retrospectively analyzed data of 388 male patients undergoing reconstructive surgery for Gustilo type III A, B, and C war wounds to the extremities at the Department of Reconstructive Surgery, Split University Hospital Center, between 1991 and 1995. The occurrence of main wound complications (deep infection, osteomyelitis, skin grafts lyses, and flap necrosis) during hospitalization and time from wounding to granulation formation were analyzed with respect to the use of HBO therapy as a risk factor. Odds ratio (OR) with 95% confidence intervals (CI) was calculated for the occurrence of wound complications with respect to HBO therapy and adjusted for NATO surgical strategy by logistic regression. RESULTS: Of 388 patients, 310 (80%) were initially treated according to the NATO surgical strategy and 99 (25%) received HBO therapy. Deep soft-tissue infection developed in 196 (68%) patients who did not receive HBO therapy and in 35 (35%) who received it ($P<0.001$, χ^2 test). Osteomyelitis developed in 214 (74%) patients who did not receive HBO therapy and in 62 (63%) who received it ($P=0.030$). Skin graft lysis occurred in 151 (52%) patients who did not receive HBO therapy and in 23 (23%) who received it ($P<0.001$). Flap necrosis occurred in 147 (51%) patients who did not receive HBO therapy and in 15 (15%) who received it ($P<0.001$). Median time to granulation formation was 9 (5-57) days in patients who received HBO therapy, and 12 (1-12) days in those who did not ($P<0.001$, Mann-

Whitney test). These results were consistent over the groups of patients stratified according to the wound severity and remained unaltered after the adjustment for NATO surgical strategy. The effect of HBO therapy was greater in non-NATO than in NATO treated patients in case of deep soft-tissue infection (OR, 10.7 vs OR, 3.8; $P=0.031$ for interaction). CONCLUSION: HBO therapy reduced the frequency of wound complications in patients with Gustilo type III wounds and shortened the time to granulation formation. HBO therapy was more effective in non-NATO than in NATO treated patients for the prevention of deep soft-tissue infection but not flap necrosis.

PMID: 18461678

38: Brain Res. 2008 May 30;1212:71-8. Epub 2008 Mar 27.

Up-regulated HIF-1 α is involved in the hypoxic tolerance induced by hyperbaric oxygen preconditioning.

Peng Z, Ren P, Kang Z, Du J, Lian Q, Liu Y, Zhang JH, Sun X.

Department of Diving Medicine, Faculty of Naval Medicine, Second Military Medical University, Shanghai, 200433, PR China.

Hyperbaric oxygen preconditioning (HBO-PC) has been shown to be effective in preventing hypoxic injuries in many animal models. The aim of the present study was to examine the hypoxic tolerance induced by HBO-PC and to explore the role of hypoxia-inducible factor-1 α (HIF-1 α) in a global hypoxia model. Male mice received HBO-PC before hypoxia exposure and swimming. HBO-PC significantly prolonged the survival time and the tolerance time of swimming under normobaric hypoxia. HBO-PC increased the protein content of HIF-1 α and erythropoietin (EPO) in the cerebral cortex and hippocampus and prevented the changes of blood brain barrier (BBB) permeability and brain edema caused by hypoxia exposure. The results suggested that HBO-PC induced hypoxic tolerance in mice via up-regulation of HIF-1 α and its downstream genes.

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

PMID: 18439571

39: J Chin Med Assoc. 2008 Apr;71(4):218-20.

Hyperbaric oxygen therapy for cyclophosphamide-induced intractable refractory hemorrhagic cystitis in a systemic lupus erythematosus patient.

Jou YC, Lien FC, Cheng MC, Shen CH, Lin CT, Chen PC.

Department of Urology, Chiayi Christian Hospital, Chiayi, Taiwan, R.O.C. b729@cych.org.tw

Hemorrhagic cystitis is a complication of systemic lupus erythematosus and is also a common side effect after cyclophosphamide therapy. Intractable hemorrhagic cystitis is not unusual and may be a life-threatening condition; it has no effective noninvasive treatment at present. We report a case of hemorrhagic cystitis with intractable refractory bleeding that occurred in a 40-year-old woman after cyclophosphamide treatment for systemic lupus erythematosus. The hemorrhage was resistant to various therapies but resolved after hyperbaric oxygen therapy. There was no recurrent hematuria after hyperbaric oxygen therapy during 6 months of follow-up.

Publication Types: Case Reports

PMID: 18436507

40: Zhongguo Dang Dai Er Ke Za Zhi. 2008 Apr;10(2):195-8.

[Effect of hyperbaric oxygenation on the differentiation of implanted human neural stem cells into neurons in vivo]

[Article in Chinese]

Bai J, Luan Z, Zhou CL, Qu SQ, Jiang Y, Wang ZY.

Department of Pediatrics, First Hospital of Peking University, Beijing 100034, China.

OBJECTIVE: To study the effect of hyperbaric oxygenation (HBO) on the differentiation of the implanted human neural stem cells (hNSCs) into neurons in neonatal rats following hypoxic-ischemic brain damage (HIBD). METHODS: HIBD model was prepared by ligation of the left common carotid artery, followed by 8% hypoxia exposure in 7-day-old Sprague-Dawley rat pups. Three days later, the rats received implantation of hNSCs into the left

cerebral ventricles. Then the survived rats were randomly divided into two groups: transplantation alone and transplantation+HBO (n=8 each). HBO treatment was administered (1.8 ATA, 1 hr once daily for 10 days) in the transplantation+HBO group 1 hr after hNSCs transplantation. Brains were removed 10 days after transplantation. Frozen coronal sections were prepared for immunofluorescence analysis to detect the neural differentiation of the transplanted cells in the cerebral cortex and hippocampus. RESULTS: Differentiated neurons of implanted cells distributed mainly in the cortex and the hippocampus of the injured side. There was no difference in the number of neurons in the cortex between the two groups, while the number of neurons in the hippocampus significantly increased in the transplantation+HBO group compared with that in the transplantation alone group (231.4±15.1 vs 162.6±5.6; P<0.05). CONCLUSIONS: HBO treatment may promote the differentiation of implanted hNSCs into neurons in the hippocampus of neonatal rats following HIBD.

Publication Types: English Abstract

PMID: 18433546

41: Zhongguo Dang Dai Er Ke Za Zhi. 2008 Apr;10(2):133-5.

[Efficacy of hyperbaric oxygen therapy under different pressures on neonatal hypoxic-ischemic encephalopathy]

[Article in Chinese]

Zhou BY, Lu GJ, Huang YQ, Ye ZZ, Han YK.

Department of Neonatology, Bao'an Maternal and Child Health Care Hospital of Shenzhen, Shenzhen, Guangdong 518103, China.

OBJECTIVE: Some research has shown that hyperbaric oxygen (HBO) can decrease the rate of mortality and disability caused by hypoxic-ischemic encephalopathy (HIE) in neonates. However, the HBO pressure used in the clinical reports and the efficacy of HBO are different. This study was designed to investigate the efficacy of HBO therapy under different pressures by observing the changes of peroxidation, antioxidant levels

and brain vasomotor regulation factors as well as the score of neonatal behavioral neurological assessment (NBNA) in neonates with HIE after HBO therapy. METHODS: Sixty neonates with HIE were randomly administered with 1.4, 1.5 or 1.6 atmosphere absolute (ATA) of HBO, once daily for seven days. Serum levels of malondialdehyde (MDA), superoxide dismutase (SOD), nitric oxide (NO) and nitric oxide synthase (NOS) were measured before and after HBO therapy. Meanwhile, NBNA and eye ground examination were performed. RESULTS: Serum SOD level increased and serum levels of MDA, NO and NOS decreased significantly after HBO therapy in the three HBO therapy groups ($P < 0.01$). Serum SOD level was significantly higher and serum levels of MDA, NO and NOS were significantly lower in the 1.6 ATA HBO group than those in the 1.4 ATA HBO group after therapy ($P < 0.05$). The 1.6 ATA HBO group also showed increased SOD and decreased MDA levels compared with the 1.5 ATA HBO group after therapy ($P < 0.05$). NBNA scores in the three groups increased significantly after HBO therapy ($P < 0.05$). None of the three HBO therapy group patients showed abnormal eye grounds after therapy. CONCLUSIONS: HBO therapy with 1.4, 1.5 or 1.6 ATA is safe and effective for neonatal HIE. The antioxidant capacity increases with the increasing HBO pressure in neonates with HIE.

Publication Types: English Abstract
Randomized Controlled Trial
PMID: 18433528

42: Clin Exp Pharmacol Physiol. 2008 Aug;35(8):957-64. Epub 2008 Apr 21.

Topical oxygen therapy induces vascular endothelial growth factor expression and improves closure of clinically presented chronic wounds.

Gordillo GM, Roy S, Khanna S, Schlanger R, Khandelwal S, Phillips G, Sen CK.

The Comprehensive Wound Center, The Ohio State University Medical Center, Columbus, Ohio 43210, USA. gayle.gordillo@osumc.edu

1. Chronic wounds, especially in diabetics, represent a serious

threat to human health. 2. Correcting a compromised state of tissue oxygenation by the administration of supplemental O_2 is known to benefit wound healing. Beyond its role as a nutrient and antibiotic, O_2 supports wound healing by driving redox signaling. 3. Hyperbaric oxygen (HBO) therapy is widely used and approved by Center for Medicare and Medicaid Services to treat specific ulcerations. The current literature supports the notion that approaches to topically oxygenate wounds may be productive. 4. Here, we present the results of two simultaneous studies testing the effects of HBO and portable topical oxygen (TO) therapies. These two therapeutic approaches have several contrasting features. 5. In total, 1854 patients were screened in outpatient wound clinics for non-randomized enrolments into the HBO ($n = 32$; 31% diabetic) and TO ($n = 25$; 52% diabetic) studies. 6. Under the conditions of the present study, HBO treatment seemed to benefit some wounds while not benefiting others. Overall, HBO did not result in statistically significant improvements in wound size in the given population over the time monitored in the present study. 7. However, TO significantly improved wound size. Among the three O_2 -sensitive genes (VEGF, TGF β 1 and COL1A1) studied in wound edge tissue biopsies, TO treatment was associated with higher VEGF165 expression in healing wounds. Expression of the other genes mentioned was not affected by TO. There was no significant change in the expression levels of any of genes studied in patients in the HBO study. This establishes a link between VEGF gene expression and healing outcome for TO therapy. 8. Taken together, the present study provides evidence demonstrating that TO treatment benefits wound healing in patients suffering from chronic wounds. Treatment with TO is associated with an induction of VEGF expression in wound edge tissue and an improvement in wound size.

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

PMID: 18430064

43: Kokubyo Gakkai Zasshi. 2008 Mar;75(1):55-64.

[Effects of hyperbaric oxygen treatment on healing of maxillary distraction osteogenesis in beagle dogs]

[Article in Japanese]

Kudoh A.

Maxillofacial Orthognathics, Department of Maxillofacial Reconstruction and Function, Division of Maxillofacial/ Neck Reconstruction, Graduate School, Tokyo Medical and Dental University.

Distraction osteogenesis has been widely used even in the craniofacial region. A long fixation time during the consolidation period, however, is a major clinical disadvantage. Hyperbaric oxygen (HBO) has been used to improve healing in ischemic wounds. We have recently started applying hyperbaric oxygen to cleft palate patients after maxillary distraction, but there is little basic evidence. We hypothesized that hyperbaric oxygen would enhance the healing of distraction osteogenesis in the cleft palate model in dogs. A bony segment including a canine was transported proximally into an artificial bone defect in the left palate. Three dogs were treated with hyperbaric oxygen for 20 days just after the distraction and three other dogs underwent only the distraction process (control group). Blood flow of the canine pulp in the bone segment was monitored using a laser Doppler flowmeter throughout the experiment. All the dogs were sacrificed on day 100, and radiological analysis using peripheral quantitative CT and histomorphometric evaluations were performed. Blood flow in the HBO-treated group recovered to the original level about 30 days faster than in the control group ($p < 0.05$). Cortical bone mineral density was significantly higher at the distraction site in the HBO-treated group than in the control group ($p < 0.05$). The histomorphometric analysis revealed that the newly formed bone area was also larger in the HBO-treated group than in the control group ($p < 0.05$). These

results suggest that hyperbaric oxygen treatment could be useful for early removal of the distraction device in distraction osteogenesis.

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

PMID: 18421952

44: Brain Res. 2008 May 19;1210:223-9. Epub 2008 Mar 12.

Hyperbaric oxygen preconditioning induces tolerance against brain ischemia-reperfusion injury by upregulation of antioxidant enzymes in rats.

Li J, Liu W, Ding S, Xu W, Guan Y, Zhang JH, Sun X.

Department of Neurology, Changhai Hospital, 174 Changhai Road, Shanghai 200433, PR China.

The present study examined the hypothesis that cerebral ischemic tolerance induced by hyperbaric oxygen preconditioning (HBO-PC) is associated with an increase of antioxidant enzyme activity. Male Sprague-Dawley rats (250-280 g, $n = 74$) were divided into sham, middle cerebral artery occlusion (MCAO) for 90 min, and MCAO plus HBO-PC groups. HBO-PC was conducted four times by given 100% oxygen at 2.5 atmosphere absolute (ATA), for 1 h at every 12 h interval for 2 days. At 24 h after the last HBO-PC, MCAO was performed and at 24 h after MCAO, neurological function and Nissl Staining were performed to evaluate the effect of HBO-PC. Malondialdehyde (MDA) content, activity of catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GSH-px) were measured. HBO-PC decreased mortality rate, improved neurological recovery, lessened neuronal injury, reduced the level of MDA and increased the antioxidant activity of CAT and SOD. These observations demonstrated that an upregulation of the antioxidant enzyme activity by HBO preconditioning plays an important role in the generation of tolerance against brain ischemia-reperfusion injury.

PMID: 18407255

45: Emerg Med Clin North Am. 2008 May;26(2):571-95, xi.

Hyperbaric oxygen: applications in infectious disease.

Kaide CG, Khandelwal S.

Department of Emergency Medicine, The Ohio State University Medical Center, 0136 Means Hall, 1654 Upham Drive, Columbus, OH 43240, USA. colin.kaide@osumc.edu

This article reviews the applications of hyperbaric oxygen (HBO) as an adjunctive treatment of certain infectious processes. Infections for which HBO has been studied and is recommended by the Undersea and Hyperbaric Medicine Society include necrotizing fasciitis, gas gangrene, chronic refractory osteomyelitis (including malignant otitis externa), mucormycosis, intracranial abscesses, and diabetic foot ulcers that have concomitant infections. In all of these processes, HBO is used adjunctively along with antimicrobial agents and aggressive surgical debridement. This article describes the details of each infection and the research that supports the use of HBO.

Publication Types: Review

PMID: 18406988

46: ORL J Otorhinolaryngol Relat Spec. 2008;70(3):210-3. Epub 2008 Apr 8.

Hyperbaric oxygen treatment restores sudden hearing loss in a patient with Fabry disease.

Frantz MC, Pontz BF, Arnold W.

Department of Otorhinolaryngology, Head and Neck Surgery, Klinikum rechts der Isar, Munich, Germany. m.frantz@lrz.tum.de

Fabry disease is an X-linked inherited disorder of glycosphingolipid metabolism due to the deficient activity of a lysosomal enzyme, alpha-galactosidase A. The resultant systemic accumulation of sphingolipids can lead to progressive and sudden hearing loss alongside renal, cardiac and cerebrovascular complications. Although replacement therapy seems to be beneficial for cochlear function, few data are available regarding treatment of sudden hearing loss. This case report describes the course of a unilateral sudden hearing loss in a

young (15-year-old) male patient and its improvement following hyperbaric oxygen treatment. 2008 S. Karger AG, Basel

Publication Types:

Case

Reports

PMID: 18401198

47: Int J Technol Assess Health Care. 2008 Spring;24(2):178-83.

Cost-effectiveness and budget impact of adjunctive hyperbaric oxygen therapy for diabetic foot ulcers.

Chuck AW, Hailey D, Jacobs P, Perry DC.

University of Alberta, Alberta, Canada. achuck@ihe.ca

BACKGROUND: Hyperbaric oxygen therapy (HBOT) has been proposed as an adjunct to standard methods of care for diabetic foot ulcers (DFU). Its use may decrease the risk of infection and lower extremity amputations (LEAs). As part of a Canadian assessment, we estimated the cost-effectiveness and budget impact of HBOT in this application. METHODS: We developed a decision model comparing adjunctive HBOT with standard care alone. The population was a 65-year-old cohort with DFU. The time horizon was 12 years taken from a Ministry of Health perspective. The health states were a healed wound with or without a minor LEA, an unhealed wound with no related surgery, and a major LEA. Efficacy data were based on outcomes reported in studies included in a literature review. Cost and capacity needs for treating DFU patients in Canada were estimated using prevalence data from the literature, and cost and utilization data from government records. RESULTS: The 12-year cost for patients receiving HBOT was CND\$40,695 compared with CND\$49,786 for standard care alone. Outcomes were 3.64 quality-adjusted life-years (QALYs) for those receiving HBOT and 3.01 QALYs for controls. Estimated cost to treat all prevalent DFU cases in Canada was CND\$14.4-19.7 million/year over 4 years. If seven-person HBOT chambers were used, a further nineteen to thirty-five machines would be required nationally. CONCLUSIONS: Adjunctive HBOT for DFU is cost-effective compared with

standard care. Additional HBOT capacity would be needed if it were to be adopted as the standard of care throughout Canada.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 18400121

48: Rev Assoc Med Bras. 2008 Jan-Feb;54(1):77-81.

[The splenic inferior pole of rats and hyperbaric oxygen]

[Article in Portuguese]

Paulo IC, Paulo DN, Ferrari TA, Azeredo TC, Silva AL.

Laboratório da Disciplina de Fundamentos da Cirurgia, Escola Superior de Ciências, Santa Casa de Misericórdia de Vitória, ES, Brazil.

OBJECTIVE: To study the functional and morphological features of the lower pole of the spleen in rats submitted, or not, to postoperative hyperbaric oxygen therapy. METHODS: Seventy-nine Wistar rats, weighing 248.7 +/- 27 g, divided into two groups [group A - simulation (n=40), group B - lower pole (n=39)] underwent surgery and were subdivided into two groups: 11 and 70 postoperative days. Each subgroup was subdivided into animals not treated (nt) (A11nt, n=10; B11nt, n=13; A70nt, n=10; B70nt, n=9) and treated with hyperbaric oxygen (t) (A11t, n=10; B11t, n=9; A70t, n=10; B70t, n=8). Blood was collected for measurement of lipids and immunoglobulins, platelet and Howell-Jolly body count before and after surgery. The spleen and lower pole were removed for histology. RESULTS: There was an increase of total cholesterol (p=0.002), VLDL-cholesterol and triglycerides (p=0.003) and of LDL-cholesterol (p=0.013) in subgroup B11nt, and no alterations were observed in the other subgroups. IgM decreased in subgroups B11t (p=0.007), B11nt (p=0.0000), B70nt (p=0.0005), B70t (p=0.02), and no change was observed in the simulation group. The number of platelets increased in subgroups B11nt (p=0.002) and B11t (p=0.01) and remained unchanged in the other subgroups. Howell-Jolly bodies were less numerous in subgroup B70nt than in subgroup B11nt (p=0.019). Lower pole viability was better in subgroup B11t than in B11nt and in

subgroup B70 than in B11, and did not differ between subgroups B70t and B70nt. CONCLUSION: Function and viability of the remaining lower pole improved during the late postoperative period. Viability and function of the lower pole were better during the early but not during the late postoperative period, in animals submitted to hyperbaric oxygen therapy.

Publication Types: English Abstract
Research Support, Non-U.S. Gov't
PMID: 18392491

49: Microsurgery. 2008;28(4):300.

Comment on: Microsurgery. 2007;27(4):252-7.

Decreasing the expression of LFA-1 and ICAM-1 as the major mechanism for the protective effect of hyperbaric oxygen on ischemia-reperfusion injury.

Namazi H.

Publication Types: Comment Letter

PMID: 18383352

50: J Int Med Res. 2008 Mar-Apr;36(2):222-6.

MRI screening of dysbaric osteonecrosis in hyperbaric-chamber inside attendants.

Ozkan H, Uzun G, Yildiz S, Sonmez G, Mutlu H, Aktas S.

Department of Orthopaedics and Traumatology, Gulhane Military Medical Academy, Etlik, Ankara, Turkey.

Inside attendants are medical staff who accompany patients during hyperbaric oxygen treatments. Dysbaric osteonecrosis (DON) is a well-known consequence of hyperbaric exposure. The aim of this study was to evaluate DON in inside attendants using magnetic resonance imaging (MRI). The bilateral shoulder, hip and knee joints of 12 inside attendants (four men, eight women; mean age 29 years; age range 22 - 36 years) were investigated. The mean +/- SD duration of employment as an inside attendant was 3.8 +/- 3.0 years (range 1 - 9 years) and the mean +/- SD number of hyperbaric exposures was 198 +/- 267 (median 96; range 30 - 950). None of the inside attendants had a history of decompression sickness. The MRIs of the attendants did not reveal bone

lesions consistent with DON. This study failed to find an increased risk for DON in inside attendants. Additional multicentre epidemiological studies are warranted to investigate the occupational safety of inside attendants.
PMID: 18380930

51: Eksp Klin Farmakol. 2008 Jan-Feb;71(1):22-5.

[Dynamics of the behavioral response and cortisol level caused by the combined action of mexidole, diazepam, thymogen, and hyperbaric oxygenation in mice under immobilization stress conditions]

[Article in Russian]

Podsevatkin VG, Kiriukhina SV, Podsevatkin DV, Podsevatkina SV, Blinov DS.

Experiments on white mice under the model immobilization stress condition showed that a combined action of mexidole, diazepam, thymogen, and hyperbaric oxygenation (pathogenetic therapy) leads to optimization of the behavioral reactions, which is manifested by a decrease in the level of anxiety, increase in the locomotor and research activity, and normalization of the cortisol level. This effect is explained by a complex pharmacological action of all factors on the immune and endocrine mechanisms of the stress pathogenesis.

Publication Types: English Abstract

PMID: 18365482

52: Brain Res Bull. 2008 Mar 28;75(5):668-73. Epub 2007 Dec 3.

The effect of hyperbaric oxygen on regional brain and spinal cord levels of nitric oxide metabolites in rat.

Ohgami Y, Chung E, Shirachi DY, Quock RM.

Department of Pharmaceutical Sciences, College of Pharmacy, Washington State University, Pullman, WA 99164-6534, USA.

Hyperbaric oxygen (HBO(2)) therapy is reported to be beneficial in transient brain ischemia. The present study was conducted to determine the influence of HBO(2) on metabolites of nitric oxide (NO) in brain and spinal cord of rats. Rats were exposed to room air (RA),

normobaric air (NBA), normobaric oxygen (NBO(2)), hyperbaric air (HBA) or HBO(2), the last two conditions at 2.5ATA (atmosphere absolute) for 60 min. The results demonstrate that, compared to the NBA control, oxygen alone generally reduced tissue levels of NO(x)(-) (nitrite plus nitrate). On the other hand, 2.5ATA alone tended to have a slight, if any, effect on tissue levels of NO(x)(-). The combination of oxygen and pressure (i.e., HBO(2)) generally led to an increase in tissue levels of NO(x)(-). Based on these findings, it is concluded that HBO(2) appears to markedly increase NO function most notably in the corpus striatum, brainstem, cerebellum and spinal cord.

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

PMID: 18355644

53: Pediatr Neurosurg. 2008;44(3):239-42. Epub 2008 Mar 20.

Hyperbaric oxygen therapy (HBO) for the treatment of an epidural abscess in the posterior fossa in an 8-month-old infant.

Baechli H, Schmutz J, Mayr JM.

Neurosurgical Department and Children's University Hospital, Basel, Switzerland.
hbaechli@uhbs.ch

Epidural abscesses in children are extremely rare, especially in the posterior fossa. In some cases antibiotic therapy and surgical drainage are insufficient for complete healing. We present the case of an 8-month-old boy who developed an epidural abscess in the posterior fossa after repeated surgical procedures for retrocerebellar arachnoid cysts and hydrocephalus. We decided to use adjuvant hyperbaric oxygen therapy (HBO) to avoid removal of the bone and the existing ventriculoperitoneal shunt. In this way osteomyelitis, potentially leading to bone removal and shunt infection, could be prevented. HBO is a relatively safe, noninvasive and cost-effective therapy to improve healing of chronic and deep-seated wound infections. To our knowledge HBO has never been used before in such a young child in neurosurgery. Multidisciplinary

management is recommended to optimize treatment.
Publication Types: Case Reports
PMID: 18354266

54: Undersea Hyperb Med. 2008 Jan-Feb;35(1):53-60.
Hyperbaric oxygen therapy: types of injury and number of sessions--a review of 1506 cases.
D'Agostino Dias M, Fontes B, Poggetti RS, Birolini D, Intensive Care Unity, Emergency Surgery Service, III Division of Surgical Clinics, Clinics Hospital of the University of São Paulo School of Medicine.
OBJECTIVE: The aim of this work was to identify clinical data indicative of the number of hyperbaric oxygen therapy HBO2 sessions that should be prescribed for adjuvant treatment of tissue injuries of differing severity.
PATIENTS: A total of 1730 cases of patients treated with HBO2 using an open protocol (without a predetermined number of sessions) was examined in this study. METHOD: A retrospective study involving charts review was conducted. Severity had been previously determined for the treatment of acute (fasciitis, myositis, gangrene, contaminated/infected perineal or lower extremity traumatic injuries) or chronic (osteomyelitis, pressure sore, diabetic or ischemic ulcer) injuries. Only patients that met or exceeded the supposed effective minimal treatment doses (5 sessions for acute, 10 sessions for chronic injuries) were included in the present study. RESULTS: The data analysis included 1506 cases. These consisted of 1014 patients with acute injuries, who required 11 to 18 sessions (depending on injury severity), and 492 patients with chronic injuries, who required a greater ($p < 0.001$) number of sessions (approximately 30/patient, independent of injury severity). Global mortality was 79/1506 patients. CONCLUSION: These results seem to support the initial indication of 15 HBO2 sessions for the treatment acute injuries, and 30 for treatment of chronic injuries. Prospective studies may better determine the number of

sessions for the treatment of different types of injuries.
Publication Types: Evaluation Studies
PMID: 18351127

55: Adv Skin Wound Care. 2008 Feb;21(2):79-84.
The selection of skin care products for use in hyperbaric chamber may depend on flammability acceptability indices score.
McCord DE, Newton BE, Fore J, Chiffolleau G, McCord Research, Iowa City, IA, USA.
PURPOSE: Current protocols call for stopping adjunctive skin care treatments during hyperbaric oxygen therapy (HBOT) because the hyperbaric environment is considered unsafe for skin care products. The elevated oxygen fraction and the increased pressure in the hyperbaric chamber dramatically increase the flammability potential of materials, leading to the need for rigorous standards to prevent flame ignition. A scientific method of evaluating the flammability risks associated with skin care products would be helpful. Several skin care products were tested, using established industrial techniques for determining flammability potential with some modification. The information obtained from these tests can help clinicians make more rational decisions about which topical products can be used safely on patients undergoing HBOT. METHODS AND MATERIALS: Wendell Hull & Associates conducted independent studies, comparing the oxygen compatibility for leading skin care products. Oxygen compatibility was determined using autogenous ignition temperature (AIT), oxygen index (OI), and heat of combustion (HoC) testing. AIT, a relative indication of a material's propensity for ignition, is the minimum temperature needed to cause a sample to self-ignite at a given pressure and oxygen concentration. OI, a relative indication of a material's flammability, is the minimum oxygen percentage that, when mixed with nitrogen, will sustain burning. HoC is the absolute value of a material's energy release when burning, if

ignition occurs. Products with a high AIT, a high OI, and a low HoC are more compatible in an oxygen-enriched atmosphere (OEA). An acceptability index (AI) based on these 3 factors was calculated for the products, so the testers could rank overall material compatibility in OEAs (Lapin A. Oxygen Compatibility of Materials. International Institute of Refrigeration Commission Meeting; Brighton, England; 1973). RESULTS: Test results for the skin products varied widely. The AIT, OI, HoC, and AI were determined for each product under described circumstances. The AIT results indicate that all products in 99.5% oxygen concentration under pressure will ignite and that a pattern based on the absence or presence of petroleum-based ingredients does not seem to exist. Products containing petrolatum, mineral oil, paraffin, and paraffin wax had a HoC that equaled or exceeded the HoC of gasoline, whereas products without petroleum-based ingredients had a significantly lower HoC. The OI of skin products not containing petrolateum-based ingredients was significantly higher than the OI of products containing it. The AI values the OI as the most important value: the higher the AI, the more acceptable the product is for use with oxygen. The silicone-containing, petroleum-free products received an AI up to 25 times higher than the petrolatum-based products. These findings suggest a wide variation in the safety profiles of skin products. Skin products being considered for use in an OEA should be screened for flammability risks. This screening will allow informed decisions about the fire safety of the products. Further research is indicated.

Publication Types: Evaluation Studies

PMID: 18349735

56: Surv Ophthalmol. 2008 Mar-Apr;53(2):112-20.

The use of hyperbaric oxygen therapy in ophthalmology.

Oguz H, Sobaci G.

Department of Ophthalmology, Harran University Medical School, Sanliurfa, Turkey.

Hyperbaric oxygen therapy is a primary or adjuvant therapeutic method used in treatment of various acute or chronic disorders. Currently, eye diseases are among the off-label use of hyperbaric oxygen. However, there is an increasing body of evidence showing its safety and efficacy in retinal artery occlusion, cystoid macular edema secondary to retinal vein occlusion, scleral thinning and necrosis faced after pterygium surgery, orbital rhino-cerebral mucormycosis, nonhealing corneal edema, and anterior segment ischemia. Its potential to treat some blinding disease has also been pointed out in recent studies. This article constitutes an up-to-date summary of knowledge and therapeutic use of hyperbaric oxygen, and aims to contribute understanding of current and potential use of hyperbaric oxygen therapy in ophthalmology.

Publication Types: Review

PMID: 18348877

57: Int J Radiat Oncol Biol Phys. 2008 Sep 1;72(1):134-143. Epub 2008 Mar 14.

Comment in: Int J Radiat Oncol Biol Phys. 2008 Dec 1;72(5):1621; author reply 1621.

Hyperbaric oxygen treatment of chronic refractory radiation proctitis: a randomized and controlled double-blind crossover trial with long-term follow-up.

Clarke RE, Tenorio LM, Hussey JR, Toklu AS, Cone DL, Hinojosa JG, Desai SP, Dominguez Parra L, Rodrigues SD, Long RJ, Walker MB.

Baromedical Research Foundation, Columbia, SC 29203, USA.

dick.clarke@palmettohealth.org

PURPOSE: Cancer patients who undergo radiotherapy remain at life-long risk of radiation-induced injury to normal tissues. We conducted a randomized, controlled, double-blind crossover trial with long-term follow-up to evaluate the effectiveness of hyperbaric oxygen for refractory radiation proctitis. METHODS AND MATERIALS: Patients with refractory radiation proctitis were randomized to hyperbaric oxygen at 2.0 atmospheres absolute (Group 1) or air at 1.1 atmospheres absolute (Group 2). The sham patients were subsequently crossed

to Group 1. All patients were re-evaluated by an investigator who was unaware of the treatment allocation at 3 and 6 months and Years 1-5. The primary outcome measures were the late effects normal tissue-subjective, objective, management, analytic (SOMA-LENT) score and standardized clinical assessment. The secondary outcome was the change in quality of life. RESULTS: Of 226 patients assessed, 150 were entered in the study and 120 were evaluable. After the initial allocation, the mean SOMA-LENT score improved in both groups. For Group 1, the mean was lower ($p = 0.0150$) and the amount of improvement nearly twice as great (5.00 vs. 2.61, $p = 0.0019$). Similarly, Group 1 had a greater portion of responders per clinical assessment than did Group 2 (88.9% vs. 62.5%, respectively; $p = 0.0009$). Significance improved when the data were analyzed from an intention to treat perspective ($p = 0.0006$). Group 1 had a better result in the quality of life bowel bother subscale. These differences were abolished after the crossover. CONCLUSION: Hyperbaric oxygen therapy significantly improved the healing responses in patients with refractory radiation proctitis, generating an absolute risk reduction of 32% (number needed to treat of 3) between the groups after the initial allocation. Other medical management requirements were discontinued, and advanced interventions were largely avoided. Enhanced bowel-specific quality of life resulted.

Publication Types: Multicenter Study
Randomized Controlled Trial
Research Support, Non-U.S. Gov't
PMID: 18342453

58: Brain Res. 2008 Mar 27;1201:128-34. Epub 2008 Feb 5. Repetitive hyperbaric oxygen exposures enhance sensitivity to convulsion by upregulation of eNOS and nNOS. Liu W, Li J, Sun X, Liu K, Zhang JH, Xu W, Tao H. Department of Diving Medicine, Faculty of Naval Medicine, Second Military Medical University, and Department of Neurology, Changhai

Hospital, Shanghai, 200433, PR China.

BACKGROUND: Repetitive hyperbaric oxygen (HBO) exposures as preconditioning methods produce ischemic tolerance, but may increase the risk of convulsions in patients. The purpose of this study was to investigate the mechanisms in increased sensitivity to convulsions and the role of nitric oxide (NO) and its synthases after repetitive HBO exposures. METHODS: Mice were randomly assigned into three groups: HBO group, hyperbaric air (HBA) group and normobaric air (NBA) group. Mice in HBO or HBA group were exposed to hyperbaric oxygen or hyperbaric air respectively for 60 min twice daily for 3 consecutive days (2.5 atmosphere absolute [ATA]). 24 h after the last exposure, mice were exposed to HBO (100% O₂, 6 ATA). The latency of convulsions was recorded. In addition, the levels of NO, NADPH-diaphorase, mRNA and protein expressions of NOS isoforms in hypothalamus and hippocampus were determined. RESULTS: Latency to seizures was significantly shortened in mice after six HBO pre-exposures. The level of NO in hypothalamus in HBO group was increased. The number of NADPH-d positive cells and the levels of protein and mRNA of eNOS and nNOS in hypothalamus and hippocampus were increased. CONCLUSION: After repeated HBO exposures, elevated NO may enhance the sensitivity to convulsions and this may lead to seizures during the subsequent oxygen exposures. Prevention of seizures is needed when HBO is used as preconditioning method.

PMID: 18342297

59: Acta Anaesthesiol Scand. 2008 Apr;52(4):566-8.

Iatrogenic systemic air embolism treated with hyperbaric oxygen therapy.

Jørgensen TB, Sørensen AM, Jansen EC.

Department of Anaesthesia, Abdominal Center, Copenhagen University Hospital Rigshospitalet, Copenhagen, Denmark. bech2000@tiscali.dk

Air embolism is a rare and potentially severe complication of surgical and invasive procedures.

Emboli large enough to produce symptoms require immediate treatment because of the risk of 'gas lock' in the right side of the heart and subsequent circulatory failure. If air is transmitted to the arterial circulation through a shunt, it may cause cerebral emboli with neurological symptoms. We present two cases with venous air emboli and concurrent cerebral arterial emboli. Both patients were successfully treated with hyperbaric oxygen therapy.

Publication Types: Case Reports
PMID: 18339163

60: J Invest Dermatol. 2008 Aug;128(8):2102-12. Epub 2008 Mar 13.

Hyperbaric oxygen attenuates apoptosis and decreases inflammation in an ischemic wound model.

Zhang Q, Chang Q, Cox RA, Gong X, Gould LJ.

Division of Plastic Surgery, Department of Surgery, University of Texas Medical Branch, Galveston, Texas, USA.

The molecular mechanisms whereby hyperbaric oxygen (HBO) improves ischemic wound healing remain elusive. In this study, a rat model of wound ischemia was used to test the hypothesis that HBO enhances wound healing by modulating hypoxia-inducible factor-1 α (HIF-1 α) signaling. Male Sprague-Dawley rats underwent creation of a previously validated ischemic flap. Three groups underwent daily treatment: HBO (90 minutes, 2.4 atm); systemic administration of the free radical scavenger, N-acetylcysteine (NAC 150 mg kg⁻¹ intraperitoneal); control (neither HBO nor NAC). HBO treatment improved healing of the ischemic wounds. Analysis of ischemic wound tissue extracts demonstrated significantly reduced expression of HIF-1 α , p53, and BNip3. Additionally, HBO increased expression of Bcl-2 while decreasing cleaved caspase-3. DNA fragmentation was abolished and the number of TUNEL-positive cells was reduced compared to the other groups. Vascular endothelial growth factor, cyclooxygenase-2, and neutrophil infiltration were

reduced in ischemic wounds treated with HBO. These results indicate that HBO improves ischemic wound healing by downregulation of HIF-1 α and subsequent target gene expression with attenuation of cell apoptosis and reduction of inflammation.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 18337831

61: J Emerg Med. 2009 Apr;36(3):296-7. Epub 2008 Mar 5.

Radiation cystitis: indication for hyperbaric oxygen.
Witucki PJ.

Department of Emergency Medicine, Hyperbaric and Diving Medicine, University of California-San Diego, San Diego, California 92103-8819, USA.

Publication Types: Case Reports
PMID: 18325711

62: Tohoku J Exp Med. 2008 Mar;214(3):281-9.

Hyperbaric oxygen therapy improves myocardial diastolic function in diabetic patients.

Aparci M, Kardesoglu E, Suleymanoglu S, Uzun G, Onem Y, Uz O, Kucukardali Y, Ozkan S.

Department of Cardiology, Gulhane Military Medical Academy, Haydarpasa Teaching Hospital.

Myocardial diastolic dysfunction is the relaxation abnormality of ventricles that limits the diastolic filling and generally precedes diastolic heart failure. Diastolic dysfunction is a common finding in diabetes. Diabetic patients receive hyperbaric oxygen (HBO) therapy for non-healing lower extremity ulcers, and exposure to HBO therapy is known to influence cardiovascular functions. This study was designed to evaluate the effect of HBO therapy on myocardial diastolic function in diabetic patients. Thirty diabetic patients (18 male and 12 female, 59.9 +/- 10 years old), who were planning to undergo HBO therapy, were consecutively enrolled. Myocardial diastolic function was evaluated by pulsed wave Doppler echocardiography and tissue Doppler echocardiography before the first HBO therapy and after the tenth HBO therapy session. HBO therapy

improved the relaxation capability of left ventricular myocardium, which was reflected by reduction in E wave deceleration time of mitral valve inflow (286.1 +/- 65.8 msec vs 214.3 +/- 32.1 msec, $p < 0.05$). HBO therapy also affected favorably the diastolic filling dynamics of right ventricle, which was partially reflected by the changes in E wave peak velocity of tricuspid valve inflow (0.48 +/- 0.07 m/sec vs 0.46 +/- 0.09 m/sec, $p < 0.05$). Tissue Doppler parameters of mitral lateral annulus, which are better correlated with ventricular relaxation, tended to be improved after HBO therapy, but the degree of improvement was not statistically significant. In conclusion, we suggest that HBO therapy may improve the myocardial diastolic function of diabetic patients when applied repetitively.
Publication Types: Clinical Trial
PMID: 18323697

63: J Surg Res. 2008 Nov;150(1):11-6. Epub 2008 Jan 22.
Reperfusion-induced neutrophil CD18 polarization: effect of hyperbaric oxygen.
Khiabani KT, Bellister SA, Skaggs SS, Stephenson LL, Nataraj C, Wang WZ, Zamboni WA.
Microsurgery and Hyperbaric Laboratory, Division of Plastic Surgery, University of Nevada School of Medicine, Las Vegas, Nevada 89102-2227, USA.
BACKGROUND: Hyperbaric oxygen (HBO) inhibits ischemia reperfusion (IR)-induced neutrophil adhesion to endothelium through an unknown mechanism. This study evaluates the effect of HBO on IR-stimulated neutrophil adhesion and polarization of expressed CD18 adhesion molecules using a novel in vitro adhesion assay and confocal microscopy. MATERIALS AND METHODS: Neutrophils from normal animals were isolated from whole blood and incubated with plasma from rat gracilis muscle flaps on coverslips pretreated with ICAM. Percent adherence to ICAM and CD18 polarization was evaluated in the following five groups: (1) Nonischemic control, $n = 15$; (2) 4 h ischemia (IR, $n = 15$); (3) 4 h

ischemia with HBO treatment (100% oxygen at 2.5 atmospheres absolute (IR + HBO, $n = 15$)); (4) 4 h ischemia with 100% oxygen at room temperature and pressure (RTP) (IR + normobaric hyperoxia, $n = 5$); and (5) 4 h ischemia with 8% oxygen at 2.5 atmospheres absolute (IR + hyperbaric normoxia, $n = 5$). Direct HBO treatment of neutrophils was also evaluated. RESULTS: Neutrophils exposed to IR plasma showed a significant increase in percent adherent (0.8 +/- 0.1% versus 16.7 +/- 2.2%, $P < 0.05$) and polarized cells (6.2 +/- 1.7% versus 43.9 +/- 12.2%, $P < 0.05$) compared to controls. Hyperbaric oxygen significantly reduced the adhesion and polarization to 1.6 +/- 0.3 and 4.1 +/- 2.5%, respectively ($P = < 0.05$). Normobaric hyperoxia and hyperbaric normoxia did not affect neutrophil adherence or CD18 polarization following IR. Direct HBO treatment of neutrophils did not change the percent of polarized cells in IR. CONCLUSIONS: Hyperbaric oxygen inhibits IR-induced neutrophil adhesion by blocking CD18 surface polarization and requires plasma exposure to HBO. Treatment with oxygen or pressure alone is not effective.
PMID: 18316093

64: Singapore Med J. 2008 Feb;49(2):105-9.
Hyperbaric oxygen therapy in the management of diabetic lower limb wounds.
Ong M.
Hyperbaric Medicine Centre, Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, Singapore 308433. mikeong@pacific.net.sg
INTRODUCTION: Hyperbaric oxygen therapy (HBOT) involves the inhalation of 100 percent oxygen at pressures greater than at sea level. One of the most common indications for HBOT is to aid healing of diabetic foot wounds. METHODS: All cases of diabetic foot wounds that were seen by the Hyperbaric Medicine Centre in Tan Tock Seng Hospital from May 2005 to March 2006 were analysed in terms of outcome (wound healing) after HBOT. RESULTS: A total of 45 cases of foot ulcers/wounds were analysed. 32 patients had a

favourable outcome, giving a success rate of 71 percent. The remaining 13 (28 percent) did not have a favourable outcome to HBOT. The success rate was even more significant as a large number of these patients (34 [77 percent]) were told by their specialist that they were at high risk of a further amputation. No major complications were noted. CONCLUSION: The experience of the Hyperbaric Medicine Centre in Singapore is consistent with that reported in other centres. With proper patient selection, HBOT, together with a multidisciplinary team of vascular and orthopaedic surgeons, podiatrists, infection disease physicians and endocrinologists, can help reduce the numbers and severity of amputations as well as downtime due to increased wound healing.

PMID: 18301835

65: Ren Fail. 2008;30(2):233-7.

Comment in: Ren Fail. 2008;30(6):665.

Adjuvant hyperbaric oxygen therapy in the treatment of hemodialysis patients with chronic osteomyelitis.

Chen CY, Lin KP, Lu SH, Chen YJ, Lin CF.

Department of Nephrology, Tian-Sheng Memorial Hospital, Tong-Kang, Ping-Tong, Taiwan.

BACKGROUND: Hemodialysis dependence is an independent risk factor for hematogenous complication, including distant metastatic infection and osteomyelitis. Chronic osteomyelitis is a serious disease that fails to respond to aggressive medical and surgical treatment. Hyperbaric oxygen therapy has been proved to enhance bone and soft tissue healing in many studies. This article presents the preliminary result of hyperbaric oxygen therapy in hemodialysis-dependent patients with chronic osteomyelitis. MATERIALS AND METHODS: Ten hemodialysis dependent patients who were diagnosed with chronic diffuse osteomyelitis were treated prospectively with adjunctive hyperbaric oxygen therapy, in addition to aggressive surgical debridement and antibiotic treatment. RESULTS: The hyperbaric

oxygen therapy averaged 20 daily sessions. Successful treatment was achieved in eight patients (80%). The mean length of treatment was 21 days. The preliminary results are comparable with other series. CONCLUSION: Hyperbaric oxygen is effective as an adjunct to aggressive medical and surgical treatment in chronic refractory osteomyelitis among hemodialysis-dependent patients.

Publication Types: Comparative Study

PMID: 18300127

66: J Strength Cond Res. 2008 Jan;22(1):66-74.

Effects of pre-exposure to hyperbaric hyperoxia on high-intensity exercise performance.

Kawada S, Fukaya K, Ohtani M, Kobayashi K, Fukusaki C.

The Department of Human and Engineered Environmental Studies, Graduate School of Frontier Sciences, The University of Tokyo, Chiba Prefecture, Japan. kawada@k.u-tokyo.ac.jp

This study comprised 2 main experiments: one was to determine the oxidative DNA damage under hyperbaric hyperoxia (HBO), and the other was to evaluate the effects of pre-exposure to HBO on high-intensity exercise performance. Healthy subjects (n = 8) inspired 100% O₂ in an experimental chamber at a pressure of 1.3 atmospheres absolute (ATA) for 50 minutes once per week for 2 weeks. Urinary 8-hydroxy-2'-deoxyguanosine (8-OHdG) was measured as a marker of DNA oxidative damage on day 0 and on days 1, 3, and 5 after each HBO exposure. To investigate the effects of pre-exposure to HBO on high-intensity exercise performance, subjects (n = 6) performed maximal isometric knee extensor exercise (30 repetitions x 2 sets) with and without HBO pre-exposure (100% O₂ at 1.3 ATA for 50 minutes). Urinary 8-OHdG did not show any significant change after HBO exposure. Isometric knee extensor torque was significantly lower during the first half of the first set of exercises after HBO pre-exposure compared with the normobaric normoxia (NBO) trial. The decreased torque was associated with the lower integrated

electromyography with respect to time. Changes in the degree of ischemia-reperfusion in the vastus lateralis muscle during exercise were larger in the HBO pre-exposure trial than in the NBO trial. Muscle fatigue index, serum lactate concentration, heart rate, and systolic blood pressure showed no differences between the 2 trials. These results indicated that HBO exposure was harmless to DNA, and HBO pre-exposure did not enhance high-intensity exercise performance. As a practical application, athletes who require maximal muscle strength should not inspire high-concentration of O₂ just before their competitions because it might, as the case may be, impair their performance.

Publication Types: Comparative Study
Research Support, Non-U.S. Gov't
PMID: 18296957

67: Arch Dis Child. 2008 Jun;93(6):528-33. Epub 2008 Feb 19.
Comment in: Arch Dis Child. 2009 Jul;94(7):562.

Taking young children on aeroplanes: what are the risks?

Bossley C, Balfour-Lynn IM.
Department of Paediatric Respiratory Medicine, Royal Brompton Hospital, London, UK.

Publication Types: Review
PMID: 18285390

68: Ann Emerg Med. 2008 Mar;51(3):339-40; author reply 340-2.

Comment on: Ann Emerg Med. 2008 Feb;51(2):138-52.

An inconvenient truth?

Logue CJ; Hyperbaric Medicine Section of ACEP.

Publication Types: Comment Letter
PMID: 18282535

69: Ann Plast Surg. 2008 Jan;60(1):81-8.

The effect of hyperbaric oxygen treatment on squamous cell cancer growth and tumor hypoxia.

Schönmeyr BH, Wong AK, Reid VJ, Gwalli F, Mehrara BJ.

Division of Plastic and Reconstructive Surgery, Department of Surgery, Memorial Sloan-Kettering Cancer Center, New York, NY, USA.

Anecdotal studies have reported explosive tumor growth in patients with a history of squamous cell carcinoma after hyperbaric oxygen (HBO) treatment. Conflicting experimental results have followed. In this study, squamous cancer cells were subjected to daily HBO treatment. No difference in cellular proliferation was noted in vitro when comparing HBO and control treated cells (P = 0.534). Similarly, immunostaining for in vivo DNA synthesis failed to demonstrate any significant difference in the number of proliferating cells after treatment with HBO (P = 0.388). No significant difference in tumor volume or mass was found after in vivo implantation (P = 0.471). HBO was found to reduce tumor hypoxia, which trended towards significance when compared with controls (P = 0.057); however, there was no difference in serum VEGF levels or vessel ingrowth. Thus, even though HBO may reduce the levels of hypoxia within squamous cell tumors, it does not appear to enhance short-term growth or promote cellular proliferation or angiogenesis.

Publication Types: In Vitro
Research Support, Non-U.S. Gov't
PMID: 18281803

70: J Clin Neurosci. 2008 Apr;15(4):445-50. Epub 2008 Feb 15.

Effects of hyperbaric oxygen on energy production and xanthine oxidase levels in striated muscle tissue of healthy rats.

Kurt B, Kurt Y, Karslıoğlu Y, Topal T, Erdamar H, Korkmaz A, Türközkan N, Yaman H, Odabaşı Z, Günhan O.

Department of Pathology, Gulhane Military Medical Academy and Medical School, Etlik, Ankara, Turkey. bkurt_md@yahoo.com

We investigated the effects of hyperbaric oxygen (HBO) treatment on striated muscle tissue in healthy rats. The treatment group of rats (n=16) was given HBO daily on weekdays for 2 h over a 4-week period while a control group (n=8) was not treated. Tissue samples were taken from the left and right vastus lateralis before and after the HBO treatment period, respectively, for all rats in both groups. Levels of adenosine

monophosphate (AMP), adenosine diphosphate, adenosine triphosphate (ATP) and xanthine oxidase in the muscle tissue were determined. HBO treatment caused a statistically significant increase in ATP ($p=0.001$) and decrease in AMP ($p=0.02$) in the HBO-treated group, while there were no significant differences in metabolites in the control group. These results suggest that HBO treatment induces an increase in the ATP levels of muscle tissue with normal mitochondria. Thus, HBO might have some beneficial effects in the treatment of heteroplasmic mitochondrial disease, where normal and defective mitochondria coexist.

Publication Types: In Vitro
PMID: 18280739

71: Acta Cir Bras. 2008 Jan-Feb;23(1):11-5.

Effect of different periods of hyperbaric oxygen on ischemia-reperfusion injury of rat small bowel.

Bertoletto PR, Chaves JC, Fagundes AT, Simões RS, Oshima CT, Simões Mde J, Fagundes DJ.

University of Grande Dourados, Mato Grosso do Sul, Brazil.
bertoletto@terra.com.br

PURPOSE: To determine whether hyperbaric oxygen (HBO) could effectively protect the small intestine mucosa against an ischemic insult, according to different periods of application. METHODS: The gut of 32 male rats was subjected to 60-min ischemia (clamping the mesenteric artery and vein); After they were further reperfused upon clamp opening during 60 min. Animal groups were as follows. GII = placed on HBO during the ischemia period; GIII = placed on HBO during reperfusion; GIV = treated with HBO throughout the ischemia-reperfusion period. Some animals (GI) did not receive HBO treatment at all and served as reference of ischemia-reperfusion injury (IR). HBO was carried out in a cylindrical acrylic chamber (2.0 ATA). Samples of small bowel were prepared for H.E staining for histological evaluations. RESULTS: The histological injury of mucosa was significantly less when HBO was administered during the ischemia period (17.6 ± 0.6) as compared

with the IR (21.3 ± 1.8). HBO was not effective when applied during reperfusion (23.1 ± 2.1) or during the ischemia plus reperfusion period (18.7 ± 1.9). The thickness of the mucosa was preserved by HBO in ischemia (327.50 ± 30.23 microm) in comparison with the IR (172.79 ± 5.95 microm). In the periods of reperfusion (162.50 ± 6.05 microm) and ischemia plus reperfusion (296.49 ± 20.01 microm) the mucosa revealed a structural injury. CONCLUSION: Hyperbaric oxygen affects the ischemic insult of small bowel, being the favorable effect obtained when hyperbaric oxygen was administered early in the ischemic period.

PMID: 18278387

72: Int J Oral Maxillofac Surg. 2008 Mar;37(3):255-9. Epub 2008 Feb 11.

Comment in: Int J Oral Maxillofac Surg. 2009 Jan;38(1):99-100; author reply 100.

The effect of hyperbaric oxygen therapy on quality of life in oral and oropharyngeal cancer patients treated with radiotherapy.

Gerlach NL, Barkhuysen R, Kaanders JH, Janssens GO, Sterk W, Merckx MA. Department of Oral and Maxillofacial Surgery, Radboud University Nijmegen Medical Centre, Nijmegen, the Netherlands.

Radiotherapy is used in the setting of curative treatment for head and neck cancer. Xerostomia and related problems occur when major salivary glands are included in the irradiation fields. This reduces quality of life (QOL). Hyperbaric oxygen therapy (HBOT) is a well accepted treatment or prevention modality for osteoradionecrosis of the jawbones and soft-tissue necrosis. It is unknown if and to what extent HBOT influences xerostomia and xerostomia-related QOL. To address this, a prospective study was conducted. Twenty-one patients who underwent radiotherapy for an oral or oropharyngeal carcinoma completed a European Organization for Research and Treatment of Cancer QOL questionnaire before HBOT, as part of the treatment/prevention of osteoradionecrosis, and 1 and 2

years after HBOT. Swallowing-related problems significantly decreased in time, and there was a reported subjective increase in saliva quantity and an improvement in sense of taste. The results suggest that HBOT may positively influence these long-term radiotherapy sequelae.
PMID: 18262761

73: Zhongguo Zhen Jiu. 2008 Jan;28(1):30-2.

[Analysis on therapeutic effect of acupuncture combined with hyperbaric oxygenation on delayed encephalopathy in the patient of acute carbon monoxide poisoning]
[Article in Chinese]

He J.

The First Affiliated Hospital, Tianjin University of TCM, Tianjin 300193, China. gymgymgym@163.com

OBJECTIVE: To compare therapeutic effects of acupuncture combined with hyperbaric oxygenation and simple hyperbaric oxygenation on delayed encephalopathy in the patient of acute carbon monoxide poisoning. METHODS: Sixty inpatients were randomly divided into an observation group and a control group. The observation group were treated with acupuncture at Neiguan (PC 6), Shuigou (GV 26), Sanyinjiao (SP 6), Baihui (GV 20), Sishencong (EX-HN 1), etc., and hyperbaric oxygenation. The control group were treated with simple hyperbaric oxygenation. Nerve function defect was evaluated.

RESULTS: The total effective rate was 96.7% in the observation group and 86.7% in the control group, the observation group being significantly higher than the control group ($P < 0.05$).

CONCLUSION: Acupuncture combined with hyperbaric oxygenation has a significant therapeutic effect on delayed encephalopathy in the patient of acute carbon monoxide poisoning.

Publication Types: English Abstract
Randomized Controlled Trial

PMID: 18257185

74: Cochrane Database Syst Rev. 2008 Jan 23;(1):CD003603.

Update of: Cochrane Database Syst Rev. 2002;(3):CD003603.

Interventions for replacing missing teeth: hyperbaric oxygen therapy for irradiated patients who require dental implants.

Esposito M, Grusovin MG, Patel S, Worthington HV, Coulthard P.

School of Dentistry, Department of Oral and Maxillofacial Surgery, University of Manchester, Higher Cambridge Street, Manchester, UK M15 6FH. espositomarco@hotmail.com

BACKGROUND: Dental implants offer one way to replace missing teeth. Patients who have undergone radiotherapy and those that have also undergone surgery for cancer in the head and neck region may benefit particularly from reconstruction with implants.

Hyperbaric oxygen therapy (HBO) has been advocated to improve the success of implant treatment in patients who have undergone radiotherapy but this remains a controversial issue. OBJECTIVES: To compare success, morbidity, patient satisfaction and cost effectiveness of dental implant treatment carried out with and without HBO in irradiated patients. SEARCH STRATEGY: We searched the Cochrane Oral Health Group's Trials Register, The Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE and EMBASE. Handsearching included several dental journals. We checked the bibliographies of relevant clinical trials and review articles for studies outside the handsearched journals. We wrote to authors of the identified randomised controlled trials (RCTs), to more than 55 oral implant manufacturers; we used personal contacts and we asked on an internet discussion group in an attempt to identify unpublished or ongoing RCTs. No language restriction was applied. The last electronic search was conducted on 13 June 2007. SELECTION CRITERIA: Randomised controlled trials of HBO therapy for irradiated patients requiring dental implants. DATA COLLECTION AND ANALYSIS: Screening of eligible studies, assessment of the methodological quality of the trials and data extraction were conducted in duplicate and independently by two review authors. Results were expressed as random-effects models using mean

differences for continuous outcomes and risk ratios for dichotomous outcomes with 95% confidence intervals. MAIN RESULTS: Only one RCT was identified and included. Thirteen patients received HBO therapy while other 13 did not. Two to six implants were placed in fully edentulous mandibles to be rehabilitated with bar-retained overdentures. One year after implant loading four patients died from each group. One patient, treated with HBO, developed an osteoradionecrosis and lost all implants so the prosthesis could not be provided. Five patients in the HBO group had at least one implant failure versus two in the control group. There were no statistically significant differences for prosthesis and implant failures, postoperative complications and patient satisfaction between the two groups. AUTHORS' CONCLUSIONS: Despite the limited amount of clinical research available, it appears that HBO therapy in irradiated patients requiring dental implants may not offer any appreciable clinical benefits. There is a definite need for more RCTs to ascertain the effectiveness of HBO in irradiated patients requiring dental implants. These trials ought to be of a high quality and reported as recommended by the CONSORT statement (<http://www.consort-statement.org/>). Each clinical centre may have limited numbers of patients and it is likely that trials will need to be multicentred. Publication Types: Review PMID: 18254025

75: Angle Orthod. 2008 Mar;78(2):304-8. Effects of hyperbaric oxygen during experimental tooth movement. Gokce S, Bengi AO, Akin E, Karacay S, Sagdic D, Kurkcu M, Gokce HS. Department of Orthodontics, Gulhane Military Medical Academy, Dental Sciences Center, Ankara, Turkey. silagokce@yahoo.com OBJECTIVE: To determine the effects of hyperbaric oxygen (HBO) on bone remodeling during orthodontic tooth movement. MATERIALS AND METHODS: Twenty-four male, adult Sprague

Dawley rats were randomly divided into two groups. HBO was administered in the first group, and the second group served as a control. The mandibular first molars were moved mesially by means of Ni-Ti closed coil springs in all groups. RESULTS: Results were evaluated histomorphometrically and the parameters of trabecular bone volume (BV/TV), trabecular bone number (Tr.N), and trabecular separation (Tr.Sep) were evaluated at the interradicular bone area of the mandibular first molars. Increases in BV/TV and Tr.N and decreases in Tr.Sep revealed the osteoblastic activity of HBO. HBO application caused an increase in bone apposition and osteoblastic activity or a decrease in osteoclastic activity. CONCLUSIONS: HBO enhanced the bone formation during experimental tooth movement. Therefore, the findings of this study support our hypothesis that osteoblastic activity might be modulated by changes in the environmental oxygen tension. Publication Types: Research Support, Non-U.S. Gov't PMID: 18251603

76: Basic Clin Pharmacol Toxicol. 2008 Mar;102(3):287-92. Epub 2008 Jan 30. Hyperbaric oxygen therapy does not potentiate doxorubicin-induced cardiotoxicity in rats. Karagoz B, Suleymanoglu S, Uzun G, Bilgi O, Aydinoz S, Haholu A, Turken O, Onem Y, Kandemir EG. Department of Medical Oncology, Gulhane Military Medical Academy, Haydarpasa Training Hospital, Istanbul, Turkey. The current use of doxorubicin is regarded as an absolute contraindication for hyperbaric oxygen (HBO2) therapy because of the increased risk of cardiotoxicity. The aim of this study was to investigate whether additional exposure to HBO2 during the course of doxorubicin treatment would further increase the cardiotoxicity of doxorubicin in rats. Female Wistar rats were treated with either HBO2 (n = 10) or doxorubicin (n = 8) or a combination of both treatments (n = 10) for 4 consecutive weeks and followed up for an additional 4

weeks. Cardiomyopathy was evaluated using two-dimensional and M-mode echocardiography at baseline, at the fourth, sixth and eighth weeks, and by histopathological investigation of the rat hearts at the eighth week. Doxorubicin treatment significantly reduced ejection fraction and fractional shortening ($P < 0.001$) and caused severe histopathological injury ($P < 0.05$) indicating development of cardiotoxicity. Although the combination of doxorubicin and HBO(2) also markedly reduced ejection fraction and fractional shortening ($P < 0.001$), this reduction was significantly less than that of doxorubicin treatment ($P < 0.05$). HBO2 therapy also attenuated doxorubicin-induced histopathological changes in rat hearts ($P < 0.05$). HBO2 alone did not alter echocardiographic parameters or histopathological findings ($P > 0.05$). In conclusion, HBO2 therapy does not potentiate doxorubicin-induced cardiotoxicity in rats. Cardioprotection conferred by HBO2 against doxorubicin warrants further investigation.
PMID: 18248515

77: Stroke. 2008 Mar;39(3):1000-6. Epub 2008 Jan 31.
Hyperbaric oxygen reduces tissue hypoxia and hypoxia-inducible factor-1 alpha expression in focal cerebral ischemia.
Sun L, Marti HH, Veltkamp R.
Department of Neurology, Ruprecht-Karls-University Heidelberg, Heidelberg, Germany.
BACKGROUND AND PURPOSE: The usefulness of hyperbaric oxygen (HBO) and normobaric hyperoxia in acute ischemic stroke is being reexplored because both improve outcome in experimental cerebral ischemia. However, even the basic mechanisms underlying oxygen therapy are poorly understood. We investigated the effect of both oxygen therapies on tissue hypoxia and on the transcription factor hypoxia-inducible factor-1 alpha.
METHODS: Mice were subjected to filament-induced middle cerebral artery occlusion for 2 hours. Twenty-five minutes after filament introduction, mice breathed normobaric air, normobaric 100% O(2) (normobaric hyperoxia), or

100% O(2) at 3 ata (HBO) for 95 minutes. Hypoxic regions were mapped on tissue sections after preischemic infusion of the in vivo hypoxia marker EF-5. Hypoxia-inducible factor-1 alpha protein was measured after 2-hour middle cerebral artery occlusion using immunofluorescence and immunoblotting. Vascular endothelial growth factor expression was analyzed using in situ mRNA hybridization. RESULTS: Severity of ischemia did not differ among groups. HBO (35.2+/-10.4 mm(2)) significantly reduced the area of EF-5-stained hypoxic regions in focal cerebral ischemia compared with normobaric hyperoxia (46.4+/-11.2 mm(2)) and air (49.1+/-8 mm(2), $P < 0.05$, analysis of variance). Topographically, EF-5 fluorescence was decreased in medial striatum and in cortical ischemic border areas. Immunohistochemistry and immunoblotting revealed lower hypoxia-inducible factor-1 alpha protein in the ischemic hemisphere of HBO-treated mice. Moreover, mRNA in situ hybridization showed lower expression of vascular endothelial growth factor in HBO and normobaric hyperoxia groups. CONCLUSIONS: Measurement of extrinsic and intrinsic markers of hypoxia revealed that HBO improves penumbral oxygenation in focal ischemia. Modification of the transcription factor hypoxia-inducible factor-1 alpha and its downstream targets may be involved in effects of HBO.
Publication Types: Research Support, Non-U.S. Gov't
PMID: 18239183

78: Clin Oncol (R Coll Radiol). 2008 May;20(4):284-7. Epub 2008 Jan 28.
Improved quality of life with hyperbaric oxygen therapy in patients with persistent pelvic radiation-induced toxicity.
Safra T, Gutman G, Fishlev G, Soyfer V, Gall N, Lessing JB, Almog R, Matcivsky D, Grisaru D.
Department of Oncology, Tel-Aviv Sourasky Medical Center, Tel-Aviv, Israel.
AIMS: We report the results of hyperbaric oxygen therapy (HBOT) used in the treatment of radiation-

induced persistent side-effects after the irradiation of pelvic tumours. MATERIALS AND METHODS: Between January 2001 and December 2005, 13 women (median age 60.3 years) with radiation combined proctitis/cystitis (n=6), longstanding vaginal ulcers and fistulas (n=5) and longstanding skin injuries (n=2) underwent HBOT in a multiplace chamber for a median of 27 sessions (range 16-40). The treatment schedule was HBOT 100% oxygen, at 2 absolute atmospheres, for 90 min, once a day. For radiation-induced toxicity grading we used the National Cancer Institute Common Toxicity Criteria (CTC) grading system, before and after HBOT. RESULTS: Thirteen patients underwent an adequate number of HBOT sessions. The mean CTC grading score before HBOT was 3.3+/-0.75, whereas the mean CTC grading score after HBOT was 0.3+/-0.63. The scores showed a significant improvement after HBOT (P=0.001; exact Wilcoxon signed-rank test). Rectal bleeding ceased in five of six patients with proctitis and dysuria resolved in six of seven cystitis patients. Macroscopic haematuria stopped in seven of seven patients. Scar complications resolved in two of two patients. None reported HBOT-associated side-effects. CONCLUSION: HBOT is apparently safe and effective in managing radiation-induced late side-effects, such as soft tissue necrosis (skin and vagina), cystitis, proctitis and fistulas. PMID: 18222656

79: Brain Res. 2008 Feb 27;1196:151-6. Epub 2007 Dec 28. Mechanism of hyperbaric oxygen preconditioning in neonatal hypoxia-ischemia rat model. Li Z, Liu W, Kang Z, Lv S, Han C, Yun L, Sun X, Zhang JH. Department of Pathology, Weifang Medical College, Shandong, 261042, PR China. Hypoxic ischemic (HI) injury in neonates damages brain tissues. We examined the mechanism of hyperbaric oxygen preconditioning (HBO-PC) in neonatal HI rat model. Seven-day-old rat pups were subjected to left common carotid artery ligation and hypoxia (8%

oxygen at 37 degrees C) for 90 min. HBO (100% O₂, 2.5 atmospheres absolute for 2.5 h) were administered by placing pups in a chamber 24 h before HI insult. Brain injury was assessed by the survival rate, 2,3,5-triphenyltetrazolium chloride (TTC), Nissl, TUNEL staining and caspase-3, caspase-9 activities after HI. In HBO preconditioned animals, survival rate was increased, infarct ratio was decreased, and the positive stained TUNEL cells were reduced, accompanied by the suppression of caspase-3 and -9 activities. These results indicate that a single HBO-PC appears to provide brain protection against HI insult via inhibition of neuronal apoptosis pathways. PMID: 18221732

80: Cerebrovasc Dis. 2008;25(3):193-201. Epub 2008 Jan 23. Neuroprotection by oxygen in acute transient focal cerebral ischemia is dose dependent and shows superiority of hyperbaric oxygenation. Eschenfelder CC, Krug R, Yusofi AF, Meyne JK, Herdegen T, Koch A, Zhao Y, Carl UM, Deuschl G. Department of Neurology, University Hospital Schleswig-Holstein, Kiel, Germany. c.eschenfelder@neurologie.uni-kiel.de

The neuroprotective effect of oxygen after acute stroke in rats has been shown previously. However, the question of optimal dosing still remains unanswered. Thus, we investigated the use of oxygen at different concentrations by either normobaric oxygenation (NBO) or hyperbaric oxygenation (HBO) at different pressures in a model of transient ischemia/reperfusion in rats. Animals underwent 90 min of middle cerebral artery occlusion (MCAO) followed by 90 min of reperfusion before oxygen treatment. Oxygen was applied either by NBO (100% O₂; 1.0 absolute atmosphere, ATA) or HBO (100% O₂; 1.5, 2.0, 2.5 or 3.0 ATA) for 1 h. Primary endpoints were infarct volume and clinical outcome measured 24 h and 7 days following the MCAO. A statistically

significant and long-lasting reduction in infarct volume was seen in the HBO 2.5 ATA and 3.0 ATA groups over a period of 7 days. The reduced infarct volume was accompanied with a statistically significant improvement in clinical outcome in the high-dose oxygen-treated groups. The presented data indicate that oxygen is a highly neuroprotective molecule in transient focal cerebral ischemia in rats, when applied early and at high doses. The effect is dose dependent and shows a superiority of HBO over NBO, when the primary endpoints infarct volume reduction and clinical outcome are analyzed. These data are important for the development of new acute stroke treatment studies in humans.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 18212507

81: Auris Nasus Larynx. 2008 Jun;35(2):318; author reply 319. Epub 2008 Jan 22.

Comment on: Auris Nasus Larynx. 2008 Jun;35(2):192-7. Therapeutic window for the use of hyperbaric oxygen therapy in idiopathic sudden sensorineural hearing loss.

Uzun G, Yildiz S.
Publication Types: Comment Letter
PMID: 18207344

82: Ann Emerg Med. 2008 Feb;51(2):138-52.

Comment in: Ann Emerg Med. 2008 Mar;51(3):339-40; author reply 340-2.

Republished in: J Emerg Nurs. 2008 Apr;34(2):e19-32.

Clinical policy: Critical issues in the management of adult patients presenting to the emergency department with acute carbon monoxide poisoning.

Wolf SJ, Lavonas EJ, Sloan EP, Jagoda AS; American College of Emergency Physicians.

This clinical policy focuses on critical issues concerning the management of adult patients presenting to the emergency department (ED) with acute symptomatic carbon monoxide (CO) poisoning. The subcommittee reviewed the medical literature relevant to the questions posed.

The critical questions are: Should hyperbaric oxygen (HBO2) therapy be used for the treatment of patients with acute CO poisoning; and Can clinical or laboratory criteria identify CO-poisoned patients who are most or least likely to benefit from this therapy. Recommendations are provided on the basis of the strength of evidence of the literature. Level A recommendations represent patient management principles that reflect a high degree of clinical certainty; Level B recommendations represent patient management principles that reflect moderate clinical certainty; and Level C recommendations represent other patient management strategies that are based on preliminary, inconclusive, or conflicting evidence, or based on committee consensus. This clinical policy is intended for physicians working in hospital-based EDs.

Publication Types: Practice Guideline
PMID: 18206551

83: Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008 Apr;105(4):417-22. Epub 2008 Feb 21.

Hyperbaric oxygen results in increased vascular endothelial growth factor (VEGF) protein expression in rabbit calvarial critical-sized defects.

Fok TC, Jan A, Peel SA, Evans AW, Clokie CM, Sándor GK.

Schulich School of Medicine and Dentistry, University of Western Ontario, London, Canada.

BACKGROUND: Hyperbaric oxygen therapy (HBO) promotes osseous healing, however the mechanism by which this occurs has not been elucidated. HBO may promote angiogenesis, which is vital for bone healing. Vascular endothelial growth factor (VEGF) is one of the key factors that stimulates angiogenesis. OBJECTIVE: The objective of this study was to investigate whether HBO altered VEGF expression during bone healing. METHODS AND MATERIALS: Archived samples from calvarial defects of rabbits exposed to HBO (2.4 ATA, 90 minutes a day, 5 days a week for 4 weeks) and normobaric oxygen controls (NBO) were analyzed by immunohistochemistry. RESULTS:

VEGF expression in 6-week HBO samples was elevated compared to NBO ($P = .012$). Staining of the 12-week HBO samples was reduced compared to 6-week HBO ($P = .008$) and was similar to 6- and 12-week NBO control samples. CONCLUSION: HBO therapy resulted in increased VEGF expression in the defects even 2 weeks after the termination of treatment (6 weeks postsurgery).
Publication Types: Research Support, Non-U.S. Gov't
PMID: 18206401

84: J Ultrasound Med. 2008 Feb;27(2):209-14.

Effect of hyperbaric oxygen on flow-mediated vasodilation: an ultrasound study.

Saglam M, Bozlar U, Kantarci F, Ay H, Battal B, Coskun U.

Department of Radiology, Gulhane School of Medicine, Ankara, Turkey. mdsaglam@yahoo.com

OBJECTIVE: The purpose of this study was to investigate the effect of hyperbaric oxygen (HBO) treatment on flow-mediated vasodilation (FMD) by ultrasound examination. METHODS: We studied 14 young patients without cardiovascular problems who underwent HBO treatment. The indications for HBO treatment were osteomyelitis ($n = 8$), Crohn disease ($n = 2$), perianal abscesses ($n = 2$), lingual artery embolization ($n = 1$), and aseptic necrosis ($n = 1$). The ultrasound evaluation for FMD was performed before HBO treatment, after 1 session of HBO treatment, and after 10 sessions of HBO treatment. The right brachial artery FMD response was evaluated by the mean of the baseline right brachial artery diameter, absolute change in the diameter before and after cuff inflation/deflation, and percent change in the diameter. RESULTS: Statistical analysis showed a significant change in the preinflation right brachial artery diameter before (mean \pm SD, 3.6 \pm 0.54 mm) and after (3.76 \pm 0.56 mm) 10 sessions of HBO treatment ($P < .05$). The absolute changes in the right brachial artery diameter before and after cuff inflation/deflation (0.36 \pm 0.2 mm before HBO treatment, 0.37 \pm 0.22 mm after 1 session of HBO

treatment, and 0.38 \pm 0.21 mm after 10 sessions) and percent change in FMD (10% \pm 5.8% before HBO treatment, 10.6% \pm 7.5% after 1 session of HBO treatment, and 10.6% \pm 7.7% after 10 sessions) after induction of a hyperemic response by cuff inflation were not statistically significant ($P > .05$). CONCLUSIONS: Hyperbaric oxygen treatment did not have an immediate effect on FMD (absolute change in the right brachial artery diameter after cuff inflation/deflation); however, the right brachial artery diameter increased after 10 sessions of HBO treatment. This may suggest chronic stress on the vascular endothelium after HBO.

PMID: 18204011

85: Eur J Neurol. 2008 Mar;15(3):e19-20. Epub 2008 Jan 14.

Efficacy of combined hyperbaric oxygenation therapy in a case of pyogenic spondylodiscitis accompanied by an epidural and pelvic intramuscular gaseous abscess and encephal meningitis.

Omori N, Takeuchi K, Tanaka T, Narai H, Kitagawa T, Abe K, Manabe Y.

Publication Types: Case Reports Letter

PMID: 18201194

86: J Sex Med. 2008 Mar;5(3):562-70. Epub 2008 Jan 11.

The effect of hyperbaric oxygen therapy on erectile function recovery in a rat cavernous nerve injury model.

Müller A, Tal R, Donohue JF, Akin-Olugbade Y, Kobylarz K, Paduch D, Cutter SC, Mehrara BJ, Scardino PT, Mulhall JP.

Department of Urology, Memorial Sloan Kettering Cancer Center, New York, NY 10021, USA.

INTRODUCTION: Cavernosal oxygenation appears to be important for preservation of erectile tissue health. Hyperbaric oxygen therapy (HBOT) has been shown to improve tissue oxygenation and has neuromodulatory effects. AIM: This study was designed to define the effects of HBOT on erectile function (EF) and cavernosal tissue in the rat cavernous nerve (CN) injury model. METHODS: Four groups of Sprague-Dawley rats were

studied: rats with bilateral CN crush, HBOT treated (Crush+/HBOT+); bilateral CN-crush/no HBOT (C+/H-); no crush/no HBOT (C-/H-); and no crush/HBOT (C-/H+). HBOT was delivered daily for 90 minutes at three atmospheres for 10 days commencing the day of CN crush. MAIN OUTCOME MEASURES: Ten days after CN injury, the animals underwent CN stimulation measuring the maximal intracavernosal pressure/mean arterial pressure (ICP/MAP) ratios. Corporal tissue was harvested pre-sacrifice, and immunohistochemically stained for nerve growth factor (NGF), endothelial nitric oxide synthase (eNOS), and cluster of differentiation molecule (CD31). Histologic analysis was performed for Masson's trichrome to assess the smooth muscle-collagen ratio. Terminal deoxynucleotidyl transferase Biotin-dUTP Nick End Labeling assay was used to define apoptotic indices (AIs). RESULTS: The C+/H- group had significantly lower ICP/MAP ratios compared with C-/H- rats, (31% vs. 70%, $P < 0.001$). C+/H+ rats had significantly higher ICP/MAP ratio recovery compared with the C+/H- group (55% vs. 31%, $P = 0.005$). NGF and eNOS staining densities were higher in C+/H+ rats compared with C+/H- rats ($P < 0.05$ and $P < 0.001$, respectively). No difference was seen in CD31 expression. Staining density for MT displayed a trend toward higher smooth muscle preservation after HBOT. AIs were significantly increased by HBOT ($P < 0.05$). CONCLUSION: HBOT following a CN injury improved EF preservation in this model, supporting the cavernosal oxygenation concept as protective mechanism for EF. The effects appear to be mediated via preservation of neurotrophic and endothelial factor expression. Publication Types: Research Support, Non-U.S. Gov't PMID: 18194179

87: Intensive Care Med. 2008 Jun;34(6):1122-32. Epub 2008 Jan 12. Hyperbaric oxygenation reduces overexpression of c-Fos and oxidative stress in the brain stem of experimental endotoxemic rats.

Lin HC, Wan FJ. Department of Pharmacology, National Defense Medical Center, No. 161 Section 6 Min-Chuan East Road, 114 Taipei, Taiwan. hclin@ndmctsgh.edu.tw OBJECTIVE: Septic encephalopathy is associated with an increased mortality rate in septic patients. We have previously shown that a peripheral lipopolysaccharide (LPS) injection induces neuronal activation in the brain-stem nuclei of rats. Nitric oxide (NO) and superoxide are involved in LPS-induced brain damage. Hyperbaric oxygenation (HBO) provides protective effects against systemic oxidative stress and mortality in animals with septic shock. We examined the effects of HBO on neuronal activation and oxidative stress in the brain-stem nuclei of LPS-treated rats. DESIGN AND INTERVENTIONS: Wistar rats were randomly distributed into six groups for the following treatments: (a) normal saline injection (NS); (b) HBO; (c) LPS; (d) LPS-HBO; (e) LPS-aminoguanidine (AG, an inhibitor of inducible nitric oxide synthase); or (f) hydralazine (HYD, a direct vasodilator). The HYD induces prolonged hypotension and was used as a comparison for LPS stimulation. The AG was used as a comparison for HBO treatment. Two HBO sessions were administered, 1 and 4[Symbol: see text]h after LPS. RESULTS: HBO and AG significantly reversed the overproduction of c-Fos induced by LPS in the brain stems of rats, with greater reversal in the nucleus tractus solitarius (NTS) by HBO. Although AG did not reduce the superoxide level, HBO significantly abolished superoxide production and NADPH diaphorase expression in the brain stems of LPS-treated rats. The HYD induced much lower c-Fos expression in the brain-stem nuclei than that in LPS-treated animals and caused no significant increase in NADPH diaphorase expression or superoxide formation. CONCLUSION: HBO protects against endotoxin-related neuronal activation and oxidative stress in the brain-stem nuclei of rats. Publication Types: Research Support, Non-U.S. Gov't

PMID: 18193191

88: Pancreas. 2008 Jan;36(1):70-5.
Hyperbaric oxygen improves capillary morphology in severe acute pancreatitis.
Cuthbertson CM, Su KH, Muralidharan V, Millar I, Malcontenti-Wilson C, Christophi C.
Department of Surgery, Austin Health, Heidelberg, Victoria, Australia.

OBJECTIVES: This article aims to determine the effect of acute pancreatitis on microvascular morphology and the impact of treatment with hyperbaric oxygen (HBO). METHODS: Sixty-seven male Wistar rats were induced with acute pancreatitis by retrograde bile duct injection. Rats were randomized to 12-hourly HBO or control treatment. Two rats in each group were killed at baseline and 24, 48, and 72 hours postinduction, and a cast of the pancreatic microvasculature was examined using scanning electron microscopy. RESULTS: Normal pancreatic vasculature is a dense network with a consistent capillary diameter. In acute pancreatitis, mean capillary diameter is increased at 24 hours ($P < 0.001$) and further increased at 48 hours ($P = 0.007$). From 24 hours, diameter heterogeneity is increased ($P < 0.001$) and capillary density is reduced ($P < 0.001$). Hyperbaric oxygen has a significant effect on vascular morphology changes from 48 hours after induction. Capillary diameter and heterogeneity of diameter are decreased by HBO (both $P < 0.001$). Capillary density is increased by HBO at 48 and 72 hours ($P < 0.001$). CONCLUSIONS: In acute pancreatitis, structural capillary diameter and heterogeneity of diameter increase and capillary density decreases. These parameters are all improved by HBO treatment. Hyperbaric oxygen treatment normalizes the pancreatic microvasculature after acute pancreatitis and may be a potentially effective treatment of this disease.

PMID: 18192884

89: Stroke. 2008 Feb;39(2):289-91. Epub 2008 Jan 10.
Advances in emerging nondrug therapies for acute stroke 2007.

Singhal AB, Lo EH.

Neuroprotection Research Laboratory, Harvard Medical School, Department of Neurology, Massachusetts General Hospital, Boston, MA 02114, USA.
asinghal@partners.org

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

PMID: 18187678

90: Plast Reconstr Surg. 2008 Jan;121(1):360-1.

Comment in: Plast Reconstr Surg. 2008 Dec;122(6):1984-5.
Early radical surgery and antimicrobial therapy with hyperbaric oxygen in necrotizing fasciitis.

Anwar MU, Haque AK, Rahman J, Morris R, McDermott J.

Publication Types: Letter

PMID: 18176272

91: Clin Exp Nephrol. 2008 Apr;12(2):110-8. Epub 2008 Jan 5.

Hyperbaric oxygen treatment augments the efficacy of cilazapril and simvastatin regimens in an experimental nephrotic syndrome model.

Sonmez A, Yilmaz MI, Korkmaz A, Topal T, Caglar K, Kaya A, Eyiletten T, Yenicesu M, Oguz Y, Basal S, Ipcioglu OM, Vural A.

Department of Internal Medicine, Gülhane School of Medicine, Etlik, 06018 Ankara, Turkey.

BACKGROUND: Oxidative stress plays a role in the mechanism of chronic kidney disease (CKD), and antioxidant regimes are regarded as promising treatment modalities. We compared the effects of cilazapril, simvastatin, and hyperbaric oxygen (HBO) treatment on proteinuria and on oxidative stress in adriamycin (ADR)-induced proteinuria. METHODS: Seventy male Sprague-Dawley rats were housed, and 60 were injected with ADR to induce nephrosis. After the stabilization of proteinuria, rats were treated for 6 weeks with simvastatin ($n = 10$, 4 mg/kg/day), cilazapril ($n = 10$, 10 mg/kg/day), HBO ($n = 10$, 2.8 atmosphere absolute, 90 min/daily), HBO + cilazapril ($n = 10$), HBO + simvastatin ($n = 10$), and vehicle ($n = 10$). After euthanization at 12 weeks, protein carbonyl (PCO), superoxide dismutase (SOD), and

glutathion peroxidase (GPx) levels were analyzed from tissues. The histological alterations in the kidneys were determined by semiquantitative scoring. RESULTS: Protein carbonyl (PCO) levels were higher ($p < 0.001$), and the GPx and SOD levels were lower ($p < 0.001$ for all) in the nephrotic rats. Proteinuria was correlated to PCO ($r = 0.483$), GPx ($r = -0.686$), or SOD ($r = -0.620$) ($p < 0.001$ for all). Superoxide dismutase (SOD) ($\beta = -0.381$, $p = 0.02$) and GPx ($\beta = -0.509$, $p < 0.001$) were independently related to proteinuria levels. Both cilazapril and simvastatin significantly improved GPx, SOD, PCO, and proteinuria. When HBO was combined with either drug, the above markers further improved ($p < 0.001$). Both regimens caused distinct histological features, while the combination of HBO made much significant histological improvement. CONCLUSION: Both cilazapril and simvastatin regimens improve oxidative stress and proteinuria, while the effects significantly increase with the combination of HBO treatment. HBO seems to be a candidate antioxidant strategy in glomerular diseases. Publication Types: Comparative Study Research Support, Non-U.S. Gov't PMID: 18175058

92: J Appl Physiol. 2008 Apr;104(4):1185-91. Epub 2008 Jan 3.

Mechanism of ischemic tolerance induced by hyperbaric oxygen preconditioning involves upregulation of hypoxia-inducible factor-1alpha and erythropoietin in rats.

Gu GJ, Li YP, Peng ZY, Xu JJ, Kang ZM, Xu WG, Tao HY, Ostrowski RP, Zhang JH, Sun XJ.

Department of Diving Medicine, Faculty of Naval Medicine, Second Military Medical University, Shanghai 200433, People's Republic of China.

We studied the effect of hyperbaric oxygen (HBO) preconditioning on the molecular mechanisms of neuroprotection in a rat focal cerebral ischemic model. Seventy-two male Sprague-Dawley rats were pretreated with HBO (100% O₂, 2

atmospheres absolute, 1 h once every other day for 5 sessions) or with room air. In experiment 1, HBO-preconditioned rats and matched room air controls were subjected to focal cerebral ischemia or sham surgery. Postinjury motor parameters and infarction volumes of HBO-preconditioned rats were compared with those of controls. In experiment 2, HBO-preconditioned rats and matched room air controls were killed at different time points. Brain levels of hypoxia-inducible factor-1alpha (HIF-1alpha) and its downstream target gene erythropoietin (EPO) analyzed by Western blotting and RT-PCR as well as HIF-1alpha DNA-binding and transcriptional activities were determined in the ipsilateral hemisphere. HBO induced a marked increase in the protein expressions of HIF-1alpha and EPO and the activity of HIF-1alpha, as well as the expression of EPO mRNA. HBO preconditioning dramatically improved the neurobehavioral outcome at all time points (3.0 +/- 2.1 vs. 5.6 +/- 1.5 at 4 h, 5.0 +/- 1.8 vs. 8.8 +/- 1.4 at 8 h, 6.4 +/- 1.8 vs. 9.7 +/- 1.3 at 24 h; $P < 0.01$, respectively) and reduced infarction volumes (20.7 +/- 4.5 vs. 12.5 +/- 3.6%, 2,3,5-Triphenyltetrazolium chloride staining) after cerebral ischemia. This observation indicates that the neuroprotection induced by HBO preconditioning may be mediated by an upregulation of HIF-1alpha and its target gene EPO.

Publication Types: Research Support, Non-U.S. Gov't PMID: 18174394

93: Am J Vet Res. 2008 Jan;69(1):144-7.

Effects of hyperbaric oxygen on full-thickness meshed sheet skin grafts applied to fresh and granulating wounds in horses.

Holder TE, Schumacher J, Donnell RL, Rohrbach BW, Adair HS.

Department of Large Animal Clinical Sciences, College of Veterinary Medicine, University of Tennessee, Knoxville, TN 37996, USA.

OBJECTIVE: To determine the effects of hyperbaric oxygen therapy (HBOT) on full-thickness skin grafts applied to fresh and granulating wounds of horses. ANIMALS: 6

horses. PROCEDURES: On day 0, two 4-cm-diameter circular sections of full-thickness skin were removed from each of 2 randomly selected limbs of each horse, and two 4-cm-diameter circular skin grafts were harvested from the pectoral region. A skin graft was applied to 1 randomly selected wound on each limb, leaving the 2 nongrafted wounds to heal by second intention. On day 7, 2 grafts were harvested from the pectoral region and applied to the granulating wounds, and wounds grafted on day 0 were biopsied. On day 14, 1 wound was created on each of the 2 unwounded limbs, and the wounds that were grafted on day 7 were biopsied. All 4 ungrafted wounds (ie, 2 fresh wounds and 2 wounds with 1-week-old granulation beds) were grafted. The horses then received HBOT for 1 hour daily at 23 PSI for 7 days. On day 21, the grafts applied on day 14 were biopsied. RESULTS: Histologic examination of biopsy specimens revealed that grafts treated with HBOT developed less granulation tissue, edema, and neovascularization, but more inflammation. The superficial portion of the graft was also less viable than the superficial portion of those not treated with HBOT. CONCLUSIONS AND CLINICAL RELEVANCE: The use of HBOT after full-thickness skin grafting of uncompromised fresh and granulating wounds of horses is not indicated. Publication Types: Controlled Clinical Trial PMID: 18167100

94: Anestezjol Intens Ter. 2008 Jan-Mar;40(1):35-8.
[Pneumothorax during hyperbaric oxygenation]
[Article in Polish]
Kot J, Michałkiewicz M, Sićko Z.
Klinika Medycyny Hiperbarycznej i Ratownictwa Morskiego, Akademickie Centrum Medycyny Morskiej i Tropikalnej AM w Gdańsku.
jkot@amg.gda.pl
BACKGROUND: Tension pneumothorax is an absolute contraindication to hyperbaric oxygenation (HBO). During the decompression, at the end of the hyperbaric session, the increase in gas volume related to decreasing the pressure in the chamber can induce tension

pneumothorax. The risk can be minimised, when pleural cavities have been drained before the session. CASE REPORT: A 13-year-old girl was admitted to the Hyperbaric Intensive Therapy Unit after carbon monoxide poisoning and subsequent drowning in a bath and cardiac arrest. She was resuscitated at the site of the accident and transferred to the hyperbaric centre. On admission, she was deeply unconscious, hypothermic, her GCS was 3, and her pupils were non-reacting and maximally dilated. COHb concentration was 48.7%, and X-ray revealed pulmonary oedema. She arrested again and HBO was started during CPR. After 30 min, spontaneous circulation returned and her COHb concentration decreased to 25.6%. During the next 6 h, COHb decreased to 6.5%. The patient developed severe ARDS, and HBO sessions were continued. During the fourth session, the HBO team became aware of an earlier chest x-ray showing a left-sided tension pneumothorax. Emergency decompression was attempted, but it resulted in rapid enlargement of the pneumothorax and deterioration in the patient's condition. The pressure in the chamber was immediately increased and a thoracic drain inserted by the attending anaesthesiologist. Further decompression was uneventful. Despite intensive treatment, the girl died after 85 h of treatment because of severe ARDS. DISCUSSION: Despite initial successful resuscitation, the girl died, primarily due to severe ARDS that was probably related to the near-drowning and repeated CPR. In such cases it is essential to be able to react quickly inside the chamber and an attending anaesthesiologist should be always present in the chamber during HBO sessions. Publication Types: Case Reports English Abstract PMID: 19469097

95: Acta Neurochir Suppl. 2008;102:441-5.
Protective effect of hyperbaric oxygen therapy on experimental brain contusions.

Voigt C, Förschler A, Jaeger M, Meixensberger J, Küppers-Tiedt L, Schuhmann MU.

Department of Neurosurgery, University of Leipzig, 04103 Leipzig, Germany. dat_conny@web.de

BACKGROUND: We evaluated the effect of hyperbaric oxygen therapy (HBO) on experimental brain contusions in rats using magnetic resonance imaging (MRI). MATERIALS AND METHODS: Ten Sprague-Dawley rats were investigated at 24 h and 72 h after controlled cortical impact injury. One hour after trauma, 5 rats were treated for 60 min with 100% oxygen at 2.5 absolute atmosphere (ATA), 5 were kept at normobaric room air. MRI was performed longitudinally at 24 h and 72 h after injury. Lesion volume was determined in T2 weighted MRI scans. Relative apparent diffusion coefficient (ADC) changes were calculated in comparison to the contralateral side. RESULTS: Following HBO, T2 lesion volume was smaller at 24 h versus controls (63.1 +/- 16.5 mm³ vs. 87.4 +/- 13.8 mm³, p < 0.05), and decreased further at 72 h (46.8 +/- 17.8 mm³ vs. 92.5 +/- 13.1 mm³, p < 0.01). At 24 h, the mean relative ADC change in the lesion area decreased from + 26.8 +/- 2.3% in controls to + 2.3 +/- 12.2% in HBO animals (p < 0.01). At 72 h, the HBO effect on relative ADC values was less when compared to 24 h. DISCUSSION: A 60-minute exposure to hyperbaric oxygen starting 1 h after impact injury significantly attenuated lesion growth and relative increase of ADC values within the contused area for up to 72 h. Thus, a "single-shot" HBO treatment seems to have long-lasting neuroprotective effects on the contused brain and its penumbra.

PMID: 19388363

96: Acta Neurochir Suppl. 2008;102:317-20.

Hyperbaric oxygen preconditioning activates ribosomal protein S6 kinases and reduces brain swelling after intracerebral hemorrhage.

Qin Z, Hua Y, Liu W, Silbergleit R, He Y, Keep RF, Hoff JT, Xi G.

Department of Neurosurgery, Room 5018, BSRB, University of Michigan, Ann Arbor, MI 48109-2200, USA.

BACKGROUND: New protein synthesis is key to ischemic tolerance induced by preconditioning and ribosomal protein S6 kinases (p70 S6 K) are important enzymes in protein synthesis. Hyperbaric oxygen preconditioning (HBOP) reduces ischemic brain damage. This study investigated if HBOP can activate p70 S6 K and increase new protein synthesis and if HBOP induces brain tolerance against brain swelling after intracerebral hemorrhage (ICH). METHODS: There were two parts of the studies. 1) Rats received five consecutive sessions of HBOP. Twenty-four hours after HBOP, the rats had an ICH and were sacrificed one or three days later for brain edema measurement. 2) Rats received five sessions of HBOP or control pretreatment and were sacrificed for Western blot analysis and immunohistochemistry of activated p70 S6 K and heme oxygenase-1 (HO-1). FINDINGS: Five sessions of HBOP significantly reduced brain edema in the ipsilateral basal ganglia after ICH. Western blot analysis showed that HBOP activated p70 S6 K and increased HO-1 levels in the basal ganglia. Strong activated p70 S6 K immunoreactivity was also found in the basal ganglia. CONCLUSIONS: Our results suggest activation of p70 S6 K may have a role in heat shock protein synthesis after HBOP and may contribute to HBOP-induced brain protection.

Publication Types: Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't
PMID: 19388337

97: Acta Neurochir Suppl. 2008;102:21-4.

Hyperbaric oxygen therapy for consciousness disturbance following head injury in subacute phase.

Nakamura T, Kuroda Y, Yamashita S, Kawakita K, Kawai N, Tamiya T, Itano T, Nagao S.

Department of Neurobiology, Faculty of Medicine, Kagawa University, 1750-1 Ikenobe, Miki, Kita, Kagawa 761-0173, Japan. tanakamu@kms.ac.jp

BACKGROUND: Hyperbaric oxygen (HBO) therapy has been shown to improve outcome after brain injury, however its mechanisms are not understood. The purpose of the present study was to investigate the effect of

hyperbaric oxygen (HBO) therapy on the cerebral circulation and metabolism of patients with disturbances in consciousness after head injury in the subacute phase. METHODS: Seven head injury patients underwent HBO treatment after leaving the intensive care unit. Oxygen (100% O₂, 2.7 atm absolute) was delivered to patients in a hyperbaric chamber for 60 min every 24 h (total five treatments/patient). Cerebral circulation monitoring (mean flow velocity: mFV, and pulsatility index: PI at horizontal portion of middle cerebral artery by transcranial Doppler) and cerebral metabolism monitoring (arterio-jugular venous difference of oxygen: AJDO₂ and jugular venous lactate: lac-JV) before and after the series of treatments were evaluated. FINDINGS: Both PI and lac-JV were significantly decreased after HBO treatment, while there were no significant changes in mFV and AJDO₂. The decreased PI and lac-JV after HBO therapy might indicate that this treatment couples cerebral circulation and metabolism. CONCLUSIONS: The measurement of cerebral circulation and metabolism parameters, especially PI and lac-JV, is useful for estimation of effect of HBO therapy in patients with disturbances in consciousness after head injury in the subacute phase. Publication Types: Clinical Trial
PMID: 19388281

98: Cell Transplant. 2008;17(12):1295-304.
Combined treatment of intrapancreatic autologous bone marrow stem cells and hyperbaric oxygen in type 2 diabetes mellitus. Estrada EJ, Valacchi F, Nicora E, Brieva S, Esteve C, Echevarria L, Froud T, Bernetti K, Cayetano SM, Velazquez O, Alejandro R, Ricordi C.
Stem Cell Argentina, Buenos Aires, Argentina.
info@stemcellargentina.com
The objective of this study was to determine whether the combination therapy of intrapancreatic autologous stem cell infusion (ASC) and hyperbaric oxygen treatment (HBO) before and after ASC can

improve islet function and metabolic control in patients with type 2 diabetes mellitus (T2DM). This prospective phase 1 study enrolled 25 patients with T2DM who received a combination therapy of intrapancreatic ASC and peri-infusion HBO between March 2004 and October 2006 at Stem Cells Argentina Medical Center Buenos Aires, Argentina. Clinical variables (body mass index, oral hypoglycemic drugs, insulin requirement) and metabolic variables (fasting plasma glucose, C-peptide, HbA_{1c}, and calculation of C-peptide/glucose ratio) were assessed over quartile periods starting at baseline and up to 1 year follow-up after intervention. Means were calculated in each quartile period and compared to baseline. Seventeen male and eight female patients were enrolled. Baseline variables expressed as means +/- SEs were: age 55 +/- 2.14 years, diabetes duration 13.2 +/- 1.62 years, insulin dose 34.8 +/- 2.96 U/day, and BMI 27.11 +/- 0.51. All metabolic variables showed significant improvement when comparing baseline to 12 months follow-up, respectively: fasting glucose 205.6 +/- 5.9 versus 105.2 +/- 14.2 mg/dl, HbA_{1c} 8.8 +/- 0.2 versus 6.0 +/- 0.4%, fasting C-peptide 1.5 +/- 0.2 versus 3.3 +/- 0.3 ng/ml, C-peptide/glucose ratio 0.7 +/- 0.2 versus 3.5 +/- 0.3, and insulin requirements 34.8 +/- 2.9 versus 2.5 +/- 6.7 U/day. BMI remained constant over the 1-year follow-up. Combined therapy of intrapancreatic ASC infusion and HBO can improve metabolic control and reduce insulin requirements in patients with T2DM. Further randomized controlled clinical trials will be required to confirm these findings. Publication Types: Clinical Trial, Phase I
PMID: 19364067

99: Mol Med. 2008 Mar-Apr;14(3-4):175-83.
alpha-Lipoic acid modulates extracellular matrix and angiogenesis gene expression in non-healing wounds treated with hyperbaric oxygen therapy.

Alleva R, Tomasetti M, Sartini D, Emanuelli M, Nasole E, Di Donato F, Borghi B, Santarelli L, Neuzil J. Department of Anesthesiology, IRCCS Istituti Ortopedici Rizzoli, Bologna, Italy. renalle@libero.it alpha-Lipoic acid (LA) has been found previously to accelerate wound repair in patients affected by chronic wounds who underwent hyperbaric oxygen (HBO) therapy. Because proteinases are important in wound repair, we hypothesized that LA may regulate matrix metalloproteinase (MMP) expression in cells that are involved in wound repair. Patients undergoing HBO therapy were double-blind randomized into two groups: the LA group and the placebo group. Gene expression profiles for MMPs and for angiogenesis mediators were evaluated in biopsies collected at the first HBO session, at the seventh HBO session, and after 14 days of HBO treatment. ELISA tests were used to validate microarray expression of selected genes. LA supplementation in combination with HBO therapy downregulated the inflammatory cytokines and the growth factors which, in turn, affect MMPs expression. The disruption of the positive autocrine feedback loops that maintain the chronic wound state promotes progression of the healing process.

Publication Types: Randomized Controlled Trial
PMID: 18079998

100: Eur J Appl Physiol. 2008 Mar;102(5):525-32. Epub 2007 Nov 22.

Mechanisms of protection against pulmonary hyperbaric O₂ toxicity by intermittent air breaks.

Chavko M, Mahon RT, McCarron RM. Trauma and Resuscitative Medicine Department, Naval Medical Research Center, 503 Robert Grant Avenue, Silver Spring, MD 20910, USA. chavkom@nmrc.navy.mil

Intermittent exposure to air is used as a protective strategy against hyperbaric O₂ (HBO₂) toxicity. Little is known about optimal intermittent exposure schedules and the mechanism of protection. In this study, we examined the role of antioxidant enzymes, and inflammatory cytokines

in the mechanism of HBO₂ tolerance by intermittent air breaks. One group of rats was exposed continuously to 282 kPa O₂ until death. Other groups were exposed to 30, 60, and 120 min intervals of HBO₂ with different numbers of intermittent 30 min air breaks (1-12 breaks). After the final break, animals were exposed to HBO₂ until death. In a separate experiment, animals were sacrificed before terminal exposure and lung tissues were collected for analysis of gene expression. Two intermittent schedules with 6 h cumulative O₂ time (30/30 and 60/30 min schedules) were compared with continuous exposure to HBO₂ for 6 h and with intermittent exposure of 8 h (120/30 min schedule) duration. Continuous exposure resulted in activation of inflammatory cytokine TNF-alpha and IL-1beta mRNA expression, an increase in lung protein nitration and activation of inducible NOS (iNOS) mRNA. Inflammatory response was not observed at intermittent exposures of the same cumulative O₂ time duration (30/30 and 60/30 min schedule). Expression of heme oxygenase-1 (HO-1) mRNA was significantly increased in all exposure groups while manganese superoxide dismutase (MnSOD) mRNA expression was increased only in continuous and 120/30 exposure groups. Results show that intermittent exposure to air protects against pulmonary HBO₂ toxicity by inhibiting inflammation. The mechanism of inhibition may involve the antiinflammatory and antioxidative effect of HO-1 but some other mechanisms may also be involved in protection by intermittent air breaks.

Publication Types: Comparative Study
Research Support, U.S. Gov't, Non-P.H.S.
PMID: 18034261

101: Int J Oral Maxillofac Surg. 2008 Apr;37(4):404. Epub 2007 Nov 7.

Comment on: Int J Oral Maxillofac Surg. 2007 Sep;36(9):783-7.

The influence of hyperbaric oxygen on the outcome of patients treated

for osteoradionecrosis: 8 year study.
Kanas AN.
Publication Types: Comment Letter
PMID: 17988835

102: Dig Dis Sci. 2008 Feb;53(2):481-5. Epub 2007 Oct 13.
Hyperbaric oxygen therapy is as effective as dexamethasone in the treatment of TNBS-E-induced experimental colitis.

Atug O, Hamzaoglu H, Tahan V, Alican I, Kurtkaya O, Elbuken E, Ozdogan O, Tozun N.
Department of Gastroenterology, Marmara University School of Medicine, Altunizade, Uskudar, Istanbul 34662, Turkey.

INTRODUCTION: Hyperbaric oxygen (HBO) has been demonstrated to be useful as an adjunctive therapy for Crohn's disease. In the present study, HBO was tested as a treatment for trinitrobenzenesulfonic acid-ethanol (TNBS-E)-induced distal colitis, and its effects were compared with dexamethasone therapy. METHODS: A total of 48 Sprague-Dawley rats were separated into six groups: the control, and those treated with vehicle, TNBS-E, HBO, dexamethasone, or combined HBO + dexamethasone. The HBO treatment group was exposed to 100% HBO at 2 ATM for 75 min twice daily at 6-h intervals in a HBO chamber, both on the day of colitis induction and 3 days thereafter. Treatment with intraperitoneal dexamethasone twice daily was started 1 h before the induction of colitis and was continued for 7 days in the dexamethasone group. The rats were decapitated 8 days after the induction of colitis, and the colonic tissue wet weight, macroscopic and microscopic lesion score, and tissue myeloperoxidase (MPO) activity were determined. RESULTS: HBO therapy decreased the activity of experimental colitis measured by the tissue wet weight, macroscopic score, microscopic score, and MPO activity. The dexamethasone treatment significantly reduced the colitis activity as determined by the tissue MPO activity and wet weight. There were also decreases in the macroscopic and microscopic

activity scores with the dexamethasone therapy; however, these changes were not statistically significant. The combined therapy with HBO and dexamethasone provided no additional benefit over HBO therapy alone. CONCLUSION: HBO therapy can be a valuable therapeutic option in treatment of patients with inflammatory bowel disease. HBO therapy in the refractory patients deserves further, larger clinical studies.

PMID: 17934837

103: Burns. 2008 Jun;34(4):467-73. Epub 2007 Sep 25.

Effects of hyperbaric oxygen therapy on fibrovascular ingrowth in porous polyethylene blocks implanted under burn scar tissue: an experimental study.

Dinar S, Agir H, Sen C, Yazir Y, Dalcik H, Unal C.

Department of Plastic and Reconstructive Surgery, Kocaeli University Hospital, Umuttepe Kampusu, Izmit 41000, Turkey.

Effects of hyperbaric oxygen (HBO) therapy on biointegration of porous polyethylene (PP) implanted beneath dorsal burn scar and normal skin were experimentally examined in Sprague-Dawley rats. In Group One (n=20), daily HBO treatments were given after the implantation of PP material under dorsal burn scar, whereas, in Group Two (n=20) no treatment was given following the same surgical procedure. In Group Three (n=20), PP was placed under dorsal normal skin and subsequently HBO therapy protocol was applied while Group Four (n=20) stayed without HBO treatment after the implantation. One, 2, 3 and 4 weeks after the implantations, sections were respectively taken from five rats from each group. Biointegration process and effects of HBO therapy were evaluated microscopically and the ratio of fibrovascular ingrowth (FVI) was determined for each rat. The results showed significantly superior FVI in Group One compared to Group Two and again FVI into PP under normal skin treated with HBO revealed better results against Group Four (p<0.05). Well-vascularized capsule formation and tissue integration was delayed both

in Group Two and in Group Three in the first 3 weeks. In conclusion, HBO therapy enhances biointegration of PP in hypoxic burn scar areas via improving collagen synthesis and neovascularization; otherwise, it apparently delays tissue ingrowth into porous structure implanted in normal healthy tissues.

PMID: 17897787

104: Schmerz. 2008 Apr;22(2):129-32, 134-6.

[Hyper- or normobaric oxygen therapy to treat migraine and cluster headache pain. Cochrane review]

[Article in German]

Schnabel A, Bennet M, Schuster F, Roewer N, Kranke P.

Klinik und Poliklinik für Anästhesiologie und operative Intensivmedizin, Universitätsklinikum Münster, Münster, Germany.

BACKGROUND: The aim of this systematic review was to assess the benefits and harms of supplemental oxygen (HBOT/NBOT) for treating and preventing migraine and cluster headaches. **MATERIAL AND METHODS:** All randomized trials comparing the effect of supplemental oxygen on migraine or cluster headache with those that exclude supplemental oxygen were included in this review. The systematic search included all relevant sources according to the paradigms of the Cochrane Collaboration. Data were analyzed with RevMan 4.2. **RESULTS:** Nine trials involving 201 participants satisfied the inclusion criteria. HBOT was effective in relieving an acute migraine and seemed to be sufficient in the treatment of an acute cluster attack. NBOT was effective in terminating acute cluster headache compared to sham treatment, but not in comparison to sublingual ergotamine. There was no evidence for any prophylactic effects. Serious adverse effects were not noted in the trials investigated. **CONCLUSIONS:** There is some evidence that HBOT is effective for termination of acute migraine. NBOT was similarly effective in cluster headache, however with sparse data. Because of costs and poor availability HBOT

cannot be regarded as a routine therapy. Further indications in the case of treatment failure using standard therapy need to be defined based on data of future clinical trials.

Publication Types: English

Abstract Review

PMID: 17885769

105: Acta Otolaryngol. 2008 Jan;128(1):61-5.

Prostaglandin E1 in combination with hyperbaric oxygen therapy for idiopathic sudden sensorineural hearing loss.

Suzuki H, Fujimura T, Ikeda K, Shiomori T, Udaka T, Ohbuchi T, Nagatani G.

Department of Otorhinolaryngology, School of Medicine, University of Occupational and Environmental Health, Yahatanishi-ku, Kitakyushu, Japan. suzuhyde@med.uoeh-u.ac.jp

CONCLUSIONS: Prostaglandin E1 (PGE1) is less effective than stellate ganglion block (SGB) in the treatment of idiopathic sudden sensorineural hearing loss (ISSNHL) patients with severe hearing losses when used together with hyperbaric oxygen (HBO) therapy. In contrast with the systemic action of intravenous PGE1, SGB's localized vasodilating action may explain its advantage over intravenous PGE1. **OBJECTIVES:** To investigate the effect of PGE1 plus HBO therapy on ISSNHL in comparison with that of SGB plus HBO therapy. **PATIENTS AND METHODS:** We retrospectively analyzed 205 consecutive patients with ISSNHL (hearing levels > or = 40 dB; time from the onset of hearing loss to the start of treatment < or = 30 days). Ninety-five patients underwent intravenous PGE1 plus HBO therapy (PG group) and 110 underwent SGB plus HBO therapy (SGB group). Hearing recovery was evaluated by grade assessment and by hearing improvement compared to that in the unaffected contralateral ear. **RESULTS:** The overall hearing outcome was not statistically different between the two groups. For patients with initial hearing levels <80 dB, the groups had roughly equivalent hearing outcomes, whereas in patients with initial hearing levels > or = 80 dB, the hearing improvement rate

was significantly higher in the SGB group than in the PG group (53.0 +/- 5.0% vs 35.3 +/- 6.8%; $p < 0.05$).

Publication Types: Comparative Study

PMID: 17851957

106: Auris Nasus Larynx. 2008 Jun;35(2):192-7. Epub 2007 Sep 10.

Comment in: Auris Nasus Larynx. 2008 Jun;35(2):318; author reply 319.

Prostaglandin E1 versus steroid in combination with hyperbaric oxygen therapy for idiopathic sudden sensorineural hearing loss.

Suzuki H, Fujimura T, Shiomori T, Ohbuchi T, Kitamura T, Hashida K, Udaka T.

Department of Otorhinolaryngology, School of Medicine, University of Occupational and Environmental Health, 1-1 Iseigaoka, Yahatanishiku, Kitakyushu 807-8555, Japan. suzhyde@med.uoeh-u.ac.jp

OBJECTIVE: We conducted a controlled retrospective analysis of patients with idiopathic sudden sensorineural hearing loss (ISSNHL) in order to investigate the effect of prostaglandin E1 (PGE1) plus hyperbaric oxygen (HBO) therapy in comparison with that of steroid plus HBO therapy. **METHODS:** One hundred and ninety-six consecutive patients with ISSNHL (hearing levels $>$ or $=40$ dB; time from the onset of hearing loss to the start of treatment $<$ or $=30$ days) were enrolled. Ninety-five patients underwent PGE1 plus HBO therapy (PG group) and 101 underwent steroid administration plus HBO therapy (steroid group). Hearing recovery was evaluated by grade assessment and by the improvement in hearing compared to the unaffected contralateral ear. **RESULTS:** The hearing levels after treatment were 52.2 ± 3.0 and 47.5 ± 2.8 dB, the hearing gains were 31.3 ± 2.2 and 27.2 ± 2.3 dB, the cure rates were 28.4% and 28.7%, the recovery rates were 54.7% and 53.5%, and the hearing improvement rates were $48.4 \pm 5.1\%$ and $53.9 \pm 4.2\%$ in the PG and steroid groups, respectively. There were no significant differences between the two groups. **CONCLUSION:** We concluded that PGE1 and a steroid are equally effective in the

treatment of ISSNHL when used together with HBO therapy. PGE1 plus HBO therapy can be one of the potential alternative treatments for ISSNHL, particularly in steroid-intolerant patients such as those with severe diabetes mellitus, an active peptic ulcer, or viral hepatitis.

Publication Types: Comparative Study

PMID: 17826927

107: Neurobiol Dis. 2008 Jan;29(1):1-13. Epub 2007 Jul 28.

The hyperbaric oxygen preconditioning-induced brain protection is mediated by a reduction of early apoptosis after transient global cerebral ischemia. Ostrowski RP, Graupner G, Titova E, Zhang J, Chiu J, Dach N, Corleone D, Tang J, Zhang JH.

Department of Physiology and Pharmacology, Loma Linda University School of Medicine, Loma Linda, CA 92350, USA.

We hypothesized that the brain-protective effect of hyperbaric oxygen (HBO) preconditioning in a transient global cerebral ischemia rat model is mediated by the inhibition of early apoptosis. One hundred ten male Sprague-Dawley (SD) rats (300-350 g body weight) were allocated to the sham group and three other groups with 10 min of four-vessel occlusion, untreated or preconditioned with either 3 or 5 hyperbaric oxygenations. HBO preconditioning improved neurobehavioral scores and reduced mortality, decreased ischemic cell change, reduced the number of early apoptotic cells and hampered a conversion of early to late apoptotic alterations. HBO preconditioning reduced the immunoreactivity of phosphorylated p38 in vulnerable neurons and increased the expression of brain derived neurotrophic factor (BDNF) in early stage post-ischemia. However, preconditioning with 3 HBO treatments proved less beneficial than with 5 HBO treatments. We conclude that HBO preconditioning may be neuroprotective by reducing early apoptosis and inhibition of the conversion of early to late apoptosis, possibly through an increase in brain BDNF level and the suppression of p38 activation.

Publication Types: Research Support, N.I.H., Extramural
PMID: 17822911

108: Neurochem Res. 2008 Jan;33(1):185-93. Epub 2007 Aug 22. Rapid decrease of GAD 67 content before the convulsion induced by hyperbaric oxygen exposure.

Li Q, Guo M, Xu X, Xiao X, Xu W, Sun X, Tao H, Li R.

Department of Diving Medicine, Faculty of Naval Medicine, Second Military Medical University, 800 Xiangyin Road, Shanghai 200433, China.

Exposure to hyperbaric oxygen (HBO) can lead to seizures, the etiology of which is not completely understood. Glutamic acid decarboxylase (GAD) plays a very important role in maintaining excitatory-inhibitory balance of the central nervous system (CNS). In the present study we investigated the effects of HBO on the activity and content of GAD in vivo and in primarily cultured neurons to probe in detail its effect on the formation of convulsion induced by HBO exposure. The results obtained from in vivo and in vitro experiments were identical. In the latent period before the onset of seizure, the GAD activity followed a rise-and-fall pattern with the prolongation of HBO exposure. At the time of the onset of seizure, GAD activity descended to the normal level. Besides, in the latent period, GAD content also reduced. Such reduction came from a GAD subtype, GAD67, while the content of another GAD subtype, GAD65, remained almost unchanged. Our investigations indicated that GAD is indeed an enzyme highly sensitive to the effect of HBO exposure. The rapid reduction in GAD67 content may be very closely related to seizures induced by HBO exposure.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 17712632

109: Neurochem Res. 2008 Jan;33(1):160-6. Epub 2007 Aug 21. Exposure time related oxidative action of hyperbaric oxygen in rat brain.

Korkmaz A, Oter S, Sadir S, Topal T, Uysal B, Ozler M, Ay H, Akin A.

Department of Physiology, Gülhane Askeri Tip Akademisi, Fizyoloji Anabilim Dalı, 06018 Ankara, Turkey.

Hyperbaric oxygen (HBO) is known to cause oxidative stress in several organs and tissues. Due to its high rate of blood flow and oxygen consumption, the brain is one of the most sensitive organs to this effect. The present study was performed to elucidate the relation of HBO exposure time to its oxidative effects in rats' brain cortex tissue. For this purpose, 49 rats were randomly divided into five groups. Except the control group, study groups were subjected to three atmospheres HBO for 30, 60, 90, and 120 min. Their cerebral cortex layer was taken immediately after exposure and used for analysis. Thiobarbituric acid reactive substances (TBARS), superoxide dismutase (SOD), glutathione peroxidase (GSH-Px), and nitrate-nitrite (NOX) levels were determined. TBARS and SOD levels were found to increase in a time-dependent manner. GSH-Px activity reflected an inconsistent course. NOX levels were found to be increased only in the 120 min exposed group. The results of this study suggests that HBO induced oxidative effects are strongly related with exposure time.

PMID: 17710543

110: Graefes Arch Clin Exp Ophthalmol. 2008 Jan;246(1):93-8. Epub 2007 Aug 3.

Slowing the degenerative process, long lasting effect of hyperbaric oxygen therapy in retinitis pigmentosa.

Vingolo EM, Rocco M, Grenga P, Salvatore S, Pelaia P.

Inherited Degenerative Retinal Diseases Unit, Department of Ophthalmology, Policlinico Umberto I, University of Rome La Sapienza, Rome, Italy.

BACKGROUND: Retinitis pigmentosa (RP) therapy is still an unsolved challenge. Recent reports have underlined that hyperbaric oxygen (HBO) therapy could play a role in slowing the retinal degenerative process. The aim of this study was to assess the efficacy of HBO therapy on visual function in RP

patients. METHODS: We performed a single-center, comparative, longitudinal case-controlled randomized clinical trial, which lasted 10 years. We randomly divided RP patients into two groups. Group 1, the control group, consisted of 44 RP patients (21 males and 23 females; mean age 35.5) who took Vitamin A. Group 2, with 44 RP patients (21 males and 23 females; mean age 35,02), underwent HBO therapy. No statistically significant difference was found at the beginning of the study between the two groups. We compared the results concerning visual acuity, Goldmann perimetry, static perimetry Humphrey field analyzer (HFA), and electroretinogram (ERG) obtained in the two groups at 5 and 10 years follow-up. Statistical analysis was performed with Kaplan-Meier life-table with the evaluation of log-rank coefficient. RESULTS: At 5 year follow-up, 87.5% of group 2 patients preserved 80% of the initial visual acuity, while the same result was achieved in only 70.4% of group 1 patients ($X(2) = 8.2$; $p < 0.01$); at 10 year follow-up, 63.33% of group 2 patients preserved 80% of the initial visual acuity, while the same percentage of residual visual acuity was maintained in 40% of group 1 patients ($X(2) = 3.22$; $p = 0.05$). At 10 year follow-up, Goldmann perimetry (target I4e) did not change in 31.6% of group 2 and in 10.5% of group 1; evaluation of mean defect (MD) with static perimetry HFA showed that 53% of HBO patients had 80% of residual mean sensitivity compared to 23.5% of the control group patients ($X(2) = 4.72$; $p = 0.035$). ERG b-wave mean values at the end of the protocol were significantly higher in the HBO treated group ($X(2) = 4.53$; $p = 0.013$). CONCLUSION: Our study underlines that HBO therapy can be a safe alternative approach to RP patients, contributing to the stabilization of their visual function concerning visual acuity, visual field, and ERG responses while waiting for a definite cure. Publication Types: Comparative Study Randomized Controlled Trial

PMID: 17674017

111: *Physiol Res.* 2008;57(1):41-7. Epub 2007 Jan 2.

Early and late effects of hyperbaric oxygen treatment on oxidative stress parameters in diabetic patients.

Gürdöl F, Cimşit M, Oner-Iyidoğan Y, Körpınar S, Yalçinkaya S, Koçak H.

Department of Biochemistry, Istanbul Faculty of Medicine, Istanbul University, Capa, Istanbul, Turkey. figur@istanbul.edu.tr

Exposure to hyperbaric oxygen leads to increased amount of reactive oxygen species (ROS) that are derived from various sources. After the discovery that ROS can function as signaling molecules, the idea of ROS being hazardous to biological tissues has been challenged. The aim of this study was to examine the changes in oxidative stress parameters in diabetics undergoing hyperbaric oxygen therapy (HBOT) due to foot ulcers. Twenty patients, who received HBOT for diabetic foot ulcers, were included in the study. Blood samples were taken before HBOT and 30 min after exit from the chamber, on the day of the first and the fifteenth HBOT sessions. They were used for the determinations of malondialdehyde (MDA), 8-isoprostane and advanced oxidation protein products (AOPPs). 8-Isoprostane and AOPP levels were not altered significantly after the first HBOT session, while both were increased on the fifteenth day ($p < 0.05$). MDA was significantly increased only after the first HBOT session, and remained unchanged on the fifteenth day (within-day variations). Plasma AOPP levels were lowered significantly after fifteen consecutive HBOT sessions (between-day variations). Decreased AOPP levels suggest that increased oxygenation of tissues due to HBO therapy may activate some endogenous factors that prevent hazardous effects of the disease itself.

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