



GENERAL LITERATURE

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.

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.



GENERAL LITERATURE

Adv Ther. 2005 Nov-Dec;22(6):659-78.

Hyperbaric oxygen in the treatment of patients with cerebral stroke, brain trauma, and neurologic disease.

Al-Waili NS, Butler GJ, Beale J, Abdullah MS, Hamilton RW, Lee BY, Lucus P, Allen MW, Petrillo RL, Carrey Z, Finkelstein M.

Hyperbaric oxygen (HBO) therapy has been used to treat patients with numerous disorders, including stroke. This treatment has been shown to decrease cerebral edema, normalize water content in the brain, decrease the severity of brain infarction, and maintain blood-brain barrier integrity. In addition, HBO therapy attenuates motor deficits, decreases the risks of sequelae, and prevents recurrent cerebral circulatory disorders, thereby leading to improved outcomes and survival. Hyperbaric oxygen also accelerates the regression of atherosclerotic lesions, promotes antioxidant defenses, and suppresses the proliferation of macrophages and foam cells in atherosclerotic lesions. Although no medical treatment is available for patients with cerebral palsy, in some studies, HBO therapy has improved the function of damaged cells, attenuated the effects of hypoxia on the neonatal brain, enhanced gross motor function and fine motor control, and alleviated spasticity. In the treatment of patients with migraine, HBO therapy has been shown to reduce intracranial pressure significantly and abort acute attacks of migraine, reduce migraine headache pain, and prevent cluster headache. In studies that investigated the effects of HBO therapy on the damaged brain, the treatment was found to inhibit neuronal death, arrest the progression of radiation-induced neurologic necrosis, improve blood flow in regions affected by chronic neurologic disease as well as aerobic metabolism in brain injury, and accelerate the resolution of clinical symptoms. Hyperbaric oxygen has also been reported to accelerate neurologic recovery after spinal cord injury by ameliorating mitochondrial dysfunction in the motor cortex and spinal cord, arresting the spread of hemorrhage, reversing hypoxia, and reducing edema. HBO has enhanced wound healing in patients with chronic osteomyelitis. The results of HBO therapy in the treatment of patients with stroke, atherosclerosis, cerebral palsy, intracranial pressure, headache, and brain and spinal cord injury are promising and warrant further investigation.

GENERAL LITERATURE

Br J Dermatol. 2005 Jan;152(1):166-9.

Cannabis arteritis.

Combemale P, Consort T, Denis-Thelis L, Estival JL, Dupin M, Kanitakis J.

The main causes of arteriopathy in young patients include drugs, metabolic diseases, pseudoxanthoma elasticum and Buerger's disease. Arteritis due to Cannabis indica was first reported in 1960, and the role of this drug as a risk factor for arteritis was confirmed in several subsequent publications. A 38-year-old smoker with no previous contributory medical history except for long-standing cannabis abuse developed a dry necrotic lesion of the left big toe. Imaging examinations revealed proximal arteriopathy of the lower limbs that predominated on the left side. He had no atherogenic or thrombogenic risk factors, and no signs of pseudoxanthoma elasticum were found. Remarkably, the development of arteritis paralleled cannabis abuse. **The course was slowly favourable after weaning from the drug, vasodilator treatment and hyperbaric oxygen therapy.** Despite some subtle clinical differences (more proximal than distal involvement), cannabis arteritis may be considered as a particular form of Buerger's disease, where cannabis, along with tobacco, seems to cause arterial lesions. Along with the noxious effects of cannabis on vessels, a role for contaminating arsenic is also possible. Cannabis arteritis is not widely known, but may prove not to be so rare if one considers consumption of cannabis besides that of tobacco.

J Crit Care. 2008 Sep;23(3):295-300. Epub 2007 Dec 11.

Analysis of risk factors associated with complications of hyperbaric oxygen therapy.

Ambiru S, Furuyama N, Aono M, Otsuka H, Suzuki T, Miyazaki M.

PURPOSE: The aim of this study was to verify independent risk factors of pressure equalization problems associated with hyperbaric oxygen (HBO(2)) therapy. **METHODS:** We reviewed a single-institutional study of 1609 patients with 17604 treatments who had HBO(2) therapy in a multiplace chamber, in which the factors examined and their relationship to complications were assessed, using multivariate analyses, to determine the significantly independent risk factors of complications related to HBO(2) therapy.

RESULTS: The compression rate was 0.067 atmospheres absolute/min (6.8 kPa/min). Pressure equalization problems of the middle ear, expressed as pain or discomfort, such as cranial sinus pain, and teeth pain were observed in 156 patients (9.7%). Sixty-six of them could not continue HBO(2) therapy because of these problems. Peripheral circulatory disorders with refractory ulcers or nonhealing wounds and the interval between clinical symptoms and the first day of HBO(2) therapy were independent risk factors of pressure equalization problems. Independent risk factors of cessation due to pressure equalization problems were identified as age more than 61 years, female sex, and interval between symptoms and the first day of HBO(2) therapy. **CONCLUSION:** It is suggested that chamber compression must be performed with particular care when patients have peripheral circulatory disorders and have short interval between clinical symptoms and the first day of HBO(2) therapy.

GENERAL LITERATURE

Nephrol Dial Transplant. 2008 Sep 17. [Epub ahead of print]

Hyperbaric oxygen treatment improves GFR in rats with ischaemia/reperfusion renal injury: a possible role for the antioxidant/oxidant balance in the ischaemic kidney.

Rubinstein I, Abassi Z, Milman F, Ovcharenko E, Coleman R, Winaver J, Better OS.

BACKGROUND: Ischaemic kidney injury continues to play a dominant role in the pathogenesis of acute renal failure (ARF) in many surgical and medical settings. A major event in the induction of renal injury is related to the generation of oxygen-free radicals. Hyperbaric oxygen therapy (HBO) is indicated for treatment of many ischaemic events but not for ARF. Therefore, the present study examined the effects of HBO on kidney function and renal haemodynamics in rats with ischaemic ARF. **METHODS:** Renal ischaemia was induced by unilateral renal artery clamping (45 min) in rats. Within 24 h following ischaemia, rats were treated twice with HBO of 100% O₂ at 2.5 absolute atmospheres for 90 min each (+HBO). Untreated rats (-HBO) served as a control. Forty-eight hours later, GFR, RBF and endothelial-dependent vasorelaxation were measured. In addition, the immunoreactive staining of 4-hydroxy-2-noneal (4-HNE), a major product of endogenous lipid peroxidation, and superoxide dismutase (SOD) were assessed. **RESULTS:** In the -HBO group, GFR was reduced by 94% compared with the untouched normal kidney (ischaemic: 0.06 +/- 0.03 ml/min, normal: 1.02 +/- 0.13 ml). In contrast, in the +HBO group, GFR of the ischaemic kidney (0.36 +/- 0.07 ml/min) was reduced only by 68% compared with the contralateral normal kidney (1.12 +/- 0.12 ml/min). In line with these findings, HBO improved the vasodilatory response to ACh as expressed in enhancement of both total and regional renal blood flow. In addition, HBO reduced the formation of 4-HNE by 33% and 76% and increased SOD by 30% and 70% in the cortex and outer stripe region of the medulla of the ischaemic kidney, respectively. **CONCLUSION: HBO attenuates the decline in GFR following renal ischaemia, and improves endothelial-dependent vasorelaxation, suggesting that treatment with HBO may be beneficial in the setting of ischaemic ARF.**



GENERAL LITERATURE

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.

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.

J Assoc Nurses AIDS Care. 1993 Jul-Sep;4(3):33-8.

Hyperbaric oxygen therapy for the treatment of debilitating fatigue associated with HIV/AIDS.

Reillo MR.

Twenty-five HIV-infected patients underwent hyperbaric oxygen therapy to determine the treatment's effectiveness in relieving the debilitating fatigue associated with HIV/AIDS and its effect on immunologic function. Patients were treated with 100% oxygen at two atmospheres of absolute pressure three times per week for two months, then two times per week on an ongoing basis. Laboratory markers were assessed monthly. All patients experienced relief of debilitating fatigue within one month of hyperbaric oxygen therapy. It was concluded that hyperbaric oxygen therapy is an effective adjunctive treatment in the medical management of HIV/AIDS. Laboratory markers, clinical significance, nursing implications, and cost-effectiveness of hyperbaric oxygen therapy are discussed.



GENERAL LITERATURE

Neurochem Res. 2008 Nov 18. [Epub ahead of print]

Microarray Analysis of Gene Expression in Rat Cortical Neurons Exposed to Hyperbaric Air and Oxygen.

Chen Y, Nadi NS, Chavko M, Auker CR, McCarron RM.

To gain a global view of the genomic response of neurons to normobaric and hyperbaric hyperoxic stress, we performed a microarray analysis of gene expression after exposure to varying levels of partial oxygen pressures. Rat neurons were exposed to normobaric hyperoxia, hyperbaric (2, 4, and 6 atmosphere absolute) air or hyperbaric O₂. We identified 183 genes significantly altered (increased or decreased ≥ 1.5 -fold) in response to pressure and/or oxidative stress. Among them, 17 genes changed in response to all exposure conditions. More genes were altered in response to hyperbaric air than hyperbaric O₂. The altered genes included factors associated with stress responses, transport/neurotransmission, signal transduction, and transcription factors. The results may serve as guidance for selection of biomarkers of hyperoxia and hyperbaric O₂ response and provide a starting point for further studies to investigate the global molecular mechanisms underlying hyperbaric oxidative stress.

Gynecol Oncol. 2008 Nov;111(2 Suppl):S92-7. Epub 2008 Sep 16.

How to make a hospital-based wound center financially viable: the Georgetown University Hospital model.

As the medical need and expenditure for chronic wound care have increased markedly over the past decade, wound centers have grown exponentially throughout the country. They can be community-based or hospital-based, and in either case, can be run by the facility or by a national chain. The wound center's viability is dependent on generated revenue, and its clinical effectiveness is based on a multidisciplinary approach to wound care. By incorporating the wound center into an existing hospital system, one can take advantage of the hospital's resources to effectively treat the more complex patients. Additionally, by focusing on limb salvage, the hospital attracts the critical limb ischemia and other complex patients that often require inpatient admission. We examined the Georgetown University Hospital Center for Wound Healing performance over the first 6 years of operation. Since opening the wound center in 1999, the number of outpatient visits has doubled, the wound care inpatient census has doubled, and the operative cases have increased 3-fold. Because the outpatient segment of the wound center can at best cover its direct cost, it cannot financially justify its existence. Hyperbaric oxygen (HBO) can increase the revenue to the point where the indirect costs are covered as well and the wound center can be revenue neutral. Due to the medical complexity of limb salvage patients, the inpatient collections are much higher than those of the outpatient wound center and therefore can serve as justification for the latter's financial viability. More importantly, with the wound center in place, the hospital can provide the local/regional community with a comprehensive service that can effectively treat the most challenging wounds. The success is built on a multidisciplinary team approach, use of evidence-based treatment protocols, efficient clinical structure, and a supportive hospital system. The beneficiaries include the patient with a healed wound, the physician with a gratifying practice, the health care system with lower costs, and the hospital with a steady influx of complex patients.



GENERAL LITERATURE

J Appl Physiol. 1997 Aug;83(2):354-8.

Acutely administered melatonin reduces oxidative damage in lung and brain induced by hyperbaric oxygen.

Pablos MI, Reiter RJ, Chuang JI, Ortiz GG, Guerrero JM, Sewerynek E, Agapito MT, Melchiorri D, Lawrence R, Deneke SM.

Hyperbaric oxygen exposure rapidly induces lipid peroxidation and cellular damage in a variety of organs. In this study, we demonstrate that the exposure of rats to 4 atmospheres of 100% oxygen for 90 min is associated with increased levels of lipid peroxidation products [malonaldehyde (MDA) and 4-hydroxyalkenals (4-HDA)] and with changes in the activities of two antioxidative enzymes [glutathione peroxidase (GPX) and glutathione reductase (GR)], as well as in the glutathione status in the lungs and in the brain. Products of lipid peroxidation increased after hyperbaric hyperoxia, both GPX and GR activities were decreased, and levels of total glutathione (reduced+oxidized) and glutathione disulfide (oxidized glutathione) increased in both lung and brain areas (cerebral cortex, hippocampus, hypothalamus, striatum, and cerebellum) but not in liver. When animals were injected with melatonin (10 mg/kg) immediately before the 90-min hyperbaric oxygen exposure, all measurements of oxidative damage were prevented and were similar to those in untreated control animals. Melatonin's actions may be related to a variety of mechanisms, some of which remain to be identified, including its ability to directly scavenge free radicals and its induction of antioxidative enzymes via specific melatonin receptors.