

E-NEWS

EDITORIAL NOTE – December 2018

The E-News is the monthly newsletter of CUHMA used to share news and information. We invite relevant content, including announcements, upcoming conferences, new publication abstracts, job postings, professional perspectives, incident reports, and relevant images of related professional scenes. Feel free to share issues with interested colleagues. All past issues are available at <https://cuhma.ca>.

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NEWS/ANNOUNCEMENTS

The 2018 CUHMA annual scientific meeting was held in Quebec City November 02-04. The program was accredited through the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada. It drew 104 registrants, mostly from across Canada, but with some from the US and Europe. New this year, we produced enduring material to expand the impact of the conference - 15 mini-lectures or video summaries of workshop events. These will be made available on the CUHMA website in the coming months. See the E-News for details.



Seven of the recently elected 2018 CUHMA BOD members at the annual scientific meeting (l-r) - Ron Linden, Caroline Bain, Neal Pollock, Afshin Khazaei, Debbie Pestell, Geoff Zbitnew, George Harpur (photo by Philip Frazier)

Call for Abstracts – CUHMA 2019

Both original research and review session abstracts will be considered for the 2019 CUHMA annual scientific meeting in St. John's, NL. The submission deadline is May 15, 2019, with decisions returned to corresponding authors by July 15. Original research abstracts should be in the 250-300 word range, with data included, for 15-min oral presentations. Review session abstracts should be in the 150-250 word count range, for variable length presentations. Detailed submission guidelines will be posted in the March E-News.

UPCOMING EVENTS

OZTek 2019

OZTek 2019 will be held March 16-17 at the International Convention Centre in Sydney, Australia. For further information, see: www.diveoztek.com.

Undersea Medicine Canada Level 2 Course

Undersea Medicine Canada is offering a CSA Z275.2-15 Level 2 'Advanced Course in Diving Medicine: Diagnosis and Treatment' in Halifax, NS May 6-11, 2019. Augmenting classroom instruction and case-based learning, site visits will be arranged to observe commercial diver training and diving operations. A CSA Z275.2-15 Level 1 'Introductory Course in Diving Medicine: Fitness to Dive' or equivalent training is a prerequisite for this 50-hour course. Further details will be added to the Undersea Medicine Canada website in the coming weeks (www.underseamedicine.ca). Registration will open in early 2019.

RECENT PUBLICATIONS

Aghajan Y, Grover I, Gorski H, Tumblin M, Crawford JR. Use of hyperbaric oxygen therapy in pediatric neuro-oncology: a single institutional experience. J Neurooncol. 2018 Nov 13. doi: 10.1007/s11060-018-03021-x. [Epub ahead of print]

INTRODUCTION: Hyperbaric oxygen therapy (HBOT) has been utilized as adjunctive treatment of CNS tumors and for radiation necrosis (RN) with reported success. The safety and efficacy in pediatric patients is less understood. **METHODS:** Seven patients (ages 10-23 years, six females) were treated with HBOT (3-60 sessions) for either RN (n=5) or tumor-associated edema (n=2). Tumor

diagnosis included low-grade glioma (n=4, two with neurofibromatosis type 1), meningioma (n=1), medulloblastoma (n=1) and secondary high grade glioma (n=1). Prior therapies included: surgery (n=4), chemotherapy (n=4) and radiation (n=5: four focal, one craniospinal). Three underwent biopsy: one confirming RN, one high-grade glioma, and one low-grade glioma. Patients were assessed for clinical and radiographic changes post HBOT. RESULTS: Median time to clinical and radiographic presentation was 8.5 months (range 6 months-11 years) in those who had prior radiation. Clinical improvement after HBOT (median: 40 sessions) was observed in four of seven patients. Symptoms were stable in two and worsened in one patient. Radiographic improvement was seen in four patients; three had radiographic disease progression. In the subgroup treated for presumed and biopsy-confirmed RN (n=5), four of five (80%) had clinical and radiographic improvement. There were no long-term adverse events due to HBOT. CONCLUSIONS: HBOT is safe and well-tolerated in pediatric and young adult patients with CNS tumors. Clinical and radiographic improvements were observed in over half of patients. Clinical trials are needed to establish safety and efficacy of HBOT as adjunct therapy in pediatric CNS tumors.

Bosco G, Rizzato A, Martani L, Schiavo S, Talamonti E, Garetto G, Paganini M, Camporesi EM, Moon RE. Arterial blood gas analysis in breath-hold divers at depth. *Front Physiol.* 2018 Nov 5;9:1558. doi: 10.3389/fphys.2018.01558. eCollection 2018.

The present study aimed to evaluate the partial pressure of arterial blood gases in breath-hold divers performing a submersion at 40 m. Eight breath-hold divers were enrolled for the trials held at "Y-40 THE DEEP JOY" pool (Montegrotto Terme, Padova, Italy). Prior to submersion, an arterial cannula in the radial artery of the non-dominant limb was positioned. All divers performed a sled-assisted breath-hold dive to 40 m. Three blood samplings occurred: at 10 min prior to submersion, at 40 m depth, and within 2 min after diver's surfacing and after resuming normal ventilation. Blood samples were analyzed immediately on site. Six subjects completed the experiment, without diving-related problems. The theoretically predicted hyperoxia at the bottom was observed in 4 divers out of 6, while the other 2 experienced a reduction in the partial pressure of oxygen (PaO₂) at the bottom. There were no significant increases in arterial partial pressure of carbon dioxide (PaCO₂) at the end of descent in 4 of 6 divers, while in 2 divers PaCO₂ decreased. Arterial mean pH and mean bicarbonate (HCO₃) levels exhibited minor changes. There was a statistically significant increase in mean arterial lactate level after the exercise. Ours was the first attempt to verify real changes in blood gases at a depth of 40 m during a breath-hold descent in free-divers. We demonstrated that, at depth, relative hypoxemia can occur,

presumably caused by lung compression. Also, hypercapnia exists at depth, to a lesser degree than would be expected from calculations, presumably because of pre-dive hyperventilation and carbon dioxide distribution in blood and tissues.

Chabowska AM, Radziwon BB, Lukaszuk B, Lipska A, Chabowski A, Kaczerska D, Siermuntowski P, Radziwon P. Fatty acids and sphingolipids profile in the blood plasma of experienced divers in response to hyperbaric exposure. *Undersea Hyperb Med.* 2018;45:521-9.

INTRODUCTION: Hyperbaric exposure mimics air-breathing scuba diving, which is reaching enormous popularity around the world. The diver's body is subjected to a broad range of divergent effects exerted by, e.g.: an increased partial pressure of inert gases, microclotting, oxidative stress and/or production of gas bubbles. However, very little is known regarding the impact of hyperbaric exposure on plasma fatty acids content and composition, together with the body's sphingolipids profile. MATERIAL AND METHODS: The aim of this study was to investigate the contents of major fatty acids present in the plasma as well as sphingolipids, namely: sphingosine (SPH); sphingosine-1-phosphate (S1P); sphinganine (SPA); and ceramide (CER), after hyperbaric exposure corresponding to dives conducted to the depths of 30 and 60 meters of seawater. For the plasma lipids measurements, high-performance liquid chromatography together with gas-liquid chromatography were applied. RESULTS: We demonstrated that hyperbaric exposure does not affect the content and composition of plasma fatty acids of experienced divers. Similarly, the amounts of major sphingolipids fractions were not influenced, as only the content of sphingosine-1-phosphate in the plasma was significantly decreased. CONCLUSIONS: Observed lack of significant changes in plasma lipid profile after hyperbaric exposure suggests that the procedure might be considered as secure. However, decreased sphingosine-1-phosphate content in the plasma might possibly exert some adverse effects

Cho I, Lee HM, Choi SW, Kong SK, Lee IW, Goh EK, Oh SJ. Comparison of two different treatment protocols using systemic and intratympanic steroids with and without hyperbaric oxygen therapy in patients with severe to profound idiopathic sudden sensorineural hearing loss: a randomized controlled trial. *Audiol Neurootol.* 2018;23(4):199-207.

OBJECTIVES: This study aimed to investigate the efficacy of simultaneous steroid and hyperbaric oxygen therapy (HBOT) in patients with severe to profound idiopathic sudden sensorineural hearing loss (ISSNHL), which has a poor prognosis. METHODS: Sixty patients diagnosed with severe to profound ISSNHL (≥70 dB HL) were randomly divided into two groups in a prospective controlled trial: an oral steroid + intratympanic steroid

injection (ITSI) group (control group) and an oral steroid + ITSI + HBOT group (study group). Pure-tone audiometry (PTA) results and word discrimination scores (WDS) were compared between the two groups before treatment and 10 days and 1, 2, and 3 months after treatment. Hearing improvement was assessed using the modified American Academy of Otolaryngology-Head and Neck Surgery criteria. Analyses were by both intention to treat and per protocol. **RESULTS:** A total of 58 patients completed the 3-month follow-up, and 2 patients in the study group were excluded due to follow-up loss in the per-protocol analysis. In the intention-to-treat and per-protocol analyses, the study group showed significantly better hearing levels than did the control group at 500 Hz ($p < 0.05$) 1 month after treatment and at 1 kHz ($p < 0.05$) 3 months after treatment. However, the average PTA values and PTA at 2, 4, and 8 kHz showed no significant difference. WDS improvement was significantly higher in the study group compared to the control group 3 months after treatment by both per-protocol (66.4 ± 13.3 and $56.7 \pm 19.1\%$, respectively; $p = 0.029$) and intention-to-treat analyses (65.9 ± 14.1 and $56.7 \pm 19.1\%$, respectively; $p = 0.035$). The sum of complete and partial hearing recovery for the study group was significantly higher than that for the control group by per-protocol analysis (60.7 vs. 33.3% ; $p = 0.037$) and intention-to-treat analysis (60.0 vs. 33.3% ; $p = 0.038$). **CONCLUSION:** These results demonstrate that the addition of HBOT to steroid combination therapy does not improve the average PTA values in severe to profound ISSNHL; however, it was associated with a better outcome at 500 Hz 1 month after treatment and, at 1 kHz, WDS 3 months after treatment. The sum of complete and partial hearing recovery was significantly higher for the study group than for the control group.

Erdoğan A, Düzgün AP, Erdoğan K, Özkan MB, Coşkun F. Efficacy of hyperbaric oxygen therapy in diabetic foot ulcers based on Wagner classification. J Foot Ankle Surg. 2018;57(6):1115-9.

Diabetic foot ulcer is a common chronic complication of diabetes mellitus. In addition to conventional primary therapy, there are adjuvant therapy methods such as hyperbaric oxygen therapy for the healing of diabetic foot ulcer wounds. The present study aimed to determine the efficacy of hyperbaric oxygen therapy in diabetic foot ulcers based on Wagner classification. It was performed retrospectively from prospectively collected data. One hundred thirty patients with diabetic foot ulcers were assessed in 2 groups: 1 group received hyperbaric oxygen therapy; the other group did not. Patients were examined according to age, sex, ulcer grade based on Wagner classification; ulcer healing status; whether hyperbaric oxygen therapy was received; duration of diabetes in years; HbA1C, sedimentation, C-reactive protein levels; and presence of accompanying diseases, including

peripheral arterial disease, chronic obstructive pulmonary disease, hypertension, chronic kidney disease, neuropathy, and retinopathy. The mean follow-up period was 19.5 ± 4.45 months (range 12 to 28 months). Seventy-one (54.6%) patients received hyperbaric oxygen therapy, and 59 (45.4%) patients did not. All patients in Wagner grade 2 healed in both groups. In the group that received hyperbaric oxygen therapy for grade 3 and 4 patients, 35 (87.5%) and 11 (84.6%) healed, respectively. In total, 60 (84.5%) patients in the group that received hyperbaric oxygen therapy healed. The subgroup comparison conducted according to Wagner classification revealed no differences between the 2 groups of grades 2 and 5 patients. It also revealed that treatment had higher levels of efficacy in the healing of ulcers in grade 3 and 4 patients.

Harrison LE, Giardina C, Hightower LE, Anderson C, Perdrizet GA. Might hyperbaric oxygen therapy (HBOT) reduce renal injury in diabetic people with diabetes mellitus? From preclinical models to human metabolomics. Cell Stress Chaperones. 2018 Oct 30. doi: 10.1007/s12192-018-0944-8. [Epub ahead of print]

Diabetic kidney disease (DKD) is the leading cause of end-stage renal failure in the western world. Current treatment of diabetic kidney disease relies on nutritional management and drug therapies to achieve metabolic control. Here, we discuss the potential application of hyperbaric oxygen therapy (HBOT) for the treatment of diabetic kidney disease (DKD), a treatment which requires patients to breathe in 100% oxygen at elevated ambient pressures. HBOT has traditionally been used to diabetic foot ulcers (DFU) refractory to conventional medical treatments. Successful clinic responses seen in the DFU provide the underlying therapeutic rationale for testing HBOT in the setting of DKD. Both the DFU and DKD have microvascular endothelial disease as a common underlying pathologic feature. Supporting evidence for HBOT of DKD comes from previous animal studies and from our preliminary prospective clinical trial reported here. We report urinary metabolomic data obtained from patients undergoing HBOT for DFU, before and after exposure to 6 weeks of HBOT. The preliminary data support the concept that HBOT can reduce biomarkers of renal injury, oxidant stress, and mitochondrial dysfunction in patients receiving HBOT for DFU. Further studies are needed to confirm these initial findings and correlate them with simultaneous measures of renal function. HBOT is a safe and effective treatment for DFU and could also be for individuals with DKD.

Huchim-Lara O, Hernández-Flores A, Villanueva-Poot R, Garcia E. The cost of decompression illness: the case of lobster and sea cucumber fishery in Yucatan, Mexico. Undersea Hyperb Med. 2018;45:531-9.

Diving fisheries are an important source of income and protein for many coastal communities around the world. However, these fisheries are also the cause of both fatal and non-fatal injuries. The aim of this study is to estimate the costs of decompression sickness (DCS) in the diving small-scale fisheries that target benthic resources in the Yucatan, Mexico. The DCS cases that occurred during three fishing seasons for sea cucumber (*Isostichopus badiionotus*) and one for spiny lobster (*Panulirus argus*) were used to calculate the direct medical costs. The catch data during the same fishing seasons were used to calculate the potential losses caused by disability as indirect costs. In the three years (from 2013 to 2016) the total number of fishermen treated in the region numbered 282; 116 during lobster fishing and 166 during sea cucumber season. The direct medical costs were estimated to be USD \$120,269; the temporary loss of income in USD \$724,377; and the permanent loss of income was USD \$737,053. Considering the direct and indirect costs, the social costs of diving in both small-scale fisheries was USD \$1,614,121. This is a first approach to estimate the cost of the use of diving in fisheries for the health services but for the fishing communities as well. Furthermore, this is an important first step on the road to a full economic evaluation of the benthic fisheries in order to improve their management.

Liao J, Wu MJ, Mu YD, Li P, Go J. Impact of hyperbaric oxygen on tissue healing around dental implants in beagles. Med Sci Monit. 2018; 24:8150-9.

BACKGROUND: The impact of hyperbaric oxygen (HBO) on the healing of soft tissues around dental implants was studied in a beagle model. **MATERIAL AND METHODS:** Beagle dogs were randomized to receive implants, followed by postoperative HBO therapy or not (n=10 per group). On postoperative days 3, 7, and 14, tissue specimens were paraffin-embedded and analyzed by hematoxylin-eosin and Masson staining, as well as immunohistochemistry against CD31. **RESULTS:** Scores for inflammation pathology based on hematoxylin-eosin staining and mean optical density of collagen fibers were significantly different between the HBO and control groups on postoperative days 3 and 7 ($P<0.05$), but not on day 14. Mean optical density due to anti-CD31 staining was significantly higher in the HBO group on postoperative days 3, 7, and 14 ($P<0.05$). **CONCLUSIONS:** These results suggest that HBO may promote early osteogenesis and soft tissue healing after implantation.

Lucrezi S, Egi SM, Pieri M, Burman F, Ozyigit T, Cialoni D, Thomas G, Marroni A, Saayman M. Safety priorities and underestimations in recreational scuba diving operations: a European study supporting the implementation of new risk management programmes.

Front Psychol. 2018 Mar 23;9:383. doi: 10.3389/fpsyg.2018.00383. eCollection 2018.

Introduction: Scuba diving is an important marine tourism sector, but requires proper safety standards to reduce the risks and increase accessibility to its market. To achieve safety goals, safety awareness and positive safety attitudes in recreational scuba diving operations are essential. However, there is no published research exclusively focusing on scuba divers' and dive centres' perceptions toward safety. This study assessed safety perceptions in recreational scuba diving operations, with the aim to inform and enhance safety and risk management programmes within the scuba diving tourism industry. **Materials and Methods:** Two structured questionnaire surveys were prepared by the organisation Divers Alert Network and administered online to scuba diving operators in Italy and scuba divers in Europe, using a mixture of convenience and snowball sampling. Questions in the survey included experience and safety offered at the dive centre; the buddy system; equipment and accessories for safe diving activities; safety issues in the certification of new scuba divers; incidents/accidents; and attitudes toward safety. **Results:** 91 scuba diving centres and 3,766 scuba divers participated in the study. Scuba divers gave importance to safety and the responsiveness of service providers, here represented by the dive centres. However, they underestimated the importance of a personal emergency action/assistance plan and, partly, of the buddy system alongside other safety procedures. Scuba divers agreed that some risks, such as those associated with running out of gas, deserve attention. Dive centres gave importance to aspects such as training and emergency action/assistance plans. However, they were limitedly involved in safety campaigning. Dive centres' perceptions of safety in part aligned with those of scuba divers, with some exceptions. **Conclusion:** Greater responsibility is required in raising awareness and educating scuba divers, through participation in prevention campaigns and training. The study supports the introduction of programmes aiming to create a culture of safety among dive centres and scuba divers. Two examples, which are described in this paper, include the Hazard Identification and Risk Assessment protocol for dive centres and scuba divers, and the Diving Safety Officer programme to create awareness, improve risk management, and mitigate health and safety risks

Mina A, Shune L, Abdelhakim H, Lin TL, Ganguly S, Baran A, et al. Long-term results of a pilot study evaluating hyperbaric oxygen therapy to improve umbilical cord blood engraftment. Ann Hematol. 2018 Oct 31. doi: 10.1007/s00277-018-3532-1. [Epub ahead of print]

Umbilical cord blood (UCB) transplantation is a promising option for hematopoietic stem cell transplantation in patients with hematologic malignancies

who lack an HLA-matched sibling or well-matched unrelated donor; however, it has a higher incidence of delayed or failed engraftment because cell doses are low and bone marrow homing is inefficient. We have demonstrated that pre-treating irradiated immune-deficient mice with hyperbaric oxygen (HBO) prior to UCB CD34+ cell transplantation lowered host systemic erythropoietin (EPO) and improved UCB CD34+ cell homing and engraftment. These findings suggested that EPO-EPO-R signaling plays a role in UCB CD34+ homing and engraftment. In a pilot clinical trial, we showed that recipients of HBO therapy prior to UCB cell infusion had reduced systemic EPO, which was associated with improved kinetics of blood count recovery. Although early clinical outcomes at day 100 were encouraging, with improved overall survival, the long-term effects of HBO therapy on UCB-transplanted patients were not evaluated. In this study, we examined the long-term outcome of patients in our pilot study, compared with a historic control group, and correlated their clinical outcomes to serum EPO response to HBO. While 50% of HBO-treated patients received single UCB units, ~90% of the control patients received double UCB units. Although HBO patients had much better rates of survival at 6 months, their 1-year survival did not significantly differ from the control group. HBO-treated patients had on average lower relapse and non-relapse mortality rates, and less chronic graft versus host disease (GVHD), but had increased acute GVHD. However, these differences were not statistically significant, probably because of the small sample size. In the HBO-treated cohort, immune reconstitution analysis showed significant improvement in early B cell recovery, with a trend toward improvement in early NK cell recovery. When we evaluated the ratio of 8 h to baseline EPO levels, we found a non-significant trend toward lower EPO values in those who neither relapsed nor died by 1 year, compared to those who died or relapsed. This result suggests that EPO response to HBO may be associated with better outcomes. Disease progression-free survival was also improved in those who had more than 80% reduction in EPO levels in response to HBO. Our study highlights the long-term safety of HBO therapy when used prior to UCB transplantation. Future UCB transplant patients who receive HBO should have their serum EPO response measured, as it may be a marker of relapse/mortality

Mirasoglu B, Arslan A, Aktas S, Toklu AS. Eurasian Tunnel Project: the first saturation dives during compressed-air work in Turkey. Undersea Hyperb Med. 2018;45:489-94.

The Eurasian Tunnel is a 5.64-km crossroad tunnel that connects Europe and Asia. Located under the seabed for the first time, 3.34 km of the tunnel that crosses the Bosphorus was built by advanced tunneling techniques. An exclusively designed tunnel boring machine (TBM),

which has an operating pressure of 11 bars and a diameter of 13.7 meters was used for boring the seabed tunnel. The deepest point was 106 meters below sea level. One bounce diving period and seven saturation diving periods were needed for the repair and maintenance of the TBM during the project. Total time spent under pressure was 5,763 hours. A saturation decompression chamber for four divers was used for the saturation interventions, and divers breathed trimix at storage and excursion depths. The longest saturation run was the second, with storage at 10 bars and excursions to 10.4 bars. Twenty-three professional divers who were all experienced in compressed-air work were assigned to work on the project. Four dive physicians provided medical support, which included screening of divers before and during the hyperbaric interventions as well as on-site supervision. There were no diving-related accidents. A minor hand trauma, an external otitis and occasional insomnia were non-diving-related health issues that occurred during saturation and bounce diving. To our knowledge, the Eurasian Tunnel was the first project to perform TBM repair operations at such depths under the seabed and the first saturation diving in Turkey. In this report, we aimed to share our experiences of hyperbaric medical consulting in support of this type of tunneling project.

Muller A, Rochoy M. Diving and asthma: literature review [French]. Rev Pneumol Clin. 2018 Nov 12. pii: S0761-8417(18)30176-7. doi:10.1016/j.pneumo. 2018. 10.002. [Epub ahead of print]

INTRODUCTION: Scuba diving has long been contraindicated for asthmatics. Recommendations are evolving towards authorisation under certain conditions. Our objective was to review the literature on the risks associated with scuba diving among asthmatics and about recommendations on this subject. MATERIALS AND METHODS: We used the MEDLINE and LiSSa databases, until June 2018, in French, English or Spanish language, with the keywords "asthma AND diving" and "asthme plongée" respectively. References to the first degree were analyzed. RESULTS: We have included 65 articles. Risk of bronchospasm is well documented, particularly in cold and/or deep water, or in the event of exposure to allergens (compressor without filter). Nonasthmatic atopic divers may be at greater risk of developing bronchial hyper-reactivity. Although the theoretical risk exists, epidemiological studies do not seem to show an over-risk of barotrauma, decompression sickness or arterial gas embolism in asthmatics. French, British, American, Spanish and Australian societies agreed on the exclusion of patients with moderate to severe persistent asthma, FEV₁<80%, active asthma in the last 48 hours, exercise/cold asthma and poor physical fitness. CONCLUSION: A diver's examination should include a triple assessment: asthma control, number of exacerbations and treatment compliance. Homogenizing

the recommendations would improve the framework for the practice of diving among asthmatics and allow larger studies in this population. Communicating the current recommendations remains important to divers, dive instructors and doctors in the context of the development of scuba diving.

Rocco M, Pelaia P, Di Benedetto P, Conte G, Maggi L, Fiorelli S, Mercieri M, Balestra C, De Blasi RA; ROAD Project Investigators. Inert gas narcosis in scuba diving, different gases different reactions. Eur J Appl Physiol. 2018 Oct 22. doi: 10.1007/s00421-018-4020-y. [Epub ahead of print]

PURPOSE: Underwater divers face several potential neurological hazards when breathing compressed gas mixtures including nitrogen narcosis which can impact diver's safety. Various human studies have clearly demonstrated brain impairment due to nitrogen narcosis in divers at 4 ATA using critical flicker fusion frequency (CFFF) as a cortical performance indicator. However, recently some authors have proposed a probable adaptive phenomenon during repetitive exposure to high nitrogen pressure in rats, where they found a reversal effect on dopamine release. **METHODS:** Sixty experienced divers breathing air, trimix or heliox, were studied during an open water dive to a depth of 6 ATA with a square profile testing CFFF measurement before (T0), during the dive upon arriving at the bottom (6 ATA) (T1), 20 min of bottom time (T2), and at 5 m (1.5 ATA) (T3). **RESULTS:** CFFF results showed a slight increase in alertness and arousal during the deep dive regardless of the gas mixture breathed. The percent change in CFFF values at T1 and T2 differed among the three groups being lower in the air group than in the other groups. All CFFF values returned to basal values 5 min before the final ascent at 5 m (T3), but the trimix measurements were still slightly better than those at T0. **CONCLUSIONS:** Our results highlight that nitrogen and oxygen alone and in combination can produce neuronal excitability or depression in a dose-related response.

Rosario ER, Kaplan SE, Khonsari S, Vazquez G, Solanki N, Lane M, Brownell H, Rosenberg SS. The effect of hyperbaric oxygen therapy on functional impairments caused by ischemic stroke. Neurol Res Int. 2018 Oct 9;2018:3172679. doi: 10.1155/2018/3172679. eCollection 2018.

BACKGROUND: While research suggests a benefit of hyperbaric oxygen therapy (HBOT) for neurologic injury, controlled clinical trials have not been able to clearly define the benefits. **OBJECTIVE:** To investigate the effects of HBOT on physical and cognitive impairments resulting from an ischemic stroke. **METHODS:** Using a within-subject design a baseline for current functional abilities was established over a 3-month period for all subjects (n=7). Each subject then received two 4-week

periods of HBOT for a total of 40 90-minute treatments over a 12-week period. Subjects completed a battery of assessments and had blood drawn six times over the 9-month total duration of the study. **RESULTS:** We found improvements in cognition and executive function as well as physical abilities, specifically, improved gait. Participants reported improved sleep and quality of life following HBOT treatment. We also saw changes in serum levels of biomarkers for inflammation and neural recovery. In the functional domains where improvement was observed following HBOT treatment, the improvements were maintained up to 3 months following the last treatment. However, the physiological biomarkers showed a pattern of more transient changes following HBOT treatment. **CONCLUSIONS:** Findings from this study support the idea of HBOT as a potential intervention following stroke

Schipke JD, Eichhorn L, Behm P, Cleveland S, Kelm M, Boenner F. Glossopharyngeal insufflation and kissing papillary muscles. Scand J Med Sci Sports. 2018 Oct 30. doi: 10.1111/sms.13329. [Epub ahead of print]

BACKGROUND: Breath-hold diving has increasingly established itself within the leisure sector as near-natural sport. In parallel, a number of competitive disciplines have developed. To reach greater depths various breathing maneuvers are employed one of them being glossopharyngeal insufflation (GI), for which air is repetitively "pumped" into the lungs in order to increase the intrathoracic air volume. As intrapulmonary pressure is considerably increased in parallel, venous return is impeded, leading to incomplete filling of the cardiac chambers. In this case study, the assumption will be addressed that after GI and breath-holding cardiac filling can become entirely incomplete, such that kissing papillary muscle occurs. **PARTICIPANT/METHODS:** An elite breath-hold diver was examined using cardiovascular magnetic resonance (CMR). The corresponding images were analyzed via calculating end-diastolic and end-systolic left ventricular volumes together with their related wall volumes before and at the end of breath-holding and approximating the left ventricular volume on the basis of an ellipsoid of rotation. **RESULTS:** The estimates of left ventricular volume suggest that GI and 2-min breath-holding can lead to end-systolic volumes in the range of zero milliliters. **SUMMARY/CONCLUSION:** CMR imaging combined with mathematical modelling of ventricular volume supports the notion that GI can lead to kissing papillaries. It remains open, however, whether ECG changes observed after lung packing and breath-holding in other studies are the result of such unphysiological contractions or of a reduced subendocardial oxygen supply. The pulmonary and cardiovascular consequences of this breathing maneuver sound a clear note of caution.

Song KX, Liu S, Zhang MZ, Liang WZ, Liu H, Dong XH, Wang YB, Wang XJ. Hyperbaric oxygen therapy improves the effect of keloid surgery and radiotherapy by reducing the recurrence rate. J Zhejiang Univ Sci B. 2018;19(11):853-62.

OBJECTIVE: Keloids are exuberant cutaneous scars that form due to abnormal growth of fibrous tissue following an injury. The primary aim of this study was to assess the efficacy and mechanism of hyperbaric oxygen therapy (HBOT) to reduce the keloid recurrence rate after surgical excision and radiotherapy. **METHODS:** (1) A total of 240 patients were randomly divided into two groups. Patients in the HBOT group (O group) received HBOT after surgical excision and radiotherapy. Patients in the other group were treated with only surgical excision and radiotherapy (K group). (2) Scar tissue from recurrent patients was collected after a second operation. Hematoxylin and eosin (H&E) staining was used to observe keloid morphology. Certain inflammatory factors (interleukin-6 (IL-6), hypoxia-inducible factor-1 α (HIF-1 α), tumor necrosis factor- α (TNF- α), nuclear factor κ B (NF- κ B), and vascular endothelial growth factor (VEGF)) were measured using immunohistochemical staining. **RESULTS:** (1) The recurrence rate of the O group (5.97%) was significantly lower than that of the K group (14.15%), $P < 0.05$. Moreover, patients in the O group reported greater satisfaction than those in the K group ($P < 0.05$). (2) Compared with the recurrent scar tissue of the K group, the expression levels of the inflammatory factors were lower in the recurrent scar tissue of the O group. **CONCLUSIONS:** Adjunctive HBOT effectively reduces the keloid recurrence rate after surgical excision and radiotherapy by improving the oxygen level of the tissue and alleviating the inflammatory process.

Wu HH, Huang CC, Chang CP, Lin MT, Niu KC, Tian YF. Heat shock protein 70 (HSP70) reduces hepatic inflammatory & oxidative damage in a rat model of liver ischemia/reperfusion injury with hyperbaric oxygen preconditioning. Med Sci Monit. 2018;24:8096-104.

BACKGROUND: Several clinical conditions can cause hepatic ischemia/reperfusion (I/R) injury. This study aimed to determine the mechanism of the protective effect of hyperbaric oxygen preconditioning (HBO₂P) on hepatic ischemia/reperfusion (I/R) injury in a rat model, and to investigate the effects on HBO₂P and I/R injury of blocking HSP70 using antibody (Ab) pretreatment. **MATERIAL AND METHODS:** Male Sprague-Dawley rats underwent HBO₂P for 60 min at 2.0 atmosphere absolute (ATA) pressure for five consecutive days before surgical hepatic I/R injury, performed by clamping the portal vein and hepatic lobe. Four groups studied included: the non-HBO₂P+ non-I/R group, which underwent sham surgery (N=10); the non-HBO₂P + I/R group (N=10); the HBO₂P + I/R group (N=10); and the HBO₂P + HSP70-Ab + I/R group (N=10) received one dose of HSP70 antibody

one day before hepatic I/R injury. Serum lactate dehydrogenase (LDH), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and pro-inflammatory cytokines, tumor necrosis factor- α (TNF- α) and interleukin-6 (IL-6), and hepatic malondialdehyde (MDA) and myeloperoxidase (MPO) were measured biochemically. Rat liver tissues were examined histologically. **RESULTS:** In rats with hepatic I/R injury without HSP70 antibody pre-treatment, HBO₂P significantly reduced hepatic injury and levels of LDH, AST, ALT, TNF- α , IL-6, MDA, and MPO levels; in comparison, the group pre-treated with an antibody to inhibit HSP70 (the HBO₂P + HSP70-Ab + I/R group) showed significant reversal of the beneficial effects of HBO₂P on hepatic I/R injury ($p < 0.05$). **CONCLUSIONS:** In a rat model of hepatic I/R injury with HBO₂P, HSP70 reduced hepatic inflammatory and oxidative damage.

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