CUHMA ACMHS
Canadian Undersea and Hyperbaric Medical Association
Association Canadienne de Médecine Hyperbare et Subaquatique

E-NEWS

EDITOR'S NOTE – August 2023

The E-News is the monthly newsletter of CUHMA, the primary outlet to share news/announcements, upcoming events, abstracts of recent publications, job postings, professional perspectives, and images of relevant professional scenes. Submission of applicable content is welcome. New issues are released on the last business day of each month. Past issues are available at https://cuhma.ca. Direct correspondence to info@cuhma.ca.

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NEWS/ANNOUNCEMENTS

Dive Deeper

The Huntsman Marine Science Centre, St. Andrews, NB has produced a free virtual exhibit exploring the underwater abundance of the Bay of Fundy. The multi-media presentation includes still and video images and a wealth of natural history information. Visit: https://divedeeper.site.

UPCOMING EVENTS

UMC Introductory Diving Medicine Course

Undersea Medicine Canada is offering a Level 1 'Introductory Course in Diving Medicine - Fitness to Dive' September 18-22 in Quebec City, QC. An optional half-day pre-course will be held September 17 for those wanting additional preparation for the program. For more information visit: https://underseamedicine.ca.

WMS Diving and Environmental Medicine CME

The Wilderness Medical Society is holding a continuing medical education course September 30-October 07, 2023 in Cayman Brac (travel on Saturdays on both ends). Each of six days includes four hours of interactive lectures and two boat dives. Visit: https://wms.org/DM23.

DEMA Show 2023

The Diving Equipment & Marketing Association (DEMA) show will be held November 14-17 at the Ernest N Morial Convention Center in New Orleans, LA. This is a popular industry event. Visit: https://www.demashow.com.

RECENT PUBLICATIONS

Cooperman S, Kruse D, Sachs BD, Cornett B, Choi YJ. Evaluating the efficacy of hyperbaric oxygen therapy in digital frostbite. J Foot Ankle Surg. 2023 Jun 30;S1067-2516(23)00160-6. doi: 10.1053/j.jfas.2023.06.007. Online ahead of print.

Frostbite is a cold-induced tissue injury most commonly affecting the extremities, potentially leading to amputation. Hyperbaric oxygen therapy (HBOT) is a proposed adjunctive treatment for this condition which acts by increasing cellular oxygen availability in the damaged tissues. Currently, there is a lack of data regarding the effectiveness of HBOT in the literature. Therefore, the purpose of this study is to further the research as one of the largest retrospective comparative cohort studies to date. We evaluated the efficacy of HBOT in the treatment of digital frostbite compared to a non-HBOT-treated group, with a focus on amputation outcomes between each group. A multicenter retrospective cohort study was performed from January 2016 to August 2021 observing patients seen for frostbite. Amputation characteristics and encounter outcomes of patients treated with HBOT were compared to those in patients treated without HBOT. A one-to-one matching of HBOT-treated and non-HBOT-treated patients was also performed, followed by Chi-Square and Fisher's exact test statistical analysis. The results of the study found a low overall amputation rate of 5.2% across both cohorts. Comparison between groups identified no statistical difference between HBOT and non-HBOT groups regarding amputation characteristics through matched cohort analysis and very little difference in the unmatched groups. However, an increased length of hospital stay in patients treated with HBOT (22.2 days) compared to the non-HBOT group (6.39 days) was identified. Based on this study, recommendations for future HBOT studies should evaluate more severe cases of frostbite, with additional consideration for cost analysis studies.

Kelly KR, Pautz CM, Palombo LJ, Jensen AE, Melau J, Turcotte LP, Solberg PA. Altered sympathoadrenal activity following cold-water diving. J Spec Oper Med. 2023 Jul 25;T5CZ-JXVK. doi: 10.55460/T5CZ-JXVK. Online ahead of print.

Introduction: Little data exist on the effect of extremely cold-water diving on thermo-metabolic hormone secretion. Moreover, the impact of repetitive dives on the stress

response is unknown. The purpose of this study was to determine the effects of two daily bouts of cold-water diving on the hormonal and metabolic profile of elite military personnel and to measure the stress response. Methods: Healthy, male, Norwegian Special Forces operators (n=5) volunteered for this study. Physiological and hormone data were analyzed prior to and following twice-daily Arctic dives (3.3°C). Results: Core temperature was maintained ($p>0.05$), whereas skin temperature was significantly reduced over the course of each dive ($p<0.01$). Pairwise comparisons revealed adrenocorticotropic hormone (ACTH) and cortisol concentration significantly decreased across both dives and days ($p<0.001$). Adrenaline and noradrenaline significantly increased across both time and day ($p<0.001$). Leptin, testosterone, and IGF-1 significantly decreased over time but recovered between days. Conclusion: The main findings of this effort are that there is a rapid sympathetic-adreno-medullary (SAM/SNS) response to cold-water diving and a suppression of the hypothalamic-pituitary-adrenal (HPA) axis and hormones related to repair and recovery. While the sample size was too small to determine the role of SAM/SNS, HPA, and thyroid hormone effect on thermoregulation, it addresses a gap in our understanding of physiological adaptions that occurs in extreme environments.

Kjellberg A, Douglas J, Hassler A, Al-Ezerjawi S, Boström E, Abdel-Halim L, Liwenborg L, Hetting E, Jonasdottir Njåstad AD, Kowalski J, Catrina SB, Rodriguez-Wallberg KA, Lindholm P. COVID-19-induced acute respiratory distress syndrome treated with hyperbaric oxygen: interim safety report from a randomized clinical trial (COVID-19-HBO). J Clin Med. 2023 Jul 24;12(14):4850. doi: 10.3390/jcm12144850.

Background: A few prospective trials and case series have suggested that hyperbaric oxygen therapy (HBOT) may be efficacious for the treatment of severe COVID-19, but safety is a concern for critically ill patients. We present an interim analysis of the safety of HBOT via a randomized controlled trial (COVID-19-HBO). Methods: A randomized controlled, open-label, clinical trial was conducted in compliance with good clinical practice to explore the safety and efficacy of HBOT for severe COVID-19 in critically ill patients with moderate acute respiratory distress syndrome (ARDS). Between 3 June 2020, and 17 May 2021, 31 patients with severe COVID-19 and moderate-to-severe ARDS, a ratio of arterial oxygen partial pressure to fractional inspired oxygen (P_aO_2/F_iO_2) <26.7 kPa (200 mmHg), and at least two defined risk factors for intensive care unit (ICU) admission and/or mortality were enrolled in the trial and randomized 1:1 to best practice, or HBOT in addition to best practice. The subjects allocated to HBOT received a maximum of five treatments at 2.4 atmospheres absolute (ATA) for 80 min over seven days. The subjects were followed up for 30 days. The safety endpoints were analyzed. Results: Adverse events (AEs) were common. Hypoxia was the most common adverse event reported. There was no statistically significant difference between the groups. Numerically, serious adverse events (SAEs) and barotrauma were more frequent in the control group, and the differences between groups were in favor of the HBOT in PaO2/FiO2 (PFI) and the national early warning score (NEWS); statistically, however, the differences were not significant at day 7, and no difference was observed for the total oxygen burden and cumulative pulmonary oxygen toxicity dose (CPTD). Conclusion: HBOT appears to be safe as an intervention for critically ill patients with moderate-to-severe ARDS induced by COVID-19.

Lee HJ, Lim DS, Lee J, Lee DG, Oh MY, Park J, Kim CH, Jung JH, Choi RK, Kang YC. Decompression illness in divers with or without patent foramen ovale: a cohort study. Ann Intern Med. 2023 Jul 11. doi: 10.7326/M23-0260. Online ahead of print.

Background: In previous studies, the prevalence of patent foramen ovale (PFO) has been reported to be higher in scuba divers who experienced decompression illness (DCI) than in those who did not. Objective: To assess the association between PFO and DCI in scuba divers. Design: Prospective cohort study. Setting: Tertiary cardiac center in South Korea. Participants: One hundred experienced divers from 13 diving organizations who did more than 50 dives per year. Measurements: Participants had transesophageal echocardiography with a saline bubble test to determine the presence of a PFO and were subsequently divided into high- and low-risk groups. They were followed using a self-reported questionnaire while blinded to their PFO status. All of the reported symptoms were adjudicated in a blinded manner. The primary end point of this study was PFO-related DCI. Logistic regression analysis was done to determine the odds ratio of PFO-related DCI. Results: Patent foramen ovale was seen in 68 divers (37 at high risk and 31 at low risk). Patent foramen ovale-related DCI occurred in 12 divers in the PFO group (non-PFO vs. high-risk PFO vs. low-risk PFO: 0 vs. 8.4 vs. 2.0 incidences per 10 000 person-dives; P=0.001) during a mean follow-up of 28.7 months. Multivariable analysis showed that high-risk PFO was independently associated with an increased risk for PFO-related DCI (odds ratio, 9.34 [95% CI, 1.95 to 44.88]). Limitation: The sample size was insufficient to assess the association between low-risk PFO and DCI. Conclusion: High-risk PFO was associated with an increased risk for DCI in scuba divers. This finding indicates that divers with high-risk PFO are more susceptible to DCI than what has been previously reported and should consider either refraining from diving or adhering to a conservative diving protocol.

Moes MI, Elia A, Gennser M, Eiken O, Keramidas ME. Nitrous oxide consistently attenuates thermogenic and thermoperceptual responses to repetitive cold stress in humans. J Appl Physiol (1985). 2023 Jul 20. doi: 10.1152/japplphysiol.00309.2023. Online ahead of print.

Divers are at enhanced risk of hypothermia, due to the independent action of the inspired inert gases on thermoregulation. Thus, narcosis induced by acute (≤2 h) exposure to either hyperbaric nitrogen, or normobaric nitrous oxide (N_2O) impairs shivering thermogenesis and accelerates body core cooling. Animal-based studies, however, have indicated that repeated and sustained N_2O administration may prevent the N_2O-evoked hypometabolism. We therefore examined the effects of prolonged intermittent exposure to 30% N_2O on human thermoeffector plasticity in response to moderate cold. Fourteen men participated in two ~12-h sessions, during which they performed sequentially three 120-min immersions (CWI) in 20˚C water, separated by 120-min rewarming. During CWIs, subjects were breathing either normal air, or a normoxic gas mixture containing 30% N_2O. Rectal and skin temperatures, metabolic heat production (via indirect calorimetry), finger and forearm cutaneous vascular conductance (CVC; laser-Doppler fluxmetry/mean arterial pressure), and thermal sensation and comfort were monitored. N2O aggravated the drop in rectal temperature (P=0.01), especially during the first (by ~0.3°C) and third (by ~0.4°C) CWIs. N_2O invariably blunted the cold-induced elevation of metabolic heat production by ~22-25% (P<0.001). During the initial ~30 min of the first and second CWIs, N_2O attenuated the cold-induced drop in finger (P≤0.001), but not in forearm CVC. N_2O alleviated the sensation of coldness and thermal discomfort throughout (P<0.001). Thus, present results demonstrate that, regardless of the cumulative duration of gas exposure, a subanasthetic dose of N_2O depresses human thermoregulatory functions, and precipitates the development of hypothermia.

Skarzynski PH, Kolodziejak A, Gos E, Skarzynska MB, Czajka N, Skarzynski H. Hyperbaric oxygen therapy as an adjunct to corticosteroid treatment in sudden sensorineural hearing loss: a retrospective study. Front Neurol. 2023 Jul 5;14:1225135. doi: 10.3389/fneur.2023.1225135. eCollection 2023.

Background: A retrospective clinical study was conducted to test the impact of including hyperbaric oxygen therapy in the treatment of patients with sudden sensorineural hearing loss (SSNHL). Materials and methods: A total of 63 adult patients with sudden sensorineural hearing loss diagnosed between 2015 and 2023 were divided into two groups: 36 patients treated with intratympanic glucocorticoid and orally administered glucocorticoid who also underwent hyperbaric oxygen therapy and 27 patients treated with intratympanic glucocorticoid and prolonged orally administered glucocorticoid (without hyperbaric oxygen therapy). An audiological evaluation was performed using pure-tone audiometry. Results: Average hearing gain as measured by pure tone average was 12.5 dB HL (±19.9 dB HL) in the patients treated with steroids combined with HBOT, and was 14.1 dB HL (±17.9 dB) in the patients treated with steroids alone. Successful treatment (complete recovery or marked improvement) was observed in 27.8% of the patients in the first group and in 25.5% in the second group. There was no statistically significant difference between the groups. Conclusion: Both groups of patients-those treated with glucocorticoids and those treated with glucocorticoids and HBOT-had similar hearing outcomes. A prospective, controlled, and randomized study would provide more reliable knowledge about the efficacy of HBOT in treating SSNHL.

CUHMA-ACMHS is the Canadian voice for the advancement of hyperbaric and diving medicine throughout our country and beyond. Our activities include continuous medical education for physicians, nurses, respiratory therapists and anyone involved in the fields of hyperbaric and diving medicine. We are also promoting dissemination of clinical research, publishing position statements, liaising with related professional associations and government agencies. Our main goal is advocating on behalf of our patients. Our vision is to be the reference for the development and delivery of hyperbaric and diving medicine in Canada and beyond. Our mission is to promote excellence in hyperbaric and diving medicine through leadership in education, promotion of best practices and advocacy for our patients. Our values are excellence, leadership, collaboration, communication, and integrity.

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