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

E-NEWS

EDITOR'S NOTE – March 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.

The growing roster of upcoming events is a sign of a progressive return to pre-COVID levels of activity.

Neal W. Pollock, PhD
Université Laval

PRESIDENT'S NOTE

As we work our way through another winter, we are planning for future events later this year. We will be looking forward to seeing how the website performs as a host for future educational activities as the online environment is a great way to reach many members.

As we got into the finer details of our participation in the UHMS meeting in San Diego, it appears that it would be best to have a meeting of CUHMA members attending the conference on Saturday, June 17th. We will announce the time and place for anyone wishing to attend. Please remember that CUHMA members receive a discount on UHMS membership which allows for a reduced conference registration fee.

As always, if there are any educational topics that members would like presented, please reach out to the board. Our goal is to aid in and improve the practice of diving and hyperbaric medicine in Canada.

Thank you for your efforts.

Geoff Zbitnew, MD
Memorial University

NEWS/ANNOUNCEMENTS

Tang.ɢwan-ḥačxʷiqak-Tsigis Marine Protected Area

Announced in early February, Canada is establishing a new 133,000 km^2 marine protected area (MPA) located an average of 150 km west of Vancouver Island, BC. The site is entirely underwater, including a string of seamounts rising from a ridge at a depth of 2500 m and the 97 km^2 Endeavour Hydrothermal Vents MPA, Canada's first. The goal is to conserve, protect and enhance understanding of unique seafloor features, including seamounts and hydrothermal vents and the marine ecosystems they support. This is part of a larger plan to protect 25% of Canada's ocean territory by 2025 and 30% by 2030.
https://www.timescolonist.com/islander/canadas-about-to-create-a-massive-protected-area-and-its-underwater-6488942.
https://www.dfo-mpo.gc.ca/oceans/aoi-si/tht-eng.html.
https://www.canada.ca/en/fisheries-oceans/news/2023/02/tangwan--hacxwiqak--tsigis-marine-protected-area.html.

UPCOMING EVENTS

Canadian Underwater Conference & Exhibition

The CUCE will be held March 26-28 in Halifax, NS. The event focuses on all aspects of onshore and offshore underwater industries, including occupational, scientific, military/police/fire rescue diving, and oil & gas, health & safety, ports & harbors, diving regulators, training, and remotely operated vehicles. A technician training course will be offered by Aqualung Canada March 29-31. For more information visit: https://www.underwaterconference.ca.

Rebreather Forum 4

Rebreather Forum 4 will be held April 20-22, 2023 in Valletta, Malta. The purpose of the scientific and leadership meeting is to advance the diving community's state of knowledge regarding rebreather technology and its uses, with the goal of promoting rebreather diving safety. Optional diving activities are planned before and after. Details and registration: https://rebreatherforum.tech.

AAUS Diving for Science Symposium

The 2023 American Academy of Underwater Sciences symposium will be held April 23-29 in Pensacola, FL. Four

days of workshops precede business meetings and the two-day science symposium. For details and registration:: https://aaus.org/AAUS/annual_symposium.aspx.

SPUMS Annual Scientific Meeting 2023

The South Pacific Underwater Medicine Society annual scientific meeting will be held June 04-09 in Cairns, Australia. The theme is diver health and ocean health amid the storm clouds of climate change. Details and registration: https://spums.au.

UHMS Annual Scientific Meeting 2023

The Undersea and Hyperbaric Medical Society (UHMS) annual scientific meeting will be held June 16-18 in San Diego, CA. Visit: https://www.uhms.org.

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. Successful completion will qualify physicians as CSA Z275.2-15 Level 1 Diving Medical Examiners and to have their names listed with the Diver Certification Board of Canada (DCBC) to conduct commercial diver medicals in Canada. This 40-h course has been accredited for 35 MAINPRO+ CME credits by the College of Family Physicians of Canada. Contact Dr. Debbie Pestell (drdeb1@ns.sympatico.ca; 902-225-8214) or visit: https://underseamedicine.ca for more information.

International Congress of Hyperbaric Medicine

The 20th ICHM will be held November 02-04, 2023 at the Windsor Barra Hotel in Rio de Janeiro, Brazil, hosted by the Brazilian Society of Hyperbaric Medicine. The ICHM is generally held every three years, and is unusual in not being linked to any single institution. The scientific program will include oral and poster research presentations and invited lectures by renowned national and international speakers. There will be simultaneous translation of speeches and question and answer periods. Website details available soon.

RECENT PUBLICATIONS

Bao XC, Wang N, Xu J, Ma J, Fang YQ. Effects of different simulated submarine escape depths by free ascent in animal models. Front Physiol. 2023 Jan 27;14:1107782. doi: 10.3389/fphys.2023.1107782.

Objective: If a damaged submarine cannot be rescued in time, it is necessary to carry out a submarine escape by free ascent. Decompression illness is the greatest threat to the safety of submariners. The maximum depth at which a safe escape can be carried out is unknown. This study intends to explore the maximum safe escape depth by observing the effects of simulated submarine escape at different depths on animal models. Methods: We evaluated pulmonary function indexes, blood gas values, blood cell counts, the myocardial enzyme spectrum, coagulation parameters, and proinflammatory cytokine levels in rats, electrocardiographic activity in rabbits after simulated 150-m, 200-m, 220-m, and 250-m submarine escape by free ascent. Results: An escape depth of 150 m did not cause significant changes in the indicators. An escape depth of >200 m led to pulmonary ventilation and gas diffusion dysfunction, hypoxemia, myocardial ischemia, and activation of the fibrinolytic and inflammatory systems. The magnitudes of the changes in the indicators were proportional to escape depth. Conclusion: An escape depth of 150 m in animal models is safe, whereas escape at >200 m can be harmful.

Hedetoft M, Madsen MB, Hyldegaard O. Hyperbaric oxygen treatment in the management of necrotising soft-tissue infections: results from a Danish nationwide registry study. BMJ Open. 2023 Feb 22;13(2):e066117. doi: 10.1136/bmjopen-2022-066117.

Objectives: Application of hyperbaric oxygen (HBO_2) treatment in the multidisciplinary setting of necrotising soft-tissue infection (NSTI) is debated as a considerable number of studies are of low quality with marked prognostication bias due to inadequately addressing disease severity. The objective of this study was to associate HBO2 treatment with mortality in patients with NSTI including disease severity as a prognostic variable. Design: Nationwide population-based register study. Setting: Denmark. Participants: Danish residents with NSTI patients between January 2011 and June 2016. Primary and secondary outcome measures: Thirty-day mortality was compared between patients receiving and patients not receiving HBO_2 treatment using inverse probability of treatment weighting and propensity-score matching with predetermined variables (age, sex and weighted Charlson comorbidity score, presence of septic shock and Simplified Acute Physiology Score II (SAPS II)). Results: A total of 671 NSTI patients were included with a median age of 63 (52-71), 61% male sex, 30% had septic shock and a median SAPS II of 46 (34-58). Patients who received HBO_2 treatment (n=266) were younger and had lower SAPS II, but a larger fraction had septic shock compared with patients not receiving HBO_2 treatment. Overall, all-cause 30-day mortality was 19% (95% CI 17% to 23%). The statistical models were in general acceptably balanced with covariates reaching <0.1 absolute standardised mean differences and patients receiving HBO_2 treatment were associated with lower 30-day mortality (OR 0.40, 95% CI 0.30 to 0.53, p<0.001). Conclusions: In analyses using inverse probability of treatment weighting and propensity score analysis, patients treated with HBO_2 treatment were associated with improved 30-day survival.

Keller GA, Colaianni I, Coria J, Di Girolamo G, Miranda S. Clinical and biochemical short-term effects of hyperbaric oxygen therapy on SARS-Cov-2+ hospitalized patients with hypoxemic respiratory failure. Respir Med. 2023 Feb 14; 209: 107155. doi: 10.1016/j.rmed.2023.107155. Online ahead of print.

Background: Hyperbaric oxygen therapy (HBOT) has been proposed to address COVID-19- associated respiratory failure. However, its biochemical effects are poorly known. Method: 50 patients with hypoxemic COVID-19 pneumonia were divided into C group (standard care) and H group (standard care plus HBOT). Blood was obtained at t=0 and t=5 days. Oxygen saturation (O_2 sat) was followed up. White blood cell (WC) count, lymphocytes (L) and platelets. (P) and serum analysis (glucose, urea, creatinine, sodium, potassium, ferritin, D dimer, LDH and CRP) were carried out. Plasma levels of sVCAM, sICAM, sPselectin, SAA and MPO, and of cytokines (IL-1β, IL-1RA, IL-6, TNFα, IFNα, IFNγ, IL-15, VEGF, MIP1α, IL-12p70, IL-2 and IP-10) were measured by multiplex assays. Angiotensin converting enzyme 2 (ACE-2) levels were determined by ELISA. Results: The average basal O_2 sat was 85±3%. The days needed to reach O_2 sat >90% were: H: 3±1 and C: 5±1 (P<0,01). At term, H increased WC, L and P counts (all, H vs C: P<0,01). Also, H diminished D dimer levels (H vs C, P<0,001) and LDH concentration (H vs C, P<0.01]. At term, H showed lower levels of sVCAM, sPselectin and SAA than C with respect to basal values (H vs C: ΔsVCAM: P<0,01; ΔsPselectin: P<0,05; ΔSAA: P<0,01). Similarly, H showed diminished levels of TNFα (ΔTNFα: P<0,05) and increased levels of IL-1RA and VEGF than C respect to basal values (H vs C: ΔIL-1RA and ΔVEGF: P<0,05). Conclusion: Patients underwent HBOT improved O_2 sat with lower levels of severity markers (WC and platelets count, D dimer, LDH, SAA). Moreover, HBOT reduced proinflammatory agents (sVCAM, sPselectin, TNFα) and increased anti-inflammatory and pro-angiogenic ones (IL-1RA and VEGF).

Kutz CJ, Kirby IJ, Grover IR, Tanaka HL. Aviation decompression sickness in aerospace and hyperbaric medicine. Aerosp Med Hum Perform. 2023; 94(1):11-17.

INTRODUCTION: The US Navy experienced a series of physiological events in aircrew involving primarily the F/A-18 airframe related to rapid decompression of cabin pressures, of which aviation decompression sickness (DCS) was felt to contribute. The underlying pathophysiology of aviation DCS is the same as that of diving-related. However, based on the innate multifactorial circumstances surrounding hypobaric DCS, in clinical practice it continues to be unpredictable and less familiar as it falls at the intersect of aerospace and hyperbaric medicine. This retrospective study aimed to review the case series diagnosed as aviation DCS in a collaborative effort between aerospace specialists and hyperbaricists to increase appropriate identification and treatment of hypobaric DCS. METHODS: We identified 18 cases involving high-performance aircraft emergently treated as aviation DCS at a civilian hyperbaric chamber. Four reviewers with dual training in aviation and hyperbaric medicine retrospectively reviewed cases and categorized presentations as "DCS" or "Alternative diagnosis". RESULTS: Reviewers identified over half of presenting cases could be attributed to an alternative diagnosis. In events that occurred at flight altitudes below 17,000 ft (5182 m) or with rapid decompression pressure changes under 0.3 atm, DCS was less likely to be the etiology of the presenting symptoms. CONCLUSIONS: Aviation physiological events continue to be difficult to diagnose. This study aimed to better understand this phenomenon and provide additional insight and key characteristics for both flight physicians and hyperbaric physicians. As human exploration continues to challenge the limits of sustainable physiology, the incidence of aerospace DCS may increase and underscores our need to recognize and appropriately treat it.

Katarzyna Latusek 1, Adrianna Slotwinska 1, Anna Michniak 2, Boguslawa Orzechowska-Wylegala 1. Effects of hyperbaric oxygen therapy on periodontal disease: a literature review. Undersea Hyperb Med. 2023 First Quarter;50(1):17-27. doi: 10.22462/01.01.2023.17.

Background and objective: Hyperbaric oxygen (HBO2) has been the subject of research in many areas of dentistry. HBO2 seems to be a useable, additional treatment method. However, there are still no certain conclusions and clear guidelines for procedures. The aim of the study was to collect current literature assessing the use of hyperbaric oxygen therapy in the treatment of periodontitis. Materials and methods: The following review was performed using medical databases Medline via PubMed and Google Scholar. The review presents articles which assess the effect of hyperbaric oxygen therapy in combination with non-surgical scaling and root planing (SRP) in patients with periodontitis as an adjunctive method to standard protocols. Results: There are potentially plausible mechanisms by which HBO2 could be beneficial. Further well-designed science research and clinical trials are needed. Due to a small body of literature, differences in methodology and observation periods the data are not sufficient for statistical analysis. Conclusion: The use of HBO_2 seems to be reasonable as an adjunct method of the periodontitis treatment. However, authors of this literature review could not unambiguously state that hyperbaric oxygen therapy could be commonly recommended as a potential method of periodontitis treatment. It is essential to develop consistent protocols for the procedure and further research in this area.

Lundell R, Järvinen V, Mäkitalo H, Parkkola K, Wuorimaa T. Changes in cardiac function in Navy divers during four days of successive dives in very cold diving conditions. Clin Physiol Funct Imaging. 2023 Feb 9. doi: 10.1111/cpf.12814. Online ahead of print.

Introduction and methods: There is limited knowledge of cumulative effect of repetitive cold-water diving on cardiac function. Single cold dives cause some known cardiological risks, such as malign arrhythmia, due to a concurrent activation of the sympathetic and parasympathetic autonomic nervous system. A previous study from warmer water dives has shown that successive dives cause a decrease in vagal tone and a less responsive cardiovascular system. The aim of this study was to evaluate changes in cardiac function with 2D echocardiography during 4 days of diving in near-freezing water. Results: Left ventricle systolic function measures did not show any uniform changes. E/A ratio seemed to decrease successively with the number of dives. The diastolic tissue velocity of relaxing basal septum (e') showed a decreasing trend as well. Diastolic blood pressure seemed to increase from predive (mean: 83 RR mmHg) to postdive values (mean: 87 RR mmHg) (p=NS). Heart rate decreased significantly from predive (mean: 71 bpm, range: 56-103) to postdive values (mean: 60 bpm, range: 37-88) ($p<0.03$). Discussion and conclusions: The study was conducted in very cold condition and with limited number of divers. Results of this preliminary study suggested a decreasing trend in left ventricular diastolic function in successive cold dives. Cumulative changes in cardiac function may cause health risks that need to be considered during cold water diving operations.

McGlynn J, Heyboer M. Successful treatment of radiation-induced vaginal soft tissue radionecrosis with HBO_2. Undersea Hyperb Med. 2023; 50(1):9-15. doi: 10.22462/01.01.2023.16.

Introduction: Radiation therapy to the pelvis can result in radiation-induced vaginal soft tissue necrosis. This significantly impacts quality of life. Studies evaluating the efficacy of HBO_2 are limited. Methods: In this retrospective report, we reviewed the medical records of patients treated with once-daily HBO_2 for radiation-induced vaginal soft tissue necrosis. We included females between the ages of 18 to 90 with history of pelvic cancer treated with radiotherapy and resultant soft tissue radionecrosis. Data collected included age, comorbid disease, cancer type, radiation dose, HBO_2 treatment pressure, time, and total treatments. Primary outcome was improvement of radionecrosis; secondary outcomes were improvement of pelvic pain, reduction in need for analgesia, and improvement of vaginal bleeding. Results: Seven patients were identified, of which six received HBO_2. One patient had a vaginal fistula. Four patients had documented improvement of radionecrosis. Four out of five patients with pelvic pain had resolution of their pain, with two patients no longer requiring opioid analgesia. Two patients who presented with vaginal bleeding showed improvement with one resolved and one significantly decreased requiring no further hospitalization or transfusion. One patient experienced no documented improvement in any of the measured outcomes. Conclusion: In this case series, five out of six (83%) patients treated with HBO_2 for radiation-induced vaginal necrosis improved in at least one outcome measure. While the sample size is small, these results add to the data available that supports the use of HBO_2 in suitable candidates without contraindications who have symptoms related to radiation-induced vaginal soft tissue necrosis.

Mulder E, Längle L, Pernett F, Bouten J, Sieber A, Schagatay E. Case studies in physiology: is blackout in breath-hold diving related to cardiac arrhythmias? J Appl Physiol (1985). 2023 Feb 24. doi: 10.1152/japplphysiol.00708.2022. Online ahead of print.

Syncope or "blackout" (BO) in breath-hold diving (freediving) is generally considered to be caused by hypoxia. However, it has been suggested that cardiac arrhythmias affecting the pumping effectivity could contribute to BO. BO is fairly common in competitive freediving, where athletes aim for maximal performance. We recorded heart rate (HR) during a static apnea (STA) competition, to reveal if arrhythmias occur. Four male freedivers with STA personal best (PB) of 349±43s, volunteered during national championships, where they performed STA floating face down in a shallow indoor pool. A non-coded Polar T31 chest strap recorded R-R intervals and a water- and pressure proof pulse oximeter arterial oxygen saturation. Three divers produced STA near their PB without problems, while one diver ended with BO at 5min17s, which was 12s beyond his PB. He was immediately brought up by safety divers and resumed breathing within 10s. All divers attained similar lowest diving HR (47±4bpm), but HR recordings displayed a different pattern for the diver ending with BO. After a short tachycardia the three successful divers developed bradycardia which became more pronounced during the second half of the apnea. The fourth diver developed pronounced bradycardia earlier, and at 2.5min into the apnea HR started alternating between approximately 50 and 140 bpm, until the diver lost consciousness. At resumed breathing, HR returned to baseline. Nadir oxygen saturation was similar for all divers. We speculate that arrhythmia could have contributed to BO, by lowering stroke volume leading to a systolic blood pressure drop, affecting brain perfusion.

Özdemir Ü, Akin M, Sözen I, Erkent M, Tatar S, Yasti AÇ. Effects of hyperbaric oxygen therapy on clinical and economic outcomes in patients with deep second-degree burns. Undersea Hyperb Med. 2023; 50(1): 29-37. doi: 10.22462/01.01.2023.18.

Introduction: Deep second-degree burn injuries are the most challenging situations for the burn surgeon in the treatment of adult cases. While waiting for spontaneous closure increases the risk of hypertrophic scar and keloid, early excision and grafting pose the risk of donor site wound and permanent color differences. Unlike many studies in the literature, the current study was planned in a way to minimize factors other than burn wounds to investigate the effect of adding hyperbaric oxygen (HBO_2) therapy to conventional treatment in deep second-degree burn wounds. Material and methods: This prospective observational study included patients with burn injuries who underwent conventional treatment alone and those who underwent conventional plus HBO_2 treatment performed by a single experienced surgeon and who met the study criteria. Results: Thirty-eight patients completed the study. Mean burned total body surface area (TBSA) was 9.22±3.43% (range 5% to 20%). There was no difference between the two groups in terms of age, burned TBSA, and burn etiology. The need for surgery and grafting was lower in patients who received HBO_2 in addition to conventional treatment ($p=0.003$ and $p=0.03$, respectively). The patients in the HBO2 group had a shorter hospital stay, and their wounds epithelialized in a shorter time ($p=0.169$ and $p<0.001$, respectively). They also had a higher satisfaction level and lower treatment cost ($p=0.03$ and $p=0.36$, respectively). Discussion: The results of this prospective study, in which co-factors were eliminated, showed that adding HBO2 to the conventional treatment of deep second-degree burns had a significant positive effect on patient outcomes, as well as reducing treatment costs.

Sharma RI, Marcinkowska AB, Mankowska ND, Waśkow M, Kot J, Winklewski PJ. Cognitive functions in scuba, technical and saturation diving. Biol (Basel). 2023; 12(2): 229. doi: 10.3390/biology12020229.

Scuba diving as a recreational activity is becoming increasingly popular. However, the safety of this activity, especially in the out-of-comfort zone, has been discussed worldwide. The latest publications bring conclusions regarding negative effects on cognitive functions. We compare the acute and chronic effects of diving on cognitive functioning depending on the type of dive performed, including recreational, technical and saturation diving. However, the results of research show that acute and chronic effects on cognitive functions can be negative. While acute effects are reversible after the ascent, chronic effects include white matter lesions in magnetic resonance imaging scans. We believe that more investigations should be performed to determine the chronic effects that could be observed after a few months of observations in a group of regular, intense divers. In addition, publications referring to technical divers are very limited, which is disquieting, as this particular group of divers seems to be neglected in research concerning the effects of diving on cognitive functions.

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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