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

E-NEWS

EDITOR'S NOTE – August 2024

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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UPCOMING EVENTS

EUBS Annual Scientific Meeting 2024

The 48th annual scientific meeting of the European Underwater and Baromedical Society will be held September 16-20 in the port city of Brest, France. Visit: https://eubs2024.sciencesconf.org

Divescapes Scuba Conference 2024

The Divescapes scuba conference and exhibition will be held October 18-19 at the Deerfoot Inn and Casino in Calgary, AB. The Alberta Underwater Council program includes international speakers, workshops, and trade show booths. Visit: https://www.divescapes.ca.

Canadian Association of Wilderness Medicine 2024

CAWM was founded in 2020 as a non-profit organization with the goal of connecting Canadian practitioners and researchers with an interest in Wilderness Medicine, and in promoting the field as an area of focus and specialization. The fifth annual conference will be held in hybrid form November 01-03 in Halifax, NS, with pre-conference courses October 30-31. Early bird registration ends August 01. Visit: https://cawm.ca/cawm2024.

DEMA Show 2024

The Diving Equipment & Marketing Association (DEMA) show will be held November 19-22 at the Las Vegas Convention Center in Las Vegas, NV. The long-standing industry event promises 500 exhibitor booths, educational seminars, and a variety of evening events. Visit: https://www.demashow.com.

RECENT PUBLICATIONS

Clarke TM, Barnett A, Fitzpatrick R, Ryan LA, Hart NS, Gauthier ARG, Scott-Holland TB, Huveneers C. Personal electric deterrents can reduce shark bites from the three species responsible for the most fatal interactions. Sci Rep. 2024 Jul 15;14(1):16307. doi: 10.1038/s41598-024-66679-6.

The frequency of unprovoked shark bites is increasing worldwide, leading to a growing pressure for mitigation measures to reduce shark-bite risk while maintaining conservation objectives. Personal shark deterrents are a promising and non-lethal strategy that can protect ocean users, but few have been independently and scientifically tested. In Australia, bull (*Carcharhinus leucas*), tiger (*Galeocerdo cuvier*), and white sharks (*Carcharodon carcharias*) are responsible for the highest number of bites and fatalities. We tested the effects of two electric deterrents (Ocean Guardian's Freedom+ Surf and Freedom7) on the behaviour of these three species. The surf product reduced the probability of bites by 54% across all three species. The diving product had a similar effect on tiger shark bites (69% reduction) but did not reduce the frequency of bites from white sharks (1% increase), likely because the electrodes were placed further away from the bait. Electric deterrents also increased the time for bites to occur, and frequency of reactions and passes for all species tested. Our findings reveal that both Freedom+ Surf and Freedom7 electric deterrents affect shark behaviour and can reduce shark-bite risk for water users, but neither product eliminated the risk of shark bites entirely. The increasing number of studies showing the ability of personal electric deterrents to reduce shark-bite risk highlights personal protection as an effective and important part of the toolbox of shark-bite mitigation measures.

Declercq L, Bouten J, Van Dyck M, Boone J, Derave W, Heyse B, Bourgois JG. A dive into the physiological responses to maximal apneas, O_2 and CO_2 tables in apnea novices. Eur J Appl Physiol. 2024 Jul 24. doi: 10.1007/s00421-024-05563-7. Online ahead of print.

Purpose: Apnea duration is dependent on three factors: oxygen storage, oxygen consumption, hypoxia and hypercapnia tolerance. While current literature focuses on maximal apneas to improve apnea duration, apnea trained individuals use timed-repeated submaximal apneas, called "O_2 and CO_2 tables". These tables claim to accommodate

the body to cope with hypoxia and hypercapnia, respectively. The aim of this study was twofold. First, to investigate the determinants of maximal apnea duration in apnea novices. Second, to compare physiologic responses to maximal apneas, O_2 and CO_2 tables. Methods: After medical screening, lung function test and hemoglobin mass measurement, twenty-eight apnea novices performed three apnea protocols in random order: maximal apneas, O_2 table and CO_2 table. During apnea, peripheral oxygen saturation (SpO_2), heart rate (HR), muscle (mTOI) and cerebral (cTOI) tissue oxygenation index were measured continuously. End-tidal carbon dioxide ($EtCO_2$) was measured before and after apneas. Results: Larger lung volumes, higher resting cTOI and lower resting $EtCO_2$ levels correlated with longer apnea durations. Maximal apneas induced greater decreases in SpO_2 (-16%) and cTOI (-13%) than O_2 (-8%; -8%) and CO_2 tables (-6%; -6%), whereas changes in $EtCO_2$, HR and mTOI did not differ between protocols. Conclusion: These results suggest that, in apnea novices, O_2 and CO_2 tables did not induce a more profound hypoxia and hypercapnia, but a similar reduction in oxygen consumption than maximal apneas. Therefore, apnea novices should mainly focus on maximal apneas to improve hypoxia and hypercapnia tolerance. The use of specific lung training protocols can help to increase oxygen storage capacity.

Feldmeier JJ, Kirby JP, Gelly HB, Robins M, Peters J, Gruhn P, Pal S. Controlled CMS data demonstrates a cost and clinical advantage for hyperbaric oxygen for radiation cystitis. Undersea Hyperb Med. 2024; 51(2): 145-57. PMID: 38985151.

Introduction: Increasing cancer survivorship, in part due to new radiation treatments, has created a larger population at risk for delayed complications of treatment. Radiation cystitis continues to occur despite targeted radiation techniques. Materials and methods: To investigate value-based care applying hyperbaric oxygen (HBO_2) to treat delayed radiation cystitis, we reviewed public-access Medicare data from 3,309 patients from Oct 1, 2014, through Dec 31, 2019. Using novel statistical modeling, we compared cost and clinical effectiveness in a hyperbaric oxygen group to a control group receiving conventional therapies. Results: Treatment in the hyperbaric group provided a 36% reduction in urinary bleeding, a 78% reduced frequency of blood transfusion for hematuria, a 31% reduction in endoscopic procedures, and fewer hospitalizations when study patients were compared to control. There was a 53% reduction in mortality and reduced unadjusted Medicare costs of $5,059 per patient within the first year after completion of HBO_2 treatment per patient. When at least 40 treatments were provided, cost savings per patient increased to $11,548 for the HBO_2 study group compared to the control group. This represents a 37% reduction in Medicare spending for the HBO_2-treated group. We also validate a dose-response curve effect with a complete course of 40 or more HBO_2 treatments having better clinical outcomes than those treated with fewer treatments. Conclusion: These data support previous studies that demonstrate clinical benefits now with cost-effectiveness when adjunctive HBO_2 treatments are added to routine interventions. The methodology provides a comparative group selected without bias. It also provides validation of statistical modeling techniques that may be valuable in future analysis, complementary to more traditional methods.

Harrison DW, Brasher PM, Eng JJ, Harris D, Hoens AM, Khazei A, Yao JK, Abu-Laban RB. Hyperbaric oxygen post established stroke. Cureus. 2024; 16(6): e63395. doi: 10.7759/cureus.63395. eCollection 2024 Jun.

Background and purpose: Hyperbaric oxygen therapy (HBOT) has been reported to improve neurological function in the chronic phase of stroke in a single trial having significant limitations, including a lack of a sham control. Methods: We conducted a single-center, parallel-group, randomized trial to determine the effectiveness of HBOT compared with a sham control in adults who were 6 to 36 months post-ischemic stroke. The treatment group received 40 sessions of HBOT at the Vancouver General Hospital Hyperbaric Unit. The control group received 40 sessions of sham treatment designed to replicate an HBOT experience. Due to recruitment challenges and timeline/feasibility tracking by the research team, the control arm was altered after 20 months to a waitlist in the hope of increasing participation. In the second phase, participants were randomized to receive HBOT immediately or following an eight-week observation period. The primary outcome was the post-treatment Stroke Impact Scale-16 (SIS-16). Secondary outcomes included the National Institute of Health Stroke Scale, Berg Balance Test, Digit Symbol Substitution Test, 5-metre Walk Test, 6-minute Walk Test, Grip Strength, Montreal Cognitive Assessment, Box/Block Test, and Center for Epidemiological Studies - Depression and Short Form-36. Based on detecting a clinically important between-group difference of 10 on the SIS-16 score, our target sample size was 68 participants per arm. Results: From January 5, 2016 to October 9, 2018, 34 participants were enrolled in the trial, 27 during the first phase and seven in the second phase. The study was stopped after 36 months, and prior to meeting the sample size target, due to low recruitment. At the end of treatment, the difference in the SIS-16 between groups was 5.5 (95% CI: 1.3 to 9.7, p=0.01) in favor of the sham group. Conclusions: Our results exclude a clinically important benefit of HBOT on the primary outcome of the SIS-16. These findings do not support the use of HBOT in chronic stroke survivors.

Kelly M, Gelly H, O'Neill O, Shapshak D. UHMS position statement: physician's duties in hyperbaric medicine - 99183. Undersea Hyperb Med. 2024; 51(2): v-viii. PMID: 38985156

Introduction: The Undersea and Hyperbaric Medical Society (UHMS) is at the forefront of advancing medical knowledge and promoting patient safety in the field of hyperbaric medicine. In the dynamic landscape of healthcare, physicians' critical role in overseeing hyperbaric oxygen treatment (HBO_2) cannot be overstated. This position statement aims to underscore the significance of physician involvement in delivering HBO_2 and articulate UHMS's commitment to maintaining the highest standards of care and safety for patients undergoing hyperbaric treatments. Abstract: Hyperbaric oxygen treatment demands a meticulous approach to patient management. As the complexity of hyperbaric patients continues to evolve, the direct oversight of qualified physicians becomes paramount to ensuring optimal patient outcomes and safeguarding against potential risks. In this statement, we outline the key reasons physician involvement is essential in every facet of HBO_2, addressing the technical intricacies of the treatment and the broader spectrum of patient care. Rationale: Physician oversight for hyperbaric oxygen treatment is rooted in the technical complexities of the treatment and the broader responsibilities associated with clinical patient care. The responsibilities outlined below delineate services intrinsic to the physician's duties for treating patients undergoing hyperbaric oxygen treatments.

Kjellberg A, Douglas J, Pawlik MT, Hassler A, Al-Ezerjawi S, Boström E, Abdel-Halim L, Liwenborg L, Jonasdottir-Njåstad AD, Kowalski J, Catrina SB, Rodriguez-Wallberg KA, Lindholm P. Five sessions of hyperbaric oxygen for critically ill patients with COVID-19-induced ARDS: a randomised, open label, phase II trial. Respir Med. 2024 Jul 24:107744. doi: 10.1016/j.rmed.2024.107744. Online ahead of print.

Background: Few treatment options exist for patients with COVID-19-induced acute respiratory distress syndrome (ARDS). Data on the benefits and harms of hyperbaric oxygen treatment (HBOT) for this condition is limited. Objective: To evaluate benefits and harms of HBOT in patients with COVID-19 induced ARDS. Methods: In this open-label trial conducted at three hospitals in Sweden and Germany, patients with moderate to severe ARDS and at least two risk factors for unfavourable outcome, were randomly assigned (1:1) to medical oxygen 100%, 2·4 atmospheres absolute (ATA), 80 minutes (HBOT) adjuvant to best practice or to best practice alone (Control). Randomisation was stratified by sex and site. The primary endpoint was ICU admission by Day 30. Results: Between June 4, 2020, and Dec 1, 2021, 34 subjects were randomised to HBOT (n=18) or Control (n=16). The trial was prematurely terminated for futility. There was no statistically significant difference in ICU admission, 5 (50%) in Control vs 13 (72%) in HBOT. OR 2·54 [95% CI 0·62-10·39], p=0·19. Harms: 102 adverse events (AEs) were recorded. 16 (94%) subjects in the HBOT group and 14 (93%) in the control group had at least one AE. Three serious adverse events (SAEs), were at least, possibly related to HBOT. All deaths were unlikely related to HBOT. Conclusions: HBOT did not reduce ICU admission or mortality in patients with COVID-19-induced ARDS. The trial cannot conclude definitive benefits or harms. Treating COVID-19-induced ARDS with HBOT is feasible with a favourable harms profile.

Lamont D, Colvin A, Heili A, Ridley T, Slocombe R, Wendling J. Advanced high pressure hyperbaric techniques in tunnelling. Undersea Hyperb Med. 2024; 51(2): 159-71. PMID: 38985152.

Work in compressed air and diving are both occupational activities that have been around since the mid-19th century, and those undertaking their work under elevated pressure. Meeting the demand to go to "higher pressure for longer" in tunneling has lagged in diving, but both activities have found it necessary to adopt mixed gas breathing and saturation exposure techniques. This paper explains how work in hyperbaric conditions at high pressure is undertaken in tunneling and is illustrated by the hyperbaric activity likely to be involved in constructing a large-diameter road tunnel below a body of water such as an estuary. It also explores the practical differences between work in compressed air and diving.

Parsons D, Utz E, Kidd G, Virgilio G. Inner ear decompression sickness after a routine dive and recompression chamber drill. Undersea Hyperb Med. 2024; 51(2): 129-35. PMID: 38985149.

Inner ear decompression sickness (IEDCS) is an uncommon diving-related injury affecting the vestibulocochlear system, with symptoms typically including vertigo, tinnitus, and hearing loss, either in isolation or combination. Classically associated with deep, mixed-gas diving, more recent case series have shown that IEDCS is indeed possible after seemingly innocuous recreational dives, and there has been one previous report of IEDCS following routine hyperbaric chamber operations. The presence of right-to-left shunt (RLS), dehydration, and increases in intrathoracic pressure have been identified as risk factors for IEDCS, and previous studies have shown a predominance of vestibular rather than cochlear symptoms, with a preference for lateralization to the right side. Most importantly, rapid identification and initiation of recompression treatment are critical to preventing long-term or permanent inner ear deficits. This case of a US Navy (USN) diver with previously unidentified RLS reemphasizes the potential for IEDCS following uncomplicated diving and recompression chamber operations - only the second reported instance of the latter.

Smolle C, Auinger D, Lindenmann J, Smolle J, Smolle-Juettner FM, Kamolz LP. Hyperbaric oxygen (HBO_2) therapy in thermal burn injury revisited. Pressure does matter. Review. Undersea Hyperb Med. 2024; 51(2): 115-27. PMID: 38985148.

For over five decades, many experimental and clinical studies have shown predominantly positive but controversial results on the efficacy of hyperbaric oxygen (HBO_2) therapy in burns. The study aimed to define a common denominator or constellations, respectively, linked to the effects of HBO_2 in burns with a special focus on dosage parameters. Based on original work since 1965, species, number of individuals, type of study, percentage of total body surface area (TBSA), region, depth of burn, causative agent, interval between burn and first HBO_2 session, pressure, duration of individual session, number of HBO_2 sessions per day, cumulative number of HBO_2 sessions and type of chamber were assessed. Out of 47 publications included, 32 were animal trials, four were trials in human volunteers, and 11 were clinical studies. They contained 94 experiments whose features were processed for statistical evaluation. 64 (67.4%) showed a positive outcome, 16 (17.9%) an ambiguous one, and 14 (14.7%) a negative outcome. The only factor independently influencing the results was pressure with ATA (atmospheres absolute) lower than 3 ATA being significantly associated with better outcomes (p=0.0005). There is a dire need for well-designed clinical studies in burn centers equipped with hyperbaric facilities to establish dedicated treatment protocols.

Yanagawa Y, Ohsaka H, Yatsu S, Suwa S. Acute aortic dissection during scuba diving. Undersea Hyperb Med. 2024; 51(2): 185-7. PMID: 38985154.

A 60-year-old man with hypertension and dyslipidemia complained of chest pain upon ascending from a maximum depth of 27 meters while diving. After reaching the shore, his chest pain persisted, and he called an ambulance. When a physician checked him on the doctor's helicopter, his electrocardiogram (ECG) was normal, and there were no bubbles in his inferior vena cava or heart on a portable ultrasound examination. The physician still suspected that he had acute coronary syndrome instead of decompression illness; therefore, he was transported to our hospital. After arrival at the hospital, standard cardiac echography showed a flap in the ascending aorta. Immediate enhanced computed tomography revealed Stanford type A aortic dissection. The patient obtained a survival outcome after emergency surgery. To our knowledge, this is the first reported case of aortic dissection potentially associated with scuba diving. It highlights the importance of considering aortic dissection in patients with sudden-onset chest pain during physical activity. In addition, this serves as a reminder that symptoms during scuba diving are not always related to decompression. This report also suggests the usefulness of on-site ultrasound for the differential diagnosis of decompression sickness from endogenous diseases that induce chest pain. Further clinical studies of this management approach are warranted.

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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