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

E-NEWS

EDITOR'S NOTE – July 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

Deep Sea Submersibles and Submergence Vehicles

Many of those involved in diving or hyperbaric medicine will be acutely aware of the June 18 accident occurring while the submersible was en route to the *Titanic* in its resting place at 3800 m (12,600 ft) in the Atlantic Ocean 690 km (370 nautical miles) south-southeast of Newfoundland. The expedition launched out of St John's, NL with the Canadian-registered m/v *Polar Prince* as support vessel, which gives Canada investigation authority in the accident inquiry:
https://www.bst-tsb.gc.ca/eng/medias-media/deploiement-deployment/marine/2023/m23a0169-20230623.html
https://globalnews.ca/news/9798445/titan-debris-canada-investigation
The following review the capabilities of established deepsea submersibles and submergence vehicles:
https://en.wikipedia.org/wiki/Deep-submergence_vehicle
https://www.youtube.com/watch?v=QKqEoTSJOtc
https://www.youtube.com/watch?v=eantS7q1pb8
https://www.whoi.edu/what-we-do/explore/underwater-vehicles/hov-alvin https://tritonsubs.com
https://en.wikipedia.org/wiki/Deepsea_Challenger
https://www.livescience.com/chinese-submarine-record-dive.html
https://www.bbc.com/news/science-environment-48230157

Publishing Diving Science Across the Spectrum

Hyperbaric medicine research publication is typically most appropriate for peer reviewed medical journals. The primary readership is the clinician using or referring patients for hyperbaric oxygen therapy. Diving medicine research has much broader application, including practicing clinicians, training organizations and other industry leaders, instructors, and divers from an array disciplines. It is for this reason that publishing across the spectrum is beneficial. Examples of recent user level publications follow:

Pollock NW. What is undeserved in "undeserved decompression sickness"? InDepth. 2023 May 31.
https://gue.com/blog/what-is-undeserved-in-undeserved-decompression-sickness

Stewart A. Has rebreather diving gotten safer? InDepth. 2023 May 10.
https://gue.com/blog/has-rebreather-diving-gotten-safer

Stewart A. Rebreather Forum 4 yields CCR market data and consensus statements. InDepth. 2023 May 10.
https://gue.com/blog/rf4-overview-rebreather-forum-4-yields-ccr-market-data-and-consensus-statements

UPCOMING EVENTS

AHDMA Annual Scientific Meeting 2023

The Asian Hyperbaric and Diving Medical Association annual scientific meeting will be held July 13-16 in Kota Kimabalu, Sabah, Malaysia. For further information visit: https://ahdma.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. 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

Aldè M, Cantarella G, Piatti G, Ambrosetti U. Sudden hearing loss and early hyperbaric oxygen therapy: A preliminary study. Undersea Hyperb Med. 2023; 50(2): 145-53.

Purpose: Sudden sensorineural hearing loss (SSNHL) is a time-sensitive urgent condition. The aim of this study was to evaluate the frequency of hearing improvement in patients with idiopathic SSNHL who only received hyperbaric oxygen (HBO_2) therapy within three days of symptom onset, instead of conventional corticosteroid treatment. Methods: The medical charts of patients who experienced SSNHL between January 1, 2012, and December 31, 2021, were reviewed. The present study included all adult patients who were diagnosed with idiopathic SSNHL and started HBO2 therapy within 72 hours of symptom onset. These subjects did not take corticosteroids due to contraindications or because they were concerned about possible side effects. The HBO_2 therapy protocol consisted of at least 10 sessions of 85 minutes each with pure oxygen inhalation at 2.5 atmospheres absolute pressure. Results: Overall, 49 subjects (26 males and 23 females) met the inclusion criteria, with a mean age of 47 (±20.4) years. The mean initial hearing threshold was 69.8 dB (±18.0). After HBO2 therapy, complete hearing recovery was observed in 35 patients (71.4%), and the mean hearing threshold improved significantly ($p<0.001$) to 31.4 dB (±24.5). In patients with complete hearing recovery, no significant differences were found between males and females ($p=0.79$), right and left ears ($p=0.72$) or initial grades of hearing loss ($p=0.90$). Conclusion: This study suggests that, in the absence of the confounding effect of concurrent steroid therapy, starting HBO_2 therapy within three days of symptom onset could have a positive impact on patients with idiopathic SSNHL.

Castagna O, Druelle A, Michoud G, Prevautel T, Lacour JR. Individual changes in respiratory compliance upon immersion may predict susceptibility to immersion pulmonary edema. Sports Med Open. 2023 Jun 1; 9(1):39. doi: 10.1186/s40798-023-00590-8.

Background: Immersion pulmonary edema (IPE) is a frequent diving accident, and it is the primary cause of hospitalization for young military divers during training. The objective of this study was to identify immersion-induced parameters predicting individual susceptibility to IPE. Methods: Eighteen experienced male divers having completed at least 100 dives were recruited. Eight divers had previously been hospitalized for IPE (IPE), and the other ten had never developed IPE (non-IPE). The two groups were matched for age, BMI, and number of dives performed. Ventilatory function and overall compliance of the respiratory system (Crs) were measured on land and during head-out-of-water immersion. Subjects also performed 30 min of fin swimming in a channel at 33 m min^{-1}. Following this exercise, the presence of extravascular lung water, revealed by ultrasound lung comets (ULC), was assessed. Results: In the whole group, the decrease in Crs upon immersion correlated with the immersion-induced alterations to expiratory reserve volume, ERV ($r^2=0.91$; $p<0.001$), inspiratory reserve volume, IRV ($r^2=0.94$; $p<0.001$), and tidal volume, Vt, changes ($r^2=0.43$; $p<0.003$). The number of ULC correlated strongly with immersion-induced changes in ventilatory function ($r2=0.818$; $p<0.001$ for ERV, $r^2=0.849$; $p<0.001$ for IRV, $r^2=0.304$; $p=0.0164$ for Vt) and reduced Crs ($r^2=0.19$; $p<0.001$). The variations of ERV, IRV, and Crs at rest induced by head-out-of-water immersion and the number of ULC measured after swimming for 30 min were significantly greater in IPE subjects. Conclusion: In the face of similar immersion stresses, the extent of alterations to ventilatory function and the number of ULCs were very different between individuals but remained statistically correlated. These parameters were significantly greater in divers with a history of IPE. Alterations to pulmonary function and, in particular, to pulmonary compliance induced by head-out-of-water immersion, through their effects on work of breathing appear to allow the identification of divers with a greater susceptibility to developing IPE. Measurement of these parameters could therefore be proposed as a predictive test for the risk of developing IPE.

Kaur H, Kochhar GS, Dulai PS. Role of hyperbaric oxygen therapy in patients with inflammatory bowel disease. Curr Opin Gastroenterol. 2023 May 31. doi: 10.1097/MOG.0000000000000952. Online ahead of print.

Purpose of review: Hypoxia is a known contributor to inflammation in inflammatory bowel diseases (IBD), and a growing interest has emerged in pharmacologically targeting hypoxia response pathways to treat IBD. The most basic form of treatment for hypoxia is delivering higher amounts of oxygen to the intestinal mucosa. In this review, we summarize the evidence in support of hyperbaric oxygen therapy (HBOT), a mechanism to deliver high amounts of oxygen to tissue, for treating IBD. Recent findings: Two phase 2 clinical trials in hospitalized ulcerative colitis patients suffering from moderate-to-severe flares have demonstrated that HBOT improves responsiveness to steroids and avoidance of rescue medical and surgical therapy. Outpatient cohort studies in perianal fistulizing Crohn's disease and fistulizing complications of the pouch have demonstrated improved healing, particularly for complex fistulae. Several systematic reviews have now been completed, and HBOT has been observed to be well tolerated with low rates of adverse events. Summary: HBOT may be considered as an adjunctive treatment for hospitalized ulcerative colitis flares and Crohn's disease-related fistulae. Higher quality trials are needed to confirm efficacy.

Kelly KR, Palombo LJ, Jensen AE, Bernards JR. Efficacy of closed cell wet-suit at various depths and gas mixtures for thermoprotection during military training dives. Front Physiol. 2023 May 24;14:1165196. doi: 10.3389/fphys.2023.1165196. eCollection 2023.

Purpose: To evaluate a closed-cell wet-suit for thermal protective capability during extreme cold water exposure at various depths. Methods: Thirteen (n = 13) elite military divers who were tasked with cold-water training, participated in this study. To mimic various depths, the Ocean Simulation Facility (OSF) at the Navy Experimental Diving Unit (NEDU) was pressurized to simulate dive depths of 30, 50, and 75fsw. Water temperature remained at 1.8-2.0°C for all dives. Four divers dove each day and used the MK16 underwater breathing apparatus with gas mixes of either N_2O_2 (79:21) or HeO_2 (88:12). Mean skin temperature (TSK) (Ramanathan, 1964), core temperature (Tc), hand and foot readings were obtained every 30 min for 30 and 50 fsw and every 15 min during the 75 fsw dive. Results: TC was significantly reduced across all dives ($p=0.004$); however, was preserved above the threshold for hypothermia (post-dive Tc = 36.5±0.4). There was no effect of gas mix on TC. TSK significantly decreased ($p<0.001$) across all dives independent of depth and gas. Hand and foot temperatures resulted in the termination of three of the dives. There were no significant main effects for depth or gas, but there were significant main effects for time on hand temperature ($p<0.001$) and foot temperature ($p<0.001$). Conclusion: Core temperature is maintained above threshold for hypothermia. Variations in Tc and TSK are a function of dive duration independent of depth or gas for a closed-cell wet-suit in cold water at various depths. However, both hand and foot temperatures reached values at which dexterity is compromised.

Lippmann J, Lawrence C, Fock A. Compressed gas diving fatalities in Australian waters 2014 to 2018. Diving Hyperb Med. 2023 Jun 30;53(2):76-84. doi: 10.28920/dhm53.2.76-84.

Introduction: This study aimed to investigate compressed gas diving deaths in Australia from 2014-2018 and make comparison to those from 2001-2013 to identify ongoing problems and assess countermeasures. Methods: Media reports and the National Coronial Information System were searched to identify scuba diving deaths for 2014-2018, inclusive. Data were extracted from the witness and police reports, medical histories, and autopsies. An Excel® database was created and a chain of events analysis conducted. Comparisons were made with the earlier report. Results: Forty-two fatalities were identified, 38 using scuba and four using surface-supplied breathing apparatus involving 30 males and 12 females. The mean age of victims was 49.7 years, six years higher than the previous cohort. Fifty-four percent were obese. Six victims were unqualified, three were under instruction and at least 28 were experienced divers, significantly more than in the previous cohort. Health-related predisposing factors, predominantly obesity and cardiac-related, were identified as likely contributory to 26 incidents, and planning shortcomings to at least 22 deaths. One-third of the disabling conditions were primary drowning and one-quarter were cardiac. Three divers died subsequent to carbon monoxide poisoning and three likely from immersion pulmonary oedema. Conclusions: Advancing age, obesity and the associated cardiac disease have become increasingly prevalent in diving fatalities and the need for appropriate assessment of fitness to dive is evident.

Mitchell SJ, Pollock NW. Rebreather Forum Four consensus statements. Diving Hyperb Med. 2023 Jun 30;53(2):142-6. doi: 10.28920/dhm53.2.142-146.

Closed circuit rebreathers have been widely adopted by technical divers as tools for reducing gas consumption and extending depth and duration capabilities. Rebreathers are technologically complex with many failure points, and their use appears associated with a higher accident rate than open circuit scuba. Rebreather Forum Four (RF4) was held in Malta in April 2023 attracting approximately 300 attendees and representatives of multiple manufacturers and training agencies. Over two and a half days a series of lectures was given by influential divers, engineers, researchers and educators on topics of contemporary relevance to rebreather diving safety. Each lecture was followed by a discussion session with audience participation. Potential consensus statements were drafted by the authors (SJM and NWP) during the course of the meeting. These were worded to be confluent with some important messages emerging from the presentations and subsequent discussions. The statements were presented one by one in a half-day plenary session of participants, and discussion was invited on each. After discussion and any necessary revision, the participants voted on whether to adopt the statement as a position of the forum. A clear majority was required for acceptance. Twenty-eight statements embracing thematic areas designated 'safety', 'research', 'operational issues', 'education and training', and 'engineering' were adopted. Those statements are presented along with contextualising narrative where necessary. The statements may help shape research and teaching initiatives, and research and development strategies over subsequent years.

Mulder E, Staunton C, Sieber A, Schagatay E. Unlocking the depths: multiple factors contribute to risk for hypoxic blackout during deep freediving. Eur J Appl Physiol. 2023 Jun 10. doi: 10.1007/s00421-023-05250-z. Online ahead of print.

Purpose: To examine the effect of freediving depth on risk for hypoxic blackout by recording arterial oxygen saturation (S_pO_2) and heart rate (HR) during deep and shallow dives in the sea. Methods: Fourteen competitive

freedivers conducted open-water training dives wearing a water-/pressure proof pulse oximeter continuously recording HR and S_pO_2. Dives were divided into deep (>35 m) and shallow (10-25 m) post-hoc and data from one deep and one shallow dive from 10 divers were compared. Results: Mean±SD depth was 53±14 m for deep and 17±4 m for shallow dives. Respective dive durations (120±18 s and 116±43 s) did not differ. Deep dives resulted in lower minimum S_pO_2 (58±17%) compared with shallow dives (74±17%; P=0.029). Overall diving HR was 7 bpm higher in deep dives (P=0.002) although minimum HR was similar in both types of dives (39 bpm). Three divers desaturated early at depth, of which two exhibited severe hypoxia ($S_pO_2 \leq 65\%$) upon resurfacing. Additionally, four divers developed severe hypoxia after dives. Conclusions: Despite similar dive durations, oxygen desaturation was greater during deep dives, confirming increased risk of hypoxic blackout with increased depth. In addition to the rapid drop in alveolar pressure and oxygen uptake during ascent, several other risk factors associated with deep freediving were identified, including higher swimming effort and oxygen consumption, a compromised diving response, an autonomic conflict possibly causing arrhythmias, and compromised oxygen uptake at depth by lung compression possibly leading to atelectasis or pulmonary edema in some individuals. Individuals with elevated risk could likely be identified using wearable technology.

Schaap JP, Zuluaga Fernandez ME, Houtkooper A, Endert EL, van Ooij PAM. How fit are military hyperbaric personnel after an asymptomatic or mild symptomatic COVID-19 infection? A retrospective study. Diving Hyperb Med. 2023 Jun 30;53(2):120-8. doi: 10.28920/dhm53.2.120-128.

Introduction: In the diving community there is a special need to know if asymptomatic or mild COVID-19 disease impacts the cardiopulmonary functioning of individuals with occupational exposure to extreme environments. To date, no controlled studies have been conducted comparing COVID-19-infected hyperbaric employees and non-COVID-19-infected peers in a military setting. Methods: Between June 2020 and June 2021, healthy, hyperbaric, military personnel aged between 18 and 54 years old, who had recovered from asymptomatic or subclinical COVID-19 disease at least one month earlier, were analysed. Non-COVID-infected peers with medical assessments during the same period were used as the control group. Somatometry, spirometry, $VO_{2\ max}$, and DL_{CO} were measured for each group. Results: No clinically relevant differences in somatometry, lung function tests, and exercise testing were found between the COVID-19 group and the controls. However, the percentage of individuals with a decrease in estimated $VO_{2\ max}$ of 10% or more was significantly greater in the COVID group than in the control group (24 vs. 7.8%, P=0.004). Conclusions: After asymptomatic or mild symptomatic COVID-19 infections, military hyperbaric employees are as fit as those who had not encountered COVID-19. As this research was based on a military population, it cannot be extrapolated to a nonmilitary population. Further studies in nonmilitary populations are necessary to determine the medical relevance of the present findings.

Siglioccolo A, Gammaldi R, Vicinanza V, Galardo A, Caterino V, Palmese S, Ferraiuoli C, Calicchio A, Romanelli A. Advance in hyperbaric oxygen therapy in spinal cord injury. Chin J Traumatol. 2023 May 12;S1008-1275(23)00044-5. doi: 10.1016/j.cjtee.2023.05.002. Online ahead of print.

Spinal cord injury (SCI) is a severe lesion comporting various motor, sensory and sphincter dysfunctions, abnormal muscle tone and pathological reflex, resulting in a severe and permanent lifetime disability. The primary injury is the immediate effect of trauma and includes compression, contusion, and shear injury to the spinal cord. A secondary and progressive injury usually follows, beginning within minutes and evolving over several hours after the first ones. Because ischemia is one of the most important mechanisms involved in secondary injury, a treatment to increase the oxygen tension of the injured site, such as hyperbaric oxygen therapy, should theoretically help recovery. Although a meta-analysis concluded that hyperbaric oxygen therapy might be helpful for clinical treatment as a safe, promising and effective choice to limit secondary injury when appropriately started, useful and well-defined protocols/guidelines still need to be created, and its application is influenced by local/national practice. The topic is not a secondary issue because a well-designed randomized controlled trial requires a proper sample size to demonstrate the clinical efficacy of a treatment, and the absence of a common practice guideline represents a limit for results generalization. This narrative review aims to reassemble the evidence on hyperbaric oxygen therapy to treat SCI, focusing on adopted protocols in the studies and underlining the critical issues. Furthermore, we tried to elaborate on a protocol with a flowchart for an evidence-based hyperbaric oxygen therapy treatment. In conclusion, a rationale and shared protocol to standardize as much as possible is needed for the population to be studied, the treatment to be adopted, and the outcomes to be evaluated. Further studies, above all, well-designed randomized controlled trials, are needed to clarify the role of hyperbaric oxygen therapy as a strategic tool to prevent/reduce secondary injury in SCI and evaluate its effectiveness based on an evidence-based treatment protocol. We hope that adopting the proposed protocol can reduce the risk of bias and drive future studies.

Talbot Z, Lee A, Boet S. Hyperbaric medicine in Canadian undergraduate medical school curriculum. Diving Hyperb Med. 2023 Jun 30;53(2):138-141. doi: 10.28920/dhm53.2.138-141.

Introduction: Hyperbaric oxygen treatment (HBOT) has 14 approved indications in the management of acute and chronic diseases in various medical specialties. However, lack of physician knowledge and exposure to hyperbaric medicine may hinder the ability of patients to access this treatment option for approved indications. We aimed to determine the prevalence and nature of HBOT-related learning objectives in Canadian undergraduate medical education programs. Methods: Pre-clerkship and clerkship learning objectives from responding Canadian medical schools' curricula were reviewed. These were acquired through the school websites or by emailing the faculties. Descriptive statistics were used to summarise the number of hyperbaric medicine objectives taught in Canadian medical schools, and within each institution. Results: Learning objectives from 7 of the 17 Canadian medical schools were received and reviewed. From the curriculum of the responding schools, only one objective was found to be related to hyperbaric medicine. Hyperbaric medicine was absent from the other six schools' objectives. Conclusions: Based on the responding Canadian medical schools, hyperbaric medicine objectives were mostly absent from undergraduate medical curricula. These findings illustrate a possible gap in HBOT education and the need for discussion regarding the design and implementation of HBOT educational initiatives in medical training.

Tetzlaff K. Pulmonary physiology and medicine of diving. Semin Respir Crit Care Med. 2023 Jun 27. doi: 10.1055/s-0043-1770065. Online ahead of print.

Pulmonary physiology is significantly altered during underwater exposure, as immersion of the body and increased ambient pressure elicit profound effects on both the cardiovascular and respiratory systems. Thoracic blood pooling, increased breathing gas pressures, and variations in gas volumes alongside ambient pressure changes put the heart and lungs under stress. Normal physiologic function and fitness of the cardiovascular and respiratory systems are prerequisites to safely cope with the challenges of the underwater environment when freediving, or diving with underwater breathing apparatus. Few physicians are trained to understand the physiology and medicine of diving and how to recognize or manage diving injuries. This article provides an overview of the physiologic challenges to the respiratory system during diving, with or without breathing apparatus, and outlines possible health risks and hazards unique to the underwater environment. The underlying pathologic mechanisms of dive-related injuries are reviewed, with an emphasis on pulmonary physiology and pathophysiology.

Tucker A, Smart D. Technical validation of the EMMA capnometer under hyperbaric conditions. Diving Hyperb Med. 2023 Jun 30;53(2):100-10. doi: 10.28920/dhm53.2.100-110.

Introduction: End-tidal carbon dioxide ($ETCO_2$) monitoring is essential for monitoring intubated critical care patients, yet its use in hyperbaric environments can be problematic. We postulated that the EMMA mainstream capnometer may function accurately under hyperbaric conditions. Methods: Stage 1. The EMMA mainstream capnometer was tested at 101 kPa against a reference side-stream capnometer, Philips IntelliVue M3015B microstream, using 10 customised reference gases of various carbon dioxide (CO_2) concentrations (2.47%-8.09%, or 18.5-60.7 mmHg at 101 kPa) in either air or oxygen. Stage 2. The functionality and accuracy of the EMMA capnometer was tested under hyperbaric conditions, 121-281 kPa, using the same test gases. Results: At 101 kPa, the EMMA capnometer measured CO_2 at levels lower than expected (mean of differences = -2.5 mmHg (95% CI -2.1 to -2.9, $P<0.001$)). The Philips capnometer measured CO_2 more closely to expected CO_2 (mean of differences = -1.1 mmHg (95% CI -0.69 to -1.4, $P<0.001$). Both devices demonstrated a significant linear relationship with expected CO_2. The EMMA capnometer functioned up to the maximum test pressure (281 kPa). The device over-read CO_2 measurements at pressures >141 kPa. Although variance increased at pressures in the therapeutic range for hyperbaric treatments, a significant linear relationship between expected and EMMA measured CO_2 was demonstrated. The EMMA capnometer tolerated pressures to 281 kPa, but its display was limited to CO_2 <99 mmHg. Conclusions: This study validated EMMA capnometer function to 281 kPa in the hyperbaric environment. The device over-read CO_2 measurements at pressures >141 kPa, however there was a linear relationship between expected and measured CO_2. The EMMA capnometer may be clinically useful for monitoring expired CO_2 in patients undergoing hyperbaric oxygen treatment.

Wang C, Xue L, Yu Q, Liu Y, Ren Z, Liu Y. Evaluation of a new hyperbaric oxygen ventilator during volume-controlled ventilation. Diving Hyperb Med. 2023 Jun 30;53(2):129-37. doi: 10.28920/dhm53.2.129-137.

Introduction: The performance of the Shangrila590 hyperbaric ventilator (Beijing Aeonmed Company, Beijing, China) was evaluated during volume-controlled ventilation. Methods: Experiments were conducted in a multiplace hyperbaric chamber at 101, 152, 203, and 284 kPa (1.0, 1.5, 2.0 and 2.8 atmospheres absolute [atm abs]). With the ventilator in volume control ventilation (VCV) mode and connected to a test lung, comparison was made of the set tidal volume (VT_{set}) versus delivered tidal volume (VT) and minute volume (MV) at VT_{set} between 400 and 1000 mL. Peak inspiratory pressure was also

recorded. All measurements were made across 20 respiratory cycles. Results: Across all ambient pressures and ventilator settings the difference between VT_{set} and actual VT and between predicted MV and actual MV were small and clinically insignificant despite reaching statistical significance. Predictably, Ppeak increased at higher ambient pressures. With VT_{set} 1000 mL at 2.8 atm abs the ventilator produced significantly greater VT, MV and P_{peak}. Conclusions: This new ventilator designed for use in hyperbaric environments performs well. It provides relatively stable VT and MV during VCV with VT_{set} from 400 mL to 800 mL at ambient pressures from 1.0 to 2.8 atm abs, as well as VT_{set} 1000 mL at ambient pressures from 1.0 to 2.0 atm abs.

Zhang Y, Zhou Y, Jia Y, Wang T, Meng D. Adverse effects of hyperbaric oxygen therapy: a systematic review and meta-analysis. Front Med (Lausanne). 2023 May 18;10:1160774. doi: 10.3389/fmed.2023.1160774. eCollection 2023.

Introduction: Hyperbaric oxygen therapy (HBOT) is one of the common clinical treatments, but adverse effects have hampered and limited the clinical application and promotion of hyperbaric oxygen therapy. A systematic review and meta-analysis of the adverse effects of hyperbaric oxygen therapy have conducted by our group to provide a theoretical basis for clinical treatment. Methods: Three electronic databases (PubMed, Web of Science, and The Cochrane Library) were comprehensively searched for randomized clinical trials (RCTs) from March 2012 to October 2022. Two reviewers independently screened titles and abstracts for eligibility and assessed the quality of the included studies. The meta-analysis was performed using RevMan 5.3. Results: A total of 24 RCTs involving 1,497 participants were identified. ① The HBOT group reported more adverse effects (30.11% vs. 10.43%, $p<0.05$). ② The most frequent side effect of HBOT is ear discomfort (113 cases). ③ When the course of hyperbaric oxygen was >10 sessions, the incidence of adverse effects was higher than that of the control group; when the course of HBOT was ≤10 sessions, the adverse effects caused by hyperbaric oxygen were comparatively lower. ④ When the chamber pressure is above 2.0 ATA, the incidence of adverse effects is higher than that of the control group. While the chamber pressure is lower than 2.0 ATA, HBOT is relatively safe compared with the previous one. Conclusion: HBOT is more likely to cause adverse reactions when the chamber pressure is above 2.0 ATA. More attention should be paid to the possible occurrence of related adverse effects if the treatment course is >10 sessions. Systematic review registration: https://www.crd.york.ac.uk/PROSPERO/, identifier CRD42022316605.

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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