

# E-NEWS

## EDITOR'S NOTE – December 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](mailto:info@cuhma.ca).

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## NEWS/ANNOUNCEMENTS

### CUHMA Board of Directors Elections

The nomination period for the board of directors election is open through December 11 (0800 Eastern time). Please send nominations (of other or self) to [info@cuhma.ca](mailto:info@cuhma.ca). Voting in the online election will run from December 27 (0800 Eastern time) through December 29 (2359 Eastern time). Open positions include President-Elect, Vice-President, Secretary, Treasurer, and Director-at-Large. Further details will be shared in a separate communication.

## UPCOMING EVENTS

### Boston Sea Rovers 2025

The 71<sup>st</sup> international ocean symposium and film festival will be held March 15-17 at the DoubleTree by Hilton-Boston North Shore in Danvers, MA. For more information: <https://bostonsearovers.com>.

### AAUS Diving for Science Symposium 2025

The American Academy of Underwater Science Diving for Science symposium will be held March 23-29 in Seattle, WA. The event will be hosted by the University of Washington, the National Oceanic and Atmospheric Administration, and the Seattle Aquarium. Visit: <https://aaus.org/annualsymposium>.

### Canadian Underwater Conference 2025

The Diver Certification Board of Canada (DCBC) will hold the 13<sup>th</sup> Canadian Underwater Conference & Exhibition

March 30-April 01 at the Executive Hotel Vancouver Airport in Richmond, BC. For more information, visit: <https://www.underwaterconference.ca>.

### UMC Introductory Diving Medicine Course

Undersea Medicine Canada is offering a Level 1 'Introductory Course in Diving Medicine - Fitness to Dive' May 12-16 at the Atlantic Commercial Diving Centre in Summerside, PEI. An optional half-day pre-course will be held on May 11 for those wanting additional preparation for the program. Visit: <https://underseamedicine.ca> or contact Dr. Debbie Pestell at [drdebl@ns.sympatico.ca](mailto:drdebl@ns.sympatico.ca) or 902-225-8214 for more information.

### AsMA/UHMS Joint Scientific Meeting 2025

The joint scientific meeting of the Aerospace Medical Association and the Undersea and Hyperbaric Medical Association will be held June 01-06 at the Hyatt Regency Hotel in Atlanta, GA. For more information, visit: <https://www.asma.org/scientific-meetings/asma-annual-scientific-meeting/2025-asma-uhms-annual-scientific-meeting>.

### EUBS Annual Scientific Meeting 2025

The annual scientific meeting of the European Underwater and Baromedical Society will be held September 02-06 in Helsinki, Finland. Information will be posted on the dedicated conference website: [www.eubs2025.com](http://www.eubs2025.com).

## RECENT PUBLICATIONS

**Akai R, Ishida M, Ueda-Consolvo T, Hayashi A. Comparative efficacy of conservative, hyperbaric oxygen, and endovascular retinal surgery approaches in central retinal artery occlusion. Int Ophthalmol. 2024 Nov 9;44(1):419. doi: 10.1007/s10792-024-03335-y.**

Purpose: To assess and compare the efficacy of three treatment modalities for central retinal artery occlusion (CRAO): conservative therapy, hyperbaric oxygen therapy (HBOT), and endovascular retinal surgery (ERS). Patients and methods: We retrospectively analyzed the cases of CRAO patients treated at the Toyama University Hospital. Their age range was 44-87 years; a balanced gender distribution was observed. The conservative therapy group included 13 eyes (6 males, 7 females, average age 74 years). HBOT group: 11 eyes from 10 patients (5 males, 5

females, average age 70 years). ERS group: 10 eyes (7 males, 3 females, average age 74 years). The treatments were as follows. Conservative group: ocular massage and sublingual nitroglycerin. HBOT: 60-min sessions at 2 atmospheres. ERS: vitrectomy followed by tissue plasminogen activator injection using a 47-ga. microneedle. Visual acuity was assessed using logMAR units, with statistical analyses by paired t-test, Kruskal-Wallis test, and Mann-Whitney U-test with Bonferroni correction. Results: The conservative group showed a slight visual acuity change from  $1.96\pm 0.53$  to  $1.88\pm 0.56$  ( $p=0.56$ ). The HBOT group exhibited a significant improvement from  $1.79\pm 0.80$  to  $1.28\pm 0.81$  ( $p=0.007$ ). The ERS group displayed the most substantial improvement, with scores moving from  $1.98\pm 0.36$  to  $0.68\pm 0.49$  ( $p=0.0000413$ ). The ERS group's outcomes were significantly superior to those of the other groups. Conclusion: These results suggest that while conservative treatment may not be sufficient, both HBOT and endovascular retinal surgery show promise, with the latter demonstrating the most significant improvement.

**Brekke FB, von der Lippe N, Røed I, Gudmundsdottir H, Braaten M, Nordheim E. Hyperbaric oxygen treatment in addition to conventional multidisciplinary care in patients with calciphylaxis. Clin Nephrol. 2024 Nov 20. doi: 10.5414/CN111423. Online ahead of print.**

Background: Calciphylaxis is a rare and serious complication in patients with kidney disease. It has few treatment options and poor prognosis. Hyperbaric oxygen therapy (HBOT) may improve wound healing and was added to our conventional care in 2012. Materials and methods: Data from all calciphylaxis patients treated from 2012 to 2022 were retrieved from hospital records. HBOT was added to our multidisciplinary care of calciphylaxis, which included sodium-thiosulphate, dialysis if indicated, medical optimization of calcium-phosphate homeostasis, substitution of vitamin K2, withdrawal of warfarin, iron and vitamin D, and minimization of systemic steroids. In addition, weight- and nutritional status was optimized, and wound care was thoroughly performed. Results: 25 patients received a total number of 1,493 HBOT treatments in addition to conventional care in the study period. Median HBOT per patient was 45 (range 1 - 267). One year after diagnosis, 18 out of 25 patients were alive. 15 out of the 18 patients alive 1 year after diagnosis had completely resolved wound lesions. Seven patients died within the first year after diagnosis due to cardiovascular disease ( $n=3$ ), infection ( $n=3$ ), and cancer ( $n=1$ ). Conclusion: Our results suggest that HBOT is well-tolerated and may be associated with beneficial effects on survival and wound-healing when combined with multidisciplinary care.

**Demir N, Kayhan B, Acar M, Sevincli S, Sonmez M. Retinal layer and choroidal changes in deep and scuba divers: evidence of pachychoroid spectrum-like findings.**

**J Ophthalmol. 2024 Nov 15:2024:1600148. doi: 10.1155/2024/1600148. eCollection 2024.**

Purpose: Diving is an intense physical activity under hyperbaric and hyperoxic conditions. The aim of this study is to evaluate the long-term effects of diving on the thicknesses of retinal layers and retinal anatomy in professional deep and scuba divers. Methods: The study included 52 eyes of deep divers who dive to depths of more than 130 feet (ft), 49 eyes of scuba divers who dive up to 130 ft, and 66 eyes of the control group, consisting of nondiving but regularly exercising males. Measurements of macular retinal layer thicknesses, peripapillary nerve fiber layer thickness, subfoveal choroidal thickness, and peripheral retinal examinations with scleral indentation were performed and statistically compared between the groups. Results: The mean diving duration was  $455.00\pm 318.88$  h in deep divers and  $451.67\pm 281.10$  h in scuba divers. The retinal pigment epithelium (RPE) was statistically significantly thicker in deep divers than in scuba divers and the control group on the 3 mm ring of the Early Treatment Diabetic Retinopathy Study grid. Subfoveal choroidal thickness was significantly thicker in deep divers than in scuba divers ( $p<0.05$ ). RPE abnormalities showed a significant increase in both the deep and scuba diver groups ( $p=0.01$ ). Conclusion: An increased thickening of the subfoveal choroid and RPE, resembling pachychoroid pigment epitheliopathy, was detected in deep divers over a long-term duration.

**Hubbard CD, Cross TJ, Merdich GZ, Vrdoliak D, Foretic N, Dujic Ž, Duke JW. Respiratory system responses to a maximal apnoea. Exp Physiol. 2024 Nov 21. doi: 10.1113/EP091346. Online ahead of print.**

A maximal apnoea provides significant challenges to one's physiological systems, including significantly altered arterial blood gases, and requires a highly integrative response from multiple systems, that is, changes in blood pressure, maintenance of cerebral blood flow, etc. Previous work and reviews have focused on the cardiovascular responses to a maximal apnoea, but very little work has focused upon the responses of the respiratory muscles and respiratory mechanics. This is important because of the changes to arterial blood gases leading to an increased drive to breathe and the appearance of involuntary respiratory muscle contractions. This review outlines what is known about how the respiratory system responds to a maximal apnoea. We put forth the hypothesis that the respiratory muscles may become fatigued following a maximal apnoea and that the respiratory muscles of elite divers may be more fatigue-resistant, which could be an important feature of these individuals which allows them to be successful in this sport. Finally, we provide direction for future work to explore the long-term health of apnoea diving.

**Imtiyaz Z, O'Neill OJ, Sward D, Le PJ, Arya AK, Bhopale VM, Bhat AR, Thom SR. Influence of exposure duration on human pressure-induced inflammatory responses: Comparison between tunnel workers and underwater divers. *Physiol Rep.* 2024 Nov;12(22):e70130. doi: 10.14814/phy2.70130.**

Information is scarce on human responses to high pressure exposures out of water, such as related to tunnel construction workers. We hypothesized that differences in the longer durations of exposures for tunnel workers versus underwater divers results in greater inflammatory responses linked to the pathophysiology of decompression sickness (DCS). Blood was analyzed from 15 tunnel workers (36.1±10.5 (SD) years old, 6 women) exposed to 142-156 kPa pressure for 4.1-4.9 h compared to 8 SCUBA divers (39.3±13.3 (SD) years old, 6 women) exposed to 149 kPa for 0.61 hours. Despite differences in pressure duration between groups, elevations were the same for blood microparticles (MPs) (128±28% MPs/μl) and intra-MPs interleukin (IL-1β) (376±212% pg/million MPs), and for decreases of plasma gelsolin (pGSN, 31±27% μg/mL). The number of circulating CD66b + neutrophils and evidence of cell activation, insignificant for divers, increased in tunnel workers. Across 3 exposures, the mean neutrophil count increased 150±11%. Neutrophil activation increased by 1 to 2% of cells expressing cell surface CD18, myeloperoxidase, platelet-specific CD41, and decrease of cell bound pGSN. We conclude that MPs elevations occur rapidly in humans and reach steady state in minutes with pressure exposures and neutrophil activation requires significantly longer exposure times.

**Michalica T, Březina J, Polach M, Born DP, Mališ J, Svozil Z, Kociánová E. Changes in race performance during the underwater phases of a 200 m bi-fins race simulation after application of respiratory muscle training - a case study in the current world record holder. *Sports (Basel).* 2024 Nov 12;12(11):306. doi: 10.3390/sports12110306.**

Maximal athletic performance can be limited by various factors, including restricted respiratory function. These limitations can be mitigated through targeted respiratory muscle training, as supported by numerous studies. However, the full potential of respiratory training in competitive finswimming has not been fully investigated. This case study aims to evaluate the effects of eight-week respiratory muscle training (RMT) on performance variability during the underwater phases of a 200 m bi-fins race simulation in an elite finswimmer (current world record holder and multiple world championship medalist). Performance variability was assessed based on pre-test, inter-test, and post-test data. Each measurement included pulmonary function and swim performance evaluations. In this study, underwater performance parameters, such as distance, time, velocity, and number of kicks, were assessed using video analysis synchronized with race

timing and evaluated using the Dartfish software. The swimmer followed a 28-day training program with an Airofit PRO™ respiratory trainer between tests, with daily sessions targeting both inspiratory and expiratory muscles. The training involved 6-10 min of targeted exercises per day. Significant improvements were observed in Wilcoxon's paired-sample test between the pre-test and post-test results in terms of underwater distance (p=0.012; d=1.26), underwater time (p=0.012; d=1.26), and number of underwater kicks (p=0.043; d=1.01), resulting in a 14.23% longer underwater distance, 14.08% longer underwater time, and 14.94% increase in underwater kicks. Despite the increased distance and time, underwater velocity remained stable, indicating improved underwater performance efficiency. Despite some improvements, it is not possible to conclude that respiratory muscle training (RMT) can contribute to improved finswimming performance during the underwater phases of a 200 m bi-fins race simulation in this particular athlete's case. Further research with a larger sample size is necessary to fully understand the impact of RMT on finswimming performance.

**Pathault E, Sanchez S, Husson B, Vanhaecke C, Georges P, Brazier C, Mourvillier B, Viguier M. Hyperbaric oxygen therapy enables pain reduction and healing in painful chronic wounds, including in calciphylaxis. *Ann Dermatol Venereol.* 2024 Nov 21;151(4):103325. doi: 10.1016/j.annder.2024.103325. Online ahead of print.**

Background: The effects of hyperbaric oxygen therapy (HBOT) on wound healing have been demonstrated mainly in diabetic foot ulcer. Objectives: To study the efficacy and safety of HBOT in chronic painful wounds, excluding diabetic foot ulcers. Methods: From 2008 to 2021, patients with chronic wounds showing no clinical improvement for more than 1 month, who were in pain despite the use of level 2 or 3 analgesics, and who had undergone HBOT sessions, were included in a monocentric retrospective study. The primary objective was to evaluate the course of pain by studying analgesic consumption before and up to a maximum of 12 months after HBOT. Achievement of complete or partial healing was also recorded. Results: Eighteen patients with calciphylaxis (n=6), vasculitis (n=4), hypertensive leg ulcer (n=3), mixed ulcer (n=3), Buerger's disease (n=1), and livedoid vasculitis (n=1) were included. Decrease in analgesic step, dose or number was noted in 15 of 18 patients (83.3%) within a median time of 3.5 (0.3-12) months, with a significant decrease in strong opioid use (72.2% before vs. 11.1% after, p = 0.005), as well as local improvement in 15 of 18 patients (83.3%) within a median time of 3.9 (1-10.3) months. Conclusion: HBOT as an adjuvant in chronic painful wounds of various etiologies allows a significant reduction in strong opioid consumption. This finding in a population with frequent adverse reactions to opioids requires demonstration in prospective and controlled studies.

**Pawlik MT, Rinneberg G, Koch A, Meyringer H, Loew TH, Kiellberg A. Is there a rationale for hyperbaric oxygen therapy in the patients with Post COVID syndrome?: a critical review. Eur Arch Psychiatry Clin Neurosci. 2024 Nov 15. doi: 10.1007/s00406-024-01911-y.**

The SARS-CoV-2 pandemic has resulted in 762 million infections worldwide from 2020 to date, of which approximately ten percent are suffering from the effects after infection in 2019 (COVID-19) [1, 40]. In Germany, it is now assumed that at least one million people suffer from post-COVID condition with long-term consequences. These have been previously reported in diseases like myalgic encephalomyelitis (ME) and chronic fatigue syndrome (CFS). Symptoms show a changing variability and recent surveys in the COVID context indicate that 10-30% of outpatients, 50 to 70% of hospitalised patients suffer from sequelae. Recent data suggest that only 13% of all ill people were completely free of symptoms after recovery [3,9]. Current hypotheses consider chronic inflammation, mitochondrial dysfunction, latent viral persistence, autoimmunity, changes of the human microbiome or multilocular sequelae in various organ system after infection. Hyperbaric oxygen therapy (HBOT) is applied since 1957 for heart surgery, scuba dive accidents, CO intoxication, air embolisms and infections with anaerobic pathogens. Under hyperbaric pressure, oxygen is physically dissolved in the blood in higher concentrations and reaches levels four times higher than under normobaric oxygen application. Moreover, the alternation of hyperoxia and normoxia induces a variety of processes at the cellular level, which improves oxygen supply in areas of locoregional hypoxia. Numerous target gene effects on new vessel formation, anti-inflammatory and anti-oedematous effects have been demonstrated [74]. The provision of intermittently high, local oxygen concentrations increases repair and regeneration processes and normalises the predominance of hyperinflammation. At present time only one prospective, randomized and placebo-controlled study exists with positive effects on global cognitive function, attention and executive function, psychiatric symptoms and pain interference. In conclusion, up to this date HBO is the only scientifically proven treatment in a prospective randomized controlled trial to be effective for cognitive improvement, regeneration of brain network and improvement of cardiac function. HBOT may have not only theoretical but also potential impact on targets of current pathophysiology of post-COVID condition, which warrants further scientific studies in patients.

**Pollock NW, Gennser M, Blogg SL, Risberg J. Comment on Loddé et al. Does decreased diffusing capacity of the lungs for carbon monoxide constitute a risk of decompression sickness in occupational divers? [Int. J. Environ. Res. Public Health 2023, 20, 6516.] Int J Environ Res Public Health. 2024 Nov 8;21(11):1486. doi: 10.3390/ijerph21111486. PMID: PMC11593936.**

This letter addresses errors in the statistical analysis found in a paper addressing pulmonary diffusing capacity and decompression sickness. Our re-analysis could not confirm any of the significant statistical contrasts described for the bubble data, invalidating the speculation on the relationships between bubble scores and decompression sickness.

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.

**Canadian Undersea and Hyperbaric Medical Association**

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