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

# E-NEWS

## EDITORIAL NOTE – April 2019

The E-News is the monthly newsletter of CUHMA used to share news and information. We invite relevant content, including announcements, upcoming conferences, new publication abstracts, job postings, professional perspectives, incident reports, and relevant images of related professional scenes. Feel free to share issues with interested colleagues. All past issues are available at https://cuhma.ca.

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## NEWS/ANNOUNCEMENTS

### Call for Original Research – CUHMA 2019

Both original research and review session abstracts will be considered for oral presentation at the 2019 CUHMA annual scientific meeting in St. John's, NL October 03-06. The submission deadline is June 15, 2019, with decisions returned to corresponding authors by July 15. Submit abstracts to neal.pollock@kin.ulaval.ca.

**Abstract Submission Guidelines** (Word file)
Line 1 - informative title, bold and block capitals.
Line 2 - author(s) (surname followed by initials for each).
Line 3 - professional affiliations for author(s).
Lines 4+ (research abstracts) - maximum 250 words (introduction, methods, results, conclusions, funding acknowledgment), 10 pitch Times New Roman, block format (ie, no indenting), complete data but no references, tables or figures.
Lines 4+ (review session abstracts) - 150-250 words, 10 pitch Times New Roman, block format (ie, no indenting), overview of proposed presentation but no references, tables or figures.

## UPCOMING EVENTS

### Colloque de la FQAS 2019

The annual symposium of the Federation Québécoise des Activités Subaquatiques will take place at Maisonneuve College in Montreal on April 13. For more information, see http://fqas.qc.ca/colloque-2019 .

### UMC Level 2 Advanced Diving Medicine Course

Undersea Medicine Canada is offering a CSA Z275 Level 2 'Advanced Course in Diving Medicine: Diagnosis and Treatment'. This 6-day course will be held May 06-11 at the Canadian Museum of Immigration, Pier 21 in Halifax, NS. Augmenting classroom instruction and case-based learning, site visits will allow observation of commercial diver training and diving operations, as well as training at the Hyperbaric Medicine Unit at the QEII Health Sciences Centre in Halifax. A CSA Z275.2-15 Level 1 course or equivalent training is a prerequisite for this 45-h program. You can register at https://underseamedicine.ca or contact Dr. Debbie Pestell at drdeb1@ns.sympatico.ca or 902-225-8214 for more information.

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### CUHMA Annual Scientific Meeting 2019

The 2019 CUHMA ASM will be held October 03-06 in St. John's, NL, hosted by Memorial University Faculty of Medicine. Two days of pre-conference events will be followed by two days of scientific talks. Pre-conference events include:

- BLS/ACLS course
- Offshore Safety and Survival Centre tour (underwater helicopter escape training facility)
- Hyperbaric procedures simulation course
- Board of Directors meeting

A welcome reception with be held on Friday evening, and the awards banquet on Saturday evening. Visit our website for updates and registration: https://cuhma.ca.

### UMC Level 1 Introductory Diving Medicine Course

Undersea Medicine Canada is offering a CSA Z275.2-15 Level 1 'Introductory Course in Diving Medicine - Fitness to Dive' October 28-November 01 in Quebec City, QC. Upon successful completion of the course, physicians will qualify as CSA Z275.2-15 Level 1 Diving Medical Examiners and can 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.

## RECENT PUBLICATIONS

**Ascencio-Lane JC, Smart D, Lippmann J. A 20-year analysis of compressed gas diving-related deaths in Tasmania, Australia. Diving Hyperb Med. 2019; 49(1):21-9.**

INTRODUCTION: This study reviews diving deaths that occurred in Tasmanian waters over a 20-year period. METHODS: Detailed analysis was undertaken of deaths that occurred from 01 January 1995 to 31 December 2014. The cases were collated from numerous sources. Utilising a chain of events analysis, factors were identified and assigned to predisposing factors, triggers, disabling agents, disabling injuries and cause of death. These were then scrutinised to ascertain regional variables, remediable factors and linkages which may benefit from targeted risk mitigation strategies. RESULTS: Seventeen deaths were identified across this 20-year period, which included one additional case not previously recorded. All were recreational divers and 15 were male. Five were hookah divers, 12 were scuba divers. Important predisposing factors identified included equipment (condition and maintenance), pre-existing health conditions, diver experience and training. These factors can now be used to promote public health messages for divers. CONCLUSIONS: This 20-year study highlighted regional variations for Tasmanian deaths and presents opportunities for strategies to prevent diving deaths in the future. Of particular concern was the diving practice of 'hookah' diving, which has no governing regulations. The study highlighted the importance of applying a structured methodology such as chain of events analysis to scrutinise diving deaths

**Buzzacott P, Grier JW, Walker J, Bennett CM, Denoble PJ. Estimated workload intensity during volunteer aquarium dives. Occup Med (Lond). 2019 Mar 27. pii: kqz011. doi: 10.1093/occmed/kqz011. [Epub ahead of print]**

BACKGROUND: This study aimed to characterize the physiological demands of working dives on volunteer divers at a public aquarium in the USA. AIMS: To estimate the workloads associated with volunteer dives in a US aquarium. METHODS: Participants completed a medical and diving history questionnaire. Measurements included blood pressure before and after diving and continuous ECG (Holter) monitoring during diving. Dive profiles were recorded using loggers. Mean workload was estimated from total air consumption. RESULTS: Twenty-seven divers recorded 49 air dives over 5 days. Two-thirds were male and ages ranged from 40 to 78 years. Typically, each diver made two dives with a 30-60 min surface interval. Mean heart rate while diving was 100 beats per minute (bpm). Mean estimated workload during the dives recorded during this study was 5.8 metabolic equivalents (METS), with a range from 4.1 to 10.5. The highest mean recorded heart rate was 120 bpm over 40 min, vacuuming the floor in the shark exhibit. CONCLUSIONS: Given the mean age of this sample and the prevalence of cardiovascular risk factors (body mass index, high cholesterol and hypertension), it may be prudent for aquariums to regularly monitor SAC/kg and heart rate in volunteer divers, to identify which tasks require the highest workload intensity. Divers with existing cardiovascular risk factors might then be employed in dives with lighter workloads. In conclusion, volunteer dives at this aquarium required a mean workload intensity that was described by recreational divers as moderate. The highest workload, at 10 METS for 23 min, would be considered by many recreational divers as exhausting.

**Casadesús JM, Aguirre F, Carrera A, Boadas-Vaello P, Serrando MT, Reina F. Diving-related fatalities: multidisciplinary, experience-based investigation. Forensic Sci Med Pathol. 2019 Mar 27. doi: 10.1007/s12024-019-00109-2. [Epub ahead of print]**

To describe the technical characteristics of fatal diving mishaps and to elucidate the causes of death using a sequence analysis and a multidisciplinary investigation of diving-related fatalities. All cases of diving deaths recorded on the coast of Girona (Spain) between January 2009 and May 2018 were analyzed. Most data were obtained from the police technical reports and the forensic pathology service. Each accident was analyzed in order to identify the trigger, disabling agent, disabling injury, and cause of death. During the study period 25 diving-related fatalities were recorded. Most of the victims were males aged 50-69 years, and 11 were experienced divers. Almost all victims were using open-circuit scuba to breathe with compressed air as their sole gas supply. None of the victims were diving alone. The most common identified triggers included exertion, panic, buoyancy problems, disorientation and confusion. The main factors identified as disabling agents were rapid ascent, a cardiac incident, panic and entrapment. Asphyxia, lung over expansion, and myocardial ischemia were the most frequent disabling injuries. Finally, drowning represented the main cause of death, followed by arterial gas embolism and natural causes or internal diseases. A differential diagnosis, performed in the setting of a multidisciplinary investigation, is essential for elucidating the cause of death in diving-related fatalities. The proposed sequence analysis allows to clarify underlying problems in these cases and to identify risk factors and unsafe behaviors in diving.

**Cialoni D, Brizzolari A, Samaja M, Pieri M, Marroni A. Altered venous blood nitric oxide levels at depth and related bubble formation during scuba diving. Front Physiol. 2019 Feb 21;10:57.**

Introduction: Nitric oxide (NO) plays an important role in the physiology and pathophysiology of diving, and the

related endothelial dysfunction and oxidative stress roles have been extensively investigated. However, most available data have been obtained before and after the dive, whilst, as far as we know, no data is available about what happens during the water immersion phase of dive. The scope of this study is to investigate the nitrate and nitrite (NOX) concentration and the total plasma antioxidant capacity (TAC) before, during and after a single scuba dive in healthy scuba diving volunteers, as well as to look for evidence of a possible relationship with venous gas bubble formation. Materials and Methods: Plasma, obtained from blood of 15 expert scuba divers, 13 male and 2 female, was investigated for differences in NOX and TAC values in different dive times. Differences in NOX and TAC values in subjects previously known as "bubble resistant" (non-bubblers - NB) and "bubble prone" (Bubblers - B) were investigated. Results: We found a statistically significant increase of NOX plasma concentration in the "bottom blood draw" and in the "safety stop blood draw" as compared to the basal pre diving condition. We did not find any difference in NOX plasma concentration between the basal value and the post diving samples. We did not find any significant statistical difference in TAC in the bottom blood sample, while the safety-stop and the post-dive samples showed higher TAC values compared with the basal value. We did not find any difference in NOX and TAC mean values between non-bubblers and Bubblers. Discussion: Our protocol, by including underwater blood drawing, allowed to monitor plasma NOX changes occurred during diving activity, and not only by comparing pre and post diving values. It is particularly interesting to note that the increased NOX values found at the bottom and at the safety stop were not observed at post dive sampling (T0, T30, T60), showing a very rapid return to the pre-dive values. In this preliminary study we did not find any relationship between bubble formation and changes in NOX parameters and TAC response.

**Garrido Campos MA, Hindelang BA, De Carvalho DS, Urzúa Finke I, Herrera R, Radon K. Prevalence and risk factors for hearing loss in Chilean shellfish divers. Ann Glob Health. 2018;84(3):442-9.**

BACKGROUND: Diving within artisanal fishing is a profession carried out by many men in coastal communities of southern Chile. These shellfish divers use surface supplied air for breathing. Among potential health threats are occupational accidents, decompression sickness and barotrauma. Repeated middle and inner ear barotrauma and decompression sickness of the ear may result in hearing loss. OBJECTIVE: To determine the prevalence of hearing loss and related risk factors in artisanal shellfish divers. METHODS: A cross-sectional study including 125 male shellfish divers was carried out in a coastal village in southern Chile. Participants were interviewed using a standard Spanish questionnaire adapted for this population. Hearing loss was assessed through audiometry. Any hearing loss, sensorineural hearing loss and other types of hearing loss (conduction, unilateral and mixed) were used as the outcomes. Bivariate and multiple logistic regression models were carried out to identify risk factors for hearing loss. FINDINGS: Median duration on the job was 25 years (range 1-52), 64% of divers had a low level of schooling and 52% reported not knowing how to use decompression tables. Most (86%) of the divers dove deeper than 30 meters exceeding the 20 meters permitted by law. The majority (80%) reported having experienced several episodes of type II decompression sickness during their working life. The prevalence of any type of hearing loss was 54.4%: 29.0% presented sensorineural hearing loss and 25.6% presented other types of hearing impairment. After adjustment for age and other potential risk factors, diving more than 25 years was the main predictor for all kinds of hearing loss under study. CONCLUSIONS: Hearing loss is frequent in artisanal shellfish divers and safety measures are limited. Although based on small numbers and lacking an unexposed comparison group, our results suggest the need for community-based interventions.

**Giunta AA, Liberati L, Pellegrino C, Ricci G, Rizzo S. Eustachian tube balloon dilation in treatment of equalization problems of freediving spearfishermen. Diving Hyperb Med. 2019;49(1):9-15.**

BACKGROUND: Eustachian tube balloon dilation is a minimally invasive surgical procedure used to treat Eustachian tube dysfunction which is not responsive to conventional therapies. METHODS: In this cohort intervention series we report the results of balloon dilation in treating refractory equalization problems in 20 freediving spearfishermen; in 19 cases the problem was unilateral and in one case bilateral. All the patients had already received medical and insufflation therapy and four patients had also had nasal surgery. None of these treatments or procedures had achieved improvement. We used a 20 mm x 3 mm disposable balloon catheter inserted through a 70-degree guide catheter and inflated up to 12 ATM three times at three different depths of insertion within the Eustachian tube. Every inflation lasted 120 seconds. RESULTS: Fifteen out of 20 patients improved. Ten patients reported a complete resolution of equalization problems, five showed improvement with persistence of a slight equalization delay on the treated side. Five patients did not report any improvement. Two complications occurred: subcutaneous emphysema of the parotid region in one case; and a mild high frequency (4-8 KHz) sensorineural hearing loss in another patient. CONCLUSION: Balloon dilation of the Eustachian tube is an effective therapy in the treatment of equalization problems with a good success rate.

**Hatibie MJ, Islam AA, Hatta M, Moenadjat Y, Susilo RH, Rendy L. Hyperbaric oxygen therapy for second-degree burn healing: an experimental study in rabbits. Adv Skin Wound Care. 2019;32(3):1-4.**

BACKGROUND: The wound healing process includes inflammation, proliferation, and remodelling phases, the main features of which are inflammation, neoangiogenesis, and epithelialization. Hyperbaric oxygen therapy (HBOT) is one modality postulated to improve wound healing. The objective of this study was to determine whether HBOT could improve selected features of burn wound healing in an experimental rabbit model. METHODS: Researchers conducted an experimental study with 36 rabbits given second-degree burns. Subjects were separated into two groups: a control group (n=18) and an intervention group that was given HBOT at 2.4 atmospheres absolute for 6 days (n=18). The main outcome measure was wound healing. RESULTS: Compared with the control group, the HBOT group showed more robust inflammatory cells (P=0.025) and epithelialization (P=0.024), but no significant difference in angiogenesis (P=0.442). CONCLUSIONS: The authors conclude that HBOT may improve second-degree burn healing by increasing inflammatory cell migration and re-epithelialization

**Hintze JM, Geyer L, Fitzgerald CW, Simoes Franklin C, Glynn F, Viani L, Walshe P. The impact of repetitive hyperbaric exposure during scuba diving on cochlear implants. Laryngoscope. 2019 Feb 27. doi: 10.1002/ lary.27880. [Epub ahead of print]**

OBJECTIVES/HYPOTHESIS: Complications during or after cochlear implantation are relatively rare. They occur more frequently in patients who partake in activities that can potentially lead to local trauma. No formal recommendations exist for participation in self-contained underwater breathing apparatus (scuba) activities. We describe three patients with a combined five cochlear implants and extensive diving experience, the largest case series to date, and highlight some of the difficulties faced. We also review the literature on previously described scuba-diving patients with cochlear implants. STUDY DESIGN: Retrospective case series and literature review. METHODS: A review of the known scuba divers in the National Hearing Implant and Research Centre in Ireland was conducted, and a review of the literature was carried out using PubMed and Google Scholar. RESULTS: Of the three scuba divers with cochlear implants, two required reimplantation, the first due to nonauditory stimulation, and the second due to extrusion of the electrode through the tympanic membrane following repetitive scuba dives. The third patient remains without complications after 80 dives. CONCLUSIONS: Patients with cochlear implants can have complications relating to the implant itself, with device failure a theoretical risk. The cochleostomy can lead to perilymphatic extravasation, as well as inner ear barotrauma, decompression sickness, and formation of air bubbles along the electrode. A combination of deafness, vestibulopathy with abrupt perilymph leak, and loss of proprioception can lead to disorientation and blue dome syndrome. Based on our experience with cochlear implants in scuba divers, along with those reported in the literature, we recommend caution in patients with cochlear implants who scuba dive regularly and strict adherence to the recommended safety limits

**Ilieva I, Jouvet L, Seidelin L, Best BD, Aldabet S, da Silva R, Conde DA. A global database of intentionally deployed wrecks to serve as artificial reefs. Data Brief. 2018 Dec 29;23:103584. doi: 10.1016/j.dib.2018.12.023. eCollection 2019 Apr.**

This paper contains data on intentionally deployed wrecks to serve as artificial reefs from 1942 to 2016. The deployment of decommissioned vessels and other available wrecks is a common practice in many coastal countries, such as the USA, Australia, Malta, and New Zealand. We obtained data of georeferenced sites of wrecks from the scientific literature, local databases, and diving web sites published in the English language. Furthermore, we included information regarding the type of structure, location, depth, country, year of deployment and estimated life span. Moreover, we provide information on whether the wreck is located inside one of the World's Protected Areas, key biophysical Standard Level Data from the World Ocean Database, distance to reefs from the Coral Trait Database, and distances to 597 aquariums that are members of the Species360 global network of Aquariums and Zoological institutions, in the Zoological Information Management System (ZIMS). We provide data for wrecks with monitoring surveys in the peer-review literature, although these only comprise 2% of the records (36 of 1907 wrecks). The data we provide here can be used for research and evaluation of already deployed reefs, especially if combined with additional spatial information on biodiversity and threats.

**Lee WG. Carbon monoxide poisoning presenting as non-convulsive status epilepticus treated with hyperbaric oxygen therapy. J Epilepsy Res. 2018;8(2):100-4.**

Carbon monoxide (CO) poisoning is one of the most serious medical emergencies causing life-threatening conditions, including cardiovascular and neurological sequelae. Acute CO poisoning can lead to myocardial ischemia, ventricular arrhythmia, syncope, seizures, and coma. Seizures and other neurological complications in the early stages of presentation are related to severe intoxication in CO poisoning. In such situations, aggressive hyperbaric oxygen therapy is recommended. In CO poisoning, non-convulsive status epilepticus has rarely been observed following hyperbaric oxygen therapy ($HBO_2$). We report a case of CO poisoning presenting as non-convulsive status epilepticus treated with $HBO_2$.

Mechanisms and implications for non-convulsive status epilepticus provocation during $HBO_2$ treatment are discussed.

**Lormeau B, Pichat S, Dufaitre L, Chamouine A, Gataa M, Rastami J, Coll-Lormeau C, Goury G, François AL, Etien V, Blanchard JL, Hervé D, Sola-Gazagnes A. Impact of a sports project centered on scuba diving for adolescents with type 1 diabetes mellitus: New guidelines for adolescent recreational diving, a modification of the French regulations. Arch Pediatr. 2019 Mar 15. pii: S0929-693X(18)30270-7. doi: 10.1016/j.arcped.2018.12.006. [Epub ahead of print]**

BACKGROUND: Recreational scuba diving has been authorized for type 1 diabetics over 18 years old - the age of majority in France - since 2004, but it remained forbidden for younger diabetics by the French underwater federation (FFESSM). Here, we present a study to evaluate: - the conditions under which diving could be authorized for 14- to 18 year olds with type 1 diabetes; - the value of continuous glucose monitoring (CGM) while diving. A secondary objective was to monitor the impact of diving on the teenagers' quality of life. SUBJECT AND METHODS: Sixteen adolescents (14-17.5 years old) were included. Diabetes was known for 6 years (range, 1-14) and Hb1Ac was 9.0% (range, 7.7-11.9). The study was conducted in Mayotte with both capillary glycemia (CG) and CGM measurements taken during five dives. RESULTS: The average CG prior to diving was 283mg/dL and decreased by 75±76mg/dL during the dive. No hypoglycemia occurred during the dives and four episodes occurred after. Glycemia variations during dives and for the overall duration of the study were greater than for adults, most likely due to the general adolescent behavior, notably regarding diet and diabetes management. CGM was greatly appreciated by the adolescents. They had an overall satisfactory quality of life. No significant variations were observed during the entire course of the study. CONCLUSIONS: Although in need of further studies, these preliminary results show that CGM can be used while diving. CGM records show a continuous decrease of glycemia during dives. Based on these results, the French underwater federation has now authorized diving for adolescent type 1 diabetics following a specific diving protocol that includes HbA1c<8.5%, autonomous management of diabetes by the adolescent, reduction of insulin doses, and target glycemia prior to the dive>250mg/dL.

**Marlinge M, Coulange M, Fitzpatrick RC, Delacroix R, Gabarre A, Lainé N, Cautela J, Louge P, Boussuges A, Rostain JC, Guieu R, Joulia FC. Physiological stress markers during breath-hold diving and scuba diving. Physiol Rep. 2019;7(6):e14033.**

This study investigated the sources of physiological stress in diving by comparing scuba dives (stressors: hydrostatic pressure, cold, and hyperoxia), apneic dives (hydrostatic pressure, cold, physical activity, hypoxia), and dry static apnea (hypoxia only). We hypothesized that despite the hypoxia induces by a long static apnea, it would be less stressful than scuba dive or apneic dives since the latter combined high pressure, physical activity, and cold exposure. Blood samples were collected from 12 scuba and 12 apnea divers before and after dives. On a different occasion, samples were collected from the apneic group before and after a maximal static dry apnea. We measured changes in levels of the stress hormones cortisol and copeptin in each situation. To identify localized effects of the stress, we measured levels of the cardiac injury markers troponin (cTnI) and brain natriuretic peptide (BNP), the muscular stress markers myoglobin and lactate), and the hypoxemia marker ischemia-modified albumin (IMA). Copeptin, cortisol, and IMA levels increased for the apneic dive and the static dry apnea, whereas they decreased for the scuba dive. Troponin, BNP, and myoglobin levels increased for the apneic dive, but were unchanged for the scuba dive and the static dry apnea. We conclude that hypoxia induced by apnea is the dominant trigger for the release of stress hormones and cardiac injury markers, whereas cold or and hyperbaric exposures play a minor role. These results indicate that subjects should be screened carefully for pre-existing cardiac diseases before undertaking significant apneic maneuvers.

**Querido AL, van Hulst RA. Diving and attention deficit hyperactivity disorder. Diving Hyperb Med. 2019; 49(1):41-7.**

Attention deficit hyperactivity disorder (ADHD) is a psychiatric condition that affects attention, concentration, impulse control and awareness. Not only these symptoms, but also the medications used to treat ADHD (psychostimulants) pose a risk to both the diver and his or her buddy. This article presents guidelines for recreational diving in combination with ADHD and psychostimulants. These guidelines are based solely on 'expert' opinion and were adopted at a meeting of the Dutch Association for Diving Medicine in 2017.

**Sames C, Gorman DF, Mitchell SJ, Zhou L. The impact of diving on hearing: a 10-25 year audit of New Zealand professional divers. Diving Hyperb Med. 2019;49(1):2-8.**

INTRODUCTION: Surveillance of professional divers' hearing is routinely undertaken on an annual basis despite lack of evidence of benefit to the diver. The aim of this study was to determine the magnitude and significance of changes in auditory function over a 10-25 year period of occupational diving with the intention of informing future health surveillance policy for professional divers. METHODS: All divers with adequate audiological records spanning at least 10 years were identified from the New Zealand occupational diver database. Changes in auditory

function over time were compared with internationally accepted normative values. Any significant changes were tested for correlation with diving exposure, smoking history and body mass index. RESULTS: The audiological records of 227 professional divers were analysed for periods ranging from 10 to 25 years. Initial hearing was poorer than population norms, and deterioration over the observation period was less than that predicted by normative data. Changes in hearing were not related to diving exposure, or smoking history. CONCLUSION: Audiological changes over 10 to 25 years of occupational diving were not found to be significantly different from age-related changes. Routine annual audiological testing of professional divers does not appear to be justifiable.

**Silvanius M, Mitchell SJ, Pollock NW, Frånberg O, Gennser M, Lindén J, Mesley P, Gant N. The performance of 'temperature stick' carbon dioxide absorbent monitors in diving rebreathers. Diving Hyperb Med. 2019;49(1):48-56.**

INTRODUCTION: Diving rebreathers use canisters containing soda lime to remove carbon dioxide ($CO_2$) from expired gas. Soda lime has a finite ability to absorb $CO_2$. Temperature sticks monitor the exothermic reaction between $CO_2$ and soda lime to predict remaining absorptive capacity. The accuracy of these predictions was investigated in two rebreathers that utilise temperature sticks. METHODS: Inspiration and rEvo rebreathers filled with new soda lime were immersed in water at 19°C and operated on mechanical circuits whose ventilation and $CO_2$-addition parameters simulated dives involving either moderate exercise (6 MET) throughout (mod-ex), or 90 minutes of 6 MET exercise followed by 2 MET exercise (low-ex) until breakthrough (inspired $PCO_2$ [$PiCO_2$] = 1 kPa). Simulated dives were conducted at surface pressure (sea-level) (low-ex: Inspiration, n=5; rEvo, n=5; mod-ex: Inspiration, n=7, rEvo, n=5) and at 3-6 metres' sea water (msw) depth (mod-ex protocol only: Inspiration, n=8; rEvo, n=5). RESULTS: Operated at surface pressure, both rebreathers warned appropriately in four of five low-ex tests but failed to do so in the 12 mod-ex tests. At 3-6 msw depth, warnings preceded breakthrough in 11 of 13 mod-ex tests. The rEvo warned conservatively in all five tests (approximately 60 minutes prior). Inspiration warnings immediately preceded breakthrough in six of eight tests, but were marginally late in one test and 13 minutes late in another. CONCLUSION: When operated at even shallow depth, temperature sticks provided timely warning of significant $CO_2$ breakthrough in the scenarios examined. They are much less accurate during simulated exercise at surface pressure.

**Wilmshurst PT. Immersion pulmonary oedema: a cardiological perspective. Diving Hyperb Med. 2019;49(1):30-40.**

It is postulated that immersion pulmonary oedema (IPE) occurs because of combinations of factors that each increase the hydrostatic pressure gradient between the pulmonary capillaries and the alveoli. The factors, by definition, include the effects of immersion, particularly raised central blood volume and hence cardiac filling pressures. Breathing against a negative pressure is important but the magnitude of the effect depends on the relation of the diver's lung centroid to the source of the breathing gas and the breathing characteristics of diving equipment. Other factors are cold-induced vasoconstriction, exertion and emotional stress, but variations of the responses of individuals to these stimuli are important. Hypertension is the most frequent cardiovascular disease predisposing to IPE but other medical conditions are implicated in some patients.

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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## CUHMA BOARD OF DIRECTORS