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

E-NEWS

EDITORIAL NOTE – July 2018

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, and relevant underwater images. Past issues are available at https://cuhma.ca, serving an ongoing role as an information repository.

Neal W. Pollock

NEWS/ANNOUNCEMENTS

Health Canada Medical Device Rule Change

Health Canada is completing the transition to the new Medical Device Single Audit Program (MDSAP) from the Canadian Medical Devices Conformity Assessment System (CMDCAS) effective 01 January 2019. All medical device manufacturers will require certification to sell products in Canada. For more information, visit:
https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-devices/activities/international/transition-medical-device-single-audit-program.html

Journal Impact Factors for 2017

Diving and Hyperbaric Medicine (1.197) continues to outperform Undersea and Hyperbaric Medicine (0.636) in journal impact factor computed for 2017. DHM is just ahead of Wilderness & Environmental Medicine (1.161).

DCBC Trainer Accreditation Awarded to HDL

The Hôtel-Dieu de Lévis Hyperbaric Department has received accreditation from the Diver Certification Board of Canada (DCBC) to teach the Clinical Hyperbaric Chamber Operator course. HDL is currently the only clinical institution in Canada with such an accreditation. The course meets the requirements of Z275.1-16, Z275.4-12, Z275.5, chapter 18.2.3, and chapter 22.9. Course graduates will receive a DCBC operator's certificate. Available in both français and English, the training will address monoplace and multiplace chamber operations, emergency and elective treatments, medical monitoring, maintenance, safety and emergency procedures. Contact Jocelyn (Josh) Boisvert (jocelyn_boisvert@ssss.gouv.qc.ca) for more information.

UPCOMING EVENTS

Second Tricontinental Scientific Conference on Diving and Hyperbaric Medicine

The second Tricontinental Scientific Conference will be held in Durban, KwaZulu Natal, South Africa, September 23-29, 2018. The week will combine scientific meetings, diving workshops, and social events. The joint organizing committee includes EUBS, SPUMS, SAUHMA and the Scott Haldane Foundation, working with local Durban Hyperbaric Centre staff and a South Africa event management bureau. For more information, visit: www.tricon2018.org.

AAUS Diving for Science Symposium 2018

The 2018 American Academy of Underwater Sciences Diving for Science Symposium will be held October 09-13 in Tahoe City, CA. University of California (UC) Berkeley and UC Davis will serve as hosts. This meeting is relevant to diving scientists, students, diving safety officers, and anyone with an interest in diving science. For more information: www.aaus.org/annual_symposium.

CUHMA Annual Scientific Meeting 2018

The 2018 CUHMA ASM will be held November 02-04, in Quebec City, hosted by Université Laval and Hôtel-Dieu de Lévis. One day of pre-conference events will be followed by two days of scientific talks. Pre-conference events include:

- CHT exam offered by the National Board of Diving and Hyperbaric Medical Technology (NBDHMT)
- Hyperbaric emergency team simulation (HETS) course to be held at the hyperbaric chamber at Hôtel-Dieu de Lévis
- 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 future registration: https://cuhma.ca.

STUDENT OPPORTUNITIES

Doctoral Studies in Diving Research

Active recruitment is underway at Université Laval for qualified and motivated students wanting to pursue doctoral studies in environmental physiology related to diving. The research focus is health and safety in extreme environments, with concentration in decompression stress, monitoring technology, and diver safety. Students will also gain experience with a variety of studies in hyperbaric medicine. Contact Dr. Neal Pollock (neal.pollock@kin.ulaval.ca) for more information. Inquiries would best include concise CVs and a description of key interests and goals.

RECENT PUBLICATIONS

An LS, Ting LS, Chuan LC, Joang KS, Rick SC. Performance of the Oxylog® 1000 portable ventilator in a hyperbaric environment. Diving Hyperb Med. 2018; 48(2):102-6.

INTRODUCTION: The management of mechanically ventilated patients in the hyperbaric environment requires knowledge of how the physical properties of gases change under pressure and how this affects the operation of the ventilator. The primary objective of this study was to test the performance of the Dräger Oxylog 1000® ventilator in a hyperbaric environment. METHODS: Each of two ventilators was connected to a mechanical test lung system with an in-built pressure gauge. We used a Wright's respirometer to measure the tidal volumes. The same ventilator settings were tested under varying environmental pressures from ambient (101.3 kPa) to 18 meters' sea water (284 kPa) in a multiplace hyperbaric chamber. RESULTS: A decrease was found in tidal volume, decrease in airway pressure and increase in respiratory rate delivered by the Dräger Oxylog 1000 portable ventilator with increasing pressures to 284 kPa. DISCUSSION: These findings can be explained by the operating principles of the Oxylog 1000, which is a time-controlled, constant-volume ventilator that functions as a flow chopper. Even between the two Oxylog 1000 ventilators tested there were different absolute changes in tidal volume, airway pressures and respiratory rates at various depths. Hence, the trend of changes in these variables is probably more important than absolute values. CONCLUSION: In summary, understanding the trend of changes in ventilator variables will allow clinicians to make appropriate corrections in ventilator settings and carefully monitor adequacy of ventilation to prevent adverse ventilator-associated events. The Dräger Oxylog 1000 portable ventilator is an adequate back-up ventilator for use with straight-forward, ventilator-dependent patients undergoing hyperbaric treatment.

Arieli R. Do skin rash and cutis marmorata stem from lamellar bodies within the skin? Diving Hyperb Med. 2018; 48(2):114.

Cutis marmorata (CM) manifests as bluish-red spots on the skin following decompression. These are often itchy or painful to touch, and appear half to one hour after surfacing. The pathogenesis of skin lesions in decompression illness (DCI) remains unresolved. The common belief has been that bubbles that shunted to the arterial circulation reached the skin and clogged blood vessels. An alternative explanation from studies in which air was injected into the internal carotid artery of swine is that arterial bubbles at the brain stem disturb the control of skin blood flow, causing CM. Other brain syndromes have also been seen to cause CM. It was suggested that bubbles affecting the brain stem result in the release of neuropeptides in the skin which control vasodilatation and vasoconstriction. However, this does not explain the inflammation in the skin lesions, with red blood cells, haemorrhage and neutrophil infiltrates. The percentage of right-to-left circulatory shunts in divers who suffered CM was 77% compared with 28% in divers with no record of CM, a finding which supports either of these explanations. Another study in swine concluded that there was "strong evidence to support autochthonous bubbles as the etiology of skin lesions". Lesions appeared without right-to-left shunting. Skin thickness from the squamous keratin to the dermis increased by 10% in the affected areas. The lesions showed congestion, haemorrhage and neutrophil infiltrates. Superficial counter-diffusion as a cause of CM, the increased risk of CM in a dry as opposed to a wet dive and the prevalence of CM in proximity to subcutaneous fat (which acts as a nitrogen reservoir), all support an autochthonous origin. Decompression bubbles can develop and expand only from pre-existing gas micronuclei. It is known that nanobubbles form spontaneously when a smooth hydrophobic surface is submerged in water containing dissolved gas. We have shown that these nanobubbles are the gas micronuclei underlying decompression bubbles and DCI. After decompression, bubbles evolved at definite hydrophobic sites composed of the lung surfactant dipalmitoylphosphatidylcholine. Nanobubbles are formed on the surface of these lamellar layers of phospholipids, and on decompression expand into venous and arterial bubbles. Lamellar bodies of phospholipids produced in the granular layer of the skin are used for the formation of a hydrophobic barrier at the cornified layer. We suggest that the hydrophobic layers in the skin may be the site at which bubbles develop from nanobubbles and cause CM, just as occurs at the active hydrophobic spots on the luminal aspect of a blood vessel. This is the reason no bubbles were observed in the skin microcirculation. Unlike bubbles on the inner wall of venous blood vessels, which are supplied with high quantities of nitrogen from the incoming venous blood, the expansion of skin bubbles will be limited due to a low supply of nitrogen (possibly from the nearby subcutaneous fat). Therefore, skin bubbles should be small and have a short life span, which may be why they have hitherto remained undetected. The sensitivity of some divers to CM and its localization to specific skin areas may be related to individual variability in the lamellar bodies and phospholipid skin barriers. Support for the present hypothesis may be found in the observation in some cases (though not all) of the movement of gas under the skin by means of echography

(Balestra C, personal communication, 2018). CM is more frequent in female divers, and more so in subtropical than in cold European waters (van Ooij P-JAM, personal communication, 2018). This may be explained by women having more subcutaneous fat than men, coupled with the higher skin perfusion (and nitrogen loading) in warm water. This suggestion of possible autochthonous bubble formation in the skin does not exclude other causes, but may open a window for further investigation.

Bennett MH. Evidence brief: hyperbaric oxygen therapy (HBOT) for traumatic brain injury and/or post-traumatic stress disorder. Diving Hyperb Med. 2018; 48(2):115.

This report is a product of the VA Evidence-based Synthesis Program. The purpose is to provide "timely and accurate syntheses of targeted healthcare topics …. to improve the health and healthcare of Veterans." The authors have made a comprehensive search and analysis of the literature and make recommendations to assist clinicians in dealing with veterans suffering from either traumatic brain injury (TBI) or post-traumatic stress disorder (PTSD). The report is timely and of great potential impact given the vigorous and lengthy debate among hyperbaric physicians and lay people determined to find an answer for the large numbers of veterans deeply affected with some combination of PTSD and post-concussion dysfunction. The authors lament the evidence on using hyperbaric oxygen treatment (HBOT) for TBI/PTSD has been "controversial, widely debated, and potentially confusing." Unfortunately, this report will not improve that situation. The report is as much a political document as it is evidence-based. That politics are involved is apparent from the outset with the statement "The ESP Coordinating Center is responding to a request from the Center for Compassionate Innovation (CCI)…" The report fails to further illuminate the situation than the many thousands of words already spent on summarising the evidence. Let me save you some time and get to the quick of this report. The authors (rightly) highlight the fact that uncontrolled case series and a randomised, controlled trial (RCT) without blinding or a sham control all suggest HBOT may be of benefit for these Veterans. Somewhat disappointingly, well-controlled, blinded RCTs using a sham exposure to 1.2 or 1.3 ATA breathing air fail to confirm any such benefit. While the conventional interpretation of these data is that there is no reliable evidence of an effect of HBOT, proponents have responded by postulating these control exposures are not 'sham' because they are clinically active. Any putative mechanism remains unknown and unproven outside the context of this clinical area. These exposures just happen to be about equipotent with true HBOT. With this accurate summary, the authors conclude that any effect of HBOT is as yet unclear. They suggest that in Veterans who have not responded to other therapeutic options, the use of HBOT is "reasonable". This conclusion allows for a similar recommendation for any unproven therapeutic option where there is no clearly effective treatment available and is, to this reviewer, unacceptable. While any putative mechanism for low-pressure air exposure owes more to magical thinking than physics, physiology or therapeutics, this is an argument the authors of this report seem to have accepted at some level. The proponents of HBOT have an obligation to both show the greater effectiveness of HBOT than a functional sham and to demonstrate a plausible mechanism. Until then, the strongest recommendation that should be made is that the 'sham' therapy can be used until the case is proven. It is not clear why the proponents of HBOT do not advocate this, given the 'efficacy' seems roughly equal with HBOT. Logic determines one cannot prove a negative. This reviewer agrees it is not possible to definitively prove trivial pressure exposures breathing air may have a comparable effectiveness in treating TBI/PTSD as true HBOT. Using the principle of Occam's razor it seems far more likely any apparent effectiveness is the result of a participation effect in both groups. In my view, the authors of this report have taken an easy option in allowing that HBOT use is reasonable. The tragedy is potentially the waste of time, money and hope this may bring to the very Veterans the authors are charged to serve. I have discussed this issue in more detail previously in the pages of this journal.

Doolette DJ, Mitchell SJ. In-water recompression. Diving Hyperb Med. 2018;48(2):84-95.

Divers suspected of suffering decompression illness (DCI) in locations remote from a recompression chamber are sometimes treated with in-water recompression (IWR). There are no data that establish the benefits of IWR compared to conventional first aid with surface oxygen and transport to the nearest chamber. However, the theoretical benefit of IWR is that it can be initiated with a very short delay to recompression after onset of manifestations of DCI. Retrospective analyses of the effect on outcome of increasing delay generally do not capture this very short delay achievable with IWR. However, in military training and experimental diving, delay to recompression is typically less than two hours and more than 90% of cases have complete resolution of manifestations during the first treatment, often within minutes of recompression. A major risk of IWR is that of an oxygen convulsion resulting in drowning. As a result, typical IWR oxygen-breathing protocols use shallower maximum depths (9 metres' sea water (msw), 191 kPa) and are shorter (1-3 hours) than standard recompression protocols for the initial treatment of DCI (e.g., US Navy Treatment Tables 5 and 6). There has been no experimentation with initial treatment of DCI at pressures less than 285 kPa since the original development of these treatment tables, when no differences in outcomes were seen between maximum pressures of 203 kPa (10 msw) and 285 kPa (18 msw) or deeper. These data and case series suggest that recompression treatment comprising pressures and durations similar to IWR protocols can be effective. The risk of IWR is not justified for treatment of mild symptoms likely to resolve spontaneously or for divers so functionally compromised that they would not be safe in the water. However, IWR conducted by properly trained and equipped divers may be justified for manifestations that are life or limb threatening where timely recompression is unavailable.

Dünnwald T, Held J, Balan P, Pecher O, Zeiger T, Hartig F, Mur E, Weiss G, Schobersberger W. Combined hyperbaric oxygen partial pressure at 1.4 bar with infrared radiation: a useful tool to improve tissue hypoxemia? Med Sci Monit. 2018; 24: 4009-19.

Tissue hypoxia contributes to the pathogenesis of several acute and chronic diseases. Hyperbaric oxygen therapy (HBO) and whole-body warming using low-temperature infrared technology (LIT) are techniques that might improve hypoxemia. Combining HBO and LIT as hyperbaric oxygen therapy combined with low-temperature infrared radiation (HBOIR) might be an approach that results in positive synergistic effects on oxygenation. LIT increases blood flow and could reduce HBO-induced vasoconstriction, and hyperoxia could compensate for the increased metabolic oxygen requirements mediated by LIT. Both LIT and HBO increase the oxygen diffusion distance in the tissues. HBOIR at 0.5 bar has been shown to be safe and feasible. However, physiological responses and the safety of HBOIR at an increased oxygen (O_2) partial pressure of 1.4 bar or 2.4 atmospheres absolute (ATA) still need to be determined. The hope is that should HBOIR at an increased oxygen partial pressure of 1.4 bar be safe, future studies to examine its efficacy in patients with clinical conditions, which include peripheral arterial disease (PAD) or wound healing disorders, will follow. The results of pilot studies have shown that HBOIR at an overload pressure is safe and well tolerated in healthy participants but can generate moderate cardiovascular changes and an increase in body temperature. From the findings of this pilot study, due to its potential synergistic effects, HBOIR could be a promising tool for the treatment of human diseases associated with hypoxemia.

Eichhorn L, Doerner J, Luetkens JA, Lunkenheimer JM, Dolscheid-Pommerich RC, Erdfelder F, Fimmers R, Nadal J, Stoffel-Wagner B, Schild HH, Hoeft A, Zur B, Naehle CP. Cardiovascular magnetic resonance assessment of acute cardiovascular effects of voluntary apnoea in elite divers. J Cardiovasc Magn Reson. 2018; 20(1):40.

BACKGROUND: Prolonged breath holding results in hypoxemia and hypercapnia. Compensatory mechanisms help maintain adequate oxygen supply to hypoxia sensitive organs, but burden the cardiovascular system. The aim was to investigate human compensatory mechanisms and their effects on the cardiovascular system with regard to cardiac function and morphology, blood flow redistribution, serum biomarkers of the adrenergic system and myocardial injury markers following prolonged apnoea. METHODS: Seventeen elite apnoea divers performed maximal breath-hold during cardiovascular magnetic resonance imaging (CMR). Two breath-hold sessions were performed to assess (1) cardiac function, myocardial tissue properties and (2) blood flow. In between CMR sessions, a head MRI was performed for the assessment of signs of silent brain ischemia. Urine and blood samples were analysed prior to and up to 4 h after the first breath-hold. RESULTS: Mean breath-hold time was 297 ± 52 s. Left ventricular (LV) end-systolic, end-diastolic, and stroke volume increased significantly ($p < 0.05$). Peripheral oxygen saturation, LV ejection fraction, LV fractional shortening, and heart rate decreased significantly ($p < 0.05$). Blood distribution was diverted to cerebral regions with no significant changes in the descending aorta. Catecholamine levels, high-sensitivity cardiac troponin, and NT-pro-BNP levels increased significantly, but did not reach pathological levels. CONCLUSION: Compensatory effects of prolonged apnoea substantially burden the cardiovascular system. CMR tissue characterisation did not reveal acute myocardial injury, indicating that the resulting cardiovascular stress does not exceed compensatory physiological limits in healthy subjects. However, these compensatory mechanisms could overly tax those limits in subjects with pre-existing cardiac disease. For divers interested in competetive apnoea diving, a comprehensive medical exam with a special focus on the cardiovascular system may be warranted.

Lansdorp CA, van Hulst RA. Double-blind trials in hyperbaric medicine: A narrative review on past experiences and considerations in designing sham hyperbaric treatment. Clin Trials. 2018 Jun 1:1740774518776952. doi: 10.1177/1740774518776952. [Epub ahead of print]

Background: Hyperbaric oxygen therapy, which consists of breathing 100% oxygen under a higher atmospheric pressure than normal, is utilized worldwide in the treatment of several diseases. With the growing demand for evidence-based research, hyperbaric oxygen therapy has been criticized for delivering too little high-quality research, mainly in the form of randomized controlled trials. While not always indispensable, the addition of a sham-controlled group to such a trial can contribute to the quality of the research. However, the design of a sham (hyperbaric) treatment is associated with several considerations regarding adequate blinding and the use of pressure and oxygen. This narrative review discusses information on the sham profile and the blinding and safety of double-blind trials in hyperbaric medicine, irrespective of the indication for treatment. Methods: MEDLINE, Embase and CENTRAL were searched for sham-controlled trials on hyperbaric oxygen therapy. The control treatment was considered sham if patients were blinded to their allocation and treatment took place in a hyperbaric chamber, with no restrictions regarding pressurization, oxygen levels or indication. Studies involving children or only one session of hyperbaric oxygen were excluded. Information on (the choice of) treatment profile, blinding measures, patient's perception regarding allocation and safety issues was extracted from eligible studies. Results: A total of 42 eligible trials were included. The main strategies for sham treatment were (1) use of a lower pressure than that of the hyperbaric oxygen group, while breathing 21% oxygen; (2) use of the same pressure as the hyperbaric oxygen group, while breathing an adjusted percentage of oxygen; and (3) use of the same pressure as the hyperbaric oxygen group, while breathing 21% oxygen. The advantages and disadvantages of each strategy are discussed using the information provided by the trials. Conclusion: Based on this review, using a lower pressure than the hyperbaric oxygen group while breathing 21% oxygen best matches the inertness of the placebo. Although studies show that use of a lower pressure does allow adequate blinding, this is associated with more practical issues than with the other strategies. The choice of which sham profile to use requires careful consideration; moreover, to ensure proper performance, a clear and detailed protocol is also required

Le Corfec T, Maurin O, Foucher S, Bertho K, Lefort H. [Carbon monoxide poison ing, treatment and orientation]. [French] Rev Infirm. 2018; 67(242):18-20.

Colourless and odourless, each year carbon monoxide is responsible for several thousand cases of poisoning. Often collective, their symptoms are non-specific and can result in serious neurological sequelae or even death, if they are not detected in time. The (pre-) hospital emergency nurse plays an important role in the management of these patients, in terms of assessment, treatment and monitoring as well as the organisation of the admittance of victims, categorisation and medical triage. As part of a team, the nurse ensures that the patient enters an adapted, regulated pathway, with the most serious cases being directed towards a hospital equipped with a hyperbaric medicine facility

Livingstone DM, Lange B. Rhinologic and oral-maxillofacial complications from scuba diving: a systematic review with recommendations. Diving Hyperb Med. 2018;48(2):79-83.

Rhinologic and oral maxillofacial complications from scuba diving are common, representing approximately 35% of head and neck pathology related to diving. We performed a systematic and comprehensive literature review on the pathophysiology, diagnosis, and treatment of rhinologic and oral maxillofacial pathology related to diving. This included complications due to sinus barotrauma, barodontalgia, odontocrexis, temporomandibular joint dysfunction, partially dentulous patients, and considerations for patients following major head and neck surgery. Of 113 papers accessed, 32 were included in the final synthesis. We created a succinct summary on each topic that should inform clinical decision making by otolaryngologists, dive medicine specialists and primary care providers when faced with pathology of these anatomic sub-sites.

Møllerløkken A. The future of diving research in Norway. Diving Hyperb Med. 2018;48(2):72.

Norway has a long tradition of quality research within the field of baromedicine. With the discovery of oil in the North Sea, it became important to establish scientific research facilities to overcome immediate challenges, but also to work towards long-term goals. For the diving community, an understanding of the pathophysiology of decompression sickness (DCS) has been one of the major forces to maintain focus on the importance of scientific research in this field. In addition to oil, the aquaculture and fish farming industries are increasing in size and are Norway's second biggest export industry today. It also requires underwater workers for the inspection and repair of underwater structures and fishnets. The importance of health and safety for the underwater worker was identified early on by the offshore industry. The Norwegian Petroleum Safety Authority publishes a yearly report that identifies all offshore diving activity. The last reported incident of DCS was in 2002, whilst the last fatal saturation diving accident was in 1987. In-shore diving operations in Norway are regulated through the Norwegian Labour Inspection Authority and here the track record is different; since 1979 there have been 28 fatalities, and they continue to occur. At the Norwegian University of Science and Technology (NTNU), there has been a research group investigating barophysiology since the early 1980s. Led by Professor Alf O Brubakk, this research has been recognized internationally and has provided ground-breaking insights into the pathophysiology of DCS. This has included the identification of vascular gas bubbles through the use of ultrasound and identifying the importance of both protecting the vascular endothelium to maintain fitness to dive and also regular physical activity to reduce the risk of the adverse effects of diving. The group has educated many students, physiologists, engineers, medical doctors and researchers, all in the spirit of Professor Brubakk who considered that education was at least as important as the research itself. In 2008, Professor Brubakk was concerned about the future, as he was soon to retire. Great effort was put into perpetuating his position but this process ended when the University axed the only professorial position in environmental physiology in Norway. Today, there is only one non-permanent barophysiology research position at NTNU. This position and all research activity is dependent on external funding, so the education and research environment has changed drastically. Whilst there are clinicians in Norway working at different hyperbaric centres who participate in research related to barophysiology, this is not their primary task. With the lack of funding to include education and students in research, the rich history of barophysiological research at NTNU will be at an end. In Norway, the majority of grant-funded scientific programmes last only three years, so it has not been easy to recruit or to keep expertise between grants. So, who is planning for long-term research efforts in Norway? Whilst there are obvious challenges left to study in barophysiology, there is a lack of understanding amongst those responsible for decision-making and funding of the importance of having an academic-based research centre for diving research. NTNU, one of the world's most advanced hyperbaric laboratories, built up at considerable capital expense to investigate the pathophysiology of diving and decompression, is about to be closed and dismantled. At a time when the off-shore industry is putting greater focus on finding better solutions for safer underwater work environments, and in-shore diving is facing huge challenges due to a worrying level of serious accidents and increasing activity, there is no political drive in Norway to acknowledge the importance of maintaining the research facilities that support this industry. If the door does close on the NTNU facility, it will take many years and substantial funding to re-establish a modern research centre. Most importantly, it will be impossible to bring new students into the field of barophysiology in the foreseeable future. Whilst the off-shore oil industry has a finite future, aquaculture and other in-shore activities requiring diving support continue to expand. Good barophysiological research in established centres will be essential to support these industries into the future. Alf Brubakk often quoted an old Chinese proverb: "When planning for a month, sow rice, when planning for a year, plant trees, when planning for a decade, train and educate men". In Norway, we are only planting trees.

Omar AR, Ibrahim M, Hussein A. Acute ophthalmic artery occlusion in decompression illness with underlying anterior cerebral artery A1 segment hypoplasia. Diving Hyperb Med. 2018;48(2):112-3.

A diver presented with total loss of vision in the left eye and right hemiparesis following a routine no-stop scuba dive to 20 metres' depth. A diagnosis of decompression illness (DCI) with acute ophthalmic artery air embolism and left carotid artery insult causing acute anterior circulatory ischaemia was made. He underwent seven hyperbaric treatments leading to a full recovery. Magnetic resonance angiography revealed an underlying left anterior cerebral artery A1 segment hypoplasia. Making a prompt diagnosis and early hyperbaric oxygen treatment are crucial to halt further tissue damage from ischaemia in central nervous system DCI. In this case, the finding of a left A1 anterior cerebral artery segment hypoplasia variant may have increased the severity of DCI due to deficient collateral circulation.

Parotto M, Ouzounian M, Fedorko L, Oreopoulos G, Lindsay T, Katznelson R.Hyperbaric oxygen therapy for spinal cord ischaemia after complex aortic repair - a retrospective review. Anaesthesiol Intensive Ther. 2018. doi: 10.5603/AIT.a2018.0010. [Epub ahead of print]

BACKGROUND: Complex aortic repair (CAR) carries high rates of debilitating postoperative complications, including spinal cord injury. The rate of spinal cord deficits post-CAR is approximately 10%, with permanent paraplegia in 2.9% and paraparesis in 2.4% of patients. Treatment options are limited. Rescue therapies include optimization of spinal cord perfusion and oxygen delivery by mean arterial pressure augmentation (>90 mm Hg), cerebrospinal fluid drainage, and preservation of adequate haemoglobin concentration (>100 g L^{-1}). Hyperbaric oxygen therapy (HBOT) has been described in several case reports as part of the multimodal treatment for spinal cord ischemia. HBOT has been used in our centre as adjunct rescue treatment for patients with spinal cord injury post-CAR that were refractory to traditional medical management, and we aimed to retrospectively review these cases. METHODS: After Research Ethics Board approval, we performed a retrospective review of all post-CAR patients who developed spinal cord injury with severe motor deficit and were treated with HBOT at our institution since 2013. RESULTS: Seven patients with spinal cord injury after CAR were treated with HBOT in addition to traditional rescue therapies. Five patients showed varying degrees of recovery, with two displaying full recovery. One developed oxygen-induced seizure, medically treated. No other HBOT-related complications were noted. CONCLUSIONS: Our retrospective study shows a potential benefit of hyperbaric oxygen therapy on neurological outcome in patients who developed spinal cord injury after CAR. Prospective research is needed to understand the role, efficacy, benefits and risks of HBOT in this setting.

Pollock NW, Gant N, Harvey D, Mesley P, Hart J, Mitchell SJ. Storage of partly used closed-circuit rebreather carbon dioxide absorbent canisters. Diving Hyperb Med. 2018;48(2):96-101.

INTRODUCTION: Diving rebreathers use "scrubber" canisters containing soda lime to remove carbon dioxide (CO_2) from the expired gas. Soda lime has a finite ability to absorb CO_2. We undertook an experiment to determine whether the manner of storage of a partly used scrubber affected subsequent CO_2 absorption. METHODS: An Evolution Plus™ rebreather was mechanically ventilated in a benchtop circuit. Respiratory minute volume was 45 $L \cdot min^{-1}$ and CO_2 was introduced to the expiratory limb at 2 $L \cdot min^{-1}$. The scrubber canister was packed with 2.64 kg of Sofnolime 797™. Scrubbers were run in this circuit for 90 minutes then removed from the rebreather and stored in packed form under one of three conditions: "open" (unsealed) for 28 days (n = 4); vacuum "sealed" in an airtight plastic bag for 28 days (n = 5); or open overnight (n = 5). Following storage the scrubber canisters were placed back in the rebreather and run as above until the PCO_2 in the inspired gas exceeded 1 kPa. The total duration of operation to reach this end-point in each storage condition was compared. RESULTS: The mean run times to reach an inspired CO_2 of 1 kPa were 188, 241, and 239 minutes in the open-28-day, the sealed-28-day and the open-overnight storage conditions, respectively. CONCLUSION: Rebreather divers should consider placing partially used soda lime scrubber canisters in vacuum-sealed plastic bags if storing them for longer periods than overnight. If a partially used scrubber canister is to be used again the next day then the storage modality is unlikely to influence scrubber efficacy

Sherlock S, Way M, Tabah A. Audit of practice in Australasian hyperbaric units on the incidence of central nervous system oxygen toxicity. Diving Hyperb Med. 2018;48(2):73-8.

INTRODUCTION: Central nervous system oxygen toxicity (CNS-OT) is an uncommon complication of hyperbaric oxygen treatment (HBOT). Different facilities have developed local protocols in an attempt to reduce the risk of CNS-OT. This audit was performed to elucidate which protocols might be of benefit in mitigating CNS-OT and to open discussion on adopting a common protocol for Treatment Table 14 (TT14) to enable future multicentre clinical trials. METHODS: Audit of CNS-OT events between units using different compression profiles for TT14, performed at 243 kPa with variable durations of oxygen breathing and 'air breaks', to assess whether there is a statistical difference between protocols. Data were collected retrospectively from public and private hyperbaric facilities in Australia and New Zealand between 01 January 2010 and 31 December 2014. RESULTS: Eight of 15 units approached participated. During the five-year period 5,193 patients received 96,670 treatments. There were a total of 38 seizures in 33 patients when all treatment pressures were examined. In the group of patients treated at 243 kPa there were a total of 26 seizures in 23 patients. The incidence of seizure per treatment was 0.024% (2.4 per 10,000 treatments) at 243 kPa and the risk per patient was 0.45% (4.5 in 1,000 patients). There were no statistically significant differences between the incidences of CNS-OT using different TT14 protocols in this analysis. CONCLUSION: HBOT is safe and CNS-OT is uncommon. The risk of CNS-OT per patient at 243 kPa was 1 in 222 (0.45%; range 0-1%) and the overall risk irrespective of treatment table was 0.6% (range 0.31-1.8%). These figures are higher than previously reported as they represent individual patient risk as opposed to risk per treatment. The wide disparity of facility protocols for a 243 kPa table without discernible influence on the incidence of CNS-OT rates should facilitate a national approach to consensus.

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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