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

E-NEWS

EDITORIAL NOTE – July 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.

Neal W. Pollock, PhD
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NEWS/ANNOUNCEMENTS

CUHMA Annual Scientific Meeting Interest

We had a strong response to the call for original research abstracts for the 2019 CUHMA meeting by the June 15 deadline. Similarly, we are seeing an increase in the number of international inquiries about the conference. Both are very gratifying developments. We can look forward to a great meeting.

COMMUNITY IMAGES

Students (along with some faculty), attending the recent UMC Level 2 Advanced Course in Diving Medicine held in Halifax, NS in May 2019. Picture taken outside the chamber at the Hyperbaric Medicine Unit, QEII Heath Sciences Centre in Halifax following a clinical treatment simulation session.

UPCOMING EVENTS

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 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.

UHN Introductory Hyperbaric Medicine Course

The University Health Network, Toronto General Hospital, is offering an Introductory Course in Hyperbaric Medicine on November 26-30, 2019. The program will provide participants the basic competencies to practice in hyperbaric medicine. Content will include the indications and contraindications for hyperbaric treatments and guidelines on the usage of treatment tables. There will be hands-on clinical practice of skills, opportunities to learn how to manage the chamber and clinical emergencies during hyperbaric treatments, as well as theory and historical background. For more information visit:
https://www.uhn.ca/Surgery/PatientsFamilies/Clinics_Tests/Hyperbaric_Medicine_Unit/Pages/Continuing_Education.aspx

RECENT PUBLICATIONS

Abdelhakim H, Shune L, Bhatti S, Cantilena AR, Baran A, Lin TL, et al. Results of the first clinical study in humans that combines hyperbaric oxygen pre-treatment with autologous peripheral blood stem cell transplantation. Biol Blood Marrow Transplant. 2019 Jun 3. pii: S1083-8791(19)30353-2. doi: 10.1016/ j.bbmt.2019.05.028. [Epub ahead of print]

Patients undergoing high-dose chemotherapy and autologous hematopoietic cell transplantation (Auto-HCT) are at risk for multiple morbidities, including mucosal inflammation and neutropenic fever, both related to neutropenia. Evidence from our pre-clinical work in an umbilical cord blood (UCB) transplantation murine model suggests that treatment with hyperbaric oxygen (HBO) prior to UCB infusion improves UCB CD34+ cell engraftment by reducing erythropoietin levels. A pilot clinical trial using HBO in patients undergoing UCB transplantation showed improvement in kinetics of blood count recovery. In this study, we evaluated HBO in combination with Auto-HCT. Our primary aim was to determine the safety of HBO in this setting, and secondarily to determine its efficacy in reducing time to neutrophil and platelet engraftment, compared to matched historic controls. Patients with multiple myeloma (MM), non-Hodgkin's lymphoma (NHL) and Hodgkin's disease (HD) eligible for Auto-HCT were included. On day 0, patients received HBO treatment consisting of exposure to 2.5 atmosphere absolutes for a total of 90 minutes, in a monoplace hyperbaric chamber, breathing 100% oxygen. Six hours after the start of HBO, peripherally mobilized stem/progenitor cells were infused and patients were followed daily for toxicity and blood count recovery. All patients received daily granulocyte-colony stimulating factor (G-CSF) starting on day +5 and until absolute neutrophil count (ANC) of ≥1,500 or ANC of 500 for three consecutive days. A matched historic cohort of 225 patients who received Auto-HCT between January 2008 and December 2012 was chosen for comparison, and was matched on gender, age, conditioning regimen, and disease type. We screened 26 patients for this study, 20 were treated and were included in the primary analysis, and 19 completed the HBO therapy and were included in the secondary analysis. While the median time to neutrophil count recovery was 11 days in both the HBO and control cohorts, the Kaplan Meier estimates of the full distributions indicate that the time to neutrophil recovery was generally about 1 day sooner for HBO vs historical controls (logrank p = 0.005; range: 9-13 for HBO patients, range: 7-18 for controls). The median time to platelet count recovery was 16 days (range: 14-21) for HBO vs 18 days (range: 11-86) for controls (logrank p < 0.0001). In the secondary analysis comparing the HBO cohort who completed HBO therapy (n=19) to our historical cohort, we evaluated neutropenic fever, growth factor use, mucositis, day +100 disease responses, and blood product use. HBO was associated with less growth factor use (median 6 days in HBO cohort vs median 8 days in controls, p<0.0001). PRBC and platelet transfusion requirements were not statistically different between the two cohorts. Mucositis incidence was significantly lower in the HBO cohort (26.3% in HBO cohort vs 64.2% in controls, P=0.002). HBO therapy appears to be well-tolerated in the setting of high-dose therapy and Auto-HCT. Prospective studies are needed to confirm potential benefits of HBO with respect to earlier blood count recovery, reduced mucositis and growth factor use, and a cost-benefit analysis is warranted

Anderson G, Ebersole D, Covington D, Denoble PJ. The effectiveness of risk mitigation interventions in divers with persistent (patent) foramen ovale. Diving Hyperb Med. 201;49(2):80-7.

INTRODUCTION: Persistent (patent) foramen ovale (PFO) is a recognized risk for decompression sickness (DCS) in divers, which may be mitigated by conservative diving or by PFO closure. Our study aimed to compare the effectiveness of these two risk mitigation interventions. METHODS: This was a prospective study on divers who tested positive for PFO or an atrial septal defect (ASD) and either decided to continue diving without closure ('conservative group'), or to close their PFO/ASD and continue diving ('closure group'). Divers' characteristics, medical history, history of diving and history of DCS were reported at enrollment and annually after that. The outcome measures were the incidence rate of DCS, frequency and intensity of diving activities, and adverse events of closure. RESULTS: Divers in both groups dived less and had a lower incidence rate of confirmed DCS than before the intervention. In the closure group (n = 42) the incidence rate of confirmed DCS decreased significantly. Divers with a large PFO experienced the greatest reduction in total DCS. In the conservative group (n = 23), the post-intervention decrease in confirmed DCS incidence rate was not significant. Of note, not all divers returned to diving after closure. Seven subjects reported mild adverse events associated with closure; one subject reported a serious adverse event. CONCLUSIONS: PFO closure should be considered on an individual basis. In particular, individuals who are healthy, have a significant DCS burden, a large PFO or seek to pursue advanced diving may benefit from closure.

Arieli R. Pulmonary oxygen toxicity in saturation dives with PO_2 close to the lower end of the toxic range - a quantitative approach. Respir Physiol Neurobiol. 2019 May 31. pii: S1569-9048(19)30145-4. doi: 10.1016/ j.resp.2019.05.017. [Epub ahead of print]

Pulmonary oxygen toxicity (POT) has been extensively described at partial pressures of oxygen (PO_2) ≥1 atmosphere absolute (ATA), but much less so at lower

PO_2. We proposed the POT index [$K=t^2\times PO_2^{4.57}$] as a means of evaluating the severity of POT, expressed either as reduced lung function or the incidence of POT in a group of divers. In the exponential recovery process (e - [-0.42+0.384×(PO_2)ex]×tr), the time constant increases linearly from 0.0024 to 0.54 h^{-1} for a PO_2 of 1.1 to 2.5 bar. A linear relationship was demonstrated between the incidence of POT and the POT index, given by the equation: POT incidence %=1.85+0.171×K. In saturation diving, PO_2 is kept close to the lower end of the toxic limits for POT, which is approximately 0.5 bar. We suggested that at this low range of PO_2, the two processes of cumulative toxicity and recovery operate simultaneously. For one example of saturation diving, we show that a recovery time constant of 0.0135 h^{-1} yields the measured incidence of POT. We therefore propose the formula $K=t^2\times PO_2^{4.57}\times e^{-0.0135}\times t$ for calculation of the POT index in further analyses of POT in saturation diving.

Burkett JG, Nahas-Geiger SJ. Diving headache. Curr Pain Headache Rep. 2019;23(7):46. doi: 10.1007/s11916-019-0787-8.

This review will focus on the most recent information regarding the ICHD-3 definition of diving headache as well as other important causes of diving headache that are not listed in the ICHD-3 classification system. The paper will discuss etiology, diagnosis, and management of these disorders, focusing, when possible, on the newest research available. ICHD-3 diving headache is due to hypercapnia and is treated accordingly with oxygen. Other causes of diving headache range from decompression sickness to external compression headache to primary headache disorders, such as migraine. Correctly determining the underlying cause of the diving headache is critical to management and relies on history taking and physical exam. The pathophysiology of newly described types of diving headache, such as diving ascent headache, remains under investigation but may be related to other homeostatic headache causes, such as airplane headache. Further investigation may yield more information regarding management as well as possible insight into other headache disorders.

Douglas Shytle R, Eve DJ, Kim SH, Spiegel A, Sanberg PR, Borlongan CV. Retrospective case series of traumatic brain injury and post-traumatic stress disorder treated with hyperbaric oxygen therapy. Cell Transplant. 2019 May 28:963689719853232. doi: 10.1177/0963689719853232. [Epub ahead of print]

Returning veterans are frequently diagnosed with traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD). Considering a recent case-controlled study of hyperbaric oxygen therapy (HBOT) reporting a reduction in suicidal ideation, we investigated retrospectively three veterans with chronic TBI/PTSD symptoms who were treated with multiple rounds of HBOT with neurophysiological testing performed before and after treatment. Improvements were detected on parameters within neurocognitive domains, including reductions in suicide-related symptoms. These findings independently confirm that HBOT may be effective in treating specific symptoms of TBI/PTSD that are not currently addressed with existing therapeutic approaches.

Franz BKG, Patuzzi R, Wraight CJ, Kay G, Ng A, Anderson CR. Measuring dynamic Eustachian tube function using tympanometry in a pressure chamber: the effect of nasal betahistine application. J Laryngol Otol. 2019 Jun 24:1-8. doi: 10.1017/S0022215119001270. [Epub ahead of print]

OBJECTIVE: To assess the effect of topical betahistine on Eustachian tube function in subjectively abnormal subjects in a hyperbaric chamber. METHOD: Active and passive Eustachian tube function was examined using tympanometry in a pressure chamber. RESULTS: Active Eustachian tube function was tested against the negative middle ear pressure induced by increasing the chamber pressure to +3 kPa. One voluntary swallow decreased middle-ear pressure by a mean of 1.36 kPa. Passive Eustachian tube function was tested by measuring spontaneous Eustachian tube openings as the chamber pressure dropped from +10 kPa to ambient. Four distinct patterns of Eustachian tube behaviour were seen, three of which indicated Eustachian tube dysfunction. Betahistine had no positive effect on Eustachian tube opening, although previous animal studies had suggested a beneficial effect. CONCLUSION: Topical betahistine had no effect on Eustachian tube function. Combining a hyperbaric chamber with tympanometry proved ideal for evaluating Eustachian tube function.

Goffinet CM, Simpson G. Cerebral arterial gas embolism in a scuba diver with a primary lung bulla. Diving Hyperb Med. 2019;49(2):141-4.

Primary lung bullae have been reported to cause pulmonary barotrauma and lead to cerebral arterial gas embolism (CAGE) in the context of diving; however, a lack of symptoms and often minimal radiographic findings often preclude a diagnosis of lung bullae prior to undertaking diving activity. We present the case of a healthy 27-year-old Caucasian male who presented following the second of two introductory resort dives with neurological symptoms attributable to CAGE. Investigations revealed a previously undiagnosed large primary lung bulla. This case highlights the clinical sequelae of primary lung bullae in the context of pulmonary barotrauma related to recreational diving activity.

Goggins CA, Khachemoune A. The use of hyperbaric oxygen therapy in the treatment of necrotizing soft tissue infections, compromised grafts and flaps, hidradenitis

suppurativa, and pyoderma gangrenosum. Acta Dermatovenerol Alp Pannonica Adriat. 2019;28(2):81-4.

Hyperbaric oxygen therapy (HBOT) is used in the management of a wide array of disease states, including acute thermal burn injuries, carbon monoxide poisoning, and decompression sickness, to name a few. Although HBOT is approved by the Undersea and Hyperbaric Medical Society for the treatment of only 14 conditions, it has been used "off-label" in the management of a variety of dermatological diseases. This review investigates the utilization of HBOT in dermatology and appraises the evidence behind its use. We focus on the role of HBOT in treating necrotizing soft tissue infections, compromised grafts and flaps, hidradenitis suppurativa, and pyoderma gangrenosum.

Hoencamp E, van Dongen TT, van Ooij PA, Wingelaar TT, Vervelde ML, Koch DA, van Hulst RA, Hoencamp R. Systematic review on the effects of medication under hyperbaric conditions: consequences for the diver. Diving Hyperb Med. 2019;49(2):127-36.

BACKGROUND: Physiological changes are induced by immersion, swimming and using diving equipment. Divers must be fit to dive. Using medication may impact the capacity to adapt to hyperbaric conditions. The aim of this systematic review is to assess the interaction of diving/hyperbaric conditions and medication and to provide basic heuristics to support decision making regarding fitness to dive in medicated divers. METHODS: This was a systematic review of human and animal studies of medications in the hyperbaric environment. Studies were subdivided into those describing a medication/hyperbaric environment interaction and those concerned with prevention of diving disorders. Studies without a relation to diving with compressed air, and those concerning oxygen toxicity, hyperbaric oxygen therapy or the treatment of decompression sickness were excluded. RESULTS: Forty-four studies matched the inclusion criteria. Animal studies revealed that diazepam and valproate gave limited protection against the onset of the high-pressure neurological syndrome. Lithium had a protective effect against nitrogen-narcosis and losartan reduced cardiac changes in repetitive diving. Human studies showed no beneficial or dangerous pressure-related interactions. In prevention of diving disorders, pseudoephedrine reduced otic barotrauma, vitamins C and E reduced endothelial dysfunction after bounce diving and hepatic oxidative stress in saturation diving. DISCUSSION AND CONCLUSIONS: Animal studies revealed that psycho-pharmaceuticals can limit the onset of neurologic symptoms and cardiovascular protective drugs might add a potential protective effect against decompression sickness. No evidence of significant risks due to changes in pharmacologic mechanisms were revealed and most medication is not a contraindication to diving. For improving decision making in prescribing medicine for recreational and occupational divers and to enhance safety by increasing our understanding of pharmacology in hyperbaric conditions, future research should focus on controlled human studies.

Koca E, Sam B, Arican N, Toklu AS. Evaluation of fatal diving accidents in Turkey. Undersea Hyperb Med. 2019;45(6):633-8.

In any kind of diving there is a risk of accidents, as the move from the topside environment to underwater can affect a diver's physiological and psychological condition. It is important to investigate dive accidents to clarify the causative factors and determine preventive measures. In this study, autopsy files of fatal dive accident cases were reviewed to evaluate demographic data, type of diving, purpose of dive, seasonal distribution, autopsy findings, and causes of death. We reviewed 56 fatal dive accident files from autopsy units in cities where dive activities are concentrated and from the archive of the Turkish Underwater Federation. Four cases were excluded from the study since we were unable to obtain autopsy reports. Of 52 cases there were 20 scuba divers, two surface-supplied divers and 30 breath-hold divers. The majority of cases involved males (94%). The average age of 50 cases was 38.6; age estimation for two cases could not be determined due to advanced putrefaction. Of these fatal dive accidents 75% took place over a period of six months between May and October. Drowning was recorded as the primary cause of death in these cases. X-ray imaging was used in four (8%) cases. A special autopsy technique was used for nine (17%) cases, to detect possible pulmonary barotrauma and arterial gas embolism. The forensic specialist who is planning to conduct the autopsy for a dive fatality should have knowledge and experience about dive physics and physiology as well as physiopathology of dysbaric injuries.

Martin JH, Van Wijk CH, Bowden WJ. Diving, cannabis use, and techniques of neutralisation: exploring how divers rationalise cannabis use. Int Marit Health. 2019;70(2):88-94. doi: 10.5603/IMH.2019.0014.

BACKGROUND: Diving medicine literature often regards the use of cannabis as a potential contra-indicator for fitness to dive. With that said, there has been no empirical research done with cannabis-using divers to examine how they subjectively understand and construct the risks that their cannabis use may have on their diving. This study explored how cannabis-using divers rationalise the pejorative associations of cannabis use through rhetorical techniques of neutralisation (TON) that function to deny the risks that cannabis use may have on their diving. MATERIALS AND METHODS: Ten medically-fit professional divers from South Africa were individually intervie- wed. The interviews focussed on each diver's reported recreational use of cannabis. The interviews were transcribed and analysed through a framework for TON

originally formulated by Sykes and Matza (1957). RESULTS: Analysis revealed six primary TON employed to refute the pejorative associations of cannabis use on dive work, namely: 1. Denial of responsibility: which denies a diver's direct culpability for their cannabis use; 2. Denial of injury: which asserts that no (serious) harm results from a diver's cannabis use; 3. Denial of victim: which repudiates the potentially deleterious effects that cannabis use may have on a diver; 4. Condemnation of condemners: which minimises cannabis use in relation to other divers' unsafe diving practices; 5. Appeal to loyalties: which situates cannabis use within interpersonal networks to whom a diver has a "higher" allegiance; 6. Denial of penalty: which justifies cannabis use by virtue of a perceived lack of punitive action by a Diving Medical Examiner. CONCLUSIONS: The findings of this research highlight the TON which potentially inform a diver's cannabis use, particularly in relation to their diving. Identifying such TON carry important implications for the ways in which fitness to dive is assessed.

Mitchell SJ, Green HM, Reading SA, Gant N. The utility and safety of hypoxia experiences for rebreather divers. Diving Hyperb Med. 2019;49(2):112-8.

BACKGROUND: Aircrew training often includes an hypoxic experience aimed at improving symptom recognition and self-rescue in a subsequent hypoxic event. Similar training has been advocated for rebreather divers. We investigated the effect of a prior hypoxic experience on actual and perceived cognitive function during subsequent hypoxia and measured the physiological responses to severe progressive hypoxia. METHODS: Twenty-five subjects underwent two hypoxic hypoxia experiences (trials one and two) approximately five weeks apart. Subjects breathed 5.5% oxygen whilst performing a playing card recognition test. The primary endpoint was the time taken to make three consecutive errors in the card recognition test (time of useful consciousness, TUC). Secondary endpoints were the total number of errors made, accuracy of error recollection and physiological variables. RESULTS: Mean (SD) TUC was 166 seconds (37) and 169 s (35), and subjects made 8.9 (2.4) and 7.8 (2.0) errors in trials one and two respectively. Error recall was identical between trials with participants failing to recall 6 (3) and 6 (2) errors made in trials one and two respectively. Across both trials mean nadir arterial blood and cerebral oxygen saturations were 52% and 49% respectively. The mean (SD) increase in heart rate was 42 (16) beats·min^{-1}. CONCLUSION: An hypoxic experience did not improve cognitive performance or subject insight into performance in a second exposure five weeks later. Hypoxia imposes a significant physiological stress which may be hazardous in unscreened, non-medically supervised subjects. Hypoxia experience training is not recommended for rebreather divers at this time.

Monnot D, Michot T, Dugrenot E, Guerrero F, Lafère P. A survey of scuba diving-related injuries and outcomes among French recreational divers. Diving Hyperb Med. 2019;49(2):96-106.

INTRODUCTION: Few studies are available to appreciate the broad spectrum of dive-related injuries (DI), which are not limited to decompression illness (DCI) and fatalities. Studies supporting injury-management efficacy from early recognition to first-aid, final treatment and outcome are also lacking. This study aims at making an epidemiologic inventory of DI among French scuba divers. METHODS: This online, retrospective, cross-sectional survey analyzed self-reported symptoms, context of occurrence, initial response and outcome. The relationships between symptoms and diver characteristics were assessed and severity scores created from the reports. RESULTS: A total of 799 divers responded, of whose questionnaires 784 were sufficiently complete to be analyzed. Approximately one-third (35%) of respondents had never experienced a DI. DCI-like symptoms represent a small fraction of DIs, the most commonly reported being ear barotrauma. Self-reported symptom rates decreased with increasing age and male sex. The ranking dive leader was the primary care provider in 58% of reports and 32% of injured divers never sought help. Management decisions (first aid and/or hyperbaric oxygen treatment) were related to the severity score. Complete resolution was achieved in 84 (74%) of 114 DCI cases, whilst mild (n=22, 19%) and severe (n=8, 7%) residual symptoms were reported. One in 10 divers who did not seek treatment for symptoms believed to be related to DCI declared some residual symptoms. CONCLUSION: Based on these results, diving injury rates may be higher than previously reported. However, the most frequent symptoms appear to be of only a modest nature.

Poolpol P, Sithisarankul P, Rattananupong T. Lung function change in hyperbaric chamber inside attendants. Int Marit Health. 2019;70(2):125-131.

BACKGROUND: Hyperbaric oxygen therapy is one of new trends of additional treatment, especially for non-diving-related diseases in Thailand. Hyperbaric inside attendants have to work under hyperbaric environment to provide medical care for patients in the hyperbaric chamber. This study aims to investigate longitudinal change in lung function in hyperbaric inside attendants (HIAs) and the relationship with hyperbaric exposure. MATERIALS AND METHODS: This is a retrospective longitudinal study exploring the adverse long-term effects to the lungs in HIAs. All inside attendants (HIAs) who worked in the public hospitals or medical centres with multiplace hyperbaric chamber in Thailand were included. To be considered for inclusion in the study, inside attendants were required to have at least two follow-up lung function tests and minimum 1-year interval at baseline from annually periodic examination. Lung

function of HIAs were compared against reference values of the Thai population. RESULTS: There were 51 subjects with 9.26-year mean period of follow-up. The HIAs showed a significantly decrease in measured lung function in average forced expiratory volume in 1 second (FEV_1), forced expiratory flow at 25-75% of functional vital capacity ($FEF_{25-75\%}$) and FEV_1/FVC ratio over time. The annual reductions in FEV_1, $FEF_{25-75\%}$ and FEV_1/FVC ratio were 22.52 mL per year, 44.92 mL/s per year and 0.48% per year, respectively. The study showed significant differences in annual changes in FVC, $FEF_{25-75\%}$ and FEV_1/FVC ratio between HIAs and the lung function predicted values for the Thais. However, the results revealed no differences of annual change in FEV_1 from predicted values. The average working depths, average session duration and total working hours as HIAs were related with the changes of lung function. CONCLUSIONS: Working in a hyperbaric environment does affect the lung function of HIAs. In addition to fitness to work implementation, periodic lung function evaluation should be encouraged to monitor further possible harm to the attendants.

Qing L, Meng W, Zhang W, Yi HJ, Zhang K, Ariyadewa DK, Xu WG. Benefits of escin for decompression sickness in Bama pigs by endothelial-targeting protection. Front Physiol. 2019 May 21;10:605. doi: 10.3389/fphys.2019.00605. eCollection 2019.

Endothelial dysfunction has been considered as pivotal in the pathogenesis of decompression sickness (DCS) and contributes substantively to subsequent inflammatory responses. Escin is well known for its endothelial protection and anti-inflammatory properties, and its protection against DCS has been proved in a rat model. This study aimed to further investigate the protection of escin against DCS in swine. Sixteen swine were subjected to a two-stage experiment with an interval of 7 days. In each stage, 7 days before a simulated air dive, the swine were treated with escin or saline. The first group received a successive administration of escin for 7 days prior to the first dive and saline for 7 days prior to the second; the second group was treated with saline and then escin. After decompression, signs of DCS and circulating bubbles were monitored, and blood was sampled for platelet count and determination of inflammatory and endothelial related indices. The death rate of DCS was markedly decreased in swine treated with escin compared with that in animals treated with saline, though not statistically significant due to the limited number of animals. Escin had no effect on bubble load but significantly ameliorated platelet reduction and endothelial dysfunction, as well as oxidative and inflammatory responses. The results further suggest the beneficial effects of escin on DCS by its endothelia-protective properties, and escin has the potential to be a candidate drug for DCS prevention and treatment.

Rosén A, Oscarsson N, Kvarnström A, Gennser M, Sandström G, Blennow K, Seeman-Lodding H, Zetterberg H. Serum tau concentration after diving - an observational pilot study. Diving Hyperb Med. 2019; 49(2):88-95.

INTRODUCTION: Increased concentrations of tau protein are associated with medical conditions involving the central nervous system, such as Alzheimer's disease, traumatic brain injury and hypoxia. Diving, by way of an elevated ambient pressure, can affect the nervous system, however it is not known whether it causes a rise in tau protein levels in serum. A prospective observational pilot study was performed to investigate changes in tau protein concentrations in serum after diving and also determine their relationship, if any, to the amount of inert gas bubbling in the venous blood. METHODS: Subjects were 10 navy divers performing one or two dives per day, increasing in depth, over four days. Maximum dive depths ranged from 52-90 metres' sea water (msw). Air or trimix (nitrogen/oxygen/helium) was used as the breathing gas and the oxygen partial pressure did not exceed 160 kPa. Blood samples taken before the first and after the last dives were analyzed. Divers were monitored for the presence of venous gas emboli (VGE) at 10 to15 minute intervals for up to 120 minutes using precordial Doppler ultrasound. RESULTS: Median tau protein before diving was 0.200 $pg{\cdot}mL^{-1}$ (range 0.100 to 1.10 $pg{\cdot}mL^{-1}$) and after diving was 0.450 $pg{\cdot}mL^{-1}$ (range 0.100 to 1.20 $pg{\cdot}mL^{-1}$; $P = 0.016$). Glial fibrillary acidic protein and neurofilament light protein concentrations analyzed in the same assay did not change after diving. No correlation was found between serum tau protein concentration and the amount of VGE. CONCLUSION: Repeated diving to between 52-90 msw is associated with a statistically significant increase in serum tau protein concentration, which could indicate neuronal stress.

Sames C, Gorman DF, Mitchell SJ, Zhou L. The impact of health on professional diver attrition. Diving Hyperb Med. 2019;49(2):107-11.

INTRODUCTION: Approximately 77% of professional divers leave the industry within five years of entry, for reasons that are uncertain. One possibility is that attrition is due to ill-health. The health of New Zealand occupational divers is surveyed by a comprehensive medical examination every five years and by a health questionnaire in the intervening years. Divers are thereby confirmed 'fit' annually. The aim of this study was to determine if divers quit the industry due to a health problem not identified by this health surveillance system. METHOD: 601 divers who had left the industry within five years of entry medical examination ('quitters') were identified from a computerised database. One hundred and thirty-six who could be contacted were questioned about their principal reason for quitting. Comparison was made between the health data of all those defined as 'quitters'

and a group of 436 'stayers' who have remained active in the industry for over 10 years. RESULTS: Health was the principal reason for abandoning a diving career for only 2.9% of quitters. The overwhelming majority (97.1%) quit because of dissatisfaction with aspects of the work, such as remuneration and reliability of employment. Besides gender, the only significant difference between the health data of quitters and stayers was that smoking was four times more prevalent among quitters. CONCLUSIONS: The key determinant of early attrition from the New Zealand professional diver workforce is industry-related rather than health-related. The current New Zealand diver health surveillance system detects the medical problems that cause divers to quit the industry

Taboni A, Fagoni N, Moia C, Vinetti G, Ferretti G. Gas exchange and cardiovascular responses during breath-holding in divers. Respir Physiol Neurobiol. 2019 Sep;267:27-34.

To check whether the evolution of alveolar pressures of O_2 (P_AO_2) and CO_2 (P_ACO_2) explains the cardiovascular responses to apnoea, eight divers performed resting apnoeas of increasing duration in air and in O_2. We measured heart rate (fH), arterial pressure (AP), and peripheral resistances (TPR) beat-by-beat, P_AO_2 and P_ACO_2 at the end of each apnoea. The three phases of the cardiovascular response to apnoea were observed. In O_2, TPR increase (9±4 mmHg min l^{-1}) and f_H decrease (-11±8 bpm) were lower than in air (15±5 mmHg min l^{-1} and -28±13 bpm, respectively). At end of maximal apnoeas in air, P_AO_2 and P_ACO_2 were 50±9 and 48±5 mmHg, respectively; corresponding values in O_2 were 653±8 mmHg and 55±5 mmHg. At end of phase II, P_AO_2 and P_ACO_2 in air were 90±13 mmHg and 42±4 mmHg respectively; corresponding values in O_2 were 669±7 mmHg and 47±6 mmHg. The P_ACO_2 increase may trigger the AP rise in phase III.

Xu F, Zhang R, Zhang Q, Xu Z, Li D, Li Y. Hyperbaric oxygen therapy: an effective and noninvasive therapy for complications of ear reconstruction. J Craniofac Surg. 2019;30(4):e382-5.

OBJECTIVES: Although complications of ear reconstruction are rare, common salvage procedures involve invasive surgery, and final outcomes can be uncertain. In this study, the authors have successfully applied noninvasive hyperbaric oxygen therapy (HBOT) as an adjunct treatment for the complications of ear reconstruction. METHODS: During a 2-year period, 42 patients with complications of ear reconstruction were included in the study. All patients received HBOT twice a day for 2 to 3 courses, and each course lasted for 10 days. RESULTS: Patients suffered from 4 different complications: hematoma (15), flap venous congestion (13), frame exposure (10), and postoperative infection (4). After HBOT, 41 patients recovered without a need for additional surgical repair. One patient developed an infection and required further treatment. CONCLUSIONS: Combined with traditional salvage procedures, HBOT effectively treated various complications of ear reconstruction.

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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