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RICERCA IN MEDLINE DEI LAVORI DI MEDICINA SUBACQUEA INDICIZZATI CON PAROLA CHIAVE

2004
SECONDO SEMESTRE

a cura del
Dott. Francesco Ruocco
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Anestesia e Rianimazione del Dipartimento di Emergenza
della Azienda Ospedaliera Universitaria di Careggi

Search **"Diving"[MAJR]** Limits: **Publication Date from 2004/07 to 2004/12**

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1: Proc Biol Sci. 2004 Dec 7;271 Suppl 6:S383-6.
Beaked whales echolocate on prey.
Johnson M, Madsen PT, Zimmer WM, de Soto NA, Tyack PL.
Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA. mjohnson@whoi.edu
Beaked whales (Cetacea: Ziphiidea) of the genera Ziphius and Mesoplodon are so difficult to study that they are mostly known from strandings. How these elusive toothed whales use and react to sound is of concern because they mass strand during naval sonar exercises. A new non-invasive acoustic ording tag was attached to four beaked whales(two Mesoplodon densirostris and two Ziphius cavirostris) and recorded high-frequency clicks during deep dives. The tagged whales only clicked at depths below 200 m, down to a maximum depth of 1267 m. Both species produced a large number of short, directional, ultrasonic clicks with significant energy below 20 kHz. The tags recorded echoes from prey items; to our knowledge, a first for any animal echolocating in the wild. As far as we are aware, these echoes provide the first direct evidence on how free-ranging toothed whales use echolocation in foraging. The strength of these echoes suggests that the source level of Mesoplodon clicks is in the range of 200-220 dB re 1 microPa at 1 m.This paper presents conclusive data on the normal vocalizations of these beaked whale species, which may enable acoustic monitoring to mitigate exposure to sounds intense enough to harm them.
PMID: 15801582 [PubMed - indexed for MEDLINE]

2: Eur J Appl Physiol. 2005 Mar;93(5-6):701-7. Epub 2004 Nov 25.
Aggravated hypoxia during breath-holds after prolonged exercise.
Lindholm P, Gennser M.
Section of Environmental Physiology, Department of Physiology and Pharmacology, Karolinska Institutet, Berzelius vag 13, 17177 Stockholm, Sweden. peter.lindholm@fyfa.ki.se
Hyperventilation prior to breath-hold diving increases the risk of syncope as a result of hypoxia. Recently, a number of cases of near-drownings in which the swimmers did not hyperventilate before breath-hold diving have come to our attention. These individuals had engaged in prolonged exercise prior to breath-hold diving and it is known that such exercise enhances lipid metabolism relative to carbohydrate metabolism, resulting in a lower production of CO(2) per amount of O(2)consumed. Therefore, our hypothesis was that an exercise-induced increase in lipid metabolism and the associated reduction in the amount of CO(2) produced would cause the urge to breathe to develop at a lower P O(2), thereby increasing the risk of syncope due to hypoxia. Eight experienced breath-hold divers performed 5 or 6 breath-holds at rest in the supine position and then 5 or 6 additional breath-holds during intermittent light ergometer exercise with simultaneous apnoea (dynamic apnoea, DA) on two different days: control (C) and post prolonged sub-maximal exercise (PPE), when the breath-holds were performed 30 min after 2 h of sub-maximal exercise. After C and before the prolonged submaximal exercise subjects were put on a carbohydrate-free diet for 18 h to start the depletion of glycogen. The respiratory exchange ratio (RER) and end-tidal P CO(2), P O(2), and SaO(2) values were determined and the data were presented as means (SD). The RER prior to breath-holding under control conditions was 0.83 (0.09), whereas the corresponding value after exercise was 0.70 (0.05) (P <0.01). When the three apnoeas of the longest duration for each subject were analysed, the average duration of the dynamic apnoeas was 96 (14) s under control conditions and 96 (17) s following exercise. Both P O(2) and P CO(2) were higher during the control dynamic apnoeas than after PPE [PO(2) 6.9 (1.0) kPa vs 6.2 (1.2) kPa, P <0.01; P CO(2) 7.8 (0.5) kPa vs 6.7 (0.4) kPa, P <0.001; ANOVA testing]. A similar pattern was observed after breath-holding under resting conditions, i.e., a lower end-tidal P O(2) and P CO(2) after exercise (PPE) compared to control conditions. Our findings demonstrate that under the conditions of a relatively low RER following prolonged exercise, breath-holding is terminated at a lower P O(2) and a lower P CO(2) than under normal conditions. This suggests that elevated lipid metabolism may constitute a risk factor in connection with breath-holding during swimming and diving.
PMID: 15778900 [PubMed - indexed for MEDLINE]

3: Free Radic Res. 2004 Sep;38(9):1003-9.
Neutrophil tolerance to oxidative stress induced by hypoxia/reoxygenation.
Sureda A, Batle JM, Tauler P, Cases N, Aguilo A, Tur JA, Pons A.
Laboratori de Ciencies de l'Activitat Fisica, Departament de Biologia Fonamental i Ciencies de la Salut, Universitat de les Illes Balears, Campus Universitari, Crtra. Valldemossa, Km 7.5, E-07122-Palma de Mallorca, Illes Balears, Spain.
Repetitive episodes of hypoxia/reoxygenation induce cellular adaptations resulting in a tolerance process against oxidative stress. We studied the effects of chronic episodes of hypoxia/reoxygenation on neutrophil antioxidant defenses, neutrophil oxidative capability, and oxidative damage induced in neutrophils and plasma. Seven professional apnea divers participated in the study. Blood samples were taken under basal conditions, after a diving apnea session, and under basal conditions after five consecutive days of diving apnea sessions (basal

post-diving). Chronic episodes of hypoxia/reoxygenation increased malondialdehyde (MDA), carbonyl derivates and creatine kinase (CPK) in plasma. Neutrophil catalase (CAT) levels were higher in basal post-diving. Neutrophil oxidative burst was maintained after diving, although the maximum response was delayed in basal post-diving. Neutrophil thioredoxin reductase (TR) activity increased in basal post-diving, and glutathione reductase (GR) activity was maintained. Chronic, repetitive episodes of diving apnea induce neutrophil adaptations in order to delay the oxidative burst response and to facilitate protein reduction. Diving apnea could be a good model to study tolerance to the oxidative stress generated by hypoxia/ reoxygenation.
PMID: 15621719 [PubMed - indexed for MEDLINE]

4: Aviat Space Environ Med. 2004 Dec;75(12):1023-8.
Consensus factors used by experts in the diagnosis of decompression illness.
Freiberger JJ, Lyman SJ, Denoble PJ, Pieper CF, Vann RD.
Research Department, Diver's Alert Network, Durham, NC, USA. jfreiberger@dan.duke.edu
INTRODUCTION: The diagnosis of decompression illness (DCI) is entirely based on clinical findings and DCI experts are rare. Of all the chambers reporting to Diver's Alert Network (DAN), 86% see less than 10 cases per year. Simulated diving injury cases (vignettes) were used to identify diagnostic factors important to 11 international experts attending the 2003 Undersea and Hyperbaric Medical Society symposium on DCI diagnosis. METHODS: There were 200 vignettes evaluated for the probability of DCS and/or arterial gas embolism (AGE). Vignettes were constructed from 141 factors that modeled information from DAN's emergency call system. Factor probability mirrored DAN's 2001 Report on Decompression Illness and Diving Fatalities. Factors included: diver characteristics, exposure characteristics, signs, symptoms, treatment, and response. Multiple linear regression with stepwise elimination identified and ordered the significant factors in terms of their importance to the experts. Results were confirmed with logistic regression. RESULTS: For DCS, the top five factors in order of importance were: 1) a neurological symptom as the primary presenting symptom; 2) onset time of symptoms; 3) joint pain as a presenting symptom; 4) any relief after recompression treatment; and 5) the maximum depth of the last dive. For AGE, the top five factors were: 1) onset time of symptoms; 2) altered consciousness; 3) any neurological symptoms as a presenting symptom; 4) motor weakness; and 5) seizure as the primary presenting symptom. Age, gender, or physical characteristics were not statistically important. CONCLUSIONS: The vignette concept may be useful in the development of consensus standards for DCI diagnosis.
Publication Types: Evaluation Studies
PMID: 15619855 [PubMed - indexed for MEDLINE]

5: Science. 2004 Dec 24;306(5705):2215.
Comment in: Science. 2005 Apr 29;308(5722):631-2; author reply 631-2. Science. 2005 Apr 29;308(5722):631-2; author reply 631-2.
Cumulative sperm whale bone damage and the bends.
Moore MJ, Early GA.
Department of Biology, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA. mmoore@whoi.edu
Diving mosasaurs, plesiosaurs, and humans develop dysbaric osteonecrosis from end-artery nitrogen embolism ("the bends") in certain bones. Sixteen sperm whales from calves to large adults showed a size-related development of osteonecrosis in chevron and rib bone articulations, deltoid crests, and nasal bones. Occurrence in animals from the Pacific and Atlantic oceans over 111 years made a pathophysiological diagnosis of dysbarism most likely. Decompression avoidance therefore may constrain diving behavior. This suggests why some deep-diving mammals show periodic shallow-depth activity and why gas emboli are found in animals driven to surface precipitously by acoustic stressors such as mid-frequency sonar systems.
PMID: 15618509 [PubMed - indexed for MEDLINE]

6: HNO. 2004 Oct;52(10):891-6.
[Treatment of acute cochleovestibular damage after diving]
[Article in German]
Klingmann C.
Hals-Nasen-Ohren-Universitatsklinik Heidelberg. christoph_klingmann@med.uni-heidelberg.de
BACKGROUND: There has been a steady in-crease of recreational scuba divers in the last years. The majority of diving associated diseases involve otorhinolaryngology, the most important of which are cochleovestibular dysfunctions as these can lead to permanent inner ear failure. MATERIAL AND METHODS: We discuss the origin and clinical symptoms, as well as the therapy, of both inner ear barotrauma and inner ear decompression illness. Our own experiences are considered together with a review of the literature from the last decade. RESULTS: Inner ear decompression illness seems to be a relatively common diving associated incident and is not as rare as previously thought. DISCUSSION: Hyperbaric oxygen therapy is the treatment of choice for patients with inner ear decompression sickness, but is contraindicated in patients with inner ear barotrauma. As long as an inner ear decompression illness can not be ruled out, we suggest that every patient should be treated using hyperbaric oxygen therapy but only after bilateral paracentesis.
Publication Types: Review Review, Tutorial
PMID: 15609428 [PubMed - indexed for MEDLINE]

7: J Appl Physiol. 2005 May;98(5):1653-9. Epub 2004 Dec 17.

Response to CO2 in novice closed-circuit apparatus divers and after 1 year of active oxygen diving at shallow depths.
Eynan M, Arieli R, Adir Y.
Israel Naval Medical Institute, POB 8040, Haifa 31080, Israel. emirit@netvision.net.il
Elevated arterial Pco(2) (hypercapnia) has a major effect on central nervous system oxygen toxicity in diving with a closed-circuit breathing apparatus. The purpose of the present study was to follow up the ability of divers to detect CO(2) and to determine the CO(2) retention trait after 1 year of active oxygen diving with closed-circuit apparatus. Ventilatory and perceptual responses to variations in inspired CO(2) (range: 0-5.6 kPa, 0-42 Torr) during moderate exercise were assessed in Israeli Navy combat divers on active duty. Tests were carried out on 40 divers during the novice oxygen diving phase (ND) and the experienced oxygen diving phase. No significant changes were found between the two phases for the minimal mean inspired Pco(2) that could be detected. The mean (with SD in parentheses) end-tidal Pco(2) during exposure to an inspired Pco(2) of 5.6 kPa (42 Torr) was significantly higher in the novice diving phase than in the experienced diving phase [8.1 kPa (SD 0.7), 62 Torr (SD 5) and 7.8 kPa (SD 0.6), 59 Torr (SD 4), respectively; P < or = 0.001]. One year of shallow oxygen diving activity with a closed-circuit apparatus does not affect the ability to detect CO(2) nor does it lead to increased CO(2) retention; rather, it may even bring about a decrease in this trait. This finding suggests that acquiring experience in oxygen diving with a closed-circuit apparatus at shallow depths does not place the diver at a greater risk of central nervous system oxygen toxicity due to CO(2) retention.
PMID: 15608093 [PubMed - indexed for MEDLINE]

8: J Exp Biol. 2004 Dec;207(Pt 26):4679-95.
Stroke patterns and regulation of swim speed and energy cost in free-ranging Brunnich's guillemots.
Lovvorn JR, Watanuki Y, Kato A, Naito Y, Liggins GA.
Department of Zoology, University of Wyoming, Laramie, WY 82071, USA. lovvorn@uwyo.edu
Loggers were attached to free-ranging Brunnich's guillemots Uria lomvia during dives, to measure swim speeds, body angles, stroke rates, stroke and glide durations, and acceleration patterns within strokes, and the data were used to model the mechanical costs of propelling the body fuselage (head and trunk excluding wings). During vertical dives to 102-135 m, guillemots regulated their speed during descent and much of ascent to about 1.6+/-0.2 m s(-1). Stroke rate declined very gradually with depth, with little or no gliding between strokes. Entire strokes from 2 m to 20 m depth had similar forward thrust on upstroke vs downstroke, whereas at deeper depths and during horizontal swimming there was much greater thrust on the downstroke. Despite this distinct transition, these differences had small effect (<6%) on our estimates of mechanical cost to propel the body fuselage, which did not include drag of the wings. Work stroke(-1) was quite high as speed increased dramatically in the first 5 m of descent against high buoyancy. Thereafter, speed and associated drag increased gradually as buoyancy slowly declined, so that mechanical work stroke(-1) during the rest of descent stayed relatively constant. Similar work stroke(-1) was maintained during non-pursuit swimming at the bottom, and during powered ascent to the depth of neutral buoyancy (about 71 m). Even with adjustments in respiratory air volume of +/-60%, modeled work against buoyancy was important mainly in the top 15 m of descent, after which almost all work was against drag. Drag was in fact underestimated, as our values did not include enhancement of drag by altered flow around active swimmers. With increasing buoyancy during ascent above 71 m, stroke rate, glide periods, stroke acceleration patterns, body angle and work stroke(-1) were far more variable than during descent; however, mean speed remained fairly constant until buoyancy increased rapidly near the surface. For dives to depths >20 m, drag is by far the main component of mechanical work for these diving birds, and speed may be regulated to keep work against drag within a relatively narrow range.
PMID: 15579562 [PubMed - indexed for MEDLINE]

9: Eur Heart J. 2004 Dec;25(23):2173-4.
Comment on: Eur Heart J. 2004 Jun;25(12):1014-20.
Risk of decompression illness among 230 divers in relation to the presence and size of patent foramen ovale.
Germonpre P, Balestra C.
Publication Types: Comment Letter
PMID: 15571841 [PubMed - indexed for MEDLINE]

10: Undersea Hyperb Med. 2004 Fall;31(3):291-301.
Plasma glucose responses in recreational divers with insulin-requiring diabetes.
Dear Gde L, Pollock NW, Uguccioni DM, Dovenbarger J, Feinglos MN, Moon RE.
Dept. of Anesthesiology, Center for Hyperbaric Medicine and Environmental Physiology, Duke University Medical Center, Durham, NC 27710, USA.
Insulin-requiring diabetes mellitus (IRDM) is commonly described as an absolute contraindication to scuba diving. A 1993 Divers Alert Network survey, however, identified many active IRDM divers. We report on the plasma glucose response to recreational diving in IRDM divers. Plasma glucose values were collected before and after diving in IRDM and healthy control divers. Time/depth profiles of 555 dives in IRDM divers were recorded. IRDM divers had been diving for a mean of almost nine years and had diabetes for a mean of over 15 years. No symptoms or complications related to hypoglycemia were reported (or observed). Post-dive plasma glucose fell below 70 mg x dL(-1) in 7% (37/555) of the IRDM group dives compared to 1%

(6/504) of the controls (p<0.05). Moderate levels of hyperglycemia were also noted in 23 divers with IRDM on 84 occasions. While large plasma glucose swings from pre-dive to post-dive were noted, our observations indicate that plasma glucose levels, in moderately-controlled IRDM, can be managed to avoid hypoglycemia during routine recreational dives under ordinary environmental conditions and low risk decompression profiles.
PMID: 15568417 [PubMed - indexed for MEDLINE]

11: Anaesthesist. 2004 Nov;53(11):1093-102.
[Diving accidents. Emergency treatment of serious diving accidents]
[Article in German]
Schroder S, Lier H, Wiese S.
Klinik fur Anasthesie und Intensivmedizin, Westkustenklinikum Heide. SSchroeder@WKK-Hei.de
Decompression injuries are potentially life-threatening incidents mainly due to a rapid decline in ambient pressure. Decompression illness (DCI) results from the presence of gas bubbles in the blood and tissue. DCI may be classified as decompression sickness (DCS) generated from the liberation of gas bubbles following an oversaturation of tissues with inert gas and arterial gas embolism (AGE) mainly due to pulmonary barotrauma. People working under hyperbaric pressure, e.g. in a caisson for general construction under water, and scuba divers are exposed to certain risks. Diving accidents can be fatal and are often characterized by organ dysfunction, especially neurological deficits. They have become comparatively rare among professional divers and workers. However, since recreational scuba diving is gaining more and more popularity there is an increasing likelihood of severe diving accidents. Thus, emergency staff working close to areas with a high scuba diving activity, e.g. lakes or rivers, may be called more frequently to a scuba diving accident. The correct and professional emergency treatment on site, especially the immediate and continuous administration of normobaric oxygen, is decisive for the outcome of the accident victim. The definitive treatment includes rapid recompression with hyperbaric oxygen. The value of adjunctive medication, however, remains controversial.
PMID: 15565421 [PubMed - indexed for MEDLINE]

12: Br J Sports Med. 2004 Dec;38(6):754-7.
Three year follow up of a self certification system for the assessment of fitness to dive in Scotland.
Glen S.
Department of Medicine, Stirling Royal Infirmary, Livilands, Stirling FK8 2AU, Scotland, UK. stephen.glen@fvah.scot.nhs.uk
BACKGROUND: The need for routine medical examinations of sport divers in the Scottish Sub-Aqua Club (Scot-SAC) was revised in March 2000, and a new system using a self administered screening questionnaire was developed to allow divers to be assessed when necessary by doctors with diving medicine experience. OBJECTIVE: To assess the effect of the new medical system on medical referee workload, diver exclusion rates, and diving incident frequency. METHODS: All divers were required to complete a questionnaire to screen for conditions that might affect fitness to dive. Divers answering "Yes" to any of the questions had their medical background assessed by a diving doctor, and, if necessary, received a clinical examination or investigation. The rate of diver exclusions based on the questionnaire response was recorded in conjunction with analysis of the incident reports. RESULTS: The number of forms requiring review by diving doctors increased from 1.2% to 5.7% (p<0.0001, 95% confidence interval (CI) -0.06 to -0.03) in the year after the introduction of the new medical system and gradually increased in subsequent years to 7.7% (p<0.0001, 95% CI -0.08 to -0.05). The number of divers failing to be certified fit to dive increased slightly from 0.7% to 1.0% after one year (p = 0.26, 95% CI -0.01 to 0.00) and subsequently to 2.0% (p = 0.0003, 95% CI 0.02 to -0.01) after three years. Most divers were certified fit to dive on the basis of the questionnaire alone, and only 0.9% required objective investigation (such as exercise testing or echocardiography). Analysis of the incidents during three years of follow up confirmed that no incident occurred because of an undetected pre-existing medical condition. Two incidents involved divers with hypertension, but both had received medical examinations and investigation based on their responses to the questionnaire. CONCLUSION: The new self administered questionnaire system appears to be an effective screening tool for the detection of divers requiring detailed assessment by doctors with diving medicine experience.
PMID: 15562174 [PubMed - indexed for MEDLINE]

13: Respir Physiol Neurobiol. 2004 Dec 15;144(2-3):263-79.
The effect of O2 and CO2 on the dive behavior and heart rate of lesser scaup ducks (Aythya affinis): quantification of the critical PaO2 that initiates a diving bradycardia.
Borg KA, Milsom WK, Jones DR.
Department of Zoology, University of British Columbia, 6270 University Boulevard, Vancouver, BC, V6T 1Z4, Canada. borg@zoology.ubc.ca
Lesser scaup ducks were trained to dive for short and long durations following exposure to various gas concentrations to determine the influence of oxygen (O2) and carbon dioxide (CO2) on diving behavior and heart rate. Compared with normoxia, hyperoxia (50% O2) significantly increased the duration of long dives, whereas severe hypoxia (9% O2) significantly decreased the duration of both short and long dives. Hypercapnia (5% CO2) had no effect on dive duration. Surface intervals were not significantly altered by the oxygen treatments, but significantly increased following CO2 exposure. Heart rate during diving was unaffected by hyperoxia and hypercapnia, but gradually declined in long dives after severe

hypoxia. Thus, our results suggest that during the majority of dives, O2 and CO2 levels in lesser scaup ducks are managed through changes in diving behavior without any major cardiovascular adjustments, but below a threshold PaO2, a bradycardia is evoked to conserve the remaining oxygen for hypoxia sensitive tissues. A model of oxygen store utilization during voluntary diving was developed to estimate the critical PaO2 below which bradycardia is initiated (approximately 26 mmHg) and predicted that this critical PaO2 would be reached 19s into a dive after exposure to severe hypoxia, which corresponded exactly with the time of initiation of bradycardia in the severe hypoxia trials.
PMID: 15556108 [PubMed - indexed for MEDLINE]

14: Comp Biochem Physiol B Biochem Mol Biol. 2004 Nov;139(3):509-18.
Defining the limits of diving biochemistry in marine mammals.
Castellini MA, Castellini JM.
Institute of Marine Science, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Fairbanks, AK 99775, USA. mikec@ims.uaf.edu
The field of marine mammal diving biochemistry was essentially untouched when Peter Hochachka turned his attention to it in the mid-1970s. Over the next 30 years, his work followed three main themes in this area: first, most biologists at that time supported the theory that diving mammals utilized enhanced metabolic pathways for hypoxic energy production (glycolysis to lactate) and reduced their metabolic rate while diving. Peter began his work on potential hypoxic adaptations in marine mammals by working out the details of how these pathways would be regulated. By the 1980s, he started to ask how diving mammals balanced the increased demands of exercise with the apparently conflicting demands to reduce aerobic metabolism while exercising underwater. By the 1990s, his work involved complex models of the interplay between the neural, hormonal, behavioral and evolutionary components of diving biochemistry and animal exercise. From a comparative approach, he excelled at bringing themes of hypoxic adaptation from many different types of animals to the field of diving mammal biochemistry. This review traces the history of Peter Hochachka's work on diving biochemistry from the perspective of those of us who spent time with him both inside the laboratory and outside in the field from Antarctica to Iceland.
Publication Types: Historical Article Review Review, Tutorial
PMID: 15544972 [PubMed - indexed for MEDLINE]

15: Proc Biol Sci. 2004 Nov 7;271(1554):2239-47.
Sperm whale behaviour indicates the use of echolocation click buzzes "creaks" in prey capture.
Miller PJ, Johnson MP, Tyack PL.
NERC Sea Mammal Research Unit, School of Biology, University of St Andrews, St Andrews KY16 9QQ, UK. pm29@st-andrews.ac.uk
During foraging dives, sperm whales (Physeter macrocephalus) produce long series of regular clicks at 0.5-2 s intervals interspersed with rapid-click buzzes called "creaks". Sound, depth and orientation recording Dtags were attached to 23 whales in the Ligurian Sea and Gulf of Mexico to test whether the behaviour of diving sperm whales supports the hypothesis that creaks are produced during prey capture. Sperm whales spent most of their bottom time within one or two depth bands, apparently feeding in vertically stratified prey layers. Creak rates were highest during the bottom phase: 99.8% of creaks were produced in the deepest 50% of dives, 57% in the deepest 15% of dives. Whales swam actively during the bottom phase, producing a mean of 12.5 depth inflections per dive. A mean of 32% of creaks produced during the bottom phase occurred within 10 s of an inflection (13x more than chance). Sperm whales actively altered their body orientation throughout the bottom phase with significantly increased rates of change during creaks, reflecting increased manoeuvring. Sperm whales increased their bottom foraging time when creak rates were higher. These results all strongly support the hypothesis that creaks are an echolocation signal adapted for foraging, analogous to terminal buzzes in taxonomically diverse echolocating species.
PMID: 15539349 [PubMed - indexed for MEDLINE]

16: Int J Sports Med. 2004 Nov;25(8):575-81.
Brain magnetic resonance imaging, aerobic power, and metabolic parameters among 30 asymptomatic scuba divers.
Tripodi D, Dupas B, Potiron M, Louvet S, Geraut C.
Institute of Occupational Health, Clinical Biomechanics and Laboratory of Epidemiology (PIMESP), Centre Hospitalier Universitaire Hotel-Dieu, Nantes, France. dominique.tripodi@chu-nantes.fr
The aim of the study was to evaluate the presence of cerebral lesions in asymptomatic scuba divers and explain the causes of them: potential risk factors associating cardiovascular risk factors, low aerobic capacity, or characteristics of diving (maximum depth, ascent rate). Experienced scuba divers, over 40 years of age, without any decompression sickness (DCS) history were included. We studied 30 scuba divers (instructors) without any clinical symptoms. For all of them, we carried out a clinical examination with fatty body mass determination and we questioned them about their diving habits. A brain Magnetic Resonance imaging (MRI), an assessment of maximal oxygen uptake, glycemia, triglyceridemia, and cholesterolemia were systematically carried out. Cerebral spots of high intensity were found at 33 % in the scuba diving group and 30 % in the control group. In the diving group, abnormalities were related to unsafe scuba-diving or metabolic abnormalities. In our study, we did not find a significant relationship between the lesions of the central nervous system, and the age, depth of the dives, number of dives, and ergometric

performances (maximal oxygen uptake, V.O (2max), serum level of blood lactate). Nevertheless, we found a significant relationship between the lesions of the central nervous system and ascent rate faster than 10 meters per minute ($r = 0.57$; $p = 0.003$) or presence of high level of cholesterolemia ($r = 0.6$; $p = 0.001$). We found concordant results using the Cochran's Test: meaningful link between the number of brain lesions and the speed of decompression ($Uexp = 14 < Utable = 43$; alpha = 0.05, $p < 0.01$). We concluded that hyperintensities can be explained by preformed nitrogen gas microbubbles and particularly in presence of cholesterol, when the ascent rate is up to 10 meters per minute. So, it was remarkable to note that asymptomatic patients practicing scuba diving either professionally or recreationally, presented lesions of the central nervous system. This survey permitted us to highlight in a population of professional divers, neurological and also cardiovascular abnormalities (ventricular arrhythmias); although none of them present any symptoms today. It seems therefore important to us to propose in the future, for a better prevention of neurological injuries, a systematic follow-up by maximal oxygen consumption measure, brain MRI, and cholesterolemia. In the same way, our results suggest a modification of the diving tables with a maximal decompression rate at 9 m . mn (-1).
PMID: 15531999 [PubMed - indexed for MEDLINE]

17: Free Radic Biol Med. 2004 Dec 1;37(11):1744-55.
Hypoxia/reoxygenation and vitamin C intake influence NO synthesis and antioxidant defenses of neutrophils.
Sureda A, Batle JM, Tauler P, Aguilo A, Cases N, Tur JA, Pons A.
Departament de Biologia Fonamental i Ciencies de la Salut, Universitat de les Illes Balears, Campus Universitari, Crtra. Valldemossa, km 7.5, E-07122 Palma de Mallorca, Illes Balears, Spain.
Oxidative stress induced by hypoxia/reoxygenation mediates the pathophysiological consequence of ischemia/reperfusion and human diseases. Diving apnea could be a good model of oxidative stress induced by hypoxia/reoxygenation. We studied the influence of vitamin C diet supplementation on the response of neutrophil antioxidant defenses, NO production, and redox status to diving apnea. Seven professional apnea divers participated in a double-blind cross study. Divers were assigned to either vitamin C-supplemented (1 g/d for a week) or placebo groups. Blood samples were taken under basal conditions, immediately after diving apnea for 4 h and after 1 h of recovery. Plasma vitamin C increased only in the supplemented group after diving and was maintained high in recovery. Diving apnea decreased neutrophil GSH/GSSG ratio in both groups, but maintained protein carbonyl derivates. Neutrophil catalase activity and levels and glutathione peroxidase activity were lower in the supplemented group than in the placebo group after diving. iNOS and nitrite levels decreased only in the supplemented group after diving and recovery. Diving apnea induced oxidative stress and initiated neutrophil reactions that resemble the acute-phase immune response with increased myeloperoxidase activity in neutrophils. Diet supplementation with vitamin C reduced neutrophil iNOS levels and NO production.
Publication Types: Clinical Trial Randomized Controlled Trial
PMID: 15528034 [PubMed - indexed for MEDLINE]

18: Laryngoscope. 2004 Nov;114(11):2048-50.
A safe treatment concept for divers with acute inner ear disorders.
Klingmann C, Benton P, Schellinger P, Knauth M.
Department of Otorhinolaryngology--Head and Neck Surgery, University of Heidelberg, Heidelberg, Germany. christoph_klingmann@med.uni-heidelberg.de
PMID: 15510042 [PubMed - indexed for MEDLINE]

19: J Laryngol Otol. 2004 Sep;118(9):721-3.
Facial baroparesis secondary to middle-ear over-pressure: a rare complication of scuba diving.
Hyams AF, Toynton SC, Jaramillo M, Stone LR, Bryson PJ.
University of Bristol, School of Medical Sciences, University Walk, Bristol, UK.
A facial nerve palsy, as a result of middle-ear high pressure, is a rare complication of sub-aqua diving. It may occur as a result of an acute pressure change in the middle ear during ascent in those patients who have experienced difficulty equalizing their middle-ear pressure during the prior descent. We present the case history of this occurring in a 21-year-old diver and discuss the pathophysiology, management and the previous literature. The correct diagnosis of this condition is important if unnecessary, and potentially hazardous, recompression treatment is to be avoided.
Publication Types: Case Reports Review Review of Reported Cases
PMID: 15509373 [PubMed - indexed for MEDLINE]

20: J Prosthet Dent. 2004 Oct;92(4):392-4.
Fabrication of a custom diving mouthpiece using a thermoforming material.
Matsui R, Ueno T, Ohyama T.
Tokyo Medical and Dental University, Tokyo, Japan. r.matsui.spmd@tmd.ac.jp
Scuba divers may suffer from temporomandibular joint dysfunction and related problems associated with the use of commercially available diving mouthpieces. Several authors have recommended that custom diving mouthpieces be fabricated for relieving the symptoms of diver's mouth syndrome. The lost wax technique is commonly used for this purpose but may be time-consuming and is technically complicated. This article describes a simplified technique using thermoforming material for fabricating a custom diving mouthpiece.
PMID: 15507915 [PubMed - indexed for MEDLINE]

21: Eur J Appl Physiol. 2005 Jan;93(4):447-52. Epub 2004 Oct 21.
Speed of spleen volume changes evoked by serial apneas.
Schagatay E, Haughey H, Reimers J.
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Diving mammals may enhance dive duration by injecting extra erythrocytes into the circulation by spleen contraction. This mechanism may also be important for apneic duration in humans. We studied the speed and magnitude of spleen volume changes evoked by serial apneas, and the associated changes in hematocrit (Hct) and hemoglobin (Hb) concentration, diving response and apneic duration. Three maximal apneas separated by 2 min rest elicited spleen contraction in all ten subjects, by a mean of 49 (27) ml (18%; P<0.001). During the same period, Hct and Hb rose by 2.2 and 2.4% respectively (P<0.01 and P<0.001), and apneic duration rose by 20 s (22% P<0.05). The mean heart rate reduction of the diving response was 15%, which remained the same throughout the apnea series. While the diving response was completely reversed between the apneas, spleen size was not recovered until 8-9 min after the final apnea corresponding with recovery of Hct and Hb. Thus, although the spleen contraction may be associated with the cardiovascular diving response, it is likely to be triggered by different mechanisms, and it may remain activated between dives spaced by short pauses. The two adjustments may provide a fast, quickly reversed, and a slow, but long-lasting, way of shifting to a diving mode in humans.
Publication Types: Clinical Trial Controlled Clinical Trial
PMID: 15503125 [PubMed - indexed for MEDLINE]

22: J Exp Biol. 2004 Nov;207(Pt 23):4057-65.
Why do macaroni penguins choose shallow body angles that result in longer descent and ascent durations?
Sato K, Charrassin JB, Bost CA, Naito Y.
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It is generally assumed that air-breathing aquatic animals always choose the shortest route to minimize duration for transit between the surface and foraging depth in order to maximize the proportion of time spent foraging. However, empirical data indicate that the body angles of some diving animals are rarely vertical during descent and ascent. Why do they choose shallower body angles that result in longer descent and ascent durations? To investigate this question, we attached acceleration data loggers to eight female macaroni penguins, breeding on the Kerguelen Islands (48 degrees 45'-50 degrees 00' S, 68 degrees 45'-70 degrees 58' E; South Indian Ocean), to record depth, two-dimensional acceleration (stroke cycle frequency and body angle) and temperature. We investigated how they controlled body angle and allocated their submerged time. The instrumented females performed multiple dives (N=6952) with a mean dive depth for each bird ranging from 24.5+/-28.5 m to 56.4+/-75.1 m. Mean body angles during descent and ascent were not vertical. There was large variation in mean descent and ascent angles for a given dive depth, which, in turn, caused large variation in descent and ascent duration. Body angles were significantly correlated with time spent at the bottom-phase of the dive. Birds that spent long periods at the bottom exhibited steep body angles during ascent and subsequent descent. By contrast, they adopted shallow body angles after they had short or no bottom phases. Our results suggest that macaroni penguins stay at the bottom longer after encountering a good prey patch and then travel to the surface at steep body angles. If they do not encounter prey, they discontinue the dive, without staying at the bottom, ascend at shallow body angles and descend at shallow body angles in a subsequent dive. A shallow body angle can increase the horizontal distance covered during a dive, contributing to the move into a more profitable area in the following dive. During the ascent, in particular, macaroni penguins stopped beating their flippers. The buoyantly gliding penguins can move horizontally with minimum stroking effort before reaching the surface.
PMID: 15498951 [PubMed - indexed for MEDLINE]

23: Aviat Space Environ Med. 2004 Oct;75(10):876-80.
Apnea-induced changes in time estimation and its relation to bradycardia.
Jamin T, Joulia F, Fontanari P, Giacomoni M, Bonnon M, Vidal F, Cremieux J.
Laboratoire E.S.P. (EA 3162), Universite du Sud Toulon-Var, La Garde, France.
INTRODUCTION: Both exercise and hypoxia affect human ability to estimate time, an alteration thought to be induced by changes in subjects' level of arousal. Apnea induces cardiovascular changes and a decrease in oxygen uptake that indicate changes in physiological arousal. We tested time estimation (TE) during brief periods of voluntary apnea. We hypothesized that there would be a relationship between TE and heart rate (HR), a physiological indicator of arousal. METHODS: Subjects were two different groups of seven triathletes. To measure TE, the target time interval (20 or 30 s) was demonstrated and the subject was then asked to reproduce it under various conditions. Experiment 1 required 1 min of breath-holding while immersed in a pool at 31 degrees C. Experiment 2 was performed seated on a cycle ergometer in a laboratory and involved short periods of apnea at rest and during exercise. RESULTS: TE during apnea was significantly greater than baseline during both immersion and at rest on the cycle (+27% and +17% compared with their respective baselines). A significant linear negative

correlation was demonstrated between TE and HR. Training in apnea during exercise had no effect on TE. DISCUSSION: Although this study revealed a relationship between TE and HR, our results should be interpreted with caution. Further studies are needed to confirm the relationship between HR and TE. A misperception of elapsed time may be a contributing factor in diving accidents which involve inexperienced breath-hold divers.
PMID: 15497368 [PubMed - indexed for MEDLINE]

24: Eur Radiol. 2005 Feb;15(2):368-75. Epub 2004 Oct 15.
Detection of dysbaric osteonecrosis in military divers using magnetic resonance imaging.
Bolte H, Koch A, Tetzlaff K, Bettinghausen E, Heller M, Reuter M.
Klinik fuer Diagnostische Radiologie, Universitaetsklinikum Schleswig-Holstein Campus Kiel, Arnold-Heller-Strasse 9, 24105, Kiel, Germany. hendrikbolte@rad.uni-kiel.de
This was a controlled cross-sectional study to investigate the prevalence of dysbaric osteonecrosis (DON) in military divers. MRI examinations of the large joints and adjacent bones were performed in a cross-sectional group of 32 highly experienced military divers and 28 non-divers matched for age and anthropometric data. Additional plain radiographs and follow-up controls were performed in all persons with signs certain or suspicious of DON. In two subject groups (one of divers and one of non-divers), lesions characteristic of DON were detected. From this controlled study, it may be concluded that MRI is a highly sensitive method to detect signs of osteonecrosis. It could be shown that the prevalence of bone lesions characteristic of osteonecrosis in highly experienced military divers is not higher than in non-diving subjects of comparable age. The outcome of this comparably small study group fits to the results of previous extensive studies performed with radiographs. The detected low incidence of DON in this collective may be due to the fact that military divers follow stricter selection criteria, decompression schemes and medical surveillance than commercial divers.
PMID: 15490180 [PubMed - indexed for MEDLINE]

25: Undersea Hyperb Med. 2004 Summer;31(2):261-8.
Incidence of abnormal cerebral findings in the MRI of clinically healthy divers: role of a patent foramen ovale.
Koch AE, Kampen J, Tetzlaff K, Reuter M, McCormack P, Schnoor PW, Struck N, Heine L, Prytulla I, Rieckert H.
German Naval Medical Institute, Kiel-Kronshagen, Germany.
BACKGROUND: To investigate incidence and number of abnormal cerebral hyperintensities (ACFs) in Magnet Resonance Imaging (MRI) and its relation to a patent foramen ovale (PFO) in divers with no history of decompression illness. METHODS: Cohort study on 50 divers (21-5500 dives). MAIN OUTCOME MEASURES: Incidence and number of ACFs visualized by cranial MRI and presence and size of a PFO as documented by echocardiography and transcranial Doppler ultrasound (TCD) with echocontrast. RESULTS: A total of 137 ACFs was found in the 50 subjects, with a significant correlation between the number of dives and number of ACFs ($r = 0.28$; $p < 0.05$); but after correction for age, the remaining correlation ($r = 0.15$) did not reach significance. In 18 divers, a PFO was present by either the application of echocardiography or TCD; in 12 divers, the PFO was of high hemodynamic relevance. Ten of 18 divers with a PFO had at least one ACF, while in the remaining 32 divers, only 14 had at least one ACF (56% versus 44%, p = NS). Seven of 14 divers (50%) with 4 ACFs had a PFO, compared to 11 of 36 (31%) with less than 4 ACFs (p = NS). CONCLUSION: In this cohort of healthy divers, in contrast to an earlier report, no significant association was found between PFO presence and incidence or number of ACFs.
PMID: 15485089 [PubMed - indexed for MEDLINE]

26: Undersea Hyperb Med. 2004 Summer;31(2):233-43.
Comment in: Undersea Hyperb Med. 2005 Mar-Apr;32(2):85-8; author reply 89-92.
A deep stop during decompression from 82 fsw (25 m) significantly reduces bubbles and fast tissue gas tensions.
Marroni A, Bennett PB, Cronje FJ, Cali-Corleo R, Germonpre P, Pieri M, Bonuccelli C, Balestra C.
DAN Europe Foundation, Research Division.
In spite of many modifications to decompression algorithms, the incidence of decompression sickness (DCS) in scuba divers has changed very little. The success of stage, compared to linear ascents, is well described yet theoretical changes in decompression ratios have diminished the importance of fast tissue gas tensions as critical for bubble generation. The most serious signs and symptoms of DCS involve the spinal cord, with a tissue half time of only 12.5 minutes. It is proposed that present decompression schedules do not permit sufficient gas elimination from such fast tissues, resulting in bubble formation. Further, it is hypothesized that introduction of a deep stop will significantly reduce fast tissue bubble formation and neurological DCS risk. A total of 181 dives were made to 82 fsw (25 m) by 22 volunteers. Two dives of 25 min and 20 min were made, with a 3 hr 30 min surface interval and according to 8 different ascent protocols. Ascent rates of 10, 33 or 60 fsw/min (3, 10, 18 m/min) were combined with no stops or a shallow stop at 20 fsw (6 m) or a deep stop at 50 fsw (15 m) and a shallow at 20 fsw (6 m). The highest bubbles scores (8.78/9.97), using the Spencer Scale (SS) and Extended Spencer Scale (ESS) respectively, were with the slowest ascent rate. This also showed the highest 5 min and 10 min tissue loads of 48% and 75%. The lowest bubble scores (1.79/2.50) were with an ascent rate of 33 fsw (10

m/min) and stops for 5 min at 50 fsw (15 m) and 20 fsw (6 m). This also showed the lowest 5 and 10 min tissue loads at 25% and 52% respectively. Thus, introduction of a deep stop significantly reduced Doppler detected bubbles together with tissue gas tensions in the 5 and 10 min tissues, which has implications for reducing the incidence of neurological DCS in divers.
Publication Types: Evaluation Studies
PMID: 15485086 [PubMed - indexed for MEDLINE]

27: Undersea Hyperb Med. 2004 Summer;31(2):217-24.
Leukotriene-B4 concentrations in breathing condensate before and after simulated deep dives.
Neubauer B, Schotte U, Struck N, Langfeldt N, Mutzbauer TS.
Behorde fur Umwelt und Gesundheit, Tesdorpfstrasse 8, D-20148 Hamburg.
During diving the respiratory tract is exposed to occupational hazards (increased oxygen partial pressure, pulmonary vessel engorgement during submersion, inert gas micro embolism during decompression). Leukotriene-B4 [LTB4] concentrations in the exhaled breath mirrors the inflammatory activity of the airways if the respiratory tract has been exposed to occupational hazards. In this study LTB4-concentrations in the exhaled breath and spirometry data obtained before and after simulated dives helped to elucidate any contributions by hyperbaric exposure to impaired lung function and to separate effects of ambient pressure from those of submersion and increased oxygen partial pressure. Thirty two healthy subjects carried out dives in a hyperbaric chamber using a cross over design to 600 kPa ambient pressure with and without submersion and a dry exposure to pure oxygen at 120 kPa ambient pressure (durations: 43 min). Pre-dive and four hours after surfacing the exhaled breath was collected non-invasively. Condensate was measured by a standard enzyme immuno-assay for LTB4 in parallel with lung function values (FVC, FEV1, MEF 25-75). Pre-exposure baseline values of LTB4-concentrations and lung function values were in the normal range. Post-exposure values did not differ significantly from the baseline values. The data gave no evidence of any inflammatory activity in the subjects' airways after hyperbaric exposure.
PMID: 15485084 [PubMed - indexed for MEDLINE]

28: Undersea Hyperb Med. 2004 Summer;31(2):199-202.
Incidence of oxygen toxicity during the treatment of dysbarism.
Smerz RW.
Hyperbaric Treatment Center, University of Hawaii, John A. Burns School of Medicine, Honolulu, Hawaii, USA.
Oxygen (O2) toxicity may result from exposure to partial pressures of O2 above 0.6ATA. Potential toxic exposure for divers occurs during the treatment of dysbarism. In the recompression chamber, PO2 may range from 0.9ATA to 3.3ATA depending upon the treatment table employed. This retrospective study examines the nature and incidence of O2 toxicity in 998 patients who underwent recompression treatment at our facility from 1983 through 2001. Only patients evaluated for diving related injury were considered for this study. Of 1189 charts reviewed, 998 patients received recompression and were entered into this study. The total number of treatment exposures was determined as was the total number of O2 toxicity events characterized as either pulmonary or CNS, and patients were divided into male/female analysis. Overall incidence as well as the incidence for both toxicity types was determined, and their occurrence in both male and female patients was ascertained. 2166 recompressions were undertaken, 449 female and 1717 male. The peak PO2 for these treatments ranged from 2.6ATA to 2.9ATA. 155 O2 toxicity events occurred in 152 patients, 49 females and 103 males. Three patients, 2 females and 1 male, had mixed events. Incidence of an O2 toxic event = 7.0 per 100 recompressions. Incidence of pulmonary toxicity overall = 5.0 per 100 recompressions, while CNS events = 2.0 per 100 recompressions with overall seizure rate = 0.6 per 100 recompressions. In females, pulmonary toxicity rate = 6.9 per 100 recompressions, CNS toxicity rate = 4.4 per 100 recompressions with seizures occurring at 1.3 per 100 recompressions. In males, pulmonary toxicity rate = 4.6 per 100 recompressions, CNS toxicity rate = 1.4 per 100 recompressions, and seizures at 0.4 per 100 recompressions.
PMID: 15485081 [PubMed - indexed for MEDLINE]

29: Minn Med. 2004 Aug;87(8):16-8, 20.
Super-specialized.
Ash SW.
PMID: 15478818 [PubMed - indexed for MEDLINE]

30: J Exp Biol. 2004 Oct;207(Pt 22):3917-26.
Heart rate and energetics of free-ranging king penguins (Aptenodytes patagonicus).
Froget G, Butler PJ, Woakes AJ, Fahlman A, Kuntz G, Le Maho Y, Handrich Y.
School of Biosciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
The main objective of this study was to determine heart rate (fh) and the energetic costs of specific behaviours of king penguins while ashore and while foraging at sea during their breeding period. In particular, an estimate was made of the energetic cost of diving in order to determine the proportion of dives that may exceed the calculated aerobic dive limit (cADL; estimated usable O2 stores/estimated rate of oxygen consumption during diving). An implanted data logger enabled fh and diving behaviour to be monitored from 10 free-ranging king penguins during their breeding period. Using previously determined calibration equations, it was possible to estimate rate of oxygen consumption (VO2) when the birds were ashore and during various phases of their foraging trips. Diving behaviour

showed a clear diurnal pattern, with a mixture of deep (>40 m), long (>3 min) and shallow (<40 m), short (<3 min) dives from dawn to dusk and shallow, short dives at night. Heart rate during dive bouts and dive cycles (dive + post-dive interval) was 42% greater than that when the birds were ashore. During diving, fh was similar to the 'ashore' value (87+/-4 beats min(-1)), but it did decline to 76% of the value recorded from king penguins resting in water. During the first hour after a diving bout, fh was significantly higher than the average value during diving (101+/-4 beats min(-1)) and for the remainder of the dive bout. Rates of oxygen consumption estimated from these (and other) values of fh indicate that when at sea, metabolic rate (MR) was 83% greater than that when the birds were ashore [3.15 W kg(-1) (-0.71, +0.93), where the values in parentheses are the computed standard errors of the estimate], while during diving bouts and dive cycles, it was 73% greater than the 'ashore' value. Although estimated MR during the total period between dive bouts was not significantly different from that during dive bouts [5.44 W kg(-1) (-0.30, +0.32)], MR during the first hour following a dive bout was 52% greater than that during a diving bout. It is suggested that this large increase following diving (foraging) activity is, at least in part, the result of rewarming the body, which occurs at the end of a diving bout. From the measured behaviour and estimated values of VO2, it was evident that approximately 35% of the dives were in excess of the cADL. Even if VO2 during diving was assumed to be the same as when the birds were resting on water, approximately 20% of dives would exceed the cADL. As VO2 during diving is, in fact, that estimated for a complete dive cycle, it is quite feasible that VO2 during diving itself is less than that measured for birds resting in water. It is suggested that the regional hypothermia that has been recorded in this species during diving bouts may be at least a contributing factor to such hypometabolism.
PMID: 15472022 [PubMed - indexed for MEDLINE]

31: Br J Sports Med. 2004 Oct;38(5):E19.
Aseptic bone necrosis in an amateur scuba diver.
Laden GD, Grout P.
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A case is reported that provides further evidence of an old occupational hazard, dysbaric osteonecrosis, presenting in a new population (sports scuba divers) who also appear to be at risk. It highlights the need for an accurate diagnosis of diving related illness.
Publication Types: Case Reports
PMID: 15388563 [PubMed - indexed for MEDLINE]

32: J Exp Biol. 2004 Oct;207(Pt 21):3775-84.
Time-dependent expression of heat shock proteins 70 and 90 in tissues of the anoxic western painted turtle.
Ramaglia V, Buck LT.
Department of Zoology, University of Toronto, Toronto, ON, Canada, M5S 3G5.
Expression of the constitutive Hsp73, inducible Hsp72 and Hsp90 was investigated in brain, heart, liver and skeletal muscle of the anoxia-tolerant western painted turtle Chrysemys picta bellii in response to 2, 6, 12, 18, 24 and 30 h forced dives and following 1 h recovery from 12, 24 and 30 h forced dives at 17 degrees C. During a dive, expression of all three Hsps examined remained at control levels for at least 12 h in all tissues examined except the liver, where Hsp72 showed a decrease at 12 h, reaching a significant threefold decrease by 24 h. Brain and liver Hsp73, 72 and 90 expression increased two- to threefold at 18, 24 and 30 h. Heart and muscle Hsp73 and heart Hsp90 expression remained at normoxic levels throughout the entire dive, while heart and muscle Hsp72 and muscle Hsp90 increased two- to fourfold at 24 and 30 h. Following reoxygenation, Hsp expression increased in all tissues examined. These data indicate that increased Hsp expression is not critical in the early adaptation to anoxic survival and that short-term anoxia is probably not a stress for species adapted to survive long periods without oxygen. However, the late upregulation of heat shock proteins during anoxia suggests that stress proteins play a role in promoting long-term anoxia tolerance.
PMID: 15371485 [PubMed - indexed for MEDLINE]

33: Spine J. 2004 Sep-Oct;4(5):584-90.
Spinal injury considerations in the competitive diver: a case report and review of the literature.
Badman BL, Rechtine GR.
Department of Orthopedics, University of Florida, P.O. Box 100246, Gainesville, FL 32610-0246, USA.
BACKGROUND CONTEXT: Despite significant literature associated with spinal injuries and recreational diving, few articles exist regarding competitive diving injuries, with no reports pertaining specifically to spinal injuries. As a result, a case report of a collegiate diver with C5-C6 ligamentous instability requiring operative stabilization is currently presented in addition to a review of the literature. PURPOSE: Present a case report of cervical C5-C6 ligamentous instability in a collegiate diver. STUDY DESIGN: Case report and literature review. METHODS: Not applicable. RESULTS: Not applicable. CONCLUSIONS: Diving injuries pertaining to competitive diving do occur but to a lesser extent than would be expected given the large forces the spine experiences. Training, experience and appropriate technique greatly minimize potential spinal hazards. Persistent complaints of neck pain after a competitive diving injury mandate aggressive evaluation and further workup.
Publication Types: Case Reports Review Review of Reported Cases
PMID: 15363432 [PubMed - indexed for MEDLINE]

34: Aviat Space Environ Med. 2004 Aug;75(8):673-5.

Dysbaric osteonecrosis screening in submarine escape instructors.
Yildiz S, Cimsit C, Toklu AS, Cimsit M.
Gulhane Military Medical Academy Haydarpasa Training Hospital, Department of Underwater and Hyperbaric Medicine, Istanbul, Turkey. syildiz@gata.edu.tr
INTRODUCTION: Dysbaric osteonecrosis (DON) is an avascular bone necrosis that can be seen in divers and compressed air workers. Submarine escape instructors constitute a specific group who are exposed to hyperbaric conditions with a constant profile. METHODS: We screened 21 Turkish Navy submarine escape instructors and evaluated 147 skeletal radiographs for dysbaric osteonecrosis. Two instructors who had suspicious DON lesions on the X-rays underwent examination by MRI of the suspected sites. RESULTS: We found no evidence of DON in the radiographs and MRIs of the submarine escape instructors. DISCUSSION: We concluded that the risk of DON is very low for submarine escape instructors who work at the Submarine Escape Training Tower (SETT) at a depth of 60 ft and who strictly obey the decompression rules.
PMID: 15328783 [PubMed - indexed for MEDLINE]

35: Comp Biochem Physiol A Mol Integr Physiol. 2004 Jul;138(3):263-8.
The diving paradox: new insights into the role of the dive response in air-breathing vertebrates.
Davis RW, Polasek L, Watson R, Fuson A, Williams TM, Kanatous SB.
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When aquatic reptiles, birds and mammals submerge, they typically exhibit a dive response in which breathing ceases, heart rate slows, and blood flow to peripheral tissues is reduced. The profound dive response that occurs during forced submergence sequesters blood oxygen for the brain and heart while allowing peripheral tissues to become anaerobic, thus protecting the animal from immediate asphyxiation. However, the decrease in peripheral blood flow is in direct conflict with the exercise response necessary for supporting muscle metabolism during submerged swimming. In free diving animals, a dive response still occurs, but it is less intense than during forced submergence, and whole-body metabolism remains aerobic. If blood oxygen is not sequestered for brain and heart metabolism during normal diving, then what is the purpose of the dive response? Here, we show that its primary role may be to regulate the degree of hypoxia in skeletal muscle so that blood and muscle oxygen stores can be efficiently used. Paradoxically, the muscles of diving vertebrates must become hypoxic to maximize aerobic dive duration. At the same time, morphological and enzymatic adaptations enhance intracellular oxygen diffusion at low partial pressures of oxygen. Optimizing the use of blood and muscle oxygen stores allows aquatic, air-breathing vertebrates to exercise for prolonged periods while holding their breath.
Publication Types: Review Review, Tutorial
PMID: 15313479 [PubMed - indexed for MEDLINE]

36: Tohoku J Exp Med. 2004 Aug;203(4):353-7.
Supplementation of antioxidants prevents oxidative stress during a deep saturation dive.
Ikeda M, Nakabayashi K, Shinkai M, Hara Y, Kizaki T, Oh-ishi S, Ohno H.
Japan Maritime Self-Defense Force Undersea Medical Center, Yokosuka.
Conflicting views exist at the present regarding the influences of a deep saturation dive on liver function in divers. Therefore, we first reevaluated whether a deep saturation dive (400 msw) induces a hepatic disturbance. As the result, plasma activities of both transaminases (aspartate aminotransferase [AST] and alanine aminotransferase [ALT]) increased significantly, whereas cholinesterase (Ch-E) activity decreased markedly, being highly suggestive of liver dysfunction. Assuming that the liver dysfunction was attributable to oxidative stress, we next examined the effects of supplementation of antioxidants (600 mg of vitamin C, 150 mg of alpha-tocopherol, and 600 mg of tea catechins per day) on liver function in saturation divers. As was anticipated, the antioxidants taken appeared to prevent a hepatic disturbance, indicating that a deep saturation dive provokes liver dysfunction probably due to oxidative stress. Thus, we recommend that saturation divers should take supplements of antioxidants.
PMID: 15297742 [PubMed - indexed for MEDLINE]

37: J Acoust Soc Am. 2004 Jul;116(1):245-53.
Tracking sperm whale (Physeter macrocephalus) dive profiles using a towed passive acoustic array.
Thode A.
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A passive acoustic method is presented for tracking sperm whale dive profiles, using two or three hydrophones deployed as either a vertical or large-aperture towed array. The relative arrival times between the direct and surface-reflected acoustic paths are used to obtain the ranges and depths of animals with respect to the array, provided that the hydrophone depths are independently measured. Besides reducing the number of hydrophones required, exploiting surface reflections simplifies automation of the data processing. Experimental results are shown from 2002 and 2003 cruises in the Gulf of Mexico for two different towed array deployments. The 2002 deployment consisted of two short-aperture towed arrays separated by 170 m, while the 2003 deployment placed an autonomous acoustic recorder in tandem with a short-aperture towed array, and used ship noise to time-align the acoustic data. The resulting dive profiles were independently checked using single-hydrophone localizations, whenever multipath reflections from

the ocean bottom could be exploited to effectively create a large-aperture vertical array. This technique may have applications for basic research and for real-time mitigation for seismic airgun surveys.
PMID: 15295984 [PubMed - indexed for MEDLINE]

38: Respir Physiol Neurobiol. 2004 Aug 12;141(3):297-315.
Metabolic regulation in diving birds and mammals.
Butler PJ.
School of Biosciences, University of Birmingham, Birmingham B15 2TT, UK. p.j.butler@bham.ac.uk
Ducks, fur seals, Weddell seals and probably most cetaceans seem to be able to dive and remain aerobic for durations that are consistent with their elevated stores of usable oxygen and their metabolic rate while diving being similar to that when they are resting at the surface of the water. Ducks, in fact, have a high metabolic rate while diving, mainly because of their large positive buoyancy, but other species have relatively low buoyancy, are better streamlined and use lift-based rather than drag-based propulsion. However, species such as the larger penguins, grey seals and elephant seals seem to achieve the impossible by performing a substantial proportion of their dives for periods longer than would be expected on the above assumptions, and yet remaining aerobic. The logical conclusion is that during such dives these species reduce their metabolic rate below the resting level (hypometabolism) and, in some of them, there is a regional reduction in body temperature (hypothermia) which may contribute to the reduction in metabolic rate.
Publication Types: Review
PMID: 15288601 [PubMed - indexed for MEDLINE]

39: Laryngoscope. 2004 Aug;114(8):1510; author reply 1510-1.
Comment on: Laryngoscope. 2003 Aug;113(8):1356-61.
Inner ear decompression illness.
Parell GJ, Becker GD.
Publication Types: Comment Letter
PMID: 15280736 [PubMed - indexed for MEDLINE]

40: J Exp Biol. 2004 Aug;207(Pt 17):3099-107.
Effect of water depth and water velocity upon the surfacing frequency of the bimodally respiring freshwater turtle, Rheodytes leukops.
Gordos MA, Franklin CE, Limpus CJ.
School of Life Sciences, The University of Queensland, Brisbane, QLD 4072, Australia. mgordos@zen.uq.edu.au
This study examines the effect of increasing water depth and water velocity upon the surfacing behaviour of the bimodally respiring turtle, Rheodytes leukops. Surfacing frequency was recorded for R. leukops at varying water depths (50, 100, 150 cm) and water velocities (5, 15, 30 cm s(-1)) during independent trials to provide an indirect cost-benefit analysis of aquatic versus pulmonary respiration. With increasing water velocity, R. leukops decreased its surfacing frequency twentyfold, thus suggesting a heightened reliance upon aquatic gas exchange. An elevated reliance upon aquatic respiration, which presumably translates into a decreased air-breathing frequency, may be metabolically more efficient for R. leukops compared to the expenditure (i.e. time and energy) associated with air-breathing within fast-flowing riffle zones. Additionally, R. leukops at higher water velocities preferentially selected low-velocity microhabitats, presumably to avoid the metabolic expenditure associated with high water flow. Alternatively, increasing water depth had no effect upon the surfacing frequency of R. leukops, suggesting little to no change in the respiratory partitioning of the species across treatment settings. Routinely long dives (>90 min) recorded for R. leukops indicate a high reliance upon aquatic O2 uptake regardless of water depth. Moreover, metabolic and temporal costs attributed to pulmonary gas exchange within a pool-like environment were likely minimal for R. leukops, irrespective of water depth.
PMID: 15277564 [PubMed - indexed for MEDLINE]

41: J Exp Biol. 2004 Aug;207(Pt 17):3003-14.
The effects of intense wing molt on diving in alcids and potential influences on the evolution of molt patterns.
Bridge ES.
University of Minnesota Department of Ecology, Evolution, and Behavior, 100 Ecology Building, 1987 Upper Buford Circle, Saint Paul, MN 55108, USA. ebridge@memphis.edu
Large and medium-sized alcids have a very intense wing molt wherein many flight feathers are shed in rapid succession and wing surface area is reduced by as much as 40%. Although these birds are rendered flightless during wing molt, they must still use their wings to propel themselves underwater. A molt-induced loss of wing area could simply reduce wing propulsion such that more muscular work would be required to maintain a given speed. Alternatively, molt could reduce drag on the wings, making a bird more penguin-like and actually enhancing diving ability. I addressed this issue by filming captive common guillemots Uria aalge and tufted puffins Fratercula cirrhata using an array of video cameras to plot the birds' movements in three dimensions. From these coordinate data I calculated swimming velocities, angles of descent and absolute depths. These values allowed me to estimate the forces due to drag and buoyancy that must be counteracted by flapping, which in turn yielded estimates of the amount of work generated during each flap as well as the average power and cost of transport. Within-bird comparisons of diving performance when wings were intact and during several stages of wing molt indicated that molt is associated with more frequent flapping, reduced displacement during the flap cycle, and possibly reduced work per flap. These negative effects on diving may explain why primary and secondary molts were offset in the birds I studied

such that the period during which all of the flight feathers are effectively missing is minimized.
PMID: 15277555 [PubMed - indexed for MEDLINE]

42: Br J Sports Med. 2004 Aug;38(4):E6.
Desbaric air embolism during diving: an unusual complication of Osler-Weber-Rendu disease.
Hsu YL, Wang HC, Yang PC.
Far Eastern Memorial Hospital, Pulmonary and Critical Care Medicine, 2F, No. 25, Lane 461, Chi-Lin Road, Taipei 104, Taiwan. Hsu619@sinamail.com
Cerebral manifestations of Osler-Weber-Rendu disease (OWRD, hereditary haemorrhagic telangiectasia) including telangiectases, venous malformations, and arteriovenous malformations, are usually under-recognised. The highest complication rate is observed in high flow cerebral arteriovenous malformations, which may present with headache, epilepsy, ischaemia, or haemorrhage. Cerebral air embolism during self-contained underwater breathing apparatus (scuba) diving as the first manifestation of pulmonary arteriovenous malformation (PAVM) in OWRD patients has never been reported before. Here we report a 31 year old male who presented desbaric air embolism as the first manifestation of PAVM. As far as we know, this is the first such case published in English medical literature.
Publication Types: Case Reports
PMID: 15273199 [PubMed - indexed for MEDLINE]

43: Am J Cardiol. 2004 Jul 15;94(2):270-3.
Identification of professional scuba divers with patent foramen ovale at risk for decompression illness.
Cartoni D, De Castro S, Valente G, Costanzo C, Pelliccia A, Beni S, Di Angelantonio E, Papetti F, Vitali Serdoz L, Fedele F.
Department of Clinical Medicine, La Sapienza University, Rome, Italy.
Functional and anatomic characteristics of patent foramen ovale (PFO) were investigated in 66 professional scuba divers (41 with and 25 without decompression illness) using transthoracic and transesophageal echocardiography. PFO with right-to-left shunting at rest is associated with decompression illness, particularly the neurologic type. A wider patency diameter together with a higher membrane mobility are associated with the risk of developing the disease in divers with PFO.
PMID: 15246922 [PubMed - indexed for MEDLINE]

44: Curr Pain Headache Rep. 2004 Aug;8(4):315-20.
Headache and facial pain in scuba divers.
Cheshire WP.
Mayo Clinic, 4500 San Pablo Road, Jacksonville, FL 32224, USA. cheshire@mayo.edu
Headache occasionally occurs during or after scuba diving. Although its significance often is benign, headache may signal a serious neurological disorder in some circumstances. In addition to the usual causes of headache, the diagnostic evaluation should consider otic and paranasal sinus barotrauma, arterial gas embolism, decompression sickness, carbon dioxide retention, carbon monoxide toxicity, hyperbaric-triggered migraine, cervical and temporomandibular joint strain, supraorbital neuralgia, carotid artery dissection, and exertional and cold stimulus headache syndromes. Focal neurologic symptoms, even in the migraineur, should not be ignored, but rather treated with 100% oxygen acutely and referred without delay to a facility with a hyperbaric chamber.
Publication Types: Review Review, Tutorial
PMID: 15228893 [PubMed - indexed for MEDLINE]

45: J Nutr. 2004 Jul;134(7):1765-71.
Nutritional status changes in humans during a 14-day saturation dive: the NASA Extreme Environment Mission Operations V project.
Smith SM, Davis-Street JE, Fesperman JV, Smith MD, Rice BL, Zwart SR.
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Ground-based analogs of spaceflight are an important means of studying physiologic and nutritional changes associated with space travel, and the NASA Extreme Environment Mission Operations V (NEEMO) is such an analog. To determine whether saturation diving has nutrition-related effects similar to those of spaceflight, we conducted a clinical nutritional assessment of the NEEMO crew (4 men, 2 women) before, during, and after their 14-d saturation dive. Blood and urine samples were collected before, during, and after the dive. The foods consumed by the crew were typical of the spaceflight food system. A number of physiologic changes were observed, during and after the dive, that are also commonly observed during spaceflight. Hemoglobin and hematocrit were lower ($P < 0.05$) after the dive. Transferrin receptors were significantly lower immediately after the dive. Serum ferritin increased significantly during the dive. There was also evidence indicating that oxidative damage and stress increased during the dive. Glutathione peroxidase and superoxide dismutase decreased during and after the dive ($P < 0.05$). Decreased leptin during the dive ($P < 0.05$) may have been related to the increased stress. Subjects had decreased energy intake and weight loss during the dive, similar to what is observed during spaceflight. Together, these similarities to spaceflight provide a model to use in further defining the physiologic effects of spaceflight and investigating potential countermeasures.
PMID: 15226467 [PubMed - indexed for MEDLINE]

46: HNO. 2004 Sep;52(9):845-7; quiz 858-9.
[Health aspects of diving in ENT medicine. Part II: Diving fitness]
[Article in German]
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Diving has become increasingly popular. With the growing number of patients who want to dive, there is an increasing number of divers who require their regular medical examination. As ENT problems are the most common disorders in divers, otorhinolaryngologists regularly have to assess the diver's fitness. It should be noted that an ENT examination does not certify complete fitness to dive! Diving can be resumed 3 months after middle ear surgery, especially after tympanoplastic type I, II and III with insertion of a PORP, when there is regular middle ear ventilation without atrophic scars of the tympanic membrane. Even after stapes surgery, diving can be resumed when there are no signs of vestibular irritation during a provocation test. By 3 months after sinus surgery, the diver should perform a test dive under supervision before fitness to dive can be certified. After inner ear barotrauma, the diver remains fit to dive depending on his hearing ability in the involved ear. After inner ear decompression illness, one should look for a vascular right-to-left shunt before diving can be resumed. These and many more aspects are discussed in this article on how to determine whether a diver with ENT problems is fit to dive.
Publication Types: Guideline Practice Guideline
PMID: 15221086 [PubMed - indexed for MEDLINE]

47: HNO. 2004 Aug;52(8):757-67; quiz 768-9.
[Health aspects of diving in ENT medicine. Part I: Diving associated diseases]
[Article in German]
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There has been a steady increase in the number of recreational scuba divers in the last years, with a growing number of diving associated diseases involving ENT medicine. Disorders of the ears, sinuses and pharynx are those most common in divers. In particular, external otitis and barotrauma of the middle ear are commonly treated by every ENT specialist. They usually do not lead to any permanent complaints. Incidents involving the cochleovestibular system are less common, but can result in deafness, vertigo and tinnitus, and therefore have to be treated appropriately. To treat diving medical disorders, the physician has to have some basic understanding of the physical laws that lead to diving incidents. This article will inform the reader of the forces that are encountered by divers, and then give details of the treatment of acute ENT diseases which result from diving incidents.
PMID: 15221085 [PubMed - indexed for MEDLINE]

48: Heart. 2004 Jul;90(7):806-7.
Pulmonary oedema induced by emotional stress, by sexual intercourse, and by exertion in a cold environment in people without evidence of heart disease.
Wilmshurst PT.
Publication Types: Case Reports Letter
PMID: 15201259 [PubMed - indexed for MEDLINE]

49: Appl Ergon. 2004 Jul;35(4):383-91.
Microgravity simulation: physical and psychological workload evaluation tests in an underwater environment.
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As weightlessness is not completely reproducible on Earth, usability evaluation of space systems is often simulated through tests in an aquatic environment. A Neutral Buoyancy Facility test programme was organized in a special pool to simulate Extra-Vehicular Activities on the Columbus module of the future International Space Station with the aim of assessing various aspects of crew interface design. This study was designed to evaluate workload using visibility, accessibility and operability tests. Diving workload was determined through basic physiological measurements, such as pulmonary ventilation and heart rate during underwater operations. As anxiety can influence physiological processes, and consequently also the workload evaluation determined through these parameters, we developed an evaluation methodology to investigate the anxiety level based on a specific questionnaire submitted to all subjects before and after the dives. Heart rate increased in underwater work to a value approximately 50% larger than the value obtained in the resting condition while sitting outside the pool. This increase in heart rate was accompanied by an increase in pulmonary ventilation of 200% larger than the value recorded in the rest condition while sitting outside the water. The extent of these increases was notable in all the test subjects, who varied in age and stature. Recorded values of workload, heart rate and pulmonary ventilation were evaluated on the basis of Christensen's (Arbeitsphysiol. 14 (1950) 251) and Wells' (J. Appl. Physiol. 10 (1957) 51) classifications. Through this analysis it was possible to determine that the workload, indicated by performance on our neutral buoyancy tests, corresponds to moderate physiological work. For test subjects, anxiety related to underwater performance was light. Among the causes of anxiety all the subjects indicated the lack of confidence with neutral buoyancy tests and a feeling of lack of safety, typical of aquatic environments. We can conclude that context did not produce considerable psychological effects, and consequently that the psychological load did not influence heart rate and pulmonary ventilation values that can therefore be directly related to task workload.

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50: HNO. 2004 Jul;52(7):585-9.

[Current diving medicine. 1. The Heidelberg Symposium on Diving Medicine, 22 November 2003]
[Article in German]
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