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Official NEWSLETTER

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ECHM	European Committee for Hyperbaric Medicine
SPUMS	South Pacific Underwater Medicine Society
UHMS	Undersea and Hyperbaric Medical Society

MANUSCRIPTS: see INSTRUCTIONS TO AUTHORS on inside of back cover.

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FROM THE EDITOR

Dear Readers!

As Editor of the European Journal of Underwater and Hyperbaric Medicine it is a pleasure to watch the Journal taking on an increasingly scientific shape. This has been possible with the support from the Editorial Board, in the form of several valuable suggestions on how to improve the contents and look of the Journal. I would like to express my gratefulness to those who have supported me herein.

As you will notice we have a very good exchange between the corresponding scientific societies in diving and hyperbaric medicine. In my opinion this shows that there is no competition between the existing publications, but a fruitful inspiration which our members can take advantage of.

This leads me to an important issue. Before we started I was in contact with several Societies from European countries regarding a joint venture in publication. As I mentioned in an earlier editorial, the plan was to include the Newsletters of these Societies, some with very interesting scientific communications, in the EJUHM in order to bring this information to a wider audience.

As an example I believed that it would not cause any difficulties to have sections in the Journal which are published in the original language (French, Italian, Spanish, German, etc.) and thereby address many more readers interested in this information. At present this does not seem so easy to achieve, because as usual personal and/or local objectives prevail.

It should also be possible to give all members of these Societies access to the EJUHM, for no more than the cost for printing and mailing it to those not interested in becoming regular members of the EUBS. The Societies participating in this joint venture would have the added advantage of having a scientific journal available to their members while maintaining their Newsletters within the EJUHM at no additional costs.

I still hope that this goal can be achieved and we that can demonstrate the European concept behind this idea, which is to have a multilingual information source accessible to members of Societies from different European countries, while still maintaining their countries individual aspects.

Talking about individual perspectives, it brings me to a new series of Reviews we have started in this issue. It is called "Reflections on diving-related issues" and the first contribution was offered by Dr. Oskar Ehm, whom I would call my mentor in my development as a diving physician for almost ten years now. He has again raised an old issue, one that has been puzzling diving physicians for generations. We hope that this paper will stimulate a lively discussion!

This series will continue in the next issues, as the series “Back to fundamentals” does here. The only problem seems to be to keep to the deadline for submission of papers to the EJUHM. I have therefore listed the dates for the release of the Journal on page 13 as well as the corresponding deadlines for submission of articles. I hope this will save me from having to answer e-mails asking “When is the deadline for the next issue” after the deadline has just expired!

As a more technical communication we have Dick Clarke’s paper about the “HORTIS” study. I encourage you all to submit similar articles on multi-centric studies willing to accept participants. If your studies have been approved by an ethical committee, as is the case with the HORTIS study, I have no objections to publishing this information without further review.

Several multi-centric studies are being initiated in Europe by COST Action B14 “Hyperbaric Oxygen Therapy”. Those of you who do not yet know everything about COST B14 or who are interested in participating should visit the website of this Action at http://www.oxynet.org where you will find all the details and regular updates on its progress.

As decided by the EUBS Executive Committee last year a new Membership Directory has been produced. All EUBS Members will receive it with this issue of the EJUHM. Additional copies are available from our Membership Secretary, Angela Randell, to whom all corrections regarding names or addresses should be sent to.

Please keep in mind that the EUBS will celebrate its 30th Anniversary with the 27th Annual Scientific Meeting in Hamburg, September 12th- 16th this year, a special occasion where all members can meet! Visit http://www.eubs.org for more info.

Peter

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PRESIDENT'S COLUMN

Winter is upon us and it tends to be a relatively quiet period for those of us who are active in the treatment of acute diving illness. This does not mean that we have nothing to do. Far from it.

However this could be the time for some of us to put pen to paper and write something interesting for our Journal, Articles are as essential to a journal as Oxygen is to us. Our Editor would be very happy to receive both scientific oriented articles as well as news items on our often generally interesting activities.

Our good friend Dr Uli van Laak, Secretary General of the EUBS 2001 meeting, and his team are working very hard to ensure that this year's meeting will be one to remember. He is planning a number of activities during and around the meeting and I am sure they will be worth joining. Let us wish him every success and contribute to it with our presence in Hamburg and send him many good scientific papers!

I would like to remind you all that poster presentations are an excellent means of presenting one's work and that is why the EUBS committee set up an annual award for the best poster presentation. Many of the posters presented in the past were of high quality both in presentation as well as content, I am sure that this trend will continue for the Germany meeting and beyond.

Now all arguments on when the new millennium really starts have died down and the end of the world some predicted did not occur so I can safely wish all of you a prosperous 2001.

Dr Ramiro Cali-Corleo
President EUBS

LETTERS TO THE EDITOR

Dear Peter!

I was indeed very pleased to hear about the steady progress that has been made in the last year in Europe by the Organizing Committee of the European College of Baromedicine and as presented by Ramiro Cali-Corleo during the Malta meetings. I talked to Alessandro Marroni briefly following Ramiro's presentation and he suggested that I communicate any comments about the College to him or to the journal. I am therefore responding with a letter to the Editor.

As those EUBS members who are also members of the UHMS already know, the UHMS went through a long and tortuous journey to its present state where the Society has rightfully and finally gained recognition for undersea and hyperbaric medicine as a viable treatment modality in American medicine and especially by the American Medical Association (AMA). It was a long, long time in coming but the year 1999 was a landmark year.

Jefferson Davis and his colleague, Dean Heimbach organized the American College of Undersea and Hyperbaric Medicine in the early 1980s as a mechanism to begin to establish training and medical practice standards for physicians practicing in the fields of undersea (diving) and hyperbaric medicine. They also began to quietly interact with the staff of the country's Health Care and Financing Administration and some physicians whose specialty was preventive and occupational medicine.

All of this was a preamble to eventually getting a medical specialty organization, viz The American Board of Preventive Medicine (ABPM) to sponsor us through the American Board of Medical Specialties, the certification arm of the American Medical Association. It should be pointed out that another organization, the College of Hyperbaric Medicine, with headquarters in Florida was established; its aim was to certify physicians in hyperbaric medicine, but outside the aegis or control of the AMA. Most UHMS members felt that this was the wrong approach because it was operating outside of mainstream medicine in the United States. There was no examination process and if you paid the registration fee you received a certificate of certification.

As soon as the ABPM agreed to sponsor us, a faculty of UHMS members was designated to prepare examination questions for the first group of applicants who took the first exam in November 1999. Sixty physicians successfully qualified after taking the exam and in the year 2000 another group of physicians passed the exam. It should be pointed out that only those physicians who were boarded in a primary specialty (medicine, neurology, surgery, etc) could sit for the exam. The Society also provided a primer text and precourse with highly skilled faculty to lecture on some of the basics.

I recognize full well that developing a system of training and a certification process for the fields of undersea and hyperbaric medicine may be very difficult in Europe because of some national differences. Knowing that however, I offer up the following questions, hopefully helpful, to structure some of your thinking and maybe even gain some benefit by knowing about the approaches we took in the United States. It indeed was a SLOW process and sometimes not easy.

I have the following questions. Once the examination process is established, will it be recognized by each of the member countries in the European Union? When preparing the exam, will any idiosyncrasies or differences of different countries be taken into account? Will continuing education credits be required to maintain certification, once granted? Do you plan to "grandfather" those physicians who have had an extensive experience in the field and will they be employed to construct the first examination? How much "on hands" practice experience will be required before one is allowed to take the exam?

I am certain that many or most of these concerns have already been reviewed and discussed by the Organizing Committee and therefore are non-issues. There is no doubt at all in my mind that you will be successful and I do wish the College well.

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PULMONARY BAROTRAUMA: Reflections on its causes

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Ehm OF. Pulmonary Barotrauma: reflections on its causes. European J Underwater Hyperbaric Med 2001; 2(1): 4-7. – New studies on the condition which has come to be known as vocal cord dysfunction provide substantiation for the hypothesis that laryngospasms triggered by panic anxiety may be a cause of pulmonary barotrauma. The fundamental factors involved in pulmonary barotrauma are discussed anew and possible links with vocal cord dysfunction indicated.

pulmonary barotrauma, vocal cord dysfunction, diving, underwater accidents

Introduction

In Peter Bennett and David Elliott's standard reference work *The Physiology and Medicine of Diving* (4th ed. 1993), G.Y. Mebane and N.K.I. McIver state that "the mechanism of lung rupture in diving is not fully understood" (1). Very little has happened since then to challenge the validity of that statement.

Pulmonary barotraumas (PBT) occur in the ascent phase of a dive using compressed air or other gas mixtures. Under increased ambient pressure, the air inhaled from the bottles decreases in volume in the lungs. In accordance with Boyle's Law, this volume is in inverse proportion to the ambient pressure. As ambient pressure decreases during ascent, the volume of air in the lungs increases accordingly. If this increased volume of air cannot be vented, over-distension of the lung is the result. The possible consequences of this are intravascular gas embolisms, mediastinal or subcutaneous emphysema, pneumothorax and pneumo-pericardium. The following remarks refer exclusively to PBTs occurring under these conditions. The very rare PBTs occurring in the compression phase of ascents without breathing apparatus or caused by sudden accidental pressure fluctuations in helmet diving are not considered here. Also excluded from consideration in this article are pre-existing pathological changes in the lung such as emphysema bubbles, cysts or air trapping demonstrably caused by obstructions in the bronchial system.

It is generally held to be uncontroversial that over-distension of the lung can lead to the rupture of alveoli and a subsequent passage of air into the parenchyma and the thorax. As I.M. Calder (2) indicates, "lung tissue over a large volume will obey the principle of Hooke's Law", which states that the stress imposed on a solid is directly proportional to the strain produced, within the elastic limit. In other words, bubbles will only burst when their distension coefficient is exceeded. This is obviously not the case in everyday situations involving internally produced pressure from coughing, lifting heavy objects or playing the trumpet. Here, the active muscular compression of the chest will prevent any significant distension of the lungs. Brief increases of intra-pulmonary pressure to even 200 or 300 mmHg, such as may occur in severe fits of coughing, do not normally result in alveolar rupture. On the other hand, we know that in diving intra-pulmonary pressures of approx. 100 millibars (= 80 mmHg) can be enough to trigger PBT. A number of such accidents have been described as occurring in ascents from depths little over 1 meter (= 100 millibars).

Pathological/anatomical studies

In a study, I.M. Calder (2) attempted to establish the pathological/anatomical causes of PBT, evaluating for this purpose 55 fatal underwater accidents between 1969 and 1976 involving professional divers. 9 of the fatalities were caused by PBT, 4 by pneumothorax. Calder exposed the lungs of 7 fresh young cadavers to increased pressures via the trachea, basing his approach on trials and the techniques employed in experiments on rabbits by M.S. Malhotra and H.C. Wright (3). Further experiments on rabbits and a mechanical model for studying the problem of over-distension were developed by H. Hartmann (4) at the Institute of Aviation Science of the German Experimental Aerospace Center in Bad Godesberg. All the investigations concluded unanimously that alveolar rupture occurs following overpressure of 40-100 mmHg. However, ruptures of the alveoli occurred only at significantly higher

pressure if the chest and/or abdomen of the experimental animals and human cadavers were tightly bound.

As a consequence of his findings, Malhotra recommended for diving ascents a firm binding of the abdomen, which did not interfere with the normal respiration since the chest was free. Binding of the thorax alone was not found to be effective.

All these experimental trials led to the conclusion that over-expansion of the lungs is primarily responsible for barotrauma.

Functional factors

The fundamental question of what precisely causes over-expansion of the lungs during diving has yet to be satisfactorily resolved. Colebatch et al. (5) tested the pulmonary conductance and compliance of 16 young divers, 6 of whom had previously suffered PBT. They found that the lungs of the divers who had had accidents caused by increased transpulmonary pressure were less distensible than those of their fellows. They arrived at this conclusion on the basis of higher recoil pressures, earlier deflation of the lung and lower compliances, considering increased elastic recoil, however, to be a consequence rather than a cause of PBT. Of approx. 500 divers at risk only 6 suffered PBT. Study of elastic recoil in 26 healthy males under 40 showed that 3 had an increase in elastic recoil similar to that found in the PBT group, corresponding to a proportion of 58 out of a group of 500. Therefore the majority with increased elastic recoil did not suffer PBT. According to Colebatch's findings divers displaying these mechanical properties are more susceptible to PBT.

The mechanical properties of the lung prompted A.A. Bühlmann (6) to similar conclusions: the simultaneous presence of different flow resistances will effect the simultaneous presence of differently distended regions. Over-distended regions will compress those parts of the lung with low extensibility. The flow resistances thus caused lead to air-trapping, ultimately effecting over-expansion and rupture in the regions concerned during ascent. In his studies on change in pulmonary elastic recoil pressure, Colebatch suggests the possibility of the density of elastic fibers not being constant throughout the lung. Areas with normal fiber density may be surrounded by areas with increased fiber density. These conclusions might indicate constitutional anatomical changes representing a predisposition for PBT. But if over-expansion of the lung is a necessary prerequisite for PBT the question still remains as to how such over-expansion can come about.

Occlusion of the glottis

Hermetic sealing of the airways is only possible at one single point: the larynx. It results from an occlusion of the glottis. Occlusion of the larynx can occur at three levels:

- at the opening of the larynx via closure of the plicae aryepiglotticae;
- from closure of the plicae vestibulares;
- from occlusion of the vocal cords (plicae vocales).

It is generally accepted that all three mechanisms are involved in laryngospasms. The nervous regulation for this event occurs in the medulla oblongata and takes place via a reflex (7).

In the field of clinical medicine only very few cases of laryngospasm have been recorded so far. Alongside the rare cases of calcium deficiency tetany in hypoparathyroidism there has been a report of Ictus laryngis (glottic seizure) leading to brief loss of consciousness after a bout of coughing. In children we also have croup and pseudo-croup, both triggered by inflammatory changes in the larynx. These conditions may cause the entry of air into the pleural space but not the usually severe damage typically the consequence of PBT.

PBT prevention in practice

In scuba diving we have a situation where gas inhaled at increased pressure under water expands its volume several times over during ascent as ambient pressure diminishes. If this increased volume of gas cannot be vented there will be an attendant increase in pressure in the airways leading to over-expansion of the alveoli and the irruption of respiratory gas into the arterial blood circulation. The result is frequently an arterial gas embolism (AGE).

These hazards have long been a recognized factor in diving medicine. A practical method of preventing pulmonary overpressure by means of "involuntary breath-holding" is employed in emergency ascents by all submarine units. In submarine accidents emergency ascent may be the sole prospect of survival. The air pressure maintained in submarines corresponds to

atmospheric pressure. To leave the vessel in cases of emergency, crew members have to adjust to the prevailing water pressure in a pressure lock before the hatch can be opened. In this way ascents from 30-50 m without breathing or breathing apparatus are entirely feasible. To prevent individuals from intentionally or inadvertently holding their breath, emergency ascents are simulated for practice in escape training tanks usually at a depth of 30 m. Although much care is taken in the selection of divers and in training and supervision, accidents have been known to occur, albeit seldom. US Navy statistics estimate the ratio of emergency ascent accidents to be 1:3.000; for fatal accidents it is 1:50.000.

The percentage of fatal air embolism accidents involving sport divers is very much higher. According to the US Underwater Diving Fatality Statistics (8) 16 of 39 (41%) fatal accidents for medical reasons in 1985 were caused by air embolisms. The 1992 DAN Report (9) lists the relevant percentage as 19.2% for the year 1987, 12.4% for 1991 and 9.2% for 1992. This clear fall-off is probably traceable to substantially greater caution in connection with emergency ascent exercises, notably for beginners, and the overall improvement in the training of diving instructors. In Britain practice in emergency ascents was temporarily removed from training programs for sport divers.

The purpose of such emergency ascent training is obvious. It is designed to alleviate beginners' fears about ascending from the depths to the surface without having to breathe. In reality, there is no necessity to breathe during the relatively brief period it takes to accomplish such an ascent, the increased O_2 intake at such depths is sufficient in itself to ensure that the supply of oxygen is fully adequate. A compulsion to breathe will not occur as the urge to do so stemming from increased carbon dioxide pressure is offset by the exhalation of breathing air during ascent. In diving reality, ascents from a depth of 100 m have been accomplished in this way.

The probability principle

The conclusion drawn by the author from all these facts is that panic fear is the operative factor in PBT, triggering an occlusion of the respiratory passages via a laryngospasm. This conclusion is based on the probability principle. An experiment with a mouse established that even when the ascent time was artificially prolonged it was not possible to induce a laryngospasm. The conclusion drawn from this was that mice (and probably other rodents as well) are not suitable as an experimental model for overpressure accidents (10).

According to Berendes (11) the original function of the larynx in phylogenetic terms was that of a sphincter. Only in the course of evolution did the larynx develop into a sound generator. Thus the larynx has evolved from a simple reflex innervated ring muscle to a highly sophisticated organ with extremely sensitive nervous regulation mechanisms. The original primitive function of the larynx has however remained that of guarding the lungs.

The survival of this primitive function may be the foundation on which a glottis spasm can originate. An emergency ascent is a situation where it is no longer possible for the diver to breathe as before. The feeling of incipient suffocation is known to lead to an elemental condition of alarm, often coupled with violent defence mechanisms. When such elemental anxiety sets in, the organism no longer reacts rationally but via primitive functions. In the case of PBT, laryngospasms are set off by just such a primitive function.

Vocal cord dysfunction

For some 10 years now the meagre knowledge we have of conditions associated with laryngeal stridor has been extended by reports of a disorder involving intermittent, functional inspiratory or expiratory laryngospasm for which the term "vocal cord dysfunction" (VCD) has established itself in the international literature. Wamboldt et al. (12) call VCD "a disorder of unclear aetiology and pathophysiology for which both psychiatric and biomedical explanations have been proposed". Wamboldt and his co-investigators have submitted a major study with extensive test material on this phenomenon. 30 patients assigned to 4 different comparison groups were subjected to a battery of pulmonary function and psychiatric tests. The authors proceeded on the hypothesis that VCD occurs after exposure to environmental irritants.

But they also found that VCD is associated with panic disorders and that patients displaying VCD have a significantly higher level of anxiety symptoms. Wambold (12) states: “Yet the crucial question remains concerning how the patho-physiology of VCD and Panic Disorder might be linked. We propose that Klein's Faulty Suffocation Alarm Model of PD (13) provides the required link. Klein's model argues that physiological hyper-

sensitivity of the medullary and pontine respiratory control centres to a variety of stimuli that can be interpreted as indicating impending threat of suffocation leads to the ensuing physiological and psychological cascade of symptoms constituting a panic attack. Five sets of data supportive of Klein's "*False Suffocation Alarm Model*" are particularly important in linking his Suffocation Alarm Model of Panic Disorder to VCD".

K. Kenn (14) observed in 5% of his asthma patients that the frequently severe dyspnoea was conditioned by VCD. A number of these patients had been diagnosed for therapy-resistant asthma or steroid refractor and were physically impaired by the side-effects of long-term corticosteroid therapy. He feels it to be unjustified to adhere to a monocausal psychosomatic view of the condition. Kenn's report does however only refer to asthma patients.

Now in most cases, PBT is not caused by prior changes in the lung and not even by asthma but is an instance of dyspnoea occurring suddenly in an extreme situation and experienced by the victim as actively life-threatening. According to Klein (13) the physiological and pharmacological trials undertaken so far to explain the suffocation symptom are not convincing. He concludes from his own findings that although there must be a suffocation alarm detector, this detector cannot be explained by the theory of carbon dioxide hypersensitivity as this is merely one aspect of more general suffocation hypersensitivity. A pharmacological counterpart to Panic Disorder is Ondine's curse, a congenital central hypo-ventilation syndrome. Children with this disorder show no distress when severely hypoxic or hypocapnic. From this Klein concludes that there is a striking indication of the loss of a specific suffocation detector. His concluding hypothesis is that "a physiological misinterpretation by a suffocation monitor misfires an evolved suffocation alarm system. This produces sudden respiratory distress followed swiftly by a brief hyperventilation, panic and urge to flee."

The adoption of such a model and the clinical observations on VCD allow for a new perspective on the hypothesis that in diving panic is the trigger of laryngospasm.

At all events, further studies on the causes of PBT will be unable to ignore the vocal cord dysfunction. Accordingly, the aim of this article is to provide an impetus for corresponding investigations on the problem.

References

1. Mebane GY, McIver NKI. Fitness to dive. In: Bennett PB, Elliott EH (Eds.) The physiology and medicine of diving, 4th Edn. London: WB Saunders, 1993:60.
2. Calder IM. Autopsy and experimental observations on factors leading to barotrauma in man. Undersea Biomedical Research 1985; 12:165-182.
3. Malhotra MS, Wright HC. Arterial air embolism during decompression and its prevention. Proc. Roy. Soc. London Ser B 154:418-427.
4. Hartmann H. Pathogenese und Therapie der Luftembolie im Hinblick auf die Problematik im Überdruck. Der Anästhesist 1966; 15:359-369.
5. Colebatch HJH, Smith MM, Ng CKY. Increased elastic recoil as a determinant of pulmonary barotrauma in divers. Respiration Physiology 1976; 26:55-64.
6. Bühlmann, AA. Tauchmedizin, 3rd Edn. Berlin: Springer, 1993.
7. Ehm OF. Panik als Ursache des Lungenüberdruckunfalls. In: Gerstenbrand, Lorenzoni, Seemann (Eds.). Tauchmedizin 2 Hannover: Schlütersche, 1983 (Symposium Tauchmedizin 1981):133-152.
8. McAniff, JJ. US underwater diving fatalities statistics 1985. U.S. Dept. Commer., NOAA, Undersea Research Program, Washington DC, 1985:1-63.
9. Divers Alert Network 1992. Report on diving accidents & fatalities. Box 3823 Duke University Medical Center, Durham, North Carolina 2771 D, 1994:1-67.
10. Ehm OF. The causes of pulmonary barotrauma. In: Blanchard J, Mair J, Morrison I, eds. Proceedings of the diving science symposium CMAS. Edinburgh, 1980:58.
11. Berendes J. Handbuch für Hals-, Nasen-, Ohrenheilkunde. Stuttgart: Georg Thieme Verlag, 1963:2,2.
12. Wamboldt, F. In: Gavin LA, Wamboldt F, Brigmann S, Roesler TA. Psychological and family characteristics of adolescents with Vocal Cord Dysfunction. Journal of Asthma 1998; 35,5: 409-417.
13. Klein, DF. False suffocation alarms, spontaneous panics, and related conditions. An integrative hypothesis. Arch. Gen. Psychiatry 1993; 50: 306-317.
14. Kenn K. Personal communication.

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Carl UM et al. Hyperbaric Oxygen in the Treatment of Radiation Therapy Sequelae. European J Underwater Hyperbaric Med 2001; 2(1): 8-10 – Radiation therapy side effects develop to an endpoint that is not predictable at the time of diagnosis. Established treatment options deal basically with the symptoms only. In some cases conservative treatments are less potent then large surgical interventions. Looking at the underlying pathologic mechanisms in irradiated tissues hyperbaric oxygen (HBO) therapy appears to be a promising approach in order to overcome consequential late radiation damage with hypovascularity, hypocellularity and hypoxia. Basically patients suffer from pain, edema, necrosis, fibrosis in compromised tissues. From 1997 to 1999 more then 200 patients with late radiation side effects presented at the Clinic for Radiation Oncology, University Duesseldorf. Out of them 66 patients with 211 endpoints were found suitable for HBO therapy. With 82.5% reduction of symptoms best palliative results were seen in pain and edema. Also xerostomia (69.2% effect) seems to be an interesting endpoint. The present study shows that HBO is a valid therapy in the treatment of radiation therapy side effects. More emphasis needs to be put upon prospective randomised studies in selected indication, such as xerostomia.

normal tissue reaction, radiation sequelae, HBO, hyperbaric oxygen

Introduction

Late radiation sequelae may occur some time after the actual tumor treatment. (Carl et al. 2000) Basically chronic inflammation is initially accompanied by edema, and later by vessel depletion leading to hypoxic necrosis of inflicted tissues and to predominantly fibrotic alterations (Trott 1998). The severity of normal tissue reactions cannot be predicted at the time of diagnosis. Moreover, it has been stated that such reactions develop progressively (Hartmann et al. 1996). From the pathophysiologic point of view, hyperbaric oxygen (HBO) is a treatment option that is suited to address those problems caused by radiation. It has been shown, that resolution of edema (Carl et. al. 2001), restoration of lymphocyte activity (Hunt 1988), induction of angiogenesis (Marx et al. 1990) and prevention of fibrosis (Feldmeier et al. 1995a) are basic and beneficial mechanisms for HBO in radiation injured tissues. From 1997 to 1999 more then 200 patients with late complications after radiation therapy (RT) were referred to the University of Duesseldorf, Clinic for Radiation Oncology. The question addressed in this study is whether HBO therapy can be broadly applied as a feasible treatment option for late radiation sequelae. Additionally, it seems appropriate to determine the effects of HBO by examining more then one outcome parameter for each patient. Thus, the outcome in 66 patients suffering from radiation injuries with 211 endpoints is the subject of the present investigation.

Patients and Methods

From 1997 to 1999, 66 patients (28 females and 38 males) of 200 patients with late radiation therapy (RT) side effects were treated with HBO. Most of the reported side effects occurred in the first year after RT, (range from 2 months to more then 30 years). The HBO treatment schedule was performed as described by Hartmann et al. (1996). Ten to 68 treatments (Median 25) were applied at 240 kPa for 90 minutes after patients were found suitable for exposure to hyperbaric oxygen therapy. Independent of the extent or the location of the primary tumours, RT-side effects were grouped according to LENT-SOMA tables (Pavy et al. 1995). A total number of 211 endpoints were documented in 7 groups. As might be expected, several patients presented with more than one manifestation of injury, and more than one endpoint of treatment was followed. Table 1 gives an overview of the sequelae treated. In the same manner as Anderud et al. (1998) the outcome was grouped as no-change, moderately improved, or markedly improved.

Results

Indications for HBO were seen in 66 patients with a total of 211 identifiable injuries and endpoints of

treatment at a mean time of 3.1 years after irradiation (range: 0.7 to 6.3 years). Endpoints were monitored before, during and after HBO treatment. RT side effects are very often accompanied by pain and edema. Following HBO treatment, a marked improvement was seen in 35% of the endpoints while 36% experienced moderate improvement. Only 29% of the endpoints did not show response to HBO treatment. Alleviation of edema (n=39) and pain (n=35) are clinically important accompanying endpoints. HBO showed a good palliation (85% improvement) in such cases. In contrast about 50% of necrotic tissues seemed to profit from HBO. Also xerostomia is a significant complication of irradiation and showed an improvement in 18 out of 26 cases. The basic pathologic mechanism for xerostomia is the RT induced dysfunction of mucosal glands.

Endpoint	Marked improvement	Moderate improvement	No change	Total
Edema	16	17	7	40
Pain	26	12	8	46
Xerostomia	7	11	8	26
Soft tissue necrosis	13	16	18	47
Osteo-radionecrosis		5	7	12
Neurological symptoms	8	7	10	25
Enteritis/Proctitis	3	8	4	15
Total	73	76	62	211

Table 1: HBO therapy was applied in a number of RT side effects. Best palliation was seen in the clinical endpoints of edema and pain. Xerostomia is also of great clinical importance. Due to its consistent and homogeneous appearance, this endpoint should be subject to further studies.

Discussion

The presented results demonstrate that HBO may be of considerable importance in selected RT late sequelae. Late RT side effects are defined by a time scale beginning day 90 after start of radiation treatment. The type of RT side effect seems to allow a much better grouping. In general both systems may be congruent. The definition shall not be made not subject to the present discussion. The process progressing from the tissue damage to fibrosis and vessel depletion has recently been described (Trott 1998) and demonstrated (Carl et al. 2000). In the latter referenced study, it was suspected that fibrosis and vascular changes lead to chronic ischemia and tissue inflammation. From this postulated approach, it can not be concluded whether vessel depletion after RT (c.f. Ang et al. 1993) is an important target for HBO. But from the previous work of Marx et al. (1990), it is very likely that HBO plays an important role by its angiogenic potency, thus preventing the full spectrum of RT side effects. Long term effects after HBO treatment will be the subject of further ongoing studies. In contrast, cancer patients suffering from RT side effects need an immediate palliative and effective support.

There are few publications dealing with delayed radiation complications or their treatment. In 1985 Arndt presented his investigations on the topic. It seems necessary from an oncological point of view to state that tumors need to be cured and patients have to survive their cancers long enough in order to develop side effects. This might also serve as an additional explanation why most of the presented RT side effects are seen in the first year after treatment, which is in contrast to the report by Jain (1996) who described much longer disease-free intervals. Most general practitioners do not understand that RT side effects may occur long after RT. Thus patients are not frequently referred to a radiation oncologist when side effects occur. Moreover at the time of cancer diagnosis (according to life tables) patients are often at an advanced age with a limited remaining life expectancy reducing the probability that radiation complications will be expressed during their remaining lifetime. In regard to the actual side effects, the investigator deals with a dynamic process with an uncertain endpoint (Hartmann et al. 1996). Furthermore total and fraction dose, the size of the treated volume, the organs/regions at risk, and the total number of recruitable patients disturb a clear endpoint definition (Spanos et al. 1980). In spite of these confounding difficulties, the presented retrospective review reports the results in 66 patients with 211 outcome measures.

Referring to table 1, edema and pain are among the most important clinical endpoints. Their presence has profound negative effects on quality of life. With 82.5% reduction of symptoms, HBO is a powerful palliative tool. Also xerostomia is a very troublesome side effect. With 69.2% reduction of xerostomia symptoms, HBO might be of great importance in this respect. Since xerostomia is a common and well defined side effect of head and neck irradiation, it may be possible to quantify its extent by 99-m-Tc-Diphosphonate scintigraphy before, during and after therapy. In this way, the present report of subjective patient reactions might become the subject of a prospective randomised study. When comparing the outcome in treating soft tissue and bone necrosis, the latter is found to be more resistant to HBO therapy. Marx et al. (1983) and Feldmeier et al. (1995a) have previously reported the need for adequate surgical debridement when bone is involved by radiation necrosis. Devitalized bone acts like a xenograft and is the most important stimulus for a chronic infection (Lanz 1978). The optimal extent and timing of surgery in conjunction with hyperbaric oxygen is not yet firmly established due to limited experience in this regard.

Marx et al. (1983) has shown the importance in delivering about 30 hyperbaric oxygen treatments prior and about 10 treatments after surgical intervention. Looking at neurological symptoms, sensory as well motor deficits can be influenced by HBO therapy in 60% of all cases. It has been previously demonstrated, that enteritis and proctitis can be treated successfully by HBO therapy (Carl et al 1998, Feldmeier et al. 1995b).

HBO presents both an interesting therapeutic option in the treatment of RT side effects and a scientific field in which many aspects still need to be investigated. As a first step, a retrospective report of clinical outcome has been presented in 66 desperate cases, where no other treatment option was available at the time of their diagnosis. These results are encouraging and justify additional study. Improvements in Xerostomia and pelvic disorders represent endpoints which will allow prospective studies.

References

- Aanderud, L., Brattebo, G., Forland, M., Thorsen, E.: Effects of hyperbaric oxygen (HBO) treatment on radiation induced symptoms in the head/neck and pelvic regions. Proceedings of the XXIV Annual Meeting of the EUBS (1998); 46.
- Ang, K.K., Price, R.E., Stephens, L.C., Jiang, G.L., Feng, Y., Schultheiss, T.E., Peters, L.J.: The tolerance of primate spinal cord to re-irradiation. Int. J. Radiat. Biol. Phys. 25 (1993); 459-464.
- Arndt, D.: Die gutachterliche Bewertung von Komplikationen im Zusammenhang mit medizinischer Strahlenanwendung in der DDR. Ergebnisse der zentralen Begutachtung im Zeitraum 1/68-3/84 und Ableitung von Begutachtungskriterien. Habilitationsschrift, Akademie für ärztliche Fortbildung der ehemaligen DDR, Berlin-Lichtenberg (1985).
- Carl, U.M., Peusch-Dreyer, D., Frieling, T., Schmitt, G., Hartmann, K.A.: Treatment of radiation proctitis with hyperbaric oxygen: What is the optimal number of HBO treatments? Strahlenther. Onkol. 174 (1998); 482-483.
- Carl, U.M., Sarbia, M., Hartmann, K.A.: Subcutaneous calcification after radiation therapy. Europ J Underwater Hyperbaric Med 1 (2000); 26-29.
- Carl, U.M., Hartmann, K.A., Feldmeier, J.J., Schmitt, G.: Hyperbaric oxygen therapy (HOT) for late sequelae in women receiving radiation after breast conserving surgery. Int J Rad Oncol Biol Phys (2001), preprint.
- Feldmeier, JJ, Heimbach, RD, Davolt,DA, Court, WS, Stegmann, BJ, Sheffield PJ: Hyperbaric oxygen as an adjunctive treatment for delayed radiation injury of the chest wall: a retrospective review of twenty-three cases. Undersea and Hyperbaric Medicine 22 (1995a); 383-393.
- Feldmeier, JJ, Jelen I, Davolt DA, Valente, PT, Meltz ML, Alecu RA: Hyperbaric oxygen as a prophylaxis for radiation-induced delayed enteropathy. Radiotherapy and Oncology 35 (1995b); 138-144.
- Hartmann, K.A., Almeling, M., Carl, U.M.: Hyperbare Oxygenierung (HBO) zur Behandlung radiogener Nebenwirkungen. Strahlenther. Onkol. 172 (1996); 641-648.
- Hunt, T.K.: The physiology of wound healing Ann Emerg Med 17 (1988); 1265-1273.
- Jain, K.K.: Hyperbaric Oxgen Therapy in the Management of Radionecrosis. In: Textbook of Hyperbaric Medicine. Jain, K.K. (Editor), Hogrrefe and Huber Publishers, Inc. USA (1996); 225-235.
- Lanz, R.: Grundsätze der Chirurgie unter Katastrophenbedingungen. In: Symposium Kriegschirurgie `77. K.-W. Wedel (Editor), Verlag Wehr und Wissen, Koblenz, Bonn (1978); 27-32
- Marx, R.E.: A new concept in the treatment of osteoradionecrosis. J Oral Maxillofac Surg 41 (1983); 351-358.
- Marx, R.E., Ehler, W.J., Tayapongsak, P., Pierce, L.W.: Relationship of oxygen dose to angiogenesis induction in irradiated tissues. Am. J. Surg. 160 (1990); 519-524.
- Pavy, J.-J., Denekamp, J., Letschert, J., Littbrand, B., Mornex, F., Bernier, J., Gonzales-Gonzales, D., Horiot, J.-C., Bolla, M., Bartelink, H. (EORTC late effect working group): Late effects toxicity scoring: the SOMA scale. Radiother. Oncol. 35 (1995) 11-60.
- Spanos, W.J., Montague, E.D., Fletcher, G.H.: Late complications of radiation only for advanced breast cancer. Int. J. Radiat. Biol. Phys. 6 (1980); 1473-1476.
- Trott, K.-R.: Pathogenesis of consequential late radiation damage. Radiother. Oncol. 48 (1998); 246.

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HYPERBARIC OXYGEN RADIATION TISSUE INJURY STUDY "H O R T I S"

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Clarke D. Hyperbaric oxygen radiation tissue injury study "HORTIS". European J Underwater Hyperbaric Med 2001; 2(1): 11-13 – A great deal of hyperbaric data has addressed the problem of radiation tissue injury involving the mandible. The present level of evidence is certainly encouraging, and highly suggestive of hyperbaric oxygen therapy being both clinically efficacious and cost effective. As the same damaging effects of radiotherapy have been observed at other anatomic sites, hyperbaric oxygen therapy has likewise been incorporated into its medical and surgical management elsewhere. The level of evidence, however, is less impressive, although wide-ranging case experience is uniformly positive. In order to improve upon this level of evidence, and better determine the effectiveness of hyperbaric oxygen therapy, project HORTIS has been conceived.

late radiation injury, hyperbaric oxygen, study design

Objectives

The principle objective of this research is to more precisely determine the degree of benefit that hyperbaric oxygen therapy affords in the treatment of late radiation tissue injury.

The study has eight components. Seven involve evaluation of established radionecrosis at varying anatomic sites. The eighth will investigate the potential of hyperbaric oxygen therapy to prophylax against late radiation tissue injury.

This study will also generate more precise "Benchmarking" data as to the complications associated with hyperbaric exposure, including incidence and degree of morbidity.

Background and Rationale

Radiation therapy is a key component of the control and eradication of malignant disease. Adequate tumorcidal doses may, however, result in damage to surrounding healthy tissue. Therapeutic radiation injuries can be divided into acute, sub-acute, and delayed complications (1). Acute injuries are considered a direct cellular toxicity, self-limiting, and managed symptomatic-cally. Sub-acute injuries are typically identifiable in only a few organ systems, e.g., radiation pneumonitis. These, too, are generally limited but occasionally evolve to late complications. Late changes occur several months to many years after completing radiotherapy.

The etiology of radiation's late effects to normal tissue (LENT) varies somewhat between organ systems. Its hallmark, however, is one of culminating in an obliterative endarteritis.

The incidence of LENT is related to both total radiation exposure (2) and the length of time a patient is out from completing radiotherapy (1). The higher the dose, the longer the interval from exposure, the greater the risk. In many cases, resulting radionecrotic lesions seriously impair form and function, and require extensive surgical correction or repair (3, 4). Such surgery is fraught with complications (3, 4). Hence, the inclusion of a "prophylactic" hyperbaric oxygen arm to Project HORTIS. A disturbing degree of mortality further complicates the development of LENT[3,5].

Hyperbaric oxygen has been utilized in the treatment of radiation tissue injury for several decades (6, 7). Most of the supportive basic science and clinical evidence stems from the management of mandibular osteoradionecrosis (8, 9). More recently, the use of hyperbaric oxygen has been extended to other anatomic sites (10, 11, 12, 13). This expended use is based, in large part, on a presumed common underlying patho-physiology of LENT, regardless of the site involved. Supportive clinical evidence for these other sites is limited, however, and in need of a greater degree of scientific scrutiny.

Study Type

HORTIS has been developed as a multi-center study of international participation, involving a randomized, double blind, placebo-controlled clinical trial, with patient cross over.

Patient Eligibility

Patients will be eligible to enter the HORTIS trial if they have a history of exposure to therapeutic radiation, and have developed clinically manifest late radiation tissue injury (HORTIS I-VII).

A separate group of patients are eligible to be enrolled if they have likewise been irradiated, have not developed clinically manifest radionecrosis, and face surgical intervention within or through the radiation portal (HORTIS VIII).

Patients would be considered ineligible if they have active cancer, and/or are thought to be at high risk for hyperbaric-hyperoxic related complications.

Treatment Plan

Patients will be initially randomized to receive either oxygen at 2.0 atmospheres absolute, or air at 1.0 atmospheres absolute.

The therapeutic algorithm is personalized to each patient's degree of response at specific points during their course of hyperbaric exposure. The total number of exposures will vary from between 20 and 40.

Following a 30-day observation/"wash out" period, each patient will be offered the opportunity to cross over to the study arm not previously experienced. The offer is mandatory, not so the requirement of the patient to cross over. A therapeutic algorithm identical to the first randomization will be undertaken during the subsequent crossover phase.

Data Collection

Data will be entered into a central electronic HORTIS database, via the internet. Database access is password protected. Clinicians approved as HORTIS investigators will be granted controlled access. The randomization sequence will be revealed at the time of initial entry of background patient information.

The database is available in both English and Spanish.

HORTIS investigators will be responsible for entering all required data. Assessment of change, and clinical outcomes, will be determined by each patient's referring/specialty physician, who will remain blinded as to randomization sequence (hyperbaric oxygen vs. normobaric air). Such determinations will be undertaken using forms provided by The Baromedical Research Foundation. All such documents become a part of the Medical Record.

Once the electronic database record has been "Finalized", the information so contained cannot be altered ("corrected") by the treating physician. Should an error in data entry occur, a formal correction request must be transmitted to the HORTIS Principle Investigator, in care of The Baromedical Research Foundation.

Approved changes will be made by the Principle Investigator, in his capacity as guarantor of study integrity.

Data Analysis

All data analysis will be undertaken by faculty and graduate students at the Biostatistical Department, School of Public Health at The University of South Carolina, USA.

The biostatisticians will have "download only" access to the database, and no facility to alter the data contained therein.

The statistical procedures used in the analysis of data will include simple tests of two proportions (comparing the proportion that heal in the treatment and control groups); chi-square tests of independence when the outcome is classified into more than two levels, and multiple logistic regression, to adjust for other (demographic) factors when comparing the two groups.

All analyses will be performed using statistical programs in SAS.

Publication

It is intended that the results of HORTIS research will be published in "English-speaking" specialty journals specific to the anatomic sites/medical specialties involved. A separate paper is planned for each of the eight HORTIS

arms. Papers will be submitted for publication upon availability of the results of the initial randomization (pre-cross over). A separate set of papers will be generated once the cross over component is complete.

Each center contributing patients to the database will have a local Principle Investigator identified. Each local P.I. will feature in the author listing, as appropriate (number of patients referred, and any additional contributions to the manuscripts development or review). All other local co-investigators who likewise contribute will be recognized where appropriate (author listing, or under the "Acknowledgements" section).

For further information on Project HORTIS, please contact The Baromedical Research Foundation.

References

1. Rubin P, Casarret GW: Clinical Radiation Pathology, Vol. 1. Philadelphia, PA. W. B. Saunders, 1968:58-61.
2. Curi MM, Dib LL: Osteoradionecrosis of the jaws: a retrospective study of the background factors and treatment in 104 cases. Journal Oral Maxillofacial Surgery 1997;55:540-544.
3. Joseph DL, Shumrick DL: Risks of head and neck surgery in previously irradiated patients. Arch Otolaryn 1973;97:381-384.
4. Samuels L, Granick MS, Ramasastry S, et al.: Reconstruction of radiation-induced chest wall lesions. Annals of Plastic Surgery 1993;31(5):399-405.
5. Bolis G, et al.: The impact of whole abdomen radiotherapy on survival in advanced ovarian cancer patients with minimal residual disease after chemotherapy. Gynecology, Oncology 1980;39:150-154.
6. Marx RE, Ames JR: The use of hyperbaric oxygen in bony reconstruction of the irradiated and tissue-deficient patient. Journal Oral Maxillofacial Surgery 1982;41:351-357.
7. Hart GB, Mainous EG: The treatment of radionecrosis with hyperbaric oxygen. Cancer 1976;37:2580-2585.
8. Marx RE: Osteoradionecrosis: a new concept of its pathophysiology. Journal Oral Maxillofacial Surgery 1983;41:283-288.
9. Marx RE: A new concept in the treatment of osteoradionecrosis. Journal Oral Maxillofacial Surgery 1983;41:351-357.
10. Bevers RF, Bakker DJ, Kurth KH: Hyperbaric oxygen treatment for haemorrhagic radiation cystitis. Lancet 1995;346:803-805.
11. Woo TCS, Joseph D, Oxer H: Hyperbaric oxygen treatment for radiation proctitis. Int. Journal Radiation Oncology Biology Physics 1997;38(3):619-622.
12. Williams J, Clarke D, Dennis WA, et al.: The treatment of pelvic soft tissue radiation necrosis with hyperbaric oxygen. American Journal Obstetrics & Gynecology 1992;167(2):412-416.
13. Feldmeier JJ, Heimbach RD, Davolt DA, et al.: Hyperbaric oxygen as an adjunctive treatment for severe laryngeal necrosis: a report of nine consecutive cases. Undersea & Hyperbaric Medicine 1993;20(4):329-335.

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EJUHM ARTICLES SUBMISSION CALENDAR

Issue	Deadline
Spring: March	**15 February**
Summer: June	**15 May**
Autumn: September	**15 August**
Winter: December	**15 November**

EUBS Annual Scientific Meeting 2000 in Malta

Lee J. Greenbaum, Jr.

Malta to many non-Europeans conjures up thoughts of exotic places on earth and on our

arrival at 02:00 by air during a full moon in cloudless skies confirmed our imagined thoughts of a beautiful island. Since we had thirty hours of transit time from home to touch-down in Malta our first thoughts were of sleep, in spite of lost luggage.

Breakfast the next morning was slow and easy as we enjoyed the lovely vista of the coral blue sea, and again under cloudless skies. The meeting hotel, the Westin Dragonara was easily seen from our hotel dining room and was only a three to four minute walk from our hotel, the Golden Tulip Vivaldi. Since we had at our disposal part of the day without schedule before the meeting registration, we took a slow walk through Paceville.

The island of Malta is about 350 Km south of Sicily, which because of its strategic position between Europe and Africa, made it a prime

bombing target during the early days of World War II and Malta sustained major losses of life and property during the bombings. Malta is about 14 Km long and 7 Km wide. The second language of the Maltese is English; their language is an Arab dialect with borrowings from Spanish and French. Conversation was never a problem, especially in the shops and restaurants.

The Westin Dragonara was well equipped to handle a scientific/medical meeting with a large meeting room and modern audio-visual equipment. Approximately sixty papers were presented, either in open sessions or as posters. One very nice element of the EUBS meetings were the guest lectures that are given each year and the quality of these lectures was such that they could really be published on their own as review papers. This year the attendees were treated to four presentations, the first by David Elliott on “Fit to Dive? Anyone Can Do It”. Noemi Bitterman followed with “Oxygen Toxicity; Where are We Today”, and the paper by Alessandro

Marroni on “Acute Management of Decompression Accidents in Normal and Remote Locations”. The last paper by Daniel Mathieu from Lille had as its primary focus, “Transcutaneous Oximetry in Hyperbaric Medicine”.

The meetings were opened with a diving session. Very few of the papers presented dealt with basic physiology; most of the diving papers reported human dives and analyses of these dives. However, an excellent animal study by Skoglund, Stuhr, Sundland and Hope on the effect of enriched oxygen during decompression on gas bubble fom1ation helps to support the assumption that indeed oxygen enriched breathing gases

reduce the number of intravascular bubbles. The authors used a rat model. The rats were pressurized to 600 kPa (pO_2=100 kPa and pN_2=500 kPa) for 120 minutes. Linear decompression was used. One day before the first exposure a 20 MHZ Doppler probe was implanted and placed around the vena cava. During and after decompression intravenous gas bubbles were recorded and quantified. The investigators reminded us that even though the decompression rate differs from human tables, the experiments did show that increasing the pO_2/pN_2 ratio prior to and during decompression reduces the number of intravenous bubbles.

Human plasma levels of serotonin, dopamine and cortisol were measured during heliox (60-40) in eight divers by Jellestad and Hope. The rate of compression was one meter per minute to a pressure of 1.1 mPa and a decompression rate of 6.5 meters per minute. Blood was sampled at two days predive, during compression and at maximum pressure, plus two days post dive. There were no changes in dopamine or cortisol, even though they are indicators of emotional stress. The investigators concluded that the elevated 5-HT levels are related to pressurization and not to emotional stress.

Microdialysis sampling of the cisterna magna in pigs following air embolization of a carotid artery yielded increases ill the lactate-pyruvate ratios. This study from Trondheim by Medby, Ro, Koteng, Juul and Brubakk were able to demonstrate alterations ill anaerobic metabolism which were a result of depressed brain blood flow that followed the embolization. Blood flow in the air injected carotid artery was also significantly decreased.

Reni and collaborators from Toulon, using the unanesthetized rabbit model with spinal cord evoked potentials (SEP) were able to demonstrate that reduced perfusion of the spinal cord was a necessary concomitant for the reduction of the SEP during decompression sickness. The rabbits were pressurized to four atmospheres and after 30 minutes at pressure were rapidly decompressed. The spinal cord ischemia was produced with an indwelling balloon in the abdominal aorta. The control animals were decompressed without aortic occlusion during decompression. Their results demonstrated that spinal cord ischemia is implicated in the pathophysiology of spinal cord decompression sickness.

The possible beneficial effect of introducing extra deep stops during ascent from depth on the production of gas emboli was studied by Marroni, Cali-Corleo, Balestra, Longobardi, Voellm, Pieri and Pepoli. Three square dive profiles were selected, viz. a single dive to 20 m for 60 minutes, a single dive to 40 m for 10 minutes and finally, a series of three repetitive dives to 30 m for 16 minutes with a 75 minute surface interval between the dives. The ZH-L8ADT dive model was used. Doppler recordings were carried out every 15 minutes post dive on the nine volunteer divers.

Following the sixty minute dive to 20 m, five of the nine divers presented with “high” bubble grades and one of the divers had a skin bend. Only “mild” bubble grades were in evidence for the remaining dive series which led the investigators to conclude that by reducing the pressure differential on the fast to medium half times and by keeping the $PvenN_2$ and $PltN_2$ within the above limits, the procedure may be an effective means to reduce or prevent gas nucleation during air dive decompression.

In another paper in which Doppler recording was used to relate bubble presence to decompression sickness, Sterk and Sterk studied deep tunnel workers using a trimix (25% 0_2, 50% N_2 and 25% He) breathing gas. The greatest depth the divers were exposed to was 65 meters. The decompression tables on air and oxygen were computed using a conservative version of the neo-Haldanian model that generated the Netherlands Diving Center tables. No cases of decompression sickness were in evidence after the 50 trimix exposures to a pressure of 4.65 bar (G) with an average bottom time of 59.2 minutes. No bubbles were detected in sixteen divers at rest and ten divers after movement. Bubble grades in excess of 2 were recorded in 3 divers at rest and twelve divers after movement. The authors conclude by saying that “silent bubbles” might cause long term effects and therefore “bubble free” tables may be an illusion.

Two non-experimental papers (Aydin, Aktas and Cimsit) (Sipinen and Ahovuo) suggest that there are diagnostic benefits of employing magnetic resonance imaging (MRI) for the detection of bone lesions in the professional diving community. Naval and coast guard divers in Finland were studied by Sipinen and Ahovuo using MR1 scans of the hips, knees and shoulders. Ninety two hips in 94 divers were normal. Twenty eight of 44 knees and 19 of 42 shoulders were without lesions. The abnormal hip scans showed evidence of diaphyseal stress, plus one small cyst in the femoral neck. Minuscule tears in the knees were seen in nine divers, in addition to four Baker cysts and partial rupture of the anterior cruciate ligament. The primary finding in the shoulders was degenerative rotator cuff rupture in 18 divers. Cimsit and collaborators also felt that the employment of MRI is a far better diagnostic tool, as opposed to standard x-ray in detecting bone lesions in divers who have experienced decompression sickness.

Changes in lung function following dives in cold water were recorded by Tetzlaff, Mueller, Heine, Neubauer and Mutzbauer. German Navy and recreational divers made dives to 50 m in 20° C water and the dive data was compared to the data of divers in 25° C water. In a second series of dives, the subjects underwent randomized cold water dives to 50 m and ten 10 m. Pulmonary function testing was carried out before the dives and then one hour and 24 hours after the dives.

In the first dive series to 50 m in cold water, there was an increase in residual volume, a decrease in forced expiratory volume, as well as in mid expiratory flow at 75% of forced vital capacity one hour after the cold dives. Following randomized cold dives, significant increases in airway resistance were recorded along with decreases in forced expiratory volume, forced vital capacity and in mid expiratory flow at 25% of forced vital capacity. However, airway resistance was increased during the 10 m dives.

In the area of hyperbaric oxygen physiology and therapy there were far fewer experimental papers to select from In fact, it is helpful to quote from the paper by Muth, Raekers, Siebenschuh and Koschnick because it puts in focus the major reason that hyperbaric oxygen therapy (HBOT) is having difficulties in being accepted in some parts of the world as viable therapeutic tool. “Hyperbaric oxygen therapy is not widely used as an adjuvant therapeutic approach to treat complicated wounds because of the lack of randomized studies.”

Their study investigated the effect of HBOT on epithelialization and formation of granulation tissue in diabetic rats. These data were compared to the effects of topical application of hyaluronic acid. Wound healing was documented by intravital microscopy every third day and then evaluated by planimetric analysis. At day 15 HBO treated wounds were significantly better epithelialized when compared to the hyaluronic acid animals. Wound closure at day 15 in the untreated diabetic rats was significantly delayed.

An interesting study from the University of Hull by Abidia and coworkers in which they employed a double blinded randomized controlled trial to demonstrate the enhanced healing of ischemic, non-healing of diabetic leg ulcers with hyperbaric oxygen therapy. Eighteen diabetic patients with ischemic, non-healing lower extremity ulcers were randomly assigned to be treated daily with HBO_2 or air at 2.4 ATA pressure for 90 minutes for a total of 30 treatments. Wound surface areas were measured at baseline and then at two, four, twelve weeks and six months.

Healing and complete epithelialization was seen in thirteen out of nineteen ulcers in twelve weeks. In the control group four of fourteen ulcers showed similar improvements. The mean decrease of the wound areas in the treatment group was 83 percent and the control group, 56 percent. The differences between the HBO_2 group and the control group may have been even greater if the controls were pressurized with a mixed gas (oxygen/nitrogen) where the pO_2 was equal to surface pO_2.

Abidia, Kuhan, Laden and McCollum studied the microvascular reflexes in diabetic patients with peripheral arterial disease as an

effort to better understand the pathophysiology of these patients and the rationale for using HBOT to improve their vascular reflexes in the lower limbs. Eighteen patients and three non-diabetic patients with occlusive arterial disease and five normal subjects were studied using laser Doppler flowmetry and transcutaneous oximetry. The recordings were made in the supine position and then ten minutes after laser Doppler probe was heated to 44° C. The tests were repeated in HBO_2 conditions at 2.4 ATA.

During HBOT, tissue oxygenation increased from 48 to 496 mmHg in the diabetic patients and from 58 to 777 mmHg in the arterial occlusive disease patients. In addition, the mean the mean response increased to 1425% and 924% respectively. The mean leg dependency responses improved to 35% and 45% respectively. Their data demonstrate the fact that oxygen treatment normalizes the reflex vasoconstriction induced by leg dependency and the vasodilation induced by thermal stimulation in diabetic and non- diabetic patients with arterial disease and would seem to suggest an improvement in endothelial function with improvement in autonomic function in the diabetic patients.

There were a myriad of great social functions to take advantage of during the meetings, giving the attendees great opportunities to visit some wonderful historical sites on the island. However, the crème de la crème of events was the banquet that was held in the Knights of Saint John Hospital in Valetta. The initial work on the hospital's foundation was begun 1574 and extensions were added over the next century. The banquet was held in the world's longest hospital ward that had a lovely arched brick ceiling, truly a magnificent and awe inspiring hall. To give the non-attendee some feeling for its size, the banquet occupied no more than a third of the available space.

As the guests arrived and proceeded down the large stone stairway to the hall below, they were greeted with a fanfare from trumpets and drummers in ancient dress and each attendee was offered wine as they proceeded to the hall. During dinner a dance band provided background music and for dancing after dinner. One of the amusing highlights of the evening was the extemporaneous playing of the saxophone, and very well done by one of our members. A wonderful time was had by all and it certainly was a fitting end to the millennial year meeting of the European Underwater and Baromedical Society. Four cheers for Ramiro Cali-Corleo.

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All pictures courtesy of Dr. Lee Greenbaum except those taken from the EUBS website (http://www.eubs.org).

MEETING ANNOUNCEMENTS

CONSENSUS CONFERENCE

on

Hyperbaric Oxygen Therapy in the treatment of Radio-induced lesions in normal tissues

Organised jointly by the

European Society of Therapeutic Radiology and Oncology

and

European Committee for Hyperbaric Medicine

Lisbon, October 19-20th, 2001

The efficacy of radiation therapy in the treatment of malignant disease has been proven over time. The goal of radiation therapy is to eradicate tumours with minimal, if any, adverse effects on the surrounding normal tissue. Many efforts have been made to limit these adverse effects. Despite these preventive measures, radiation-induced lesions to normal tissue may occur and result in permanent damage. This leads, too often, to painful and disabling conditions.

Conventional treatment of these lesions often has frustrating results. .As the main underlying mechanism of radio-induced lesions appears to be a progressive loss of the microvasculature resulting in a tissue hypoxia, Hyperbaric Oxygenation (HBO_2) has been proposed as a part of the overall treatment since the mid 1960s and several studies have reported beneficial effects.

Because the clinical importance of this problem, the European Society of Therapeutic Radiology and Oncology and the European Committee for Hyperbaric Medicine have decided jointly to organise a Consensus Conference on this topic in order to review the evidences for the use of HBO_2 in radio-induced lesions in normal tissues, and to identify unresolved questions for future investigation.

① Faculty

a- Scientific Committee:

Pr. LARTIGAU Eric
(ESTRO General Secretary, Professor in Radiation Oncology - Centre Oscar Lambret - Lille - France)

Pr. MATHIEU Daniel
(ECHM General Secretary, Professor in Critical Care Medicine - Centre Hospitalier Universitaire - Lille - France)

b- Jury:

Pr. DISCHE Stanley, President
(Honorary Professor in Oncology - Center for Cancer treatment - Mount Vernon Hospital - United Kingdom)

Pr. BAKKER Dirk
(Professor of Surgery - Academic Medical Center - Amsterdam - The Netherlands)

Pr. BUDACH Volker
(Professor in Radiation Oncology - Universität Klinikum Charité - Berlin - Germany)

Pr. CIANFRONE Giancarlo
(Professor in Audiolaryngology Surgery - Clinica ORL - Universite la Sapienza - Roma - Italy)

Pr. GEDEA Ferran
(Professor in Radiation Oncology - Institut Catala d'Oncologia - Barcelona - Spain)

Dr. GOUVEIA Joaquim
(Director - Instituto Português de Oncologia - Lisboa - Portugal)

Pr. NIINIKOSKI Juha
(Professor of Surgery - University of Turku - Finland)

c- Literature Reviewer:

D. PASQUIER
(Centre Oscar Lambret - Lille - France)

J. SCHMUTZ
(Hyperbaric Center - Basel - Switzerland)

d- Experts:

Pr. BAUMANN Michael
(Professor in Radiation Oncology - UK Carl Gustav Carus - Dresden - Germany)

Pr. FELDMEIER John

(Professor in Oncology - Medical College of Ohio - USA)

d- Experts (continued):

Pr. GRANSTRÖM Gosta
(Professor in Audiolaryngology Surgery - Göteborg Universität - Göteborg - Sweden)

Pr. MARRONI Alessandro
(Professor in Diving and Hyperbaric Medicine - Rosetto Abruzzi - Italy)

Pr. MORNEX Françoise
(Professor in Radiation Oncology - Centre Hospitalier et Universitaire - Lyon - France)

Dr. ROQUE Filipe
(Centro de Medicina Hiperbárica - Hospital da Marinha - Lisboa - Portugal)

Pr. VAN DER KLEIJ Adrian
(Professor of Surgery - Academic Medical Center - Amsterdam - The Netherlands)

Pr. VAN MERKESTEYN Johannes
(Professor of Oral and Maxillofacial Surgery - Leiden University Medical Center - Leiden - The Netherlands)

Dr. YARNOLD John
(Consultant in Oncology - Royal Mardren NHS Trust - Sutton - United Kingdom)

② Questions to be answered by the Jury:

1. What is the incidence and the cost of the radio-induced lesions in normal tissues?
2. What tissue changes induced by radiotherapy lead to impaired healing in radio-injured normal tissues?
3. What is the rationale for hyperbaric oxygen therapy in the treatment of radio-induced lesions in normal tissues?
4. What are the locations of radio-induced lesions where Hyperbaric Oxygen Therapy has shown efficacy?
5. May Hyperbaric Oxygen Therapy play any role in the prevention of radio-induced tissue lesions?
6. Is Hyperbaric Oxygen Therapy cost effective in these indications?

③ Program:

- "Incidence, risk factors and cost of radio-induced lesions in normal tissues"
  ↳ M. BAUMANN (D)
- "Pathophysiological basis of radio-induced lesions in normal tissues."
  ↳ F. MORNEX (F)
- "Pathophysiological basis for Hyperbaric Oxygen in the treatment of healing disorders in radio-injured normal tissues".
  ↳ G. GRANSTRÖM (S)
- "Hyperbaric Oxygen Therapy in osteoradionecrosis."
  ↳ J. VAN MERKESTEYN (NL)
- "Hyperbaric Oxygen Therapy in soft tissue radionecrosis.
  - radio-induced cystitis"
  ↳ A. VAN DER KLEIJ (NL)
  - radio-induced proctitis and enteritis"
  ↳ F. ROQUE (P)
  - radio-induced myelitis and plexopathy"
  ↳ J. YARNOLD (UK)
- "Hyperbaric Oxygen and Tumor recurrence."
  ↳ J. FELDMEIER (USA)
- "Cost effectiveness of HBO use in radio-induced lesions of normal tissue."
  ↳ A. MARRONI (I)

④ General Information

a- Dates:

The Conference will be held 19-20th of October 2001, just prior to the ECCO congress.

b- Conference venue:

The Conference will take place at the:
Centro de Congressos AIP, Auditório 1
Parque das Nações (ex EXPO 98)
Lisboa, Portugal

c- Registration fees

Doctors: Before 01 June 2000: 150 Euro
After 01 June 2000: 200 Euro
Student : 100 Euro
Registration fees covers attendance at the Conference, the proceedings book and the Conference banquet.

d- Contact person

Dr. Filipe ROQUE
Centro de Medicina Hiperbárica
Hospital da Marinha
Campo de Santa Clara
1149-061 Lisboa
Phone: 351.21.8840822 / 21
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CROATIAN MARITIME UNDERSEA, AND HYPERBARIC MEDICAL SOCIETY OF CROATIAN MEDICAL ASSOCIATION

with

NAVAL MEDICAL INSTITUTE OF THE CROATIAN NAVY
UNIVERSITY OF RIJEKA SCHOOL OF MEDICINE
UNIVERSITY OF SPLIT SCHOOL OF MEDICINE
CROATIAN ACADEMY OF MEDICAL SCIENCES

announce that

1st CONFERENCE OF THE ALPS-ADRIA WORKING COMMUNITY ON MARITIME, UNDERSEA, AND HYPERBARIC MEDICINE

will be held in Grand hotel "Adriatic" Opatija, Croatia, from 18 to 21 April 2001

ORGANIZING AND SCIENTIFIC COMMITTEE

President: Nadan M. Petri (Croatia)
Secretary General: Dejan Andric (Croatia)
Members: Smolle Jüttner (Austria)
Danica Barkovic (Croatia)
Ivica Kontosic (Croatia)
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Stracimir Gosovic (Croatia)
Igor Jelcic (Croatia)
Stipe Jonjic (Croatia)
Nikola Korin (Croatia)
Zvonimir Rumboldt (Croatia)
Mladen Stulhofer (Croatia)
W. Hartmut G. Goethe (Germany)
Gyorgy Ungvary (Hungary)
Claudio Longoni (Italia)
Giorgio Odaglia (Italia)
Rafaelle Pallotta (Italia)
Damiano Zannini (Italia)
Samo Modic (Slovenia)
Vladimir Trost (Slovenia)

MAIN TOPICS

- History of maritime, undersea, and hyperbaric medicine
- Occupational medicine in maritime industry
- Telemedicine in seafaring
- Diseases and injuries of seafarers
- Diseases and injuries of fishermen
- Medical oceanography
- Maritime epidemiology and DDD
- Port authorities duties in maritime medicine
- Medicine of water sports
- Diving and submarine medicine
- Hyperbaric medicine
- Health care of inhabitants and tourists in the Adriatic
- Medico-technical aspects of search and rescue at sea and rivers
- Case reports from medical practice
- Free topics

GUIDELINES FOR AUTHORS

Preparation of manuscripts

The manuscripts should be written in national language of the author(s). The title of the manuscript should be short and illustrating the content of the paper. For the title use capital letters. Throughout the bold or italic letters in the text, do not use tabs, do not underline parts of the text, and do not use super or subscripts. The summary should be written in the national language of the author(s) and in the English language. It should consist of no more than 250 words and should be, where appropriate, divided in sections: Introduction/Objective, Subjects and Methods, Results, and Discussion.

The text should be divided accordingly. References should be cited in order of appearance, in brackets, and formatted using the Vancouver system (N Eng J Med 1997;336:309-15.) Avoid unnecessary tables and graphs. Whenever possible, describe results in the text instead of using simple tables and graphs. Graphs should be sent in camera ready format.

Submission of manuscripts

Deadline for the admission of the manuscript is 15 March 2001.

Submit two copies of the manuscript including illustrations, and a 3.5" disk. Applications for PC and Macintosh are acceptable. Label floppy disk with last name of the first author, title of the manuscript, and application(s) used. A cover letter should give the address, telephone number, fax number, and e-mail address of the responsible author.

Official languages of the Congress will be the languages of the Alps-Adria Working Community: German, Hungarian, Italian, Slovene, and Croatian. Oral (slides, transparencies, PowerPoint), video, and poster presentations will be organized. Oral presentations will be translated simultaneously. If you are intending to present a poster, send the abstract of no more than 500 words. For posters use format A0. The best poster will be awarded. For additional information, please visit also our web-site www.mzt.hr

Registration fee (all payments must be in EUR)

Early payment, received before 31 January 2001
- 80 EUR for the participants
- 60 EUR for the accompanying persons
- 400 Croatian kunas for the members of the Croatian Maritime, Undersea, and Hyperbaric Medical Society

Late payment, received after 31 January 2001
- 100 EUR for the participants
- 80 EUR for the accompanying persons
- 500 Croatian kunas for the members of the Croatian Maritime, Undersea, and Hyperbaric Medical Society

Registration fee includes various organization expenses, book of proceedings (participants only), welcome party, trip by boat, social events, and gala farewell dinner. To register please use the registration form attached, and send it to the Organizing Committee as early as possible. It will be returned to you so you could use it to get your bonus on airplane tickets.

Registration fees should be paid on bank account number Privredna banka Zagreb, Croatia, 703001-0882800-526357, swift PBZGHR 2X

Registration fee for the participants from Croatia should be paid on ZAP Split 34400-678-40386

Accomodation

A sufficient number of rooms are reserved in Grand hotel Adriatic, Opatija. Reservations should be confirmed personally by phone (00385-51-719-010), fax (00385-51-719-015), or e-mail (adriatic@pro.hr).

Hotel fees at a special rate for the participants and the accompanying persons are arranged with Grand Hotel Adriatic Opatija. The prices are per person and per day, all meals and taxes included, the prices might slightly vary due to unforeseen correction of prices and/exchange rate.

Payment by cash, personal checks and major credit cards (AmEx, DC, Visa, Eurocard-MasterCard are accepted).

- Single room 105.50 DEM
- Double room 70.50 DEM

For more information about Opatija, weather conditions in April, hotel accommodation, cultural monuments, exchange rates, domestic cuisine, excursions, traffic connections, festivals, etc. please check the web-site www.multilink.hr/tz-opatija CROATIA AIRLINES - OFFICIAL CARRIER. Croatia Airlines will grant all participants of the 1st Congress of Working Community Alps-Adria on Maritime, Undersea, and Hyperbaric Medicine a 25 % discount on flights to Rijeka (this discount is applicable on Croatia Airlines flights only). To obtain discount, confirmed registration form or other written proof of participation must be presented. Period of application is from 11 April to 28 April 2001. If you would like the advantage of this special offer, please contact your nearest Croatia Airlines office. The list of offices can be found at www.croatiaairlines.hr

Information and correspondence

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We are looking forward to seeing you in Croatia!

FIRST ANNOUNCEMENT AND CALL FOR PAPERS

3rd Hamburg Symposium on Occupational Risks in Hyperbaric Tunneling and Commercial Diving

Employment, Health and Social Welfare Authority, Hamburg

Freie und Hansestadt Hamburg
Behörde für Arbeit, Gesundheit und Soziales
Staatlicher Gewerbearzt

in cooperation with

EUBS and "Ärztekammer, Hamburg"

In hyperbaric tunneling parallel to increasing depths, the variety of new materials and technical procedures is increasing. Standards and codes of practice concerning protection against occupational hazards have been established for normal ambient pressure, however knowledge concerning the effects of toxic agents under increased ambient pressure is limited. At raised ambient pressure risk assessment concerning chemical compounds is seldom based upon evaluated data.

The contamination of waters by chemical and biological hazards and the decontamination procedures after surfacing may be the source of health risks for commercial divers.

In cooperation with the EUBS and the "Ärztekammer, Hamburg" the 3rd Hamburg Symposium will concentrate on occupational hazards arising from construction procedures and contamination of the hyperbaric working environment.

The aim is to give an overview of the

- established methods of risk assessment (effects on humans, measurement techniques)
- accepted safety procedures
- unsolved problems of protection equipment and quantification of occupational hazards

Aspects of the Symposium will be

- Mineral dust in hyperbaric tunneling
- Hyperbaric tunneling in contaminated grounds
- Breathing gas contaminations
- Welding fumes
- Contaminations from pyrolysis
- Organic volatiles
- Waterborne sound
- Diving in chemically contaminated waters
- Diving in microbiologically contaminated waters

The Venue

The planned Symposium will take place as a satellite symposium of the Annual Scientific Meeting of the European Underwater and Baromedical Society in Hamburg, September 2001.

Call for Papers

Oral presentations are requested on all aspects of

- mineral dust in hyperbaric tunneling
- commercial diving in contaminated waters

Abstracts may be written in English or German and must be limited to 500 words. If approved all authors will be required to present their papers in person and to submit their final manuscripts for publication.

Time Table

- Deadline for abstract submission: 31st March 2001.
- Notification of the authors by 15th Mai 2001.
- Submission of final manuscripts by 15th July 2001.

Please send your abstracts as well as any requests for further information to

Dr. med. Birger Neubauer
Staatlicher Gewerbearzt
Amt für Arbeitsschutz G2 / AS 35
Adolph-Schoenfelder-Str. 5
D-22083 Hamburg, Germany
e-mail: Birger.Neubauer@bags.hamburg.de

FIRST ANNOUNCEMENT:

Fire Fighting Course in the Hyperbaric Environment

The recent interest for hyperbaric oxygen therapy has resulted in a development of hyperbaric centres everywhere in Europe. Contrary to most of the previous hyperbaric centres, the personnel of these new hyperbaric centres are mostly not issued from the professional world of diving. This has often as consequence a sub-optimal technical formation, a lack of specific knowledge to the hyperbaric environment, a less than optimal perception and evaluation of the possible dangers of the hyperbaric system.

Fire and its consequences surely represent the biggest danger in a hyperbaric environment. Indeed, the increase of the partial pressure of oxygen will quickly lead to an uncontrollable extension of the fire, and this in a closed space without exits.

In case of fire in the hyperbaric chamber, three parameters will quickly change:

- the temperature
- the volumetric mass, provoking a pressure increase in a confined space
- the partial pressure of the different composing gases with concomitant increased possible toxicity of these gases

Emergency intervention in case of fire is not limited to actions directed at extinguishing the flames but implicates a series of actions which must be executed in a quick and timely manner.

If it is true that this type of accidents are rare, never the less we must be aware that the consequences of fire in a hyperbaric oxygen chamber are almost always fatal for the occupants.

From a analysis of the causes of fire inside hyperbaric chambers, (*P. Sheffield and D. Desautels*, Hyperbaric and hypobaric chamber fires: a 73 year analysis, Undersea Hyperb Med, 24 (3), 153) it is known that a large number of fires are the consequences of the objects taken inside the chamber by the patients. Moreover, the oxygen concentration in the hyperbaric chamber environment too often surpassed 28 percent!

From this survey, casualties amounted to 60 dead and only 8 wounded, indicating that when a fire does happen, survival chances for inside occupants are small... So it is necessary to focus on a politic of prevention, rather than remedy.

Two possible solutions can be outlined in order to cope with the fire safety problem:

- Active means for the fight against fire
- Preventive security

Active fire-fighting means

Today, many European manufacturers have developed new means for the active fight against fire, coupled in some cases to a quick decompression of the hyperbaric chamber.

Preventive security

Aside from the systems for active extinguishment of the fire, there are certain safety rules that have to be applied by the personnel and the respect (or not) of which does not come under the responsibility of the manufacturer. Indeed, the sole responsibility comes to the user.

It is obvious that, whereas all the means of active fight against fire can be provided, they can never be optimised without the creation and application of a preventive fire safety policy. An effective preventive fire safety policy means on one hand the establishment of certain rules and measures, but can not be implemented without the full understanding of these rules and measures by the personnel involved.

Certainly in the case of preventive measures against fire, it is necessary that the personnel knows about all the aspects and dangers in the hyperbaric environment. This will permit a good understanding of the problems related to fire safety and will ensure the daily application of all these preventive measures.

In order to optimise the assimilation of all these measures by the personnel, a Course in Fire Fighting in the Hyperbaric Environment is proposed.

The goals of this Course are twofold:

- A theoretic course focused on preventive measures of fire safety.
- A practical training by intervention on a real fire situation in a hyperbaric chamber.

Theoretic course

This part of the Course will focus on acquiring a profound knowledge of all the phenomena related to fire, a knowledge of the different risk factors and their consequences, and to create an awareness of the dangers. It aims at the sensibilisation of the hyperbaric personnel to the preventive fire safety measures.

Practical training

This training serves to demonstrate and acquire the correct reflex actions in case of fire, and this by creating the real conditions of fire in an hyperbaric chamber as an exercise. These exercises for the fight against fire will involve the use of all active means available for the extinguishment of the fire, in real time, and the organisation of the evacuation of the patients out of the hyperbaric chamber.

This lesson is unique in Europe and is organised by the Advisory Committee for Hyperbaric Oxygen Therapy in Belgium (ACHOBEL). It is accessible for all categories of hyperbaric personnel (medical doctors, nurses and technicians).

Practical information

The Course will take place in Germany and will take two days. The lessons are given in English or in French. Depending on the demand, a course in any other language can be provided. A certification of the Advisory Committee for Hyperbaric Oxygen Therapy in Belgium will be issued to the participants upon completion of the Course. Further information can be obtained from the Secretary of ACHOBEL, 9 Rue St Anne, B-7880 Flobecq - Belgium, by fax +32 68 449 628 or by e-mail rhouman@pronet.be.

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BOOK REVIEWS

HISTORY OF HYPERBARIC CHAMBERS

Gerhard F K Haux and Tom Workman

ISBN 0-941332-82-9. Published 2000. 154pp.
Best Publishing Company, P.O.Box 30100, Flagstaff, Arizona 86003-0100, U.S.A.
Price from the publishers $US 14.95. Postage and packing extra.
Also available as a CDRom for $US 9.95. Postage and packing extra.
Credit card orders may be placed by phone on +1-520-527-1055 or faxed to +1-520-526-0370.
E-mail: divebooks@bestpub.com.

Nothing is new, indeed a diving researcher once said to me “Nothing is new since Boyle”, indeed this may be true. Looking back into history is one way of avoiding the mistakes of those who have gone before. Sound advice, but until now, where to look for the history of hyperbaric chambers has been a task in itself. Most hyperbaric and even some diving textbooks have some information on the early history of chambers, some do this very well, such as Eric Kindwall. But all have only used the “History” as a lead in to their text. Haux, has been much more thorough. He has been in this chamber business a long time, he is a collector of knowledge and photographs. This book is a tribute to his knowledge, contacts and the many photos that he and Petra have gathered in their travels. It covers diving and clinical systems.

The first thing that strikes one about this book is the plethora of photographs, some of which date from the late 1800s. The text starts correctly in 1662, with Henshaw, stops briefly with Priestly, 1774, and heads off to really get to grips with the earliest days of hyperbaric chambers in around 1830s and onward.

The time line that the book follows clearly shows design styles changes. Design, before there were graduate engineers, was intuitive and functional, this is seen in the comfortable, room-like chambers of the late 1800s early 1900s. The Dianabad, Germany, chambers were prime early examples of this. But it is not for me to say if Dr Orval J Cunningham went too far in this direction, with the 6 floor high, 72 room, spherical “hyperbaric hotel” of 1928. The sphere and cylinders that came with technology restricted hyperbaric chamber design with the efficient shape approach. It is only in the comparatively recent times that a few engineers braved the effective round shapes of the past and looked again to function. Engineers like Haux, and Fink in Australia, have moved HBO_2T along with providing the industry a great new tools to work with, that the clients like. These new shapes of course only really apply to clinical HBO_2T, diving chambers are not so forgiving, and in the main remain conventional in shape.

Tom Workman provides a chapter on the future of hyperbaric chamber design and what direction that the industry may take. This is a good closing section, recording where we have been and where we now are. The book is not all history, information right up until 1999 is included.

The book comes to a logical concluding chapter by Haux, a collection of pairs of photographs, old and newer shots of like equipment, in many cases often separated by "only" 100 years.

Most countries that have hyperbaric chambers (possibly all) are recognised in the text and by photos, however German chambers predominate. Gerhard's career has had a profound impact on chamber design over the last 40 years, so I suggest that this small indulgence is quite acceptable. The fact that the book was originally written in German, has resulted in, at times, a rather tortured version of English (a point that, as only a speaker of English, I am rather reluctant to make). But these criticisms are quite minor when the real value of the book is considered.

I enjoyed the book and highly recommend it, both as an interesting one to read, but also because it can stay near the desk as a reference. As the millennium passes, it is timely to record HBO_2 of the past. Gerhard, Petra and Tom have done an excellent job for future generations and for us.

Bob Ramsay

Key Words: History, hyperbaric facilities.

The above review is reprinted, by kind permission of the Editor, from the South Pacific Underwater Medicine Society Journal 2000; 30 (4): 202

INSTRUCTIONS TO AUTHORS

The **EJUHM** welcomes contributions (including letters to the Editor) on all aspects of diving and of hyperbaric medicine. Manuscripts must be offered exclusively to the **EJUHM**, unless clearly authenticated copyright exemption accompanies the manuscript. All manuscripts will be subject to peer review, with feedback to the authors. Accepted contributions will be subject to editing.

Manuscripts are accepted in English, and also in major European languages (French, Spanish, Italian and German) when accompanied by an English abstract and a letter of recommendation of a member of the **International Editorial Board**.

Contributions should be sent to
Dr. Peter HJ Mueller, Editor EJUHM, C/o HBO-Zentrum Rhein-Neckar am Diakoniekrankenhaus Mannheim, Speyerer Strasse 91-93, D-68163 Mannheim/Germany. Fax: +49-621-8102 393. Phone: +49-621-8102 390. E-mail: eubs@hbo-mannheim.de

Requirements for Manuscripts
The **EJUHM** is composed on a PC using Word processing. Documents are acceptable on disc or by e-mail. Illustrations and tables should **NOT** be embedded in the Word document, only their position indicated. All tables are to be separate documents. Illustrations should be separate documents in Word or TIFF, clearly marked with the format used. **References should be in the correct format, shown in the next column.** Submissions must be accompanied by two printed copies of all text, tables and illustrations.

The printed copies should be double-spaced, using both upper and lower case, on one side of the paper only, on A4 paper. Headings should conform to the format in the **Journal**. All pages should be numbered. No part of the text should be underlined. These requirements also apply to the abstract, references, and legends to figures. Measurements are to be in SI units (mm Hg are acceptable for blood pressure measurements) and normal ranges should be included. All tables should be double spaced on separate sheets of paper. **No vertical or horizontal rules are to be used.**

Photographs should be glossy black-and-white and slides should be converted to photographs before being sent. Colour reproduction is not available. Legends should be less than 40 words, and indicate magnification.

Abbreviations do not mean the same to all readers. To avoid confusion they should only be used after they have appeared in brackets after the complete expression, e.g. decompression illness (DCI) can thereafter be referred to as DCI.

The preferred length for original articles is 2,500 words or less. Inclusion of more than 5 authors requires justification. Original articles should include a title page, given the title of the paper and the first names and surnames of the authors, an abstract of no more than 200 words and except in unusual situations be subdivided into Introduction, Methods, Results, Discussion and References. After the references the authors should provide their initials and surnames, their qualifications, and the positions held when doing the work being reported. One author should be identified as Correspondent for the Editor and for readers of the Journal. The full current postal address of each author, with the Telephone, facsimile numbers and e-mail address of the corresponding author, should be supplied with the contribution. No more than 20 references per major article will be accepted. Accuracy of the references is the responsibility of authors. Acknowledgments should be brief.

Abstracts are also required for all case reports and reviews. Letters to the Editor should not exceed 400 words (including references which should be limited to 5 per letter).

References
Authors are responsible for verifying references against the original documents. References must be numbered consecutively in the order in which they first appear in the text, and identified in the text by arabic numerals in parentheses. References cited only in tables or legends should be numbered in accordance with a sequence corresponding to the first mention of the table or figure in the text. The reference list must be double spaced. List names and initials of all authors when six or less, when seven or more, list only the first three authors and add et al. Citations in the reference list are to be in the form used by the U. S. National Library of Medicine and *Index Medicus.*

1. Thorsen E, Risberg J, Segadal K, Hope A. Effects of venous gas microemboli on pulmonary gas transfer function. Undersea Hyperbaric Med 1995; 22:347-353.
2. Hempleman HV. History of decompression procedures. In: Bennett PB, Elliott EH, eds. The physiology and medicine of diving. London: WB Saunders, 1993:324-375.
3. Kindwall EP, Goldmann RW. Hyperbaric medicine procedures. Milwaukee, WI: St. Luke's Medical Center, 1970.

Manuscripts that have been accepted should be cited in the reference list as regular references, with "in press" in place of journal pages. Citations such as "unpublished observations", personal communication", "manuscript in preparation", or "to be published" are not to appear in the reference list, although reference to such a communication, if it exists in written form, may be cited in the text in parentheses. References to government reports should not be cited unless such reports are easily available to all readers.

Consent
The **EUBS** endorses the principles of the Declaration of Helsinki on the treatment of human subjects and approved guiding principles in the care and use of animals. Any report of experimental investigation on human subjects must contain evidence of informed consent by the subjects and of approval by the relevant institutional ethical committee.

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EUBS ANNUIAL SCIENTFIC MEETING 2001

EUBS 2001 - 27th Annual Meeting of the European Underwater and Baromedical Society on Diving and Hyperbaric Medicine

Hamburg, Germany

September 12 - 16, 2001

Dear Friends and Colleagues,

it is my great honour to announce the **EUBS 27th Annual Meeting** and cordially invite you all together with your partners and families to come to Hamburg, where I have the pleasure of hosting our **2001 EUBS** annual meeting as your **Secretary General**.

The scientific program will include invited lecturers, oral and poster presentations, and, supported by you, a broad forum of discussion.

Besides the **EUBS** conference with it's scientific topics:

- pressure physiology and medicine
- diving physiology
- diving medicine
- maritime medicine
- physiology of hyperbaric oxygen therapy
- clinical hyperbaric oxygen therapy
- hyperbaric oxygen technology
- hyperbaric oxygen safety

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satellite workshops on the special aspects of tropical diving vacations and on the fitness to dive, hosted by the **GTÜM (German Society of Diving and Hyperbaric Medicine)** and an international satellite symposium on physics, chemical and biological hazards of working under hyperbaric and diving conditions will be offered. The scientific program will be rounded off by a **DAN Europe** seminar.

Preliminary scientific program in detail:

- September 13 to 15: EUBS 2001 Annual Scientific Meeting
- September 12: 3rd Hamburg Symposium on Occupational Risks in Hyperbaric Tunnelling and Commercial Diving – Physical, Chemical and Biological Hazards in Hyperbaric Environments
- September 16: Full day presentation: Fitness Standards for Recreational Divers
- September 12: Satellite 1 - Symposium on Selected Tropical Medicine Topics in Diving Medicine
- September 13: Satellite 2 - 2nd International "Arthur-Bornstein-Workshop" on Compressed Air Work and Deep Diving in Tunnel Construction

The conference centre and most accommodation facilities are located at the **Hotel Inter-Continental** (http://www.interconti.com/germany/hamburg/hotel_hamic.html), ideally situated on the attractive waterfront of the outer part of the city's lake Alster and within walking distance to the city centre of **Hamburg**. Mid September in **Hamburg** offers a late summer atmosphere.

With the second largest port in **Europe**, **Hamburg** is a media and trade metropolis, a gateway to the world. I can assure you a very personal experience whatever the point of attraction – be it the river Elbe, the Alster lake, the Jungfernstieg boulevard, city arcades, art galleries or night life in St. Pauli's "Reeperbahn".

Besides the scientific program interesting and entertaining satellite programs for participants and partners will be offered as well as a full partner program. Special packages for exiting pre- and post-conference activities and tours will be available.

The First Announcement and Call for Papers will be mailed individually in December. The Final Announcement with all details will follow in February 2001. Full details of all activities are available on the **EUBS** website (http://www.eubs.org) as well - according to the meeting's planning stage.

We look forward to welcoming you to our **EUBS** meeting the coming year in **Hamburg**!

Yours sincerely,

Dr. Ulrich van Laak
Secretary General EUBS 2001 Hamburg