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Hyperbaric Medicine & the Brain; European Underwater and Baromedical Society Annual Meeting – conference report

Hyperbarická oxygenoterapie & mozek; přehled z výroční konference EUBS 2019

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Introduction

The European Underwater and Baromedical Society (EUBS) is the European scientific society dedicated to the study and promotion of diving medicine and hyperbaric oxygen therapy (HBOT). The EUBS convenes at an annual conference for the purpose of a global knowledge exchange, creating new research partnerships, and initiating new scientific intentions in these two areas of medicine.

The 45th EUBS Annual Scientific Meeting was held at the David InterContinental Hotel in Tel Aviv, Israel September 9–12, 2019 and was themed „Hyperbaric Medicine & the Brain." The meeting was attended by 80 speakers and the poster section included 31 statements. The conference was organized by Professor Shai Efrati and his team. The Sagol Center for Hyperbaric Medicine and Research (Be'er Ya'akov, Israel), where Efrati and his team operate, is one of the most important in the world in this area of medicine. The main topics discussed were brain diseases and hyperbaric medicine, mainly involving traumatic brain injury (TBI), post-concussion syndrome, post-traumatic stress disorder (PTSD), and influencing neuroplasticity and cognitive functions with possible application in both civilian and military health care systems. The Israeli workplace has been intensively devoted to this area for several years.

Topics Discussed

The introductory lecture of the key section included an explanation of the pathophysiological mechanisms of mild TBI in military service members caused by blast exposure, presented by Dr. D. P. Pearl (Uniformed Services University of the Health Sciences, Bethesda, USA). Astroglial scarring was found, occurring at the interfaces of tissues with differing densities – between cerebrospinal fluid and brain tissue and between gray and white matter. These blast TBIs have been called the "invisible wound" and evidence has been published in Lancet Neurology [1]. Dr. A. Hadanny (The Sagol Center for Hyperbaric Medicine and Research, Be'er Ya'akov, Israel) discussed in greater detail the pathophysiology of TBI and reviewed studies which used HBOT with the conclusion that this treatment had significant value at both the acute and chronic stages of TBI. The effect was also demonstrated in his retrospective study with significant cognitive improvements in patients who suffer from chronic neurocognitive deficits due to mild, moderate and severe TBI [2]. These results were supported in persons with disorders of consciousness treated with a combination of HBOT and intensive neurorehabilitation by Dr. A. Srivastava (Dhirubhai Ambani Hospital, Mumbai, India).

The issues of TBI and post-concussion syndrome in children, where sports injuries are at the forefront of etiology, were also found in several pilots' cases treated with HBOT. Individual results demonstrate benefits from this therapy, but some pediatric TBI studies pose many challenges with the neurocognitive and neuroimaging evaluations. Tinnitus after TBI treated with HBOT was mentioned, as evidenced by findings in a yet unpublished Israeli study, where 100% significant improvement in quality of life and objective improvement in brain perfusion were demonstrated in single photon emission CT (SPECT) in 86% of patients [3]. Animal studies are also an important source of new findings for the effects of HBOT – one of the latest indicates that interleukin 10 plays an important role in HBOT stimulation of neurogenesis and neuroprotection after TBI [4].

The first results from a prospective, randomized, cross-over trial were presented to evaluate the effect of HBOT on Israeli veterans suffering from resistant combat-related PTSD. The preliminary results indicated that HBOT induced significant clinical improvement and changes in brain activation

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were demonstrated in functional MRI [5]. It should not be forgotten to use HBOT in the treatment of fibromyalgia syndrome (FMS), achieving neuromodulation according to recent studies even in the relationship between fibromyalgia syndrome and childhood sexual abuse [6]. The new findings suggest HBOT has multifaceted effects that reduce Alzheimer's disease (AD) pathologies. Two-photon imaging of modified mice with AD revealed that HBOT reduced the volume of existing and the appearance of newly formed plaques, alleviated the reduction in blood vessel diameter, and therefore, contributed to an incremental increase in blood flow [7]. The improvement of brain perfusion by HBOT has also been demonstrated by dynamic contrast enhancement MRI evaluations in patients suffering from chronic brain damage due to TBI, stroke, and age-related cognitive decline. The diffusion tensor imaging MRI technique showed the induction of brain microstructure recovery – axonal coherence, myelination, and neuroplasticity – in these patient groups [8]. The basic principles of cognitive evaluation and the pros and cons of different methods were reviewed. The use of an objective computerized cognitive testing battery in 1,000 patients, before and after HBOT, induced significant improvement in the evaluated cognitive domains by therapy [9,10]. Other statements discussed that HBOT preconditioning stands as a robust prophylactic treatment for the sequestration of inflammation inherent in stroke and TBI, possibly facilitating the transfer of resilient mitochondria from astrocytes to inflammation-susceptible neuronal cells in mitigating cell death [11]. The final topic of main section was the effect of HBOT on autism; more evidence is needed and HBOT is not yet recommended in this indication.

Conclusion

This conference report summarizes the EUBS 2019 Annual Scientific Meeting from the perspective of participating authors and was formulated as a brief review of current and future trends in hyperbaric medicine mentioned there. The lectures are not mentioned in detail, as this would go beyond the scope of this report. A detailed program and individual communications are contained within the EUBS 2019 Conference Program & Book of Abstracts.

The 46th EUBS Annual Scientific Meeting will be held in Prague, Czech Republic in September 2021. The conference will be held in the Czech Republic for the first time and other results of studies on the combination of HBOT and the brain will be presented.

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Conflict of interest

The conference was supported by many sponsors and by the Office of the Naval Research grant. The authors declare no conflicts of interest.

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