

UHMS ASM 2021 PRECOURSE #2

Cardiopulmonary considerations for divers recovered from COVID-19 infections

This workshop will present the relevant aspects of recovery after COVID-19 infection and its aftermath in divers.

Faculty will discuss relevant aspects of the Post COVID-19 Syndrome (PCS), with particular attention to issues that can affect a diver's safety. Although these issues involve a variety of organ systems, this workshop's primary focus is on cardiopulmonary concerns: pulmonary fibrosis, pulmonary oxygen toxicity, gas exchange, shunting, cardiac dysrhythmia, myocarditis, cardiomyopathy, neuro-psych issues, and vascular injury.

The goal of this workshop is to examine current algorithms and make modifications with the most recent scientific findings related to this significant health concern. Presentations will focus on the post-infection sequelae, with brief references to prevention and acute management when needed for deeper understanding of PCS. The aim is to develop safe, cost-effective recommendations for divers returning to diving after a COVID-19 infection that includes the extremes of age and severity of illness. The identification of available screening tools readily available to the primary care physician is important given the large numbers of those infected worldwide and the need to wisely utilize finite diagnostic resources.

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- **Introduction/Goals** with Jim Chimiak MD and Richard Moon MD
 - Describe COVID-19
 - Outline risk after acute phase
 - Discuss how those risk apply to divers

Richard Moon, MD



About Dr. Moon:

Dr. Richard Moon is currently the Professor of Anesthesiology Medical Director, Hyperbaric Center, Professor of Medicine. Dr. Moon's research interests include the study of cardiorespiratory function in humans exposed to environmental conditions ranging from 200 feet of seawater depth to high altitude, gas exchange during diving, the pathophysiology of high-altitude pulmonary edema, the effect of anesthesia and postoperative analgesia on pulmonary function and monitoring of tissue oxygenation.

Ongoing human studies include mechanisms of immersion pulmonary edema and the effect of chemosensitivity on postoperative ventilation and gas exchange.

About Dr. Chimiak:

Chief Medical Officer, Diver's Alert Network

- **COVID-19 overview** with Bryan Kraft MD

- The lecture will discuss the COVID-19 pandemic in broad strokes and present data on acute and post-acute COVID-19 infection, symptoms, and disability.
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- **Imaging considerations** with Peter Lindholm MD, PhD

- To highlight the importance of adequate imaging in medical fitness evaluations in post-covid patients.
- An overview of imaging options and challenges in post-COVID-19 patients focusing on the lungs and the clinical problem of some significant pathology not being visible on a regular chest ct.



About Dr. Lindholm:

Dr. Peter Lindholm, MD, PhD, is Professor in Residence, Gurnee Endowed Chair of Hyperbaric and Diving Medicine Research, Department of Emergency Medicine, University of California San Diego. He is a radiologist (licensed in Sweden), and associate professor in physiology and radiology from the Karolinska Institutet in Sweden. Together with colleagues at UCSD he developed the widespread guidelines for clinicians in evaluation of divers post-COVID: Sadler C, Alvarez Villela M, Van Hoesen K, Grover I, Lang M, Neuman T, Lindholm P. Diving after COVID-19: Fitness to dive assessment and medical guidance. Diving Hyperbaric Medicine 2020 2020 Sep 30;50(3):278-287. doi: 10.28920/dhm50.3.278-287. PMID: 32957131.

- **Post COVID dyspnea** with Michael Ott MD

- Understand how to work up patients with post-COVID dyspnea, discuss algorithms for post-COVID evaluation.

About Dr. Ott:

USAF Pulmonary/CCM/DMO/FS

- **Pulmonary implication for divers** with Richard Moon MD

- Describe the physiological effects of COVID-19 infection on the lung; List the long term complications of COVID-19 infection; Characterize the possible implications of these changes for scuba divers and tabulate appropriate screening tests for return to diving



About Dr. Moon:

Dr. Richard Moon is currently the Professor of Anesthesiology Medical Director, Hyperbaric Center, Professor of Medicine. Dr. Moon's research interests include the study of cardiorespiratory function in humans exposed to environmental conditions ranging from 200 feet of seawater depth to high altitude, gas exchange during diving, the pathophysiology of high-altitude pulmonary edema, the effect of anesthesia and postoperative analgesia on pulmonary function and monitoring of tissue oxygenation.

Ongoing human studies include mechanisms of immersion pulmonary edema and the effect of chemosensitivity on postoperative ventilation and gas exchange.

- **Neuropsychological implications to diving after COVID-19** with Lindell Weaver MD

- Review post-COVID-19 brain injury problems and discuss possible return to diving after COVID-19, with similarities of return to diving in individuals with brain injury from non-COVID-19 causes.



About Dr. Weaver:

Pulmonary, Critical care trained, with clinical and research practice in hyperbaric medicine for decades, former President UHMS, former undersea and diving medical officer, based in Salt Lake City, UT

- **Cardiac concerns, return to play** with Matthew Martinez MD

- COVID-19 related cardiac conditions
- Data driven guidance for COVID-19 related return to play
- Normal athlete adaptations



About Dr. Martinez:

Dr. Matthew Martinez is Associate Professor of Medicine. He serves as director of Sports Cardiology and Co-Director of Hypertrophic Cardiomyopathy program at Morristown Medical Center, Atlantic Health System in New Jersey. Dr. Martinez serves as a cardiology consultant for elite and professional athletes including acting as the League cardiologist for Major League Soccer, team cardiologist for the New York Jets and cardiac consultant for the NFL. He regularly presents on Sports Cardiology and Hypertrophic cardiomyopathy at national and international meetings and served as the American College of Cardiology's Chair of Sports and Exercise section until 2020. He has expertise in advanced cardiac imaging using echo, cardiac MRI and CT and has led many educational events nationally and internationally on these topics. He has also served as the educational program chairman for the international Athletic Heart Symposium on management of athletes with cardiovascular risk.

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- **COVID-19: Cardiac Implications for divers** with Douglas Ebersole MD
 - Understand the various cardiac complications of COVID-19 infection
 - Understand how these issues can affect divers in terms of returning to scuba diving after COVID-19 infection



About Dr. Ebersole:

Douglas Ebersole, MD is an Interventional Cardiologist at Watson Clinic in Lakeland, Florida and the Director of the Structural Heart Program at Lakeland Regional Health. He is also an avid recreational, technical, rebreather, and cave diving instructor as well as a cardiology consultant to Divers Alert Network.

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- **Vascular injury implications for deco and VGE** with David Eckmann MD, PhD
 - In this lecture we will review the acute and chronic pulmonary pathophysiology of COVID-19 infection. Utilizing the current knowledge base of molecular to whole-organ scales, we will focus especially on the role of pulmonary vascular endothelium dysfunction in the disease and its role in long-term lung health. We will use the post-infection state as a framework to examine the potential roles of

diving-related exposures, including hyperbaria, hyperoxia, decompression and pulmonary venous gas embolism to impact pulmonary function.



About Dr. Eckmann:

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- **DRACO - DAN COVID-19 study update** with Frauke Tillmans PhD
 - Inform course participants about the study design and purpose and release first results of study



About Dr. Tillmans:

DAN Research Director, PhD Human Biology

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- **Diving after COVID-19 UCSD algorithm** with Charlotte Sadler MD
 - Discussion of the development and implementation guidelines of UCSD Return to Dive Guidelines



About Dr. Sadler:

Dr. Charlotte Sadler is currently an Assistant Professor of Emergency Medicine and Hyperbaric Medicine at University of California, San Diego. She is also the program director of the Undersea and Hyperbaric Medicine fellowship at UCSD. She graduated medical school in her home state of Iowa at the Carver College of Medicine, University of Iowa. She completed her residency in Emergency Medicine and fellowship in Hyperbaric Medicine at UCSD. She

currently serves on the UHMS board of directors and is co-chair of the UHMS Diving Committee. Her research interests include diving fatalities, cardiovascular disease and diving, rebreathers, and COVID-19 in divers. She helps run the diving medicine clinic at UCSD and was lead author of the UCSD Guidelines for returning to dive after COVID -19.