Duke Dive Medicine

March 13/13

My initial trip to the Duke Center for Hyperbaric Medicine was on February 14-15, 2011 for a study being conducted by Dr. Richard Moon on Immersion Pulmonary Edema (IPE) – also known as Swimming Induced Pulmonary Edema (SIPE). This particular study was looking at the effects of the 'dive reflex' on pulmonary arterial and pulmonary artery wedge pressures during exercise while submerged. With so little know about this condition, it was a great opportunity to take part in this study and try to understand more about how and why SIPE occurs. After my first visit to Duke, and based on the testing that took place, I was able to apply that knowledge to my 2011 & 2012 race seasons – where I remained SIPE free!

On October 12, 2012, I was contacted by Dr. Moon's assistant Stefanie Martina and was invited back down to Duke to take part in a 2nd study being funded by the U.S. Navy. This study was set to look further into the condition and at the effect of exercise on cardiac function while immersed to "the neck" in water. The abstract read:

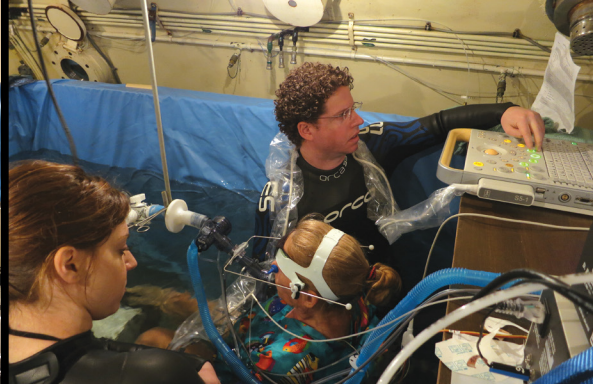
Swimming-induced pulmonary edema (SIPE) occurs during scuba diving or swimming in young, fit individuals, particularly navy recruits and triathletes (1-3). It has been reported that 1.8-60% of the general population (typically <5%) are susceptible to SIPE. The pathophysiology of SIPE is unknown, but it is suspected to be due to high pulmonary vascular pressures during immersed exercise, where the normal exercise-related increase in pulmonary artery and wedge pressures are augmented by a greater preload induced by immersion (4). We hypothesized that higher pulmonary capillary pressures in SIPE-susceptible individuals are caused by reduced left ventricular compliance. Subjects will be instrumented with an intravenous catheter and have their heart and lungs studied with echocardiography and in a few cases magnetic resonance imaging (MRI).

Given how much I had learned about myself on the first study, I was once again intrigued to pay a visit to the Hyperbaric Chamber and see what further medical-scientific testing might reveal. The passion and dedication that Dr. Moon and his team bring to these experiments – trying to unravel they mystery of IPE/SIPE – helps to reassure those of us with the condition that there is hope in discovering the triggers behind it. With such limited data available about this condition, every opportunity to gain knowledge about the possible causes gets me excited to jump in and help the researchers learn more so I was thrilled to get back down to Duke and get going!









So the study would involve forty minutes of 'head-out immersed exercise' in 68 degree water, at a moderate workload, while on a recumbent bike. Yes, the water would be cold and no wet-suit worn, but it seemed quite simple enough - pedal while submerged! The basic procedure would have them scanning my heart and lungs throughout the study using an echocardiography to evaluate if there was a presence of "comets" - which are a proposed indicator of fluid being present in the lungs - resulting in pulmonary congestion. They would also be calibrating my 'venous compliancy' to look at the stiffness of my veins and volume changes in my arm - stiffer veins mean a greater backflow pressure on the pulmonary arteries - which could cause an increase in pulmonary artery pressure. In addition, they would be applying trace amounts of CO into the breathing apparatus and looking at my venous blood gases before, during and after the exercise to detect if the alveoli was compromised due to a fluid build up or obstruction in the lungs. The final components would be pulmonary function tests to evaluate my lung capacity, as well as heart/lung MRI's being performed both pre and post exercise.

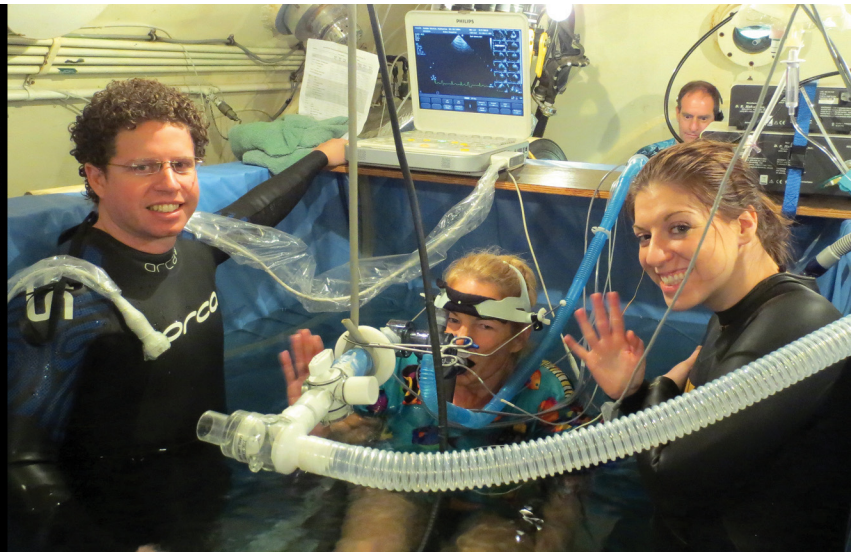
I was intrigued by the in-depth nature of the study and very excited to see what the science would reveal... before I knew it, I was on a plane headed to North Carolina! Stefanie made sure all the details were in place and greeted me with great enthusiasm upon arrival, as did Dr. Moon, Mike and the rest of the team. It was great to be back!

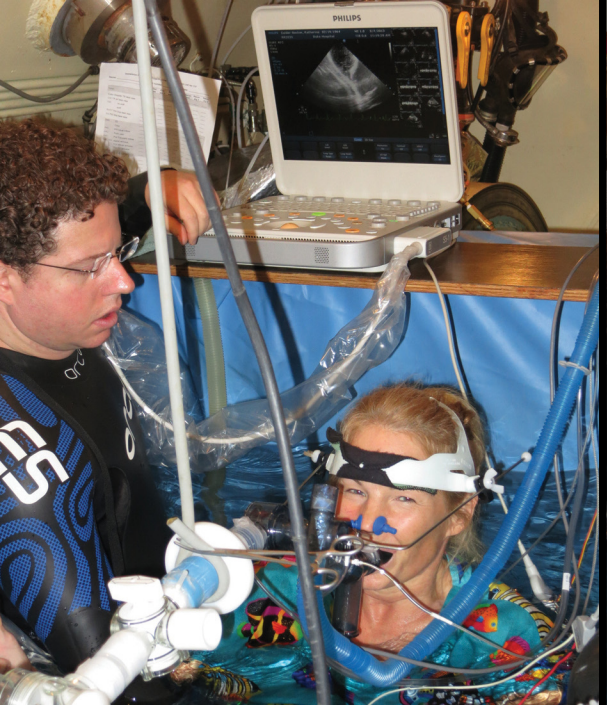
Day 1

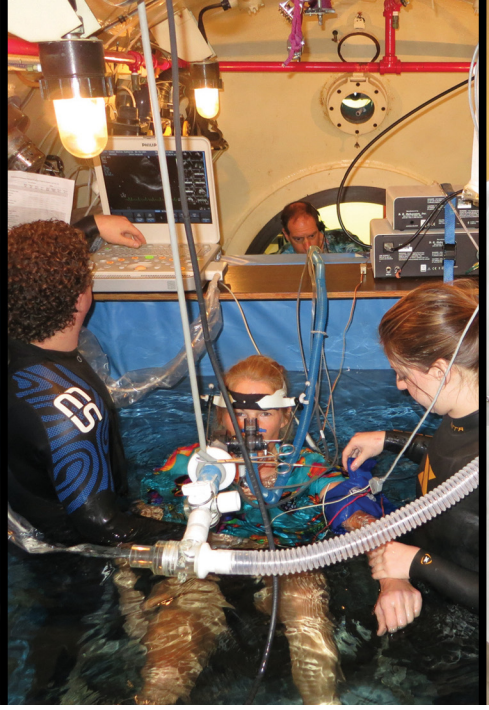
We started out with the first round of MRI's looking at the lungs and heart, then did the pulmonary function tests, venous compliancy test, and finally an ultrasound of the heart and lungs. This was done 'at rest' and out of the 'tank' so the baseline numbers could be established on dry land. Once complete, it was onwards to the 'tank' where the same series of tests were repeated, while I was submerged and resting still, then submerged riding the underwater stationary bike, and finally resting in the 'tank' submerged post-workout. The 'riding' part was rather easy as it was at a fairly low wattage and only for 40 minutes. During each phase, the exact same series of tests were performed so the team could gather data and look for signs of "comets" in my lungs, evaluate the blood gasses and check the venous compliancy. Performing this series of tests, both on dry land and in the water, combined together to help Dr. Moon and his staff get a solid overview of what was occurring in my heart and lungs in both sets of conditions. Once the 'water' testing was complete, another MRI was done post-exercise to complete the data gathering for Day 1 – the numbers had been recorded!

Day 2

It was easy to head back to the lab again to start Day 2, as it was a 'repeat' of the tests from Day 1 – the only exception was that I had to drink 2 liters of Pedialyte prior to getting in the tank! Once fully hydrated, the same series of tests were done, in the same order and at the same times as the day before – the data was once again recorded for in-depth study.





So, after two days of fun in the tank, we were finished the series of experiments! At this point, I can't reveal the specific results as the data is currently being analyzed and compiled for a detailed summary - but I will say that there was a remarkable difference between the two days of testing. I know Dr. Moon and his team are excited about the data and are working hard to get the study finalized - I'll be sure to share the data when it's available!

I was once again fascinated by the science and discovery that's taking place in the dive chamber at Duke, and being able to spend time with this incredible group of researchers was another giant step in my journey to better understand IPE/SIPE. I believe they are making advancements in understanding the complexity of SIPE and through their meticulous studies and ongoing quest for answers, hopefully someday soon we will be able to pin-point the triggers and perhaps prevent the onset of this condition. I will post updates on my website as they become available, but am willing to say that they are on to something in the 'chamber'!

You can find out more about the clinical trial at: **http://dukedivemedicine.org/?p=1656**
Or contact Dr. Moon and his team by email at : **ipedivestudy@duke.edu**

Katherine Calder-Becker
www.endurancetriathletes.com email: triathlonteam@gmail.com