Duke Dive Medicine

February 21, 2011

My Journey to the Duke Center for Hyperbaric Medicine began last fall, when I learned of a study being conducted by Dr. Richard Moon, on Immersion Pulmonary Edema (IPE) – also known as Swimming Induced Pulmonary Edema (SIPE).

Here's how it read:
Official Title: *Effects of the Dive Reflex on Pulmonary Arterial and Pulmonary Artery Wedge Pressures in Subjects Who Have Experienced Immersion Pulmonary Edema.*

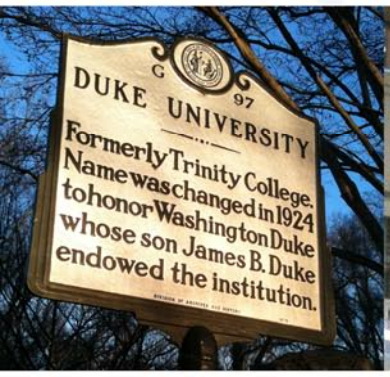
Detailed Description: *Immersion pulmonary edema (IPE) is a condition that has sudden onset in swimmers and divers, and is characterized by cough, shortness of breath, decreased blood oxygen levels, and hemoptysis. The purpose of this study is to examine the effects of cold water immersion and the dive reflex on pulmonary arterial pressure and pulmonary capillary wedge pressure in those who have already experienced IPE, as well as explore the possibility of a genetic predisposition. Healthy nonsmoking subjects who have experienced IPE will be recruited for several cold-water immersion experiments and DNA analysis. Their pulmonary arterial and pulmonary arterial wedge pressures will be measured as they undergo immersed rest and exercise trials in thermoneutral and cold water. If the pressures increase with these trials as hypothesized, the effects of sildenafil administration (a pulmonary vasodilator) will be tested during a second trial. Blood will also be drawn for DNA analysis of certain genes with possible relation to IPE. Results of these tests will be compared with those of the general population.*

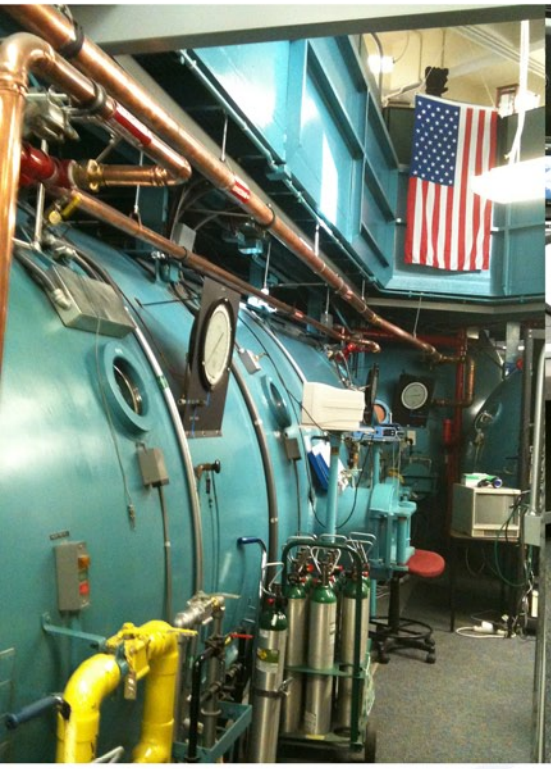
I was excited and intrigued that a study was underway that might lead to some insight into why we are susceptible to IPE/SIPE, and I knew I had to offer myself to science in hopes of solving the mystery.

There were things about the study that concerned me - mainly the catheter that they would feed through my heart in order to obtain pulmonary artery pressure at the 'exit' point, and the 'breathing' device that I would have to wear, but at the same time, this study was so unique and pointed at my condition, how could I not participate! Anyway, I figured as a triathlete I had the mental toughness to draw upon throughout the experiment, so why not JUMP IN!

Before I knew it, I was on a plane headed to North Carolina and the Duke Center for Hyperbaric Medicine. Testing was set to take place on February 14-15, 2011.

What I immediately realized upon my arrival at 'The Chamber' was how very special the group of people conducting this experiment were! Welcomed in by Dr. Freiberger and Dr. Moon's assistant Claire, it was time for some debriefing by the team. This is a dedicated group of researchers, doctors, scientists and medical professionals who are warm, friendly and eager to put you at ease.

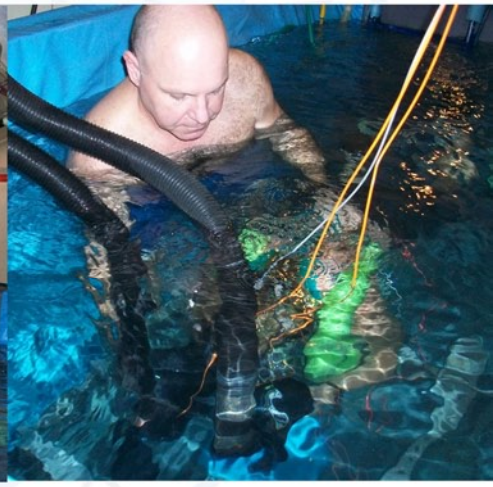


Day 1 Testing:

First, there were initial 'baseline' lab tests that took place: blood, EKG, chest x-ray and treadmill stress echo tests, all performed at the Duke medical facilities on campus. Once the medical tests were complete, it was back to 'The Chamber' where Mike performed lung function and CO2 tolerance tests, and Eric did a preliminary dryland bike assessment test. Then we began some 'tank' practice with the breathing apparatus and modified stationary bike. Part of the testing procedure would have me submerged in the tank in a 'horizontal' position with my shoulders tucked into a special harness to keep me in a swim-like position, while pedaling a modified stationary bike. This would enable me to get my heart-rate up while being submerged under water. For day 1, the water in the tank was quite warm, so it was great to get the 'feel' of the equipment in a comfortable setting. We went through the testing protocol so I was completely prepared for what was to come. There was nothing unexpected or left to chance – all the preliminary testing went smoothly and we were a 'GO' for Day 2!

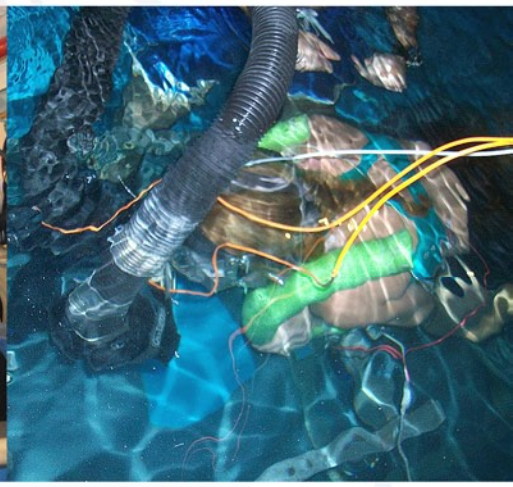




Day 2 Testing:

My day began bright and early with a nice walk to the campus. When I arrived at 'The Chamber', Dr. Moon was already there working in the lab – doing what I would describe as his 'pre-race' routine. Lots of details to cover, everything set to a meticulous flow. Dr. Moon began with the wrist catheter, which would monitor my pulse, blood oxygen levels and extract blood during the testing. Next was the catheter being fed through my heart. Now this was the part of the test that scared me the most, but actually, I didn't feel a thing! It was initially fed into my arm at my elbow, then he used x-ray imaging to guide it into place. Quite fascinating, and totally painless! Once in place, we were set for the first round of baseline tests in the lab.

Relaxing on the floor, with the breathing device in place – they took various dry-land readings to set a series of baseline data. I was so comfortable; I almost drifted off to sleep!



Next up, 'the dunk tank'. It was a little un-nerving to crawl up into the 'basket' knowing I would be dropped into 68 degree water, but hey science was calling me! Anyway, this wasn't anything different that toeing the line on race day – Lake Placid here I come! I put on some goggles, had my nose plugged and used a divers breathing device to take in oxygen. This is where the metal toughness kicked in – suck it up buttercup – here we go! I was actually fine once I got over the first 20 seconds of shock, then my breathing calmed down to something closer to normal, and I began to relax and focus. The same series of tests were performed while I was submerged - face down, lying still - as were done in the dry-land 'relaxed' state. After a few minutes, I was back up and sitting on the tank wall - part 2, complete!

The third and final test of the series was performed in the same cold water, but pedaling the modified stationary bike in a horizontal position underwater. I was wearing the larger breathing mask that was fitted to my face on Day 1, which was feeding me oxygen and quite easy to exercise with. The wattage on the bike had been calibrated in the tests on day 1, and that too was familiar, so I simply had to concentrate on the task at hand. The cold-water element required a bit of extra focus, but nothing really extreme compared to the open water swimming that us triathletes are used to! This portion of the test lasted about 8 minutes, and again, the same readings and measurements were taken as in the first two 'dryland' and 'dunk' tests.

Once 'Test 3' was complete, it was time to get out of the tank and warm up for a bit… and to take some Viagra – yes, I said Viagra!

So, the idea here is to analyze the pulmonary artery pressure (PAP) and pulmonary capillary wedge pressure (PCWP) when relaxed and out of the water, then again after being submerged in cold water lying still, and finally when exercising in these same conditions. If there was a rise in the PAP/PCWP when submerged then what effects would sildenafil (Viagra) have on reducing the PAP/PCWP?

After warming up and having a bite to eat, we were ready for a repeat of tests 1-3. The exact same tests were performed in the exact same conditions – again, a test of mental strength, but that's what I was there for. Much to my surprise, and excitement, preliminary results suggested that the Viagra may have reduced PAP/PCWP in round 2 of testing, but I will have to await the final analysis to be sure.

I can definitely say that I 'felt' much better on round 2 after having taken the Viagra – it seemed much easier to breathe in the cold water – but who knows if that was just in my head or not. Once the data has been analyzed and I have the numbers from Dr. Moon, it will be interesting to see if what I thought in my head was actual fact. I will also meet with my cardiologist to review the results and determine if the use of Viagra as part of my pre-race regimen makes sense at possibly preventing the onset of SIPE. I should also mention that pulmonary function tests were performed throughout each stage of the testing and revealed excellent lung capacity and functionality from start to finish.

There is still the DNA genetic link to this puzzle as well, which will only reveal itself after other study participants are tested and the data compared. The theory is that there may be a susceptibility to IPE/SIPE in certain individuals based on their genetic makeup.

If you, or anyone you know has suffered from IPE/SIPE, I urge you to contact the Duke Center for Hyperbaric Medicine and find out if you can be included as part of this research study. I personally found the process and interaction with Dr. Moon and his team to be fascinating. This is a rare opportunity to be part of a study that is targeted at uncovering the mechanism behind IPE/SIPE, and hopefully the data will shed some light on this complex and rare condition. The testing is challenging, but so is racing triathlons – we were made for this!

You can find out more about the trial at: **http://clinicaltrials.gov/ct2/show/NCT00815646**
Or contact Dr. Moon by email directly at : **ipedivestudy@notes.duke.edu**

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