

Overpressure: Static & Complex - Don't let it kill you!

by Dan Wulff, Region III

With the war in Iraq, we have heard many stories of blast injuries. Our men and women serving overseas are exposed to IED blasts as well as other forms of blast pressure waves. There has been much more public exposure to TBIs (Traumatic Brain Injuries) as a result. Reporter Bob Woodruff has made it a point to pass on his story as well as the story of brain injured soldiers. Please watch his video segments when you get a chance, they will help our community truly understand the dangers we face and the human aftermath when a device does detonate.

Do we as bomb techs truly understand the human ramifications of explosive blasts? We understand fragmentation and penetrating trauma injuries, but what about overpressure? I will focus on overpressure and the reflection of pressures for this article. Why? Because it almost killed me and has forever changed my life.

Let me bring you to the 9th of Feb 2005. Bomb techs from the Minneapolis Police Department were training on explosive breaching at an empty school that was soon to be torn down. It was a school that had been built some time ago with concrete and block construction. We trained our own SWAT officers as well as a SWAT team from a nearby area. After several interior breaches, including one in particular that "rang my bell," I began to feel somewhat nauseous and had a headache the remainder of the day. Keep in mind; I wore nomex clothing, a level 3A vest with frag protection, helmet, ear protection, eye protection, breaching blanket and we were stacked at the recommended distances, etc...

The following day I left work to see my family doctor about my "head cold." I could only relate how I physically felt by what I had experienced in the past. Therefore the headache had to be a cold. Eight days later, I was attending in-service department training when my headache became much worse to the point of being unbearable. Two days later, my right eye lid began to droop and my right pupil became constricted. An Emergency doctor (Dr. Autrey) identified my symptoms as Horner's Syndrome. Within two weeks of breaching training, I was lying in the ICU at a Stroke Center with a right Carotid Artery dissection as doctors tried to figure out what to do. The artery was damaged beyond the chance of surgical repair and the damage extended into my right brain. I had severe headaches and a strange "tingling" sensation, yet showed no sign of stroke. The artery eventually collapsed to the point that it no longer carried any blood, yet my brain was able to get cross flow from the left artery. "WHAT HAPPENED?" I was asked repeatedly by the medical staff. I could not think of what could have caused this. Test after test was performed to determine if I had a genetic condition that would predispose me to weak arteries. I was otherwise healthy and nothing was found that would lead to a dissected artery.

I should have had a massive stroke and died, but I didn't. I am alive due to the grace of God, in my opinion. This is why I am writing this and trying to inform others on this issue. So that others will learn from my experience.



After my 12-day hospital stay, I pondered whether or not the breaching had anything to do with my injury. I called my treating Neurologist and told her of the incident and the time line leading up to the Horner's syndrome. She immediately stated that overpressure could have done this. An independent medical examination done by a Genetic Neurologist confirmed it.

Military medical research has shown for years that reflective overpressures are a key component of blast injuries. There is what is called STATIC OVERPRESSURE and COMPLEX OVERPRESSURE. Static is what is easily quantifiable and can be calculated. This is what we are taught in breaching schools and other bomb schools to calculate. However, complex pressures (reflecting and converging pressure waves) are what kill and injure people. These pressures can be measured as the blast occurs (as in research), but are next to impossible to calculate and predict before the fact. The surface of the structure, humidity, temperature, furniture - all affect the reflective waves. Obviously the harder and smoother the surface, the more reflective the surface. But where will the pressure waves converge? This is the question. If you happen to be standing at that point in the room, look out. We know pressure will follow the wall and converge in the corners of rooms. But were else in that room will waves collide?

Complex pressures in interior blasts can be up to 20 times greater than static pressures. How does this happen? It happens when waves rebound and collide with one another, much like ocean waves converging to make a larger wave. Interior explosive detonations are a tremendous threat to human injuries. You can calculate a hallway breach by figuring out the static pressure for a hallway that is 50 feet long, 10 feet high and 8 feet wide. You have a strip charge of 160 grains and are well within the Static pressures for human injury. HOWEVER, you failed to calculate the reflective pressure waves. The waves that bounce off the opposite hallway wall and ceiling and hit the 3rd officer in the stack dead center of his exposed neck. These waves may converge on the base of his skull and drop him to his knees. Yet everyone else in your stack is fine. He walks away with a headache and symptoms of a severe head and sinus cold. He is an overpressure victim!

Another way to explain this is with LVB detonations. Why were certain buildings not affected near ground zero in Oklahoma, yet blocks away there was damage? Reflected overpressures! Imagine standing in front of a building that was blocks away and being hit by the pressure wave that was hitting that building.

Our equipment has been designed to protect us from fragmentation, but may not protect us from overpressure. In fact, it may even heighten the dangers from pressure waves. The ballistic helmet that we wear is a perfect example of this. The

bottom lip of the helmet is flared out, which may protect your neck from an overhead explosion with fragmentation, but this lip will also catch, and to a certain extent, funnel a blast pressure wave that is coming from below. The wave, once funneled, is free to ricochet around the inside of the helmet, causing microscopic and cellular level damage to the brain.

Soldiers are exposed to blast waves all the time. They are returning to their jobs sometimes completely unaware of why they just can't function like they used to, or worse yet, they have been misdiagnosed with PTSD and have been told they are suffering from emotional stress. SWAT and Bomb Team members may also have overpressure damage and not understand what happened to them. It is incumbent upon our profession to help educate and prevent these types of injuries. We are looked upon as the experts within the Bomb community, be it military or law enforcement. We are certainly not doctors, but we can help the medical community and our own troops. We can help the soldiers of this country and others by educating folks on the effects of overpressures.

How many concussions can the body take? Ask a sports medicine doctor that question and they will tell you that after three or more, you begin to get brain damage. Now ask yourself this. How many blast waves have you felt going through your body as a bomb tech? Demonstrations...training...actual incidents. These are concussions! Now converge the reflective waves and you no longer have concussions but more serious injuries. Think about that headache that you had after training, or the feeling of sinus pressure. One time is usually recoverable, but repeated injuries are cumulative. Furthermore, being exposed to repeated smaller blast waves in quick succession drastically reduces the safety threshold.

My artery has since reopened but I have continuing signs of neurological damage. Symptoms include post-concussion symptoms such as poor memory, the feeling of sensory overload when I am in crowded places, increased sensitivity to light and sound, double and strange vision, headaches, lack of stamina and difficulty concentrating. Some of the symptoms are odd enough and subtle enough (such as abnormalities in how my pupils respond to light in the opposite eye) that it has taken many months and visits to at least a dozen doctors to figure them out. I have also attended a six-month rehab program for brain injured individuals and received extensive vision therapy.

Although we as a society have become more cognizant of blast TBIs, doctors still do not know how to treat the injured person. The brain often times will not heal and the injured person is left with a whole new set of challenges. How does a person survive with their most powerful tool, their brain, broken? We as bomb technicians have the ability to help teach the mechanisms of injury and in the civilian world, where doctors don't normally see this type of injury, we need to keep an eye out for signs of blast injuries in each other so that we can help doctors recognize what to look for if one of our fellow bomb techs gets injured. We can draw upon our experiences and training to help educate our community as well as the medical community. ●*