A Whole New World

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MMT 2010 Volume: 14 Issue: 8 (December)

Programs and technologies are helping alleviate vision problems related to traumatic brain injuries.

Improved evacuation capabilities and medical care in the field has helped more wounded troops survive their injuries and return home. But that also means they're facing many hardships as a result of those injuries and the medical community is seeing new conditions present in groups of veterans that previously wouldn't have had those problems.

One of those problems is a vision impairment that was previously associated with non-combat injuries, but is now being seen in increasing numbers of young troops that have suffered traumatic brain injuries.

Hemianopsia is the loss of half of the vision field and in some cases, veterans will lose awareness of that entire area. In others, veterans can learn to compensate for the lost vision field with various techniques and technologies.

Visual field loss can occur after brain injuries because the loss is caused by damage to the nerve fibers that carry visual signals from the eyes to the brain, and also the fibers that connect operations between different parts of the brain. Brain injuries can also affect vision acuity, or clarity, according to Dr. Gregory Goodrich of the VA Western Blind Rehabilitative Center in Palo Alto, Calif.

Several efforts are under way through the VA system to study treatment options and also better screening tests to discover the problem sooner.

Typically, people with brain injuries are given a basic test called the Confrontation Visual Field Test, according to

Goodrich. But now, veterans with brain injuries are given a comprehensive visual exam at the four VA polytrauma centers—in Palo Alto; Richmond, Va.; Tampa, Fla.; and Minneapolis, Minn.

Goodrich said he recently surveyed about 600 ophthalmologists in the VA system and found that about a third were also administering a more comprehensive visual exam.

Medical staff at the VA, as well as rehabilitative ophthalmologists and occupational therapists, can work with servicemembers experiencing hemianopsia to learn techniques to see that area by turning their head more to compensate or to scan the area more with both eyes to take in what's in that lost vision field.

Twenty-five to 45 percent of people who have suffered a brain injury experience related vision problems, Goodrich said. In 2003, they were seeing age-related eye problems and Goodrich primarily worked with low vision patients, most of whom were 70 or older.

Then they started getting requests from the polytrauma center for troops returning with severe brain injuries, most of whom wouldn't have survived in previous conflicts, Goodrich said.

At the time they were only serving legally blind patients—those with 20/200 vision or less and those with a visual field of 20 percent or less. But because the troops were at the polytrauma center, they were able to get services from the Blind Rehabilitative Center.

They had hemianopsia; an entire half of their field of vision was gone. But some still had 20/20 vision and had more than 20 percent of vision field overall, so they didn't meet the criteria for legal blindness under the definition at the time, Goodrich said.

Since then, the VA has revised its definition of blindness and it's now 20/50 or less and a significant loss of the vision field. That means more are eligible for services at the Blind Rehabilitative Center Goodrich said under the previous definition, about 160,000 patients were eligible for services at the center, but under the newer definition, more than a million are eligible under the expanded VA definition. "It's had a tremendous impact," Goodrich said.

They've had to revamp many of their treatment programs, though, for the younger group of veterans. They've added new recreation programs to help TBI and vision patients relearn skills while also getting exercise, such as tandem biking.

That's the kind of thing occupational therapists can also help with, said Dr. Sudip Bose. Bose is currently an ER doctor at Medical Center Hospital in Odessa, Texas, and serves as the medical director for Ector County and the City of Odessa.

Bose is also a former Army physician and is on the Board of Directors of the American Occupational Therapists Association. He echoed Goodrich's comments that more of these veterans are returning with specialized medical and rehabilitative needs. When he was rotating as a medical student at a VA hospital, he was mostly seeing older veterans, but "now a veteran is a 19-year-old," Bose said.

Occupational therapists are often part of rehabilitative teams working with TBI patients, and other veterans, to help them regain independence and functionality. "We're not treating hemianopsia in isolation of other things," Goodrich

said.

As these TBI veterans return, more is being learned about vision problems related to the injury and also about the blast physics and injury patterns, Bose said.

A Type 1 blast injury involves those suffered from the initial blast and its pressure wave, which can cause hollow organs to rupture. Type 2 injuries occur when shrapnel from a blast pierces the body. Type 3 occurs when a person is picked up by a blast and thrown into a wall or the ground and the resulting injuries. Type 4 includes injuries resulting from any chemical agent that may have been part of the bomb.

About 70 percent of TBI patients have some sort of vision problem, Bose said, and about 20 percent of the troops injured in Afghanistan and Iraq are suffering from some sort of TBI. Those injuries range from mild to severe brain injuries and the vision problems can come from direct damage to the eye or the brain injuries that impact how the eye and brain communicate.

Goodrich and his colleagues, as well as other ophthalmologists, are looking for techniques and technologies to overcome some of the visual damage caused by brain injuries.

Some of those teach scanning for hemianopsia patients and relearning eye movements. For those who have lost awareness of the lost visual field altogether, those who have hemianopsia with neglect, they learn to also turn their head so the moving neck muscles signal to the brain that the things the patient is seeing are on his left, Goodrich said.

Another option is using prisms that are added to the side of eye glasses where the lost vision field is located. The prisms move things inward 20 to 30 degrees, which can be helpful with moving and mobility. The problem is that the prism displaces things so objects are not in the same location as seen through the prism and patients have to learn to compensate for that using scanning and other techniques.

Other technologies available to treat hemianopsia and other vision problems include Neuro Vision Rehabilitation System [NVT], which has been used in Australia for more than 25 years and has been used at the Palo Alto VA since 2006. Palo Alto was the first U.S. center to use the system and it's also used at the VA's Tampa Polytrauma unit now, said Gayle Clarke, chief marketing officer of NVT Systems.

The NVT System includes a scanning device with standardized assessments and treatment protocols, software with a rehabilitation and patient management system and comprehensive training for rehabilitation therapists. The assessment process uses a presentation of colored lights and gauges a patient's ability to detect and compare light patterns. The lights are also used for training to help patients to scan and adjust to their new visual field.

NVT staffers are also in discussions with other VA facilities and DoD to expand use of the NVT System, Clarke said, but no contracts have been awarded.

Another option is the Dynavision, which is a large reaction device containing 64 lights configured in five rings. The device can be used in training for athletes, law enforcement, military, and is also used in rehabilitative centers. The user stands in front of the lights and has to react as quickly as possible to touch the lights as they turn on in random order. The data can be saved for tracking and records.

Goodrich said he and others have started using Mobile Eye from Applied Science Laboratories to help study and treat patients. The device mounts onto eye glasses and has cameras that track eye movement and can collect data on where the eye is pointing and what the patient is seeing, Goodrich said. They use it in hallways with targets and directional signs to see how many targets the patient can spot and how many directional signs they can see and follow. The activity is timed and the cameras also show a patient's head turns.

Researchers like Goodrich and other medical professionals are still studying how brain injuries affect vision and the best treatment of visual impairments, but they agree that earlier detection of the problem can help the patients regain more of their independence and also their visual field.

Goodrich said that patients may not be able to regain parts of their visual field or clarity, but with various techniques and technologies, they can adapt to those changes so the loss doesn't become "a limitation on their life that they don't have to have."♦

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