Session Date: 12/03/2014  
Cyberseminar Trasncript  
Series: Mild TBI Diagnosis & Management Strategies  
Session: Windows to the Brain: the Neuropsychiatry of Brain Injury and Common Co-morbidities  
Presenter: Robin Hurley  
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Dr. DePalma: It’s a great pleasure to have Robin Hurley, a psychiatrist from the Medical University of South Carolina speak with us about Windows To The Brain. She’s an expert psychiatrist and neuropsychiatrist with expertise in neuroimaging research and has many qualifications in education and in research. She’s currently the Associate Chief of Staff of Research & Education at the Salisbury VAMC and she’s a VISN 6 Academic Affiliations Officer. It’s a great pleasure to have her speak with us today. She’s in the front lines of not only research, but dealing with these challenging and difficult patients. Robin?

Dr. Hurley: Thank you Dr. DePalma and Molly for this opportunity to present and to speak with everyone today. I want to make sure that my slides are up. Molly, are we good?

Molly: We are good to go. Thank you.

Dr. Hurley: And I want to thank all of you that have signed in today to listen to us talk about the neuropsychiatry of TBI and its co-morbidities as we think of it in neuropsychiatry. As Dr. DePalma said, I’m a clinician first at heart and I see brain injury patients. I’ve been in the brain injury clinic in the VA for it’ll be nineteen years this coming February and teaching clinical threads and the students. This is one of the things that has been a passion for me for a long time. I am in North Carolina. I’m with the Salisbury VA as Dr. DePalma said at the Wake Forest School of Medicine. I’m also with the VISN 6 MIRECC, which is our post-deployment mental health MIRECC in which we study the conditions that occur after our veterans have been deployed to war fronts. With that you’ll see we have a couple of disclaimers on the slide. There are a couple of things that I’d like to tell you. I have no conflicts of interest and nothing to disclose. I’m fully employed by the VA. The other thing is that sometimes folks ask us at the end of the lecture if the pictures in it are of patients. Did we do HIPAA-related examples that I give to patients? The answer is no, these are all clip art. They’re all publically used pictures off of the internet of people, or they are publically available. There’s nothing in the lecture that embargos or that can’t be accessed off of any public website.

What I’ve done to a lot of the statistics that you’ll see in this is that I’ve given you the website references. The handout that you have doesn’t have all of our clip art and pictures in it, just for necessity and the size of the file. But certainly all of the content is there in the handout that you’ll receive. With that as an introduction and thanks again for this opportunity, we’ll get right into it. Some of the things that we’re going to cover today will be the functional anatomy of emotion memory circuits as we think of them in neuropsychiatry and in the front lines. We’ll talk a little bit about the clinical deficits that we see in our patient population here. We’ll talk a little bit about the assessment and treatment advice that I would give to my residents and folks that I work with. And if we have time at the end of the discussion, we’ll talk a little bit about the VISN 6 MIRECC studies and what’s going on here in our center. Here’s our first poll question. Molly, why don’t you lead us in this? I want to know who is listening today.

Molly: Thank you. As Dr. Hurley mentioned, we’re trying to get an idea of who’s in our audience and what your primary interest in TBI is. You have a blue screen up on your page. Just click the circle next to the answer option that best describes your answer. The choices are basic science research, clinical science research, clinical care of veterans returning from OIF/OEF/OND, and educating trainees. It looks like we’ve got a very responsive audience today, which we truly appreciate. We’ve already had seventy-eight percent of our audience vote, and answers are still streaming in so we’ll give people a couple more seconds to get your responses in before we show the results. We understand that many of you wear many different hats in your careers, so this is regarding your primary interest in TBI. We’ve already had eighty-five percent of our audience vote. I’m going to go ahead and close the poll now and share the results. Four percent are interested in basic science research. Twenty-four percent are interested in clinical science research. Sixty-six percent are interested in clinical care of veterans returning from OIF/OEF/OND. And seven percent are interested in educating trainees. Thank you to those respondents. We’re back onto your slides.

Dr. Hurley: Okay. Thank you Molly, and thanks to everyone who responded, because that helps me to talk a little bit more in terms of the direction and where we stand in time on the slides. I hope everyone had coffee with lunch, because we’re going to talk about neuroanatomy and bring you back all the way to medical school or to graduate school here for just a moment. The way in neuropsychiatry that we think about the brain functions and how you live your every day with emotion and behavior responses is a series of circuits. And if you enter that circuit anywhere along the path, then you can get the same outward clinical symptoms. That’s why it’s been so hard over the years for people to tag radiology findings to specific psychiatric diagnoses, because you can have a lesion in any place along the circuit and have the same symptoms. We’re going to go through some of the important ones to us in neuropsychiatry as we think about behavior, mood, and emotion. We’ll talk about why that’s important to brain injury. I think if you follow along in the discussion it will become clearer.

Let’s start with the dorsolateral prefrontal cortex. You can see in the pictures of the brain that Dr. Taber has drawn for us, you can see the dorsolateral prefrontal cortex is really sort of on the top in front of your brain. If you notice through the circuit diagram it goes through the dorsolateral caudate to the globus pallidus through the thalamus and returns then to make a complete circuit to the dorsolateral cortex. There’s also a spin-off pathway as you see with this that goes to the pons and to the cerebellum. This becomes important in terms of thinking about the location of the head injury. This is our circuit for cognition, our thinking. The memory management, the recalling and putting together of the pieces of memory that are stored, and being able to focus, pay attention, it’s all of those things. We know about dorsolateral prefrontal injuries for example in our schizophrenics that are very concrete and unable to abstract and use their computer as you will. The second one of these that we want to talk about is the orbitofrontal cortex. As you see in the picture that point to them in a blue color on your screen, you see that it really covers the more ventral surface of the frontal lobe, a little bit on the more lateral surface, and there’s certainly plenty there on the medial. The orbitofrontal cortex is what controls your moods, your behavior, your inhibitions. It’s what keeps you from saying something ugly to the policeman who stops you from speeding, or in the slow line in the grocery store.

We know about the orbitofrontal cortex from our classic patient, Phineas Gage. For those who remember the story, Mr. Gage was a railroad worker in Vermont in the 1800’s. He was distracted when he was placing the dynamite properly in the ground to blow up a spot of land for the railroad tracks. It shot an iron rod through his skull. Fortunate for him is that he lived through this event. It didn’t cauterize and it didn’t infect. What happened is that he became very disinhibited afterwards. Mr. Gage told everyone what he thought about them, including the other City Council members and his family. He ended up wandering around both the United States and some countries in Central and South America until he died. His physicians followed him throughout his life and wrote about him. There are some very famous papers that are available if you go to the internet and search it. You can see wonderful pictures on the internet in terms of the trajectory of the iron rod and what happened. This taught us about the orbitofrontal cortex and the importance of it in our everyday control of our behavior and our moods. We know about it in terms of depression and other mood disorders. One thing to notice here is that the orbitofrontal cortex does not follow through to the pons and to the cerebellum that we know of at this point.

The third circuit that we’re going to think about today is that of the anterior cingulate. You see in the picture that it’s much more medial. It’s more protected from injury if you think about direct injury to the skull because it’s so medial. If you think about getting hit by a bat or by a steering wheel or a chair or whatever might happen in terms of a fall and the hit, the cingulate is much more protective. This is good, because it’s more in control of not only chronic pain, but it also plays a part in your memory factories. It plays a part in chronic pain, particularly in the management of central pain, and for motivation. It’s what gets you up and moving after you’ve been sitting for a while. It’s what tells you, “I’m in danger. I need to move over.” What we know about the cingulate is that if it’s injured on both sides, the patient is at risk of becoming what we call a kinetic mute, where they’re not able to get up and take care of themselves and move forward. You could have someone like that even in the middle of a freeway and they wouldn’t feel the sense of getting out. If it’s injured only on one side, interestingly and unlike other functions in the brain, the other cingulate can pick up and do the work. What we know also is that you look at this one more carefully; it goes more ventral through the basal ganglia and thalamus. It also goes through the pons and cerebellum. We’ll talk about why this is important in just a minute in terms of common brain injuries.

The last of your neuroanatomy lessons that we’ll have this morning is that of the hippocampal circuit. This is our memory factory. It’s based in the temporal lobe in the hippocampus, and as you can see as Dr. Taber’s illustrated for us, includes the hippocampus, the fornix, the mammillary bodies, and the thalamus. Of course it’s very attached to the medulla. This becomes important in thinking about our veterans because of post-traumatic stress disorder. We know about mammillary body injuries and what happens with Wernicke-Korsakoff if you don’t have thiamine. We know about the medulla and its relationship to post-traumatic stress disorder. It is the structure that adds emotion to your memory. We hope that you remember taking an exam in school has a very different emotional feel than thinking about graduation day or your wedding day. Those memories have very different emotional feels to them. We hope so anyway. That’s what the medulla does for us, as the current thinking of neuropsychiatry. That’s in the temporal lobe. We’ll think about it again in terms of injury here in a just a moment.

All of these tracts again work as one circuit. You can injure it anywhere along the way and get the same, exact symptoms. For example, if I had an isolated fornix lesion I could still have the same symptoms as if I had lost my hippocampus. None of these circuits work free. Everything has a cost in life. Neurotransmitters are the fuel and what makes all of these tracts function. The nice thing as you can see on the display on the screen is that our neurotransmitter factory that provides the fuel for all of the circuits are well protected deep in the brain. That’s good when it comes to getting hit in the head. If you notice our common ones are acetylcholine, which is in the basal forebrain. That’s certainly a part of our memory. We know about it from Alzheimer’s. It’s also in the tegmental and pedunculopontine areas. We know about dopamine, substantia nigra, and the ventral tegmental area. Serotonin and norepinephrine are used to treat depression mood disorders and in the focus concentration ability to have fast thinking processes. It’s really good that all of these are well protected when it comes to taking a hit to ones skull or brain.

Why do I bring up this neuroanatomy lesson in a brain injury lecture? It’s because of what you see on the screen in front of you now. The most common brain injury is a subdural hematoma. The dorsolateral prefrontal cortex is the most common area. That’s what happens is a rupture of the draining of the veins from the cortex to the sinuses and to the draining veins that drain from the skull to your jugular. What happens is when you get this break in these tiny veins that don’t have valves, then you just get a fill of the area with blood. As you see in the CAT scan here on the right, which is an axial or a cross section slice, you can see a classic subdural. This is an example of one after a blast injury in Iraq. The second most common kind of brain injury to occur is that of contusions. If you notice in the autopsy slice on the left of the screen you can see how close in a normal brain the tissue is to the skull. You don’t have much room there for the brain to shake or move within the skull. So it’s easy for it to get contused or bruised. The most common area for that to occur is where Dr. Taber has drawn for us in green here are over the circuits that we just talked about in terms of the orbitofrontal, the temporal lobe, the cerebellum, and then the occipital lobe which is vision. So again the two most common things to happen in any kind of brain injury are over those circuits that control your mood, your emotion, your cognition, those things that we in psychiatry think about every day with our patients. The slide on the right gives you an example of a contusion. Again, this is after a blast injury in Iraq. You can see the contusion. This is a MRI. It is a cross-sectional picture and it is a T2 because you can see the white ventricles as far as the MR slice.

The third most common thing to occur and the one that’s probably of the most interest for our researchers on the call today is Diffuse Axonal Injury. The Diffuse Axonal Injury, or DAI, is the thing we know the least about. In medicine we’ve know about subdurals with people getting hit over the head in bar fights and other things, but the thing we know the least about is diffuse axonal injury. It’s diffused in that its tiny injuries to the axons in the brain, or the pathways that connect one cellular area to another. Diffused means it happens in many places. It’s not diffused in terms of one large spot in one place as far as the definition of the word. As you can see on the drawing on the axons on the left, here is a normally functioning axon. What happens is that it’s injured. The first thing is that you get a blockade within the body of the axon. You get disruption in the myelin and eventually a break. That occurs most commonly where there’s a change in the tissue density in the brain. Again that happens commonly over areas that control moods, emotions, cognition, the things that in psychiatry we think about every day. It mostly occurs we know of in deceleration injuries where the brain kind of shakes and moves very suddenly. Driving a racing car and hitting a tree is one example. Or a really rapid fall in a bungee cord where the acceleration, deceleration is so quick. Normally this is hard to see on a MRI because they’re such tiny little spots of axonal injury. But in this particular case we do have a patient where you can see some examples of it. This is a sagittal view in this patient. It’s a flair image. What you see is the areas of injury are white in the axons. We don’t know a lot about this because it’s so tiny it’s hard to see on regular imaging, and thus it’s a real focus in research these days. It’s one of the thing by which there’s just a lot of time and energy focused. So that’s why it’s so important to understand ones neuroanatomy when it comes to looking at a brain injury.

What happens in a significant brain injury? One of the secondary effects that can happen is called a neurotransmitter storm. So if you hit the tree what happens is that all of those fuel factories that I talked about release all of their neurotransmitters at one time, which then causes increased metabolic demand, increased demands of glucose, increased demand for oxygen. So one can get a secondary injury just with the injury mechanisms itself. There are a lot of neurosurgery labs working on what could an emergency medical technician give you in the field that could stop this process. There are a lot of controversies and questions about whether taking someone into hypothermia once they’re into a medical center helps to stop this process. But I don’t think that the decisions are really formally affixed as to which way we’ll go on that. Some find it helpful and others find it not so helpful. What happens in a blast? One of the things that we want to talk about with our veterans is that there’s a peak overpressure. When the bomb explodes there’s all of this wind and air. You can see that the pressure in the air goes up before it comes down. It becomes a vacuum and then it eventually settles out. This is where there’s a lot of work and research going on with what does this peak overpressure do to the brain. We know what it does to lungs. We know what it does to intestines. We know what it can do to highly vascular areas. It’s being tested for example in terms of rest assuring leakage and other things. We know that it can burst eardrums. But there’s less information available for us in terms of what this does to the brain. Again, it’s tissue in a box under pressure because of the skull.

How do we talk about the injuries that are there? We talk about them in terms of four types. The first is the effect of the blast wind itself. The secondary effect can be what is packed into the bomb, such as nails, glass, or whatever was available at the time that the bomb was made. The tertiary injury is when the body hits something else. For example you’re driving along in a jeep and your head hits the steering wheel or your head hits the frame of a car. Or even the ground if you’re walking. The fourth type of injury is from the toxic fumes, any radiation exposure, or other things that may be going on in the environment that can cause it other injuries. Poisons or gasses that were exploded. The ones that we see most commonly among patients are one, two, and three, and not as much two as in one and three. It’s rarer to find patients that have only had exposure to blast wind and are having symptoms. We’ll talk about that in quite a bit of detail here in just a bit. It’s very common to see the third type.

Let’s talk about what we know in patients. There are certainly patients that have been exposed to blast injuries that there’s a lot of documentation in the literature, and I’ve provided you some references about sensorineural losses that go along with the neuropsychiatric symptoms, hearing loss, tinnitus, ruptured membranes. A lot of problems with rating gaze instability with accommodations, with ocular motor dysfunction, vertigo, motion intolerance, dizziness, all can also occur in the patients. I find it’s very, very, very common for my patients to have post-traumatic headaches, as well as light sensitivity. Those are two of the thing that I see in almost all of my patients. I have a few that don’t have those. What are the common mental health co-morbidities that we see? The literature shows commonly depress, anxiety, post-traumatic stress. Substance abuse can be a means of self-management. Rarely do you see psychosis. If you see psychosis and you’re not talking about someone who has an acute delirium but has a true psychosis, please look for other conditions.

It is extremely rare particularly after a mild brain injury for a person to develop a psychosis. So expand your differential and think about it more widely than just the cause of the brain injury. Personality change and cognitive impairments are symptoms that can occur. Again it’s all about how severe the injury was. What the person was like beforehand. Is it someone who had a mood disorder before? Is it someone who was in a very stressful situation and they have post-traumatic stress from being in conflict for three or four months even before the injury. It’s not just a one single event that creates this post-traumatic picture, but really it’s the compilation of everything. What I’ve given you here to look at the statistics of how common these diagnoses are is that the VA has a really nice epidemiology website for which you can go and look at the reports on the veterans returning from OIS and OEN and their utilization of the VA with their different diagnoses. This has all been publically accessible for several years now. That reference is at the bottom of your slide. You can look at every individual category in medicine just about this that there is from 1989 and see what percentage of patients have been seen for those diagnoses. The ones in yellow that you see on the screen are really the ones that you need to pay particular attention for.

Poll question number two. Do you know someone close to you who has had a mild concussion and did not have a formal medical evaluation at the time of the injury, or was briefly seen in an ER and sent home, “They’re going to be okay. They just had a mild concussion for a few seconds and everything should be fine.” Molly?

Molly: Thank you Dr. Hurley. I think respondents are tracing back through their memory to recall if they know anyone, because their answers are a little bit slower to come in, but they are streaming in. So far we’ve had about two-thirds of our audience respond so we’ll give people some more time. For those of you that joined us at the top of the hour simply click the circle next to your response of either yes or no. Okay it looks like over eighty percent have responded, so I’m going to go ahead and close the poll and share the results. A whapping eighty-one percent say yes, and nineteen percent of our respondents report no. Thank you for those respondents.

Dr. Hurley: This illustrates the perfect point for us, which is that almost everyone that has a mild concussion is just fine. They will recover from it if not immediately within a few days or a few weeks. I’ve done over a hundred and twenty lectures on brain injuries since the wars began. What I’ve seen over and over are people really worried when they go through and they hear my lecture about, “Should I pull my kids out of soccer? Is this something really scary and awful for me for the rest of my life?” The answer is no, almost everyone who has a mild concussion is going to be just fine and never have any sequelae from it. But those of us in medicine and that do this for a living and as you have responded in the poll question number one that are taking care of patients with this, we don’t take care of the well folks. We take care of people who have symptoms and injuries. So the things that I talk about do not apply to the average person. We’re looking at folks that are in medical care that are receiving treatment or in need of treatment and are coming in with symptoms. That’s why I bring it up, so please don’t take your kids out of soccer on my account. But to illustrate the point I think this really shows how common in our culture it is for folks to have had some kind of a mild concussion and it is just fine.

Let’s move on and look at the numbers coming out of Iraq and Afghanistan. What we see from the veterans’ brain injury is that the majority of diagnosed brain injuries have been mild by a longshot. You can see here 253,350. And this is during the second quarter of 2014 were mild with fewer moderates and even fewer severe injuries. This is from the DOD site where they’re asking the questions, not after folks have left the military and moved into the VA. As you can see from their follow-up slides, the numbers are beginning to drop as we move more people out and have less troops staying in Afghanistan and Iran. You can see the numbers are really beginning to drop off. What we see in the VA is there’s still a little bit of a difference depending on of course how you ask and where you ask on the statistics. Some of the original papers from 2010 showed about fifteen to twenty percent entering the VA were positive for having been exposed to conditions that create a concussion. It does not mean that they still had symptoms. About thirty-seven percent of those at this point in time continue to keep that diagnosis after a detailed exam. What we see in the VA as you can see from the epidemiology slides, is of those serving about ninety-two percent of the ones that are coming into the VA are being seen as outpatients, and about sixty percent of all of the folks that have served are using the VA for their care. That’s up from where it started out. A few years in early in the war we were about fifty percent.

The VA has been reaching out and it’s good that we’re seeing more and more of our veterans. Only eight percent have been hospitalized for any condition in the OIF/OEF veterans. If you look at some of the diagnostic statistics, the most common things are diseases of the musculoskeletal system. Then you see the mental disorders coming in second. You see the next three I put up is because sometimes folks who have been exposed to conditions that can cause a concussion really can end up in one of those three diagnostic categories and you can see the percentage. If that diagnosis you can have more than one. For example, if someone had a disease of musculoskeletal he or she might show up there. And if they also had depression they would show up there so these numbers of course do not equal a hundred percent. You can see the most common mental health diagnoses are PTSD and number one is depression and the general anxiety and neurotic mood disorders coming in third. Those are the numbers from the OIF veterans that have received a diagnosis on a clinical encounter in the VA health care system.

The VA has for those who aren’t familiar with it a wonderful Polytrauma System of Care that helps to take care of our veterans that have been injured and have symptoms of a brain injury. It’s set up in terms of a level system for what the patients might need. You can see that there are Level 1 Inpatient Centers. Those are Richmond, Tampa, Minneapolis, San Antonio, and Palo Alto. Then you have a Level 2 Intensive Outpatient Centers and multiple Level 3 Outpatient Centers, and Level 4 Centers which do screenings. Think about this as a pyramid, you have intensive inpatient, intensive outpatient. You have a Level 3 Center which screens everybody that comes into the VA from starting in Afghanistan or Iran or since 911. You have the 2nd level intensive exams and multidisciplinary follow-up. And then you have Level 4 Centers which provide just the screenings and refer to the Level 3 hospital or clinic for a further exam. To give us a brief example of what’s included in that the screenings that everyone coming into primary care is a new patient who started after 911 will get asked four questions, which is screening to basically try to catch everyone that might have been exposed. If they have symptoms and are willing to move onto the next level, they get what’s a secondary comprehensive exam that has a lot of detailed questions about how many exposures, where the exposures were, how far they were about, any post-concussive memory symptoms, when they felt like they were thinking clearly. And there’s also a huge volume of information provided to patients so that there’s not the scare factor. We all know from the news and media that it can get pretty scary if you listen to a lot of things that are out there. So we want to educate people. That’s the number one recommendation. By the way, this screen was a capture shot from our test CPRS account and not from a real patients chart. I think we used Daffy Duck and Donald Duck and some of the Disney characters as our CPRS practice screens to learn how to use it.

What we also have done at the VA is to provide clinical practice guidelines. These are available to providers outside the VA and inside to look really about how to manage the symptoms that can occur after a concussion, or if there’s co-morbidities with it as well. The nuts and bolts of this are focusing on education with how to protect yourself from further injury, making sure to wear a helmet if you’re riding a bicycle for example. It goes through using your seat belt and how to deal with it if there’re sleep problems or if there’re appetite problems or a mood disorder. It goes through in detail and these are available to anyone who wants to look at them inside or outside of the VA. We’ve also partnered with the Defense Centers of Excellence to make some recommendations for when to do imaging on patients that have had an injury. I’ll leave those for you to read after the call on your own about when one should get an MRI, when one should get a CAT scan or a SPECT scan, and what the warning signs are that you need to do a much more detailed workup. What I always teach my residents is that you start investigating and doing a detailed workup when the symptoms that the patient presents with don’t always necessarily match with the history in terms of they’ve had just for example a really super mild concussion thirty or forty years ago, and now they have something they suddenly have developed new symptoms then you want to think about something other than the TBI as the cause. You want to think about are they smoking? Do they have a vascular disease? So I teach my residents and my students is to first and foremost to get a good clinical history and go from there as to whether there’s a need for imaging. Do the patients continued symptoms outweigh what treatments that have been done in the past? Does it make sense?

The second thing that we want to talk about here briefly is about the pharmacological management. There are no large double-blinded placebo-controlled studies or FDA-approved meds for chronic symptoms after a brain injury. So what you have are just recommendations of experts in the field. It comes from our knowledge in other injuries. For example, in patients who have had Parkinson’s Disease or vascular disease, stroke, and all of those things for which in neuropsychiatry we look at it and pull our guidelines from. I tell folks that patients after a brain injury can be more sensitive to side effects. So start low and go slow. And I don’t find that people oftentimes miss that one. What I find is providers frequently give up before they give a full trial of the medication. So they know to start low and to go slow, that’s one of the things that we often get taught in residency. But what they do is that they give up early instead of taking the medication to a full trial and say, “Oh, it’s not working. I don’t know what to do.” So that’s one of the things that we see. Also be particularly mindful for drug interactions. Rule out social factors. I had one patient tell me that he couldn’t sleep, he couldn’t sleep. I’ve been taking care of him for years, and this was a new symptom. I’m thinking, “I’ve got a pill for that.” But I stopped at the last minute right before I wrote the prescription and said, “By the way, is there anything new in the household going on?” I really had to dig and he said, “No,” because he’s a bit concrete and had a slow response time. I really kept pushing and eventually he tells me, “Yeah, my brother is now working shift work and he’s playing music loud in the house at night.” Of course that was the reason that my patient couldn’t sleep, so we have to be really careful of the social factors before prescribing.

Be mindful of the lethality. The suicide rate is higher after a brain injury, sometimes because of the time loss of vision, the lack of foresight, all of those things that may occur. So we have to be careful about not giving large quantities of lethal medicines. We need to be cautious about that in this day and age of computerized prescriptions when sometimes the default is a 90-day script. You don’t want to give someone who has a brain injury 90-days a tricyclic for example, because that of course can be very, very lethal. We talked about “under treatment” a moment ago. The slide I’ll leave for you to read on your own about some of the medications that we in our clinic and in the clinics where I’ve worked in the past have used and have found successful, and some of the symptoms for which they’ve been used. I think one of the things that I get asked about the most in these lectures are the “no’s,” rather than the “yes’s.” I want providers to be mindful of is to minimize medications that can make the symptoms worse. Things that are anticholinergic, you don’t want to give them a whole bunch of Benadryl because it’s going to slow their thinking. If you can get them to avoid caffeine, which is hard, but brain stems that sometimes have been injured are much more sensitive to the agitation or to the lasting effects of caffeine. So where you or I might know that we need to stop drinking caffeine at five o’clock to be able to sleep, our patients sometimes need to stop drinking by one or two in the afternoon. I’d be very careful about the herbal diet energy products that are out there that you can buy off the internet and other places, because a lot of those products have a MAOI inhibitor compound in them, and mixed with our medicines can lead to a hypertensive crisis. Of course be careful of medicines that can lower the seizure threshold.

Rehabilitation comes multidisciplinary. We found a lot of success with cognitive behavioral programs. There’s many out there are nice examples. And if folks need references for those you can e-mail me later. There’s a really great one in Arizona and one in California that we’ve talked about before in Showcase. The brain injury support groups are wonderful. Patients can’t do this alone. They really have to have a multidisciplinary rehab program. With the new GI bill is the ability to go back to school. So what we do is we try to really work with our patients and guidance counselors to start low, go slow, in terms of not trying to do eighteen credits of physics and chemistry if one’s having cognitive symptoms after a brain injury. We have to do a lot of work there to be careful that they don’t get discouraged and take too much too fast. PTSD as we know is very common with this and we’ll show you some slides here in just a moment that talks about that. We know that the worst the level of concussion, the more likely it is that PTSD is going to be present. There are many, many symptoms that are in common to both diagnoses and you see a few of those listed on the screen before you along with the statistics in terms of the rates of PTSD in this population.

We’ve know that from a recent study in which Dr. Sefu and his group looked at veterans from OIF, OEF, that are using VA health care resources that the most common thing if the patient has been diagnosed clinically in just a clinical treatment session with the TBI, is that they’ll also have a diagnosis of chronic pain and PTSD. So we really need to be thinking about patients possibly having that triad when we go to look at treatments, because sometimes what’s good for one diagnosis may not be as good for the other. The VA has to help us with this. Guidelines have been produced from PTSD and substance abuse, and those are available at the [www.healthquality.va.gov](http://www.healthquality.va.gov) website. If there are still cognitive issues present after a brain injury, the big question that came up as we moved through our early understanding of this population is, “Can patients still do the manualized treatments and cognitive processing and other treatments for PTSD,” and the answer is absolutely, yes they can. And \_\_\_\_\_ [00:42:06] and others have done some great work looking at this. What we know is that we have to be sometimes mindful of the brain injury, be careful about things like calling patients out and kind of putting them on the spot. Things that require faster processing or \_\_\_\_\_ [00:42:21] shifting. Sometimes we have to adjust slightly for that. But absolutely, they can go on and do the PTSD treatments.

This was a conference held a few years back in which we looked at all of the things that are areas where this population of mild TBI, PTSD, and pain and what are the challenges that this group has? What are the recommendations for addressing those challenges? Of course it’s the things that we would think about in any large systems of access, coordinating care, diagnosis, education, and comprehensive treatment plans. The reference for that is on your screen. So, it’s time for us to think about future directions. We’ve all seen in our daily lives all the information that’s out there about brain injuries, particularly with the very sad sports-related injuries that make the media. In fact I think there was maybe another one this week that made national news. So what is your advice to us that do this every day in terms of how we can reach more people about education on prevention of brain injuries? Molly?

Molly: Thank you very much. As Dr. Hurley was saying, what do you think would be the best next step for continued public education on prevention of TBI? The answer options are television public service announcements aimed at prevention, social media, add it to elementary and high school health class curriculum, or use primary care providers with educators and discuss it with patients, much like they discuss smoking and smoking sensations. Our audience is taking their time making an educated decision. We’ve had about two-thirds of our audience vote so far, but the responses are still streaming in. You are not being graded on your reply so feel free to select whatever your thoughts are. We’ve had about three-fourths of our audience vote so we’ll give people a little bit more time. It looks like we’ve capped off at about eighty percent of respondents so we’re going to go ahead and close the poll and share the results. It is quite varied. We have twenty-eight percent saying televised public service announcements, thirty percent saying social media, twenty-two percent say adding it to elementary and high school health class curriculum, and twenty percent using primary care providers as educators. Thank you to our respondents.

Dr. Hurley: Thank you all for that advice. That’s something that I’ll take back to our group. One of the things at our particular center in MIRECC is education. And one of the things that I’m always worried about is that I want to make sure that we don’t just do one-time lectures. It’s easy to forget or to not make changes in one’s practice after hearing a one-time lecture. So I’m always mindful of, “How do we make sustaining change to help our patients and their families?” What I’ve done in the last forty minutes or so of the talk is to share with you how we in neuropsychiatry think about TBI and its co-morbidities as far as the patients that we see in the clinic every day and those that we’re doing work with. I wanted to in the next couple of minutes before we finish and go to questions is to tell you just a real quick brief about what our MIRECC is doing in terms of looking to the future of answering the questions about the neurobiology and the neuropsychology of a brain injury and its co-morbidities. Our MIRECC is based in North Carolina and Virginia. It really is a VISN-wide MIRECC in which we have centers in Hampton, Durham, Salisbury.

We also have other hospitals that work with us in Richmond. What we have is a registry of patients that have volunteered to be not only in our general epidemiology studies, but to also to be called back for other studies that we have going on. We have MIRECC Lab Corps leaders for looking at genetics, “What is the genetics of PTSD?” We have basic scientists looking at the role of the medulla. We have of course a big imaging corps. We have neurological studies going on and neuropsychological studies all happening within our MIRECC, with their center of the MIRECC being in Durham. If you go to our website you’ll see that Durham is the hub and those lab centers are there. Within that we have the ability to call patients back and to enroll them in our studies. I think right now we have if I’m not mistaken about two thousand patients on the registry.

Some of the ones that we’re doing here in Salisbury is that Dr. Taber led us in a study early on in the wars that looked at those primary blast only patients compared to those who’ve had the secondary, the tertiary effect. What we wanted to look at was, “Is there some kind of marker or test that we can look at that we’ll be able to ascertain what happens when you get exposed to that blast wind only.” We looked at PET scans. We looked at TBI. We looked at neuropsychological testing, and we’ve looked at then subsets of those. One of the first papers to come from that as you see where Dr. Taber has lead us through the *Journal of Head Trauma and Rehabilitation* to look at interestingly on diffusion tensor we see that patients in this study in this particular group that have self-reported exposure to a blast injury with no tertiary effects and no secondary effects, had abnormalities on diffusion tenser imaging that very closely mimicked those who did have a more formal diagnosis of, “Yes, you’ve had a primary blast traumatic brain injury with subsequent post-concussive symptoms.” So again it’s small group numbers, but what it does is that it leads us to look in larger groups and it gives us a path to looking further at what happens with exposure to that blast wind.

Another thing that’s going on is the use of magneto and cephalography, which is to look at the magnetic fields that occur when the neurons fire. Jared Rolling in our group is leading our work in this area with the Wake Forest School of Medicine. They’re looking to see with magneto if, “Can we use that as a biomarker to ascertain differences in patients that have PTSD or TBI and those that do not?” Some of his initial findings are that there are differences in a few patients. We also can use those in \_\_\_\_\_ [00:49:44] models to be able to identify the auditory cortex and to be able to understand networking within the brain and how these pathways work. Dr. Rolling’s a good resource if you want to know about a magneto and how that may be used in PTSD and TBI. Through the gracious help of Dr. Sefu and the group with the chronic effects of the Neurotrauma Consortium, he is allowing us to participate with them to further take these studies and primary blast exposed only patients further and to really look at larger groups with the magneto and the diffusion tensor imaging in the neuropsychology test results that we have in this group. We also have a study underway of a virtual patient that will help providers that are new to the system learn how to do those secondary comprehensive TBI exams. We know that there’s a wide range in the providers clinical opinions as they go through the template that I showed you across the country. There are variations in when the clinicians are confirming yes and no. So one of the things that were working on is a template to teach providers how to do that exam and to do it to the ability of what it should be.

We have other studies going along with our MIRECC. I mentioned some of the base studies in the MIRECC. We also have Dr. Marks leading us out of Durham with the \_\_\_\_\_ [00:51:13] study. We’re looking at augmentations of new compounds in PTSD with Dr. Barry Focal, and we have studies in post-traumatic growth and resiliency going on with Dr. \_\_\_\_\_ [00:51:24] as well. We have a huge education site where we provide a lot of patient education and cognition education handouts that all are on our MIRECC site if you want to use them with your patients. We spend a lot of time believing that education is really the answer after a mild concussion. We have also a lot of teaching materials that we’ve developed in terms of how to incorporate imaging into your differential diagnosis and understanding of the patient’s biology after a brain injury. Some of the examples of those that we put on the website include amnestic disorders, PTSD and TBI with headache, anger and irritability, and multiple blast injuries with co-morbidities. Those are case examples. You can to the atlases like you see an example on the page and be able to put it all together, “He had a lesion here. What does this mean in terms of the neuroanatomy, the neurophysiology? What does this mean in terms of warnings for what meds I should and should not use?” All of those are in those case examples.

But of course there’s more that we more that we don’t know than what we do know in terms of brain injury and I’ll leave you to ponder on your own some of the many questions. There’s so much that we don’t know and so little do we know about the incredibly complex human brain and it’s amazing ability to be able to come back and fully function after any kind of injury. It is truly an absolutely amazing organ. I’ve given you also a list of references of places that you can go for further information. On that I’ll turn it back over to Molly and Dr. DePalma and I will stop at this point. Thank you guys so much for listening to me and staying with me through this hour.

Molly: Thank you very much for that very informative presentation. We will now start the Q&A portion. I just want to mention to our attendees real quick that a lot of those doctors that you were referencing in our research studies, we have had those people present for us for this same series. David Sefu in particular comes to mind. And we’ve had a session on BTI, so feel free to go back to our archived catalog and watch those if they’re of interest. For anybody that joined after the top of the hour, you can submit your questions or comments using the question section of your “go to” webinar control panel on the right-hand side of your screen. Just click the plus sign next to the word question. That’ll open up the dialogue box and you can submit any questions or comments. The first question that came in is, “Are there rehabilitation programs focused on cognitive training using computer games for TBI patients?”

Dr. Hurley: Yes there are, and I mentioned three of the examples with the Phoenix group, the San Diego group, and we here use a lot of the computer programs. In our FAP program, functional adaptation and rehabilitation program, we have neuropsychologists that are experts in this area running those programs, and all three do incorporate computerized learning. I tell all of my patients, “Yes, computerized games are very helpful in stimulating frontal cortex,” and to incorporate it into a cognitive rehab program.

Molly: Thank you for that response. That submitter is new to the VA so I highly encourage them to search out some resources from those groups. The next submitter says, “I heard a talk by a Dr. Lewis, who’s retired now, in using Omega 3 fatty acid supplements immediately post-concussion/TBI. What is your opinion of this or other nutritional treatments?”

Dr. Hurley: There’s not been enough true double-blinded placebo controlled trials in which I could really comment as to whether they will be helpful or not. At this point it is not considered standard of care. Even for those of us who don’t have any FDA-approved treatments. So I would suggest on that that the jury is still out. It’s going to be a while before we know if anything is helpful in the immediate arena after an injury.

Molly: Thank you for that reply. The next question is, “For the first Taber study reported, what was the time between injury and diffusion tensor imaging?”

Dr. Hurley: It really varied in our patients, because some of them had served early in the war and some of them had served later. So there was a real variation among the patients. It was certainly at least months, if not two, three years or more afterwards. Remember it’s after they’re discharged in the VA from the military and come into the VA health care system for which we pick up their care and the ability to enroll them in our studies. So with some of them it’s even more years than that. One thing that is important to remember is that for those that were self-report in terms of them saying, “No, I did not bang my head on the steering wheel. I did not bang my head on the side of the jeep.” So that’s really important in terms of after an injury sometimes self-reports in time can change. That’s pretty well mentioned in the paper as well.

Molly: Thank you. The next question is, “Virginia Tech was doing studies on helmet and preventing head injuries. Have there been any advances in this area?”

Dr. Hurley: I am not as much familiar, because that’s with the sports literature. I know that they’re looking a lot in fact with the Wake Forest Bioengineering Department as does the Radiologic Department. I don’t know if they’ve got anything as far as any change to helmets because of it. I know there’s a lot of interest in that in the sports world, but I’m so focused on our veterans that I don’t spend as much time looking at the sports injury literature.

Molly: Thank you for that reply. The next question is, “In speaking about axon breakage, I listened to a lecture that suggested that this breakage may cause a change in the morphology of neurons, perhaps effecting the way patients function. Can you comment on that?”

Dr. Hurley: Yes indirectly. That’s of course a nice simplistic view of what happens, but you’re absolutely correct in what we know about it. What happens is if you go back to the slide that I had is that after that axon breaks, there’s a retrograde degeneration of that axon and it can go further back. So yes if you break enough of them, then your pathways will be disrupted and therefore your functions disrupted. But the thing is that it happens in only tiny spots. So the question with the diffuse axonal injury is how many tiny spots and in what location does it take to get significant clinical symptoms? We’ve all seen in our clinical practices the radiology reports that say “multiple hyperintensities of unknown significance.” So we really don’t know yet how many axonal breakages it takes to get the clinical symptoms. But we know that with enough of them, that we do see symptoms in our patients.

Molly: Thank you for that. We do have another pending question, but we are at the top of the hour. I want to let any of our attendees know if you do need to exit the session, when you do please wait for our survey to populate and please provide your feedback for today’s presentation. We do review those responses and it helps improve our program and topics we provide. For the next question, “For older veterans who experience TBI in earlier battles, for example Vietnam, Korea, WWII, is there research about the long-term impacts of TBI?”

Dr. Hurley: Yes there are studies that look at the long-term effects. I can’t remember the authors of the studies, but they did look at how patients were functioning years after in terms of head injuries from the earlier conflicts. What we know of course is that with the better protective gear that we have now is almost comparing apples and oranges in terms of the effects of the injury itself. Because if you’re more protected now with Kevlar and you’re more protected with the helmets that we have and with the vehicles that are more protected. In some ways it can give us information and in other ways they are very different wars and very different injuries. It’s going to be one of those things where we have to take it as knowledge and learn from it and then say, “How much of this is going to be exactly similar to what we have now?” But yes, there are published papers out there from the earlier conflicts. In fact in most of the patients that I had in my clinics in the late ‘90’s were patients who had had head injuries from the Vietnam era.

Molly: Thank you for that reply. Before we wrap up I just want to give you the opportunity to make any concluding comments you may have Dr. Hurley?

Dr. Hurley: Yes, I want to first thank you and Dr. DePalma for this opportunity and to thank our listeners for hearing us. I hope that I’ve given you some ideas to springboard from, not necessarily to go by my views as any representation of the way the world is, “If I were King for a day, this is how I’d view it.” But to use it as a time to think about if you’re particularly a researcher, what are the next steps that you can do or that I can do to move our knowledge forward to be able to help our veterans? And for those of you that are on the call that have served, thank you for your service. I think I’ll conclude with those remarks.

Molly: Great. I definitely want to thank our attendees for joining us, as well as Dr. DePalma for organizing this series and especially you Dr. Hurley for lending your expertise to the field. This was an invaluable presentation. As I said before for audience members, when you “x” out of today’s session, please click the little box that says, “Yes, I’ll fill out the survey,” and take just a moment to answer just a few questions. We do look at those carefully and it helps us to improve our program and to take suggestions in what we should offer for future sessions. Please keep an eye out in your e-mail and in two days from now you’ll receive a follow-up e-mail with a link leading to this recording. You can pass that along to colleagues. As always keep an eye out for our upcoming sessions, as we do have more TBI presentations on the docket for the coming months. Thanks again to everybody for joining us and this does conclude today’s HSR&D cyber seminar presentation.