

Assessment of Delirium in the Neuro-ICU

(NOTE: These comments made by Dr. E. Wesley Ely to Vanderbilt Neuro-ICU Attendings at Vanderbilt University, June 26, 2015)

At the prompting of your neuro-ICU nurses and nurse practitioners, who recently received in-servicing on CAM-ICU delirium monitoring used throughout Vanderbilt's ICUs, I have come today to discuss the emerging data surrounding delirium in neurologically critically ill patients. By this term I mean predominantly the hypoactive motoric subtype (e.g., think septic encephalopathy), which is much more common than the hyperactive type you think of with drug withdrawal. I hope to leave you with three take home points about delirium in the neurological ICU:

1. Micro-diffuse brain injury on top of an existing macro-focal injury such as ICH,SAH, or ischemic stroke would be missed if not actively monitored for in the ICU.
2. This micro-injury, let's call it Delirium, can be measured with valid and reliable instruments.
3. Delirium is something that matters to our neurologically critically ill patient population in terms of their long-term neurological quality of life outcomes. This is something that we no longer have the luxury to ignore.

If I was a neurosurgeon or a trauma surgeon working with neuro-ICU patients, my first inclination would be to consider this inconsequential. I can hear myself saying, "We have 'bigger fish to fry' in the form of this macro injury—bleeding in the head, or a large ischemic stroke or focal area of trauma." And by the way to all of you neurosurgical ICU caregivers, if you think that way, you are in good company. That's exactly how we used to think in the medical and surgical ICUs. We thought, "We have major shock and multiple organ dysfunction of the liver kidney, lung and heart, so a little delirium (i.e., ICU psychosis or encephalopathy as we used to call the hyper and hypoactive forms of delirium) won't matter on top of all that other injury." But all of our data have proven us wrong and now we know that delirium is an independent predictor of death, increase length of stay, cost of care, and increased likelihood of a dementia-like illness. So why would it be any different in a human being just because they have a stroke. It is inconceivable that with all the data we now have about delirium, that it wouldn't be an exacerbating problem for patients with stroke when layered on as a superimposed injury. Admittedly we need more data but there are investigations upon which to build at the present time.

Three studies are worthy of mention in this field, which is clearly ripe for future study.

1. Mitasova and Bednarik in the Czech Republic studied 129 patients over 1,000 times patient days, all of whom had had been admitted for a stroke. In this stroke unit, the CAM-ICU, which is one of the two major delirium assessment tools recommended by the Society of Critical Care Medicine (SCCM), had an overall accuracy of 94% in diagnosing delirium up against a DSM-IV rater serving as the reference standard. In their investigation (*Crit Care Med.* 2012;40:484-490), delirium was a predictor of increased length of stay and the authors concluded that early and serial increased screening of stroke is feasible and recommended.

2. Naidech et al. from Northwestern University in Chicago (*AM J Respir Crit Med* 2013;188:1331-1337) studied 114 pts with intracerebral hemorrhage (ICH) who were monitored for delirium using the CAM-ICU and then followed at 28 and 90 days and one year. In that investigation, 27% became delirious. Those who had delirium, as compared to the ICH pts who didn't have delirium, were found to have a longer ICU length of stay, worse overall outcomes, and most importantly worse quality of life as measured by the neuro-QOL. The authors concluded that symptoms of delirium were common and predictive of worse functional outcomes and worse neurological QOL.
3. Klein and colleagues from the Cleveland Clinic (presented at SCCM conference and in press) studied 131 patients in the neuro-ICU daily with a DSM-IV rater and with the CAM-ICU and ICDSC, both tools recommended by the SCCM PAD guidelines for daily monitoring of ICU patients. The purpose of this investigation was to see how those tools did in the neuro-surgical ICU population up against the DSM. In the investigation 44% of patients were diagnosed with delirium using the DSM-rater's evaluation and 29% were diagnosed with delirium by both the CAM ICU and the ICDSC. As is known, the CAM-ICU is highly specific, so when positive we know we have delirium but some episodes may be missed. This, taken together with the Mitsova and Naidech studies, give us a very nice set of data upon which we can move ahead using the CAM-ICU or the ICDSC for clinical monitoring and investigations in this population.

CLINICAL EXAMPLE: Importantly, how are we to consider clinically using this tool for doing delirium assessments in patients that we know already have an abnormal neurological exam based on their ICH, subarachnoid hemorrhage (SAH), or stroke. Say a patient comes in with an ICH and they have a post injury abnormal neurological exam with focal findings. That same patient can go on to develop a pneumonia or metabolic problems or hypoxemic circumstances, all of which can lead to a delirium. Now I want you to be thinking of a micro neurological injury on top of the macro-focal injury. When that occurs one might be tempted to say that their abnormal neuro exam (now manifesting inattention or other features of delirium like disorganized thinking or a change in level of consciousness) could be due to the primary admission diagnosis of ICH, but in addition the patient may have a new problem. We must not ignore the possibility of an overlying superimposed micro-diffuse injury which is now manifesting itself as delirium. In our VISIONS MRI studies (Gunther *CCM* 2012;40:2022-32 and Morandi *CCM* 2012;40:2182-89), we learned that MICU/SICU survivors with delirium were more likely to have brain atrophy in the prefrontal cortex and hippocampus as well as white matter abnormalities manifested using fractional anisotropy. These same patients later had more cognitive impairment in terms of executive dysfunction and memory deficits. Moving forward, it will be important to study the hypothesis that part of the long-term deficits we see in survivors of neurological critical illness may be because of unrecognized delirium.

The neuro-ICU nurses at Vanderbilt asked us in 2015 to in-service them on the CAM-ICU so that they could start routinely assessing their patients for delirium. It seems as if they are saying that once they know their patient's post stroke base-line neurological exam, they feel it is important to see if this exam changes over time with the superimposition of delirium. They have stated that this is their clinical chance to identify new micro injury to consider interventional steps to try and reduce any further

deficits in their patient's neurological outcomes, length of stay, costs of care. The data from Mitasova, Naidech, and Klein would indicate that not only is this clinically relevant, but it can be measured at the bedside. Neuro-ICUs are increasingly considering adding this to the tried and true tools of monitoring in the ICU such as the Glasgow Coma Scale.

Invariably an important question is asked by a neuro-surgical or neuro-intensivist audience, which would be that subsequent deficits and/or changes in the neuro exam could be caused by vasospasm or in TBI, since it is known that patients can manifest serial insults after TBI. These are absolutely correct points and should be acknowledged in evaluating the patient in the neuro-ICU, but to attribute all subsequent changes in the exam to those injuries alone would obviously be clinically inadequate and would ignore the possibility of the spectrum of other causes of delirium. Thus in evaluating the patient who becomes CAM-ICU positive, for example, one would need to consider those types of problems in the differential diagnoses (e.g., vasospasm or cyclic injury from TBI) alongside other types of medical, pharmacological or environmental causes for delirium. We use a simple mnemonic called DR.DRE to stand for Diseases, Drug Removal, and Environment. When one is told by a neuro-ICU nurse that the patient has been stable for two days after their stroke and then become CAM-ICU positive for the first time, it would be prudent to consider this differential diagnosis to try and address any reversible non-neurological causes of delirium such as onset of pneumonia, sepsis, congestive heart failure, or hypoxemia for the disease. One would then consider drugs that could be removed, such as any psychoactive medications that they no longer need. One would then consider the environment such as eyeglasses, hearing aids, light, sleep and immobility as the cause of the problem. These things form a constellation of issues that can lead to delirium, as it is very unlikely that the cause is singular. Delirium is not usually an "Ockham's razor" situation.

In conclusion, Neuro-ICUs are increasingly recognizing the importance of monitoring for delirium. This is taking place in both adult and pediatric ICU settings (using the pCAM-ICU or psCAM-ICU or CAP-D for children). Data from adult neuro-ICU investigations indicate that valid and reliable tools are available for delirium monitoring in ICH and stroke patients, as long as the tools are used as a "change over time" monitoring instrument, meaning that the team takes into account the patient's **new post stroke baseline exam** and then watches for any change over time. Data show that the duration of delirium across all types of ICU patients (medical, surgical, cardiac, burn, trauma, and even in neuro-ICU patients) is clinically important and matters to long-term outcomes such as the neurological quality of life (neuro-QOL).