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New Protocols for Pre-Hospital Stroke Care

Lucian Maidan, MD and Stacie Crain, FNP-BC

In the past 5 years, stroke research has led to treatment protocols which have dramatically improved outcomes. Endovascular clot retrieval is among the major advances.

Access to intracerebral vessels via arterial catheter, similar to a cardiac catheterization procedure, allows direct clot removal (thrombo-aspiration) or direct injection of thrombolytics into the clot in cases of ischemic stroke. Still, the time from symptom onset to treatment is critical to the end benefit. Decreasing time to reperfusion increases the probability of a good outcome, which is measured by a Modified Rankin score (mRS) of two or less, at which a patent is able to return to activities they were previously performing.

Large vessel occlusion (LVO), or emergent large vessel occlusion (ELVO), is recent terminology in stroke care. Five landmark studies presented at the International Stroke Conference in 2015 found that patients with an ELVO who received endovascular care with clot removal and restoration of blood flow with near complete perfusion, had nearly double the likelihood of improvement to a mRS <2 compared to patients who were treated with intravenous tPA only.

Determining which patients are eligible for endovascular therapy and completing the treatment rapidly is crucial and requires better ways to predict which patients would benefit. Being able to quickly and accurately screen clinically would both narrow the field of prospective candidates and save precious minutes. The Cincinnati Stroke Scale has been used in prehospital environments for over twenty years. This basic scale is used to teach the public to identify stroke. [FAST – Face, Arm, Speech, Time]. This scale is sensitive for stroke but not necessarily for a large vessel occlusion. Additional scales have been developed to specifically improve the detection of ELVO by adding assessment of vision and gaze deviation, aphasia and a component of neglect, all of which are predictive of large vessel ischemia. These scales are labeled as stroke severity scales and include RACE, LAMS, VAN, FAST-ED, and the Cincinnati Stroke Triage Assessment Tool (CSTAT).

Patients who are positive for a LVO stroke, whether assessed via clinical screening or CT angiography, should be cared for emergently at a facility that has endovascular capabilities. Currently there are 126 Comprehensive Stroke Centers (CSC) in the U.S. and 14 in California, with Mercy San Juan Medical Center being the first CSC in the Sacramento region. The current Emergency Medical Services (EMS) policy in Sacramento stipulates that all stroke patients be transported to the nearest Primary Stroke Center (PSC). However, door to needle times are longer (a national average of 67 minutes) in PSCs when compared to CSCs. After intravenous t-PA is administered at a PSC, qualified patients (those with LVO) are transferred to Comprehensive Stroke Centers. Two separate studies performing mathematical modeling compared this "drip and ship" model to direct admission to an endovascular-capable center and showed that unless the travel times to a CSC were over 45 minutes the "drip and ship" center model was not favorable.

In a recent retrospective study of 8,533 patients treated with endovascular revascularization therapy from 118 centers, a 46% increase in adjusted mortality was detected in transfer patients compared to patients that presented directly to the endovascular-capable center. Another advantage of direct admission to a CSC is that despite the delays in


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Post-Concussive Syndrome

Joel Solomon, PsyD

Education is the most important tool in the management of concussion. If well-managed, the vast majority of concussions resolve fully, without long-term sequelae. In contrast, patients who are not educated about concussion or misunderstand the information they are given can be prone to experiencing a protracted recovery. In the most unfortunate cases, persistent post-concussive symptoms can lead to significant negative psychosocial outcomes, such as loss of job, deterioration of relationships and psychiatric distress. Fortunately, research suggests that early education about concussion, symptoms and prognosis can positively impact recovery.

With this in mind, the following talking points may be helpful in educating patients about concussion and improving outcomes:

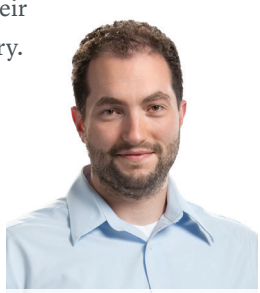
A normal head CT does not mean that an individual does not have a concussion. Patients may incorrectly conclude that a normal CT means they don't have a concussion and then become confused and distressed about their persistent symptoms. A concussion is diagnosed based upon the presence of symptoms following an impact to the head, whereas brain imaging is done to rule out more serious conditions (e.g., bleeding, swelling, skull fractures).

Many symptoms are "normal" in a concussion. Patients may or may not experience an array of symptoms following concussion, including physical symptoms (e.g., headache, sensory sensitivity, nausea, dizziness), cognitive symptoms (e.g., difficulty focusing or remembering), emotional symptoms (e.g., irritability, anxiety, depression), and sleep symptoms (e.g., difficulty falling or staying asleep; sleeping more than usual).

Consider a concussion as analogous to a sprained ankle. Though the analogy isn't perfect, it can provide a familiar template for patients. A sprained ankle is managed by staying off the ankle and resting, then gradually increasing activity, as tolerated. If you do too much on the ankle, your body lets you know through pain. If you keep going despite pain, you may aggravate the injury and suffer a setback. A concussion is managed similarly: rest in the initial stages then gradually increasing activity, as tolerated. As with the ankle, our body tells us if we are doing too much—through onset or worsening of symptoms. Persisting with an activity despite worsening of symptoms is a recipe for symptom exacerbation and slowed recovery.

Symptoms rarely worsen "for no reason." Patients often feel helpless and distressed if their symptoms seem to come on or worsen "for no reason." It can be reassuring and empowering for them to understand how their activity impacts their symptoms. The brain primarily exerts itself in three ways: cognitive activity (e.g., reading, studying, using electronics), physical activity (e.g., exercise, sports), and processing environmental stimulation (e.g., noise, brightness, commotion). Typically, when patients experience onset or worsening of their symptoms, it is due to one or more of these factors.

Patients should stop, take a break, and rest when symptoms begin to worsen, rather than waiting until they "can't take it anymore." Patients often feel that "toughing out" or "pushing through" their symptoms is the quickest path to recovery. Unfortunately, this typically results in symptom exacerbation and setbacks. Rather, they should listen to their body and take more frequent breaks in response to their symptoms. Though this may make them less "productive" in the short run, they



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The Diagnosis and Treatment of Headache

Richard Beyer, MD

Headache is a common malady of the human condition and exacts a significant toll in human suffering and cost to society. Estimated incidence of headaches in women is 17% and in men 6%. Loss of productivity is in the billions of dollars in the US.

Headache can be divided into primary (90%) and secondary (10%) types. The first goal of treatment is to correctly diagnose the headache syndrome both to identify best treatment and also to identify as early as possible deleterious secondary causes to minimize morbidity and possibly mortality. The major semiology of the primary headaches are listed in table 1 and major causes of secondary headaches in table 2. Table 3 lists danger signs for secondary headaches that must be considered.

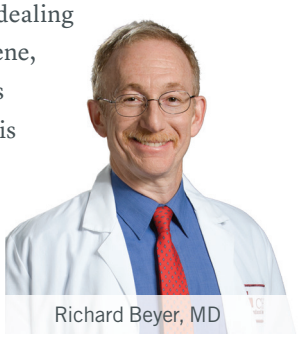
The workup for headaches first involves deciding whether the patient has primary headache or secondary. In the case of the former, no further testing is necessary other than identifying trigger factors or unhealthy lifestyles. Workup of secondary headaches may include laboratory testing or imaging depending on the differential diagnoses developed (table 4). With headaches of less than one year's duration, a neurological exam is imperative. Especially important is ocular funduscopic examination. Papilledema always should be investigated urgently.

Imaging can be beneficial in allaying fears and allowing faster treatment of the headache. However, in up to 30% of cases, incidental findings are uncovered which can stir up anxiety at the least and unnecessary surgeries at worst. Some experts include the discovery of incidental findings and their attendant anxiety provocation as part of the informed consent. If imaging is ordered, MRI would be the preferred modality over CT unless an urgent diagnosis is suspected or the patient uncooperative. Arachnoid or pineal cysts, small aneurysms, non-progressive meningiomas and especially white matter lesions are frequently discovered and often result in referral to the neurologist. White matter lesions are common in migraine and are usually punctate and parietal-occipital, distinguishing them from lesions of MS.

The treatment of headache is of course dependent on the etiology, and the rest of this article will discuss treatment of the primary headaches.

Treatments of primary headaches are divided into acute symptomatic and chronic prophylactic. Table 4 lists acute symptomatic or rescue medications, and table 5 outlines examples of prophylactic medications. As a general rule, prophylactic agents should be considered for headaches occurring one or more times a week or for those for which rescue medication doesn't work well enough. The abundance of choices attests to the only modest efficacy of most of these agents, and hence the wide variety of choices. A trial of at least two and up to three drugs in a class is recommended before moving on to the next group. Common mistakes include not giving the prophylactic drugs enough time to work (TCAs can take up to two weeks for full efficacy) or not pushing them to high enough doses. Monotherapy should be attempted first and if unsuccessful then dual therapy.

Most migraine syndromes will benefit from general lifestyle improvements such as eating better, dealing with stress, insuring good sleep hygiene, and especially aerobic exercise. It has been estimated that aerobic exercise is as effective as any prophylactic. It is recommend that patients work up to 45 minutes per day, five days per work. Keeping a diary of headaches has been shown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will likely recover more quickly than if they repeatedly aggravate their symptoms. Of note, this may cause a great deal of distress, particularly for those who equate rest with "laziness" and self-care with "selfishness."

In some cases, other medical or psychiatric issues may be contributing to a patient's symptoms. For example, neck or back injuries can contribute to headache and sleep difficulty, vestibular dysfunction can contribute to dizziness and imbalance, and psychiatric factors, either pre-existing or post-injury, may exacerbate post-concussive symptoms and hinder recovery. In each of these situations, it is appropriate to refer to specialists for further evaluation and treatment.

Stereotactic Radiosurgery Available at Mercy Cancer Center for Brain Tumors

Cully A. Cobb, MD, FAANS and Ellen Wiegner, MD

Stereotactic radiosurgery (SRS) is non-invasive radiation therapy used to treat both benign and malignant conditions in the central nervous system (CNS). SRS precisely delivers high dose radiation to small targets in the brain and spine while minimizing the exposure to normal tissues. Patients being treated with SRS typically receive one to five outpatient treatments lasting 30 to 60 minutes. In 2014, Mercy Cancer Center in Sacramento was the third center in the world to install the Varian Edge™, the latest and most advanced stereotactic radiosurgery system. Since the installation of the Edge™ Radiosurgery System over three years ago, Mercy Cancer Center has treated a broad spectrum of CNS diseases.

SRS is a highly effective treatment for a variety of malignant CNS tumors. Brain metastases are the most common intracranial malignancy, and radiation therapy is an integral part of treatment. Historically, whole brain radiation therapy (WBRT) has been a standard treatment for brain metastases. WBRT treats the entire brain with a modest dose of radiation therapy and slows intracranial progression of disease and palliates neurologic symptoms. However, patients receiving WBRT are at risk of developing neurocognitive complications in the months to years after treatment. Reducing the risk of treatment complications is increasingly important as patients are living longer with metastatic disease due to advances in systemic therapies. For select patients with a limited number of brain metastases, SRS is an alternative treatment option. Because SRS precisely directs radiation to the tumor while minimizing normal brain exposure, neurocognitive complications and other side effects are uncommon. Therefore, SRS alone is the treatment of choice for the majority of patients with limited number of brain metastases. While brain metastases are the most common malignant CNS tumor treated with SRS, focally recurrent malignant gliomas can also be treated with SRS in highly selected patients. SRS is also increasingly being used to treat metastatic spine tumors either as initial therapy in patients with limited disease or as salvage treatment for recurrent disease after prior surgery or external beam radiation therapy.

SRS is also an effective treatment option for several benign CNS tumors and conditions. Acoustic neuromas (vestibular schwannomas) are the most common benign CNS tumor treated with SRS at Mercy Cancer Center. SRS is a non-invasive alternative to surgical resection for most acoustic neuromas. SRS is effective at stabilizing the majority (>90%) of acoustic neuromas with facial nerve preservation rates >90% compared to >60% after surgical resection. Additionally, hearing preservation (if intact prior to treatment) is at least initially superior after SRS compared to surgical resection. SRS can also be utilized as an alternative for surgery for benign meningiomas with local control rates >90%. While SRS is a treatment option for the majority acoustic neuromas and meningiomas, surgical resection is preferred for larger tumors with significant compression on the adjacent brain and brainstem.

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SRS is also a non-invasive treatment for trigeminal neuralgia. The majority of cases of trigeminal neuralgia are caused by compression of the trigeminal nerve root, most commonly from adjacent vasculature, resulting in intense episodes of facial pain that can be debilitating. When medical therapy is not successful at controlling symptoms or causes intolerable side effects, SRS is a treatment option. SRS targets the trigeminal nerve root with an ablative dose of radiation with the majority of patients (70%) experiencing at least partial improvement in pain and 10-20% experiencing facial numbness after treatment. Arteriovenous malformations (AVMS) represent another benign condition that is amenable to treatment with SRS. While asymptomatic patients are often observed without intervention, patients who are at high risk of hemorrhage from AVM (typically having experienced a prior bleed) are often offered treatment. AVMs not surgically accessible may be treated with SRS resulting in obliteration rates of approximately 50-90% depending on the size and location of the AVM.

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Stereotactic Radiosurgery Available at Mercy Cancer Center for Brain Tumors—continued from page 4

In summary, SRS represents an advanced and effective noninvasive treatment for a variety of malignant and benign CNS tumors and conditions. It requires a coordinated effort among radiation oncologists, neurosurgeons, neuro-radiologists, and radiation physicists to safely and effectively deliver this treatment. Since installing the Varian Edge™ Radiosurgery System 2014, Mercy Cancer Center has treated over 100 patients with this technology.

Pediatric EEG-Video Monitoring Unit (EMU) Comes to Mercy San Juan

Ashutosh Raina, MD

EEG-video monitoring refers to a continuous EEG recorded for a prolonged period of time with simultaneous video recording of the clinical features. By creating a correlation between the recorded behavior (video), and the EEG activity, the diagnosis of seizures or non-epileptic attacks can be made with near certainty in a majority of cases.

Basic techniques, strategies of recording, and interpretation of findings of video EEG monitoring are similar for all patients, regardless of age and suspected etiology of the underlying disorder.

EMU helps characterize and localize spells. It helps answer the following questions:

- Are the episodes epileptic seizures?
- If not, what are they?
- If they are epileptic seizures, what type of epilepsy?
- If the seizures are focal, from where in the brain do they originate?

Indications

Currently, EEG-video monitoring is severely underused, as evidenced by the following: (1) the delay for successful epilepsy surgery is more than 15 years, and (2) the delay for psychogenic non-epileptic attack (PNEA) diagnosis is 7 to 10 years.

Any patient with frequent seizure-like episodes despite antiepileptic drug therapy should have EEG-video monitoring. This can help differentiate epileptic seizures from non-epileptic events so that appropriate treatment can be offered.

Role of EMU in Pediatric Epilepsy

In children and adolescents who have been misdiagnosed as having seizures, only 50% have psychological disorders (90% being PNEA), but other psychiatric diagnoses (e.g., episodic dyscontrol with rage attacks, behavioral outbursts, panic/anxiety disorder, and factitious disorder by proxy) may be present. The other 50% have non-psychogenic conditions, the most common of which is non-epileptic inattention with staring spells. Other diagnoses include stereotyped mannerisms, hypnic jerks, parasomnias, tics, gastroesophageal reflux with posturing or laryngospasm, arousals, shuddering attacks, and apneas. Physiologic and organic events predominate in infants and young children, and psychiatric disorders become much more common during later childhood and adolescence.

Limitations in EEG-Video Monitoring

- Ictal EEG may be negative in simple partial seizures and in some complex partial seizures, especially those of frontal lobe onset.
- Ictal EEG may also be difficult to read if movements generate excessive artifact.

The lack of ictal EEG changes only indicates that the episodes are non-epileptic, and non-epileptic does not always mean psychogenic.

A common myth is that a recorded episode with a negative EEG is all it takes to make a diagnosis of psychogenic non-epileptic attacks. A negative EEG can only be interpreted in the context of the semiology of the attack in question. Thus, both the video and EEG must be available. Some patients with psychogenic seizures also have epilepsy. If the combination is suspected, EMU will be helpful to make a positive diagnosis of each.


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We are excited to announce that Mercy San Juan Medical Center has established its own Pediatric EMU, opening late 2017.

For references, please email **DignityHealthNeuro@DignityHealth.org**.

Recognition of Bacterial Meningitis

Sanaz Abderrahmane, MD

Meningitis is an inflammatory disease of the leptomeninges, the tissues surrounding the brain and spinal cord.


Sanaz Abderrahmane, MD

Meningitis symptoms include subacute onset of fever, headache, and stiff neck. There are often other symptoms, such as: nausea, vomiting, photophobia (increased sensitivity to light) and altered mental status (confusion).

Approximately, 6,000 cases of pneumococcal meningitis are reported in the United States each year. It is among the 10 most common infectious causes of death and is responsible for approximately 135,000 deaths throughout the world each year. High-risk groups include infants under the age of one year, people with suppressed immune systems, travelers to foreign countries where the disease is endemic, and college students and Army recruits who reside in dormitories and other close quarters. 10-15% of cases are fatal, with another 10-15% involving brain damage and other serious side effects.

Bacterial meningitis can be community acquired or healthcare associated:

The major causes of community-acquired bacterial meningitis in adults in developed countries are Streptococcus pneumoniae, Neisseria meningitidis, and, primarily in patients over age 50 to 60 years or those who have deficiencies in cell-mediated immunity, Listeria monocytogenes.

The major causes of healthcare-associated bacterial meningitis are different (usually staphylococci and aerobic gram-negative bacilli) and, in cases occurring after neurosurgery, may vary with whether or not antimicrobial prophylaxis has been given to prevent surgical site infection. Healthcare-associated bacterial meningitis may also occur in patients with internal or external ventricular drains or following trauma (i.e., cranial trauma or after basilar skull fracture with or without clinical evidence of leak of cerebrospinal fluid).

Most types of meningitis are contagious. A person may be exposed to meningitis bacteria when someone with meningitis coughs or sneezes. The bacteria can also spread through kissing or sharing eating utensils or a toothbrush.

A CT scan of the head before LP should be performed in adult patients with suspected bacterial meningitis who have one or more of the following risk factors:

- Immunocompromised state (e.g., HIV infection, immunosuppressive therapy, solid organ or hematopoietic stem cell transplantation)
- History of central nervous system disease (mass lesion, stroke, or focal infection)
- New onset seizure (within one week of presentation)
- Papilledema
- Abnormal level of consciousness
- Focal neurologic deficit

Treatment usually involves intravenous administered antibiotics. The type of meningitis contracted will determine the specific antibiotic used. It is imperative that treatment start as early as possible, in order to avoid brain damage and death.

The most effective way to protect against certain types of bacterial meningitis is to get vaccinated. There are vaccines for three types of bacteria that can cause meningitis: Neisseria meningitidis, Streptococcus pneumonia and Hib.

As with any vaccine, the vaccines that protect against these bacteria are not 100% effective. The vaccines also do not protect against all the types (strains) of each bacteria. For these reasons, there is still a chance you can develop bacterial meningitis even if you were vaccinated.

New Protocols for Pre-Hospital Stroke Care—continued from page 1

transportation, almost twice as many patients receive IV t-PA with shorter door-to-needle times compared to those taken first to a PSC. In March 2017, the American Heart Association published their Mission Lifeline Severity Based Stroke Treatment Algorithm for EMS which supports bypassing a PSC for an endovascular-capable center for patients with a last known well of less than six hours, if the direct transfer would not delay arrival by more than 15 minutes. Overall, the goal is getting patients with an ELVO to an endovascular-capable center as quickly as possible to minimize disability and give the best chance for significant recovery.


Stacie Crain, FNP-BC

The Diagnosis and Treatment of Headache—continued from page 3

to actually decrease the number of headaches, possibly because of more accurate reporting but also because it encourages a sense of control and becomes a self- fulfilling prophecy. Finally, migraineurs have reported food triggers such as tyramine containing foods (pickled foods, red wine, aged cheeses), nitrites (red colored lunch meats, hot dogs), MSG (Asian foods, Hawaiian BBQ, Accent), and excessive caffeine intake.

The Emergency Department treatment of headache is reserved for patients who develop an acute intractable headache who are not known drug seekers. There are multiple mechanisms for triggering pain in migraine, and in these patients all those systems are firing at once and hence the treatment is directed at interfering with those multiple mechanisms. For example, there is excess production of glutamate, NMDA, serotonin, dopamine, and inflammatory cytokines and at the same time dehydration and exhaustion of protective chemicals such as GABA (table 6).

And for chronic migraine (migraine for 15 or more days of the month) Botox has been shown to be safe and effective. Opiates have no role in treatment and indeed have been shown to increase length of stay in the ED and increase relapse rates. Once the headaches are brought under control, prophylactic medication should be prescribed.

Finally, promising new treatments include Calcitonin Gene Related Peptide Antibody which blocks the peptide that seems to promote pain in the Trigeminovascular system, which is regarded as a major linchpin of the cause of migraines. Currently available are non-drug treatments including vagal nerve stimulation, Transcranial Magnetic Stimulation, and External Trigeminal Nerve Stimulation which generates a nonpainful stimulation over the forehead and is applied for 20 minutes once daily.

TABLE 1 – Primary Headache Types

Migrane	**Tension Type**
Common	**Trigeminal autonomic cephalgias**
Classic	Cluster
Complicated	Hemicranias (classified by duration of paroxysmal pains)
Chronic (>15 days per month)	**Medication overuse headache** (Untreatable until short acting pain med stopped)

TABLE 2 – Secondary Causes of Headache

Mass lesion	Post-concussion headache
Subarachnoid hemorrhage	Acute angle closure glaucoma
Temporal arteritis	Uveitis
Arterial dissection	Diabetic cranial neuropathies
Benign intracranial hypertension	Shingles (pain precedes vesicles by up to three days)
Reversible cerebral vasoconstriction syndrome	Abuse
Obstructive sleep apnea	

TABLE 3 – Danger Signs of Secondary Headaches

Aggravation by Valsalva or sleep	Worst headache of life
New onset of headache	Focal neurologic findings
Sudden onset of headache	Change in personality or confusion
Change in headache pattern	

TABLE 4 – Acute Symptomatic Medicines

Triptans (Only difference is length of duration and speed of onset)	**Dihydroergotamine (parenteral or nasal)**
NSAID	**Treximet (Sumatriptan + naproxen)**
Acetaminophen	**Hydroxyzine bedtime**
Isometheptene/ dichloralphenazone (Midrin)	**Butalbital (no more than twice per week)**

TABLE 5 – Prophylactic Treatments

Tricyclic antidepressants	Gabapentin (not verified in controlled study but anecdotal reports) Pregabalin
Selective serotonin and norepinephrine reuptake inhibitors	**Cyproheptadine**
Beta blockers	**Calcium channel blocker**
Anticonvulsants	**Angiotensin receptor blocker**
Topiramate	**Nutroceuticals**
Valproic acid	Riboflavin, coenzyme Q10, magnesium, petasites (butterburr root)

TABLE 6 – ED Treatment of Intractable Headache

IV Saline: 1-2 liters initial bolus to start	IV valproic acid if above not working
Magnesium Sulfate: 500 mg to 1 gm	IV dexamethasone: prevents recurrence for 72 hours
Metoclopramide or prochlorperazine pretreated with diphenhydramine	Dihyroergotamine 1 gm q 8H and admit if above not working: 3-5 days
Ketorolac: 60 mg more effective than 30 mg	

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New Stroke Systems of Care: Time for a Change

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