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Evidence-based summaries of the latest clinical neurology research

ABSTRACT & COMMENTARY

Episodic Vertigo? Consider and Treat as Vestibular Migraine

By Dara G. Jamieson, MD

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Dr. Jamieson reports no financial relationships relevant to this field of study.

SYNOPSIS: Vertigo is a common and integral component of migraine and occurs with neuro-otologic abnormalities and psychiatric comorbidities. Treatment of episodic vertigo suspected to be due to vestibular migraine should mirror the multimodality treatment of migraine.

SOURCES: Beh SC, Masrour S, Smith SV, Friedman DI. The spectrum of vestibular migraine: Clinical features, triggers, and examination findings. *Headache* 2019;59:727-740.
Lampl C, Rapoport A, Levin M, Brautigam E. Migraine and episodic vertigo: A cohort survey study of their relationship. *J Headache Pain* 2019;20:33.
Lapira A. Vestibular migraine treatment and prevention. *HNO* 2019;67:425-428

Beh et al published a retrospective chart review of 131 patients (105 women) with vestibular migraine (VM) seen at the University of Texas Southwestern Medical Center Vestibular & Neuro-Visual Disorders Clinic from August 2014 until March 2018. The 2012 International Headache Society — Bárány Society definition of VM used for the diagnosis is essentially a migraine with vestibular symptoms such as vertigo, dizziness, visually induced or head-motion vertigo/dizziness, positional vertigo, oscillopsia, visual lag, and postural symptoms. The mean age at onset of VM was 44.3 (± 13.7) years.

Prior to developing vestibular symptoms, most of those with VM had a history of migraine (57.3%) and motion sickness (61%). About half of the patients with the diagnosis of VM had the concurrent development of migraine and vertigo. A known family history of migraine (51%), especially with vertiginous features, and episodic vestibular symptoms (28%) were common. Vestibular migraine triggers were similar to known migraine triggers and included stress, bright lights, change in weather, and sleep deprivation. Common ictal symptoms were vertigo with photophobia, phonophobia, nausea,

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aural symptoms (e.g., tinnitus, ear fullness, muffled hearing), and headache. Vestibular migraine was associated with "Alice in Wonderland" syndrome of dysperceptions with extrapersonal misperceptions (e.g., out-of-body experience, derealization) and visual distortions in 7% and somesthetic distortions in 3% of those with VM. The majority of VM patients experienced dizziness between migraine attacks triggered by vision (89%) or head motion (66%), and 51% of patients with VM had persistent dizziness. Anxiety (70%) and other psychiatric comorbidities were common: depression (40%), insomnia (29%), phobias (11%), and psychogenic disorders (8%). The interictal neuro-otologic examination was abnormal in 43%, usually manifesting as nystagmus induced by hyperventilation, head-shaking, vibration, or position. Although gait and conventional Romberg testing usually were normal, the sharpened Romberg test (standing with feet tandem with eyes open and then eyes closed) was abnormal in 17% of patients. Brain imaging was normal or revealed incidental, unrelated findings.

Lampl et al investigated the common co-occurrence of migraine headache and vestibular-type episodic vertigo (eV) using data from 487 adult participants in a questionnaire-based survey ("Migraine and Neck Pain Study"). Almost one-third of the total migraine participants (73% female, mean age 38 years) reported eV anytime during the migraine attack: 3% in the premonitory phase, 10% within two hours prior to the headache, and 16% at the start of the headache. Episodic vertigo did not disproportionately affect patients with migraine with aura (25%) compared with migraine without aura (31%). The authors concluded that "the symptom of eV is more of a headache phase phenomenon, rather than prodromal." They predicted that eV episodes can be shown to satisfy the diagnostic criteria for VM.

In a review of the diagnosis and treatment of VM, Lapira wrote that VM probably represents the second most common cause of vertigo after benign positional vertigo and is the most common cause of eV. The symptomatic overlap between VM and the less common Ménière's disease include episodic vertigo, sensorineural hearing loss, and tinnitus. Lapira stated that VM is associated with more prolonged vertigo and imbalance than Ménière's disease. Other symptoms pointing toward VM included: photo- or phonophobia; non-progressive sensorineural hearing loss; and a history of motion intolerance, dizziness around the menstrual cycle, and/or childhood benign positional vertigo. The coexistence of VM and anxiety is established with an acronym "MARD" (migraine–anxiety-related dizziness). Treatments for VM include diet and behavior modification; abortive migraine medications; migraine preventive medication such as low-dose tricyclic antidepressants, calcium channel blockers, beta-blockers, or topiramate; and vestibular rehabilitation.

■ COMMENTARY

Vertigo and dizziness are especially frustrating symptoms for neurologists to treat and patients to endure because of their debility, subjective nature, and lack of distinct diagnostic markers or specific effective therapies. However, if the linkage between vertigo/dizziness and migraine is recognized, especially in middle-aged women in whom VM is more prevalent, then migraine treatment strategies may prevent episodic vertigo/dizziness, with or without other migraine symptomatology.

Beh et al noted that the varied and somewhat bizarre nature of the complaint in patients with VM may seem to point to a purely psychiatric etiology and that, "It is therefore vital for neurologists to recognize the clues that can help them correctly diagnose and treat this common disorder." The realization of a vertigo/dizziness–migraine connection can dispel the tendency to trivialize the sensation, which may occur especially when the patient's description is of a nonspecific or vaguely categorized dizziness, as opposed to the more validated description of vertigo. The correlating abnormalities found on neurological examination, including the sharpened Romberg test, as described by Beh et al, are helpful in establishing the diagnosis of VM, without resorting to brain imaging that is likely to be unrevealing. Lampl et al proposed that vertigo should join the environmental sensitivities to light, sound, and smell as a symptom

integrated into the headache itself. An analogy could be made that vertigo is sensitive to environmental movement. Whether the abnormal sensation associated with migraine is premonitory, aura-related, or integral is of academic but not practical interest, as complaints of vertigo/dizziness, either episodic or chronic, should initiate patient-directed questions related to migraine phenomena, with the goal of migraine-directed treatment if an association is found. If you hear episodic "vertigo" or "dizziness," consider migraine. ■

ABSTRACT & COMMENTARY

Clinical Features of Subdural Fluid Collections With Intracranial Hypotension

By Matthew S. Robbins, MD, FAAN, FAHS

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Dr. Robbins reports no financial relationships relevant to this field of study.

SYNOPSIS: Clinical features of patients with spontaneous intracranial hypotension and bilateral subdural fluid collections differ from patients who sustained previous head trauma vs. those with cerebrospinal fluid leaks.

SOURCE: Kim JH, Roh H, Yoon WK, et al. Clinical features of patients with spontaneous intracranial hypotension complicated with bilateral subdural fluid collections. *Headache* 2019;59:775-786.

Subdural fluid collections are a radiographic finding in patients who have both spontaneous intracranial hypotension (SIH) and other causes, most notably head trauma. Subdural fluid collections may progress to or evolve from chronic subdural hematomas. Distinguishing between etiologies is critical to ensure that such patients receive the correct diagnosis and treatment.

Kim et al performed a single-center, retrospective study of all patients presenting to their center in Korea with symptomatic, bilateral subdural fluid collections. They excluded any patients with prior neurosurgical intervention or acute subdural hematomas. They stratified their sample into two groups: one group fulfilled the *International Classification of Headache Disorders*, 3rd edition, diagnostic criteria for headache attributed to SIH, and the other group did not fulfill these criteria. Then, the authors compared clinical, radiological, and outcome data.

The authors' final dataset included 62 patients with bilateral symptomatic subdural fluid collections, among whom eight patients (13%) had SIH. SIH patients were significantly different from non-SIH patients, including younger age (odds ratio [OR], 0.831; 95% confidence interval [CI], 0.743-0.929; $P = 0.0012$) and fewer medical comorbidities (OR, 0.062; 95% CI, 0.007-0.544; $P = 0.0121$). On neuroimaging, patients with SIH were more likely to feature brain sagging (OR, 10.36; 95% CI, 0.912-93.411; $P = 0.0017$), pseudo-subarachnoid hemorrhage (OR, 15.6; 95% CI, 2.088-116.52; $P = 0.0074$), and smaller subdural fluid collections (OR, 0.719; 95% CI, 0.579-0.893; $P = 0.0029$). A more detailed analysis using receiver-operator characteristics yielded cutoffs of age (≤ 55 years) and total depth of subdural fluid collections (≤ 22.08 mm).

Among the eight patients with SIH, four had orthostatic headache. Three patients had pseudo-subarachnoid hemorrhage on initial CT imaging. Cerebrospinal fluid (CSF) leak sources included nerve root sleeves (5), CSF-venous fistulas (2), and a ventral dural tear (1). Most patients underwent targeted (4) or non-targeted lumbar (3) epidural blood patches, and one patient had neurosurgical drainage, did poorly, and was the subject of a separate case report. The authors concluded that bilateral subdural fluid collections associated with SIH were more likely to feature a younger age, fewer comorbidities, smaller size of subdural fluid collections, and imaging suggestive of brain sagging or pseudo-subarachnoid hemorrhage.

■ COMMENTARY

SIH is a disorder featuring low CSF pressure or volume typically secondary to a CSF leak in the spine. Although it is not a common disorder, increasingly it has been recognized as an important diagnostic consideration of the syndrome of new daily persistent headache (which itself may have up to a 0.1% population prevalence) and is highly disabling. Myriad radiological findings related to the loss of brain buoyancy and venous engorgement, including but not limited to diffuse, smooth, pachymeningeal

enhancement, often are diagnostic. However, many patients have more subtle brain or spine abnormalities or only may have unenhanced CT imaging where subdural fluid collections are noted.

The presentation of patients who typically have headache accompanied by the finding of bilateral subdural fluid collections, or hygromas, is an occasional reason for neurological or neurosurgical consultation on an inpatient or outpatient basis. The authors divided the etiologies into SIH and non-SIH causes, which typically include traumatic head injury or spontaneous collections that develop in the setting of anticoagulant or antiplatelet agent use. Although the clinical features distinguishing between the causes may be intuitive to some neurologists, such patients initially present to the emergency department, where rapid treatment decisions need to be made, particularly regarding any neurosurgical intervention.

A proper diagnosis in this patient population requires a detailed history. Patients with SIH often have an orthostatic, new, daily persistent, exertional, or "second half of the day" headache, but auditory and vestibular symptoms also are extremely common. Patients with bilateral subdural collections from other etiologies typically are older, have had closed head trauma or a recent fall, or are taking medications that increase the risk of bleeding. They also may be entirely asymptomatic and the collections, often labeled as hygromas, may be incidental findings or the sequelae of previous subdural hemorrhage.

Neurosurgical drainage of subdural collections or hematomas when the etiology is SIH may lead to clinical deterioration in some patients, so diagnostic clarity remains critical in ensuring effective and safe treatment. An area that needs further exploration is the clinical presentation of patients with SIH, with and without subdural fluid collections. It is reasonable to hypothesize that subdural fluid collections could become space-occupying lesions themselves and change the expression of headache in patients with SIH. ■

ABSTRACT & COMMENTARY

Essential Tremor and Dystonic Tremor: Similar Appearance but Different Cerebral Networks

By Claire Henchcliffe, MD, DPhil

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Dr. Henchcliffe reports she is a consultant for Amneal Pharmaceuticals, Prevail Therapeutics, and US WorldMeds, and receives grant/research support from Biogen.

SYNOPSIS: Using MRI BOLD and seed-based functional connectivity, during a grip-force task, network-level connectivity was shown to be highly distinct between two otherwise phenotypically overlapping tremor types — dystonic tremor and essential tremor.

SOURCE: DeSimone JC, Archer DB, Vaillancourt DE, Wagle Shukla A. Network-level connectivity is a critical feature distinguishing dystonic tremor and essential tremor. *Brain* 2019;142:1644-1659.

DeSimone et al examined 20 subjects with dystonic tremor (DT), 18 with essential tremor (ET), and 18 control subjects without tremor, using clinical diagnosis as the gold standard. Of the 20 with DT, 19 had cervical dystonia with a head tremor; of these, 13 also had tremor in the arms/hands. One had spasmodic dysphonia and unilateral upper limb tremor. Groups were well-matched for age, although disease duration was very different between those with ET (23.0 ± 21.0 years) and DT (6.5 ± 6.3 years). Medications were withdrawn overnight prior to MRI to minimize their effects on the studies. Previously, visual feedback was known to augment force tremor in ET. In this study, the investigators demonstrated that this also is the case for DT, allowing them to use different visual feedback conditions to manipulate tremor during neuroimaging procedures. MRI-based measures in this study were made during a grip-force task performed under high and low visual feedback conditions and comprised blood oxygen level-dependent (BOLD) signal amplitude and seed-based determination of functional connectivity.

Reduction in BOLD amplitude occurred in both ET and DT patients compared with controls in the cerebellum and cortex, but in distinct patterns. Reduction was greater in ET than DT in sensorimotor, visual, and mesial premotor cortex and in the inferior parietal lobule, whereas reduction was greater in DT than ET in the middle frontal gyrus. Functional

connectivity was markedly abnormal in DT and ET compared with controls, based on seeding from the dentate nucleus, ventral intermediate thalamic nucleus, globus pallidus pars interna, and sensorimotor cortex. However, abnormalities were much more widespread in DT than ET, involving higher level cortical regions, basal ganglia, and cerebellum irrespective of seed location. By combining specific measures, this approach achieved 83% sensitivity and 65% specificity in distinguishing ET and DT, with area under the curve (AUC) of 0.77 in the ROC analysis. By including all regions of interest measured under high and low visual feedback conditions, this improved to 78% sensitivity and 100% specificity, with AUC = 0.89.

■ COMMENTARY

ET is a common cause of tremor that affects an estimated 7 million individuals in the United States. Although its presentation is variable, it is important to make an accurate diagnosis given the potential for not only pharmacologic but also surgical therapies, the latter including the highly effective deep brain stimulation and, more recently, MRI-guided focused ultrasound. However, DT, occurring in a part of the body affected by dystonia or in a part of the body not affected by dystonia, may mimic ET. It is less common, less well-recognized, and is important to distinguish from ET both for practical considerations when advising patients on standard of care, as well as from a clinical research perspective.

DT and its underlying mechanisms are not well understood. Current diagnosis depends on clinical acumen and there is no diagnostic test. Therefore, clinicians must pay close attention to tremor characteristics and "company kept," meaning examining for signs of dystonia that may in many cases be variable and/or subtle. There are several key findings from this innovative study. First, as in ET, visual feedback worsens DT tremor in the force task used, and this seems likely related to impaired functional connectivity of a number of structures with the visual cortex. Second, specific abnormalities in BOLD changes during activation were noted in DT, that overlap with previous data on specific isolated dystonias and are distinct from ET. Third, changes in functional connectivity also distinguish DT and ET, with more widespread deficits in DT. These novel findings not only serve as a first step to better understand the underlying mechanisms of DT but also may boost efforts to diagnose and eventually provide better treatment. ■

ABSTRACT & COMMENTARY

Statin Use Moderately Reduces Dementia Risk After Concussions in Older Individuals

By Makoto Ishii, MD, PhD

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Dr. Ishii reports no financial relationships relevant to this field of study.

SYNOPSIS: In a large population study, concussion in older adults resulted in significantly higher risk for dementia that was modestly reduced among those taking a statin.

SOURCE: Redelmeier DA, Manzoor F, Thiruchelvam D. Association between statin use and risk of dementia after a concussion. *JAMA Neurol* 2019; May 20. doi: 10.1001/jamaneurol.2019.1148. [Epub ahead of print].

Due to the strong association of traumatic brain injury with chronic traumatic encephalopathy, concussions are a growing concern, especially for young adults playing contact sports. However, the long-term risk for dementia in older adults diagnosed with a concussion and whether any medications can affect this risk are not clear. Therefore, Redelmeier et al conducted a large population-based, double cohort study using linked databases to examine if statin and other medication use was associated with an increased or decreased risk of dementia in older adults after a concussion.

Over a 20-year period (April 1, 1993, to April 1, 2013), patients 66 years of age and older who were diagnosed with a concussion were identified based on physician billing data using the ICD-9 code from the Ontario Health Insurance Plan. To reduce confounding from severe brain injury, patients who were admitted to a hospital within two days of a concussion or who survived less than 90 days were excluded. To reduce confounding from past neuropsychiatric conditions, patients with a history of dementia or delirium in the prior five years were excluded. The Ontario Drug Benefit Program database provided

data on the prescription status of statin and other medications. The primary study outcome was a physician diagnosis of dementia based on ICD-9 codes.

Redelmeier et al identified 28,815 patients (median age, 76 years; 61.3% female) with a diagnosis of concussion, with 7,058 patients (24.5%) receiving a statin during the 90 days after a concussion. The demographic characteristics were similar between patients receiving statins and those who did not. A total of 4,727 patients in the study developed dementia over a mean follow-up of 3.9 years after a concussion. Statin use was associated with a modest 13% (95% confidence interval [CI], 7%-19%; $P < 0.001$) reduced risk of dementia compared with patients who did not receive a statin (relative risk, 0.87, 95% CI, 0.81-0.93; $P < 0.001$). After adjusting for all baseline characteristics, statin use was associated with a 16% (95% CI, 10%-22%; $P < 0.001$) reduction in risk of subsequent value.

Reduced dementia risk was specific to statins, as no other lipid-lowering or cardiovascular medications were associated with a consistent decrease in dementia risk, with the possible exception of angiotensin II receptor blockers. Additionally, benzodiazepines, thyroid supplements, gastric acid suppressors, inhaled bronchodilators, and glaucoma eye drops were not associated with a decreased risk of subsequent dementia. Secondary analyses found the largest risk reduction with rosuvastatin and smallest with simvastatin. Similarly, hydrophilic statins (i.e., rosuvastatin and pravastatin) were more beneficial than lipophilic statins (i.e., all other statins). A higher dosage of statins had similar benefits as a lower dosage of statins. Furthermore, in a parallel analysis investigating the dementia risk after an ankle sprain found that statin use was associated with only a 5% (95% CI, 3%-8%; $P < 0.001$) reduction in the risk of dementia. Finally, statin use was associated with an insignificant increased risk of depression after a concussion.

■ COMMENTARY

A major strength of this study is the relatively large sample size with long follow-up. This possibly was a result of the investigators leveraging a large population in Ontario with universal healthcare that was linked to multiple databases. Additionally, because of these databases, the investigators were able to conduct detailed statistical analyses on the nuances of statin use (e.g., specific statin, type of statin, dosage of statin, etc.) that often are unavailable in similar studies. Another significant strength is the use of a second cohort to investigate the association of statin use and the development of dementia in patients after an ankle sprain, which helped to effectively differentiate the stronger beneficial effect of statin use specifically after brain injury.

Although this study is well designed, there are significant limitations that should be noted. First, this was not a randomized trial. There may be significant confounders due to earlier indications for statin use. Additionally, several important covariates, including smoking history, daily exercise, and other factors that may affect dementia risk, were missing from the dataset. Although ICD-9 codes for concussion are more reliable than using self-reported measures, diagnosis codes for concussion and dementia are not fully sensitive and may underestimate the true incidence. This study also would miss any patients who had a concussion but never received medical attention. Finally, since the study relied on the use of aggregate data and broad diagnostic codes of concussion and dementia, which are highly varied disorders, it is not clear if the results could be translated to clinical care at an individual patient level. ■

ABSTRACT & COMMENTARY

EEG Reactivity for Prediction of Neurological Outcomes After Cardiac Arrest

By Peter B. Forgacs, MD

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Dr. Forgacs reports no financial relationships relevant to this field of study.

SYNOPSIS: This prospective, multicenter cohort study aimed to determine the utility of electroencephalographic reactivity (EEG-R) testing in neurological prognostication of comatose patients after cardiac arrest. The authors found that EEG-R testing, by itself, is not sufficiently reliable to predict neurological outcomes after cardiac arrest.

SOURCE: Admiraal MM, van Rootselaar AF, Homeijer J, et al. EEG reactivity as predictor of neurological outcome in postanoxic coma: A multicenter prospective cohort study. *Ann Neurol* 2019; May 24. doi: 10.1002/ana.25507. [Epub ahead of print].

Neurological prognostication in patients who regain consciousness immediately after cardiac arrest remains challenging. Current standard clinical practice guidelines recommend a multimodal approach in assessment of neurological prognosis after cardiac arrest, including bedside examination (i.e., presence of brainstem reflexes), evidence of cortical (N20) response on somatosensory-evoked potential (SSEP) examination, laboratory markers of neuronal injury (i.e., levels of neuron specific enolase [NSE]), and imaging evidence (CT and/or MRI) of overwhelming neuronal injury. In addition, the value of many electroencephalographic (EEG) features increasingly is explored in assessment of comatose postcardiac arrest patients, particularly since continuous EEG monitoring became standard of care as part of various targeted temperature management (TTM) protocols. Among these features, lack of EEG-R is considered one such important indicator for poor outcome. In fact, all major U.S. and European guidelines include EEG-R as a prognostic marker after cardiac arrest. However, none of these guidelines, including the American Clinical Neurophysiology Society (ACNS) Standardized Critical Care EEG Terminology, provide specific descriptions of stimulus administration during testing or precise definitions for determining presence or absence of EEG-R. Furthermore, most studies assessing the relationship of EEG-R and clinical outcomes either have been relatively small or designed retrospectively with variable results. Consequently, the value of EEG-R in neurological prognostication after cardiac arrest remains unclear.

In this large, multicenter, prospective cohort study, Admiraal et al used a rigorous standardized protocol for testing of EEG-R. A total of 160 patients were enrolled in three Dutch hospitals, and EEG-R was assessed twice daily while patients underwent continuous EEG monitoring. The protocol for EEG-R testing included a fixed set of auditory, visual, tactile, and noxious stimuli employed three times in a row at each evaluation. Three experienced EEG readers blinded to all clinical variables and patient outcomes independently assessed EEG-R, defined as a change in EEG amplitude or frequency at least twice in response to any of the stimuli. Increased muscle activity or stimulus-induced rhythmic or periodic discharges (SIRPIDS) were not considered as EEG-R. If the raters disagreed, a majority vote was used to decide the presence of EEG-R. As a secondary analysis, EEG-R also was re-evaluated in a consensus meeting in cases without unanimous decision. Thresholds for accurate prediction of good or poor outcomes were predefined based on the presence or absence of EEG-R, respectively, both using EEG-R alone or added to a multimodal prediction algorithm. Multimodal assessments included brainstem reflexes, N20 response of SSEP at 72 hours, and graded EEG categories based on background abnormalities in addition to EEG-R.

The main findings of the study showed that the absence of EEG-R predicted poor outcome with a specificity of 82% (below the predefined > 95%) and a sensitivity of 73%, while the presence of EEG-R predicted good outcome with a specificity of 73% (below the predefined > 80%) and a sensitivity of 82%. When EEG-R was added to a multimodal model, specificity of poor outcome prediction increased only marginally (from 98% to 99%), and specificity of good outcome prediction increased moderately (from 70% to 89%). Notably, while inter-rater reliability was relatively good, there was poor agreement between the majority vote vs. the consensus meeting (ICC of 0.40). Thus, the authors concluded that EEG-R testing alone is not sufficiently reliable for neurological outcome prediction after cardiac arrest. In addition, EEG-R has no substantial added value to multimodal assessments for poor outcome prediction, but it may add value to the prediction of good outcomes.

■ COMMENTARY

This is the first, prospectively designed, large, multicenter study assessing the value of EEG-R in neurological prognostication after cardiac arrest. Even though EEG-R is recommended by practice guidelines as an appropriate indicator for outcomes in patients who remain comatose after severe anoxic brain injury, there have been no previous studies of this scale assessing its prognostic value using a standardized, prospectively designed protocol. The results of this study suggest that even using a carefully executed protocol with a systematic approach, EEG-R is not sufficiently reliable to predict neurological outcomes in post-cardiac arrest patients.

Major efforts are devoted to find early but accurate tools for assessing neurological recovery after cardiac arrest. Recent advancements in acute medical care and novel therapeutic interventions, such as various targeted temperature protocols (including therapeutic hypothermia), have led to improved survival and better neurological outcomes after severe anoxic brain injuries. Nevertheless, in current clinical practice, withdrawal of life-sustaining therapy (WLST) decisions continue to drive mortality in patients who do not regain consciousness readily after cardiac arrest. Therefore, the results of most studies assessing prognosis carry the risk that self-fulfilling prophecies may

affect the outcomes and limit the interpretation of results. While the ratio of WLST was relatively low and EEG-R findings were not used in clinical decision-making, the results should be interpreted with caution. This study underscores the immense continued need for additional studies to develop highly precise and reproducible clinical or diagnostic assessments for accurate early neurological prognostication of comatose post-cardiac arrest patients. ■

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CME QUESTIONS

1. **Which of the following, all associated with vestibular migraine, is found most commonly in these patients?**
   a. Family history of migraine
   b. Alice in Wonderland syndrome
   c. Anxiety
   d. Head-shaking-induced nystagmus
2. **Which of the following clinical features helps to distinguish a patient with subdural fluid collections and intracranial hypotension from one with chronic subdural hematoma?**
   a. Unilateral vs. bilateral fluid collections
   b. History of head trauma or recent falls
   c. MR imaging signs of brain sagging
   d. Severity of the daily headache
3. **Which of the following best describes differences between essential tremor (ET) and dystonic tremor (DT)?**
   a. Visual feedback augments tremor in a force grip task in ET but not DT.
   b. Changes in MRI BOLD measures occur in the cortex and cerebellum in DT, but in the cerebellum alone in ET.
   c. Functional connectivity deficits are more widespread in DT than ET, and involve cortical regions, basal ganglia, and cerebellum.
   d. Differences in network level connectivity achieve lower than 50% sensitivity and specificity in classifying patient groups between ET and DT.
4. **Based on the recent study examining the association between statin use and the risk of dementia after a concussion, which of the following is *false*?**
   a. Statins, but no other lipid-lowering medications, were associated with a decreased risk of dementia after a concussion.
   b. Compared to all other statins, rosuvastatin had the highest benefit in reducing the risk of dementia after a concussion.
   c. A higher dosage of statins led to a greater benefit in reducing the risk of dementia after a concussion.
   d. Statins had a significantly greater benefit in reducing the risk of dementia after a concussion compared to after an ankle sprain.

CME OBJECTIVES

Upon completion of this educational activity, participants should be able to:

- discuss current scientific data regarding the diagnosis and treatment of neurological disease;
- discuss the pathogenesis and treatment of pain;
- describe the basic science of brain function;
- discuss new information regarding new drugs for commonly diagnosed neurological conditions and new uses for traditional drugs;
- identify nonclinical issues of importance for the neurologist.

[IN FUTURE ISSUES]

Treatment of Stroke