TEXAS NEUROLOGICAL SOCIETY JANUARY 2026

Broca's Area

The Voice of Texas Neurology

President's Message

President Katie Hendley, MD
Lubbock

As we come to the closing of another year, I am happy to reflect on an exciting year in the Texas Neurological Society and highlight upcoming opportunities for our membership..

First and foremost, I want to celebrate a victory for neurology and public health in Texas: the passage of Proposition 14 (DRPIT). This measure, approved during the recent election, provides for a dedicated $3 billion budget toward dementia research and prevention initiatives. For our community of neurologists — and more importantly, for the many Texans and families affected by dementia — this is a tremendous step forward. The funding will support cutting-edge research, improved care pathways, early detection, and community outreach aimed at reducing the burden of dementia across our state. I believe this initiative will not only accelerate scientific progress but also help our practices improve patient care and support families in meaningful ways.

I am also excited to invite you to our upcoming Texas Neurological Society Annual Winter Conference, held in Austin, Texas from January 29–February 1, 2026. This conference has always served as a valuable gathering for neurologists from across Texas — from seasoned specialists to early-career practitioners and trainees — and this year promises to uphold that tradition with both academic depth and community spirit.

Beyond the academic program, the conference offers ample time for social connection and professional networking. A couple of events are new to the agenda this year: a Saturday morning Fun Run/Walk, and a fantastic fundraising event on Saturday night to benefit the newly created TNS Foundation. Both events will provide an opportunity to gather, build relationships, celebrate and support each other in fun ways that weekend.

I encourage every member — whether you practice in an urban center, a rural community, or are still in training — to consider attending. This conference represents an excellent opportunity to stay current on developments in neurology, connect with colleagues statewide, and contribute to the growth and unity of our society.

The future is bright for neurology in Texas! Thank you for your ongoing dedication to patient care, education, research, and community. I look forward to seeing all of you in Austin.

Sincerely,

Katie Hendley
President, Texas Neurological Society

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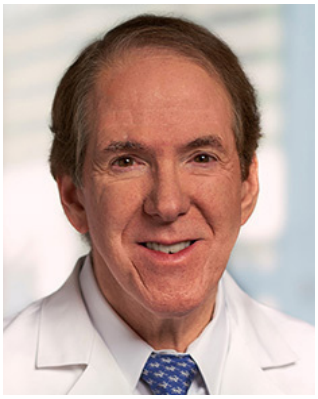


RANDOLPH W. EVANS, MD

This Issue

I thank our officers and other contributors for their excellent submissions to this issue. We look forward to seeing you at the TNS Winter Conference at the Hyatt Regency in Austin January 29-February 1, 2026. Program director Joseph Imbs; Erin Furr-Stimming, chair; and the education committee have planned an excellent program.

Homo Sapiens: Perhaps 300,000 Years and 500,000 Languages

As neurologists, we deal with language pathology. Many of us are fascinated with the development of language. I highly recommend archeologist Steve Mithen's book, "The Language Puzzle: Piecing Together the Six-Million-Year Story of How Words Evolved" (Basic Books, 2024, 544 pages).

Archaic homo sapiens appeared perhaps 300,000 years ago and early modern homo sapiens perhaps 200,000 years ago. I also recommend that you watch paleoanthropologist Ella Al-Shamahi's recent 5-part series, "Human" on PBS ("Nova") exploring the origins of homo sapiens using new fossil and DNA evidence filmed worldwide.

The numbers are astounding. The average person knows over 50,000 different words and speaks about 16,000 daily. Estimates range up to 500,000 languages invented since we began speaking with about 7000 current languages. About 7.7 billion people speak about 280 languages. There are fewer than 1000 speaking about 1750 of the surviving languages, the formula for language extinction. With over a billion speakers each, English and Mandarin are the most widely spoken followed by Spanish and Hindi with over 500 million followed by French, Arabic, Bengali, Russian, and Portuguese. Only about 20% of the population in the United States speak 2 or more languages while about 60% of the people in the word are either bilingual (about 43%) or multilingual (about 13% speak 3 or more and 3% speak four or more).

Mithen argues that Noam Chomsky's theory of "universal grammar" (our brains are "hardwired" for language using evolved cognitive mechanisms) is wrong and that language is learned through "general purpose" mechanisms throughout the brain.

It is nearly impossible for people to achieve proficiency similar to a native speaker unless they start learning a language by the age of 10 with lesser but better than adult learning ability from the ages of 10 to 17 or 18 years (Hartshorne JK, Tennenbaum JB, Pinker S. A critical period for second language acquisition: Evidence from 2/3 million English speakers. Cognition 2018: 177: 263-277). Functional imaging studies have found that Broca's, Wernicke's, and other left hemisphere regions are activated when using a language learned before puberty while after puberty, additional areas are activated including the left prefrontal cortex, left hippocampus, right inferior frontal gyrus, right superior temporal gyrus, and right anterior insula. Neuroplasticity declines with older age after puberty.

Concussion: Evolution of the Concept

Commotio cerebi to concussion. In the 10th century, Persian physician, Rhazes, described a transiently altered physiologic state following head trauma. Lanfrancus of Milan (c. 1250-1306) described head injuries as "contusio cerebri" or a bruising or shaking of the brain which could cause temporary dysfunction without visible skull damage. Guy de Chauliac (c. 1300-1368) introduced the term, "commotio cerebri" (shaking of the brain) as a transient disturbance of brain function caused by shaking or impact.

The term "concussion" appeared in Middle English around 1400 referring to a bruising or shaking of the head. Ambroise Paré (c.1510-1590) distinguished between "commotio cerebri" (a reversible, functional disturbance without visible damage) and "contusion cerebri" (visible lesions, hemorrhage, or compression) and used the term "concussion" to describe symptoms such as confusion and memory problems after head trauma. Guillaume Dupuytren (1777-1835) used the term "concussion" to describe transient disturbances of brain function with no visible structure damage or a functional brain injury.

One interesting historical case involved a 26-year-old maidservant who had been hit over the head with a stick and complained of retrograde amnesia. Six months later, she was still complaining of headaches, dizziness, tinnitus, and tiredness. A judge requested the opinion of Swiss physician J.J. Wepfer (he was a "father of neurology" and described the "Circulus arteriosus" before Willis) and two other surgeons, who stated in 1694, "We can't say anything definite, but it is certain that this will leave its mark in the form of an impediment."

In 1924, Trotter found no evidence of structural cerebral injury" and viewed concussion as a "transient state…followed by amnesia for the actual onset of the accident."

Postconcussion syndrome. The earliest uses of the term, "postconcussion syndrome," that I can find are two publications from 1934, Grinker's neurology textbook and an article by Strauss and Savitsky reflecting controversy over the topic going back at least to the 1860s: "In our opinion, the subjective post-traumatic syndrome, characterized by headache, dizziness, inordinate fatigue on effort, intolerance to intoxicants and vasomotor instability, is organic and is dependent on a disturbance in intracranial equilibrium due directly to the blow on the head. We suggest the term 'postconcussion syndrome' for this symptom complex." The concept of postconcussion syndrome has been controversial for over 160 years.

Definition of concussion. For years, the common belief was that concussion occurred only with loss of consciousness. In 1991, the Colorado Medical Society recognized that concussion can be present with transient confusion without loss of consciousness. The most recent definition of sport-related concussion is as follows:

"Sport-related concussion is a traumatic brain injury caused by a direct blow to the head, neck or body resulting in an impulsive force being transmitted to the brain that occurs in sports and exercise-related activities. This initiates a neurotransmitter and metabolic cascade, with possible axonal injury, blood flow change and inflammation affecting the brain. Symptoms and signs may present immediately, or evolve over minutes or hours, and commonly resolve within days, but may be prolonged.

No abnormality is seen on standard structural neuroimaging studies (computed tomography or magnetic resonance imaging T1- and T2-weighted images), but in the research setting, abnormalities may be present on functional, blood flow or metabolic imaging studies. Sport-related concussion results in a range of clinical symptoms and signs that may or may not involve loss of consciousness. The clinical symptoms and signs of concussion cannot be explained solely by (but may occur concomitantly with) drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction) or other comorbidities (such as psychological factors or coexisting medical conditions)."

The term "concussion" currently refers to the mildest form of mTBI although some clinicians might use the term synonymously with mTBI. There is no agreement on what duration of loss of consciousness distinguishes concussion from mTBI and no agreement on which symptoms have to be present for a concussion or mTBI to occur since there is no gold standard for concussion without loss of consciousness.

Diagnosis of a concussion based upon symptoms following a concussion (postconcussion syndrome) result in overdiagnosis of concussion as the symptoms of concussion are not specific to concussion. In a study of 90 patients with mTBI compared to 85 non-brain injured trauma controls, a diagnosis of acute postconcussion syndrome based upon symptoms was present in 43.3% of those who had sustained a mTBI vs. 43.5% of the non-brain injured trauma controls. Akin to the 1969 Led Zeppelin song, this may lead you to feel "Dazed and Confused" in making the diagnosis.

The WHO criteria, as follows, are widely used:

"MTBI is an acute brain injury resulting from mechanical energy to the head from external force. Operational criteria for clinical identification include:

1. One or more of the following: confusion or disorientation, loss of consciousness for 30 min or less, post-traumatic amnesia for <24 h, and/or other transient neurological abnormalities such as focal signs, seizure, and intracranial lesion not requiring surgery

2. Glasgow Coma Scale score of 13–15 after 30 min post head injury or later on presentation for healthcare. These manifestations of MTBI must not be due to drugs, alcohol, medications, or caused by other injuries or treatment for other injuries (e.g., systemic injuries, facial injuries or intubation), or by other problems (e.g., psychological trauma, language barrier or coexisting medical conditions) or caused by penetrating craniocerebral injury."

"The diagnostic criterion of confusion and disorientation is frequently the most challenging to establish. A survivor of an unexpected event that placed him or her in serious danger can often experience a sense of being shocked and overwhelmed. The challenge for the di-

agnostician is to differentiate between such a strong emotional reaction and evidence of external forces to the head that likely resulted in a biomechanically induced alteration of the person's mental awareness. In some circumstances, this can be extraordinarily difficult. In most cases, however, it can be determined with a reasonable degree of accuracy whether the person was frightened, stressed, and overwhelmed at the time of the accident. The clinician could ask questions like: "Were you scared after the accident? Did you feel stressed, worked up, or overwhelmed? Was your heart beating rapidly? Did you have an anxiety attack?" In many cases, the circumstances of the injury were not directly experienced as distressing or traumatic—thus, it is easier to differentiate biomechanically induced confusion from psychologically induced confusion.

…As previously noted, the word "dazed" was dropped in the WHO definition. If the descriptor of "dazed" captures an emotional reaction, then that would justify the omission. Thus, if a patient describes feeling "dazed" after the accident, then the clinician should use follow-up questions to differentiate between a concussion-mediated state of confusion or disorientation and a sense of being overwhelmed or in emotional shock ."

Perhaps 20% of people have persistent symptoms for 1 year or more after a concussion.

Diffuse axonal injury. Seventy years ago, neuropathologist, Sabina Strich (1925-2015), first described diffuse axonal injury which was present in 5 patients who died following severe traumatic brain injuries.

In 1968, Oppenheimer described diffuse axonal injury in a 66 year old male who was stunned in a motor vehicle accident with posttraumatic amnesia and died 13 days later from chest complications. In 1983, Povlishock and colleagues first reported that minor head injury in cats produced axonal changes. In 1994, Blumbergs and colleagues studied 5 adults who had sustained mild concussive injury and died of other causes 2-99 days later finding multifocal axonal injury in all 5. It is not certain what percentage of patients who have had a concussion (the mildest form of mTBI) or mTBI have diffuse axonal injury.

References

1 McCrory PR, Berkovic SF. Concussion: the history of clinical and pathophysiological concepts and misconceptions. Neurology. 2001; 57(12): 2283-2289

2 Gasquoine, P. G. (2019). Historical perspectives on evolving operational definitions of concussive brain injury: From railway spine to sport-related concussion. The Clinical Neuropsychologist, 34(2), 278–295

3 Eaton RG, Lonser RR. History of biological, mechanistic, and clinical understanding of concussion. Neurosurg Focus 2024; 57(1):E2

4 de Morsier G. Les encephalopathies traumatiques. Etude neurologique. Schweiz Arch Neurol Neurochir Psychiatr. 1943;50:161

5 Trotter W. On certain minor injuries of the brain: being the Annual Oration, Medical Society of London. BMJ. 1924;1(3306): 816-819

6 Grinker RR. Neurology. Springfield, IL: Charles C Thomas; 1934:790.

7 Strauss I, Savitsky N. Head injury: Neurologic and psychiatric aspects. Arch Neurol Psychiatry. 1934;31:893-955

8 Evans RW. Persistent post-traumatic headache, postconcussion syndrome, and whiplash injuries: the evidence for a non-traumatic basis with an historical review. Headache. 2010 Apr;50(4):716-24

9 Colorado Medical Society. Report of the Sports Medicine Committee: Guidelines for the Management of Concussion in Sports (revised). Denver: Colorado Medical Society;1991

10 Patricios JS, Schneider KJ, Dvorak J, et al. Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport-Amsterdam, October 2022. Br J Sports Med. 2023;57(11):695-711

11 Mears S, Shores EA, Taylor AJ. Mild traumatic brain injury does not predict acute postconcussion syndrome. J Neurol Neurosurg Psychiatry 2008;79:300-306

12 Carroll LJ, Cassidy JD, Holm L, et al. Methodological issues and research recommendations for mild traumatic brain injury: the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. J Rehabil Med 2004;43(Suppl):113–25

13 Ruff RM, Iverson GL, Barth JT, Bush SS, Broshek DK; NAN Policy and Planning Committee. Recommendations for diagnosing a mild traumatic brain injury: a National Academy of Neuropsychology education paper. Arch Clin Neuropsychol. 2009;24(1):3-10; p 7

14 Strich SJ. Diffuse degeneration of the cerebral white matter in severe dementia following head injury. Journal of Neurology, Neurosurgery, and Psychiatry. 1956:19(3):163–185

15 Oppenheimer DR. Microscopic lesions in the brain following head injury. J Neurol Neurosurg Psychiatry. 1968;31(4):299-306

16 Povlishock JT, Becker DP, Cheng CL, Vaughan GW. Axonal change in minor head injury. J Neuropathol Exp Neurol. 1983 May;42(3):225-42

17 Blumbergs PC, Scott G, Manavis J, Wainwright H, Simpson DA, McLean AJ. Staining of amyloid precursor protein to study axonal damage in mild head injury. Lancet. 1994 Oct 15;344(8929):1055-6

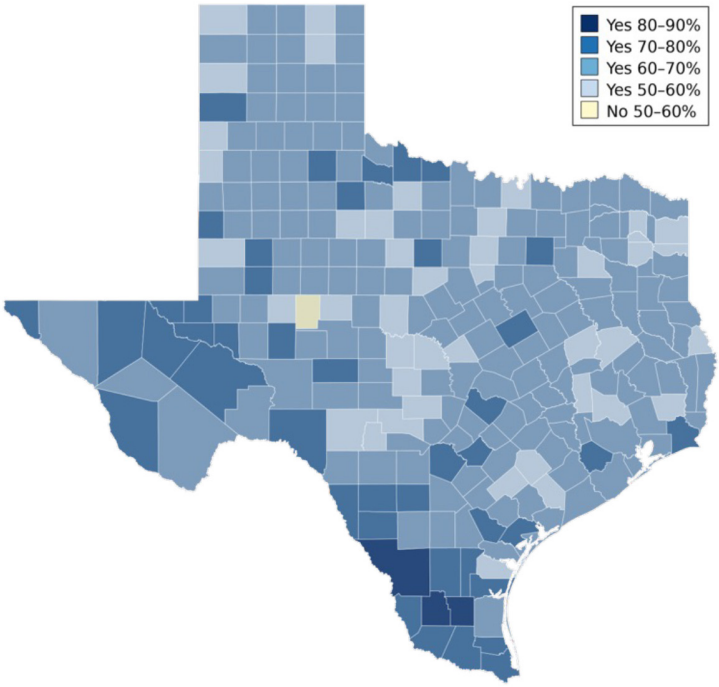
By Dr. Kim Monday, TNS Legislative Chair, and Tom Holloway, TNS Lobbyist

A Decisive Vote: How Texas Voters Embraced Proposition 14

On November 4, 2025, Texas held its constitutional amendment election, with 17 proposed amendments on the statewide ballot. With a turnout of roughly 2.9 million Texans (just under 16% of registered voters), the electorate approved all 17 proposals. Among them was Proposition 14, which will now establish the Dementia Prevention and Research Institute of Texas (DPRIT), supported by a $3 billion fund drawn from state general revenue.

When the final results were tallied, over 2 million Texans voted in support of Proposition 14, accounting for roughly 69% of the total vote and providing DPRIT with a clear, unambiguous mandate from the people of Texas. This strong statewide show of support reflects a growing consensus on the importance of brain health that spans regional, cultural, and political divides. While support varied from urban centers to more rural and conservative areas, the results highlight a shared recognition among Texans that dementia and neurocognitive decline are not partisan issues but community and public health imperatives.

Proposition 14 (2025): Dementia Prevention and Research Institute of Texas



As Texas faces a rapidly aging population in the coming decades, the demand for neurological care to address cognitive decline will only increase. Unlike narrowly focused disease-specific funding efforts, DPRIT will enable universities, health systems, and clinical programs to investigate a broad range of questions about brain aging—such as how to detect decline earlier, how to intervene more effectively, and how to help Texans maintain their independence as long as possible.

TNS Advocacy and a Digital Campaign That Moved Voters

In the weeks leading up to Election Day, TNS launched a digital advertising campaign to educate Texas voters about the importance of Proposition 14 and encourage their support for it at the ballot box. The campaign delivered more than 503,000 banner and display ads featuring the message "Help Make Dementia a Memory: Support Prop 14" to targeted voters with a history of participation in off-year constitutional elections. These ads then directed voters to the TNS website, where they could learn more about DPRIT and find their nearest polling location.

The engagement generated by this ad campaign was remarkable, and the results indicate that Texans are broadly interested in issues related to dementia, aging, and brain health. The campaign, along with TNS member outreach and physician-driven education, helped frame Proposition 14 not as an abstract budget measure but as an investment in a healthier future for Texas.

Implementation: The Next Chapter for DPRIT

As a constitutionally dedicated source of research funding, the Dementia Prevention and Research Institute of Texas (DPRIT) promises to establish Texas as a national leader in aging neuroscience. For our neurologist members, this means more opportunities to participate in meaningful studies, greater access to emerging diagnostic technologies, and increased statewide awareness about the importance of early detection and prevention.

With Proposition 14 approved by voters, focus now shifts to how the new program will be structured and administered. In the coming months, the state will start establishing advisory committees, developing scientific review processes, and drafting grant-making rules, all of which will shape the initiative's direction for years to come. The Texas Neurological Society continues to collaborate with state leaders to ensure neurologists remain engaged in these discussions and help guide priorities toward meaningful clinical and scientific outcomes.

TNS is proud of its efforts to advance this monumental effort and looks forward to ensuring that the promise of Proposition 14 leads to real improvements in patients' lives across Texas.

The AAN's work for robust research funding

BY AAN PRESIDENT NATALIA S. ROST, MD, MPH, FAAN, FAHA

The topic of research funding is an important one to me as a clinician and scientist. And as neurologists and neuroscience professionals, we all understand the critical role of research.

We understand the drive and responsibility that urges us onward to advance groundbreaking science, constantly improve patient care, and shape a healthier tomorrow. We are the transformation that the future of brain health for all deserves.

But there continue to be strong headwinds against us, with a tremendous number of individual researchers, entire labs, and many projects—both ongoing and future—being devastated by funding cuts.

At the same time, we are witnessing exceptional momentum in neuroscience research. The AAN Research Program—offering awards of up to four hundred and fifty thousand dollars—saw more than 250 applications. The American Brain Foundation's 10 million dollar award to explore neuroinflammation received nearly 500 pre-proposals, and dozens of pre-proposals were submitted for the Cure One, Cure Many Award in Lewy Body Dementia.

This is truly a testament to what's possible when philanthropy, science, and purpose align, and the AAN is proud to help guide this work forward.

However, the gap is significant. The AAN recognizes how much more research funding is needed—and it's so much more than we as an organization can provide. Therefore, our shared advocacy is another key in the fight for robust neuroscience research funding. That's why the AAN has doubled down on our commitment to support neuroscience research, as we joined forces on Capitol Hill during the Legislative Summit this fall.

We make our voices heard on the vital need for research funding—like the AAN did at the American Brain Coalition's Neuroscience Caucus Briefing, which I had the great honor of opening on the Hill. And we continue to monitor the ongoing budget work in the House and Senate that will determine the NIH's funding levels in 2026—so stay tuned for updates in our Capitol Hill Report.

I encourage you and your colleagues to do one of these two things: 1) apply for funding and move your own research ahead or 2) give to research so a colleague or a mentee can push those scientific boundaries.

Broca's Area

CASE STUDIES

CSF-Venous Fistulas and Spontaneous Idiopathic Intracranial Hypotension (SIIH)

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Affiliation: MS-IVs at Texas College of Osteopathic Medicine
Key Words: Headache, MRI, Intracranial Hypotension, CVF

Disclosure Statement

Authors have no conflict of interest to disclose and received no funding or grants. Patient information has been de-identified to protect individual privacy. Written informed consent was obtained from the patient for publication and presentation.

Abstract

- Introduction: Intracranial hypotension (ICH) is a rare condition with an annual incidence of approximately 5 in 100,000, presenting primarily with orthostatic headaches. The condition can result from iatrogenic or spontaneous causes, with spontaneous intracranial hypotension (SIH) being linked to CSF leaks. MRI is typically the diagnostic modality of choice, though its findings may not always align with clinical expectations.
- Case Presentation: A 58-year-old male with a history of lumbar spine surgery and hypertension presented with daily headaches for 3 months, exacerbated by upright posture and associated with lumbar pain. MRI findings were normal, and initial treatments, including migraine prophylaxis and an epidural blood patch, provided no improvement. CT myelograms suggested a possible CSF-venous fistula (CVF) at T11-T12, and later another at T2, confirmed by digital subtraction myelography. The patient underwent two venous embolizations, resulting in complete resolution of symptoms.
- Discussion: CVFs, an emerging cause of SIH, are challenging to diagnose with conventional imaging methods. These fistulas form an abnormal connection between the subarachnoid space and venous structures, leading to CSF loss and low intracranial pressure. Despite limited documented cases, CVFs are increasingly recognized as a significant etiology of SIH. Imaging techniques such as dynamic CT myelography and digital subtraction myelography, with provocative maneuvers, can enhance detection. Challenges in diagnosing CVFs underscore the need for specialized imaging and heightened clinical awareness.
- Conclusion: This case highlights the diagnostic challenges in identifying CVFs as a cause of SIH and emphasizes the utility of advanced imaging techniques for accurate localization and treatment.

Introduction

Intracranial hypotension (ICH) is a relatively rare condition, with an annual incidence of approximately 5 per 100,000 individuals. It typically presents with an orthostatic headache—worsening upon upright posture and relieved by lying down—which may evolve into chronic, lingering headaches (5). Two proposed mechanisms for these headaches include the traction of pain-sensitive meningeal and intracranial structures and a compensatory vasodilatory response of cerebral blood vessels to decreased cerebrospinal fluid (CSF) volume (1).

The etiology of intracranial hypotension falls into two broad categories: iatrogenic and spontaneous. Iatrogenic ICH commonly results from dural disruption following procedures such as lumbar puncture or spine surgeries. In contrast, spontaneous intracranial hypotension (SIH) has a more variable etiology. A systematic review by Wouter et al. involving 568 patients with spontaneous CSF leaks categorized SIH into three types: dural tear, meningeal diverticulum, and CSF-venous fistula (CVF) (4).

While lumbar puncture was once a primary diagnostic method for SIH, its use has diminished due to its invasiveness, low sensitivity, and the potential to exacerbate symptoms by further reducing CSF volume. Brain MRI has become the preferred non-invasive diagnostic tool. Typical MRI findings in SIH include subdural fluid collections, pachymeningeal enhancement, engorgement of venous structures, pituitary enlargement, and brain sagging (6). However, MRI findings may not always reflect classic features of SIH, as seen in this case.

Case Presentation

A 58-year-old man with a medical history of low back pain post-L4-L5 fusion, hypertension, and asthma presented to the neurology clinic with new-onset daily headaches over the preceding three months. The headaches were localized to the temporal and occipital regions and exacerbated by physical activity, coughing, sneezing, bending over, and standing. The only relief came from lying down. Associated lumbar pain was also reported. The patient had no prior history of migraines, and his neurological examination was unremarkable.

Given the strong clinical suspicion for SIH, Brain, cervical, and lumbar MRI with and without contrast were obtained but revealed no abnormalities consistent with SIH. Migraine prophylaxis was initiated, but the patient experienced no improvement. Three weeks after the initial visit, he received an L2-L3 epidural blood patch via interventional radiology, also without relief.

Subsequently, a CT lumbar myelogram was performed to guide a targeted blood patch. However, this imaging study also returned normal findings, without evidence of CSF leak. The patient was referred to the neurosurgery department at UT Houston for further evaluation. A CT myelogram identified a possible CSF-venous fistula (CVF) at the T11-T12 level on the right. This was confirmed via digital subtraction myelography (DSM), and the patient underwent successful venous embolization. One month post-procedure, he reported an 80% improvement in symptoms, with residual mild headaches occurring two to three times per week, now manageable with gabapentin. The patient returned for follow-up DSM one month later and was found to have a CSF-venous fistula at T2, for which he once again underwent transvenous embolization. Following this procedure, the patient reported complete resolution of his headaches.

CSF-Venous Fistulas and Spontaneous Idiopathic Intracranial Hypotension (SIIH)

Discussion

CSF-venous fistulas (CVFs), although only first identified in 2014, now account for a substantial number of SIH cases (3). Despite their significance in the pathophysiology of SIH, CVFs remain challenging to detect on imaging, often leading to delayed diagnosis and treatment, as illustrated in this case. A contributing factor may be the limited number of documented CVF cases and a lack of familiarity among radiologists with their appearance and typical anatomical locations.

CVFs represent an abnormal connection between the subarachnoid space and paraspinal veins, facilitating a one-way loss of CSF into the venous system. This likely occurs due to the higher CSF pressure relative to venous pressure, resulting in intracranial hypotension. Notably, up to 82% of patients with CVFs have been found to have an associated nerve root diverticulum (2). This strong correlation suggests a potential underlying mechanism, although nerve root diverticula are also frequently incidental and not always linked to CVFs.

Contrast-enhanced MRI of the brain and spine is typically the first diagnostic step when SIH is suspected. Although MRI did not demonstrate abnormalities in this case, one study found that 91% of patients with CVFs had at least one MRI brain finding consistent with SIH within the first month of symptom onset (7).

For precise localization of a CVF—especially when targeted interventions such as epidural blood patching or surgery are considered—more specialized imaging techniques are required. While CT myelography is often used initially, its effectiveness in identifying CVFs is debated. Delays between contrast administration and imaging may reduce sensitivity (7). However, some studies have shown that thin-slice axial imaging and using a 70 Hounsfield Unit (HU) threshold can make CT myelography as effective as dynamic CT myelography in CVF detection (2).

Dynamic CT myelography and digital subtraction myelography (DSM) provide real-time imaging during contrast administration and have proven more effective in CVF localization. Their sensitivity is enhanced when performed in lateral decubitus positioning with provocative maneuvers such as Valsalva or inspiration (3). However, these procedures are invasive and operator-dependent. They carry a risk of exacerbating CSF leaks and are not readily available at all centers, leading to access issues as encountered by this patient. Additionally, interpretation of these studies is critical—one study reported that 7% of CT myelograms initially interpreted as normal were retrospectively found to show evidence of a CVF.

Conclusion

This case underscores the diagnostic challenges of spontaneous intracranial hypotension, particularly when caused by a CSF-venous fistula. Although CVFs are increasingly recognized as a significant cause of SIH, their subtle imaging findings and the need for invasive diagnostic procedures contribute to frequent delays in diagnosis. High clinical suspicion, persistence with advanced imaging modalities such as digital subtraction myelography, and collaboration with specialized centers are essential to ensure timely diagnosis and treatment. Early identification and treatment, as demonstrated here, can lead to substantial symptom relief and improved quality of life.

Citations

1 Swyden Shelbi, et al. (2023). Intracranial Hypotension. In StatPearls. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK560764/

2 Kranz, Peter G. (2017). CSF Venous Fistulas in Spontaneous Intracranial Hypotension: Imaging Characteristics on Dynamic and CT Myelography. American Journal of Roentgenology, 209(6) https://doi.org/10.2214/AJR.17.18351

3 Kranz, Peter G, et al. (2021). CSF-Venous Fistulas: Anatomy and Diagnostic Imaging. American Journal of Roentgenology, 217(6), 757–766 https://doi.org/10.2214/AJR.21.26182

4 Schievink, W. I., Maya, M. M., Jean-Pierre, S., Nuño, M., Prasad, R. S., & Moser, F. G. (2016). A classification system of spontaneous spinal CSF leaks. Neurology, 87(7), 673–679. https://doi.org/10.1212/WNL.0000000000002986

5 Mokri B. (1999). Spontaneous cerebrospinal fluid leaks: from intracranial hypotension to cerebrospinal fluid hypovolemia--evolution of a concept. Mayo Clinic proceedings, 74(11), 1113–1123. https://doi.org/10.4065/74.11.1113

6 Schievink W. I. (2006). Spontaneous spinal cerebrospinal fluid leaks and intracranial hypotension. JAMA, 295(19), 2286–2296. https://doi.org/10.1001/jama.295.19.2286

7 Callen, Andrew L, et al. (2024). Diagnosis and Treatment of Spontaneous Intracranial Hypotension. Neurology Clinical Practice, 14(3), https://doi.org/10.1212/cpj.0000000000200290

8 Clark, M. S., Diehn, F. E., Verdoorn, J. T., Lehman, V. T., Liebo, G. B., Morris, J. M., Thielen, K. R., Wald, J. T., Kumar, N., & Luetmer, P. H. (2018). Prevalence of hyperdense paraspinal vein sign in patients with spontaneous intracranial hypotension without dural CSF leak on standard CT myelography. Diagnostic and interventional radiology (Ankara, Turkey), 24(1), 54–59. https://doi.org/10.5152/dir.2017.17220

Paroxysmal Kinesigenic Dyskinesia and Co-existing Focal Epilepsy: A Case Report with Treatment Response to Lacosamide

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Abstract

Paroxysmal kinesigenic dyskinesia (PKD) is a rare movement disorder that presents with sudden episodic attacks of choreoathetosis or dystonia triggered by voluntary movement.1 PKD can occur alongside focal epilepsy, complicating diagnosis and treatment.2 This case report describes a female patient with PKD and co-existing focal epilepsy with positive response to lacosamide.

Introduction

PKD has a prevalence of 1 in 150,000 people. The most common cause of PKD is a gene mutation in PRRT2 although there are several other known causative genetic mutations. PKD can also be secondarily caused by brain lesions or metabolic disorders.1 Age of onset of PKD is usually in the first or second decade, and episodes are characterized by short-lasting (<1 minute) attacks with a kinesigenic trigger. There has been found to be significant overlap between paroxysmal movement disorders and epilepsy with many of the known genetic mutations causing heterogenous phenotypes including PKD, paroxysmal non-kinesigenic dyskinesia (PNKD), episodic ataxias, epilepsy, and hemiplegic migraines. Although this overlap can make diagnosis challenging, unsurprisingly there tends to be good response to anti-epileptics, with carbamazepine being first-line therapy.[2]

Case Presentation

A 31-year-old female presented with a history of episodic abnormal movements starting at age 14. Initially, she developed episodic left lower extremity stiffness triggered by standing, which gradually progressed to involve the left upper extremity over the next 5-6 years. Movements were characterized by left knee extension and toe inversion and left arm extension and pronation. These events occurred in clusters, lasting 2 to 8 weeks, often accompanied by nocturnal spells lasting 5 to 20 seconds. These nocturnal episodes included dystonic twisting and ballistic movements.

Keppra and Carbidopa-Levodopa were ineffective. Clonazepam reportedly helped with the severity of dystonia. Initial EMU admission reportedly captured a typical spell and ruled out epileptic etiology.

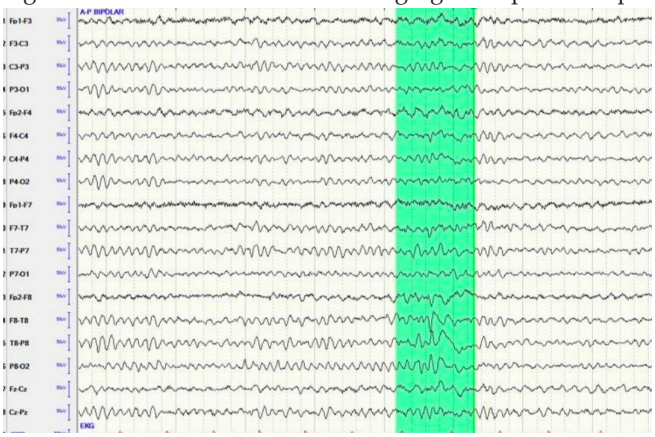
Diagnostics

- Normal labs: GAD, TPO, ASO, ceruloplasmin, celiac, lead, mercury, cadmium, arsenic, copper, RF, ANA, lupus panel, serum paraneoplastic panel
- Outpatient 48 hr EEG: unremarkable
- MR Spectroscopy wo contrast: "MR spectrum of the bilateral basal ganglia is normal."
- MR Brain wo contrast: "Unremarkable unenhanced brain MRI"
- MR C-spine wo contrast: "Minimal scattered degenerative changes without spinal canal or neural foraminal stenosis. No etiology for the patient's left-sided muscle spasms are noted."

She was given a diagnosis of PKD and initiated on carbamazepine, but the medication was stopped due to drug rash. Topiramate was not tolerated due to cognitive effects. Zonisamide was started next.

She began to have new nocturnal episodes of left-sided tonic activity evolving into generalized tonic-clonic seizures, accompanied by loss of consciousness and tongue biting. She was started on brivaracetam and arranged for repeat EMU admission. During this admission, EEG captured right and left temporal sharp waves (see Figures 1 and 2), and one focal seizure arising from right hemisphere. Clinically, she had dystonic posturing of left arm and leg followed by arousal from sleep. She then had left-sided tonic posturing associated with leftward head turning and loss of awareness for about 30 seconds. On EEG, subtle rhythmic theta appeared, then the recording was obscured by significant myogenic artifact during the tonic portion. No changes were seen during the initial dystonic posturing. She also had multiple typical PKD events without electrographic correlate.

Figure 1. Interictal EEG demonstrating right temporal sharps.



Paroxysmal Kinesigenic Dyskinesia and Co-existing Focal Epilepsy: A Case Report with Treatment Response to Lacosamide

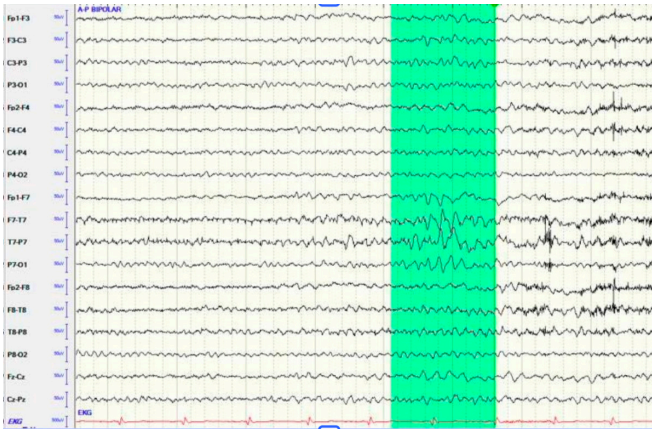


Figure 2. Interictal EEG demonstrating left temporal sharps.

Lacosamide was introduced and resulted in significant improvement in both nocturnal seizures and daytime PKD symptoms. Since then, the patient has been free from nocturnal generalized tonic-clonic seizures for more than one year. Overall, lacosamide helped to reduce the frequency of both types of events.

Discussion

This case highlights the challenges in managing patients with co-existing PKD and focal epilepsy, particularly in distinguishing between movement disorders and epileptic seizures. The use of sodium channel blockers such as carbamazepine, oxcarbazepine, and phenytoin to treat PKD is well-established, but their use can be limited by side effects. The positive response to lacosamide suggests it may be an effective treatment option for patients with both PKD and focal epilepsy. The underlying mechanisms that make lacosamide effective in this case warrant further investigation. This case contributes to the growing body of evidence supporting the efficacy of lacosamide in managing complex movement disorders with concurrent epilepsy.3-4

References

1. Xu JJ, Li HF, Wu ZY. Paroxysmal kinesigenic dyskinesia: Genetics and Pathophysiological Mechanisms. Neuroscience Bulletin. 2023;40(7):952-962. doi:10.1007/s12264-023-01157-z

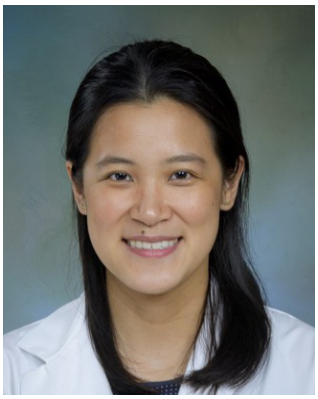
2. de Gusmão CM, Garcia L, Mikati MA, Su S, Silveira-Moriyama L. Paroxysmal genetic movement disorders and epilepsy. Frontiers in Neurology. 2021;12.

doi:10.3389/fneur.2021.648031

3. Geng JH, Zheng Y, Li QF, Hou Q, Wang XH, Jiang Y. Case report: A case of concomitant paroxysmal kinesigenic dyskinesia and epilepsy: Can we treat two birds with one stone? Frontiers in Neurology. 2022;13. doi:10.3389/fneur.2022.826897

4. Furukawa G, Negishi Y, Takeuchi T, Ishihara N, Okumura A. Lacosamide for children with paroxysmal kinesigenic dyskinesia. Brain and Development. 2020;42(8):617-620. doi:10.1016/j.braindev.2020.04.009

Self-resolving Isolated Cranial Nerve III Palsy



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Abstract

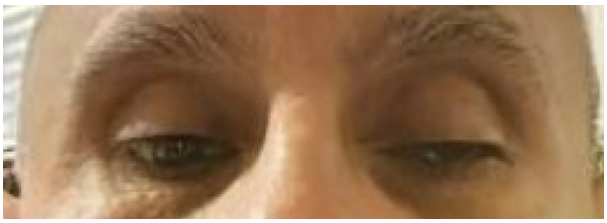
Cranial nerve III palsy presents with horizontal diplopia and ptosis in which there are many possible etiologies; however, in some cases, the etiology is unknown. We report a rare presentation of self-resolving CN III palsy in a 60-year-old male of unknown etiology. A 60-year-old male with past medical history of hypertension and hyperlipidemia presented with two months of left eye ptosis and double vision. Workup included ophthalmology exam, labs, MRA head, MRI brain, MRI orbit, and myasthenia gravis rule out. Labs showed no evidence of diabetes, inflammation, or infection. Imaging was unremarkable for aneurysm, malformation, hemorrhage, mass effect, or space occupying masses. Myasthenia gravis (MG) antibodies were negative, and clinical presentation was negative for SOB and muscle weakness, making MG less likely. The patient did not undergo any active treatment other than eye mobility exercises. After three months, the patient presented with complete resolution of symptoms. While idiopathic CN III palsy can recover in several months with limited intervention, it is still important to understand the possible etiologies and workup for timely diagnosis and management.

Introduction

Cranial nerve III (CN III), also known as the oculomotor nerve, is responsible for eyelid elevation via the levator palpebrae superioris and extraocular movements via the medial, superior and inferior recti and the inferior oblique muscles. It also carries parasympathetic fibers to the pupil and ciliary muscle for constriction and accommodation.1 CN III dysfunction typically manifests as ptosis, diplopia, a characteristic "down and out" ocular deviation, and occasionally pupillary dilation if parasympathetic fibers are involved.

Etiology of CN III palsy can be vascular, compressive, inflammatory, infectious, traumatic, or idiopathic. The most prevalent causes in adults are microvascular ischemia related to diabetes mellitus, hypertension, and atherosclerosis, which is typically pupil-sparing.2 Another common cause is compression by an intracranial aneurysm, commonly the posterior communicating artery. 3 Despite extensive work-up, some cases of CN III palsy may remain idiopathic, with no identifiable structural, vascular, inflammatory, or other cause. Potential mechanisms include transient microvascular ischemia undetectable on MRI, reversible demyelination, or limited inflammatory neuritis. Idiopathic CN III palsies typically exhibit a self-limiting course, with complete recovery within several months.4,5

This case report describes a rare presentation of an idiopathic, self-resolving CN III palsy in a 60-year-old male, including the clinical features at onset, diagnostic evaluation, and timeline of spontaneous recovery without intervention.



Case presentation

The patient is a 60-year-old male with past medical history of hypertension, hyperlipidemia, and white coat syndrome who presented for follow up for an isolated episode of acute onset left ptosis. Six months prior, the patient felt like "a rock" was in his eye. The following day, he experienced drooping of his left eyelid. He denied any prior history of similar episodes or any history of head trauma or stroke. He denied associated facial drooping, muscular weakness, shortness of breath, cough, changes in speech, nausea/vomiting. Family history was only significant for hypertension in both parents and an episode of bell's palsy in the sister. Physical exam was significant for complete left upper lid ptosis and a down and out pupil. Blood pressure was 153/102 mmHg and pulse was 83 bpm. He did not have current or priory history of alcohol or tobacco use. Workup included ophthalmology exam, labs, and imaging.

Upon ophthalmologic examination, right eye was 20/15 visual acuity, absent afferent pupillary defect, intact extraocular motility and unremarkable slit lamp and fundus exam. Left eye was 20/40 visual acuity, positive afferent pupillary defect, impaired extraocular movements of the left eye with limited abduction, complete ptosis of the lid on slit lamp exam, and unremarkable fundus exam.

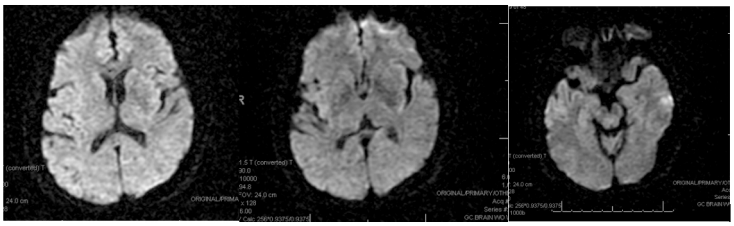
Complete blood count (CBC), complete metabolic panel (CMP), C-reactive protein, and erythrocyte sedimentation rate (ESR) were within normal limits. Hb A1c was 5.5. Initial lipid panel was significant for elevated cholesterol (208 mg/dL) and LDL (134 mg/dL). Repeat lipid panel two months later following initiation of atorvastatin demonstrated decreased cholesterol (113 mg/dL) and LDL (47mg/dL). Labs demonstrated no indication of diabetes, inflammation, or infection.

Self-resolving Isolated Cranial Nerve III Palsy

MRA head without contrast was negative for aneurysm and malformation. Possible hypoplastic left vertebral artery was observed. MRI brain without and with contrast showed no evidence of intracranial hemorrhage, mass effect, or space occupying masses (Figure 1). A 2.5cm retention cyst in the right maxillary sinus was observed and most consistent with mild paranasal sinus disease. Findings were consistent with MRI orbit with and without contrast, which showed no evidence of orbital mass or abnormal enhancing tissues in the intraocular muscle (Figure 2). Patient followed up on results with neurology where Acetylcholine binding Ab, acetylcholine blocking Ab, and acetylcholine receptor modulating Ab were ordered to rule out possible myasthenia gravis. Results were negative.

Given the clinical picture and workup, presentation was most consistent with 3rd cranial nerve palsy. Over two months, patient reported worsening vision and ptosis. Patient did not receive active treatment but performed eye exercises to improve oculomotor function. During the third month, patient noticed improved ptosis and oculomotor motility with eventual complete resolution of symptoms by the end of three months.

Figure 1: unremarkable DWI highlighting absence of concern for acute ischemic stroke.



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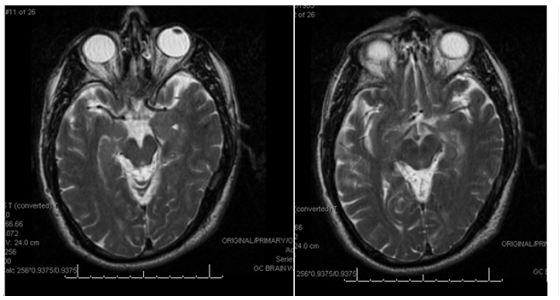

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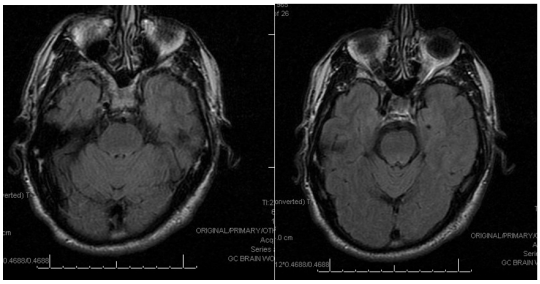

Figure 2: unremarkable T2 weighted MRI (A) and MRI flair (B) suggesting absence of concern for inflammatory, demyelinating etiology or infarcts.

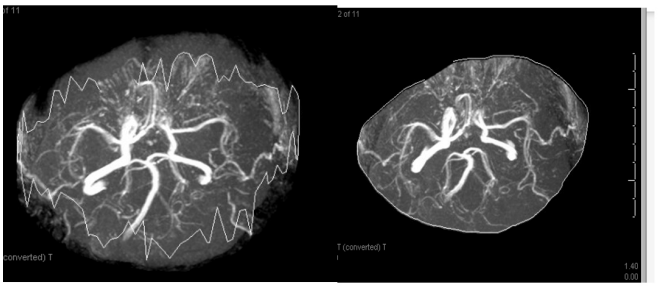

Figure 3. MRA head without contrast negative for aneurysm and malformation. Possible hypoplastic left vertebral artery.

Discussion

This case highlights an idiopathic, self-resolving CN III palsy in a 60-year-old man with no hemorrhage, mass effect, or enhancing tissues seen on imaging, but with vascular risk factors of hypertension and hyperlipidemia. It highlights the diagnostic challenge posed by CN III palsy, which can require prompt exclusion of life-threatening causes such as posterior communicating artery aneurysm. However, many idiopathic and microvascular cases can follow a self-limited course. The incidental finding of left vertebral artery hypoplasia raises discussion of its potential role as a predisposing risk factor for transient ischemia.

Idiopathic or presumed microvascular oculomotor palsies are uncommon but well documented in adults with vascular comorbidities. In a cohort of 63 patients with isolated ocular motor nerve dysfunction, Agaki et al. reported that more than 90% of microvascular and idiopathic cases recovered within six months, similar to our patient's course.6 Similarly, a study by Tiffin et al. looked at CN III, IV, and XI palsy in 165 cases and found that 57% of all patients made a total recovery in a median time of 3 months, and 80% made at least a partial recovery. 7 However, treatment varied amongst patients and in this case the patient only received supportive treatment in the form of eye exercises.

In this case, left vertebral artery hypoplasia (VAH) may have contributed to transient ischemia of the oculomotor fascicles. VAH is a developmental variant characterized by asymmetry in vertebrobasilar circulation that predisposes to posterior circulation ischemia. Multiple studies have linked VAH to increased risk of midbrain infarction and brainstem ischemia, which can manifest as isolated cranial nerve deficits. 8,9, Although no infarction was seen on imaging in our patient, coexistence of VAH with vascular risk factors of hypertension and hyperlipidemia may transiently reduce perfusion to the oculomotor fascicles of the midbrain and result in reversible CN III palsy.

In addition to spontaneous improvement, the patient's daily

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oculomotor mobility exercises may have contributed to recovery. Targeted rehabilitation programs have been shown to improve ocular alignment, extraocular muscle function, and diplopia in patients with acquired ophthalmoplegia.10 Protocols typically incorporate pursuit, fixation, saccade, and vergence exercises which promote neuromuscular education and neuroplasticity. 10,11 However, limited evidence exists on the efficacy of oculomotor exercises for patients with CN III palsy without traumatic brain injury. Evidence based studies and case reports evaluating ocular motor training primarily involved populations with a history of traumatic brain injury, infection, and brainstem insults. 10,12,13 Oculomotor rehabilitation is feasible, low-risk and potentially generalizable across etiologies including idiopathic oculomotor dysfunction, potentially supporting a more favorable trajectory of functional recovery.

Conclusion

This case demonstrates an isolated idiopathic CN III palsy in a 60-year-old male followed by a benign self-resolving course in the presence of vascular risk factors the anatomical variant of left vertebral artery. Idiopathic CN III palsy remains uncommon, particularly when it resolves spontaneously without any identifiable structural, inflammatory, infectious, or ischemic pathology. Diagnostic assessment is guided by ophthalmologic examination, laboratory testing, and neuroimaging to rule out aneurysm or compressive lesions that can be life threatening. Once other causes are excluded, many cases can follow a self-limited course. The incidental findings of vertebral artery hypoplasia highlights the importance of anatomical variants that may influence susceptibility to transient posterior circulation ischemia. Oculomotor rehabilitation exercises may serve as a low-risk treatment to support functional recovery. Clinicians should remain aware that isolated CN III palsy may reflect both self-resolving processes or serious vascular pathology, underscoring the need for careful evaluation and follow up.

References

1. Modi P, Arsiwalla T. Cranial Nerve III Palsy. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2025. http://www.ncbi.nlm.nih.gov/books/NBK526112/. Accessed October 27, 2025.
2. Kim K, Noh SR, Kang MS, Jin KH. Clinical Course and Prognostic Factors of Acquired Third, Fourth, and Sixth Cranial Nerve Palsy in Korean Patients. Korean J Ophthalmol. 2018;32(3):221-227. doi:10.3341/kjo.2017.0051
3. Kim J young, Choi SC. Third cranial nerve palsy and posterior communicating artery aneurysm. Clin Exp Emerg Med. 2014;1(1):65-66. doi:10.15441/ceem.14.002
4. Kanazawa T, Hino U, Kuramae T, Ishihara M. Idiopathic unilateral oculomotor nerve palsy: A case report. Heliyon. 2020;6(12):e05651. doi:10.1016/j.heliyon.2020.e05651
5. Agarwal D, Kasturi N, Kaliaperumal S. Clinical spectrum and its association with recovery patterns in patients with acquired isolated ocular motor nerve palsies - an observational study. Strabismus. 2024;32(3):210-216. doi:10.1080/09273972.2024.2363396
6. Akagi T, Miyamoto K, Kashii S, Yoshimura N. Cause and prognosis of neurologically isolated third, fourth, or sixth cranial nerve dysfunction in cases of oculomotor palsy. Jpn J Ophthalmol. 2008;52(1):32-35. doi:10.1007/s10384-007-0489-3
7. Tiffin PA, MacEwen CJ, Craig EA, Clayton G. Acquired palsy of the oculomotor, trochlear and abducens nerves. Eye (Lond). 1996;10 (Pt 3):377-84. doi: 10.1038/eye.1996.77. PMID: 8796166.
8. Mitsumura H, Miyagawa S, Komatsu T, Hirai T, Kono Y, Iguchi Y. Relationship between Vertebral Artery Hypoplasia and Posterior Circulation Ischemia. J Stroke Cerebrovasc Dis. 2016;25(2):266-269. doi:10.1016/j.jstrokecerebrovasdis.2015.09.027
9. Katsanos AH, Kosmidou M, Kyritsis AP, Giannopoulos S. Is vertebral artery hypoplasia a predisposing factor for posterior circulation cerebral ischemic events? A comprehensive review. Eur Neurol. 2013;70(1-2):78-83. doi:10.1159/000351786
10. Watabe T, Suzuki H, Sako R, et al. Effect of an oculomotor rehabilitation program for subacute brain injury patients with ophthalmoplegia: a case-control study.Disabil Rehabil. 2022;44(22):6642-6648. doi:10.1080/09638288.2021.1970249. https://pubmed.ncbi.nlm.nih.gov/34459519/
11. Watabe T, Suzuki H, Abe M, et al. Systematic review of visual rehabilitation interventions for oculomotor deficits in patients with brain injury. Brain Inj. 2019;33(13-14):1592-1596. doi:10.1080/02699052.2019.1658225. https://pubmed.ncbi.nlm.nih.gov/31496426/
12. Rongies W, Bojakowski J, Koktysz L, et al. Physiotherapy in postinfection injury to cranial nerves III, IV, and VI: a case study. Am J Phys Med Rehabil. 2019;98(6):e57-e59. doi:10.1097/PHM.0000000000001060. https://pubmed.ncbi.nlm.nih.gov/30946149/
13. Kawahira K, Shimodozono M, Etoh S, Tanaka N. New facilitation exercise using the vestibulo-ocular reflex for ophthalmoplegia: preliminary report.Clin Rehabil. 2005;19(6):627-634. doi:10.1191/0269215505cr895oa.

The Neurologist as a Gatekeeper: Ethics, Prognostication, and Supportive Care

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Executive Summary

This article explores the neurologist's expanding role in end-of-life care through the lens of a real-world case of catastrophic brain injury (CBI). It examines the clinical, ethical, and legal complexities faced in Texas, particularly in the context of patients who do not meet criteria for brain death but are unlikely to regain meaningful consciousness. With a focus on prognostication, cultural sensitivity, and the Texas Advance Directives Act (TADA), it calls for proactive, interdisciplinary leadership by neurologists.

Introduction

A Case Study Illustrating the Realities of Neuroprognostication in Modern Practice

A 65-year-old man with hypertension, heart failure, hyperlipidemia, poorly controlled type II diabetes, and a history of coronary artery bypass surgery following a myocardial infarction several years prior presented after suffering a cardiac arrest at home. EMS arrived approximately 20 minutes after the 911 call. CPR was initiated and continued during transport. Return of spontaneous circulation (ROSC) was achieved after one hour post-arrest, following three rounds of epinephrine and defibrillation. The patient was intubated and admitted to the cardiac intensive care unit at University Hospital. Neurology was consulted 24 hours later for assistance with neuroprognostication. The initial exam revealed absent cranial nerve reflexes but preserved respiratory drive.

MRI at 48 hours post-ROSC showed global gray matter hyperintensities on diffusion weighted imaging (DWI) consistent with diffuse anoxic brain injury, sparing the medulla and parts of the brainstem. Continuous EEG over days two and three revealed diffuse attenuation, bordering on electrocerebral silence. Neurological exams over three days remained unchanged, with no cranial or sensory reflexes, though spontaneous respirations persisted, precluding a standard brain death exam. Despite the dire prognosis, the family – guided by religious counsel – insisted withdrawal of care would be tantamount to murder unless brain death was formally declared.

This scenario exemplifies one of the most ethically and clinically fraught challenges in neurology today: managing catastrophic brain injury (CBI) in patients who do not meet the legal or medical criteria for brain death.

Defining the Gray Zone: CBI vs. Brain Death

Brain death, codified under Texas Health & Safety Code 671, is a legal and medical declaration of death, based on irreversible cessation of all brain function including the brainstem. Once declared, it permits withdrawal of all life-sustaining therapies (Lewis et al., 2023).

Catastrophic Brain injury (CBI), on the other hand, occupies a complex gray zone. It refers to a severe, irreversible injury resulting in profound neurological devastation with no meaningful chance of recovery. Unlike patients who are comatose or in a persistent vegetative state (PVS), individuals with CBI demonstrate extensive cerebral damage across both hemispheres, often with preserved autonomic and brainstem function (LaRovere & Tasker, 2020; Neal et al., 2018; Rabinstein, 2018).

Importantly, CBI patients may retain spontaneous respiration, basic reflexes, and cardiovascular regulation – features incompatible with the diagnosis of brain death but equally incompatible with meaningful consciousness or progression to meaningful recovery.

What Is "Meaningful Recovery"?

Meaningful recovery is a subjective, deeply personal concept that varies widely across patients and families. For some, it may mean regaining the ability to live independently or engage in intellectual conversation. For others, it may be the capacity to experience emotional connection, derive pleasure from food, or simply recognize and be present with loved ones. As such, defining "meaningful recovery" demands early and ongoing dialogue with surrogates to understand the patient's values, prior wishes, and vision of an acceptable quality of life.

Nevertheless, at its most fundamental level, meaningful recovery implies some degree of intellectual awareness – an ability to interact with the environment, however limited. The capacity to consciously experience life serves as a baseline criterion for what many would consider a meaningful existence. While others, particularly caregivers, may find meaning in the continued life of a loved one regardless of cognitive function, without the ability to perceive, communicate, or respond meaningfully, it becomes profoundly difficult to ascertain whether the patient themselves derives any benefit – or even awareness – of their condition.

Table 1: A Comparison Chart of Brain Death, CBI, PVS, and Coma

Condition	Spontaneous Breathing	Cranial Nerve Reflexes	EEG Activity	Consciousness	Prognosis for Recovery	Legal Status (TX)
Brain Death	No	Absent	Flat or Isoelectric	Irreversibly Absent	None	Dead
Catastrophic Brain Injury (CBI)	Yes	Variable	Severely Attenuated	Irreversibly Absent	None	Alive
Persistent Vegetative State (PVS)	Yes	Present	Variable	Absent	Very Low	Alive
Coma	Usually No	Variable	Variable	Absent	Uncertain	Alive

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Prognostic Tools in Neurocritical Care:

Prognostication in catastrophic brain injury demands a multimodal approach that synthesizes clinical examination, neuroimaging, electrophysiologic testing, and biomarkers. The foundation of prognostic evaluation typically includes MRI – particularly diffusion-weighted imaging – alongside continuous EEG monitoring and serial neurological examinations. Severely attenuated EEG activity (<10 μV), for example, is strongly associated with poor outcomes following cardiac arrest (Bronder et al., 2022).

Adjunctive modalities can enhance accuracy. Somatosensory evoked potentials (SSEPs), when available, provide valuable information about cortical integrity (Rajajee et al., 2023), and serum biomarkers such as neuron-specific enolase (NSE) may offer further prognostic insight (Clifford-Mobley et al., 2020). In addition, tools like the FOUR Score, gray-white matter ratio on head CT, and other serum markers are increasingly used to support these assessments (Wijdicks et al., 2004). However, these tools still require broader validation and should always be interpreted within the clinical context rather than as standalone determinants of outcome.

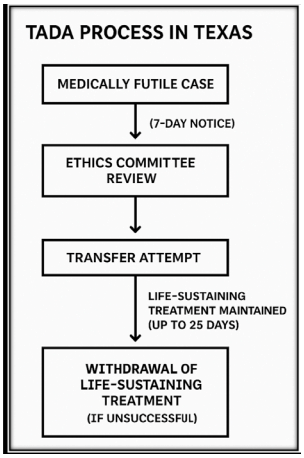
Crucially, clinical judgment – especially when informed by experience – remains indispensable. An experience-informed approach brings a nuanced understanding of complex, multifactorial presentations that often transcend what standardized metrics can capture, these include features that are not easily quantifiable such as the influence of age, comorbidities, patient and surrogate goals and values, anticipated complications, etc. In fact, clinical intuition has been shown to be among the most accurate predictors of neurologic outcome in certain cases (Kiker et al., 2022).

Ultimately, no single test should dictate prognosis. Instead, continuous reassessment that integrates multiple data sources represents the current standard of care in neuroprognostication.

Legal Tools in Texas: The Role of TADA

The Texas Advance Directives Act (TADA) allows physicians to withdraw life-sustaining treatment deemed medically futile after a specific review process (Fine, 2000). Under this law (Health & Safety Code, Chapter 166):

- The family must receive 7 days' written notice before an ethics review.
- An ethics committee must confirm the treatment is futile.
- If disagreement persists, the team must attempt transfer to another willing provider for up to 25 days.
- If no provider accepts the patient within this window, life-sustaining measures may be legally withdrawn.



TADA does not grant religious exemptions, unlike other states (New Jersey Legislature, 1991). This creates predictable conflict in families for whom death is defined by religious standards. Proactive involvement of chaplains or religious leaders is essential for helping families understand that continuing treatment in cases of irreversible injury is not always congruent with religious goals of care. See: Pope T. (2011). Legal Fundamentals of Surrogate Decision Making. Chest, 139(5), 1074–1081.

The Critical Role of Neurologists:

Neurologists are uniquely positioned to lead catastrophic brain injury cases by offering:

1. Early and Consistent Communication Family meetings co-led by neurology and palliative care reduce fragmentation and improve clarity. Mixed messaging from different services was a major source of frustration for the family in this case.

2. Standardized Neuroprognostication Using objective measures and trusting experience-informed subjective assessments by attending physicians, instead of vague descriptors builds trust and transparency.

3. Timely Palliative Care Engagement Neurologists should initiate palliative care consultations and conversations in the acute setting within 48 hours of perceiving a likely poor prognosis, particularly in cases involving severe anoxic brain injury, large vessel occlusion, massive hemorrhagic stroke, medication-refractory seizures requiring intubation, or any hospitalization in the context of advanced neurodegenerative conditions such as dementia, multiple sclerosis, Parkinson's disease, or amyotrophic lateral sclerosis (ALS).

Early involvement of palliative care and goals of care-oriented discussions can provide critical support for symptom management, advance care planning, and goal-directed decision-making. According to McConvey et al. (2022), the most appropriate triggers for referral to palliative care in both inpatient and outpatient neurology settings include: functional deterioration, dysphagia, complex or refractory symptoms, weight loss, respiratory compromise, recurrent infections, cognitive decline, and aspiration pneumonia. Identifying these indicators early and integrating palliative care accordingly can help ensure that care remains aligned with patient values while avoiding unnecessary interventions.

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Cultural and Religious Engagement:

When objections arise, neurologists must engage chaplains and clarify that in Texas, legal criteria (not spiritual definitions) govern treatment withdrawal.

Lessons from the Case: What Could Have Been Done Differently

The patient died three weeks later after another cardiac arrest. He required vasopressors, continuous renal replacement therapy (CRRT), and full ventilator support. Despite early indications of futility, no ethics or palliative care consultations occurred. Family distrust grew due to perceived mixed messaging and spiritual dismissal.

Earlier neurologist-led efforts to convene meetings, clarify prognosis, and integrate palliative and spiritual care might not have changed the outcome—but would have improved the experience of care.

Conclusion: Neurology at a Crossroads

As frontline stewards in ICU and end-of-life settings, neurologists must cultivate broader skillsets: prognostic expertise, legal literacy, communication skills, and cultural humility. In Texas, the unique legal tool of TADA empowers neurologists to lead, but also demands competence, compassion, and collaboration.

We urge Texas neurology programs to incorporate training in TADA, CBI, medical futility, and ethical consultation into their education protocols. Neurologists must not be passive consultants. We must be clinical leaders, ethical stewards, and compassionate communicators for patients in their most vulnerable moments.

References

1 Bronder, J., Cho, S.-M., Geocadin, R. G., & Ritzl, E. K. (2022). Revisiting EEG as part of the multidisciplinary approach to post-cardiac arrest care and prognostication: A review. Resuscitation Plus, 9, 100189. https://doi.org/10.1016/j.resplu.2021.100189

3 Clifford-Mobley, O., Palmer, F., Rooney, K., Skorko, A., & Bayly, G. (2020). Serum neuron-specific enolase measurement for neuro-prognostication post out-of-hospital cardiac arrest: Determination of the optimum testing strategy in routine clinical use. Annals of clinical biochemistry, 57(1), 69–76. https://doi.org/10.1177/0004563219886326

3 Fine, R. L. (2000). Medical futility and the Texas Advance Directives Act of 1999. Baylor University Medical Center Proceedings, 13(2), 144–147.

4 Kiker, W. A., Rutz Voumard, R., Plinke, W., Longstreth, W. T., Jr, Curtis, J. R., & Creutzfeldt, C. J. (2022). Prognosis Predictions by Families, Physicians, and Nurses of Patients with Severe Acute Brain Injury: Agreement and Accuracy. Neurocritical care, 37(1), 38–46. https://doi.org/10.1007/s12028-022-01501-7

5 LaRovere, K. L., & Tasker, R. C. (2020). Defining catastrophic brain injury in children leading to coma and disorders of consciousness and the scope of the problem. Current Opinion in Pediatrics, 32(6), 750–758. https://doi.org/10.1097/MOP.0000000000000951

6 Lewis, A., Kirschen, M. P., & Greer, D. (2023). The 2023 AAN/AAP/CNS/SCCM pediatric and adult brain death/death by neurologic criteria consensus practice guideline: A comparison with the 2010 and 2011 guidelines. Neurology: Clinical Practice, 13(6), e200189.

https://doi.org/10.1212/CPJ.0000000000200189

7 McConvey, K. et al. (2022). Triggers for Referral to Specialized Palliative Care in Advanced Neurologic and Neurosurgical Conditions: A Systematic Review. Neurology: Clinical Practice, 12(3), 190–202.

8 Neal, C. J., Bell, R. S., Carmichael, J. J., DuBose, J. J., Grabo, D. J., Oh, J. S., Remick, K. N., Bailey, J. A., & Stockinger, Z. T. (2018). Catastrophic non-survivable brain injury care: Role 2/3. Military Medicine, 183(Suppl 2), 73–77.
https://doi.org/10.1093/milmed/usy083

9 New Jersey Legislature. (1991, most recently amended in 2003). New Jersey Declaration of Death Act, N.J. Stat. Ann. § 26:6A-1 et seq. New Jersey Statutes. Retrieved from https://www.njleg.state.nj.us/statutes/constitution

10 Rabinstein, A. A. (2018). Coma and brain death. Continuum (Minneapolis, Minn.), 24(6), 1708–1731. https://doi.org/10.1212/CON.0000000000000670

11 Rajajee, V., Muehlschlegel, S., Wartenberg, K. E., Alexander, S. A., Busl, K. M., Chou, S. H. Y., Creutzfeldt, C. J., Fontaine, G. V., Fried, H., Hocker, S. E., Hwang, D. Y., Kim, K. S., Madzar, D., Mahanes, D., Mainali, S., Meixensberger, J., Montellano, F., Sakowitz, O. W., Weimar, C., Westermaier, T., & Varelas, P. N. (2023). Guidelines for neuroprognostication in comatose adult survivors of cardiac arrest. Neurocritical Care, 38(3), 533–563. https://doi.org/10.1007/s12028-023-01688-3

12 Texas Legislature. (1999, most recently amended in 2023). Texas Health & Safety Code, Chapter 166: Advance Directives. Texas Statutes. Retrieved from https://statutes.capitol.texas.gov/Docs/HS/htm/HS.166.htm.

13 Texas Legislature. (1999, most recently amended in 2017). Texas Health & Safety Code, Chapter 671: Determination of Death and Autopsy Reports. Texas Statutes. Retrieved from https://statutes.capitol.texas.gov/Docs/HS/htm/HS.671.htm.

14 Wijdicks, E. F. M., Bamlet, W. R., Maramattom, B. V., Manno, E. M., & McClelland, R. L. (2005). Validation of a new coma scale: The FOUR score. Annals of Neurology, 58(4), 585–593. https://doi.org/10.1002/ana.20611

Right Frontal IDH-Mutant WHO Grade 3 Oligodendroglioma Presenting with Morning Headache and Gait Imbalance

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Abstract

Background: Oligodendrogliomas are rare primary central nervous system tumors comprising a minority of adult diffuse gliomas. The 2021 World Health Organization (WHO) classification requires the presence of an isocitrate dehydrogenase (IDH) mutation and whole-arm 1p/19q codeletion to establish the diagnosis of oligodendroglioma, a molecular definition that influences prognosis and therapeutic decision-making. High-grade oligodendrogliomas (WHO grade 3) demonstrate more aggressive clinical behavior than lower-grade counterparts, often presenting with rapidly progressive symptoms and significant mass effect.

Case Presentation: I describe a 45-year-old woman who presented with a one-week history of worsening morning headaches, nausea, vomiting, blurred vision, and gait imbalance. Neuroimaging revealed a large right frontal intra-axial lesion with heterogeneous signal characteristics, peritumoral edema, and midline shift. She underwent subtotal resection, and histopathology confirmed an IDH-mutant, 1p/19q-codeleted oligodendroglioma, WHO grade 3. The patient subsequently completed chemoradiotherapy followed by adjuvant temozolomide , resulting in radiographic improvement and reduction of mass effect.

Conclusion: This case underscores the importance of prompt evaluation of new or progressive headaches accompanied by neurological deficits, particularly in the context of frontal lobe pathology. Molecular profiling remains central to accurate diagnosis, prognosis, and treatment stratification, while early surgical intervention combined with adjuvant therapy continues to represent the standard management approach for high-grade oligodendrogliomas.

Introduction

Oligodendrogliomas are rare primary central nervous system neoplasms originating from oligodendroglial lineage cells and represent a minority of adult diffuse gliomas (1,2). Historically, these tumors were classified on the basis of histopathological features; however, advances in molecular neuro-oncology have led to substantial revisions in their diagnostic criteria. The 2021 World Health Organization (WHO) Classification of Tumors of the Central Nervous System now mandates the presence of an isocitrate dehydrogenase (IDH) mutation together with whole-arm 1p/19q codeletion to define oligodendroglioma as a distinct tumor entity (1,3,4). This integrated molecular approach has replaced prior morphology-only systems, reflecting the increasing relevance of molecular biomarkers in diagnosis, prognostication, and therapeutic planning (3,5).

In adults, oligodendrogliomas typically arise in the cerebral hemispheres and show a predilection for the frontal lobes (2,6). Their clinical manifestations vary according to tumor location and growth kinetics and may include seizures, cognitive or behavioral changes, headaches, and focal neurological deficits such as gait imbalance (6,7). High-grade oligodendrogliomas (WHO grade 3) exhibit more aggressive biological behavior compared with lower-grade tumors, with rapid symptom progression, significant peritumoral edema, contrast enhancement, and mass effect including midline shift (7,8). These features highlight the importance of timely diagnostic evaluation, particularly in patients presenting with morning-predominant headaches and evolving neurologic dysfunction.

Current management strategies emphasize maximal safe surgical resection, followed by adjuvant radiotherapy and chemotherapy, most commonly using temozolomide or procarbazine, lomustine, and vincristine (PCV) regimens (8,9). Despite generally favorable long-term outcomes for IDH-mutant and 1p/19q-codeleted oligodendrogliomas, grade 3 tumors may still behave aggressively in the early stages of disease, underscoring the importance of early recognition, accurate molecular classification, and timely intervention (9,10).

This report describes a middle-aged woman who presented with worsening morning headaches and gait imbalance secondary to a right frontal IDH-mutant, 1p/19q-codeleted WHO grade 3 oligodendroglioma. The case highlights the diagnostic relevance of symptom pattern recognition, the role of contemporary neuroimaging, and the prognostic value of molecular stratification in guiding optimal management decisions.

Case Presentation

A 45-year-old right-handed woman with a past medical history of hypothyroidism presented to the neurology service with a one-week history of progressively worsening morning headaches. The headaches were described as dull, pressure-like, and predominantly frontal, accompanied by nausea, episodic vomiting, and recent onset of blurred vision. Family members additionally reported subtle changes in her gait, noting unsteadiness and difficulty initiating steps. She denied seizures, speech disturbances, or loss of consciousness.

On neurological examination, the patient was alert and fully oriented, with intact cranial nerves and preserved motor strength; however, she demonstrated a hesitant gait with mild imbalance during tandem walking. Fundoscopic examination revealed mild papilledema, suggesting elevated intracranial pressure. No focal motor or sensory deficits were noted.

A non-contrast head CT revealed a large right frontal intra-axial lesion exerting significant mass effect. Subsequent brain MRI with

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contrast demonstrated a predominantly cystic right frontal neoplasm measuring 56.2 × 42.7 × 59.8 mm, characterized by irregular thick walls, heterogeneous T1/T2 signal, blooming foci suggestive of hemorrhagic components, mild perilesional edema, and a 15 mm leftward midline shift. Diffusion-weighted imaging revealed restricted diffusion along tumor margins, and MR spectroscopy demonstrated elevated choline peaks, consistent with high-grade glioma behavior

The patient underwent a right frontal craniotomy with subtotal tumor resection. Intraoperative findings revealed a heterogeneous mass with cystic and solid components, without gross invasion of the adjacent dura. Histopathological analysis confirmed a WHO grade 3 oligodendroglioma harboring an IDH-1 mutation, retained ATRX expression, and 1p/19q codeletion, fulfilling the molecular criteria for oligodendroglioma as defined by the 2021 WHO classification.

Postoperatively, the patient recovered without new neurological deficits. Follow-up MRI demonstrated expected postoperative changes with a reduction in perilesional edema and an improvement in midline shift from 15 mm to 10 mm. No residual enhancing tumor was observed. The patient subsequently initiated combined chemoradiotherapy, consisting of external beam radiation therapy and temozolomide, followed by adjuvant temozolomide cycles. Serial imaging over the ensuing months confirmed radiographic stability and continued improvement of mass effect.

Discussion

Oligodendrogliomas represent a distinct molecular category of adult-type diffuse gliomas and are defined by the presence of an IDH mutation and whole-arm 1p/19q codeletion (1,3,4). This integrated molecular classification has reshaped the diagnostic and therapeutic landscape of diffuse gliomas, enabling more accurate prognostication than histopathological features alone

(3,5). The present case illustrates a characteristic but clinically aggressive presentation of a high-grade oligodendroglioma arising in the frontal lobe—a region commonly involved due to its glial cell density and vulnerability to neoplastic transformation (2,6).

Morning-predominant headaches, as observed in this patient, are a classic yet often overlooked manifestation of increased intracranial pressure. Nocturnal hypoventilation and impaired venous drainage during recumbency may exacerbate intracranial pressure fluctuations, explaining symptom intensification upon awakening. The accompanying gait imbalance is consistent with frontal lobe dysfunction, as this region plays a key role in motor planning and coordination. Such subtle but progressive symptoms should prompt clinicians to pursue neuroimaging, particularly when associated with nausea, vomiting, or papilledema.

Radiographic features in this case—including cystic and solid components, irregular enhancement, and significant midline shift—are frequently encountered in higher-grade oligodendrogliomas (7). The presence of elevated choline peaks on MR spectroscopy further supports increased membrane turnover and cellular proliferation, correlating with tumor aggressiveness. Although IDH-mutant and 1p/19q-codeleted tumors traditionally confer a favorable prognosis compared with IDH-wildtype astrocytomas or glioblastomas, grade 3 oligodendrogliomas may nonetheless exhibit rapid clinical progression and mass effect, as seen in this patient (7,8).

Maximal safe surgical resection remains the primary treatment modality for oligodendrogliomas to reduce tumor burden, alleviate mass effect, and establish a definitive diagnosis (8). Subtotal resection was appropriate in this case, given the lesion size, location, and surgical constraints. Adjuvant therapy plays a critical role in improving long-term outcomes. Combined chemoradiotherapy using temozolomide or PCV regimens has demonstrated substantial benefit in IDH-mutant, 1p/19q-codeleted tumors, particularly in high-grade disease (8,9). This therapeutic approach aligns with contemporary neuro-oncology guidelines emphasizing molecular stratification when selecting treatment strategies (9).

The favorable postoperative imaging in this patient, including reduction of midline shift and absence of residual enhancing tumor, reflects the success of early surgical intervention followed by appropriate adjuvant therapy. Nonetheless, long-term surveillance remains essential, as oligodendrogliomas can recur or transform despite initial good response. Molecular profiling not only guides initial management but also influences follow-up strategies, response assessment, and future eligibility for targeted therapies.

This case reinforces several critical learning points: first, subtle neurological symptoms such as morning headaches and gait imbalance warrant prompt evaluation; second, radiological and molecular characteristics are indispensable for accurate tumor classification; and third, management of high-grade oligodendrogliomas requires a multimodal approach integrating surgery, chemoradiation, and longitudinal surveillance (9,10). Through appropriate recognition and application of current molecular criteria, clinicians can optimize outcomes in patients with high-grade oligodendrogliomas.

Conclusion

This case highlights the importance of early recognition and evaluation of subtle yet progressive neurological symptoms, particularly morning headaches and gait imbalance, which may herald significant intracranial pathology. Oligodendrogliomas, now defined by IDH mutation and 1p/19q codeletion, represent a distinct molecular category of diffuse gliomas with prognostic and therapeutic implications. Although these tumors are often associated with favorable long-term outcomes, high-grade lesions may present with rapidly evolving mass effect, underscoring the necessity of prompt imaging, accurate molecular classification, and timely surgical intervention.

The patient described here benefited from early neurosurgical resection followed by appropriate chemoradiotherapy, resulting in improvement of radiographic findings and neurological status.

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This case reinforces the critical role of integrated molecular and radiological assessment in guiding modern management of oligodendrogliomas and exemplifies how adherence to updated classification standards informs treatment strategies and follow-up care. Continued attention to evolving diagnostic criteria and therapeutic recommendations is essential to optimizing outcomes for patients with high-grade oligodendrogliomas.

Disclosure Statement

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Reference List

1 Louis DN, et al. WHO Classification of Tumours of the Central Nervous System. 5th ed. World Health Organization; 2021.

2 Weller M, et al. Diffuse gliomas of adulthood. Nat Rev Dis Primers. 2015.

3 Byun YH, et al. Classification and diagnosis of adult glioma. Brain & Neurorehabilitation. 2022.

4 Cancer Genome Atlas Research Network. Comprehensive genomic characterization of gliomas. N Engl J Med. 2015.

5 van den Bent MJ. Practice-changing developments in gliomas. Neuro-Oncology. 2014.

6 Lin Y, et al. Imaging characteristics of oligodendrogliomas. J Neuroimaging. 2017.

7 Bou Zerdan M, et al. Oligodendroglioma: molecular insights and clinical implications. Front Mol Neurosci. 2021.

8 Linzey JR, et al. Aggressive phenotype in high-grade oligodendrogliomas. J Neurosurg. 2019.

9 Weller M, et al. EANO guidelines on the diagnosis and treatment of diffuse gliomas. Nat Rev Clin Oncol. 2021.

10 Jiang K, et al. Trends in contemporary management of oligodendrogliomas. World Neurosurgery. 2025.

Review of Sleep and Aging: Rethinking Sleep as the Brain's Longevity Engine

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Abstract

Sleep is a necessary biological function for all humans and animals alike. For years, society has framed sleep as a nightly "reset," a passive state that improves cognitive performance and mood. However, sleep's role impacts our physical, mental, and emotional aspects of daily life. With increasing age, sleep becomes shorter, shallower, and more fragmented and disregarded at the expense of productivity. Sleep disorders have continued to increase in prevalence, and sleep dysfunction may contribute to the onset of neurodegenerative diseases. Despite this, we often sacrifice sleep's deeper role as a dynamic biological investment in neurological longevity. These age-related changes in sleep are bidirectionally associated with physical health, cognitive health, and mental health. Reframing sleep as a modifiable driver of brain aging allows for prioritization of community-level approaches to improving sleep health, which could become powerful tools in preserving health across the lifespan.

Introduction & Review of Sleep

Sleep is necessary and serves vital functions, such as facilitating growth and development, maintaining synaptic homeostasis, supporting the immune system, and the clearance of metabolites through the glymphatic system.[4] In a society defined by its cultural drive for productivity, sleep dysregulation contributes to the rapid rise in disorders related to neurodegeneration, metabolic disease, mood disorders, and vascular risk.[6] Thus making it imperative to reclaim sleep as a form of preventative neurology that can protect our aging population. Sleep is the result of the balance between internal sleep homeostasis/pressure (Process S) and the circadian timing system (Process C). The balance of these two creates 24-hour circadian rhythmicity, coordinated by the suprachiasmatic nucleus (SCN), which modulates arousal pathways and melatonin secretion.[7] The SCN is the central clock that coordinates secondary clocks in peripheral organs such as the heart, lungs, liver, etc, and allows for the release of melatonin from the pineal gland when the body and optic nerve sense the transition from light to dark.[7] These rhythms are influenced by an individual's "zeitgebers", which are physiological and behavioral cues (meal times/brushing teeth) that work in conjunction with our internal circadian rhythm. Furthermore, sleep is categorized into non–rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep, which cycle in approximately 90–110-minute rhythms. NREM sleep encompasses stages N1, N2, and N3, and is marked by progressive cortical synchronization, reduced neuronal firing, and characteristic sleep spindles and slow waves. N1 is characterized as transitional sleep, whereas N3 sleep is described as restorative, deep, slow-wave sleep in which the glymphatic system, synaptic pruning, and strengthening occur.[8] REM sleep features cortical activation, hippocampal activity, and muscle atonia, characterized as the period in which we dream and consolidate memories.[9] Sleep requires the coordination of many physiologic cascades and individual cues to allow for clearance of metabolic waste, consolidation of memories, immune system regulation, creative thinking, and much more.

Sleep and Aging

Aging alters sleep through neurophysiological changes, increased medical comorbidities, and life stressors. The relationship is bidirectional: aging worsens sleep quality and duration, increasing vulnerability for physical, cognitive, and mental health disorders, and vice versa, as the conditions worsen sleep.8 Whether poor sleep precedes or results from age-related disease, the two processes continually reinforce one another. With age, sleep becomes more fragmented, less restorative; for example, older adults experience greater fatigue, daytime sleepiness, and increased daytime napping than younger adults.5,8 Whether due to greater personal responsibilities, nighttime interruptions, or work burden, these symptoms reflect measurable macroarchitectural changes, prolonged N1 sleep (transitional sleep), markedly reduced N3 (restorative) slow-wave sleep, and shorter REM duration.5,9 These result in "shallower" sleep with diminished glymphatic clearance, impaired memory consolidation, and higher dementia risk.1 Circadian rhythms also change with aging as a result of structural changes to the suprachiasmatic nuclei, resulting in earlier melatonin release. Earlier awakenings and earlier bedtimes produce chronic circadian disruption of circadian synchronization and a longer intrinsic period, paralleling the disruption of sleep during jet lag and again increasing the risk for Alzheimer's and dementia.3,9 Collectively, these alterations create a pattern of short, fragmented, and less restorative sleep that contributes to poorer cognitive performance and accelerates age-related decline.

Sleep and Health

Sleep disorders beyond circadian disruption profoundly influence physical, cognitive, and mental health. Obstructive sleep apnea (OSA) is a highly prevalent pulmonary sleep disorder, and due to risk factors such as obesity, particularly common among Texans. Characterized by repeated apneas or hypopneas lasting at least 10 seconds, OSA causes chronic nocturnal hypoxia and contributes to hypertension, cardiovascular complications, cerebrovascular comorbidities like stroke, and increased vulnerability to illness.12 Again, a bidirectional relationship is seen in that sleep affects the immune system and the immune system affects sleep. Recent studies demonstrate that sleep deprivation and shorter sleep increase infection susceptibility, and during an illness, individuals undergo longer sleep durations, in which immune cells help fight off infection, suggesting a significant restorative process.[4] Sleep is also fundamental to cognitive aging; therefore, disturbed circadian rhythms or insufficient sleep impairs attention, vigilance, executive functioning, and memory. Through the glymphatic system, sleep facilitates clearance of β-amyloid (Aβ), a major metabolite hallmark of Alzheimer's dis-

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ease4. With aging and reduced slow-wave sleep, higher cortical Aβ burdens emerge, increasing Alzheimer's disease risk1,[3]. Additionally, Idiopathic REM sleep behavior disorder is strongly associated with increased risk of future β β-synucleinopathies, which may include developing Parkinson's disease.[8] This is one avenue in which sleep disturbances could lead to the pathogenesis of neurodegenerative diseases, loss of memory, and neuronal and synaptic homeostasis. Older adults who show short sleep durations, and particularly worse sleep efficiency and lower slow wave activity, have greater cortical Aβ burden.[3] And those with OSA contributed to a longitudinal increase in amyloid deposition in later life, potentially contributing to cognitive decline.[10] Sleep loss has cumulative impacts on one's cognitive function. Research shows that even 17 hours of awakenings can impair performance similar to a blood alcohol concentration (BAC) of 0.05%. And 24 hours of sleep deprivation is equivalent to a BAC of 1.0% which is above the legal driving limit.2 In an age where the urge for sleep is combatted with high levels of caffeine, it is imperative to change the narrative that less sleep elicits better or prolonged productivity. Finally, sleep profoundly influences mood and mental health. Insomnia is the most common sleep disorder, and risk factors include major depressive disorder (MDD) and sleep apnea. Thus, decreased quality sleep throughout the life span can negatively contribute to one's future long-term health.

Interventions

Improving sleep requires targeted changes to the environment, behavior, cognition, and physiology. Chronic sleep loss in older adults is shaped by rising work demands, urban noise, light pollution, diet, and socioeconomic pressures. Since sleep loss is multifactorial, there is no universal solution. However, many of these changes are possible by addressing individual obstacles to good sleep and can be tailored for different demographics. Environmental optimization is a key starting point. Reducing nighttime noise, possibly through white noise machines, regulating temperature, and limiting evening light, especially from screens and television, helps maintain circadian rhythms and sleep continuity. Conversely, insufficient daytime light worsens circadian misalignment; thus, increasing morning sunlight or using bright-light therapy can stabilize rhythms. Lifestyle changes play a large role in sleep efficiency and self-reported quality. Diets high in fiber and low in saturated fats, such as in the Mediterranean diet, support deeper slow-wave sleep.11 Regular physical activity and mind–body practices reduce pain and promote relaxation.8 Mental burdens, such as rumination, stress, impede sleep onset, but meditation, expressive writing, CBT-based strategies, and techniques that lower nighttime cortisol and sympathetic activity can meaningfully improve insomnia and mood symptoms.8 While these interventions to poor sleep quality are on an individual level, a societal improvement is possible by changing the societal mindset to prioritize sleep, and encouraging local governments and urban planners to consider Texans' sleep and health.

Conclusion

Sleep powers our daily function and contributes to our longevity as a critical yet underappreciated determinant of healthy aging. Age-related sleep changes, such as fragmented sleep, reduced slow-wave activity, and circadian disruption in conjunction with societal pressures to sacrifice sleep, are contributing to the increased prevalence of Alzheimer's, Parkinson's, insomnia, MDD, and many more comorbidities. While cutting-edge research continues to advance the field of neurology in these fields, a simple modifiable driver of brain aging can be improved sleep hygiene. Prioritizing environmental, behavioral, and community-level interventions is an investment to strengthen health, maintain cognitive strength, and improve overall well-being across the lifespan. Together, these environmental adjustments, lifestyle modifications, and behavioral interventions create a multifaceted approach capable of improving sleep health across diverse aging populations.

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References

1 Ahlstrom ME, Sihvonen AJ. The sleep puzzle: Linking glymphatic function to cognitive decline. Eur J Neurol. 2025;32(12):e70451. doi: 10.1111/ene.70451.

2 Centers for Disease Control and Prevention. (2020, March 31). Module 3. impairments due to sleep deprivation are similar to impairments due to alcohol intoxication!. Centers for Disease Control and Prevention. https://www.cdc.gov/niosh/work-hour-training-for-nurses/long-hours/mod3/08.html

3 Cordi CV, Hurley JM. The link between circadian disruption and alzheimer's disease and related dementias: Insights from peripheral inflammation. Curr Opin Physiol. 2025;46:10.1016/j.cophys.2025.100859. Epub 2025 Oct 1. doi: 10.1016/j.cophys.2025.100859.

4 De la Herran-Arita AK. When sleep fails, brain clearance suffers: The role of glymphatic impairment in clinical neurology. Acta Neurol Belg. 2025. doi: 10.1007/s13760-025-02959-w.

5 Floyd JA, Janisse JJ, Jenuwine ES, Ager JW. Changes in REM-sleep percentage over the adult lifespan. Sleep. 2007;30(7):829–836. doi: 10.1093/sleep/30.7.829.

6 Namgyal D, Lim C. Circadian rhythm dysfunction in neurodegenerative diseases: A bidirectional perspective and therapeutic potential. Nat Sci Sleep. 2025;17:2969–2989. doi: 10.2147/NSS.S561326.

7 Reddy S, Reddy V, Sharma S. Physiology, Circadian Rhythm. [Updated 2023 May 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK519507/

8 Salman M, Pua KC, Scullin MK. Sleep and aging. Encyclopedia of the Human Brain. 2025:150. doi: 10.1016/b978-0-12-820480-1.00022-x.

9 Scullin MK. Do older adults need sleep? A review of neuroimaging, sleep, and aging studies. Curr Sleep Med Rep. 2017;3(3):204–214. doi: 10.1007/s40675-017-0086-z.

10 Sharma RA, Varga AW, Bubu OM, et al. Obstructive sleep apnea severity affects amyloid burden in cognitively normal elderly. A longitudinal study. Am J Respir Crit Care Med. 2018;197(7):933–943. doi: 10.1164/rccm.201704-0704OC.

11 St-Onge M, Roberts A, Shechter A, Choudhury AR. Fiber and saturated fat are associated with sleep arousals and slow wave sleep. J Clin Sleep Med. 2016;12(1):19–24. doi: 10.5664/jcsm.5384.

12 Xiang Y, Xia M, Zhang C, Chen P, Huang M, Dai X. Exploring the links between sleep quality and stroke risk in older adults. Sci Rep. 2025;15(1):42083–6. doi: 10.1038/s41598-025-26150-6.

Ptosis in Myasthenia Gravis is Not Always Myasthenics

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Background

Ptosis is common in myasthenia gravis as a presenting feature or a sign of exacerbation and or relapse. However, myasthenics may develop ptosis from other causes, some are serious. We present a case of seropositive ocular myasthenia gravis with previous relapses associated with left ptosis who presented this time with complete ptosis due to cerebral aneurysm. We will highlight the differentiating features.

Case description

A 61-year-old woman presented with horizontal diplopia and fatigable left ptosis. Binding acetylcholine receptors antibodies were positive and CT scan of the chest was negative. She was diagnosed with seropositive ocular myasthenia gravis (OMG). Symptoms responded to a brief course of prednisone and pyridostigmine. 6 months later, the disease was exacerbated following gastric bypass surgery. She developed minor fatigable left ptosis, diplopia, fatigable weakeness of the neck extensors and proximal arm muscles, particularly the triceps. She had no dyspnea, dysphagia or dysarthria. The diagnosis was changed to generalized MG. She responded to intravenous gammaglobulin, prednisone and pyridostigmine. The disease was in remission on prednisone 20 mg every other day and azathioprine 50 mg TID. No more Pyridostigmine was needed.

A few months later, she experienced horizontal diplopia, and left ptosis with sharp retroorbital pain. A virtual visit was conducted. The prednisone dose was increased to 60 mg a day and pyridostigmine was resumed at a dose of 60 mg QID.. Three weeks later, there was only slight improvement in the ptosis after each pyridostigmine dose and the retroorbital headache improved. She was asked to be examined in person. She had full left ptosis (video 1), Diplopia on right gaze, weak left medial rectus, and fully dilated nonreactive left pupil. Brain MRI revealed a void area in the left posterior communicating artery suggesting an aneurysm. MR angiography confirmed left PCA aneurysm (Figure 1) which was embolized (Figure 2).

The headache resolved but she continued to have complete left ptosis, mydriasis and MR paralysis.

Discussion

Ptosis can be caused by many disorders affecting muscles, nerves, neuromuscular junctions (NMJ) and sympathetic flow to the upper eyelids (table 1).

Myasthenic ptosis is usually partial and fluctuating, being more pronounced as the day passes and improves with rest. It usually alternates (affecting both eyes). Response to AcetylCholine esterase inhibitors is not specific and is even reported in ptosis due to brain stem glioma, therefor it is not diagnostically reliable. Ptosis due to Horner syndrome is associated with miosis and anhidrosis. Ptosis of the third cranial nerve palsy is characterized by being complete, none fluctuating and is associated with ipsilateral MR weakness. Diabetic third cranial nerve palsy usually spares pupil since the parasympathetic nerve fibers encircle the nerve and are not affected when the nerve is infarcted. To the contrary, they are affected when the insult is a compressive lesion from outside such as cerebral aneurysm, typically affecting the PCA. While headache is not uncommon in MG due to head title to avoid diplopia, leading to muscle strain, severe retroorbital headache should be taken seriously as a sign of an intracranial pathology.

Take home message

Ptosis in myasthenics can be caused by other disorders. Complete and non fluctuating ptosis with retroorbital headache should prompt careful examination of the pupils and EOMs looking for evidence of third cranial nerve palsy. An early detection and treatment of cerebral aneurysm reduces the risk of irreversible damage to the third cranial nerve and reduces the total period of recovery.

Video Link HERE

https://www.dropbox.com/scl/fi/m8f2arwzgygtxy2furpp3/ROMERO-HELEN.mp4?rlkey=haqquywq38l5qxmtkr7j7at-ph&st=s0r9vjyc&dl=0

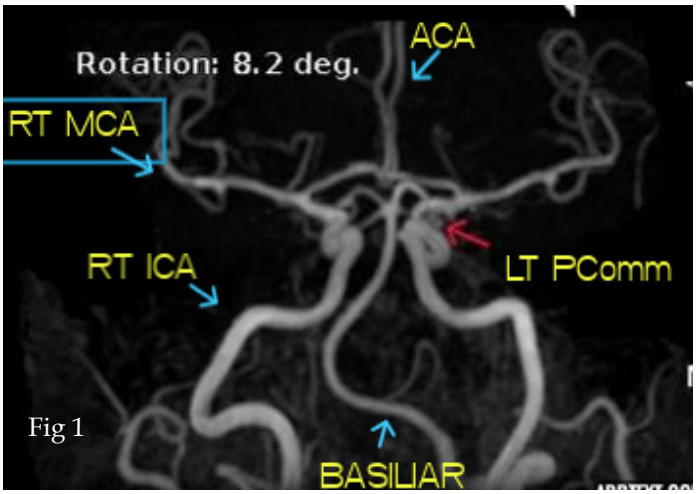


Fig 1

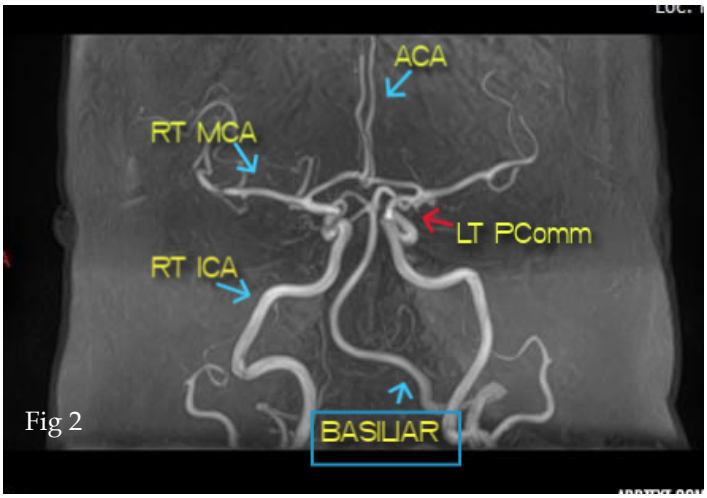


Fig 2

Ptosis in Myasthenia Gravis is Not Always Myasthenics

Table 1: causes of ptosis

Category	Cause	Examples/Notes
Neurogenic	Third nerve palsy	Often unilateral, may have diplopia, pupil involvement
	Horner's syndrome	Mild ptosis, miosis, anhidrosis (sympathetic pathway disruption)
	Myasthenia gravis	Fluctuating ptosis, worsens with fatigue, may be bilateral
Myogenic	Muscular dystrophies	e.g., oculopharyngeal muscular dystrophy, CPEO; usually bilateral
	Congenital myopathy	e.g., nemaline myopathy, centronuclear myopathy
	Myotonic dystrophy	Ptosis with frontal balding and distal weakness
Aponeurotic	Involutional (age-related)	Most common in elderly; levator dehiscence or disinsertion
	Post-surgical or contact lens use	Aponeurosis stretching or dehiscence
Mechanical	Eyelid or orbital mass	Tumors, cysts, or inflammation causing gravitational pull on the eyelid
	Edema or hematoma	Trauma-related, allergic reactions
Traumatic	Direct trauma to levator muscle	May cause muscle rupture or aponeurotic disinsertion
	Orbital fracture or surgery	Can damage neurovascular or muscular structures
Miscellaneous	Neurotoxin exposure	Botulism, snake venom, organophosphates
	Iatrogenic	Botulinum toxin local injections

Reversible Lipid Storage Myopathy Associated with Sertraline



Authors: Alexis Taylor, Muhammad Saadah, Aziz Shaibani

A 63-year-old female with 6 months history of progressive painless weakness in the legs. She denied dysphagia or dyspnea. She lost 20 pounds in 6 months. Examination is shown in the video: symmetric proximal weakness—mild in upper extremities and moderate in lower extremities—while distal strength remains intact. Creatine kinase level was persistently elevated in the range of 1000 IU/L. She had history of hypertension and Diabetes mellitus. Needle EMG was reported as normal in the weak muscles. Left biceps muscle biopsy was done to confirm myopathy and to determine its type. Figure 1 shows muscle tissue stained with H&E (400x) and Figure 2 shows the same tissue stained with Oil Red O (400x).

The following diagnostic tests are appropriate except:

a) Acylcarnitine profile
b) Total and free serum carnitine
c) Genetic testing for CPT-2 mutations
d) Genetic testing for GAA gene mutation

The correct answer is D. GAA is a gene concerned with acid maltase. The rest are related to lipid storage diseases.

Serum carnitine and CPT-2 mutation analysis were negative.

Acylcarnitine profile was abnormal and showed elevated medium and long chain acylcarnitine levels indicating abnormal medium and long chain fatty acids. See Figure 3.

The most likely diagnosis is:

a) Primary carnitine deficiency
b) Multiple Acyl Coenzyme A dehydrogenase deficiency (MADD)
c) *CPT-2* mutations
d) Neutral lipid storage disease
e) VLCAD

The answer is B, as the acylcarnitine profile indicated abnormal medium and long chain fatty acid activity. VLCAD is confined to the long chain fatty acids. CPT-2 gene and carnitine levels were normal. Neutral lipid storage disease is an infantile triglyceride disorder.

Genetic testing for fatty acid oxidation and mitochondrial disorders was negative.

Riboflavin 50 mg BID led to clinical and biochemical normalization within three months. See Figure 4.

The patient was on sertraline for depression for years. The medicine was discontinued once an association was discovered between the medication and the myopathy. However, clinical and biochemical normalization occurred even before discontinuation of sertraline, suggesting that riboflavin may have a preventive or protective function.

Lipid storage myopathies (LSM) are a group of rare disorders characterized by abnormal lipid accumulation in muscle fibers, commonly resulting in proximal muscle weakness and elevated creatine kinase levels. Within the category of LSM, there are various subtypes divided by biochemical markers and genetic mutations. While many patients have hereditary LSMs, there are ways that these myopathies can be acquired. Specifically, a subtype of LSM known as Multiple Acyl-coA Dehydrogenase Deficiency (MADD) has been associated with sertraline use. Sertraline has been linked to respiratory chain inhibition, though its role in lipid storage myopathies is not well defined1. The mainstay of treatment for MADD (including sertraline-associated) has been high-dose riboflavin supplementation.

Disclosure statement:

The authors have no financial or other disclosures to include.

References:

1 Sadeh M, Dory A, Lev D, Yosovich K, Dabby R. Riboflavin-responsive lipid-storage myopathy in elderly patients. J Neurol Sci. 2024 Jan 15;456:122808

2 Meier C, Burns K, Manolikos C, Hodge S, Bell DA. Multiple acyl-Coa dehydrogenase deficiency: an underdiagnosed disorder in adults. Intern Med J. 2024 Sep;54(9):1567-1571

3 Ingoglia F, Tanfous M, Ellezam B, Anderson KJ, Pasquali M, Botto LD. MADD-like pattern of acylcarnitines associated with sertraline use. Mol Genet Metab Rep. 2024 Sep 16;41:101142

4 Jones FJS, Mirman I, Milone M, Liewluck T. Exposure to sertraline and ranolazine is common among adult patients with genetically uncharacterized lipid storage myopathy. J Neurol Sci. 2025 Aug 15;475:123599.

Video Link HERE

https://www.dropbox.com/scl/fi/of36ea5bsmtrx5y95yl6v/Pearl-Thomas.mp4?rlkey=h9g07rqnckh73flw6mtg-sa8w4&e=1&st=r1bm2n2a&dl=0

Reversible Myopathy Associated with Sertraline

Figures:

Figure 1

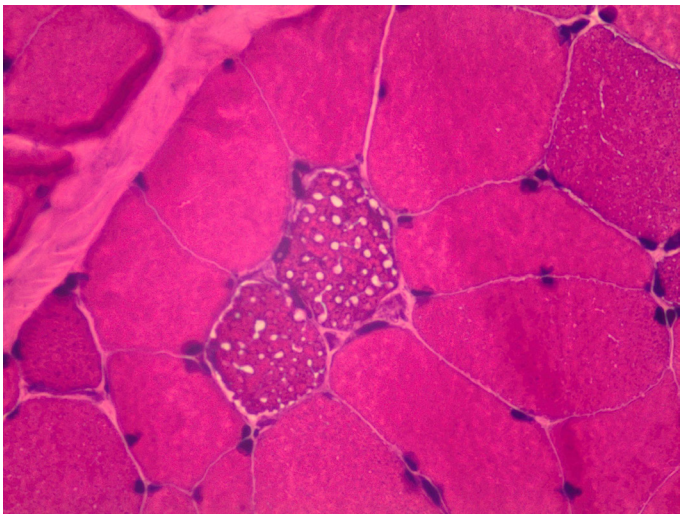


Figure 2

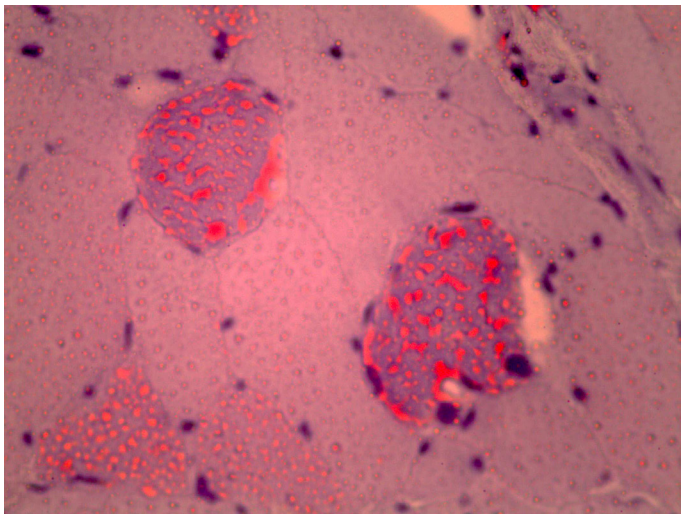


Figure 3

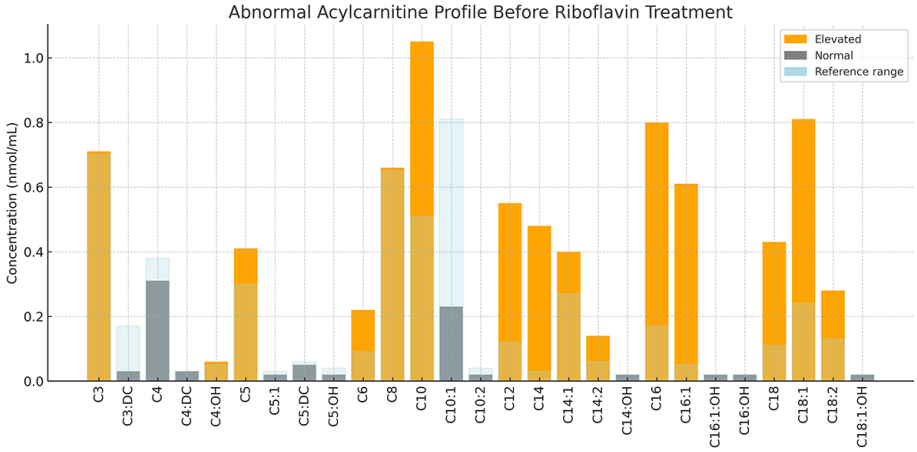
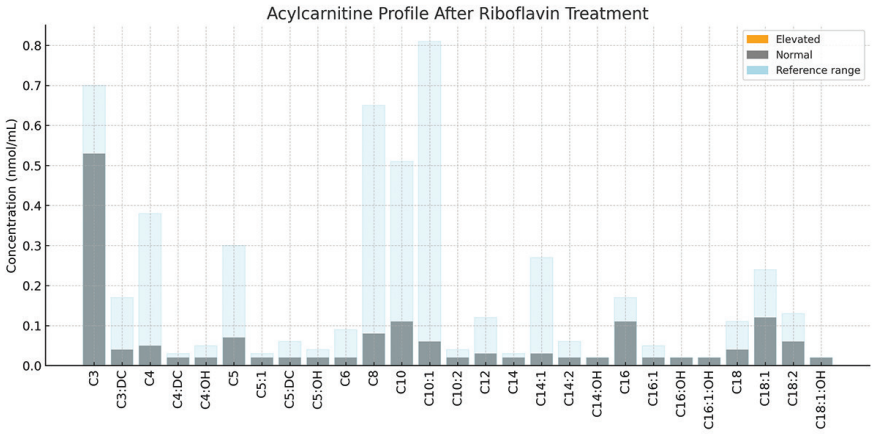


Figure 4



A Diagnostic Challenge: Tumefactive Cerebral Amyloid Angiopathy

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Introduction

Cerebral amyloid angiopathy (CAA) is a small-vessel disease characterized by the deposition of amyloid-β (Aβ) within cortical and leptomeningeal vessels. Cerebral amyloid angiopathy may be classified according to pathological characteristics, clinical presentation, or the presence of associated inflammatory changes, with the most common form being the classic sporadic variant, typically affecting older adults.[1] The clinical spectrum of CAA is broad, typically including lobar intracerebral hemorrhages, progressive cognitive decline, transient focal neurological episodes, and seizures.[1] Imaging findings of CAA include multiple strictly lobar cerebral microbleeds (CMBs), cortical superficial siderosis (cSS) or subarachnoid hemorrhage (SAH), white matter hyperintensities (WMHs), enlarged perivascular spaces in the centrum semiovale (CSO-PVS), and cortical atrophy.[2]

A less common manifestation of CAA is CAA-related inflammation (CAA-ri). This distinct form of cerebral amyloid angiopathy (CAA) involves an autoimmune reaction to cerebrovascular β-amyloid deposits within different intracerebral arterial segments, with biopsy findings ranging from perivascular inflammatory infiltrates without vessel wall involvement to true vasculitis with transmural inflammation and vascular wall destruction.[4] Patients with CAA-related inflammation (CAA-ri) present with subacute cognitive impairment, seizures or headache, rather than intracerebral or subarachnoid hemorrhage, and with brain MRI and neuropathological evidence of inflammation.[3]

on is critical, as CAA-ri is potentially reversible with prompt immunosuppressive therapy. Data from larger case series demonstrate the effectiveness of such treatment and indicate that early initiation may improve outcomes and lower the risk of recurrence.[4]

We present a case that highlights the atypical evolution, diagnostic complexity, and ultimately confirmatory pathology of CAA-ri, underscoring the importance of considering this entity in patients with unexplained mass-like or inflammatory cerebral lesions.

Case Report

The patient is a 65-year-old, right-handed Caucasian male with a past medical history significant for atrial fibrillation, status post catheter ablation in 2015, hypertension, benign prostatic hyperplasia, and an incidental left parietal mass discovered in January 2016 during admission for light-headedness. The lesion was presumed to be a low-grade glioma on stereotactic biopsy, and serial surveillance neuroimaging was planned; however, the patient was lost to follow-up after January 2017. His family history is notable for Alzheimer's disease in his father, diagnosed at the age of 65.

The patient presented to the hospital in August 2025 after being found unresponsive on the floor after a presumed fall. On arrival, the patient was unaware of the event, and Neurology was consulted, given concern for an epileptic event. On initial evaluation, the patient was awake and alert but disoriented, with impaired recall of remote information. Cranial nerves II–XII were intact. Motor strength, sensation, coordination, and gait were intact, without focal deficits, and language and speech components were preserved. Further neurological examination demonstrated a positive glabellar tap and a primitive palmar grasp reflex. Electroencephalograph (EEG) demonstrated generalized slowing, theta activity, reactive with occasional, very brief runs of 1.5 to 2 Hz, and rhythmic delta activity, lateralized to the left fronto-centro-parietal region, indicating a mild degree of encephalopathy with superimposed left fronto-centro-parietal focal dysfunction.

Levetiracetam 500 mg twice daily was initiated empirically for possible seizures in the setting of a known structural lesion.

Initial neuroimaging with Computed Tomography of the head revealed multifocal areas of vasogenic edema in the bilateral frontal and left parietal lobes.

Computed tomography angiography of the head and neck showed no large-vessel occlusion or high-grade stenosis.

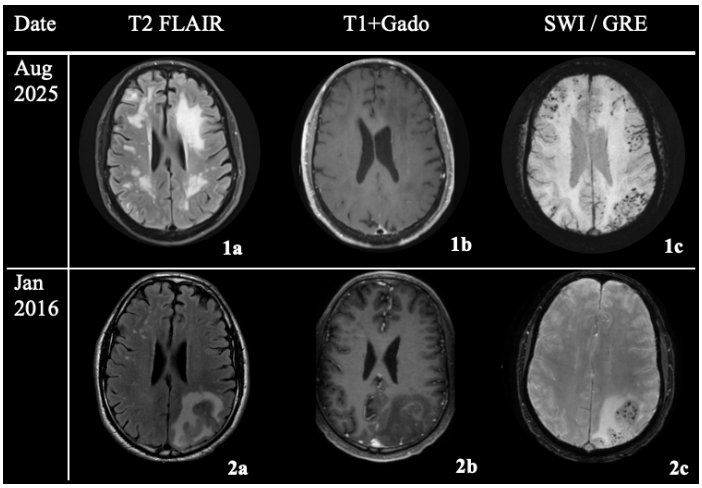
Magnetic resonance imaging of the brain, with and without contrast, revealed multifocal T2/FLAIR hyperintensities throughout both hemispheres, predominantly in the left frontal lobe, with superficial siderosis and subtle enhancement (Figure 1a, Figure 1b). This was concerning for a broad differential, including infiltrative glioma, encephalitis, or vasculitis. Magnetic resonance imaging of the cervical spine with and without contrast showed no concerning findings. Malignancy work-up was pursued with computed tomography of the thorax, abdomen, and pelvis, which demonstrated no findings suggestive of malignancy but revealed stable bilateral adrenal nodules likely representing adenomas. Lumbar puncture revealed normal opening pressure of 20 cm H2O, acellular cerebrospinal fluid, protein 48 mg/dL (reference range 15-45 mg/dL), glucose 65 mg/Dl (reference range 50-80 mg/dL), negative testing for infectious meningitis, negative Autoimmune/ Paraneoplastic serum and CSF panel, absent oligoclonal bands, no aberrant cells seen on cytology or abnormalities on flow cytometry. Serum studies showed a positive antinuclear antibody at a high titer (1:1280) with a cytoplasmic pattern. Further paraclinical testing with anti-dsDNA, rheumatoid factor, paraneoplastic panel, anti-MOG antibody, hepatitis panel, HIV, and syphilis serologies were negative.

The patient remained slow to respond with impaired remote memory.

Figure 1 MRI findings on initial presentation in January 2016 and August 2025.

(1a-1c) Axial images from August 2025. (1a): Scattered hyperintense bi-hemispheric lesions, predominantly involving the left frontal lobe on T2 FLAIR, without cortical thickening. (1b): T1 post-contrast

A Diagnostic Challenge: Tumefactive Cerebral Amyloid Angiopathy



sequence showing no significant enhancement of these lesions. (1c): SWI sequence revealing diffuse microhemorrhages more pronounced in the bifrontal and L occipital regions.

(2a-2c) Axial images from January 2016. (2a): Left focal parieto-occipital hyperintense lesion, with minimal cortical thickening on T2 FLAIR. (2b) Post-contrast T1 sequence with no lesional enhancement noted. (2c): SWI showing microhemorrhages confined to the same parieto-occipital region.

On further review of the MRI Brain, numerous punctate susceptibility foci compatible with cerebral microhemorrhages were noted on GRE/SWI sequences (Figure 1c), with a marked interval increase in number and location compared with the 2016 Brain MRI (Figure 2c).

Neurosurgery was consulted for a brain biopsy. Left frontal stereotactic biopsy confirmed cerebral amyloid angiopathy with perivascular inflammation, diagnostic of cerebral amyloid angiopathy-related inflammation. Intravenous methylprednisolone 1 g daily for 3 days was administered, followed by oral prednisone taper.

Post-biopsy, the patient developed mild expressive aphasia that improved daily, with no acute findings on follow-up imaging. Oral prednisone taper was continued at discharge alongside Levetiracetam for seizure prophylaxis.

Discussion

Cerebral Amyloid Angiopathy (CAA) is a progressive, age-dependent disorder characterized by amyloid-β deposits in the walls of small-to-medium cortical and leptomeningeal vessels, while usually sparing similar-sized vessels in the deep white matter. Sporadic forms of CAA typically present after age 60-65. [5,6] CAA-ri, however, has a more variable presentation with a similar mean age of presentation of 67 years. [8] Hence, our patient, who initially presented relatively young in his mid-50s, raises the possibility of familial CAA. His clinical and radiological presentation, mimicking a primary central nervous system neoplasm manifesting at a relatively young age, made the diagnosis even more challenging.

The tumefactive variant of CAA is a relatively infrequent subtype, and various attempts have been made to tailor diagnostic criteria to aid its diagnosis. The main approaches for establishing a possible or probable diagnosis are through susceptibility-weighted (SWI) or gradient-echo (GRE) MRI and biopsy.[7] The modified Boston criteria are the most commonly used guidelines for diagnosing CAA. [1,2] A modified CAA-related inflammation (CAA-ri) criteria published by Auriel et al. helped in further delineating the use of neuroimaging in the diagnosis, with a specificity of up to 82% and a sensitivity of 97% for the probable criteria. For a probable diagnosis to be considered, the imaging criteria specified are the presence of asymmetric unifocal or multifocal white matter hyperintensities extending to the subcortical region, along with either superficial siderosis, macro or microhaemorrhage.[3] It is noteworthy that despite these advancements, the only definitive diagnostic method for such cases is through post-mortem examination.

In this case, the patient initially presented in 2016 with non-specific symptoms, including confusion, cognitive decline, and syncopal episodes concerning for seizures. Computed tomography of the head and subsequent neuroimaging demonstrated involvement of the left parieto-occipital lobe without enhancement, along with microhemorrhages predominantly confined to that region. These findings prompted a stereotactic biopsy, which was nondiagnostic, favoring a low-grade glial neoplasm.

Approximately nine years later, after being lost to follow-up, the patient was re-admitted with another syncopal episode, suspected to be epileptic in origin. Imaging at this time revealed interval dissemination of disease, with bilateral hemispheric involvement, most prominently in the left frontal lobe, accompanied by superficial siderosis and subtle enhancement. Microhemorrhages had become more diffuse and were present in both hemispheres. Notably, no vascular gadolinium enhancement was seen on contrast studies. The patient's current MRI findings met the requirements for probable CAA per CAA-ri criteria discussed earlier. He subsequently underwent a stereotactic biopsy, which confirmed the diagnosis of cerebral amyloid angiopathy requiring steroid management.

Although the majority of CAA diagnostic criteria rely on imaging, a major requirement across all of them is the exclusion of neoplastic, infectious, or other alternative causes. This often necessitates more invasive procedures to support the diagnosis, especially given that premature initiation of corticosteroid therapy may mask conditions such as cerebral lymphoma or even worsen symptoms in the presence of an underlying infection.

Conclusion

This case report illustrates that tumefactive cerebral amyloid angiopathy (CAA) can present atypically with a subacute or chronic course characterized by progressive cognitive decline and seizure-like episodes, thereby closely mimicking a low-grade central nervous system neoplasm in a middle-aged patient. Neuroradiologic findings in such presentations may be non-specific, showing mass-like lesions, microhemorrhages, or subtle enhancement pat-

A Diagnostic Challenge: Tumefactive Cerebral Amyloid Angiopathy

terns that overlap with those seen in infiltrative tumors or inflammatory disorders. This diagnostic ambiguity often requires invasive procedures, including biopsy, to obtain definitive histopathologic confirmation.

The case underscores the importance of maintaining a high index of suspicion for tumefactive CAA when encountering unexplained and atypical mass-like cerebral lesions, especially in the context of recurrent or progressive symptoms with associated cognitive decline. Early recognition is essential, as delayed diagnosis can lead to increased morbidity, unnecessary interventions, and missed opportunities for appropriate management of this rare but clinically significant pathology.

Disclosure Statement

The authors have no financial or other disclosures to include.

References

1. Storti B, Gabriel MM, Sennfält S, Canavero I, Rifino N, Gatti L, Bersano A. Rare forms of cerebral amyloid angiopathy: pathogenesis, biological and clinical features of CAA-ri and iCAA. Front Neurosci. 2023;17:1219025. doi:10.3389/fnins.2023.1219025.
2. Sharma R, Dearaugo S, Infeld B, O'Sullivan R, Gerraty RP. Cerebral amyloid angiopathy: review of clinico-radiological features and mimics. J Med Imaging Radiat Oncol. 2018. doi:10.1111/1754-9485.12726.
3. Auriel E, Charidimou A, Gurol ME, et al. Validation of clinicoradiological criteria for the diagnosis of cerebral amyloid angiopathy–related inflammation. JAMA Neurol. 2016;73(2):197–202. doi:10.1001/jamaneurol.2015.4078.
4. Regenhardt RW, Thon JM, Das AS, et al. Association between immunosuppressive treatment and outcomes of cerebral amyloid angiopathy–related inflammation. JAMA Neurol. 2020;77(10):1261–1269. doi:10.1001/jamaneurol.2020.1782.
5. Chung KK, Anderson NE, Hutchinson D, Synek B, Barber PA. Cerebral amyloid angiopathy-related inflammation: three case reports and a review. J Neurol Neurosurg Psychiatry. 2011;82(1):20–26. doi:10.1136/jnnp.2009.204180.
6. Kotsenas AL, et al. Tumefactive cerebral amyloid angiopathy mimicking CNS neoplasm. AJR Am J Roentgenol. 2013;200(1). doi:10.2214/AJR.12.8500.
7. Ronsin S, Deiana G, Geraldo AF, et al. Pseudotumoral presentation of cerebral amyloid angiopathy-related inflammation. Neurology. 2016;86(10):912–919. doi:10.1212/WNL.0000000000002444.
8. Corovic A, Kelly S, Markus HS. Cerebral amyloid angiopathy associated with inflammation: A systematic review of clinical and imaging features and outcome. International Journal of Stroke. 2017;13(3):257-267.

Validation of a Digital Cognitive Screening App in Young Adults with Cognitive Complaints

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Background

Cognitive difficulties, such as forgetfulness, trouble focusing, and "brain fog," are common complaints by adults presenting to neurology clinics. A recent study analyzing national trends showed that the age-adjusted self-reported cognitive disability prevalence in the United States rose from 5.3% (95% CI 5.1%–5.4%) in 2013 to 7.4% (95% CI 7.2%–7.6%) in 2023, with statistically significant increases beginning in 2016. The prevalence of cognitive disability among younger adults aged 18–39 years nearly doubled, increasing from 5.1% (95% CI 4.8%–5.3%) to 9.7% (95% CI 9.2%–10.2%), making this age group the primary driver of the overall rise in cognitive disability in the United States. Because subjective cognitive complaints often do not align with objective cognitive impairment [1,2], it can be challenging to determine which patients may benefit from a more thorough neurocognitive assessment. Cognitive screening measures are often used to aid in this decision, yet most were initially developed to detect cognitive impairment in older adults, raising concerns about sensitivity in younger adults [3]. Moreover, widely used cognitive screening tools, such as the Montreal Cognitive Assessment (MoCA), require 10-15 minutes to administer and do not take advantage of modern technologies and statistical techniques, such as connected speech analysis and machine learning [4,5], which can improve efficiency and accuracy. The purpose of this project is to examine the validity and acceptability of a brief (≈ 5 minutes) digital cognitive screening tool in a younger adult neurology clinic population.

Aims

Aim 1: Validate a digital cognitive screening application (app), Memory Check, in young adult neurology patients. We hypothesize that *Memory Check* will detect cognitive impairment as good as or better than the MoCA using a more comprehensive neuropsychological test battery (NTB) as the gold standard indicator of cognitive status.

Aim 2: Examine the acceptability of *Memory Check* in younger adult neurology patients. We hypothesize that the *Memory Check* app will not differ significantly from the MoCA on ratings of enjoyability or difficulty but will be rated as less anxiety-provoking than the MoCA.

Research Plan

Participants: A total of 60 adults aged 18-50, 30 with cognitive complaints and 30 age, education and sex/gender matched subjects without, will be recruited from the Neurology Clinic at University of Texas Health San Antonio (UTHSA). Participants with cognitive complaints, defined as any report of cognitive difficulties such as trouble paying attention, forgetfulness, or brain fog, will be recruited consecutively according to the following inclusion/exclusion criteria:

Inclusion criteria: (1) Aged 18-50 years; (2) Absence of a neurological condition known to cause neurocognitive disorders (e.g., epilepsy, MS, Stroke, genetic encephalopathies) (3) Any ethnic/racial background; (4) Any sex/gender; (5) Willing to participate in the study; and (6) Fluent in English or Spanish.

Exclusion criteria: (1) Confounding conditions that could impact ability to participate in the study (e.g., cognitive impairment sufficient to impact ability to follow app instructions, motor impairment that would prohibit independent use of the app, poor visual acuity); (2) Prior diagnosis of neurocognitive disorder or intellectual disabilities; (3) active substance abuse disorder (4) Untreated serious mental illness such as Schizophrenia or Bipolar disorder and (5) Unable to read or speak English or Spanish.

Measures

Memory Check: **Memory Check** is self-administered on an iPad and consists of a digit symbol substitution task, Speeded Matching (SM) [6], and two speaking tasks, recounting a personal memory and counting backwards. Completion of these tasks takes approximately 5 minutes, after which a cognitive performance (CP) score incorporating demographic characteristics, SM scores, and acoustic and linguistic variables extracted from the speaking tasks, is generated using machine learning techniques

Neuropsychological Test Battery (NTB): A psychometric diagnostic decision-making method using six neuropsychological test scores will be utilized as a "gold standard" to identify cognitive impairment (Bondi et al., 2014; Edmonds et al., 2015). Specifically, scores on the Rey Auditory Verbal Learning Test delayed recall and recognition (memory domain), Boston Naming Test and Animal Naming (language domain), and Trail Making Test Parts A and B (attention/executive domain) – i.e. two distinct tests for each of 3 separate domains – will be used to classify participants as cognitively normal (CN) or cognitively impaired (CI).

Data Analysis

The primary outcome for Aim 1 will be the classification accuracy of the Memory Check CP score in identifying CN and CI groups according to performance on the NTB. Receiver operating characteristic analysis will be conducted with cognitive status as the reference variable and Memory Check CP score as the classification variable. The sensitivity and specificity of various Memory Check CP cut points will be determined. The same analysis will be repeated with the MoCA total score as the classification variable. The primary outcome for Aim 2 will be comparing average scores for Memory Check and MoCA on each of the three acceptability questions using independent samples t-tests.

Future Directions

In this application, we propose to validate a novel digital cognitive screening tool in young adults to use as a clinical decision support method for determining allocation of neurocognitive diagnostic and treatment services.

We have submitted the project for IRB approval and will be gathering data shortly.

Outcomes from a Stroke Support Group in an Area Underserved by Neurology in Texas

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Abstract

Community Stroke Support Groups (SSG) have demonstrated benefit in informing stroke survivors and their caregivers about key stroke concepts, which can result in better community engagement. We implemented a SSG in a community underserved by neurology, focusing on educational topics including stroke symptoms, recovery, risk-factors, and pathophysiology, and also physical therapy, nutrition, wellness, and post-stroke symptoms. Then, we assessed participant perceptions of the SSG and associated local clinical outcomes potentially reflecting community behaviors. As a proxy for assessing patient and caregiver accuracy in recognizing stroke symptoms, we evaluated the incidence of matched Emergency Medical Services (EMS) dispatch diagnoses to first responder diagnoses before and after implementing the SSG over two years. At a local hospital, we compared stroke severity to assess for changes in recognition of more subtle stroke symptoms, and time from stroke symptoms to emergency room arrival to assess how quickly EMS was activated. In our study, implementation of a SSG did not lead to measurable changes in local clinical outcomes, however participants perceived the SSG as comfortable, supportive, educational, and interactive. Based on our findings, we propose additional measures to characterize the benefits of SSGs in community health.

Introduction

In the US, death from stroke is increasing, and stroke is the fifth leading cause of death1. Stroke is a leading cause of disability2. Twelve percent of strokes recur in stroke survivors; some stroke subtypes recur is as high as 54%3. Timely recognition of stroke symptoms can lead to reduction in death and disability, given the time-sensitive nature of stroke treatments, yet delays persist in patient arrival to emergency rooms4-5. Public knowledge on stroke-associated symptoms and timeliness of seeking medical care has lacked: only 16% of respondents of a multi-state US Center for Disease Control survey demonstrated correct recognition of stroke symptoms and the need to call emergency medical services6. Stroke support groups (SSGs) have helped participants become well-informed about stroke symptoms and risk factors7. Establishing relationships among medical staff and patients with stroke may help strengthen community and sense of purpose8.

Both stroke survivors and their caregivers can experience burden and fatigue as they navigate a sudden and unexpected life change. It can be difficult to measure the level of support they may experience from a SSG due to logistics, survey fatigue, and available assessment tools. Largely, research is qualitative, demonstrating that SSG participants experience both personal and environmental support, increased social participation, and empowerment with knowledge and a sense of community9-10. Identification with a social group has been associated with reduced loneliness, and improved clarity of goals and group member continuity11. A meta-analysis found that peer support interventions improved daily living activities, motor function, and mood disorders commonly associated after stroke including depression and anxiety12. Demonstrating healthcare system, hospital-level, and patient-centered outcomes is essential to aid communities in leveraging for resources to implement and sustain effective SSGs. We initiated a SSG in a Texas community underserved by neurology, and measured perceived level of support and local acute stroke clinical outcomes.

Methods

A primary stroke center and collaborating telestroke hub, located 122 miles apart, identified the need for a SSG in Victoria, TX. Since May 2022, the SSG has met monthly for ten months yearly. About two months prior to SSG meetings, primary stroke center and telestroke hub leadership meet to determine session topics and objectives. Information for the SSG is disseminated community-wide via flyer. Session topics include stroke symptom identification, stroke prevention, causes of stroke, wellness, recovery, nutrition, timeliness of stroke emergency care, and medication adherence. Some sessions focus on stroke knowledge, others on activities to promote social interaction, wellness, and physical movement. Guest educators have included physical therapists, art therapists, chefs, and community resource providers, in addition to nurses and physicians. Guest educators attend in-person or virtually. We offer a virtual option for participants.

For the first nine months of the support group, we administered an anonymous survey (created via QualtricsTM), to assess participant perceptions of the SSG. Survey participation was optional. Respondents could complete surveys either on printed hard copy or online via QR code. The survey consisted of seven Likert-style questions addressing participant perspectives on the SSG and one free response question requesting their suggested future session topics. Guest educators from the community could also complete the survey if they self-identified as a stroke survivor or caregiver. A letter of intent was provided to participants regarding the survey, as per the University of Texas Health Science Center Institutional

Outcomes from a Stroke Support Group in an Area Underserved by Neurology in Texas

Review Board. (Exemption HSC-MS-24-0301). The authors have no disclosures.

Monthly aggregate, anonymous acute stroke clinical data was collected prospectively and compared before (6/2021-5/2022) and after initiating (6/2022-5/2024) our SSG. We included clinical variables that potentially reflected health behaviors in the community. Clinical data was also assessed for change over time (6/2022-5/2024). Variables included the following:

- The National Institutes of Health Stroke Scale (NIHSS) of patients on arrival to the emergency department, with higher scores often denoting more severe stroke13. This variable was intended to assess whether community members were detecting more subtler stroke symptoms.
- The interval of time between a patient's last-known-well-time and Emergency Room (ER) arrival time. This variable was intended to assess whether community members were arriving to the hospital faster.
- The number of stroke dispatch calls. This variable was intended to assess whether community members were alerting EMS more frequently.
- The proportion of calls with matching dispatch diagnosis (dependent on information community members provide EMS dispatchers) and EMS professional diagnosis on scene. This variable was intended to assess whether community members were more accurately recognizing stroke signs and symptoms.

We summarized observations as frequencies and percentages. We described continuous and ordinal variables using medians and interquartile ranges (IQR). A local primary stroke center and EMS institution provided clinical data. We conducted data management using Microsoft Excel 2010, and performed statistical analyses using Stata, version 12.0 (StataCorp, College Station, TX, USA). We generated graphical representations using Microsoft Excel 2010. We applied non-parametric statistical tests given the nature of the data distributions. We used Wilcoxon rank-sum (Mann-Whitney U) test to compare continuous or ordinal variables between the pre- and post-SSG periods. We employed Spearman's rank correlation coefficient to assess temporal trends in the post-implementation period. All statistical tests were two-sided; a p-value <0.05 was considered indicative of statistical significance.

Results

Over two years, there were 30 community members (including stroke survivors and caregivers) per SSG meeting.

Stroke Survivor and Caregiver Perceptions

In the first nine months, we collected 90 surveys (a 61% response rate accounting for number of participation encounters). Of survey participants, 57% were stroke survivors, 37% caregivers, and 6% community educators. A majority of respondents were comfortable participating (74%) and reported that SSG was moderately, very, or extremely supportive (94%) (Figure 1). Fifty-nine percent of respondents reported interacting with other participants a moderate amount, a lot, or a great deal. Sixty-five percent of respondents reported learning a lot or a great deal, while 34% reported learning a little to a moderate amount. Seventy-seven percent of respondents expressed they were extremely likely to recommend the SSG to other stroke survivors or caregivers.

Aggregate Clinical Outcomes in the Community

There was no difference in stroke severity, which was mild before and after implementation of the SSG (median NIHSS 2 IQR 0-7 vs 2 IQR 0-6, p=0.78). The NIHSS also did not change over the two years assessed (p=0.27) (Figure 2).

The median time from stroke patient last known well to ER arrival increased before and after implementation of the SSG (48 IQR 33-87 before vs 122 IQR 55-443 after, p<0.05), although it did not change over time (p=0.61) (Figure 3).

The median number of EMS dispatches for stroke did not change after SSG implementation (18 IQR 14-22 before vs 14.5 IQR 11-20 after, p=0.16), nor over time after implementation (p=0.69) (Figure 4).

Comparing dispatch diagnoses, based on the information community members provided, to diagnoses by EMS field assessment, the median percentage of matching stroke diagnoses did not significantly change (41% IQR 33-51 before vs 42% IQR 36-56, p=0.63), nor over time after implementation (p=0.55) (Figure 5).

Discussion

Stroke survivors and caregivers perceived the SSG as educational and supportive. Over half of the survey responses described a moderate or more amount of interaction among participants. We anecdotally noted increasing engagement and interaction among participants over time. Further, longitudinal measurement of interaction among participants could better characterize SSG influence on social interaction.

Only one participant joined the SSG virtually. A virtual option could assist specific populations of stroke survivors who may be recovering in skilled nursing facilities or rehabilitation centers, and for stroke survivors and caregivers experiencing distance barriers to participation. Educators and facilitators attended both virtually and in-person: a virtual option mitigated distance barriers and adverse weather obstacles. Further exploration on leveraging a hybrid environment to optimize community stroke education is warranted, given the potential to reach both underserved and geographically marginalized populations who also receive disparate post-stroke care[14].

We did not find any changes in stroke severity before and after implementation of the SSG. However, strokes were mild prior to SSG implementation. We received stroke severity data from a local primary stroke center; it is possible that patients with more severe stroke were triaged to higher level of care. The time from when

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patients experienced stroke symptoms and when they arrived to the ER was significantly higher after SSG implementation, however a handful of cases with very delayed presentation may have driven this in the setting of a limited sample size. A prior multilevel public stroke education initiative in a Texas community led to increased utilization of standard of care acute stroke treatments, but not reduced delays in presentation to ERs15. This metric did not change over time after SSG implementation. Incidence of EMS dispatch calls for stroke cases and alignment of dispatch and EMS diagnoses did not change.

Implementation of our SSG in a community underserved by neurology did not lead to measurable changes in local clinical outcomes. Data is limited as it does not reflect individual SSG participant outcomes however given sample size we found it reasonable to assess community level clinical outcomes. Additional outcomes that could reflect the clinical impact of a SSG, such as frequency of hospital readmissions, stroke recurrence, or ambulatory primary care or stroke clinic follow up metrics, could be explored in future studies. Given that SSG participants reported perceptions of support and increased knowledge base, our findings highlight the importance of focusing on patient perspectives (eg., quality of life, caregiver burden) to assess impact from social support interventions.

Our findings are limited given the single-community design and subsequently small sample size of participants and data. Although stroke survivors and their caregivers have unique regional needs, rigorous investigation with multi-location studies could inform common themes in structure and approach that can add to current guidance for SSG implementation8. Further study on SSG impact should assess baseline demographic and geographic characteristics of patients, to understand better how to reach all community members. Other existing assessment tools, which focus on Alzheimer's Dementia or caregiver preparedness, are potentially adaptable for further investigation of SSGs16-17. For caregivers of stroke survivors specifically, a tool assessing burden may be helpful18. Future studies will need to address survey fatigue among participants, as has been found in other longitudinal social studies19.

In our pilot project, we found that a SSG, perceived as supportive and educational by participants, was not associated with significant changes in clinical outcomes. Other measures may further characterize the impact of a SSG in future studies. Especially in areas underserved by neurology, it is crucial to provide educational and social support to the community in efforts to prevent recurrent stroke and improve quality of life. Stroke education can empower stroke survivors to seek timely management with any recurrent symptoms, and to seek preventative care. Stroke support groups can help stroke survivors and caregivers engage in meaningful occupation, manage expectations, and navigate recovery positively. SSGs can also strengthen relationships between clinicians and the communities that they serve8. Demonstrating a local and measurable impact of a SSG may help communities advocate for resources supporting SSG growth and sustainability.

Figures

Figure 1: Survey results denoting participant perceptions of the stroke support group.

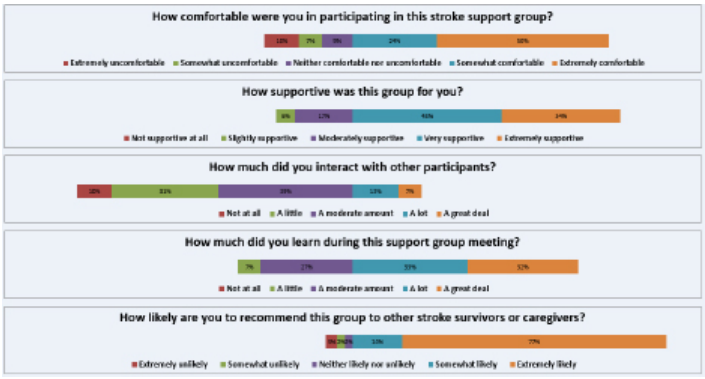

Figure 2: Stroke severity over time after implementation of the stroke support group (NIHSS = National Institutes of Health Stroke Scale).

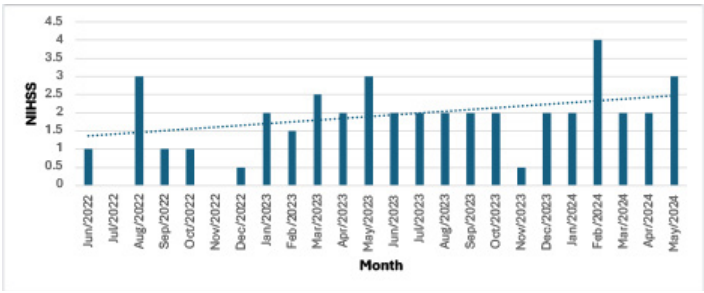

Figure 3: Time from last well to emergency room presentation over time after implementation of the stroke support group.

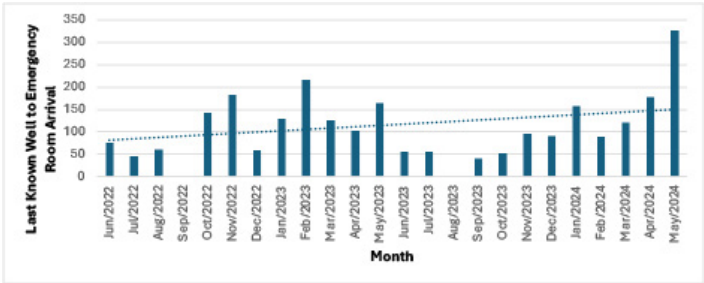

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Figure 4: Number of Emergency Medical Services dispatch calls for stroke over time after implementation of the stroke support group.

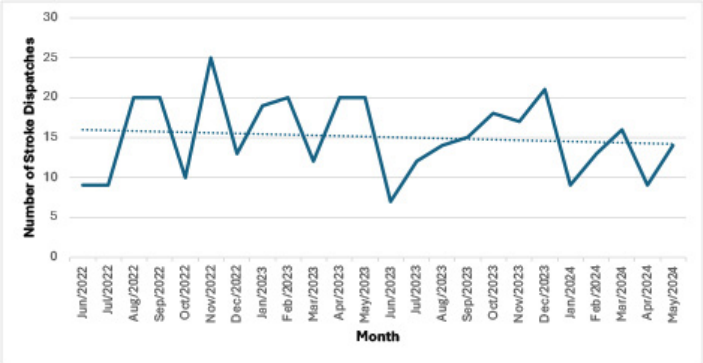
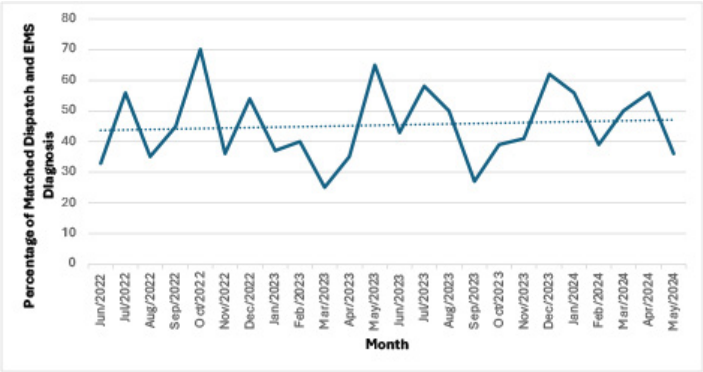


Figure 5: Proportion of correctly identified dispatches compared to Emergency Medical Services (EMS) assessment.



References

1 Curtin SC, Tejada-Vera B, Bastian BA. Deaths: Leading Causes for 2022. National Vital Statistics Reports. 2024. 73(10):1-117.

2 https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates accessed 7/29/25

3 Flach C, Muruet W, Wolfe CDA, et al. Risk and Secondary Prevention of Stroke Recurrence: A Population-Base Cohort Stduy. Stroke. 2020. 51(8):2435-2444.

4 Tsao CW, Aday AW, Almarzooq ZI, Alonso A, Beaton AZ, Bittencourt MS, Boehme AK, Buxton AE, Carson AP, Commodore-Mensah Y, Elkind MSV, Evenson KR, Eze-Nliam C, Ferguson JF, Generoso G, Ho JE, Kalani R, Khan SS, Kissela BM, Knutson KL, Levine DA, Lewis TT, Liu J, Loop MS, Ma J, Mussolino ME, Navaneethan SD, Perak AM, Poudel R, Rezk-Hanna M, Roth GA, Schroeder EB, Shah SH, Thacker EL, VanWagner LB, Virani SS, Voecks JH, Wang NY, Yaffe K, Martin SS. Heart Disease and Stroke Statistics-2022 Update: A Report From the American Heart Association. Circulation. 2022 Feb 22;145(8):e153-e639. doi: 10.1161/CIR.0000000000001052. Epub 2022 Jan 26. PMID: 35078371.

5 Lacy CR, Suh D-C, Bueno M, et al. Delay in Presentation and Evaluation for Acute Stroke: Stroke Time Registry for Outcomes Knowledge and Epidemiology (S.T.R.O.K.E). Stroke. 2001. 32(1): 63-69.

6 Centers for Disease Control and Prevention (CDC). Awareness of stroke warning symptoms--13 States and the District of Columbia, 2005. MMWR Morb Mortal Wkly Rep. 2008 May 9;57(18):481-5. PMID: 18463605.

7 Weltermann BM, Homann J, Rogalewski A, et al. Stroke knowledge among stroke support group members. Stroke. 2000 31(6):1230-3.

8 Forman, R, Parker, R, Galbraith, J, et al. Roadmap for Creating Sustainable Community Stroke Initiatives. Stroke. 2024. 55(12):e332-e335.

9 Kingau NW, Rhoda A, Louw QA, et al. The impact of stroke support groups on stroke patients and their caregivers. Rehabilitation Advances in Developing Health Systems. 2024. 1(1), a9. https://doi.org/10.4102/radhs.v1i1.9.

10 Christensen ER, Golden SL, and Gesell SB. Perceived Benefits of Peer Support Groups for Stroke Survivors and Caregivers in Rural North Caroline. N C Med J. 2019. 80(3):143-148.

11 Hollands L, Calitri R, Haslam C, et al. A UK national cross-sectional survey of stroke support groups: exploring the role of social identification and group processes in reducing loneliness. BMC Public Health. 2024. 24:2992. https://doi.org/10.1186/s12889-024-20432-w

12 Wan X, Chun Chau JP, Mou H, et al. Effects of peer support interventions on physical and psychosocial outcomes among stroke survivors: A systematic review and meta-analysis. International Journal of Nursing Studies. 2021. 121: 1-12.

13 Lyden PD. Using the National Institutes of Health Stroke Scale: A Cautionary Tale. Stroke. 2017. 48(2):513-519.

14 Zachrison KS, Asif KS, Chapman S, et al. Identifying Best Practices for Improving the Evaluation and Management of Stroke in Rural Lower-Resourced Settings: A Scientific Statement From the American Heart Association. Stroke. 2024. 56(2): e62-e74.

15 Morgenstern LB, Staub L, Chan W, et al. Improving delivery of acute stroke therapy: The TLL Temple Foundation Stroke Project. Stroke. 2002. 33(1):160-166.

16 Zarit accessed 7/31/25: https://wai.wisc.edu/wp-content/uploads/sites/1129/2021/11/Zarit-Caregiver-Burden-Assessment-Instruments.pdf

17 Camicia M, Lutz BJ, and Theodore BR. The preparedness assessment for the transition home after stroke predicts key domains of caregiver health. Top Stroke Rehabil. 2023. 30(4):384-392.

18 Scholte op Reimer WJM, de Haan RJ, Pijnenborg JMA, et al. Assessment of Burden in Partners of Stroke Patients with Sense of Competence Questionairre. Stroke. 1998. 29(2):373-379.

19 Dan S, Ling Z, Tegegne J, et al. Addressing survey fatigue bias in longitudinal social contact studies to improve pandemic preparedness. Sci Rep. 2025. 15(17935). https://doi.org/10.1038/s41598-025-02235-0

A Novel Approach to Expedite Acute Stroke Triage in Texas

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Stroke is the third leading cause of death in Texas, and acute ischemic stroke remains the most common stroke subtype.1 Reperfusion treatments such as thrombolysis and thrombectomy can improve long-term outcomes for some patients with ischemic stroke, but at present we have a poor understanding of the key imaging factors that can reliably guide emergent decision-making. The most common way to assess non-contrast CT scans in the emergency department during stroke triage is to use the Alberta Stroke Program Early CT Score (ASPECTS). However, this visual scoring system to estimate infarct size is imprecise, ranging from 0 to 10, and has wide inter-rater variability. ASPECT scoring also requires immediate expert neuroradiologist input, which is not available at many emergency departments across Texas. Here in this study, we evaluated a new non-contrast CT biomarker, net water uptake (NWU), which can be automatically obtained using an open-access imaging analysis pipeline developed at UTHealth Houston. NWU is an imaging marker that quantifies the degree of edema and tissue injury based on density differences between the stroke area and normal brain tissue. This pilot study has been supported by the Texas Neurological Society Grant, and the study findings have recently been published.[2]

In this observational cohort study, 402 subjects were included from a multicenter registry of patients with acute ischemic stroke. The developed algorithm performed automated CT pre-processing and calculation of NWU in the anterior circulation territory of the brain. The subjects' non-contrast CT scans underwent automated NWU calculation with a median time of 87 seconds [interquartile range 77-95]. The resulting NWU values were compared against neuroradiologist-assessed ASPECTS to predict 90-day functional outcome in competing multivariable logistic regression models. The confounders included in the regression models were chosen a priori because of their known association with post-stroke clinical outcomes, including age, National Institutes of Health Stroke Scale (NIHSS), received tPA, and received EVT. The primary outcome was the area under the receiver operating characteristic curve (AUROC) when predicting 90-day modified Rankin Scale (mRS).

Among 402 subjects in this study, median age was 69 [IQR 57-80], 49.3% were female, median NIHSS was 11 [IQR 5-19], and median 90-day mRS was 3 [IQR 1-5]. In multivariable logistic regression, lower ASPECTS and higher average NWU were associated with greater likelihood of poor functional outcome measured by 90-day mRS (Odds Ratio 0.84 [CI 0.74,0.95] and OR 1.14 [CI 1.02,1.26], respectively). Overall, the ASPECTS-based model performed the same as the NWU-based model when classifying 90-day mRS outcome, with AUROC 0.732 and 0.749 respectively ($p = 0.513$ with the DeLong test). In the secondary analysis, the ASPECTS and NWU models showed varying levels of performance to predict 90-day mRS outcome among different clinically relevant subgroups. For example, the NWU-based model had excellent performance when classifying 90-day mRS outcome for patients with large infarct core at presentation defined as ASPECTS 0-5 (AUROC 0.863).

This observational pilot study has shown that automated NWU obtained in a rapid fashion with an open-access imaging tool has non-inferior performance to predict 90-day outcome after ischemic stroke compared to neuroradiologist-assessed ASPECTS. This quantitative approach to evaluating non-contrast CT scans in the emergency setting may provide novel and nuanced information for stroke treatment decision-making, and it will need to be evaluated next in a larger external validation study. Eventually, the software could be implemented at emergency centers across Texas where patients are evaluated for acute stroke in order to expedite stroke treatment times and maximize the likelihood of good functional outcome. We anticipate that free, automated, and quantitative markers from non-contrast CT will eventually become the standard of care for acute stroke triage. As we maximize the information we can obtain from low-cost imaging, we can better guide our patients and move towards a future of personalized stroke medicine.

REFERENCES:

1 Texas Stroke System of Care Report 2020. Texas Department of State Health Services.

2 Mallavarapu M, Kim HW, Iyyangar A, Salazar-Marioni S, Yoo AJ, Giancardo L, Sheth SA, Jeevarajan JA. A novel automated CT biomarker to predict outcomes in acute ischemic stroke: net water uptake. Front Neurol. 2025 Aug 22;16:1629434.

Barriers in Acute Stroke Care for Patients with Limited English Proficiency

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About 3.6 million people (12.82% of the population) in Texas have limited English proficiency (LEP), a factor that can contribute to lower quality medical care. Language barriers are particularly challenging in emergent code stroke settings, where they can delay access to time-sensitive treatments such as intravenous thrombolysis and mechanical thrombectomy.

We conducted a survey study examining the availability and reliability of translation services during code stroke evaluations. A total of 130 clinicians and nurses responded. The majority reported experiencing unreliable translation services in these critical moments. Respondents also expressed strong interest in a mobile phone application that could play National Institutes of Health (NIHSS) commands and questions in multiple languages. We will be publishing the results of this study in the coming months.

To address this need, we are developing a mobile application that provides recorded audio instructions to assist clinicians and healthcare workers in performing the neurological exam and NIHSS in different languages. We are beginning with Spanish support and plan to expand to Vietnamese and Mandarin. Our goal is to reduce delays in code stroke evaluations for patients with LEP and improve clinicians' ability to communicate effectively with this vulnerable population. A prototype will be presented at the TNS 2026 Winter Conference.

In parallel, we have launched a structured Spanish course designed specifically for neurology residents and fellows to strengthen communication with Spanish-speaking patients. The course consists of five in-person workshops: the first covers the general neurological exam, the second covers the stroke exam, the third focuses on headache history, the fourth focuses on seizure history, and fifth covers examination of Parkinson patients. Course materials, including handouts, presentations, and quizzes, will be freely available online for easy integration into residency curricula. Early results from our implementation at UTHealth Houston show that 10 of 11 participants reported acquiring skills they could immediately apply in daily practice. Given that approximately 38% of Houston households primarily speak Spanish, this initiative directly addresses a critical need and enhances resident confidence, diagnostic accuracy, and patient rapport in diverse clinical settings.