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THE JOURNAL OF Legal Nurse Consulting



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LEGAL NURSE CONSULTANTS

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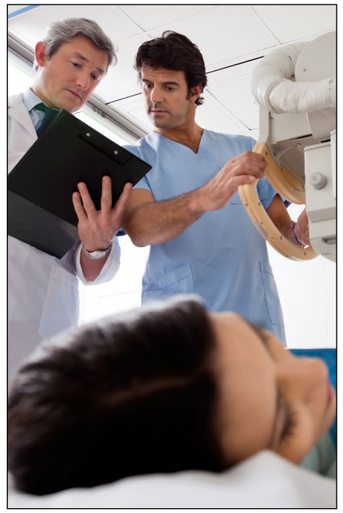

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AALNC
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PURPOSE

The purpose of the *Journal* is to promote legal nurse consulting within the medicallegal community; to provide novice and experienced legal nurse consultants (LNCs) with a quality professional publication; and to teach and inform LNCs about clinical practice, current legal issues, and professional development.

MANUSCRIPT SUBMISSION

The *Journal* accepts original articles, case studies, letters, and research. Query letters are welcomed but not required. Material must be original and never published before. A manuscript should be submitted with the understanding that it is not being sent to any other journal simultaneously. Manuscripts should be addressed to JLNC@aalnc.org. Please see the next page for Information for Authors before submitting.

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We send all submissions blinded to peer reviewers and return their blinded suggestions to the author. The final version may have minor editing for form and authors will have final approval before publication. Acceptance is based on the quality of the material and its importance to the audience.

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ARTICLE SUBMISSION

The Journal of Legal Nurse Consulting (JLNC), a peer reviewed publication, is the official journal of the American Association of Legal Nurse Consultants (AALNC). We invite interested nurses and allied professionals to submit article queries or manuscripts that educate and inform our readership about current practice methods, professional development, and the promotion of legal nurse consulting within the medical-legal community. Manuscript submissions are peer-reviewed by professional LNCs with diverse professional backgrounds. The *JLNC* follows the ethical guidelines of COPE, the Committee on Publication Ethics, which may be reviewed at: http://publicationethics.org/resources/code-conduct.

We particularly encourage first-time authors to submit manuscripts. The editor will provide writing and conceptual assistance as needed. Please follow this checklist for articles submitted for consideration.

INSTRUCTIONS FOR TEXT

- Manuscript length: 1500 – 4000 words
- Use Word© format only (.doc or .docx)
- Submit only original manuscript not under consideration by other publications
- Put title and page number in a header on each page (using the Header feature in Word)
- Place author name, contact information, and article title on a separate title page, so author name can be blinded for peer review
- Text: Use APA style (Publication Manual of the American Psychological Association, 7th edition) (https://owl.english.purdue.edu/owl/resource/560/01/)
- Legal citations: Use The Bluebook: A Uniform System of Citation (15th ed.), Cambridge, MA: The Harvard Law Review Association
- Live links are encouraged. Please include the full URL for each. Be careful that any automatic formatting does not break links and that they are all fully functional.
- Include a 100-word abstract and keywords on the first page
- Write the manuscript in third person only. If you feel an exception is warranted for the topic of your manuscript, please contact the Editor to discuss.
- Submit your article as an email attachment, with document title articlename.doc, e.g., wheelchairs.doc

INSTRUCTIONS FOR ART, FIGURES, TABLES, LINKS

- All photos, figures, and artwork must be in JPG or PDF format (JPG preferred for photos). Line art should have a minimum resolution of 1000 dpi, halftone art (photos) a minimum of 300 dpi, and combination art (line/tone) a minimum of 500 dpi.
- Each table, figure, photo, or art should be submitted as a separate file attachment, labeled to match its reference in text, with credits if needed (e.g., Table 1, Common nursing diagnoses in SCI; Figure 3, Time to endpoints by intervention, American Cancer Society, 2003)

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Acceptance will be based on the importance of the material for the audience and the quality of the material, and cannot be guaranteed. All accepted manuscripts are subject to editing, which may involve only minor changes of grammar, punctuation, paragraphing, etc. However, some editing may involve condensing or restructuring the narrative. Authors will be notified of extensive editing. Authors will approve the final revision for submission.

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Mary Flanagan,
BSN, RN, CNOR, LNCC
President, AALNC

President's Update

Dear members and readers,

Ah! Spring!

Is it too late for 2022 resolutions? No! The definition of resolution is a *firm decision to do or not to do something and the quality of being determined or resolute*. When used as an adjective, resolute is defined as *admirably* purposeful, determined, and unwavering. As I address you for the last time as President of AALNC, I and the entire board of directors, along with our managing partner, are resolute in our commitment to you, our valued new and returning members.

As I look back on this past year, I am so grateful for the support and encouragement I received and continue to receive from your intrepid Board of Directors: **Laura Nissim**, **Lisa Mancuso**, **Erin Gollogly**, **Jennifer Parks**, **Jeanine Frumenti**, and **Judy Young.** I am in awe of their knowledge, wisdom, passion, and continued commitment to AALNC and the specialty of legal nurse consulting. Thank you!

Your operations team at AALNC went above and beyond this year and seamlessly managed every challenge sent their way. My thanks to our outgoing executive director, **Jena Eberly Stack**, who now turns over the leadership of our amazing team **Melissa Van Fleteren**, **Caitlyn Hicks**, and **Sree Rajesh** to our new "ED" **Janae Lindsley**. Their talent is only matched with their enthusiasm for promoting our specialty. They get us

Besides our HQ team, AALNC is so fortunate to have our Director of Programs and Education, **Karen Wilkinson**, who seeks the best and the brightest when planning all our educational offerings and our talented *Journal* editor, **Martha Kelso** who along with a great committee of member volunteers creates one great issue after another. Last, and certainly not least, I thank all of you, our cherished members.

If you're new to legal nurse consulting, welcome! If you've been with us and this specialty for a while, thank you for your continued support of this incredible association. We quite simply could not do it without you. AALNC's mission remains the same as it has for years…*to promote the professional advancement of registered nurses consulting within the legal arena by providing a forum for education, research, and exchange of information*. We remain resolute in that mission and strive to *inspire and empower you to reach your full potential as a legal nurse consultant.*

I'm a firm believer that if you are serious about success in this interesting arena called "legal nurse consulting," you need to join, retain, and leverage your membership with AALNC to your maximum benefit. As a final encouragement, as we all move forward to better, healthier times, be resolute in pursuing your success as an LNC and join us in Orlando in April for our **in-person** educational and networking Forum. Early-bird registration closes on March 11th. Come join new and seasoned LNCs from across the country; it's the best investment you can make in 2022!

Mary Flanagan, BSN, RN, CNOR(E)®, LNCC

Martha R. Kelso,
RN, HBOT
Editor, JLNC

Editor's Note

Dear readers and colleagues,

Our spring issue is here, and Annual Forum is right around the corner. The American Association of Legal Nurse Consultants (AALNC) is your resource to help you network and prepare to be involved in various cases. The Annual Forum gives the LNC opportunities to hear from leaders in the industry while earning continuing nursing education contact hours that total 15.5. In addition, *The Journal of Legal Nurse Consulting* (*JLNC*) also offers CEs in each journal. This members only benefit allows the LNC to learn about various subjects to gain knowledge and career development.

Another way to gain recognition and assist with your career as an LNC is to author manuscripts about subjects you are knowledgeable about. Our journal is peer-reviewed and accepts a wide range of topics for print. If you have never written an article for publication, our journal committee is here to help. Although our committee is volunteer, their commitment to LNCs and the publication process for the journal include mentoring new authors. The mentoring process assists with APA formatting, sentence structure, the content of interest to LNCs, and more. If you've been hesitant to become an author because you don't know where to start, I strongly encourage you to begin with our committee at the *JLNC* and your colleagues at the AALNC.

One more way to serve as an LNC is to join an AALNC sponsored committee.There are several, and it is the best way to get involved and get known. The *Journal* is seeking to add a couple more committee members for 2022 to add a variety of subject matter experts (SMEs) to our wide variety of peer committee members. The committee meets once a month and is responsible for the peer-review process. Additionally, committee members work with authors to ensure the high quality of manuscripts currently published in the *Journal*. Assisting with author procurement and content selection is essential for every committee member. We welcome you, and I'm happy to speak with you regarding the committee commitment. If you are interested, feel free to email me at martha.kelso@aalnc.org.

Our summer issue will highlight the COVID litigation one year later. I look forward to this topic since almost every person living in the United States has been impacted somehow. Spring hopefully gives way to relief for everyone from the COVID strain on our lives, and the spring season will renew hope at getting back to some life of normalcy.

Those who want to get more exposure for your company or law firm can advertise in the *Journal*. The rates are affordable and are seen by hundreds of people in the legal industry. With the *Journal* going 100% digital this year, the exposure potential is unlimited. For those interested in advertising, contact sales@aalnc.org. We have a couple of spots available for advertising, but once they are filled, they are filled.

I hope spring brings you renewal, energy, and forward motion in all things you endeavor for 2022 and beyond.

Sincerely,

Martha R. Kelso, RN, HBOT

On the Clot:

Neuro Interventional Radiology in Certified Stroke Centers

Minda Lee Lockeretz, BSN, RN, CRN

Keywords: Comprehensive stroke, NIR, neurointervention stroke, neurointerventional, NIR nurse, IR nurse, ischemic stroke, stroke goal measures, stroke legal review

The need for emergent treatment of stroke cannot be understated. The Joint Commission (TJC), in conjunction with the American Heart Association/American Stroke Association (AHA/ASA), credentials hospitals with basic to advanced stroke programs. This article will review two types of credentialed stroke centers: primary and comprehensive. Collected data of timeliness and outcome from door-to-diagnosis-to-treatment are required quality improvement measures at certified centers and outline expectations in stroke care. Goal performance measures for ischemic stroke care from door to revascularization in Neuro Interventional Radiology or Neuro IR (NIR) will be reviewed along with the role of the NIR nurse. Information provided may benefit the legal nurse consultant and others who review ischemic stroke cases involving care provided in NIR.

There is a flurry of activity in NIR. "Code Stroke" (a term used to prioritize assessment and care of a patient presenting with signs and symptoms of a stroke) is activated, and an ischemic stroke patient needs mechanical thrombectomy. Suddenly, it's all-hands-on-deck. Advanced practice practitioners, registered nurses, radiology technologists, and anesthesia teams scramble to prepare individually supportive roles. Neuro-interventional radiologists, glued to imaging screens, plan the delicate arterial navigation required to remove the clot and restore blood flow to precious brain tissue. Mechanical thrombectomy (MT) is next-level acute stroke care for large vessel occlusions (LVO). Getting "on the clot" is another day's work in the NIR suites of certified comprehensive stroke centers.

Not every hospital is prepared for the urgency and complexity of a stroke. Personnel, imaging services, and facility resources may be self-limiting. Generally, larger academic and private medical institutions in urban and metropolitan areas have the resources to provide complete treatment to stroke patients. Primary and comprehensive stroke centers (PSC and CSC, respectively) share qualified personnel, organizational resources, and programs to treat most acute stroke patients and include specialty physicians, trained stroke care nurses, and many additional staff members for streamlined care. Radiologic imaging services include basic computerized tomography (CT) and basic magnetic resonance (MR). Neurologic and neurosurgical programs with specific inpatient wards like neuro-intensive care and neuro-stepdown units are available for patient admission. Both facilities share stroke-focused, individualized patient/family education programs that include and promote self-care after discharge. Some primary centers have NIR services but may not meet comprehensive certification criteria due to staffing, imaging service limitations, or lack of patient volume. For continuous improvement of stroke care quality, both centers collect internal treatment and performance data. They may share them as part of AHA/ASA's *Get With The Guidelines®-Stroke*, a voluntary data collection registry, and performance improvement initiative.

Comprehensive stroke centers deliver complete, complex care to patients with large vessel occlusion, intracerebral hemorrhage, and other diagnoses and provide multi-specialty management when needed. A sophisticated range of imaging services occur at CSC: CT angiograms (CTA); MRI/MR angiograms; fluoroscopic digital subtraction angiograms (DSA) used in IR; trans-cranial doppler (TCD) used to evaluate vasospasm post hemorrhagic stroke; and more. Specialty physician personnel include, among others: vascular neurologists, neuroradiologists, neuro-interventional radiologists, neuro and vascular surgeons, available 24/7 with 24/7 access to personnel (on-call staff; often multiple teams depending on patient volume), operative, and radiologic endovascular suites.

Recent public health education focuses on calling 911 at the onset of stroke symptoms instead of taking private transportation to a hospital. Stroke treatment begins in the field and alerts providers to prepare and initiate the domino effect of rapid diagnosis and treatment delivery. Unlike trauma guidelines which direct paramedics to the highest level of trauma care accessible, ambulances are not required to go to comprehensive instead of primary centers; they are referred to the closest hospital with a stroke unit. There is a debate amongst medical professionals about delayed pharmacologic treatment at PSC with tissue plasminogen activator (tPA) (e.g., alteplase) to patients who may be deemed ineligible later for endovascular treatments performed at further-out CSCs. Some groups feel that CSC should be preferred instead of PSC if less than a two-hour flight or drive, but no current formal guidance exists. For a well quoted and thoughtful published debate on the subject, consider: "Suspected Large Vessel Occlusion - Should EMS Transport to the Nearest PSC or Bypass to a CSC with Endovascular Capabilities?" https://www.ahajournals.org/doi/10.1161/STROKEAHA.115.011149

Stroke treatment begins in the field and alerts providers to prepare and initiate the domino effect of rapid diagnosis and treatment delivery.

This activity is designed to provide legal nurse consultants and other professionals insight into stroke certified hospitals and how Neuro-Interventional Radiology (NIR) plays a critical role in acute stroke treatment.

Upon completion of the learning activity the leaner will be able to:

a. Identify the similarities and differences between primary and comprehensive stroke certified centers.
b. Recognize the importance of timely goal performance measures from door to revascularization in NIR as brain saving treatment.
c. Understand the role of the NIR nurse in acute stroke treatment and care.

The author, reviewers, and nurse planners all report no financial relationships that would pose a conflict of interest.

This activity has been awarded 1 Contact Hour of credit. The activity is valid for credit until April 1, 2025.

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Nursing communication and hand-off reports are critical at each stage of care: from ED to NIR to ICU and neuro wards. Hand-off includes a shared bedside neurological assessment and establishing a National Institutes of Health Stroke Scale (NIHSS) score.

Ischemic stroke care hinges on a hospital's ability to provide timely pharmacological and endovascular treatment. The symptomatic patient presents to the Emergency Department (ED), and the clock starts. Swift imaging performed by non-contrast head CT differentiates two types of strokes (ischemic and hemorrhagic) and delineates the course of treatment. Diagnosis of ischemia (within three hours of last known well time) initiates treatment with IV tPA, the gold-standard agent of thrombolysis in ischemic stroke care. tPA is available and ready for administration by trained staff members 24/7 at acute stroke ready, PSC, CSC, and advanced CSCs.

When reviewing ischemic stroke cases, the legal nurse consultant (LNC) will pay close attention to the timeline of acute care delivered. The AHA/ASA guidelines for stroke care have been used in credentialing stroke centers since 2003. Quality measures overseen by the Joint Commission reflect the AHA/ASA's recommendations and are reviewed during these centers' initial and renewed credentialing. The Specifications Manual for Joint Commission National Quality Measures has published Comprehensive Stroke (CSTK)-1 through CSTK-12, listing quality measures for comprehensive care. These measures are a series of targets created through evidence-based practice to improve patient outcomes. Of the twelve measures, four are related to work performed in NIR. Three of the four measures are time-sensitive and are highlighted below. The LNC may use these quality measures to guide case reviews of care provided in NIR. Treatment that occurs outside of these time goals may warrant further investigation. Complete stroke measure listings are found at: https://manual.jointcommission.org/releases/TJC2018A/ComprehensiveStroke.html.

CSTK-8: TICI is an explanation of post-treatment reperfusion and referred to as Thrombolysis in Cerebral Infarction Reperfusion Grade (TICI) and scored a 0-3 scale. 0 no perfusion, 1 (perfusion past the initial occlusion, but no distal branch filling); 2 (perfusion with incomplete [2A] or slow distal branch filling [2B]; and 3 (full perfusion with filling of all distal branches). The goal for reperfusion and highest outcomes is to reach TICI 2B or 3 at completion of the procedure;

CSTK-9: Arrival to skin puncture is considered the median time. The lower the median the faster the opportunity for revascularization and increased functional outcomes (measured on a Modified Rankin Score at 90 days) and decreased mortality;

CSTK-11: A quality measure for facility process in the treatment of LVO from arrival. The goal is to obtain reperfusion as early as possible or under 6 hours from onset of symptoms. The target from the emergency department door to arterial puncture in NIR is less than or equal to 90 minutes;

CSTK-12- Measured timeliness of reperfusion from arterial puncture to revascularization at TICI 2B or greater in less than 60 minutes.

In addition to quality metrics collected and reported to the AHA/ASA and TJC (and others, ex. Centers for Disease Control and Prevention, National Quality Forum, et al.), facilities collect internal data for performance improvement often choreographed down to the minute: from door-to-needle-to-revascularization. Metrics for door-to-provider, door-to-CT, CT-to-read, diagnosis-to-tPA drip, ED-to-NIR, and more compile to meet targeted core measures. NIR participates in data collection specific to the specialty and includes department-to-endovascular suite/room, needle-to-sheath placement, time of first mechanical pass at clot, number of passes required to achieve TICI 2B or greater, and more.

Treatment of acute ischemic stroke is a team effort, but the importance of nursing across the continuum of stroke care is undeniable. Registered nurses in NIR departments must anticipate patient needs, recognize potential procedural complications, and maintain patient safety (Rogers, 2021). Nursing communication and hand-off reports are critical at each stage of care: from ED to NIR to ICU and neuro wards. Hand-off includes a shared bedside neurological assessment and establishing a National Institutes of Health Stroke Scale (NIHSS) score. Hand-off reports allow nurses to assess neurological changes early while preparing for, during, and after the mechanical thrombectomy procedure. Safety issues like allergies, weight-based drug dosing, NPO status, known airway issues, co-morbidities, and others are reviewed. Additionally, a pre-and post-intervention neurovascular assessment of distal pulses (for femoral artery access) or of the hand (for a radial artery approach) is performed and documented by the NIR nurse. Circulation findings are reviewed with the performing physician before the procedural start time and immediately when changes are noted post-intervention.

Expectations for NIR nurses are consistent with other operative and procedural areas regarding documentation, even in emergent situations. The nurse ensures documentation of the provider's scored assessment of airway (Mallampati classification), anesthetic and surgical risk (ASA, American Society of Anesthesiologists), and a brief history and physical examination before treatment. Patients with low-scoring airway and risk assessments may have mechanical thrombectomy performed under conscious sedation provided by the NIR nurse. Patients with LVO and a high-scoring NIHSS are at risk of neurological decline and inability to maintain airway patency during the procedure. MT is commonly performed utilizing endotracheal intubation and general anesthesia in larger CSCs, and when resources are available. As always, informed consent or documented emergency should be completed by start time and reviewed during the time-out procedure just before skin puncture.

Periprocedural nursing care involves monitoring of vital signs and levels of consciousness every five minutes if performing thrombectomy under conscious sedation. The nurse performing conscious sedation must have documented education and certification following hospital policy and may only administer medications ordered by a practitioner with sedation privileges. If an anesthesia team is present, the NIR nurse will act as a circulator and should have a basic understanding of specialty equipment used in MT such as sheaths, wires, stent retrievers, clot suction devices, and more. Recognition of specialized equipment and location streamlines the neuro-interventionalist's work and may decrease the time to recanalization and revascularization.

Documented time of arterial sheath removal and subsequent hemostasis time begins post-procedural care. Hemostasis might be achieved with manual pressure, closure device, or compression band if the radial artery approach was selected. Vital sign monitoring is standardized and independent of the type of treatment utilized: IV thrombolysis (tPA), tPA and MT combined, or MT alone. Post-thrombectomy vitals and neurological assessments are monitored 15 minutes from documented hemostasis time and every 15 minutes after that for 2 hours, every 30 minutes for 6 hours, and every hour for 16 hours. A procedural site and extremity neurovascular assessment are performed and documented every 15 minutes for 1 hour, 30 minutes for 1 hour, and hourly for 4 hours (Rodgers et al., 2021). Any alteration in baseline distal pulse assessment or arterial hemostasis time is immediately reported to the practitioner. If mechanical thrombectomy was provided under conscious sedation, the NIR nurse would perform a neurological assessment immediately post-procedure and as soon as possible after general anesthesia and extubation. Hand-off report to the Intensive Care Unit (ICU) or Post-Anesthesia Care Unit (PACU) nurse includes a bedside neurological exam, puncture site, distal pulse, and neurovascular assessment to be monitored and documented at the time intervals mentioned above.

Stroke is the fifth leading cause of death in the United States and the leading cause of long-term disability. (Man et al., 2018). Hospitals are encouraged to seek certification as the need for timely, standardized care is congruent with reduced mortality and debilitating sequelae after ischemic stroke. Certification requires continued execution of quality measures and evidence-based practice for safe, efficient, high-quality ischemic stroke treatment. Individuals who review stroke cases will be mindful of pre-, peri-, and post-procedural documentation by the NIR nurse following hospital policy and goal measures set by AHA/ASA and TJC, and as part of a successful neuro-interventional radiology department at a comprehensive stroke center.

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Legal Issues and Pregnancy-Related Stroke

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Brandy Frye MSN, RN, RNC-OB, CCRN-K

Keywords: Pregnancy-related stroke, gestational hypertension, hypercoagulability, stroke, pregnancy

While the overall incidence of stroke is decreasing in the general population, it is increasing in pregnant women. Pregnancy itself is a risk factor for stroke. Hypertension, advanced maternal age, and obesity contribute to an increased risk of stroke in pregnancy (Elgendy et al., 2021). Treatment modalities used in the general population should not be withheld from pregnant women.

A STROKE STORY

Twenty-seven-year-old Dorothea Parker was brought in by her mother to a small community emergency department (ED) with complaints of a migraine reported as 5/10 unrelieved by 650 mg of Tylenol®. Her headache began in the morning about three hours before her arrival at the ED. She reported a history of migraines and seasonal allergies and denied any other medical history. She was 28 weeks pregnant with her second child and denied any current or previous pregnancy problems. The date of her last menstrual period (LMP) coincided with her stated date of confinement (due date). She was alert and oriented. In triage, her vital signs were T 98.9 BP 134/82 HR 83 RR 22, and an SPO2 of 98% on room air. The triage nurse placed her for physician evaluation.

She was taking Macrobid® for a urinary tract infection diagnosed at her last prenatal visit four weeks prior and had taken Tylenol® recently. The patient and her five-year-old son lived with her mother. The father of the baby was not involved. She denied smoking, alcohol, or any drug use. Family history was significant for diabetes and heart disease.

The ED physician consulted with the obstetric (OB) hospitalist on call. The OB hospitalist recommended ordering a biophysical profile ultrasound and a urine dip, and the ED physician followed through on the recommendations. The ED physician also ordered a CBC, CMP, 500 ml bolus of normal saline, and a 4 mg dose of IV push Zofran® for the patient's report of nausea.

Over the next few hours, Dorothea remained in the ED. She remained comfortable and stated her headache was "much better." She rated her headache as a 3/10. The labor and delivery (L&D) nurse reported to the ED, performed a focused obstetrical assessment, and obtained a fetal monitoring strip to complete the biophysical profile.

The L&D nurse's note read: "Fetal HR 130, appropriate for gestational age, (+) FM (fetal movement), denies uterine contractions, abdomen soft, non-tender. Complains of headache, denies blurry vision, epigastric pain, or nausea and vomiting on assessment. Deep Tendon Reflexes are 2+." Her note also included instruction on fetal kick counts with a documented patient teach-back and "to return for any worsening symptoms." Her initial labs resulted: WBC 14.38, RBC 4.27, Hgb 9.6, Hematocrit 30.7, Platelet Count 108,000.

This activity is designed to provide legal nurse consultants and other professionals insight to triage and risk for Pregnancy-Related Stroke.

Upon completion of the learning activity the learner will be able to:

a. List the steps of triage and identify risk factors for Pregnancy-Related Stroke.
b. Recognize medications used to lower blood pressure in hypertensive pregnant patients.
c. Identify the importance of a standardized process of triage and assessment by an experienced clinician.

The author, reviewers, and nurse planners all report no financial relationships that would pose a conflict of interest.

This activity has been awarded 1 Contact Hour of credit. The activity is valid for credit until April 1, 2025.

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Before Dorothea was sent home with instructions, the ED nurse obtained a set of vital signs. She notified the ED physician that they were "slightly elevated" and that Dorothea seemed "anxious" and complained of nausea.

Vital signs recorded as headache 3/10, T 97.8 BP 164/92 HR 93 RR 23 and an SPO2 of 93%. The ED physician ordered a 20 mg dose of IV push labetalol. The nurse rechecked the BP 10 minutes later, and the BP was 166/98. The RN then administered 20 mg of labetalol over 2 minutes and reported to the physician the dose was given. The ED physician ordered a 40 mg dose of IV push labetalol to follow if the blood pressure remained elevated. Ten minutes later, the RN recorded a BP of 165/98 and administered the second dose of 40 mg of IV push labetalol. The RN requested bedside physician evaluation for patient reports of a "pounding headache."

The ED physician notified the neurologist and OB hospitalist on call. The ED physician noted that Dorothea's eyes appear to deviate up and to the left on an exam. She denied any blurry vision but was nauseated. After quickly consulting with the OB hospitalist, he ordered a computed tomography (CT) scan of the brain with and without contrast. The OB hospitalist also requested the ED physician order a 4-gram loading dose of IV magnesium sulfate and administer the magnesium loading dose stat before transfer to CT. (Magnesium sulfate is used to prevent seizures).

The OB hospitalist also ordered 12 mg of betamethasone to be given immediately to facilitate lung maturity in the fetus and notified the ED physician that she would be there in 10 minutes to perform a bedside evaluation. The OB hospitalist notified the L&D unit of patient status.

The ED nurse started the 4-gram bag of magnesium as a loading dose. Before Dorothea was transferred to CT, a recheck of the BP occurred and was 174/108. The ED RN administered a dose of 80 mg of IV push labetalol over 2 minutes and notified the ED physician.

Dorothea had just been connected to a portable monitor when she began to seize. The ED physician requested an overhead page for the OB hospitalist. Four minutes after the seizure started,

the ED nurse administered a 2 mg dose of IV push Ativan® as ordered by the ED physician. The seizure subsided after 6 minutes. The L&D team was notified of patient status during a unit safety huddle, and two L&D nurses responded to the overhead page to the ED.

Dorothea was unresponsive with a pulse and no respiratory effort. Vital signs read BP 84/48 P 98 SPO2 78% NRB 72%. The ED team provided ventilation using a bag-mask device. One of the L&D nurses attempted to locate fetal heart tones using a handheld doppler on the OB hospitalist's arrival to the ED. The OB hospitalist could not visualize any fetal-cardiac movement using the bedside ultrasound and decided to perform a cesarean section in situ. The newborn intensive care unit (NICU) team was notified earlier by the charge nurse from L&D five minutes before and was requested to attend the delivery. NICU team arrived at the delivery time, 6 minutes after the seizure end time. The baby was delivered within 6 minutes of decision time. The Apgar score was 0/0/3 at 1/5/10 minutes. After stabilization, the infant was transferred to the NICU and then transferred out for total body cooling.

Dorothea was taken to CT en route to the intensive care unit (ICU). The CT showed an intracerebral hemorrhage in the right frontal lobe. A neurological interventionist performed a bedside craniotomy to evacuate blood from a small, ruptured vessel. She was monitored and cared for according to the American Stroke Association (ASA) guidelines for hemorrhagic stroke care. She was extubated on day eight and transferred out of the ICU 18 hours later. After 15 days from her initial presentation, Dorothea was discharged home with follow-up physical therapy (PT), occupational therapy (OT), and speech therapy (ST).

BACKGROUND

Pregnancy-related stroke (PRS) is a leading cause of death and disability in pregnant women. PRS is defined as stroke occurring during pregnancy and up to 6 weeks after delivery (ElFarra & Martin, 2018). Healthcare providers who provide care for pregnant women must be aware of early stroke symptoms in addition to risk factors for stroke. They must be well-versed in the usual physiological changes of pregnancy that predispose to stroke and pathology, which increases the risk of stroke (ElFarra & Martin, 2018). Prompt recognition and intervention are imperative to prevent catastrophic deficits or death. Management of maternal stroke requires collaboration between neurology, obstetrics, maternal-fetal medicine, and neonatology.

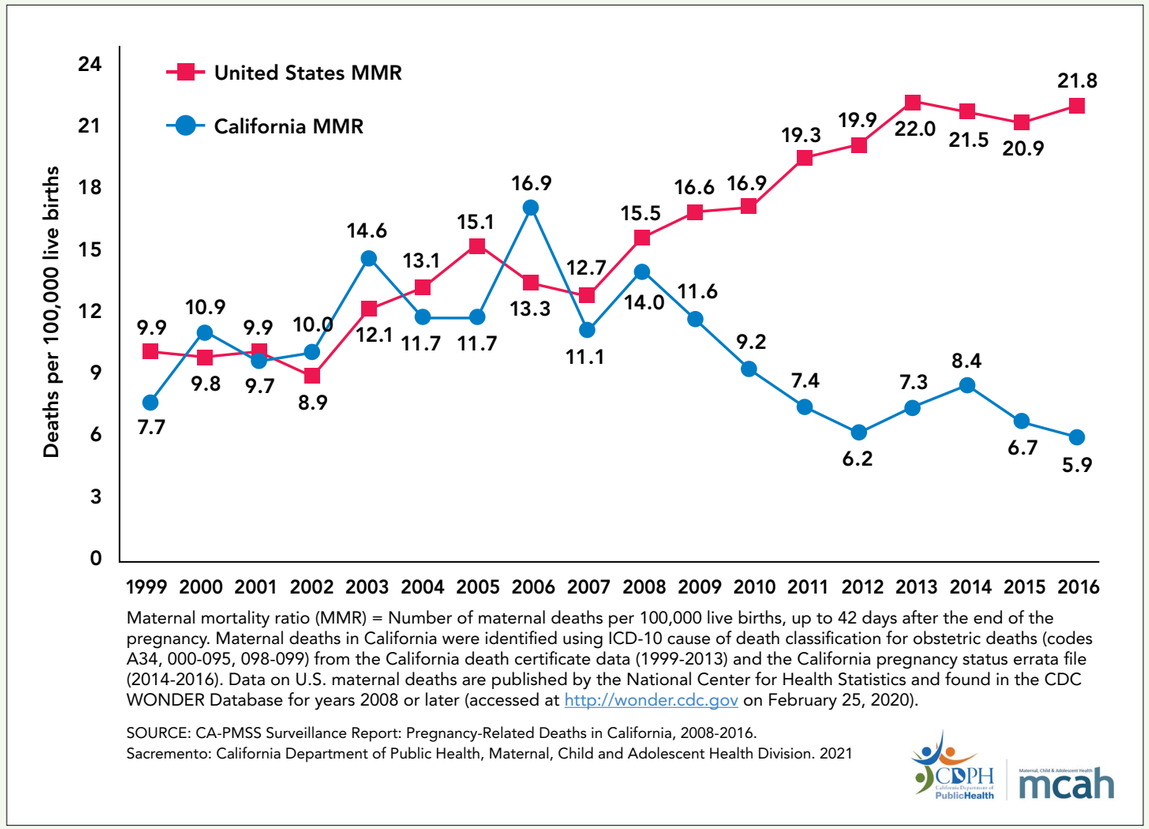

Figure 1: Maternal Mortality Ratio in U.S. and California, 1999-2016

Rates of stroke are increasing in the pregnant population, possibly related to advanced maternal age, cardiac disease, and obesity (Sanders et al., 2018). Severe disability or injury hinders newborn care and has lifelong implications. Strokes contribute to almost 8 percent of maternal deaths throughout the United States (Elgendy et al., 2021). Strokes in the pregnant population are uniquely challenging in that the effects of radiation on the fetus are concerning to women and their health care providers. The effects of stroke are confounded due to the delay in diagnosis related to the fear of exposing the fetus to radiation and exposing the fetus to other treatments used in non-pregnant stroke patients (Ladhani et al., 2018).

A stroke occurs when the brain does not receive the oxygen it needs for metabolism. A stroke can be related to either a clot that blocks a blood vessel in the brain or a hemorrhagic stroke caused by a ruptured blood vessel in the brain. Both types of strokes may be observed in the pregnant population. The exact cause of stroke remains unclear in about one-fourth of women (van Alebeek et al., 2018). Hemorrhagic stroke accounts for the majority of strokes in pregnancy. Rising blood pressures and increased intravascular pressure cause damage to the endothelial lining of blood vessels. The ability of the blood vessel to autoregulate is lost, causing vasospasm. It contributes to a vicious cycle of anoxia of the tissues and causes vessels to be friable and "leaky" (ElFarra & Martin, 2018).

Strokes in the pregnant population are uniquely challenging in that the effects of radiation on the fetus are concerning to women and their health care providers.

PREGNANCY FACTORS CONTRIBUTING TO STROKE

Normal pregnancy creates a state of hypercoagulability (an increased tendency for blood to clot) which is an adaptation that decreases the risk of hemorrhage. Higher estrogen levels create more procoagulant factors, factors VII, X, and prothrombin. Activated protein C resistance is increased, and protein S levels decrease. The placenta also has a role in reducing endogenous tissue plasminogen activity (Zambrano & Miller, 2019).

Massive hemodynamic shifts occur in pregnancy, increasing blood volume of 30-40%, 45% higher cardiac output creating a left ventricle enlargement. These changes may exacerbate a previously undiagnosed cardiac disease (van Alebeek et al., 2018). The physiological stress of pregnancy can increase the incidence of stroke in the absence of underlying disease. This is a complex and poorly understood phenomenon (ElFarra & Martin, 2018).

PATHOPHYSIOLOGICAL

Pathological conditions in pregnancy can be factors that increase the risk of PRS. These include hypertension-chronic or gestational (associated with pregnancy), preeclampsia, eclampsia, and infection. Acquired or genetic thrombophilia (tendency to develop blood clots) can also predispose the pregnant population to PRS (Elgendy et al., 2021). Examples include antiphospholipid syndrome and Factor 5 Leiden mutation. Stroke symptoms can include dizziness, difficulty walking, sudden weakness, sudden headache, vision changes, double vision, sudden difficulty with speech or expression of thought, and a sudden change in the level of consciousness (not an exhaustive list) (ElFarra & Martin, 2018).

DIAGNOSIS

A comprehensive history and physical is required, including the onset of symptoms, medications, and a complete neurological exam. The National Institute of Health Stroke Score (NIHSS) is frequently used to predict neurological deficits after stroke. Both CT (computed tomography) and MRI (magnetic resonance imaging) are the standards for stroke diagnosis and should not be avoided in the pregnant population. It is an acceptable standard of care to use contrast when results determine the plan of care. MRI is the preferred method of imaging in the pregnant population.

Laboratory studies should include

1. complete blood count with platelets
2. coagulation profile
3. urine for protein
4. toxicology screen (rule out cocaine or amphetamine use)

5. electrolytes, liver function, and glucose level

Cardiac evaluation should be conducted as well; this would include cardiac enzymes, an electrocardiogram, and an echocardiogram if indicated (ElFarra & Martin, 2018).

TREATMENT

Management in a tertiary stroke center is best practice when possible. A team approach coordinating obstetrics, neonatology, neurology, and anesthesia is required for optimal outcomes.

LEGAL NURSE CONSIDERATIONS:

Dorothea and her family engaged an attorney to represent her in a malpractice suit against the hospital. She suffers from deficits caused by her stroke, which interfere with her ability to care for her child. She has been unable to return to work. Dorothea claimed that diagnosis and treatment were delayed and that the hospital failed to recognize her stroke symptoms. She alleged the delay led to unnecessary damage, which could have been prevented. A subject matter expert (SME) reviewed the case and did not find any missed opportunities or breaches in the expected standards of care.

STANDARDS FOR MATERNAL SAFETY

Effective July 1, 2020, hospitals with The Joint Commission accreditation are now required within the Provision of Care, Treatment, and Services to develop written evidence-based procedures for managing pregnant and postpartum patients with severe hypertension/preeclampsia (The Joint Commission, 2020). These evidence-based procedures are designed to improve the quality and safety of care provided to women during all stages of pregnancy and postpartum (Main et al., 2018).

TRIAGE

The triage of patients in emergency departments in the United States is regulated by federal law. The Emergency Medical Treatment and Active Labor Act (EMTALA) defines an emergency medical condition as: "acute symptoms of sufficient severity, including pain, that the absence of immediate medical attention could reasonably be expected to place the health of the individual, including the unborn child, in serious jeopardy, serious impairment to bodily functions, or serious dysfunction of any bodily organ or part" (Lulla & Svancarek, 2021).

EMTALA requires hospitals that participate in the Medicare program to provide a medical screening exam (MSE) to determine if an emergency medical condition exists regardless of the ability to pay, to be triaged promptly. An MSE is required to be performed in a timely manner. A nursing assessment is completed and documented as part of the MSE. If an emergency condition exists, treatment and stabilization are required under the law before discharge or transfer

The Emergency Severity Index (ESI) is a five-level triage process that begins with a patient's arrival at the ED. The triage nurse first evaluates the patient's acuity and then categorizes and places the patient according to triage level. ESI levels 1 and 2 are time-sensitive and require immediate physician notification and attention. If criteria for level 1 or 2 have not been met, then resources are considered to reach disposition. ESI Level 3 is deemed urgent but not emergent, and ESI levels 4 and 5 are considered non-urgent. The triage steps include rapid assessment, identification of the problem, determination of the seriousness of the patient's condition (acuity), and deployment of equipment and personnel to meet those needs (Agency for Healthcare Research and Quality [AHRQ], 2020).

Safe and effective triage requires a high degree of clinical expertise and sound clinical judgment and should be performed by an experienced ED nurse. A visual assessment by competent staff must be done within 3-5 minutes from the documented arrival time. An ESI Level must be assigned with documentation of disposition and time of provider notification, and the initial assessment must be included (Agency for Healthcare Research and Quality [AHRQ], 2020).

EVIDENCE-BASED TOOLKIT

An algorithm specifically developed for the ED clinician by the Preeclampsia Task Force is used across California. The tool is called the Preeclampsia Early Recognition Tool (PERT). The PERT takes into account the normal physiological changes in pregnancy and alerts the bedside clinician of variations from that norm. It provides a script of what an experienced obstetrical nurse or provider would ask. The PERT triggers the bedside clinician and provider that the patient's complaint or presentation requires further examination. The tool also outlines recommendations on monitoring, testing, and treatment (California Maternal Quality Care Collaboration [CMQCC], 2014).

Diagnosis of possible hypertensive crises in pregnancy should elicit swift action by the multidisciplinary team. Labetalol, hydralazine, and nifedipine are considered first-line treatments to stabilize patients. Labetalol, intravenously over two minutes in sequentially increased doses (20 mg, 40 mg, 80 mg) is the preferred first-line medication in the absence of contraindications (von Dadelszen & Magee, 2016).

TREATMENT

Decreasing blood pressure through rapid recognition and treatment has been shown to reduce maternal morbidity and mortality. It is imperative to provide education for staff and providers on measuring accurate blood pressures, recognizing severe hypertension/pre-

Decreasing blood pressure through rapid recognition and treatment has been shown to reduce maternal morbidity and mortality.

eclampsia, and providing evidence-based treatments to lower blood pressure in a safe and timely manner (Von Dadelszen & Magee, 2016). Diagnosis of possible hypertensive crises in pregnancy should elicit swift action by the multidisciplinary team and in situations where the etiology of the hypertensive crisis is related to the pregnancy, immediate delivery of the baby is recommended (Vadhera & Simon, 2014).

THE SUBJECT MATTER EXPERT'S FINDINGS

In Dorothea Parker's case, the time from arrival to initial triage assessment was within 5 minutes. The triage nurse assigned an ESI level of 2, placed Dorothea in a bed, and immediately notified the physician. All appropriate situational assessments were completed and documented. The MSE was complete and included a complete nursing assessment. The ED physician appropriately involved the OB team. An L&D Nurse Certified for in-house Obstetrics (RNC-OB) provided a focused and appropriate assessment. This included assessment of symptoms of preeclampsia as well as deep tendon reflexes (DTRs). A fetal heart rate strip was obtained, which included a documented BP, HR, and SPO2 directly on the strip.

Prior to discharge home, the ED nurse obtained a BP, which was elevated. She appropriately notified the ED physician, who requested a recheck of the BP in 10 minutes and followed the maternal hypertension (MTN HTN) order set, starting with labetalol. The ED physician immediately assessed Dorothea and noted eye deviation. He promptly notified the OB hospitalist and the neurologist while the ED nurse prepared and began to administer magnesium as a bolus to prevent seizure before transport to CT. No deviations in the MTN HTN protocol were noted, and all necessary and available team members were involved with Dorothea's care. The decision to perform an emergency cesarean section in situ was made after seizure end time and before transfer to CT, as no fetal heart cardiac activity was noted. Following the procedure, the OB hospitalist delayed closing to facilitate immediate CT. This decision proved prudent as the neurologist identified and evacuated a hemorrhagic stroke without delay.

On further investigation, it was also noted that the ED team had recently been part of a facility-wide initiative to educate staff in the ED, L&D, and critical care areas on the early recognition, care, and treatment of maternal hypertension. Training included role-specific pre-learning via an online platform followed by high-fidelity multidisciplinary in situ simulations. The SME who reviewed the case found the team competent and could not identify any missed opportunities (Main et al., 2018).

CALIFORNIA TAKES ACTION

California has seen maternal mortality decrease by 65 percent between 2006 to 2016, while the national maternal mortality rate continues to rise. This decrease can be attributed to a plethora of quality improvement toolkits developed by the California Maternal Quality Care Collaborative (CMQCC). The CMQCC is a "multi-stakeholder organization committed to ending

Prompt recognition of stroke symptoms or risk factors can significantly reduce injury and death.

preventable morbidity, mortality and racial disparities in California maternity care. CMQCC uses research, quality improvement toolkits, statewide outreach collaboratives, and its innovative Maternal Data Center to improve health outcomes for mothers and infants" (California Maternal Quality Care Collaborative [CMQCC], 2014). The CMQCC put together a Preeclampsia Task Force to address the sizable number of cases where clinicians failed to recognize and respond to signs and symptoms of preeclampsia promptly, which led to delays in diagnosis and treatment.

CONCLUSION

The occurrence of PRS in the pregnant population has increased (Elgendy et al., 2021). While the exact causes of this escalation are not well understood, clinicians who treat pregnant patients are urged to remain vigilant for early warning signs. Prompt recognition of stroke symptoms or risk factors can significantly reduce injury and death. Algorithms and stroke protocols assist in the rapid treatment of patients to preserve neurological function.

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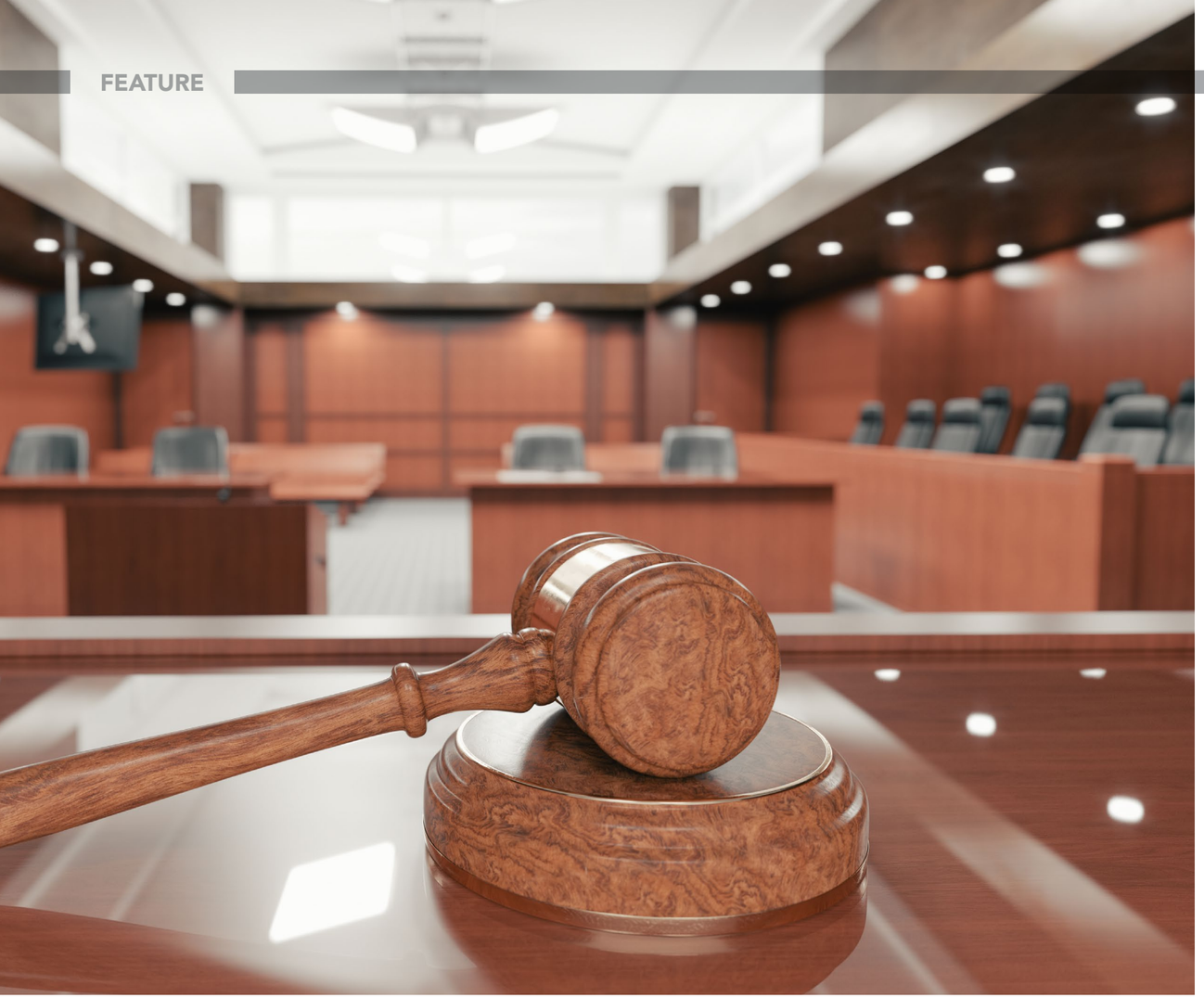


When There Is No Case:

A Personal Experience

Amy McCutcheon, RN

Keywords: pediatric stroke, neurologist, cerebral palsy, missed diagnosis

As Legal Nurse Consultants, we have all reviewed cases that ended up being a "No Case." But how often do we stop to think about what that means for the plaintiff or their family? Nine years ago, I found out exactly that. A missed diagnosis in an 11 week old, otherwise healthy infant has led to a lifetime of therapies, orthotics, surgeries, injections, behavior issues and, Individualized Education Plans (IEP).

This is my story.

On September 13, 2012, I gave birth to my third child. The pregnancy was unremarkable except for some excessive Braxton Hicks contractions at around 7.5 months, due mainly to working long shifts at the hospital. That led to me taking maternity leave three weeks early. The labor and birth were also unremarkable, so much so that I delivered at a local midwife-run birth center. My child weighed 9 pounds 3 ounces (all my babies were 8-9 pounds, no gestational diabetes) and was perfect. We all went home the same day. The first three months were unremarkable, with no indications of what was to come.

One Friday morning in December, my child had been more fussy than usual. My husband and I were sleep-deprived from a restless night, and as he headed off to work, I was getting ready to run some errands. As my baby sat wailing in the bouncy seat, I rushed to get dressed. All of a sudden, the crying stopped. When I turned around to see why the crying stopped, I knew immediately that my baby was having a seizure. The seizure was brief, and I scooped the child up as it came to an end. I called the pediatrician to let them know and called my husband. As we were driving to the local children's emergency department, I tried to explain to my husband that sometimes kids have seizures for various reasons and that sometimes there are no reasons. As we pulled into the Emergency Room (ER), my baby started seizing again, and this time was status epilepticus. The ER staff took us back immediately and began trying to start an IV so they could get the seizure medications in him. They finally resorted to inserting an IV into his scalp. As a nurse mom, I had been holding it together pretty well up until the time his oxygen saturation started to drop, and they brought out the tiniest Ambu® bag I had ever seen. Eventually, they were able to get the seizure to stop, and since my child was already pretty sedated from the medications, the ER doctor decided to go ahead and get an MRI of the brain. The MRI was interpreted as normal, and we were admitted to the Pediatric Intensive Care Unit. The diagnosis was epilepsy, and long-term medications were started to help prevent future seizures.

The next couple of weeks were rough for us as we ended up back in the hospital with more seizure activity. Once the seizures were finally under control, life went on. Development was normal, all the right milestones were met, and no more seizures. In early April 2013, we had noticed that our child had been extra crabby for a day or two but had no symptoms of illness. One morning our child was really unhappy, and I told my husband that I just felt something was wrong. He suggested, "Why don't you just go to the doctor?" My response was, "Just so they can tell us we have a fussy baby?"

I resolved to sit by my child's side all day to watch for any indication of what was going on. Around dinner time, I noticed my child was holding a toy in the left hand and that the right arm was flaccid. The nurse in me automatically went into stroke assessment mode, all the while thinking, "This can't be a stroke; babies don't have strokes!" But sure enough, when I presented a different toy, my child dropped the one in the left hand and grabbed the new one, the right arm never moving. To make a long story shorter, I saw other signs of stroke, facial droop and, right-sided leg weakness. We immediately headed back to the same to the ER. They did a quick assessment and ordered a stat CT of the brain.

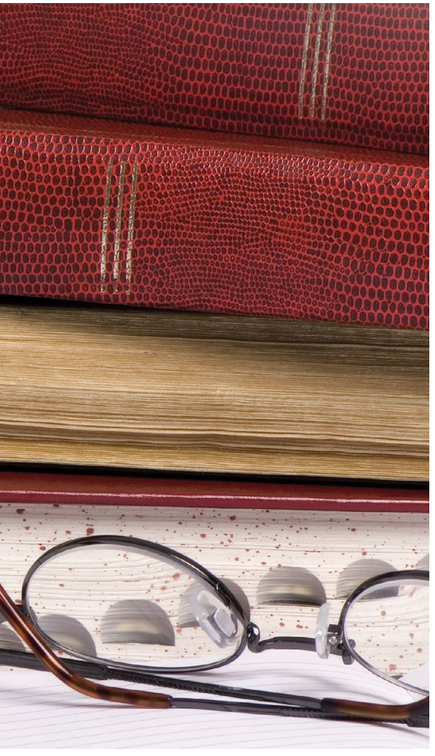
Anyone who has ever been to the ER knows that test results can take forever. I knew it was bad news when the medical team followed us back into the room immediately after the CT. They told us that the CT showed a massive stroke in the left frontal and parietal regions of the brain. We were immediately transferred to a bigger hospital where a heparin drip was started, and an MRI/MRA was performed the following morning. The MRA revealed that there was a left-sided carotid dissection. The nurse in me said, "Well, then go stent it!" They had never seen a carotid dissection in an infant and needed to consult specialists around the country to determine the best course of treatment. We were flagged for potential child abuse because dissections are typically a result of trauma. We took this in stride and let them do their query. However, our families were very upset about it. We were just glad that they were doing their job to protect children.

We were discharged about a week later with orders for Lovenox injections twice daily to prevent further strokes. We immediately started all the therapies: physical, occupational and, speech. We quickly learned that there was also right hemianopsia (blindness over half the field of vision), so vision therapy was added. Our neurologist wanted to repeat the MRI/MRA in a couple of months to ensure that the carotid artery had healed and that there were no new strokes. We did not have any indica-

They had never seen a carotid dissection in an infant and needed to consult specialists around the country to determine the best course of treatment.

What do medical malpractice attorneys fear the most? They fear getting deep into a case, possibly even to trial, and finding out that a smoking gun takes the case off the table.

tion that any additional damage had occurred, but on August 8, 2013, our world was rocked again. The new MRI/MRA showed that the carotid artery had collapsed entirely, and so had the middle cerebral artery (MCA) deep in the brain. The radiologist report stated the findings as a "catastrophic, hemispheric event." Almost the entire left side of the brain was damaged. With these new findings, the doctors feared a progressive arterial disease, so our child went through every test and procedure they could think of, all of which came back normal or inconclusive. We had monthly MRIs to monitor for any deterioration of the right side of the brain. We were blessed that no additional strokes had occurred, but we still had no actual diagnosis.



Given the severity of the damage to the brain, we decided it was time for a second opinion. It took several months, but a Pediatric Stroke Team finally saw us at Boston Children's Hospital in late October of that year. This was when we learned that the MRI at the 11-week mark had shown a small stroke. The radiologist report mentioned the IV in the scalp caused some distortion on the scan even though the stroke was not remotely close to the IV. We were devastated. We went back to the hotel and cried angry tears. The thought that any of this could have been prevented was infuriating and heartbreaking. Once we returned home, we started calling attorneys to find out what we needed to do next.

From a legal nurse perspective, how would you have handled this case had it been presented to you for a merit review and case analysis? Initially, it sounds like a case: an ischemic stroke in an infant was missed, the child was not started on blood thinners, the child had subsequent strokes, and eventually given the diagnosis of Cerebral Palsy. This child will need a life care plan to cover all the therapies, specialists, orthotics, orthopedists, surgeries, etc. It sounds like a grand slam, right? The lawyer is excited; you are excited.

As you start working on the chronology, you look for a pediatric neurologist specializing in strokes who can review the case. With thousands of pages of medical records, you have already worked through your initial retainer and secured another to continue working on the case. Finally, you have a detailed chronology and report ready, and you have located your expert. Your expert uses your guide to thoroughly review the record, only to come back and say there is no case. The expert states that because the child was never given a formal diagnosis for the cause of the strokes, they cannot state with any degree of medical certainty that proper diagnosis and treatment at 11 weeks old would have prevented future strokes. If the child had a clotting disorder or an arterial disease, that would be a different story. The attorney is angry that he has spent all this money on a case that is not pursuable. What could you, as a legal nurse, have done differently?

What do medical malpractice attorneys fear the most? They fear getting deep into a case, possibly even to trial, and finding out that a smoking gun takes the case off the table. Even though the attorney did have to invest some money in this case, the case didn't get to court before determining it was a no case for the plaintiff. In that regard, you, as a legal nurse, saved him thousands. How could you have determined the case's merit before hiring an expert? Sometimes cases aren't that simple. You may need an expert to lay eyes on it or at least to consult over the phone for a summary of the case to determine merit. In this case, once it was discovered that there was no diagnosis to explain the strokes, seeking an expert to talk it over with would have likely yielded the opinion of a no case.

As Legal Nurse Consultants, we don't always consider the ramifications to the client when we determine that there is not a case to pursue. While some cases are obvious, some cases like ours are just an unfortunate series of events with no recourse. As you work your cases, keep in mind that just because there is no legal path to pursue in every case, there can still be lasting and devastating repercussions for the client or the family. The family often wants and needs to know specifically why there isn't a case. That is where your report can help them process and heal from the injury even if they cannot take legal action. Make sure the language in your report is at a level where a non-medical person can understand and understand the bad news you are giving them. Sometimes there may be community resources or organizations that may offer support.

Some individuals act as patient advocates specifically for people who have no case and can help connect them with these resources. If appropriate, ask your attorney if it would be acceptable to include the links to those resources in your report.

As devastating as it was to get the news that our case was not pursuable, we have been blessed with these community resources that have helped us navigate the world of cerebral palsy. Our child has received the needed care to help them flourish. Despite the physical disability and some emotional regulation issues, our child is a highly functioning third grader who is on grade level with his peers. Our situation has led me to the world of Legal Nurse Consulting and gives me a special insight into those plaintiffs who don't have a case despite something going wrong.

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Code Stroke Team for the Legal Nurse Consultant

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Keywords: Code Stroke, FAST algorithm, BEFAST algorithm, timely thrombolytic treatment of strokes

This article focuses on the initial timely assessment and treatment of ischemic strokes. The Centers for Medicare & Medicaid Services (CMS) published guidelines for centers to strive to achieve when providing good outcomes for care and treating patients with strokes. A Code Stroke Team is activated in larger hospital settings to conduct timely assessments, testing, medication administration, monitoring, and transferring.

The most crucial factor for successful reperfusion therapy of acute ischemic stroke is timely recognition, diagnosis, and prompt treatment (Emberson et al., 2014). Nonetheless, selecting appropriate candidates for reperfusion demands a timely neurologic evaluation and a neuroimaging study. Even in the acute setting, stroke care is a team effort involving emergency physicians, nurses, emergency medical services (EMS) personnel, stroke neurologist, primary care providers, hospitalists, radiology and pharmacy departments, and stroke coordinators.

A FAST pre-hospital assessment tool was developed for emergency service providers and the public to recognize a developing stroke rapidly (Zhelev et al., 2019).

The FAST algorithm (Face, Arm, Speech, Time) helps identify persons having an acute stroke.

- **F** – Face drooping
- **A** – Arm weakness
- **S** – Speech difficulty
- **T** – Time to call 911

In 2014, the University of Kentucky Stroke Center reviewed stroke patients and discovered patients having strokes outside the FAST assessment tool. A revised mnemonic could capture an additional patient population with an acute stroke that had not been captured using the FAST assessment tool (Aroor et al., 2017). The inclusion of Balance-gait imbalance or lower extremity weakness, and Eye- visual loss and diplopia impairments were added: BE-FAST (Balance, Eyes, Face, Arm, Speech, Time).

- **B** – Loss of balance, headache, or dizziness
- **E** – Blurred vision
- **F** – One side of the face is drooping
- **A** – Arm or leg weakness
- **S** – Speech difficulty
- **T** – Time to call for an ambulance immediately – (911)

The gold standard medication approved by the U.S. Food and Drug Administration (FDA) since 1995 for timely treatment of an ischemic stroke is intravenous alteplase, also called Activase® (recombinant tissue plasminogen activator, abbreviated tPA) (National Institute of Neurological Disorders and Stroke, 2019). "Its primary function includes catalyzing the conversion of plasminogen to plasmin, the primary enzyme involved in dissolving blood clots" (Jilani & Siddiqui, 2021). Administration of tPA is considered standard of care for the initial treatment of ischemic stroke, provided the medication is initiated timely, within 4.5 hours of clearly defined symptom onset. However, the availability of tPA has led to the use of Tenecteplase®, a third generation thrombolytic, which is given in a bolus dose instead of an infusion (Barreto et al, 2011).

Stroke onset time is defined as the last time a person was known to be well. If a person awakens at 8 AM with neurological deficits, then the last known well time was when they went to bed, 10:30 PM. That last known well time is greater than 4.5 hours, outside the window of treatment with tPA.

A timeline for treatment with intravenous thrombolysis and endovascular thrombectomy is imperative to follow. Stroke onset time is defined as the last time a person was known to be well. If a person awakens at 8 AM with neurological deficits, then the last known well time was when they went to bed, 10:30 PM. That last known well time is greater than 4.5 hours, outside the window of treatment with tPA. Assessments would still be done to evaluate the damage to brain tissue and evaluate the core area of dead tissue and an area of penumbra, a damaged area of potentially viable tissue that would improve with circulation restored. Each hour recanalization is delayed, including by tPA or mechanical thrombectomy, a seven percent benefit is lost. Criteria for consideration for delayed mechanical thrombectomy include the following (Jilani et al, 2021):

- Proximal vessel occlusion
- Age greater than 17
- National Institute of Health Stroke Scale (NIHSS) greater than 6
- Within 6-16 hours of the onset of symptoms

A timeline of events should be followed when working with patients that exhibit changes to their baseline neurological status (National Institute of Neurological Disorders and Stroke, 2019). The legal nurse consultant can find supportive documentation within the medical record to follow the timeline for treating a stroke patient. Review nursing notes, physician consultation, and progress notes, and radiological imaging reports for the following timeline of occurrences:

- Evaluation by the physician – 10 minutes elapse from arrival to the emergency room (or alerted the rapid response team for hospitalized patients with neurological changes)
- Check the bedside glucose level and vital signs. Correct hypoglycemia if present; a possible cause of the neurologic deficit. Elevated blood pressure needs to be controlled before administering tPA. Additional routine lab values are not required to proceed with intravenous tPA treatment and should not be delayed while results are pending unless any of the following conditions are present:
  - clinical suspicion of bleeding abnormality
  - thrombocytopenia
  - current or recent use of anticoagulants (heparin, warfarin, direct oral anticoagulants, or the use of anticoagulants is not known)
- Stroke or neurologic expert contacted – (either bedside neurologist or telemedicine for stroke neurologist assessment) An assessment of an NIHSS – 15 minutes elapse

Eligibility criteria for treating acute ischemic stroke with intravenous tPA – determine if the benefit of re-cannulating the occluded artery outweighs the risk of bleeding from tPA.

- Head computed tomography (CT) scan or magnetic resonance imaging (MRI) scan – <25 minutes elapse
- CT angiography and perfusion study are beneficial to determine the presence of emergent large vessel occlusion. This study provides a step to evaluate for further treatments, such as clot retrieval therapy (National Institute of Neurological Disorders and Stroke, 2021)
- Interpretation of neuroimaging scan - <45 minutes elapse (results of the imaging verify no hemorrhage or other contraindication)
- Blood pressure management:
  - Parameters systolic at or below 185 mmHg and diastolic at or below 110 mmHg.
  - Treatment with intravenous agents such as labetalol, nicardipine, or clevidipine, or alternative agents includes hydralazine and enalaprilat to lower blood pressure.
  - If blood pressure is not controlled, the patient should not receive treatment with tPA. The already higher risk of intracerebral hemorrhage with thrombolytic therapy may increase
  - Use caution to maintain BP below 190/105 for the first 24 hours, targeting systolic blood pressure to <140 once reperfusion is achieved
  - Caution should be used due to the risk of worsening blood flow within the ischemic penumbra if the blood pressure is driven too low; therefore, it is important to avoid excessive blood pressure lowering
- Start of intravenous tPA bolus and infusion treatment – <60 minutes elapse
- For hospitals that do not have the capability for mechanical thrombectomy (clot retrieval), the patient should transfer to a tertiary hospital - <90 minutes

Eligibility criteria for treating acute ischemic stroke with intravenous tPA - determine if the benefit of re-cannulating the occluded artery outweighs the risk of bleeding from tPA. The following are items utilized for consideration (Prabhakaran et al., 2015):

Inclusion criteria:

- Clinical diagnosis of ischemic stroke causing a measurable neurologic deficit
- The onset of symptoms <4.5 hours before beginning treatment; if the exact time of stroke onset is not known, it is defined as the last time the patient was known to be normal or at their neurologic baseline
- Age >18 years

Exclusion criteria:

- Patient history:
  - History of ischemic stroke
  - Severe head trauma in the previous three months
  - Recent surgery or trauma with bleeding
  - Previous intracranial hemorrhage
  - Intra-axial intracranial neoplasm
  - Gastrointestinal malignancy
  - Intracranial or intraspinal surgery within the prior three months
  - Vascular malformations
  - Coagulation abnormality
- Clinical:
  - Symptoms suggestive of subarachnoid hemorrhage
  - Persistent blood pressure elevation (systolic >185 mmHg or diastolic >110 mmHg)
  - Therapeutic doses of low molecular weight heparin received within 24 hours (e.g., to treat VTE and ACS); this exclusion does not apply to prophylactic doses (e.g., to prevent VTE)
  - Current use (i.e., last dose within 48 hours in a patient with normal renal function) of a direct thrombin inhibitor or direct factor Xa inhibitor with evidence of anticoagulant effect by laboratory tests such as a PTT, INR, ECT, TT, or appropriate factor Xa assays
- Head CT results:
  - Evidence of hemorrhage
  - Extensive regions of obvious hypodensity consistent with the irreversible injury

Warnings: The following are conditions that need to be considered as higher risk factors that may have unfavorable outcomes or should be treated prior to consideration of tPA.

- Only minor and isolated neurologic signs or rapidly improving symptoms
- Serum glucose <50mg/ds (2.8 mmol/L)
- Serious trauma in the previous 14 days
- Major surgery in the previous 14 days
- Seizure at the onset of stroke with postictal neurologic impairments
- Pregnancy
- Arterial puncture at a noncompressible site in the previous seven days
- Large (>10 mm) untreated, unruptured intracranial aneurysm
- Untreated intracranial vascular malformation

Additional warnings for treatment from 3 to 4.5 hours from symptom onset

- Age >80 years
- Oral anticoagulant use regardless of INR – warfarin or DOAC-NOAC
- Severe stroke (NIHSS score >25)
- Combination of both previous ischemic stroke and diabetes mellitus

Nursing actions and dosing of tPA:

- A dedicated intravenous (IV) line is required for tPA, and all patients should have at least one additional large-bore IV line
  - The tPA dose is calculated at 0.9 mg/kg of actual body weight, with a maximum dose of 90 mg
  - Ten percent of the dose is given as an IV bolus over one minute, and the remainder is infused over one hour. It is not unusual for a small infusion of NS to be infused to complete the entire dose of tPA, including the amount in the intravenous drip chamber and tubing line

Nursing monitoring:

- An NIHSS should be done before the tPA infusion and post tPA infusion, and any time the patient has another nurse, at shift hand-off or from another unit hand-off, such as from the Rapid Response Team nurse or the emergency department nurse to the intensive care unit. A follow-up NIHSS should be done at least once a shift (every 12 hours) during the hospital stay and as needed with any neuro changes (high risk for intracerebral hemorrhage)
- Vital signs and neuro assessments should be checked frequently. A typical assessment would be every 15 minutes for two hours, then every 30 minutes for six hours, and then every 60 minutes until 24 hours from the start of tPA infusion. Typically, these patients are closely monitored in an ICU unit for the first 24 hours.
- Blood pressure must be maintained at or below 180/105 mmHg during the first 24 hours. Utilize beta-blocker medication such as labetalol or nicardipine for blood pressure management
- Anticoagulants and antithrombotic agents such as heparin, warfarin, direct oral anticoagulants, or antiplatelet drugs should not be administered for at least 24 hours after the tPA infusion is completed
- Placement of intra-arterial catheters, indwelling bladder catheters, and nasogastric tubes should be avoided for at least 24 hours if the patient can be safely managed without them.
- If clot retrieval, thrombectomy, is done, there will be additional monitoring of the puncture site; the groin is the most common access site. There has been an increased move towards using the radial artery access to decrease complication rates

Follow-up non-contrast CT or MRI brain scan should be obtained 24 hours after the tPA was initiated and before starting treatment with antiplatelet or anticoagulant agents.

Complications:

- The most feared complication of thrombolytic therapy is symptomatic intracerebral hemorrhage. Symptomatic intracerebral hemorrhage, systemic bleeding, and angioedema are complications that may arise. Treatment options for intracerebral hemorrhage related to IV tPA treatment are unproven but include the administration of agents to reverse the effects of thrombolytic therapy and antithrombotic therapy

Systemic bleeding:

- Mild systemic bleeding usually occurs in the form of oozing from IV catheter sites, ecchymosis (especially under automated blood pressure cuffs), and gum bleeding. These complications do not require cessation of treatment, but more serious bleeding, such as from the gastrointestinal or genitourinary system, may require discontinuation of tPA, depending on the severity of the bleeding
- Rarely, patients who suffer a stroke after a recent myocardial infarction can develop bleeding into the pericardium, resulting in life-threatening tamponade. Patients who become hypotensive after tPA should be evaluated with an urgent echocardiography

Angioedema:

- Orolingual angioedema occurs in 1-8 percent of patients treated with tPA for ischemic stroke; typically mild, transient, and contralateral to the ischemic hemisphere. Patients taking angiotensin-converting enzyme inhibitors and those with CT evidence of ischemia in the frontal and insular cortex may be at increased risk (Burd et al., 2019)

As legal nurse consultants are working on cases to review medical records for standards of care and treatment of strokes, it is important to discern the onset of symptoms, what diagnostic studies were done, and the timely manner the evaluations and studies were done and treated.

- Maintain airway – endotracheal intubation may be necessary if the patient is unable to protect the airway due to swelling of the airway
- Awake fiberoptic intubation is optimal. Nasotracheal intubation may be necessary but is associated with the risk of epistaxis after treatment with tPA infusion. Emergent cricothyrotomy is rarely needed and may also be problematic after tPA infusion, but in a life-threatening circumstance, the need to establish an airway supersedes that concern

Medical management of angioedema; given in rapid sequence:

- IV push methylprednisolone 125 mg
- IV push diphenhydramine 50 mg
- IV push famotidine 20 mg
- If further increased angioedema, give epinephrine (0.1 %) 0.3mg subcutaneously or 0.5 ml by nebulizer (but note that epinephrine has a theoretical risk of blood pressure elevation and hemorrhage.)

The overall complication rate is about 15% for a thrombectomy; clot retrieval (Palaniswami et al., 2015). Complications include:

- Intracranial hemorrhage (<8%)
- Parenchymal (5%)
- Subarachnoid (3%)
- Emboli to new territories
- Vessel perforation (1-5%)
- Arterial dissection
- Vasospasm
- Vascular access site complications
  - Groin hematoma (2-11%)
  - Retroperitoneal hematoma (<6%)

MORTALITY

In a meta-analysis, 46% of patients treated with mechanical thrombectomy achieved functional independence. Medscape shows the Modified Rankin Scale; a measure of the degree of disability in patients who have had a stroke, as follows:

- 0: no symptoms at all
- 1: no significant disability despite symptoms; able to carry out all usual duties and activities
- 2: slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
- 3: Moderate disability; requiring some help, but able to walk without assistance
- 4: Moderately severely disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
- 5: Severe disability; bedridden, incontinent, and requiring constant nursing care and attention
- 6: Dead

The 46% that were treated with mechanical thrombectomy achieved a Modified Rankin scale 0-2 at 90 days; functional independence, compared to 27% for best medical treatment (not treated with mechanical thrombectomy). Outcomes for posterior circulation strokes remain mixed.

As legal nurse consultants are working on cases to review medical records for standards of care and treatment of strokes, it is important to discern the onset of symptoms, what diagnostic studies were done, and the timely manner the evaluations and studies were done and treated. A timeline of events or a detailed chronology helps to determine the timeliness of assessment, diagnostics, medications, and reassessments.

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