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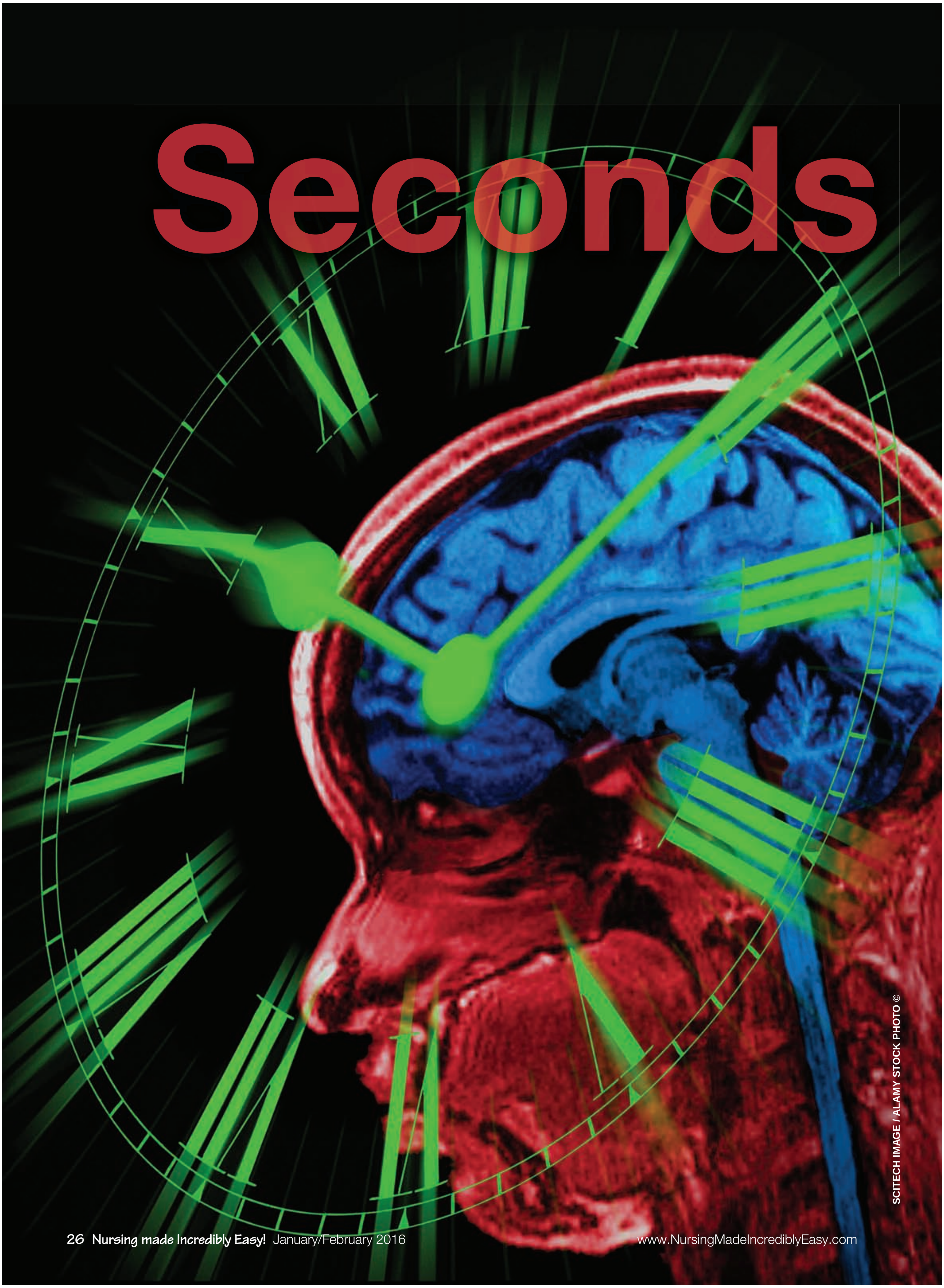

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Stroke guidelines update

Time equals tissue as the 1-hour intervention clock begins ticking to ensure optimal neurologic recovery for your patient.

By Charlotte Davis, BSN, RN, CCRN, and Lisa Lockhart, MHA, MSN, RN, NE-BC

According to the American Heart Association (AHA), someone has a stroke every 40 seconds in the United States; a person dies of one approximately every 4 minutes. This translates into 1 in every 20 deaths in the United States resulting from stroke, making it the fifth leading cause of death for Americans. Stroke has remained the leading cause of disability for the last decade. Currently, there are 3.8 million women and 3 million men living with disabilities as a direct result of stroke. Research has shown that early evaluation and assessment, diagnostics, and formulation and intervention of a treatment plan are directly linked to reduced motor and cognitive deficits, as well as lower mortality.

Two types to know

There are two types of stroke: ischemic and hemorrhagic. Both result in vital oxygen-rich blood depletion to areas of the brain. Emergent diagnosis and treatment must be implemented quickly to prevent brain tissue hypoxia and death. Although both types may cause similar clinical presentation, each requires a different approach to treatment.

Ischemic stroke

An ischemic stroke is caused by a thrombus that blocks blood supply to a cerebral artery, which supplies oxygen-rich blood to brain tissue (see *Picturing ischemic stroke*). The thrombus causes both glucose and oxygen deprivation, with subsequent mitochondrial cell death. According to the AHA, 45% of all ischemic strokes are caused by a small or large arterial thrombus, 20% are venous emboli that migrate, and the remaining 35% are of unknown origin. Microembolic showers as result of untreated atrial fibrillation, arteritis, patent foramen ovale, left ventricular dysfunction, and refractory septic shock can also cause an ischemic stroke. Other less common causes of ischemic stroke are carotid dissection, acute phase of traumatic brain injuries, and coagulopathy states such as disseminated intravascular coagulation.

An ischemic stroke may initially present as a transient ischemic attack (TIA), which is commonly referred to as a "mini-stroke" or a precursor to a future ischemic stroke. A TIA occurs when there's a temporary occlusion or blockage of blood flow to a portion of the brain. This transient occlusion can

memory jogger

Teach patients to think **FAST**.

- **F** Facial drooping
- **A** Arm weakness
- **S** Speech slurred
- **T** Time to call 911

cause symptoms that mimic a stroke, such as slurred speech; visual disturbances; weakness in an extremity; or brief changes in level of consciousness (LOC), lasting between 1 and 30 minutes and disappearing without any long-term effects. With a stroke, the symptoms last longer than 30 minutes.

It's imperative that any symptoms of a TIA or stroke be evaluated immediately so that diagnostic and treatment interventions can be initiated to minimize the likelihood of long-term cognitive, sensory, and physical impairment. According to the AHA, approximately one-third of patients who experience a TIA will have an ischemic stroke within 1 year.

Hemorrhagic stroke

A hemorrhagic stroke occurs when areas of the cerebral arterial system become weakened or thin due to long-term or acute episodes of hypertension. This weakened or thin area of the vessel wall can either result in an outpouching of the arterial blood vessels (aneurysm) or it can rupture as the arterial pressure rises, exerting pressure on the thinned fragile wall during periods of acute hypertension. Both the aneurysm and thin arterial vessel areas are prone to rupture. Intracerebral hemorrhages are typically caused by rupture of vessels due to long-term atherosclerotic damage and arterial hypertension.

did you know?

A primary stroke center is a healthcare facility that has a neurologist, neurosurgeon, and/or stroke team on site. These facilities have trained staff members who can safely assess, diagnose, and initiate treatment within the AHA stroke guidelines. Among the requirements for stroke center designation are a stroke care unit and multidisciplinary stroke care team that includes radiology, lab, neurosurgery, neurology, nursing, and pharmacy staff members who've received specific education and certification. Primary stroke centers require their nursing staff to be NIHSS certified, along with attending required education on early recognition and treatment.

Risk factors

Common risk factors include:

- age older than 45
- smoking
- atrial fibrillation
- female sex (current AHA research reveals that women between ages 55 and 75 have a 20% risk of having a stroke compared with 17% for men)
- sleep apnea
- hypertension
- heredity
- Black, Hispanic, or Asian ethnicity
- history of TIA, previous stroke, or myocardial infarction
- illicit drug abuse and alcoholism (some illicit drugs, such as cocaine, can cause profound vasoconstriction to the cerebral arteries, dramatically reducing or occluding blood supply to the brain tissue, which can result in impaired blood flow, clot formation, and an evolving ischemic stroke).

Symptoms watch

Despite the AHA's public education campaign on stroke warning signs, many patients postpone medical treatment after they begin to experience stroke symptoms. It's vital that symptoms be recognized early and time-sensitive interventions be performed within the recommended guidelines to improve clinical outcomes, minimize neurologic dysfunction, and reduce mortality.

Currently, the AHA and the National Institute of Neurological Disorders and Stroke (NINDS) recommend that healthcare facilities strategically place community education posters in heavily trafficked areas displaying the FAST mnemonic:

- facial drooping
- arm weakness
- speech slurred
- time to call 911.

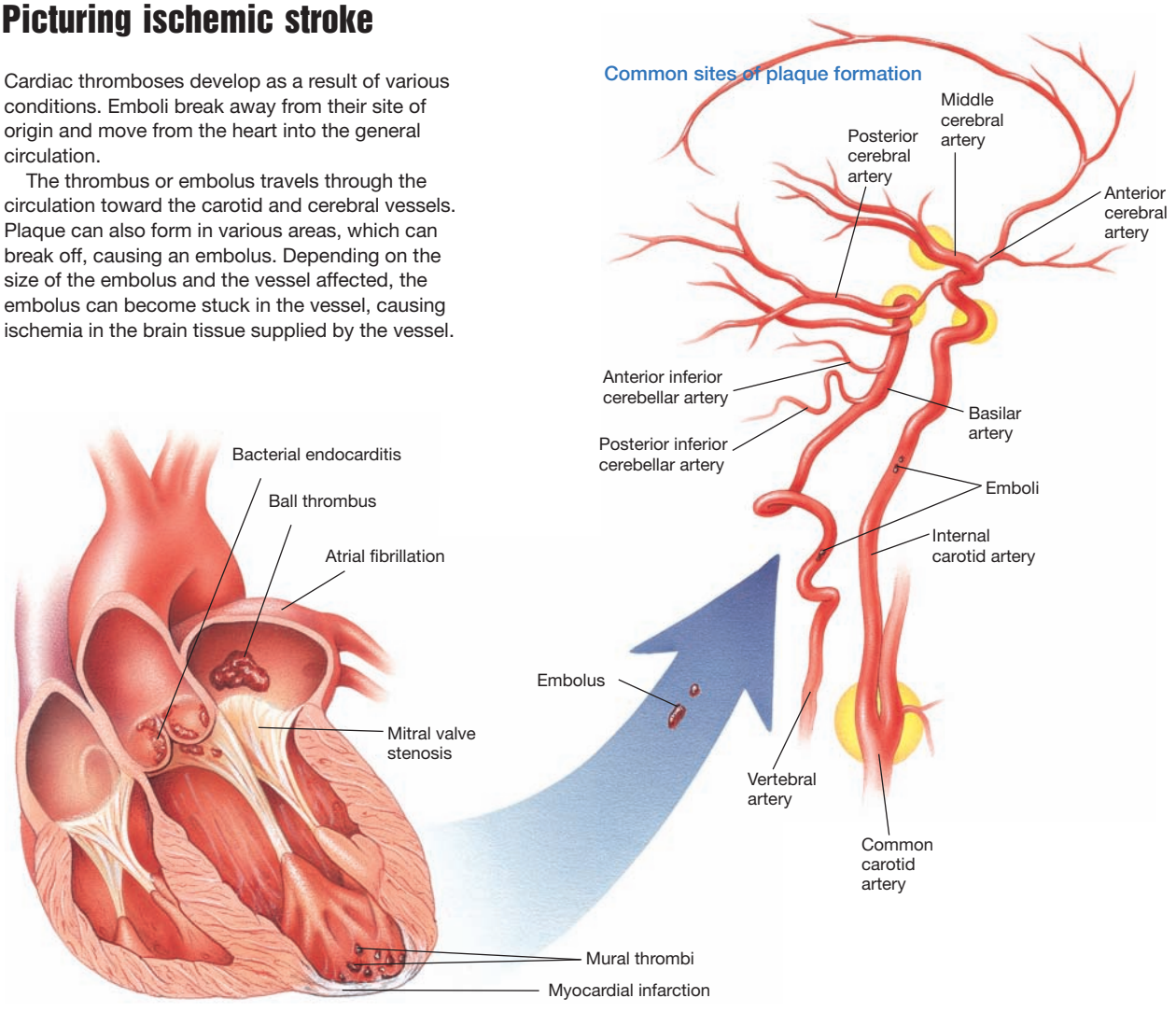
Assessment stat

The NINDS recommends utilizing a specific stroke assessment tool to evaluate

Picturing ischemic stroke

Cardiac thromboses develop as a result of various conditions. Emboli break away from their site of origin and move from the heart into the general circulation.

The thrombus or embolus travels through the circulation toward the carotid and cerebral vessels. Plaque can also form in various areas, which can break off, causing an embolus. Depending on the size of the embolus and the vessel affected, the embolus can become stuck in the vessel, causing ischemia in the brain tissue supplied by the vessel.



patients suspected of having a stroke. Two common stroke assessments are the Cincinnati Prehospital Stroke Scale (CPSS) and the National Institutes of Health Stroke Scale (NIHSS).

The CPSS is commonly utilized by emergency medical services (EMS) technicians and paramedics (see *EMS stroke algorithm*). It consists of performing the following assessment:

- facial droop
  —normal: both sides of the face move equally
  —abnormal: one side of the face doesn't move at all
- arm drift
  —normal: both arms move equally or not at all
  —abnormal: one arm drifts compared with the other
- speech
  —normal: the patient uses correct words with no slurring
  —abnormal: the patient uses slurred or inappropriate words or is mute.

The NIHSS was developed to help nurses and physicians objectively identify the severity of ischemic strokes by assessing 15 specific areas for abnormalities or disabilities. The modified version only assesses 11 specific physical areas.

An elevated NIHSS score correlates with the size of the infarction on both a computed tomography (CT) scan and magnetic resonance imaging (MRI). Scores should be assessed initially when a stroke is suspected, 24 hours after fibrinolytic therapy, 7 days post stroke, and 30 days post stroke. Scores assessed at 48 hours following a stroke have been directly correlated with clinical outcomes at the 3-month and 1-year mark.

According to the NINDS, patients with a NIHSS score of 4 or less have been linked to a high likelihood of functional independence regardless of treatment. Patients with a high score (greater than 22) may experience severe debilitation and be dependent on assistance from others to perform basic activities of daily living.

The Miami Emergency Neurologic Deficit, or MEND, exam is another stroke scoring tool that healthcare facilities may utilize, which incorporates all three components of the CPSS (speech, droop, drift) and eight additional components from the NIHSS, such as LOC, eye gaze, orientation, commands, visual fields, leg motor strength, ataxia, and sensation.

A noncontrast CT scan should be performed within 25 minutes of time zero (arrival to the ED), with diagnostic results made available to the stroke team within 45 minutes so that a decision can be made on the most appropriate treatment plan. Contrast isn't used if a stroke is suspected because it will mask blood in the cranial vault, making it difficult to differentiate between ischemic and hemorrhagic stroke.

The most common type of stroke is nonhemorrhagic-ischemic (approximately 87%), which may not be readily visualized on the CT scan. MRI may be needed in addition to a CT scan to diagnose ischemic stroke and confirm the presence of the clot or embolism occluding specific vessels within the brain. Magnetic resonance angiography and cerebral angiography are useful if the stroke team suspects that the clot is in a location where a thrombectomy may be a feasible treatment option. For example, if the patient is experiencing hemianopsia (decreased vision or blindness in half of the visual field), the stroke team may suspect a posterior cerebral artery occlusion/clot that may be resolved with thrombectomy.

Time-sensitive interventions

Early intervention when a stroke is suspected is vital to optimize neurologic outcomes. According to recent research, the ischemic brain ages 3.6 years each hour that treatment is delayed. When a large vessel ischemic stroke occurs, 1.9 million

EMS stroke algorithm

The AHA EMS stroke algorithm directs EMS workers to perform the following interventions at these specific times:

- from the time of the 911 call to dispatch notifying an EMS team should be less than 90 seconds
- dispatch time should be limited to less than 60 seconds relaying information to the EMS team
- the EMS team should arrive on the scene in less than 8 minutes
- the EMS team should spend less than 15 minutes on the scene (except in extenuating circumstances)
- the EMS team should always document the time the patient was "last known well" instead of when symptoms were first noticed because many stroke interventions are time sensitive and can only be administered within 3 to 4.5 hours of the actual stroke event; the last known well time should be conveyed to the healthcare team before the patient's arrival or during the initial moments of the patient's arrival.

The focus of EMS stroke care is performing a rapid assessment and minimizing transport time delays to a primary stroke center. The EMS team should divert the patient to a primary stroke center when possible.

Other tasks in the EMS algorithm include managing the patient's airway, breathing, and circulation; applying cardiac monitoring; establishing I.V. access; administering oxygen if needed to maintain an oxygen saturation of greater than 92%; assessing glycemic status; alerting the receiving facility; and ensuring that the facility has diagnostic and stroke intervention capabilities.

neurons, 14 billion synapses, and 12 km (7.5 miles) of myelinated fibers are destroyed every minute.

After the patient enters the ED, the 1-hour clock should be started so that all staff members are aware of when each time-sensitive intervention should be performed. The AHA recommends that all EDs have a clock or stopwatch that the healthcare team activates at time zero. The team member in charge of time should remind each staff member of how many minutes have passed since each intervention has been performed. This is the time from which all further ED interventions will start.

The AHA developed a stroke algorithm that all healthcare facilities should follow, with specific time-sensitive interventions that must be performed at 10 minutes, 15 minutes, 25 minutes, 45 minutes, and 60 minutes after the patient enters the ED. These algorithm-directed interventions are designed to improve neurologic outcomes based on clinical research findings.

The AHA stroke algorithm recommends the following sequence of events during the first hour after the patient's arrival:

- 10 minutes—patient seen by the ED physician for an initial assessment
- 15 minutes—patient seen by the stroke team
- 25 minutes—noncontrast CT scan performed
- 45 minutes—CT scan results available to the stroke team and decision made for treatment
- 60 minutes—initiation of fibrinolytic therapy within 3 hours of stroke symptoms unless contraindicated.

Medications

Tissue plasminogen activator (tPA) is the gold standard for treating ischemic stroke. It's contraindicated in hemorrhagic stroke because it can dramatically expand the area of intracranial bleeding and worsen the stroke. It's the only FDA-approved drug for administration in the acute care of ischemic stroke when systolic BP is below 185 or diastolic BP is below 100. tPA is a fibrinolytic medication that works by stimulating the production of the enzyme plasmin, which digests fibrin strands and restores oxygen-rich blood flow to the brain. However, tPA puts the patient at risk for bleeding. In a 2014 research study, 22.8% of all ischemic stroke patients treated with tPA experienced bleeding complications, including intracranial bleeding.

Getting a history as complete as possible from the patient or caregiver and verification of nonhemorrhagic stroke are required before administration of tPA. Door-to-admission time of 3 hours is the widely accepted timeline for tPA administration. However, it can be administered in well-screened patients who are at low risk for bleeding for up to 4.5 hours. tPa is contraindicated in patients with an international normalized ratio of greater than 2, those with a recent history of a traumatic brain injury (less than 90 days), and those with a history of hemorrhagic stroke.

Other medications that may be administered include:

- furosemide—a loop diuretic utilized to reduce intracranial volume in hemorrhagic stroke, resulting in a decreased incidence of transtentorial or uncal herniation
- mannitol—an osmotic diuretic used to decrease cerebral edema and tissue damage, and reduce the risk of transtentorial or uncal herniation
- fosphenytoin—a water-soluble prodrug of phenytoin utilized to stabilize neuronal membranes and decrease seizure activity
- phenytoin—an anticonvulsant used to inhibit the spread of seizure activity in the cerebral motor cortex, as well as in the brainstem centers that are responsible for the tonic phase of grand mal seizures
- benzodiazepine—a psychoactive drug utilized to reduce skeletal muscle spasms.

did you know?

Many guidelines and protocols warn that administering tPA to patients with a high NIHSS score (greater than 22) is associated with increased risk of hemorrhagic conversion.

Nursing interventions should be centered on the support of airway, breathing, and circulation as a primary goal.

Surgical procedures

Endovascular thrombectomy is an option to remove the thrombus and reestablish blood flow for the ischemic stroke patient. The benefit of endovascular thrombectomy over tPA is that it can mechanically remove a thrombus in a matter of minutes, whereas tPa can take up to 2 hours to dissolve it. Innovative endovascular catheter devices have shown to be the most effective at restoring blood flow and removing thrombi. However, an endovascular catheter has limitations, such as it can only remove thrombi from large cerebral vessels and, therefore, isn't an appropriate treatment option if the thrombus is lodged in a smaller arterial cerebral vessel.

Recent clinical research outcomes from the SWIFT-PRIME study released in February 2015 revealed that endovascular thrombectomy patients had better clinical outcomes and functional independence in 60.2% of cases of large vessel thrombi compared with 35.5% of tPA patients. In 4.3% of cases, the clinical outcomes remained unchanged.

Surgical procedures that may be considered to treat hemorrhagic stroke include:

- superficial temporal artery to middle cerebral artery bypass graft—a small, superficial temporal artery can be grafted to bypass the cerebral vessel that has the thrombus or an unruptured aneurysm (can also be used to treat ischemic stroke)
- Guglielmi detachable coils—small, platinum coils are used to occlude an inoperable, ruptured, or unruptured aneurysm
- aneurysm clipping—surgical clips may be placed to seal bleeding from a fusiform aneurysm (ruptured or unruptured) or multiple small vessel aneurysms
- decompressive craniotomy—a cranial bone flap window is removed to allow for visualization of the aneurysm during surgical clip placement (a controversial and aggressive approach to managing a hemorrhagic stroke).

With all surgical interventions, assess the surgical site at the beginning of each shift and frequently thereafter for either a puncture site hematoma formation or localized edema and erythema that may indicate infection. Changes in vital signs, such as tachycardia, hypo- or hypertension, and an elevated body temperature, may signal infection or unmet pain needs. If a hematoma or signs of localized infection are noted, immediately notify the healthcare team so that emergent evaluation, diagnostics, and treatments can be initiated.

A full neurologic assessment should be performed at least once an hour for the first 3 days after the procedure and thereafter if neurologic changes, such as a decreased LOC, new visual changes, and new onset weakness, are noted. If changes are present, alert the healthcare team immediately because this may signal an extension of the stroke area, cerebral vasospasm, or evolving cerebral brainstem herniation.

Minimizing complications

Aspiration is a potential complication of stroke. Ensure that the patient remains N.P.O. because he or she is at high risk for aspiration. The patient should successfully pass a bedside swallowing assessment before eating, drinking or consuming as needed medications. A fluoroscopic swallowing exam should be performed to assess for prominent or silent aspiration—the aspiration of gastric or orogastric contents into the lung fields without causing immediate symptoms such as coughing. Ensure that the head of the bed remains elevated at a minimum of 30 degrees unless contraindicated to decrease the risk of aspiration and reduce cerebral edema.

Other complications include:

- cerebral edema
- pneumonia
- urinary tract infection and/or bladder control
- seizures
- depression

- pressure ulcers
- limb contractures
- shoulder pain
- deep vein thrombosis
- ischemic stroke conversion to hemorrhagic stroke
- cerebral vasospasm
- hypotension or hypertension.

Monitor vital signs at least every 15 minutes. It's vital that patients who experienced an ischemic stroke avoid hypotension because they already have reduced oxygen-rich blood flow to the brain. If tPA is initiated, monitor vital signs before initiation and every 5 minutes for the first 15 minutes after administration, then every 15 minutes thereafter. Nurses managing a patient with a diagnosis of hemorrhagic stroke should avoid hypertensive states because this can result in an expansion of intracranial bleeding, which will result in increased intracranial hypertension and predispose the patient to further neurologic injury.

Nursing interventions should be centered on the support of airway, breathing, and circulation as a primary goal. These patients may need ventilator support for respiratory depression or respiratory fatigue secondary to the neurologic injury. Perform hourly neurologic assessments or as needed to closely monitor for neurologic decline. An increased frequency may be needed if hemodynamic decline is present or signs of imminent brain stem herniation are noted (increased intracranial pressure, decreasing strength in extremities, focal or global seizure activity, or pupils becoming grossly asymmetrical). Patients should be closely monitored for seizure activity, with seizure precautions in place at all times.

The earlier, the better

As the clock begins at time zero when a new stroke patient arrives at your facility, you must be proficient in your assessment and implementation of time-sensitive interventions. Adhering to the 2015 AHA stroke guidelines can improve your patient's chain of survival. As nurses continue to utilize these guidelines, lives are saved. ■

on the web

American Heart Association/American Stroke Association: www.strokeassociation.org/

CDC: www.cdc.gov/stroke/

Mayo Clinic: www.mayoclinic.org/diseases-conditions/stroke/home/ovc-20117264

MedlinePlus: https://www.nlm.nih.gov/medlineplus/stroke.html

National Institute of Neurological Disorders and Stroke: http://stroke.nih.gov/

National Stroke Association: www.stroke.org/

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