ACCORDING to the American Heart Association (AHA), more than 795,000 Americans experience a stroke each year, and first-time strokes account for over three-quarters of them. An acute stroke, whether ischemic or hemorrhagic, is a clinical emergency that requires urgent intervention. Immediate priorities include timely recognition of stroke symptoms and expedient activation of systems of care. Bedside nurses play a primary role in activating these systems and providing coordinated stroke care throughout hospitalization.

Acute ischemic stroke
The AHA reports that ischemic stroke accounts for 87% of all strokes. Causes include atherosclerosis (the most common) and thrombotic or embolic events. Common acute symptoms include facial drooping, speech difficulty, unilateral weakness or numbness, vision changes, difficulty ambulating, vertigo, and sudden decreased level of consciousness.

Initial actions
Restoring perfusion and optimizing neurologic outcomes require timely recognition of ischemic stroke symptoms and emergency response activation. Approximately 1.9 million neurons are lost during each minute of untreated large vessel stroke, high-
lighting the notion that “time is brain,” and every second counts during an acute ischemic stroke (AIS). In addition, time-limited AIS interventions (such as I.V. thrombolysis and endovascular thrombectomy) depend on knowing when the patient was last well. For these reasons, treat suspected stroke as a medical emergency that requires immediate activation of hospital-based emergency systems, whether in the emergency department or inpatient units. To facilitate expedient evaluation and care, ensure you’re familiar with your organization’s emergency stroke response protocols.

The AHA recommends clear targets to drive timely stroke care: neurologic evaluation, non-contrast head computed tomography (CT), and evaluation of eligibility for I.V. thrombolytic therapy. A standardized neurologic assessment tool, such as the National Institutes of Health Stroke Scale, can help quantify stroke symptom severity with reliable reproducibility. At the same time, continually assess the patient’s airway and cardiopulmonary stability. Nurses can provide supplemental oxygen to maintain SpO2 >94% and advocate for additional stabilizing support if needed.

If airway and hemodynamic status are stable, early priorities for suspected AIS focus on timely neuroimaging and determining treatment eligibility. To facilitate these priorities, immediate nursing actions include obtaining vital signs, capillary glucose level, and an accurate weight. Establish reliable I.V. access to obtain basic labs, accommodate I.V. contrast for a CT angiography, and for potential thrombolytic administration. The provider may order additional laboratory studies, such as complete blood count and coagulation studies, but these shouldn’t delay obtaining a CT. To determine the patient’s thrombolytic eligibility, note their history (including malignancy, recent surgery, or trauma), the timing of symptom onset, and any anticoagulating medications. (See Primary goal recommendations.)

**Treatment priorities**

Treatment priorities for AIS include I.V. thrombolysis and endovascular mechanical thrombectomy (MT).

**I.V. thrombolysis.** Because ischemic and hemorrhagic stroke symptoms may be indistinguishable, a CT scan must be performed to rule out the presence of a hemorrhage before administering thrombolytics. However, because ischemic stroke is more prevalent than hemorrhagic stroke, the healthcare team should prepare to treat an ischemic stroke until proven otherwise. A CT angiogram also can be used to identify the presence of a large vessel occlusion, which might be a target for endovascular intervention. After neuroimaging, subsequent priorities include deciding whether to administer I.V. thrombolysis and assessing eligibility for endovascular thrombectomy.

The Food and Drug Administration has approved I.V. thrombolysis with alteplase (tPA) for up to 3 hours after AIS onset or when the patient was last known to be well; the AHA endorses it for up to 4.5 hours after onset in eligible patients (those with no hemorrhage on CT, coagulopathy, recent anticoagulation, or recent surgery). This practice aligns with many U.S.-based organizational practices. In the absence of absolute contraindications for thrombolysis, you can prepare the patient for thrombolytic administration by achieving blood pressure control below 185/110 mmHg. To encourage adequate brain perfusion and limit the risk of intracranial hemorrhage while also avoiding hypotension, maintain blood pressure below 180/105 mmHg for 24 hours after thrombolytic administration.

I.V. thrombolytic complications include major intracranial or systemic bleeding, angioedema, oozing from gums and venipuncture sites, hematuria, and hemoptyis. To help detect these complications, conduct stringent vital sign checks and neurologic assessments within the first 24 hours after thrombolytic administration (every 15 minutes for the first 2 hours, every 30 minutes for the next 6 hours, then hourly for 16 hours). If major bleeding occurs during tPA ad-

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### Primary goal recommendations

The American Heart Association’s primary goal recommendations for acute ischemic stroke hospital emergency response include the following:

<table>
<thead>
<tr>
<th>Metric</th>
<th>Time standard</th>
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<tbody>
<tr>
<td>Door-to-provider</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Access to neurologic expertise</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Door-to-computed tomography (CT) completion</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Door-to-CT interpretation</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Door-to-I.V. thrombolysis</td>
<td>60 minutes</td>
</tr>
<tr>
<td>Door-to-puncture time for endovascular intervention</td>
<td>90 minutes</td>
</tr>
<tr>
<td>Door-to-recanalization</td>
<td>120 minutes</td>
</tr>
<tr>
<td>Admission to stroke unit or ICU</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
bral edema should be medically managed and response to any acute neurologic change. Cerebral edema, particularly in patients with a large hemispheric stroke for whom early recanalization wasn’t successful. The provider can consider immediate brain imaging in response to any acute neurologic change. Cerebral edema should be medically managed and may require neurosurgical intervention.

Up to 65% of patients experience some degree of swallowing dysfunction (dysphagia) after stroke. Dysphagia contributes significantly to post-stroke morbidity and mortality resulting from aspiration, pneumonia, and malnutrition. Consider performing bedside dysphagia screening (and in some cases formal evaluation) before any oral intake (including medications). If the patient experiences difficulty swallowing during screening, a speech-language pathologist should perform a complete swallowing assessment within 24 to 48 hours of hospital admission, and the healthcare team should make a decision about feeding within 72 hours of admission.

Blood pressure management is crucial in stroke patients. Excessive hypertension in patients with AIS can lead to intracerebral hemorrhage (ICH) and end-organ damage. Conversely, hypotension can lead to a lack of collateral perfusion and infarct extension. To keep blood pressure below 180/105 mmHg, administer short-acting antihypertensive agents (such as labetalol, nicardipine, and clevidipine) as ordered. Continue cardiac monitoring for at least 24 hours post-stroke to observe for any dysrhythmias.

Additional supportive elements of post-stroke care include reducing fever burden and maintaining glycemic control. Perform an infection workup and administer treatment, as ordered. Administer antipyretic medications and apply cooling measures and devices for fever management. Hyperglycemia in the first 24 hours post-AIS is associated with poor outcomes, so preserve blood glucose between 140 and 180 mg/dL.

Patients who’ve experienced a stroke may be at increased risk for immobility, skin breakdown, and bowel or bladder dysfunction. They’re also at increased risk for venous thromboembolism (VTE) for about 4 months after an acute stroke, so they’ll require pharmacologic and mechanical VTE prophylaxis and early mobilization. Adjunctive post-discharge treatments may include lipid-lowering agents, glucose management, antidepressants, and antiepileptics.

AIS, a life-altering diagnosis, requires early and frequent communication with patients and families about causes and risk factors, health maintenance, medications, and lifestyle adaptation. Nearly a quarter of patients with AIS will experience a subsequent stroke, making early targeted discussions about ongoing individual risk factors and stroke prevention measures crucial.
Hemorrhagic stroke

Hemorrhagic stroke (intracerebral hemorrhage [ICH] and subarachnoid hemorrhage [SAH]) accounts for 13% of stroke cases. ICH occurs when a cerebral blood vessel bursts, causing blood to leak into surrounding brain tissue. This accounts for about 10% of all hemorrhagic strokes. SAH results from blood leaking into the subarachnoid space (the space between the two outer layers of the brain that houses cerebrospinal fluid [CSF]). Rupture of an intracranial aneurysm or other cerebrovascular abnormalities can cause an SAH. Although hemorrhagic stroke is far less common than ischemic stroke, both ICH and SAH carry high morbidity and mortality risk and represent serious medical emergencies.

ICH

ICH can result from a number of causes, including chronic hypertension, cerebral amyloid angiopathy, coagulopathies, vascular malformations, or sympathomimetic drug use. ICH also may result from bleeding into brain tissue after ischemic stroke, a complication known as hemorrhagic transformation. Bleeding into brain tissue compresses surrounding structures, and rapid hematoma formation increases ICP. Definitive ICH diagnosis requires neuroimaging because of AIS symptom similarity. However, severe headache, quickly progressing neurologic findings, acute and severe hypertension, and decreased level of consciousness are more common in ICH than AIS.

Initial actions. Increased risk for rapid and progressive decreased consciousness requires immediate airway and circulatory stabilization. Rapid sequence intubation should occur without delay if needed to establish normal ventilation. Simultaneously, obtain an initial neurologic assessment, including, at a minimum, pupillary reactivity and Glasgow Coma Scale score. The next immediate action is a non-contrast head CT for timely diagnosis. (See Extended nursing neurologic assessment.)

Treatment priorities. After ICH diagnosis confirmation, the following treatment priorities occur quickly and in tandem: blood pressure management, coagulopathy correction, neurosurgical consultation (including for external ventricular drainage [EVD] placement for ICP management and monitoring).

Many patients with ICH experience hypertension. Convention dictates lowering blood pressure to prevent re-bleeding and hematoma expansion, but precise blood pressure management strategies remain controversial. Two randomized trials have demonstrated safety of acutely lowering systolic blood pressure to less than 140 mmHg after ICH, although exact targets that optimize overall patient outcomes remain unclear. Therefore, AHA Guidelines recommend a somewhat tailored approach to

Extended nursing neurologic assessment

A problem-focused assessment using the following components may be incorporated into ongoing nursing assessment. Standardized tools, such as the Glasgow Coma Scale or National Institutes of Health Stroke Scale, also may be incorporated in addition to or in place of these components.

<table>
<thead>
<tr>
<th>Component</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebellar system</td>
<td>• Finger-to-nose or heel-to-shin test&lt;br&gt;• Gait</td>
</tr>
<tr>
<td>Cranial nerves</td>
<td>• I through XII&lt;br&gt;• Examination components vary depending on level of patient participation</td>
</tr>
<tr>
<td>Level of consciousness</td>
<td>• Response to stimuli that exists on a continuum ranging from full consciousness to coma</td>
</tr>
<tr>
<td>Mental status</td>
<td>• Alertness&lt;br&gt;• Attention&lt;br&gt;• Comprehension&lt;br&gt;• Emotional state&lt;br&gt;• Language and speech&lt;br&gt;• Mood&lt;br&gt;• Orientation&lt;br&gt;• Thinking processes</td>
</tr>
<tr>
<td>Motor system</td>
<td>In major muscle groups, assess the following:&lt;br&gt;• Bulk&lt;br&gt;• Strength&lt;br&gt;• Tone&lt;br&gt;• At minimum, assess strength in all four extremities.</td>
</tr>
<tr>
<td>Reflexes</td>
<td>In comatose patients, assess the following reflexes:&lt;br&gt;• Corneal&lt;br&gt;• Cough&lt;br&gt;• Gag&lt;br&gt;• Pupillary&lt;br&gt;As part of a comprehensive examination, test the following reflexes:&lt;br&gt;• Deep tendon&lt;br&gt;• Oculocephalic&lt;br&gt;• Oculovestibular</td>
</tr>
<tr>
<td>Sensory system</td>
<td>Apply light touch or pinprick to the following:&lt;br&gt;• Extremities&lt;br&gt;• Face&lt;br&gt;• Trunk</td>
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</table>
blood pressure lowering based on the patient's presenting blood pressure, comorbidities, and hypertension chronicity, with the guiding principle that blood pressure shouldn't remain extremely elevated. Antihypertensive therapy should be initiated quickly, ideally with the use of titratable I.V. infusions.

Coagulopathy correction requires immediate serum coagulation studies. Coagulopathies occur as a result of underlying medical conditions or secondary to antithrombotic medication regimens. Because not all anticoagulants result in abnormal partial thromboplastin time or international normalized ratio, the healthcare team must obtain a reliable medical history with a home medication list. Familiarize yourself with your organization's anticoagulation reversal protocols; administer appropriate reversal agents as ordered and as quickly as possible. Many antithrombotic medications, with various mechanisms of action, exist. Determining the appropriate reversal agent depends on the prescribed anticoagulant and organization formula. Readily available anticoagulation reversal protocols can aid timely therapeutic goals.

Surgical options for most patients with ICH remain limited in their ability to improve long-term mortality or functional outcome. However, it's still reasonable to obtain early neurosurgical consultation for these patients. Minimally invasive surgical hematoma evacuation may offer promise for reducing mortality after supratentorial ICH. Given the physical space constraints of the posterior fossa, the AHA and the American Stroke Association recommend early surgical clot evacuation for patients with cerebellar hemorrhage and neurologic deterioration, brainstem compression, or ventricular obstruction. Overall, surgical treatment for spontaneous ICH remains limited and individualized according to hematoma size, age, timing, baseline clinical severity, and other clinical factors. EVD placement for patients with acute hydrocephalus also may require neurosurgical services.

Additional nursing care. Patients with ICH frequently experience neurologic and medical instability. Ideally, they're monitored in an ICU staffed by physicians and nurses with neuroscience expertise. Detection of neurologic deterioration and other adverse events, such as seizure or ICP elevations, requires ongoing diligent neurologic assessment. Clinical seizures require appropriate treatment; electroencephalography can help rule out subclinical seizures in patients who exhibit unexplained coma. Glycemic control, fever avoidance, and VTE prevention should continue throughout hospitalization.

Nurses provide a constant and consistent bedside presence and therefore play a critical role in patient and family education about treatment modalities and secondary ICH prevention measures. Patients with ICH also may require transport between hospitals and experience various transitions in levels of care throughout hospitalization. Apply your nursing communication skills during these transitions to help ensure safe transport and facilitate well-coordinated, evidence-based care.

SAH
Nontraumatic SAH accounts for approximately 3% of all strokes, most of which result from ruptured intracranial aneurysms. Major risk factors for aneurysmal SAH (aSAH) include hypertension, cigarette smoking, binge alcohol drinking, and drug and stimulant use. This type of stroke frequently occurs in individuals between the ages of 35 and 60. aSAH is often heralded by a sudden, severe headache, frequently characterized as the "worst headache of my life," and sometimes accompanied by vomiting, neck stiffness or pain, or loss of consciousness. Although aSAH most frequently presents as a sudden "thunderclap" headache, 10% to 40% of patients experience a more mild, preceding headache several weeks before a sentinel headache. Many patients experience altered consciousness or focal neurologic signs after aSAH, but some don't, which can lead to misdiagnosis. Atypical headache characterization, therapeutic response to analgesics, or normal mental status don't necessarily rule out aSAH.

A thorough history and clinical examination can aid aSAH diagnosis. A non-contrast head CT may reveal blood in the subarachnoid space; however, the CT may appear normal if the hemorrhage is too small to detect or if enough time has lapsed since the hemorrhage occurred and normal CSF circulation has cleared the blood. Patients with suspected aSAH but negative or equivocal CT scans should undergo lumbar puncture to assess for the presence of red blood cells in the CSF. Additional angiography after aSAH diagnosis can confirm the source of aneurysmal bleeding and assist surgical planning.

Initial actions. Top priorities in the initial care of a patient with aSAH include airway and
hemodynamic assessment and stabilization. Immediately connect the patient to cardiac telemetry monitoring and obtain a 12-lead electrocardiogram (ECG). Send a full laboratory panel, as ordered, including coagulation studies and cardiac enzymes. Cardiopulmonary injury exhibited by elevated troponin, ECG changes, cardiac arrhythmias, and pulmonary edema are common after aSAH. Catecholamine excess may result in cardiomyopathy and left ventricular failure; acute brain injury may cause neurogenic pulmonary edema. These factors, in combination with compromised neurologic status, may necessitate endotracheal intubation with mechanical ventilation and additional pharmacologic hemodynamic support. Optimal patient outcomes rely on conscientious nursing assessment and cardiopulmonary stability maintenance until definitive treatment initiation.

**Treatment priorities.** Initial treatment priorities after aSAH focus on preventing aneurysm re-rupture, managing active life-threatening conditions, and facilitating early, definitive aneurysm treatment. Anticoagulation reversal may help reduce the risk of aneurysm re-rupture and prevent neurosurgical bleeding complications. Careful blood pressure management requires avoiding hypotension to maintain cerebral perfusion while simultaneously preventing severe hypertension that could lead to re-bleeding. Short-acting, titratable I.V. antihypertensive medications can help maintain a systolic blood pressure below 160 mmHg or mean arterial pressure below 110 mmHg before aneurysm securement.

Early hydrocephalus, leading to elevated ICP, is common after aSAH. Placing an EVD can address symptomatic hydrocephalus. Nurses competent in EVD management should oversee this device, as over-drainage before aneurysm securement may increase aneurysm re-rupture risk. Ultimately, establishing an aneurysm securement plan, either via surgical clipping or endovascular occlusion, can help to definitively manage the source of bleeding and prevent re-occurrence.

After aneurysm securement, careful ongoing nursing neurologic assessments can aid identification of delayed cerebral ischemia (DCI). Angiographic narrowing of intracranial blood vessels (vasospasm) occurs in 30% to 70% of patients after aSAH, typically beginning about 3 days post-bleed and peaking around days 7 to 10. Some patients will experience ischemic, focal neurologic deficits. In addition to serial neurologic assessments, blood pressure management, euvolemia maintenance, oral or enteral administration of nimodipine (a calcium channel blocker), transcranial Doppler ultrasonography, and, if needed, intra-arterial vasospasm intervention, aid detection, prevention, and treatment of cerebral hypoperfusion and DCI.

**Additional nursing care.** Patients with aSAH need intensive nursing care. They often require long hospital stays due to the protracted nature of cerebral vasospasm and DCI after aneurysm rupture. In addition to managing hemodynamic care and diligently and continuously assessing neurologic conditions throughout hospitalization, nurses evaluate and manage pain. Severe headache, common after aSAH, necessitates a multimodal pain management strategy using the least-sedating and lowest effective analgesic dosages to maintain a reliable neurologic exam. Clustering nursing care (turning, suctioning, bathing) and maintaining 30-degree head-of-bed elevation can help prevent unnecessary ICP elevation.

As with all patients who’ve experienced a stroke, the risk of dysphagia requires conducting a swallowing assessment before oral intake. If the patient is stable, mobilize them early after aneurysm securement. In addition, maintain euvolemia. Both hyper- and hypovolemia after aSAH can result in poor outcomes. Care of patients with aSAH is lengthy and complex. Nurses play a critical role in optimizing patient outcomes across the continuum of care via ongoing detailed neurologic assessment and standardized management.

**Optimize outcomes**

Acute stroke, a medical emergency, requires urgent attention and well-coordinated care. Nurses are vital to the initial and ongoing care of these patients. Recognition, initial actions, and ongoing priorities throughout hospitalization differ among various stroke types. Familiarization with national standards and organizational protocols can help you advocate for patients and optimize outcomes.

Access references at myamericannurse.com/?p=343846.

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Please mark the correct answer online.

1. Which of the following is correct about stroke in the United States? (Select all that apply.)
   a. More than 795,000 Americans experience a stroke each year.
   b. First-time strokes account for over three-quarters of strokes.
   c. Most are hemorrhagic strokes.
   d. Causes of ischemic stroke include atherosclerosis (the most common) and thrombotic or embolic events.
   e. Acute symptoms include facial drooping, speech difficulty, unilateral weakness or numbness, vision changes, difficulty ambulating, vertigo, and sudden decreased level of consciousness.

2. Time-limited acute ischemic stroke interventions include which of the following? (Select all that apply.)
   a. I.V. thrombolysis
   b. Non-contrast computed tomography
   c. Endovascular thrombectomy
   d. Computed tomography (CT) angiogram

3. Which of the following is the AHA time standard for ischemic stroke response door-to-computed tomography completion?
   a. 15 minutes
   b. 20 minutes
   c. 45 minutes
   d. 60 minutes

4. Which of the following is the American Heart Association (AHA) time standard for ischemic stroke emergency response time for admission to the stroke unit or ICU?
   a. 45 minutes
   b. 120 minutes
   c. 3 hours
   d. 4 hours

5. The AHA endorses I.V. thrombolysis for up to how many hours after onset of acute ischemic stroke in eligible patients?
   a. 3 hours
   b. 3.5 hours
   c. 4 hours
   d. 4.5 hours
   e. 5 hours

6. Which of the following about ischemic stroke diagnosis and intervention is not correct?
   a. A CT scan must be performed to rule out the presence of a hemorrhage before administering thrombolytics.
   b. Ischemic stroke is more prevalent than hemorrhagic stroke, so the healthcare team should prepare to treat an ischemic stroke until proven otherwise.
   c. Endovascular mechanical thrombectomy (MT), with or without I.V. thrombolysis, is an additional standard of care for acute ischemic stroke resulting from large vessel occlusion.
   d. Patients with a favorable ratio of salvageable brain tissue may qualify for the administration of thrombolytics for up to 24 hours.

7. Which of the following are complications that may occur after endovascular MT? (Select all that apply?)
   a. Vessel dissection
   b. Retropertitoneal bleed
   c. Intracranial hemorrhage
   d. Extension of infarcted tissue
   e. Hematuria

8. Which of the following about patients with acute ischemic stroke and dysphagia screening and evaluation is not correct?
   a. Include a formal evaluation before oral intake except for medications.

9. Treatment priorities after ICH include which of the following? (Select all that apply.)
   a. Blood pressure management
   b. Coagulopathy correction
   c. Mechanical thrombectomy
   d. Neurosurgical consultation

10. Nontraumatic subarachnoid hemorrhage (SAH) accounts for approximately 3% of all strokes. Which of the following is correct about SAH? (Select all that apply.)
    a. Initial treatment priorities after aneurysmal SAH (aSAH) focus on preventing aneurysm re-rupture, managing active life-threatening conditions, and facilitating early, definitive aneurysm treatment.
    b. Anticoagulation may help reduce the risk of aneurysm re-rupture and prevent neurosurgical bleeding complications.
    c. Careful blood pressure management requires avoiding hypotension to maintain cerebral perfusion while simultaneously preventing severe hypertension that could lead to re-bleeding.
    d. Early hydrocephalus, leading to elevated intracranial pressure, is common after aSAH. Placing external ventricular drainage can address symptomatic hydrocephalus.