

# ACLS Suspected Stroke Algorithm

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**Version control:** This document is current with respect to 2015 American Heart Association® Guidelines for CPR and ECC. These guidelines are current until they are replaced on October 2020. If you are reading this page after October 2020, please contact ACLS Training Center at [support@acls.net](mailto:support@acls.net) for an updated document.

## Using the Suspected Stroke Algorithm for Managing Acute Ischemic Stroke

The ACLS Suspected Stroke Algorithm emphasizes critical actions for out-of-hospital and in-hospital care and treatment.

### National Institute of Neurological Disorders and Stroke Critical Time Goals

Included in the algorithm are critical time goals set by the National Institute of Neurological Disorders (NINDS) for in-hospital assessment and management. These time goals are based on findings from large studies of stroke victims. These goals include:

- Immediate general assessment by a stroke team, emergency physician, or other expert **within 10 minutes of arrival**, including the order for an urgent CT scan
- Neurologic assessment by stroke team and CT scan performed **within 25 minutes of arrival**
- Interpretation of CT scan **within 45 minutes of ED arrival**
- Initiation of fibrinolytic therapy, if appropriate, **within 1 hour of hospital arrival and 3 hours from onset of symptoms**. rTpa can be administered in “well screened” patients who are at low risk for bleeding for up to 4.5 hours.
- **Door-to-admission time of 3 hours for all patients**

### 5-Step Stroke Algorithm

#### Step 1

Identify signs of a possible stroke and the time when symptoms began.

- Facial droop (have patient show teeth or smile)
- Arm drift (patient closes eyes and extends both arms straight out, with palms up for 10 seconds)
- Speech is abnormal (have the patient say “you can’t teach an old dog new tricks”)
- Time of symptom onset (last known well time)

If any 1 of these 3 signs are abnormal, the probability of a stroke is 72%



## Step 2

**Call 911** immediately (activate EMS system).

**IMPORTANT:** EMS responders can transport the patient to a hospital that provides acute stroke care. Currently, half of all stroke victims are driven to the ED by family members or friends; however, best practice is for EMS transport. EMS will notify the hospital that an acute stroke case is on the way. The hospital staff will then prepare for efficient evaluation and management of the patient.

## Step 3

Complete the following assessments and actions.

Assessment	Actions
Define and recognize the signs of stroke.	Support the ABC's (airway, breathing, and circulation). Give oxygen as needed.
Assess the patient using the CPSS or the LAPSS. Assess orientation of patient.	Ask the patient to state name, date of birth, where they are, the date, current events, and situation. Perform CPSS FAST assessment. LAPSS- collect data about patient's age, past medical history of seizures, current blood sugar, duration of symptoms, current hospitalization status, and motor asymmetry. Record information and present to subsequent care providers.
Establish last known well time	Last known well time: set the time when the patient was last known to be neurologically normal. If the patient was sleeping and wakes up with symptoms, time last known well (LKW) is the last time the patient was known to have been alert and oriented.
Consider triage to a stroke center, if possible.	Transport the patient quickly.
Assess neurological status while the patient is being transported.	Bring a family member or witness to confirm last known well time. Alert the receiving hospital. Check glucose levels.

## General Assessment in the ED

**NINDS time goal:** 10 min

#### **Step 4**

Within 10 minutes of the patient's arrival in the ED, take the following actions:

<b>Actions</b>
Assess circulation, airway, breathing and evaluate vital signs.
Give oxygen if patient is hypoxic (less than 94% saturation). Consider oxygen if patient is not hypoxic.
Make sure that an IV has been established.
Take blood samples for blood count, coagulation studies, and blood glucose. Check the patient's blood glucose and treat if indicated. Give dextrose if the patient is hypoglycemic. Give insulin if the patient's serum glucose is more than 300. Give thiamine if the patient is an alcoholic or malnourished.
Assess the patient using a neurological screening assessment, such as the NIH Stroke Scale (NIHSS).
Order a CT brain scan without contrast and have it read quickly by a qualified specialist.
Obtain a 12-lead ECG and assess for arrhythmias.
Do not delay the CT scan to obtain the ECG. The ECG is taken to identify a recent or ongoing acute MI or arrhythmia (such as atrial fibrillation) as a cause of embolic stroke. Life-threatening arrhythmias can happen with or follow a stroke.

### **Immediate Neurological Assessment by Stroke Team**

**NINDS time goal:** 25 min

#### **Step 5**

Within 25 minutes of the patient's arrival, take the following actions:

<b>Actions</b>
Review the patient's history, including past medical history.
Perform a physical exam.
Establish last known well time if not already done.
Perform a neurological exam to assess patient's status using the NIHSS or the Canadian Neurological Scale.
The CT scan should be completed within 25 minutes from the patient's arrival in the ED and should be read within 45 minutes.

### **Treatment Decisions by Specialist**

**NINDS time goal:** 45 min

#### **Step 6**

Within 45 minutes of the patient's arrival, the specialist must decide, based on the CT scan or MRI, if a hemorrhage is present.

<b>Take these actions if a hemorrhage is present</b>	<b>Take these actions if a hemorrhage is NOT present</b>
Note that the patient is not a candidate for fibrinolytics.	Decide if the patient is a candidate for fibrinolytic therapy.
Arrange for a consultation with a neurologist or neurosurgeon.	Review criteria for IV fibrinolytic therapy by using the fibrinolytic checklist (see Figure 1).
Consider transfer, if available.	Repeat the neurological exam (NIHSS or Canadian Neurological Scale).

If the patient is rapidly improving and moving to normal, fibrinolytics may not be necessary.

## Treatment

**NINDS time goal:** 60 min

If the **patient is a candidate** for fibrinolytic therapy, review the risks and benefits of therapy with the patient and family (the main complication of IV tPA is intracranial hemorrhage) and give tissue plasminogen activator (tPA).

Do not give anticoagulants or antiplatelet treatment for 24 hours after tPA until a follow-up CT scan at 24 hrs does not show intracranial hemorrhage.

If the **patient is NOT a candidate** for fibrinolytic therapy, give the patient aspirin.

For both groups (those treated with tPA and those given aspirin), give the following basic stroke care:

Begin stroke pathway.
Support patient's airway, breathing, and circulation.
Check blood glucose.
Watch for complications of stroke and fibrinolytic therapy.
Transfer patient to intensive care if indicated.

Patients with acute ischemic stroke who are hypoglycemic tend to have worse clinical outcomes, but there is no direct evidence that active glucose control improves outcomes. Consider giving IV or subcutaneous insulin to patients whose serum glucose levels are greater than 10 mmol/L (about 200 mg/dL).

<b>Inclusion criteria</b>	<b>Exclusion criteria</b>	<b>Exclusion criteria</b>
Age: 18 yrs or older	Evidence of intracranial hemorrhage from CT scan	Active internal bleeding or acute trauma, such as a fracture

Diagnosis of an ischemic stroke with neurologic deficit	Clinical presentation suggestive of a subarachnoid hemorrhage, even with normal CT	Acute bleeding diathesis, including the following but may include other manifestations
Time from onset of symptoms is within 3 hours	Evidence of multilobar infarction in more than one-third of the cerebral hemisphere on CT	Intraspinal surgery, serious head trauma, or previous stroke within the past 3 months
	History of intracranial hemorrhage	Arterial puncture at a non-compressible site within the past 7 days
	Uncontrolled hypertension based on repeated measurements of > 185 mm Hg systolic pressure or > 110 mm Hg diastolic pressure	
	Known AV malformation, neoplasm, or aneurysm	
	Witnessed seizure at stroke onset	

### Relative contraindications/precautions

- Minor or rapidly improving stroke symptoms
- Major surgery or serious trauma within the past 14 days
- Recent gastrointestinal or urinary tract hemorrhage within the past 3 weeks
- Post-myocardial infarction pericarditis
- Recent acute myocardial infarction within the past 3 months
- Abnormal blood sugar level < 50 mg/dl or > 400 mg/dl
- Platelet count < 100,000/mm<sup>3</sup>
- Heparin received within 48 hours prior to onset of stroke, with elevated activated partial thromboplastin time (aPTT)
- Current use of anticoagulant (e.g., warfarin) with an elevated international normalized ratio (INR) > 1.7

**Complications.** The major complication of IV tPA is intracranial hemorrhage. Other bleeding complications, ranging from minor to severe, may also happen. Angioedema and transient hypotension also can occur.

**Research.** Several studies have shown that good to excellent outcomes are more likely when tPA is given to adults with acute ischemic stroke within 3 hrs of onset of symptoms. However, these results happened when tPA was given in hospitals with a stroke protocol that adheres closely to the therapeutic regimen and eligibility requirements of the NINDS protocol. Evidence from prospective randomized studies in adults documented a greater likelihood of benefit the earlier treatment began.

### Managing Hypertension in tPA Candidates

For patients who are candidates for fibrinolytic therapy, you need to control their blood pressure to lower their risk of intracerebral hemorrhage following administration of tPA. See the general guidelines in Figure 2.

**Figure 2.** Management guidelines for elevated blood pressure in patients with acute ischemic stroke

### Candidates NOT eligible for fibrinolytic therapy

Blood pressure level, mm Hg	Treatment
Systolic $\leq 220$ or diastolic $\leq 120$	Observe patient unless there is other end-organ involvement. Treat the patient's other symptoms of stroke (headache, pain, nausea, etc). Treat other acute complications of stroke, including hypoxia, increased intracranial pressure, seizures, or hypoglycemia.
Systolic $> 220$ or diastolic 121 to 140	Labetalol 10 to 20 mg IV for 1–2 min—may repeat or double every 10 min to a maximum dose of 300 mg OR Nicardipine 5 mg/hr IV infusion as initial dose; titrate to desired effect by increasing 2.5 mg/hr every 5 min to max of 15 mg/hr Aim for a 10% to 15% reduction in blood pressure
Diastolic $> 140$	Nitroprusside 0.5 $\mu\text{g}/\text{kg}$ per min IV infusion as initial dose with continuous blood pressure monitoring.  Aim for a 10% to 15% reduction in blood pressure.

### Stroke patients eligible for a fibrinolytic

PRETREATMENT	
Systolic $> 185$ or diastolic $> 110$	Labetalol 10 to 20 mg IV for 1–2 min—may repeat 1 time or nitropaste 1–2 inches
DURING or after TREATMENT	
Monitor blood pressure	Check blood pressure every 15 min for 2 hrs, then every 30 min for 6 hrs, and finally every hour for 16 hrs
Diastolic $> 140$	Sodium nitroprusside 0.5 $\mu\text{g}/\text{kg}$ per minute IV infusion as initial dose and titrate to desired blood pressure
Systolic $> 230$ or diastolic 121 to 140	Labetalol 10 mg IV for 1–2 min—may repeat or double every 10 min to maximum dose of 300 mg or give initial labetalol dose and then start labetalol drip at 2 to 8 mg/min OR nicardipine 5 mg/hr IV infusion as initial dose and titrate to desired effect by increasing 2.5 mg/hr every 5 min to a maximum of 15 mg/hr; if blood pressure is not controlled by nicardipine, consider sodium nitroprusside
Systolic 180 to 230 or diastolic 105 to 120	Labetalol 10 mg IV for 1–2 min—may repeat or double every 10 to 20 min to a maximum dose of 300 mg or give initial labetalol dose, then start labetalol drip at 2 to 8 mg/min



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