

OUT-OF HOSPITAL AND IN HOSPITAL STROKE CARE

Gheorghe Ciobanu, prof., MD, DMSci
Medical University

“Nicolae Testemitsanu” National Center of
Emergency Medicine, Kishinev, Moldova,

Stanislav Groppa, MAsci, corr. membr.,
Medical University

“Nicolae Testemitsanu”, Kishinev, Moldova

Introduction

The World Health Organization (WHO) defines stroke as the sudden onset of a neurologic deficit accompanied by a focal dysfunction and symptoms lasting more than 24 hours, which is not caused by a traumatic vascular problem. Transient ischemic attacks (TIAs) are focal neurologic events resolving completely within 24 hours. A reversible ischemic neurologic deficit (RIND) is defined as a focal neurological event that resolves within 3 days to 3 weeks. A variety of conditions may mimic stroke, including complex migraine with hemiparesis, postictal paralysis (Todd paralysis), hypoglycemia, cerebral tumors, cerebral infections or encephalitis, subdural hematoma, multiple sclerosis, and malignant hypertension. Misdiagnosis is more common in younger patients or those who present with complex or atypical symptoms [3].

Thrombotic and embolic infarctions of the brain are major causes of human morbidity and mortality. Eighty-five percent of strokes are ischemic, whereas the remaining fifteen percent are hemorrhagic. The 1-month mortality for stroke varies with etiology: 15% for ischemic stroke, 50% for subarachnoid hemorrhage (SAH), and 80% or greater with intracerebral hemorrhage (ICH). Concurrent

cardiovascular disease, pulmonary complications, and recurrent stroke may complicate patient recovery. Fully 25% to 40% of patients will have a repeat stroke within 5 years of their initial insult [18].

Risk factors for stroke include systolic and diastolic hypertension; advancing age; cardiovascular factors including atrial fibrillation, ischemic disease, cardiomyopathy and mechanical valves; diabetes; smoking; nonwhite racial background; male sex; and heavy alcohol use. TIAs are strong predictors of risk, with 12% of those with TIAs going on to experience a significant stroke within 12 months. Most strokes however, are not preceded by a TIA [19].

The target times and goals are recommended by the National Institute of Neurological Disorders and Stroke (NINDS), which has recommended measurable goals for the evaluation of stroke patients. These targets or goals should be achieved for at least 80% of patients with acute stroke [25].

The ECG does not take priority over obtaining a computed tomography (CT) scan. No arrhythmias are specific for stroke, but the ECG may identify evidence of a recent AMI or arrhythmias such as atrial fibrillation as a cause of an embolic stroke. Many patients with stroke may demonstrate arrhythmias, but if the patient is hemodynamically stable, most arrhythmias will not require treatment. There is general agreement to recommend cardiac monitoring during the first 24 hours of evaluation in patients with acute ischemic stroke to detect atrial fibrillation and potentially life-threatening arrhythmias [18].

Drugs for stroke

- Approved fibrinolytic agent (rtPA)
- Labetalol
- Nicardipine
- Enalaprilat

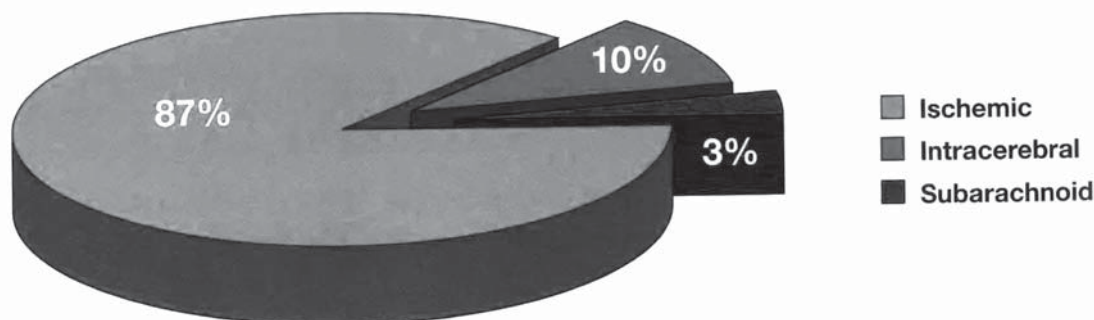


Figure 1. Types of stroke. Eighty-seven percent of strokes are ischemic and potentially eligible for fibrinolytic therapy if patients otherwise qualify. Thirteen percent of strokes are hemorrhagic, and the majority of these are intracerebral. The male-to-female incidence ratio is 1.25 in persons 55 to 64 years of age, 1.50 in those 65 to 74, 1.07 in those 75 to 84, and 0.76 in those 85 and older. Blacks have almost twice the risk of first-ever stroke compared with whites.

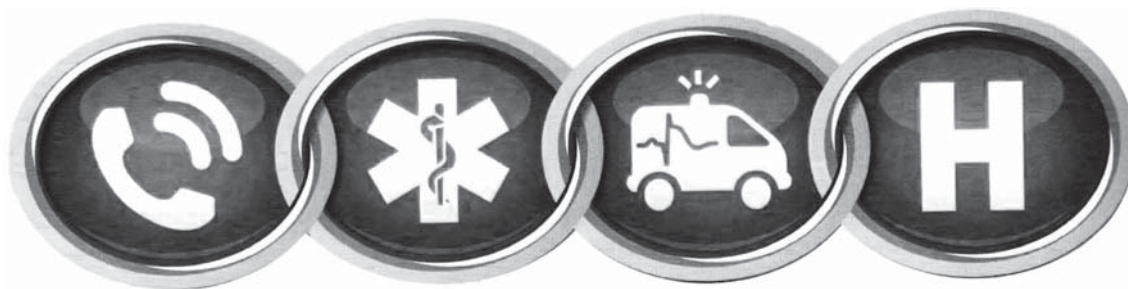


Figure 2. *The Stroke Chain of Survival.*

- Aspirin
- Nitroprusside

The major types of stroke are:

- Ischemic stroke: accounts for 87% of all strokes and is usually caused by an occlusion of an artery to a region of the brain (figure 1).
- Hemorrhagic stroke: accounts for 13% of all strokes and occurs when a blood vessel in the brain suddenly ruptures into the surrounding tissue. Fibrinolytic therapy is contraindicated in this type of stroke. Avoid anticoagulants [15].

Approach to Stroke Care

Stroke remains a leading cause of death in the United States.

Early recognition of acute ischemic stroke is important because IV fibrinolytic treatment should be provided as early as possible, generally within 3 hours of onset of symptoms, or within 4.5 hours of onset of symptoms for selected patients. Most strokes occur at home, and only half of acute stroke patients use EMS for transport to the hospital. Stroke patients often deny or try to rationalize their symptoms. Even high-risk patients, such as those with atrial fibrillation or hypertension, fail to recognize the signs of stroke. This delays activation of EMS and treatment, resulting in increased morbidity and mortality [21].

Community and professional education is essential, and it has been successful in increasing the proportion of eligible stroke patients treated with fibrinolytic therapy [18].

The goal of stroke care is to minimize brain injury and maximize the patient's recovery. The Stroke Chain of Survival (figure 2) described by the AHA and the American Stroke Association is similar to the Chain of Survival for sudden cardiac arrest. It links actions to be taken by patients, family members, and healthcare providers to maximize stroke recovery. These links are (23,"/):

- Rapid recognition and reaction to stroke warning signs.
- Rapid EMS dispatch.
- Rapid EMS system transport and prearrival notification to the receiving hospital.

- Rapid diagnosis and treatment in the hospital.

The 8 D's of Stroke Care highlight the major steps in diagnosis and treatment of stroke and key points at which delays can occur [20]:

- Detection: Rapid recognition of stroke symptoms.
- Dispatch: Early activation and dispatch of EMS by 903 [112].
- Delivery: Rapid EMS identification, management, and transport.
- Door: Appropriate triage to stroke center.
- Data: Rapid triage, evaluation, and management within the ED.
- Decision: Stroke expertise and therapy selection.
- Drug: Fibrinolytic therapy, intra-arterial strategies.
- Disposition: Rapid admission to the stroke unit or critical care unit

For more information on these critical elements, see the Suspected Stroke Algorithm (figure 3).

Goals of Stroke Care

The Suspected Stroke Algorithm (figure 3) emphasizes important elements of out-of-hospital care for possible stroke patients. These actions include a stroke scale or screen and rapid transport to the hospital. As with ACS, prior notification of the receiving hospital speeds the care of the stroke patient upon arrival (25).

The NINDS has established critical in-hospital time goals for assessment and management of patients with suspected stroke. This algorithm reviews the critical in-hospital time periods for patient assessment and treatment [2,4]:

1. Immediate general assessment by the stroke team, emergency physician, or another expert within 10 minutes of arrival; order urgent noncontrast CT scan.
2. Neurologic assessment by the stroke team or designee and CT scan performed within 25 minutes of hospital arrival.
3. Interpretation of the CT scan within 45 minutes of ED arrival.

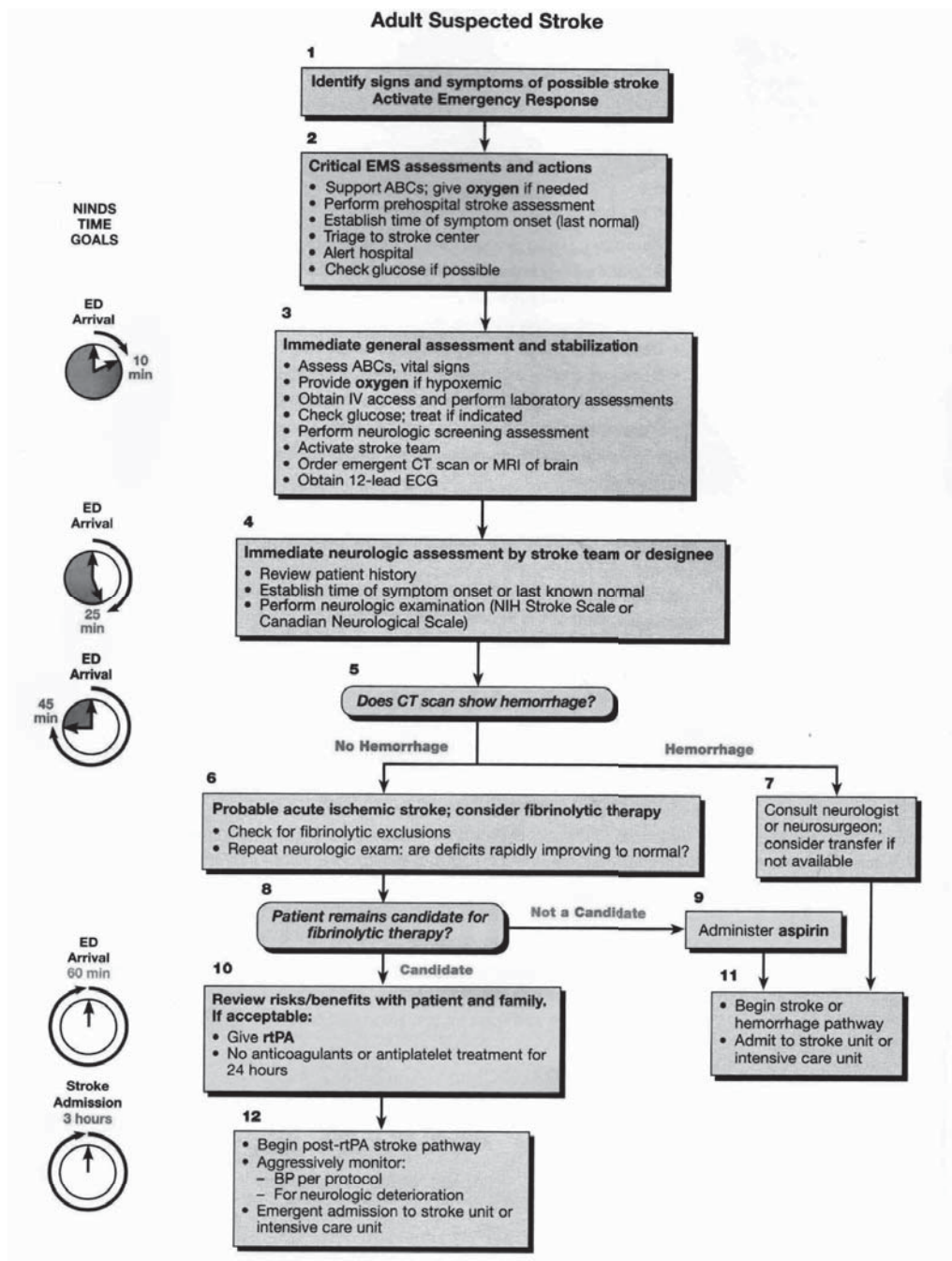


Figure 3. The suspected stroke algorithm.

4. Initiation of fibrinolytic therapy in appropriate patients (those without contraindications) within 1 hour of hospital arrival and 3 hours from symptom onset.

5. Door-to-admission time of 3 hours.

Critical Time Periods

Patients with acute ischemic stroke have a time-dependent benefit for fibrinolytic therapy similar to that of patients with ST-segment elevation MI, but this time-dependent benefit is much shorter [6].

The critical time period for administration of IV fibrinolytic therapy begins with the onset of symptoms. Critical time periods from hospital arrival are summarized below [4,5]:

Immediate general assessment	10 minutes
Immediate neurologic assessment	25 minutes
Acquisition of CT of the head	25 minutes
Interpretation of the CT scan	45 minutes
Administration of fibrinolytic therapy, timed from ED arrival	60 minutes
Administration of fibrinolytic therapy, timed from onset of symptoms	3 hours, or 4.5 hours in selected patients
Admission to a monitored bed	3 hours

The signs and symptoms of a stroke:

- Sudden weakness or numbness of the face, arm, or leg, especially on one side of the body.
- Sudden confusion.
- Trouble speaking or understanding.
- Sudden trouble seeing in one or both eyes.
- Sudden trouble walking.
- Dizziness or loss of balance or coordination.
- Sudden severe headache with no known cause.

Stroke Assessment Tools

The 2010 AHA Guidelines for CPR and ECC recommends that all EMS personnel be trained to recognize stroke using a validated, abbreviated out-of-hospital neurologic evaluation tool such as the Cincinnati Prehospital Stroke Scale (CPSS) (table 1).

Cincinnati Prehospital Stroke Scale

The CPSS identifies stroke on the basis of 3 physical findings:

- Facial droop (have the patient smile or try to show teeth).
- Arm drift (have the patient close eyes and hold both arms out, with palms up).
- Abnormal speech (have the patient say “You can’t teach an old dog new tricks”).

By using the CPSS, medical personnel can evaluate the patient in <1 minute. The presence of 1 finding on the CPSS has a sensitivity of 59% and a specificity of 89% when scored by prehospital providers.

With standard training in stroke recognition, paramedics demonstrated a sensitivity of 61% to 66% for identifying patients with stroke. After receiving training in use of a stroke assessment tool, paramedic sensitivity for identifying patients with stroke increased to 86% to 97% [11].

Critical EMS Assessments and Actions (Box 2)

Prehospital EMS must minimize the interval between the onset of symptoms and patient arrival in the ED. Specific stroke therapy can be provided only in the appropriate receiving hospital ED, so time in the field only delays (and may prevent) definitive therapy. More extensive assessments and initiation of supportive therapies can continue en route to the hospital or in the ED [12,16].

To provide the best outcome for the patient with potential stroke:

Support ABCs	Support the ABCs and provide supplemental oxygen to hypoxemic (eg, oxygen saturation <94%) stroke patients or those patients with unknown oxygen saturation.
Perform stroke assessment	Perform a rapid out-of-hospital stroke assessment (CPSS, table 1).
Establish time	Determine when the patient was last known to be normal or at neurologic baseline. This represents time zero. If the patient wakes from sleep with symptoms of stroke, time zero is the last time the patient was seen to be normal.
Triage to stroke center	Transport the patient rapidly and consider triage to a stroke center. Support cardiopulmonary function during transport. If possible, bring a witness, family member, or caregiver with the patient to confirm time of onset of stroke symptoms.
Identify Signs	Define and Recognize the Signs of Stroke (Box 1)
Alert hospital	Provide prearrival notification to the receiving hospital.
Check glucose	During transport, check blood glucose if protocols or medical control allows.

Table 1

The Cincinnati Prehospital Stroke Scale

Test	Findings
Facial droop: Have patient show teeth or smile	Normal - both sides of face move equally Abnormal - one side of face does not move as well as the other side
Arm drift: Patient closes eyes and extends both arms straight out, with palms up, for 10 seconds	Normal - both arms move the same or both arms do not move at all (other findings, such as pronator drift, may be helpful) Abnormal - one arm does not move or one arm drifts down compared with the other
Abnormal speech: Have patient say «you can't teach an old dog new tricks»	Normal -patient uses correct words with no slurring Abnormal - patient slurs words, uses the wrong words, or is unable to speak
Interpretation: If any 1 of these 3 signs is abnormal, the probability of a stroke is 72%. The presence of all 3 findings indicates that the probability of stroke is >85%.	

Modified from Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. Cincinnati Prehospital Stroke Scale: reproducibility and validity. *Ann Emergency Med.* 1999;33:373-378.

The patient with acute stroke is at risk for respiratory compromise from aspiration, upper airway obstruction, hypoventilation, and (rarely) neurogenic pulmonary edema. The combination of poor perfusion and hypoxemia will exacerbate and extend ischemic brain injury, and it has been associated with worse outcome from stroke [13,25].

Both out-of-hospital and in-hospital medical personnel should provide supplementary oxygen to hypoxic (ie, oxygen saturation <94%) stroke patients or patients for whom oxygen saturation is unknown.

In-Hospital, Immediate General Assessment and Stabilization (Box 3)

Once the patient arrives in the ED, a number of assessments and management activities must occur quickly. Protocols should be used to minimize delay in definitive diagnosis and therapy [7,8].

The goal of the stroke team, emergency physician, or other experts should be to assess the patient with suspected stroke within 10 minutes of arrival in the ED: “Time Is Brain” (Box 3).

Immediate General Assessment and Stabilization

ED providers should do the following:

Immediate Neurologic Assessment by Stroke Team or Designee (Box 4)

The stroke team, neurovascular consultant, or emergency physician does the following [9,10]:

- Reviews the patient’s history, performs a general physical examination, and establishes time of symptom onset

- Performs a neurologic examination (eg, NIHSS)

The goal for neurologic assessment is within 25 minutes of the patient’s arrival in the ED: “Time Is Brain” (Box 4).

Establish Symptom Onset

Establishing the time of symptom onset may require interviewing out-of-hospital providers, witnesses, and family members to determine the time the patient was last known to be normal.

Neurologic Examination

Assess the patient’s neurologic status using one of the more advanced stroke scales. Following is an example:

National Institutes of Health Stroke Scale

The NIHSS uses 15 items to assess the responsive stroke patient. This is a validated measure of stroke severity based on a detailed neurologic examination. A detailed discussion is beyond the scope of the ACLS Provider Course [20].

CT Scan: Hemorrhage or No Hemorrhage (Box 5)

A critical decision point in the assessment of the patient with acute stroke is the performance and interpretation of a noncontrast CT scan to differentiate ischemic from hemorrhagic stroke. Assessment also includes identifying other structural abnormalities that may be responsible for the patient’s symptoms or that represent contraindication to fibrinolytic therapy. The initial noncontrast CT scan is the most important test for a patient with acute stroke.

Assess ABCs	Assess the ABCs and evaluate baseline vital signs
Provide oxygen	Provide supplemental oxygen to hypoxic (eg, oxyhemoglobin saturation <94%) stroke patients or those patients with unknown oxygen saturation.
Establish IV access and obtain blood samples	Establish IV access and obtain blood samples for baseline blood count, coagulation studies, and blood glucose. Do not let this delay obtaining a CT scan of the brain.
Check glucose	Promptly treat hypoglycemia.
Perform neurologic assessment	Perform a neurologic screening assessment. Use the NIH Stroke Scale (NIHSS) or a similar tool.
Activate the stroke team	Activate the stroke team or arrange consultation with a stroke expert based on predetermined protocols.
Order CT brain scan	Order an emergent CT scan of the brain. Have it read promptly by a qualified physician.
Obtain 12-lead ECG	Obtain a 12-lead ECG, which may identify a recent or ongoing AMI or arrhythmias (eg, atrial fibrillation) as a cause of embolic stroke. A small percentage of patients with acute stroke or transient ischemic attack have coexisting myocardial ischemia or other abnormalities. There is general agreement to recommend cardiac monitoring during the first 24 hours of evaluation in patients with acute ischemic stroke to detect atrial fibrillation and potentially life-threatening arrhythmias. Life-threatening arrhythmias can follow or accompany stroke, particularly intracerebral hemorrhage. If the patient is hemodynamically stable, treatment of non-life-threatening arrhythmias (bradycardia, VT, and AV conduction blocks) may not be necessary. Do not delay the CT scan to obtain the ECG.

- If a CT scan is not readily available, stabilize and promptly transfer the patient to a facility with this capability.

- Do not give aspirin, heparin, or rtPA until the CT scan has ruled out intracranial hemorrhage.

The CT scan should be completed within 25 minutes of (he patient's arrival in the ED and should be read within 45 minutes from ED arrival: "Time Is Brain" (Box 5).

Decision Point: Hemorrhage or No Hemorrhage

Additional imaging techniques such as CT perfusion, CT angiography, or magnetic resonance imaging scans of patients with suspected stroke should be promptly interpreted by a physician skilled in neuroimaging interpretation. Obtaining these studies should not delay initiation of IV rtPA in eligible patients. The presence of hemorrhage versus no hemorrhage determines the next steps in treatment [20].

Yes, Hemorrhage Is Present

If hemorrhage is noted on the CT scan, the patient is not a candidate for fibrinolytics. Consult a neurologist or neurosurgeon. Consider transfer for appropriate care (Box 7).

No, Hemorrhage Is Not Present

If the CT scan shows no evidence of hemorrhage

and no sign of other abnormality (eg, tumor, recent stroke), the patient may be a candidate for fibrinolytic therapy (Boxes 6 and 8).

If hemorrhage is not present on the initial CT scan and the patient is not a candidate for fibrinolytics for other reasons, consider giving aspirin (Box 9) either rectally or orally after performing a swallowing screen. Although aspirin is not a time-critical intervention, it is appropriate to administer aspirin in the ED if the patient is not a candidate for fibrinolysis. The patient must be able to safely swallow before aspirin is given orally. Otherwise use the suppository form [14,17].

Fibrinolytic Therapy

Several studies have shown a higher likelihood of good to excellent functional outcome when rtPA is given to adults with acute ischemic stroke within 3 hours of onset of symptoms, or within 4.5 hours of onset of symptoms for selected patients. But these results are obtained when rtPA is given by physicians in hospitals with a stroke protocol that rigorously adheres to the eligibility criteria and therapeutic regimen of the NINDS protocol. Evidence from prospective randomized studies in adults also documents a greater likelihood of benefit the earlier treatment begins.

The AHA and stroke guidelines recommend

Table 2

Inclusion and Exclusion Characteristics of Patients With Ischemic Stroke Who Could Be Treated With rtPA Within 3 Hours From Symptom Onset*

Inclusion Criteria
<ul style="list-style-type: none"> • Diagnosis of ischemic stroke causing measurable neurologic deficit • Onset of symptoms <3 hours before beginning treatment • Age >18 years
Exclusion Criteria
<ul style="list-style-type: none"> • Head trauma or prior stroke in previous 3 months • Symptoms suggest subarachnoid hemorrhage • Arterial puncture at noncompressible site in previous 7 days • History of previous intracranial hemorrhage • Elevated blood pressure (systolic >185 mm Hg or diastolic >110 mm Hg) • Evidence of active bleeding on examination • Acute bleeding diathesis, including but not limited to <ul style="list-style-type: none"> - Platelet count <100 000/mm³ - Heparin received within 48 hours, resulting in an aPTT greater than the upper limit of normal - Current use of anticoagulant with INR >1.7 or PT >15 seconds • Blood glucose concentration <50 mg/dL (2.7 mmol/L) • CT demonstrates multilobar infarction (hypodensity >1/3 cerebral hemisphere)
Relative Exclusion Criteria
<p>Recent experience suggests that under some circumstances - with careful consideration and weighing of risk to benefit - patients may receive fibrinolytic therapy despite 1 or more relative contraindications. Consider risk to benefit of rtPA administration carefully if any one of these relative contraindications is present:</p> <ul style="list-style-type: none"> • Only minor or rapidly improving stroke symptoms (clearing spontaneously) • Seizure at onset with postictal residual neurologic impairments • Major surgery or serious trauma within previous 14 days • Recent gastrointestinal or urinary tract hemorrhage (within previous 21 days) • Recent acute myocardial infarction (within previous 3 months)

giving IV rtPA to patients with acute ischemic stroke who meet the NINDS eligibility criteria if it is given by

- Physicians using a clearly defined institutional protocol.
- A knowledgeable interdisciplinary team familiar with stroke care.
- An institution with a commitment to comprehensive stroke care and rehabilitation.

The superior outcomes reported in both community and tertiary care hospitals in the NINDS trials can be difficult to replicate in hospitals with less experience in, and institutional commitment to, acute stroke care. There is strong evidence to avoid all delays and treat patients as soon as possible. Failure to adhere to protocol is associated with an increased rate of complications, particularly risk of intracranial hemorrhage [26].

Evaluate for Fibrinolytic Therapy (Box 6)

If the CT scan is negative for hemorrhage, the patient may be a candidate for fibrinolytic therapy. Immediately perform further eligibility and risk stratification:

- If the CT scan shows no hemorrhage, the probability of acute ischemic stroke remains. Review inclusion and exclusion criteria for IV fibrinolytic therapy (table 2) and repeat the neurologic exam (NIHSS or Canadian Neurological Scale).
- If the patient's neurologic function is rapidly improving toward normal, fibrinolytics may be unnecessary.

Abbreviations: aPTT, activated partial thromboplastin lime; INR, international normalized ratio; PT, prothrombin time; rtPA, recombinant tissue plasminogen activator.

Potential Adverse Effects

As with all drugs, fibrinolytics have potential adverse effects. At this point weigh the patient's risk for adverse events against the potential benefit and discuss with the patient and family.

- Confirm that no exclusion criteria are present (table 5).
- Consider risks and benefits.
- Be prepared to monitor and treat any potential complications.

The major complication of IV rtPA for stroke is intracranial hemorrhage. Other bleeding complications may occur and may range from minor to major. Angioedema and transient hypotension may occur.

Patient is a Candidate for Fibrinolytic Therapy (Boxes 8 and 10)

If the patient remains a candidate for fibrinolytic therapy (Box 8), discuss the risks and potential benefits with the patient or family if available (Box

10). After this discussion, if the patient or family members decide to proceed with fibrinolytic therapy, give the patient rtPA. Begin your institution's stroke rtPA protocol, often called a "pathway of care."

Do not administer anticoagulants or antiplatelet treatment for 24 hours after administration of rtPA, typically until a follow-up CT scan at 24 hours shows no intracranial hemorrhage.

Extended IV rtPA Window 3 to 4.5 Hours

Treatment of carefully selected patients with acute ischemic stroke with IV rtPA between 3 and 4.5 hours after onset of symptoms has also been shown to improve clinical outcome, although the degree of clinical benefit is smaller than that achieved with treatment within 3 hours. Data supporting treatment in this time window come from a large, randomized trial (ECASS-3 [European Cooperative Acute Stroke Study]) that specifically enrolled patients between 3 and 4.5 hours after symptom onset, as well as a meta-analysis of prior trials [24].

At present, use of IV rtPA within the 3- to 4.5-hour window has not yet been approved by the US Food and Drug Administration (FDA), although it is recommended by an AHA/American Stroke Association science advisory. Administration of IV rtPA to patients with acute ischemic stroke who meet the NINDS or ECASS-3 eligibility criteria (table 3) is recommended if rtPA is administered by physicians in the setting of a clearly defined protocol, a knowledgeable team, and institutional commitment.

Abbreviations: FDA, Food and Drug Administration; INR, international normalized ratio; NIHSS, National Institutes of Health Stroke Scale; PT, prothrombin time; rtPA, recombinant tissue plasminogen activator.

***del Zoppo GJ, Saver JL, Jauch EC, Adams HP Jr; on behalf of the American Heart Association Stroke Council. Expansion of the time window for treatment of acute ischemic stroke with intravenous tissue plasminogen activator: a science advisory from the American Heart Association/American Stroke Association. Stroke. 2009;40:2945-2948.**

Intra-arterial rtPA

Improved outcome from use of cerebral intra-arterial rtPA has been documented. For patients with acute ischemic stroke who are not candidates for standard IV fibrinolysis, consider intra-arterial fibrinolysis in centers with the resources and expertise to provide it within the first 6 hours after onset of symptoms. Intra-arterial administration of rtPA is not yet approved by the FDA [24].

The general care of all patients with stroke includes the following:

- Begin stroke pathway.
- Support airway, breathing, and circulation.

Table 3

Inclusion and Exclusion Characteristics of Patients With Ischemic Stroke Who Could Be Treated With rtPA From 3 to 4.5 Hours From Symptom Onset”

Inclusion Criteria
<ul style="list-style-type: none"> • Diagnosis of ischemic stroke causing measurable neurologic deficit • Onset of symptoms 3 to 4.5 hours before beginning treatment
Exclusion Criteria
<ul style="list-style-type: none"> • Age >80 years • Severe stroke (NIHSS >25) • Taking an oral anticoagulant regardless of INR • History of both diabetes and prior ischemic stroke
<p>Notes</p> <ul style="list-style-type: none"> • The checklist includes some US FDA-approved indications and contraindications for administration of rtPA for acute ischemic stroke. Recent AHA/ASA guideline revisions may differ slightly from FDA criteria. A physician with expertise in acute stroke care may modify this list. • Onset time is either witnessed or last known normal. • In patients without recent use of oral anticoagulants or heparin, treatment with rtPA can be initiated before availability of coagulation study results but should be discontinued if INR is >1.7 or PT is elevated by local laboratory standards. • In patients without a history of thrombocytopenia, treatment with rtPA can be initiated before availability of platelet count but should be discontinued if platelet count is <100 000/mm³.

- Monitor blood glucose.
- Monitor blood pressure.
- Monitor temperature.
- Perform dysphagia screening.
- Monitor for complications of stroke and fibrinolytic therapy.
- Transfer to general intensive care if indicated.

Begin Stroke Pathway (Boxes 11 and 12)

Admit patients to a stroke unit (if available) for careful observation (Box 11), including monitoring of blood pressure and neurologic status. If neurologic status worsens, order an emergent CT scan. Determine if cerebral edema or hemorrhage is the cause; consult neurosurgery as appropriate. Additional stroke care includes support of the airway, oxygenation,

ventilation, and nutrition. Provide normal saline to maintain intravascular volume (eg, approximately 75 to 100 mL/7h) if needed.

Monitor Blood Glucose

Hyperglycemia is associated with worse clinical outcome in patients with acute ischemic stroke. But there is no direct evidence that active glucose control improves clinical outcome. There is evidence that insulin treatment of hyperglycemia in other critically ill patients improves survival rates. For this reason, consider giving IV or subcutaneous insulin to lower blood glucose in patients with acute ischemic stroke when the serum glucose level is >185 mg/dL [1].

Monitor for Complications of Stroke and Fibrinolytic Therapy

Prophylaxis for seizures is not recommended.

Table 4

Potential Approaches to Arterial Hypertension in Patients With Acute Ischemic Stroke Who Are Potential Candidates for Acute Reperfusion Therapy*

<p>Patient otherwise eligible for acute reperfusion therapy except that blood pressure is >185/110 mm Hg:</p> <ul style="list-style-type: none"> • Labetalol 10-20 mg IV over 1 -2 minutes, may repeat x 1, or • Nicardipine IV 5 mg per hour, titrate up by 2.5 mg per hour every 5-15 minutes, maximum 15 mg per hour; when desired blood pressure is reached, lower to 3 mg per hour, or • Other agents (hydralazine, enalaprilat, etc) may be considered when appropriate <p>If blood pressure is not maintained at or below 185/110 mm Hg, do not administer rtPA.</p>
<p>Management of blood pressure during and after rtPA or other acute reperfusion therapy:</p> <p>Monitor blood pressure every 15 minutes for 2 hours from the start of rtPA therapy, then every 30 minutes for 6 hours, and then every hour for 16 hours.</p> <p>If systolic blood pressure 180-230 mm Hg or diastolic blood pressure 105-120 mm Hg:</p> <ul style="list-style-type: none"> • Labetalol 10 mg IV followed by continuous IV infusion 2-8 mg per minute, or • Nicardipine IV 5 mg per hour, titrate up to desired effect by 2.5 mg per hour every 5-15 minutes, maximum 15 mg per hour <p>If blood pressure not controlled or diastolic blood pressure >140 mm Hg, consider sodium nitroprusside.</p>

Table 5

Approach to Arterial Hypertension in Patients With Acute Ischemic Stroke Who Are Not Potential Candidates for Acute Reperfusion Therapy*

Consider lowering blood pressure in patients with acute ischemic stroke if systolic blood pressure >220 mm Hg or diastolic blood pressure >120 mm Hg.

Consider blood pressure reduction as indicated for other concomitant organ system injury:

- Acute myocardial infarction
- Congestive heart failure
- Acute aortic dissection

A reasonable target is to lower blood pressure by 15% to 25% within the first day.

*Adams HP Jr, del Zoppo G, Alberts MJ, Bhatt DL, Brass L, Furlan A, Grubb RL, Higashida RT, Jauch EC, Kidwell C, Lyden PD, Morgenstern LB, Qureshi AI, Rosenwasser RH, Scott PA, Wijdicks EFM. Guidelines for the early management of adults with ischemic stroke: a guideline from the American Heart Association/ American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, and the Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups. *Stroke*. 2007;38:1655-1711.

But treatment of acute seizures followed by administration of anticonvulsants to prevent further seizures is recommended. Monitor the patient for signs of increased intracranial pressure. Continue to control blood pressure to reduce the potential risk of bleeding.

Hypertension Management in rtPA Candidates

Although management of hypertension in the stroke patient is controversial, patients who are candidates for fibrinolytic therapy should have their blood pressure controlled to lower the risk of intracerebral hemorrhage following administration of rtPA. General guidelines for the management of hypertension are outlined in Tables 4 and 5.

If patient is eligible for fibrinolytic therapy, blood pressure must be <185 mm Hg systolic and ≤ 110 mm Hg diastolic to limit the risk of bleeding complications. Because the maximum interval from onset of stroke until effective treatment of stroke with rtPA is limited, most patients with sustained hypertension above these levels will not be eligible for IV rtPA.

References

1. Abarbanell N.R. Is prehospital blood glucose measurement necessary in suspected cerebrovascular accident patients? *Am J Emerg Med*. 2005; 23:pp.823–827.

2. Abdullah A.R., Smith E.E., Biddinger P.D., Kalendarian D., Schwamm L.H. Advance hospital notification by EMS in acute stroke is associated with shorter door-to-computed tomography time and increased likelihood of administration of tissue-plasminogen activator. *Prehosp Emerg Care*. 2008;12:426-431.

3. Adams H., Adams R., Del Zoppo G., Goldstein LB. Guidelines for the early management of patients with ischemic stroke: 2005 guidelines update: a scientific statement from the Stroke Council of the American Heart Association/American Stroke Association. *Stroke*. 2005;36:pp.916–923.

4. Adeoye O., Lindsell C., Broderick J., Alwell

K., Jauch E., Moomaw C.J., Flaherty M.L., Pancioli A., Kissela B., Kleindorfer D. *Emergency medical services use by stroke patients: a population-based study*. *Am J Emerg Med*. 2009;27:141-145.

5. Arora S., Broderick J.P., Frankel M., Frankel M., Heinrich J.P., Hicken-bottom S., Karp H., LaBresh K.A., Malarcher A., Mensah G., Moomaw C.J., Schwamm L., Weiss P.; Paul Coverdell Prototype Registries Writing Group. Acute stroke care in the US: results from 4 pilot prototypes of the Paul Coverdell National Acute Stroke Registry. *Stroke*. 2005;36:pp.1232–1240.

6. Buck B.H. Starkman S., Eckstein M., Kidwell C.S., Haines J., Huang R., Colby D., Saver J.L.. *Dispatcher recognition of stroke using the National Academy Medical Priority Dispatch System*. *Stroke*. 2009;40: 2027-2030.

7. California Acute Stroke Pilot Registry (CASPR) Investigators. *Prioritizing interventions to improve rates of thrombolysis for ischemic stroke*. *Neurology*. 2005;64:pp.654–659.

8. Del Zoppo G.J., Saver J.L., Jauch E.C., Adams H.P. Jr. *Expansion of the time window for treatment of acute ischemic stroke with intravenous tissue plasminogen activator: a science advisory from the American Heart Association/American Stroke Association*. *Stroke*. 2009;40:2945-2948.

9. Demchuk A.M., Hill M.D., Barber P.A., Silver B., Patel S.C., Levine S.R.; NINDS rtPA Stroke Study Group, NIH. Importance of early ischemic computed tomography changes using ASPECTS in NINDS rtPA Stroke Study. *Stroke*. 2005;36:pp.2110–2115.

10. Fisher M. *Developing and implementing future stroke therapies: the potential of telemedicine*. *Ann Neurol*. 2005;58:pp.666–671.

11. Gladstone D.J., Rodan L.H., Sahlas D.J., Lee L., Murray B.J., Ween J.E., Perry J.R., Chenkin J., Morrison L.J., Beck S., Black S.E. *A citywide prehospital protocol increases access to stroke thrombolysis in Toronto*. *Stroke*. 2009;40:3841-3844.

12. Gropen T., Magdon-Ismael Z., Day D., Melluzzo S., Schwamm L.H. *Regional implementation of the stroke*

systems of care model: recommendations of the northeast cerebrovascular consortium. *Stroke*. 2009; 40:1793-1802.

13. Gropen T.I., Gagliano P.J., Blake C.A., Blake C.A., Sacco R.L., Kwiatkowski T., Richmond N.J., Leifer D., Libman R., Azhar S., Daley M.B.; *NYSDOH Stroke Center Designation Project Workgroup*. Quality improvement in acute stroke: the New York State Stroke Center Designation Project. *Neurology*. 2006;67:pp.88–93.

14. Hacke W., Kaste M., Bluhmki E., Brozman M., Davalos A., Guidetti D., Larrue V., Lees K.R., Medeghri Z., Machnig T., Schneider D., von Kummer R., Wahlgren N., Toni D. *Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke*. *N Engl J Med*. 2008;359:1317-1329.

15. Jones S.P., Jenkinson A.J., Leathley M.J., Watkins C.L. *Stroke knowledge and awareness: an integrative review of the evidence*. *Age Ageing*. 2010;39:11-22.

16. Kim S.K., Lee S.Y., Bae H.J., Lee Y.S., Kim S.Y., Kang M.J., Cha J.K. *Pre-hospital notification reduced the door-to-needle time for IV t-PA in acute ischaemic stroke*. *Eur J Neurol*. 2009;16:1331-1335.

17. Latchaw R.E., Alberts M.J., Lev M.H., Connors J.J., Harbaugh R.E., Higashida R.T., Hobson R., Kidwell C.S., Koroshetz W.J., Mathews V., Villablanca P., Warach S., Walters B. *Recommendations for imaging of acute ischemic stroke: a scientific statement from the American Heart Association*. *Stroke*. 2009;40:3646-3678.

18. Lloyd-Jones D.M., Hong Y., Labarthe D., Mozaffarian D., Appel L.J., Van Horn L., Greenland K., Daniels S., Nichol G., Tomaselli G.F., Arnett D.K., Fonarow G.C., Ho P.M., Lauer M.S., Masoudi F.A., Robertson R.M., Roger V., Schwamm L.H., Sorlie P., Yancy C.W., Rosamond W.D. *Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's strategic Impact Goal through 2020 and beyond*. *Circulation*. 2010;121:586-613.

19. Morgenstern L.B., Lisabeth L.D., Mecozi A.C., Smith M.A., Longwell P.J., McFarling D.A., Risser J.M. *A population-based study of acute stroke and TIA diagnosis*. *Neurology*. 2004;62:pp.895–900.

20. Nor A.M., Davis J., Sen B., Shipsey D., Louw S.J., Dyker A.G., Davis M., Ford G.A. *The Recognition of Stroke in the Emergency Room (ROSIER) scale: development and validation of a stroke recognition instrument*. *Lancet Neurol*. 2005;4:pp.727–734.

21. Park S., Schwamm L.H. *Organizing regional stroke systems of care*. *Curr Opin Neurol*. 2008;21:43-55.

22. Rymer M.M., Thrutchley D.E.; *Stroke Team at the Mid America Brain and Stroke Institute. Organizing regional networks to increase acute stroke intervention*. *Neurol Res*. 2005;27(suppl 1):pp.S9–S16.

23. Saver J.L., Kidwell C., Eckstein M., Starkman S.; *FAST-MAG Pilot Trial Investigators*. Prehospital neuroprotective therapy for acute stroke: results of the Field Administration of Stroke Therapy-Magnesium (FAST-MAG) pilot trial. *Stroke*. 2004;35:pp.e106–e108.

24. Saver J.L. *Intra-arterial fibrinolysis for acute*

ischemic stroke: the message of melt. *Stroke*. 2007;38:2627-2628.

25. Schwamm L.H., Fonarow G.C., Reeves M.J., Pan W., Frankel M.R., Smith E.E., Ellrodt G., Cannon C.P., Liang L., Peterson E., Labresh K.A. *Get With the Guidelines-Stroke is associated with sustained improvement in care for patients hospitalized with acute stroke or transient ischemic attack*. *Circulation*. 2009;119:107-115.

26. Virkkunen I., Yli-Hankala A., Silfvast T., *Induction of therapeutic hypothermia after cardiac arrest in prehospital patients using ice-cold Ringer's solution: a pilot study*. *Resuscitation*. 2004;62:pp.299–302.

27. Wojner-Alexandrov A.W., Alexandrov A.V., Rodriguez D., Persse D., Grotta J.C. *Houston Paramedic and Emergency Stroke Treatment and Outcomes Study (HoPSTO)*. *Stroke*. 2005;36:pp.1512–1518.

Rezumat

Datele recente statistice ne demonstrează că 29-65% din pacienții cu semne și simptome de accident vascular cerebral acut accesează asistența medicală la etapa inițială prin serviciul de asistență medicală de urgență, ceea ce ne atestă rolul serviciului AMU în lanțul de supraviețuire. Crearea centrelor (secțiilor) specializate cu unități de stroke asigurate cu personal, programe, protocoale și infrastructură pentru acordarea asistenței medicale de urgență a pacienților cu AVC și posibilități de aplicare a metodelor de tratament intensiv (ca tratamentul intravenos cu rt PA) și spitalizarea pacienților în unitatea de stroke. Unitatea de stroke este destinată pentru acordarea asistenței medicale pacienților cu hemoragii intracerebrale și a celor care necesită intervenții specifice (chirurgie sau proceduri endovasculare) sau terapie intensivă. Sunt recomandate prezența protocoalelor de evaluare a pacienților cu AVC și a unei echipe de stroke care să includă medici specialiști, asistenți medicali, medic imagist, laboranți și laborant radiolog. Administrarea intravenoasă a rt PA (0,9 mg/kg, maximum 90 mg) este recomandată pacienților selectați în primele < 3 ore de la apariția primelor semne de AVC ischemic. Tromboliza intra-arterială este o opțiune pentru tratamentul pacienților cu AVC selectați până la < 6 ore cauzate de ocluzia ACM și care nu sunt candidați pentru rtPA. Managementul corect al pacientului cu AVC în primele ore de spitalizare constituie elementul-cheie, cel mai important, de terapie intensivă. Terapiile și intervențiile aplicate ameliorează prognosticul prin micșorarea complicațiilor și termenelor de recuperare a pacienților.

Summary

Recent data indicate that 29-65% of patients with signs or symptoms of acute stroke access their initial medical via local EMS which confirm the role of EMS in the chain of survival. The creation of stroke centers with the personnel programs expertise and infrastructure to care for many patients with strokes, uses many acute therapies (such as intravenous rtPA) and admit such patients into a stroke unit. Stroke unit is designed to care for patients with complicated types of strokes, patients with intracerebral hemorrhage or

subarachnoid hemorrhage, and those requiring specific interventions (surgery or endovascular procedures) or an intensive care. An organized protocol for the emergency evaluation of patients with strokes, designation of an acute stroke team that includes physicians, nurses and laboratory/radiology personnel is recommended. Intravenous rtPA (0.9 mg/kg, maximum dose 90 mg) is recommended for selected patients who may be treated within 3 hours of onset of ischemic stroke. Intra-arterial thrombolysis is an option for treatment of selected patients who have major stroke of < 6 hours duration due to occlusions of the MCA and who are not candidates for intravenous rtPA. The management of patients after admission to the hospital remains a key component of overall treatment and it is as important as the acutely administered therapies. These therapies can improve outcomes by lessening complications and speeding recovery from stroke.

Резюме

Новые статистические данные показывают, что 29-65% больных с клиническими проявлениями острого нарушения мозгового кровообращения обращаются за медицинской помощью через службу скорой помощи, что говорит о значимости данной службе в выживании этих больных. Создание центров (специализированных отделений) с блоками интенсивной терапии оснащенными специально обученным персоналом, протоколами, экспертизам и соответствующей организа-

ционной структурой для оказания urgentной помощи больным с инсультами с использованием методов интенсивной терапии (внутривенное введение тромболитиков – rtPA) и лечение больных в блоке интенсивной терапии. Блок интенсивной терапии предназначен для лечения больных с внутримозговыми кровоизлияниями и больных которые нуждаются в специфическими процедурами (хирургические или эндоваскулярные) а также больных нуждающиеся в интенсивной терапии. В этих центрах обследования для лечения больных с инсультами рекомендовано наличие протоколов и специально обученной бригады состоящей из врачей специалистов, медицинских сестер, лаборантов и рентгенолаборантов. Внутривенное введение rtPA (0,9 mg/kg, максимум 90 мг) рекомендовано больным с показаниями у которых прошло менее 3 часов с момента возникновения первых симптомов ишемического инсульта. Интраартериальное введение тромболитиков является методом выбора для лечения больных с показаниями, у которых с момента возникновения первых признаков ишемического инсульта вследствие окклюзии средне-исонной мозговой артерии не прошло более 6 часов. Правильный менеджмент больных с инсультами в первые часы после госпитализации составляет ключевое звено в проведении интенсивной терапии. Интенсивная терапия и проведенные лечебные процедуры улучшает прогноз больных путем снижения осложнений и ускорения сроков выздоровления.