2010 ACLS Guidelines

Part 10: Acute Coronary Syndrome

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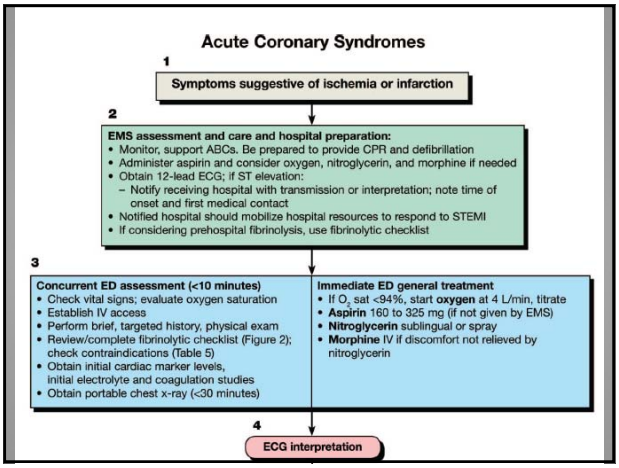
Primary goals of therapy for patients of ACS

- Reduce the amount of myocardial necrosis that occurs in patients with acute myocardial infarction (AMI), thus preserving left ventricular (LV) function, preventing heart failure, and limiting other cardiovascular complications.
- Prevent major adverse cardiac events (MACE): death, nonfatal MI, and need for urgent revascularization.

Primary goals of therapy for patients of ACS

- Treat acute, life-threatening complications of ACS, such as ventricular fibrillation (VF), pulseless ventricular tachycardia (VT), unstable tachycardias, symptomatic bradycardias, pulmonary edema, cardiogenic shock and mechanical complications of AMI.



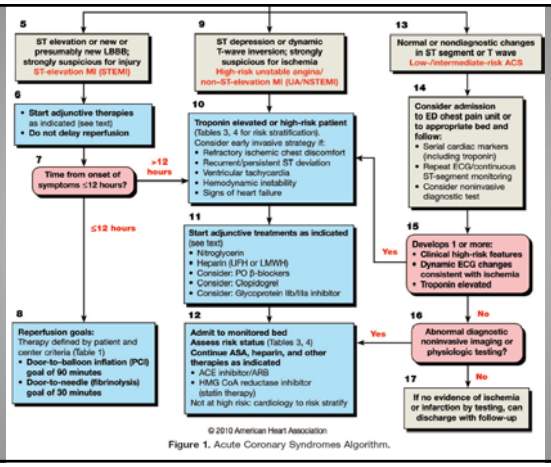
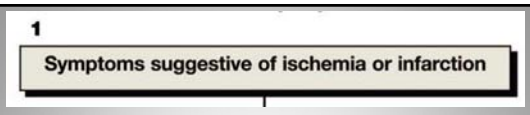
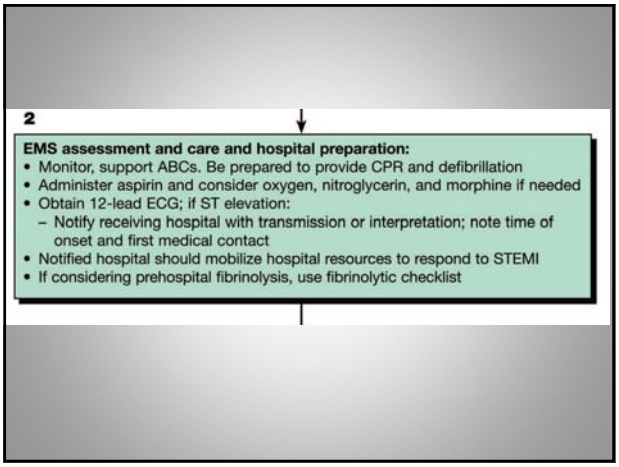


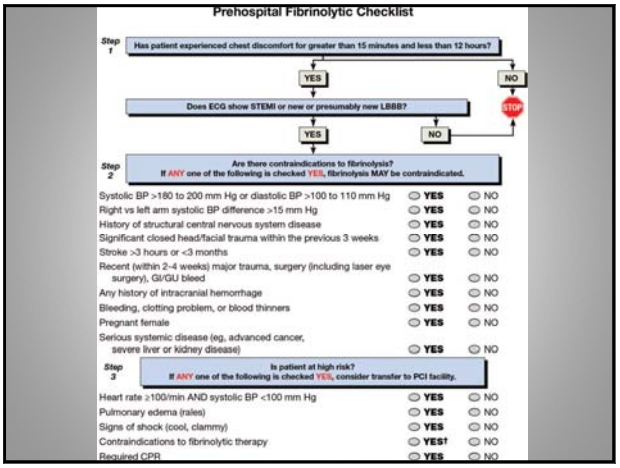
Figure 1. Acute Coronary Syndromes Algorithm.

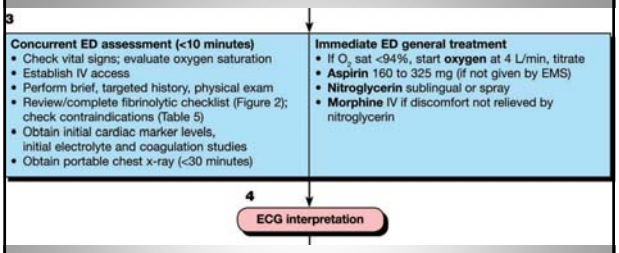


- Potential delays:
- **From onset of symptoms to patient recognition**: older age, racial and ethnic minorities, female gender, lower socioeconomic status, and solitary living arrangements.
- **During pre-hospital transport**: non-classical patient presentations and other confounding diagnostic issues to provider misinterpretation of patient data and inefficient in-hospital system of care.

- **During ED evaluation**: evaluation of AMI combined with symptoms, EKG, biomarkers, risk factors, and other diagnostic tests. Atypical and unusual symptoms are more common on women, the elderly, and diabetic patients.
- Public education campaigns increase patient awareness and knowledge of the symptoms of ACS, yet have only transient effects on time to presentation.







4D's of potential delay during the in-hospital evaluation period:
Door to Data,
Data to Decision,
Decision to Drugs.

ECG Interpretation

- ST-segment elevation or presumed new LBBB is characterized by ST-segment elevation in 2 or more contiguous leads and is classified as *ST-segment elevation MI (STEMI*).
- Threshold values for ST-segment elevation consistent with STEMI are J-point elevation 0.2 mV (2 mm) in leads V2 and V3 and 0.1 mV (1 mm) in all other leads (men≥ 40 years old); J-point elevation 0.25 mV (2.5 mm) in leads V2 and V3 and 0.1 mV (1 mm) in all other leads (men <40 years old); J-point elevation 0.15 mV (2.5 mm) in leads V2 and V3 and 0.1 mV (1 mm) in all other leads (women).

ECG Interpretation

- Ischemic ST-segment depression >0.5 mm (0.05 mV) or dynamic T-wave inversion with pain or discomfort is classified as UA/NSTEMI. Nonpersistent or transient ST-segment elevation ≥0.5 mm for <20 minutes is also included in this category.
- Threshold values for ST-segment depression consistent with ischemia are J-point depression 0.05 mV (-.5 mm) in leads V2 and V3 and -0.1 mV (-1 mm) in all other leads (men and women).

ECG Interpretation

- The nondiagnostic ECG with either normal or minimally abnormal (ie, nonspecific ST-segment or T-wave changes). This ECG is nondiagnostic and inconclusive for ischemia, requiring further risk stratification.
- This classification includes patients with normal ECGs and those with ST-segment deviation of <0.5 mm (0.05 mV) or T-wave inversion of ≤0.2 mV.
- This category of ECG is termed *nondiagnostic*.

Cardiac Biomarkers

- Cardiac troponin is more sensitive than CK-MB.
- Cardiac biomarkers ARE NOT USEFUL in the pre-hospital setting.
- If biomarkers are negative in first 4~6 hours, recheck between 6~12 hours.
- Clinical symptoms + new ECG abnormalities + one biomarker is elevated above the upper limit = MI.

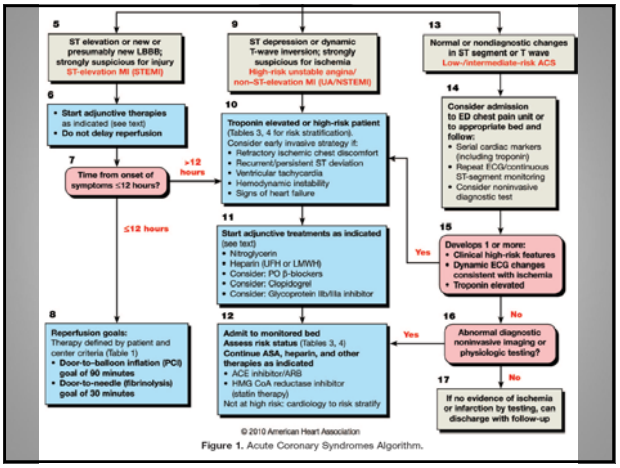


Figure 1. Acute Coronary Syndromes Algorithm.

Table 1. ST-Segment Elevation or New or Presumably New LBBB: Evaluation for Reperfusion

Step 1: Assess time and risk	
Time since onset of symptoms	
Risk of STEMI	
Risk of fibrinolysis	
Time required to transport to skilled PCI catheterization suite	
Step 2: Select reperfusion (fibrinolysis or invasive) strategy	
Note: If presentation <3 hours and no delay for PCI, then no preference for either strategy.	
Fibrinolysis is generally preferred if:	An invasive strategy is generally preferred if:
• Early presentation (≤3 hours from symptom onset)	• Late presentation (symptom onset >3 hours ago)
• Invasive strategy is not an option (eg, lack of access to skilled PCI facility or difficult vascular access) or would be delayed	• Skilled PCI facility available with surgical backup
– Medical contact-to-balloon or door-balloon >90 minutes	• Medical contact-to-balloon or door-to-balloon <90 minutes
– (Door-to-balloon) minus (door-to-needle) is >1 hour	• (Door-to-balloon) minus (door-to-needle) is <1 hour
• No contraindications to fibrinolysis	• Contraindications to fibrinolysis, including increased risk of bleeding and ICH
	• High risk from STEMI (CHF, Killip class is ≥3)
	• Diagnosis of STEMI is in doubt

Table 2. Likelihood That Signs and Symptoms Represent ACS Secondary to CAD

Feature	High Likelihood *Any of the following:*	Intermediate Likelihood *Absence of high-likelihood features and presence of any of the following:*	Low Likelihood *Absence of high- or intermediate-likelihood features but may have the following:*
History	Chest or left arm pain or discomfort as chief symptom reproducing prior documented angina; known history of CAD including MI	Chest or left arm pain or discomfort as chief symptom; age >70 years; male sex; diabetes mellitus	Probable ischemic symptoms in absence of any intermediate-likelihood characteristics; recent cocaine use
Examination	Transient MR murmur, hypotension, diaphoresis, pulmonary edema, or rales	Extracardiac vascular disease	Chest discomfort reproduced by palpation
ECG	New or presumably new transient ST-segment deviation (≥1 mm) or T-wave inversion in multiple precordial leads	Fixed Q waves ST depression 0.5 to 1 mm or T-wave inversion >1 mm	T-wave flattening or inversion <1 mm in leads with dominant R waves Normal ECG
Cardiac markers	Elevated cardiac TnI, TnT, or CK-MB	Normal	Normal

Table 3. TIMI Risk Score for Patients With Unstable Angina and Non–ST-Segment Elevation MI: Predictor Variables

Predictor Variable	Point Value of Variable	Definition
Age ≥65 years	1	
≥3 risk factors for CAD	1	Risk factors • Family history of CAD • Hypertension • Hypercholesterolemia • Diabetes • Current smoker
Aspirin use in last 7 days	1	
Recent, severe symptoms of angina	1	≥2 anginal events in last 24 hours
Elevated cardiac markers	1	CK-MB or cardiac-specific troponin level
ST deviation ≥0.5 mm	1	ST depression ≥0.5 mm is significant; transient ST elevation ≥0.5 mm for <20 minutes is treated as ST-segment depression and is high risk; ST elevation ≥1 mm for more than 20 minutes places these patients in the STEMI treatment category
Prior coronary artery stenosis ≥50%	1	Risk predictor remains valid even if this information is unknown

Calculated TIMI Risk Score	Risk of ≥1 Primary End Point* in ≤14 Days	Risk Status
0 or 1	5%	Low
2	8%	Low
3	13%	Intermediate
4	20%	Intermediate
5	26%	High

Table 4. Selection of Initial Treatment Strategy for Patients With Non-ST-Elevation ACS: Invasive Versus Conservative Strategy*

Preferred Strategy	Patient Characteristics
Invasive	• Recurrent angina or ischemia at rest or with low-level activities despite intensive medical therapy
	• Elevated cardiac biomarkers (TnT or TnI)
	• New or presumably new ST-segment depression
	• Signs or symptoms of HF or new or worsening mitral regurgitation
	• High-risk findings from noninvasive testing
	• Hemodynamic instability
	• Sustained ventricular tachycardia
	• PCI within 6 months
	• Prior CABG
	• High-risk score (eg, TIMI, GRACE)
	• Reduced LV function (LVEF less than 40%)
Conservative	• Low-risk score (eg, TIMI, GRACE)
	• Patient or physician preference in absence of high-risk features

Initial General Therapy for ACS

- Analgesia: Morphine preferred for STEMI (Class I); Class II for UA/NSTEMI.
- Oxygen: no sufficient evidence of using oxygen; harmful if using high-flow oxygen.
- Nitroglycerin: careful with low BP patients; contraindication: hypotension, bradycardia, tachycardia, RV infarction.
- Aspirin

Reperfusion Therapies

- Fibrinolytic therapy: Door-to-needle in 30 minutes.
- Primary PCI: Door-to-balloon inflation in 90 minutes.

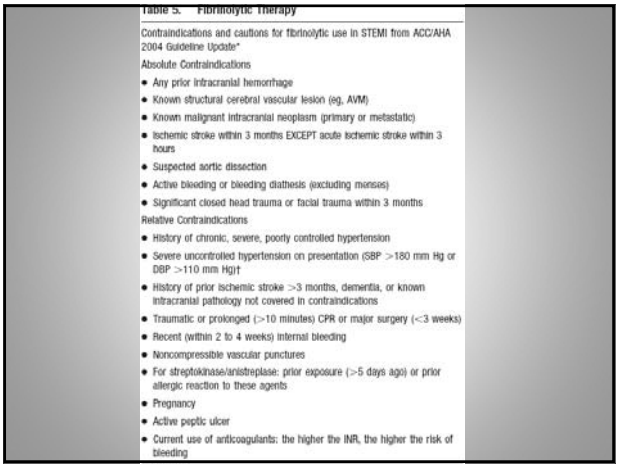


Table 5. Fibrinolytic Therapy

Contraindications and cautions for fibrinolytic use in STEMI from ACC/AHA 2004 Guideline Update*

Absolute Contraindications

- Any prior intracranial hemorrhage
- Known structural cerebral vascular lesion (eg, AVM)
- Known malignant intracranial neoplasm (primary or metastatic)
- Ischemic stroke within 3 months EXCEPT acute ischemic stroke within 3 hours
- Suspected aortic dissection
- Active bleeding or bleeding diathesis (excluding menses)
- Significant closed head trauma or facial trauma within 3 months

Relative Contraindications

- History of chronic, severe, poorly controlled hypertension
- Severe uncontrolled hypertension on presentation (SBP >180 mm Hg or DBP >110 mm Hg)†
- History of prior ischemic stroke >3 months, dementia, or known intracranial pathology not covered in contraindications
- Traumatic or prolonged (>10 minutes) CPR or major surgery (<3 weeks)
- Recent (within 2 to 4 weeks) internal bleeding
- Noncompressible vascular punctures
- For streptokinase/anistreplase: prior exposure (>5 days ago) or prior allergic reaction to these agents
- Pregnancy
- Active peptic ulcer
- Current use of anticoagulants: the higher the INR, the higher the risk of bleeding

PCI following ROSC after Cardiac Arrest

- A 12-lead ECG should be performed as soon as possible after ROSC.
- Appropriate treatment of ACS or STEMI, including PCI or fibrinolysis, should be initiated regardless of coma.
- Coma and the use of induced hypothermia are not contraindications or reasons to delay PCI or fibrinolysis.

PCI vs. Fibrinolysis

- For patients presenting within 12 hours of symptom onset and electrocardiographic findings consistent with STEMI, reperfusion should be initiated ASAP.
- Primary PCI performed at a high-volume center within 90 minutes of first medical contact by an experienced operator that maintains an appropriate expert status is reasonable, as it improves morbidity and mortality as compared with immediate fibrinolysis (30 minutes door-to-needle).

PCI vs. Fibrinolysis

- If PCI cannot be accomplished within 90 minutes of first medical contact, independent of the need for emergent transfer, then fibrinolysis is recommended, assuming the patient lacks contraindications to such therapy.
- For those patients with a contraindication to fibrinolysis, PCI is recommended despite the delay, rather than foregoing reperfusion therapy.
- For those STEMI patients presenting in shock, PCI (or CABG) is the preferred reperfusion treatment. Fibrinolysis should only be considered in consultation with the cardiologist if there is a substantial delay to PCI.

Complicated AMI

- Cardiogenic shock, LV failure, and CHF: PCI preferred as fibrinolysis; use IABP for hemodynamic support.
- RV infarction: Right side ECG; PCI as soon as fibrinolysis; avoid NTG, diuretics, or ACEI due to severe hypotension (↓ cardiac output); treat hypotension with IV bolus.

Adjunctive Therapies for ACS and AMI

- Thienopyridines– Clopidogrel , Prasugrel
- Clopidogrel: ≤75 y/o: 300~600mg loading if ACS is diagnosed; 300mg loading with patient suspect ACS (but no ECG or cardiac biomarkers change) who are allergic to aspirin or major GI intolerance; ≥75 y/o: no strong evidence.
- Prasugrel: (60mg loading dose) reduction in combined event rate with no benefit in mortality compared to clopidogrel but with an overall resultant increase in major bleeding when administered after angiography to patients with NSTEMI undergoing PCI; no direct evidence of using Prasugrel at ED or prehospital settings.

Adjunctive Therapies for ACS and AMI

- Glycoprotein IIb/IIIa Inhibitors: dual platelet inhibitor treatment of patients with planned invasive strategy taking into consideration the ACS risk of the patient and weighing this against the potential bleeding risk.
- β-Adrenergic Receptor Blockers: Contraindications are moderate to severe LV failure and pulmonary edema, bradycardia, hypotension, signs of poor peripheral perfusion, second-degree or third-degree heart block, or reactive airway disease; PO vs. IV (severe HTN or tachyarrythmias with ACS).

Adjunctive Therapies for ACS and AMI

- Calcium Channel Blockers: no evidence; beta-blockers are better than CCB with AMI patients.
- ACEI & ARB: oral ACEI is recommended within the first 24 hours after onset of symptoms in STEMI patients with pulmonary congestion or LVEF<40%, in the absence of hypotension; oral ACEI can also be useful for all other patients with AMI with or without early reperfusion therapy; IV administration of ACEI is contraindicated in the first 24 hours because of risk of hypotension.

Adjunctive Therapies for ACS and AMI

- HMG Coenzyme A Reductase Inhibitors (Statins): intensive (target LDL values optimally <70mg/dL) statin treatment should be initiated within the first 24 hours after onset of an ACS event in all patients presenting with any form of ACS unless strictly contraindicated.
- Glucose-Insulin-Potassium: no evidence, not helpful.

Adjunctive Therapies for ACS and AMI

- Heparin: UFH vs. LMWH
- UFH: need IV; aPTT; unpredictable response; thombocytopenia.
- UFH vs. LMWH in UA/ NSTEMI: initial conservative approach—enoxaparin better than UFH; planned invasive approach—enoxaparin or UFH; CRI—UFH; increased bleeding risk– UFH may be considered.

Adjunctive Therapies for ACS and AMI

- UFH vs. LMWH with Fibrinolysis in STEMI: enoxaparin better than UFH (decreased bleeding risk); may use UFH if CRI.
- UFH vs. LWMH with PPCI in STEMI: enoxaparin better than UFH (decreased bleeding risk); need dose adjustment of enoxaparin if CRI.

Summary

- Early detect, early contact EMS, early CAB support by EMS, early ECG classification, early transport.
- PCI is preferred than fibrinolysis.
- Door-to-balloon: 90 minutes.
- Door-to-needle: 30 minutes.

2010 ACLS Guidelines

Part 11: Acute Stroke

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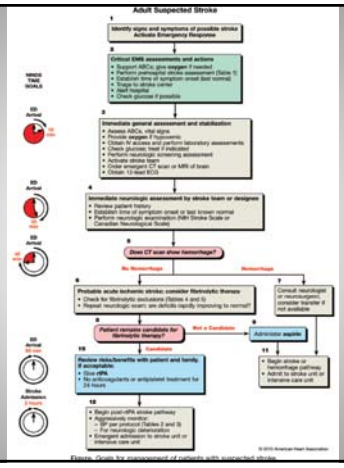
The "8D's" of Stroke Care

- Detection: Rapid recognition of stroke symptoms.
- Dispatch: Early activation and dispatch of emergency medical services (EMS) system by calling 911.
- Delivery: Rapid EMS identification, management, and transport.
- Door: Appropriate triage to stroke center.
- Data: Rapid triage, evaluation, and management within the emergency department (ED).
- Decision: Stroke expertise and therapy selection.
- Drug: Fibrinolytic therapy, intra-arterial strategies.
- Disposition: Rapid admission to stroke unit, critical-care unit.



Stroke Recognition and EMS care

- Stroke warning signs
- 119 and EMS Dispatch
- Stroke assessment tools: CPSS & LAPSS

Critical EMS assessments and actions

- Support ABCs; give **oxygen** if needed
- Perform prehospital stroke assessment (Table 1)
- Establish time of symptom onset (last normal)
- Triage to stroke center
- Alert hospital
- Check glucose if possible

Table 1. The Cincinnati Prehospital Stroke Scale

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

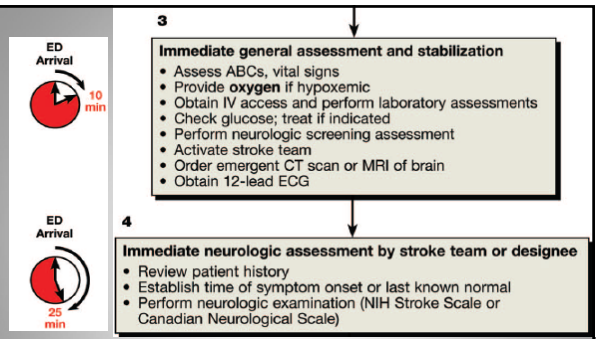
Arm drift (patient closes eyes and holds both arms straight out for 10 seconds)

- 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 the 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%.



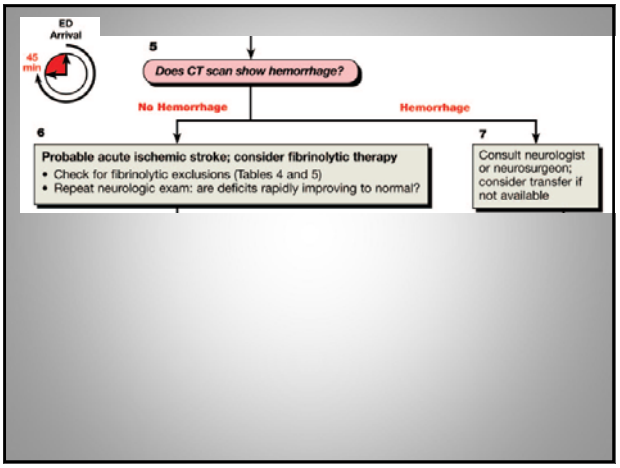


Table 2. Potential Approaches to Arterial Hypertension in Acute Ischemic Stroke Patients Who Are Potential Candidates for Acute Reperfusion Therapy

Patient otherwise eligible for acute reperfusion therapy except that blood pressure is >185/110 mm Hg

- Labetalol 10–20 mg IV over 1–2 minutes, may repeat ×1, or
- Nicardipine IV 5 mg/hr, titrate up by 2.5 mg/hr every 5–15 minutes, maximum 15 mg/hr; when desired blood pressure reached, lower to 3 mg/hr, or
- Other agents (hydralazine, enalaprilat, etc) may be considered when appropriate

If blood pressure is not maintaine
administer rtPA

Management of blood pressure d
reperfusion therapy:

- Monitor blood pressure ever
rtPA therapy; then every 30
for 16 hours

If systolic BP 180–230 mm Hg o

- Labetalol 10 mg IV followed
- Nicardipine IV 5 mg/h, titrat
5–15 minutes, maximum 15

If blood pressure not controlled o
sodium nitroprusside

Table 3. Approach to Arterial Hypertension in Acute Ischemic Stroke Patients 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

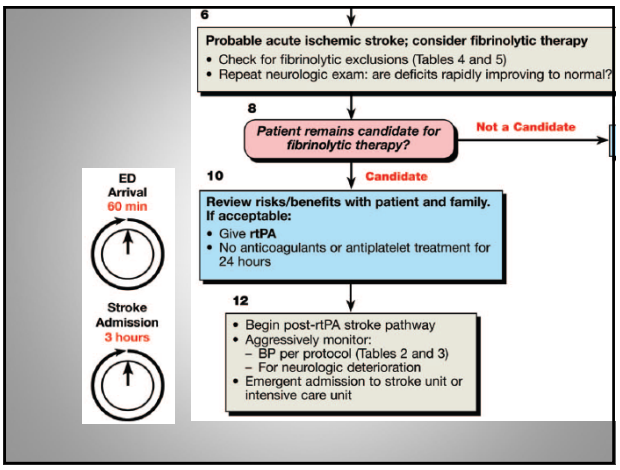


Table 4. Inclusion and Exclusion Characteristics of Patients With Ischemic Stroke Who Could Be Treated With rtPA Within 3 Hours From Symptom Onset

Inclusion criteria

- Diagnosis of ischemic stroke causing measurable neurologic deficit
- Onset of symptoms <3 hours before beginning treatment
- Age ≥18 years

Exclusion criteria

- 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
  - Platelet count <100 000/mm³
  - Heparin received within 48 hours, resulting in aPTT >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

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 of these relative contraindications is present

- 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)

Table 5. Additional 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

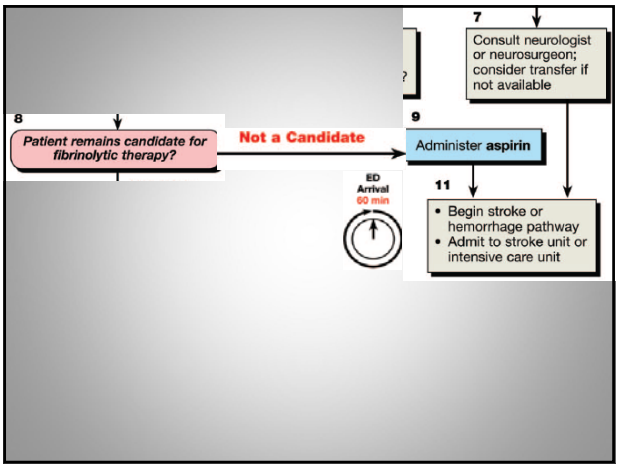
- Diagnosis of ischemic stroke causing measurable neurologic deficit
- Onset of symptoms 3 to 4.5 hours before beginning treatment

Exclusion criteria

- Age >80 years
- Severe stroke (NIHSS >25)
- Taking an oral anticoagulant regardless of INR
- History of both diabetes and prior ischemic stroke

Notes

- The checklist includes some FDA-approved indications and contraindications for administration of rtPA for acute ischemic stroke. Recent guideline revisions have modified the original 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 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



General Stroke Care

- Blood pressure management: keep adequate perfusion to maintain euvolemia.
- Glycemic control: no direct evidence that improves clinical outcome; keep F/S ≤ 185 mg/dL.
- Temperature control: treat fever ≥ 37.5℃; no evidence of hypothermia therapy.
- Dysphagia screening: to prevent aspiration pneumonia.
- Others: Airway, O2, nutrition; seizure vs. anticonvulsants; IICP.

Summary

- The ultimate goal of stroke care:
- To minimize ongoing injury.
- Emergently recanalize acute vascular occlusions .
- Begin secondary measures to maximize functional recovery.

Thanks for your attention!