Welcome

Focus on Quality

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2013 Updated Guidelines for Acute Ischemic Stroke (AIS)

- American College of Emergency Physicians (ACEP) and American Academy of Neurology (AAN)
- American Heart Association (AHA)/American Stroke Association (ASA)
Objectives

- Review the ACEP/AAN Clinical Policy Statement on the use of IV tPA for AIS in the emergency department
- Review recent revisions to the AHA/ASA guidelines on the early management of AIS, with a focus on IV fibrinolysis recommendations
- Problem based assessment - Case

IV=intravenous; tPA=tissue plasminogen activator.
Case

- 53 year old right handed male, CEO of a company with h/o Afib, HTN, hyperlipidemia
- Wakes up at 6 am for coffee
- Later wife finds him: left hemiplegic, right gaze deviation
- Brought to ED by 7:15 am
  - BP: 215/106 mm Hg, HR: 86/min, Temp: 99.2° F
  - Exam: Right gaze deviation, left facial UMN palsy, severe dysarthria without aphasia, left hemiplegia, hemianopsia, and hemianesthesia, areflexia
  - NIHSS17
Case

Labs:

- CBC:
  - Hb 13.8 mg/ml,
  - WBC: 8.5 K/ml,
  - Platelets: 189K/mL,

- Coag
  - PT: 13s
  - INR: 1.2
  - PTT: 21 s

Chem 7

- Na: 143 mEq/mL
- K: 4.1 mEq/mL
- Cl-: 102 mEq/mL,
- HCO3: 32
- BUN: 21
- Creatinine: 1.1
- Glucose: 143 mg/ml
Case
Treatment options?

- IV tPA
- IV TNK
- IV Abciximab
- IA urokinase
- Sonothrombolysis
- IA mechanical embolectomy:
  - EKOS
  - MERCI
  - PENUMBRA
  - SOLITAIRE
  - TREVO
Evolution of Stroke Policy Statements Within Emergency Medicine

Perceived concerns about use of thrombolytics in AIS (mid to late 1990s)


Growing body of literature supporting benefit of thrombolytics in AIS when given within 3 hours

Revision of stroke policy statements by various organizations

SAEM rescinded its 6-year-old clinical policy statement, citing new evidence (June 2009)

ACEP/AAN Clinical Policy Statement published (February 2013)

2013 ACEP/AAN Clinical Policy Statement

February 2013

- ACEP/AAN Clinical Policy statement on use of IV tPA for AIS published in *Annals of Emergency Medicine*
- Replaces previous ACEP Clinical Policy published in 2003

Intended Audience

- Physicians working in hospital-based EDs
2013 ACEP/AAN Clinical Policy Statement: Key Questions

1. Is IV tPA safe and effective for AIS patients if given within 3 hours of symptom onset?

2. Is IV tPA safe and effective for AIS patients treated between 3 and 4.5 hours after symptom onset?
In order to improve functional outcomes, IV tPA should be offered to AIS patients who meet NINDS inclusion/exclusion criteria and can be treated within 3 hours after symptom onset (Level A).

In order to improve functional outcomes, IV tPA should be considered in AIS patients who meet ECASS III inclusion/exclusion criteria and can be treated between 3 and 4.5 hours after symptom onset* (Level B).

Within any time window, once the decision is made to administer IV tPA, the patient should be treated as rapidly as possible.

*The effectiveness of tPA has been less well established in institutions without the systems in place to safely administer the medication.

NINDS=National Institute of Neurological Disorders and Stroke; ECASS=European Cooperative Acute Stroke Study.

Evolution of AHA/ASA Guidelines on the Early Management of AIS over the Past 2 Decades

Evidence for IV tPA

- First trial: NINDS rtPA trial:
  - 0.9mg/kg: limited to 90 mg within 180 mins of symptoms
  - Part I: 291 patients and Part II: 333 patients
  - Part I: effectiveness of tPA within 24 hours
  - Part II: clinical outcomes in 3 months

- Simultaneous European trial ECASS 1

Evidence for IV tPA

- Improvement in neurological functions < 24 hrs if given within 90 mins of symptoms

Table 3. Scores on the NIHSS 24 Hours after the Onset of Stroke.

<table>
<thead>
<tr>
<th>TIME TO TREATMENT AFTER STROKE ONSET</th>
<th>t-PA</th>
<th>PLACEBO</th>
<th>RELATIVE RISK (95% CI)</th>
<th>P VALUE</th>
<th>NIHSS SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF PATIENTS</td>
<td>NO. WITH IMPROVEMENT (%)</td>
<td>NO. OF PATIENTS</td>
<td>NO. WITH IMPROVEMENT (%)</td>
<td>t-PA</td>
</tr>
<tr>
<td>Part 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–90</td>
<td>71</td>
<td>36 (51)</td>
<td>68</td>
<td>31 (46)</td>
<td>1.1</td>
</tr>
<tr>
<td>91–180</td>
<td>73</td>
<td>31 (42)</td>
<td>79</td>
<td>26 (33)</td>
<td>1.3</td>
</tr>
<tr>
<td>0–180</td>
<td>144</td>
<td>67 (47)</td>
<td>147</td>
<td>57 (39)</td>
<td>1.2</td>
</tr>
<tr>
<td>Part 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–90</td>
<td>86</td>
<td>51 (59)</td>
<td>77</td>
<td>30 (39)</td>
<td>1.5</td>
</tr>
<tr>
<td>91–180</td>
<td>82</td>
<td>29 (35)</td>
<td>88</td>
<td>35 (40)</td>
<td>0.9</td>
</tr>
<tr>
<td>0–180</td>
<td>168</td>
<td>80 (48)</td>
<td>165</td>
<td>65 (39)</td>
<td>1.2</td>
</tr>
<tr>
<td>Combined results</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–90</td>
<td>157</td>
<td>87 (55)</td>
<td>145</td>
<td>61 (42)</td>
<td>1.3</td>
</tr>
<tr>
<td>91–180</td>
<td>155</td>
<td>60 (39)</td>
<td>167</td>
<td>61 (37)</td>
<td>1.1</td>
</tr>
<tr>
<td>0–180</td>
<td>312</td>
<td>147 (47)</td>
<td>312</td>
<td>122 (39)</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Evidence for IV tPA

- 12% ARR for improved outcome in 3 months
- NNT = 8.33

Table 4. Outcomes at Three Months According to the Time to Treatment after the Onset of Stroke.

<table>
<thead>
<tr>
<th>Assessment Instrument</th>
<th>Percentage with Favorable Outcome</th>
<th>Odds Ratio (95% CI)</th>
<th>Relative Risk (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-PA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part 2, 0–180 min‡</td>
<td>No. of patients</td>
<td>168</td>
<td>165</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Global test</td>
<td>—</td>
<td>—</td>
<td>1.7 (1.2–2.6)</td>
</tr>
<tr>
<td></td>
<td>Barthel index</td>
<td>50</td>
<td>38</td>
<td>1.6 (1.1–2.5)</td>
</tr>
<tr>
<td></td>
<td>Modified Rankin scale</td>
<td>39</td>
<td>26</td>
<td>1.7 (1.1–2.6)</td>
</tr>
<tr>
<td></td>
<td>Glasgow outcome scale</td>
<td>44</td>
<td>32</td>
<td>1.6 (1.1–2.5)</td>
</tr>
<tr>
<td></td>
<td>NIHSS</td>
<td>31</td>
<td>20</td>
<td>1.7 (1.0–2.8)</td>
</tr>
<tr>
<td>Part 1, 0–180 min‡‡</td>
<td>No. of patients</td>
<td>144</td>
<td>147</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Global test</td>
<td>—</td>
<td>—</td>
<td>2.1 (1.3–3.2)</td>
</tr>
<tr>
<td></td>
<td>Barthel index</td>
<td>54</td>
<td>39</td>
<td>1.8 (1.1–2.8)</td>
</tr>
<tr>
<td></td>
<td>Modified Rankin scale</td>
<td>47</td>
<td>27</td>
<td>2.3 (1.4–3.6)</td>
</tr>
<tr>
<td></td>
<td>Glasgow outcome scale</td>
<td>47</td>
<td>31</td>
<td>2.0 (1.2–3.1)</td>
</tr>
<tr>
<td></td>
<td>NIHSS</td>
<td>38</td>
<td>21</td>
<td>2.2 (1.3–3.7)</td>
</tr>
<tr>
<td>Combined results‡</td>
<td>No. of patients</td>
<td>157</td>
<td>145</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Global test</td>
<td>—</td>
<td>—</td>
<td>1.9 (1.2–2.9)</td>
</tr>
<tr>
<td></td>
<td>Barthel index</td>
<td>53</td>
<td>38</td>
<td>1.8 (1.2–2.9)</td>
</tr>
<tr>
<td></td>
<td>Modified Rankin scale</td>
<td>40</td>
<td>28</td>
<td>1.7 (1.0–2.6)</td>
</tr>
<tr>
<td></td>
<td>Glasgow outcome scale</td>
<td>43</td>
<td>32</td>
<td>1.6 (1.0–2.5)</td>
</tr>
<tr>
<td></td>
<td>NIHSS</td>
<td>34</td>
<td>20</td>
<td>2.0 (1.2–3.4)</td>
</tr>
<tr>
<td>91–180 min‡‡</td>
<td>No. of patients</td>
<td>155</td>
<td>167</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Global test</td>
<td>—</td>
<td>—</td>
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<td>51</td>
<td>38</td>
<td>1.6 (1.1–2.5)</td>
</tr>
<tr>
<td></td>
<td>Modified Rankin scale</td>
<td>45</td>
<td>23</td>
<td>2.4 (1.5–3.7)</td>
</tr>
<tr>
<td></td>
<td>Glasgow outcome scale</td>
<td>47</td>
<td>30</td>
<td>2.0 (1.3–3.2)</td>
</tr>
<tr>
<td></td>
<td>NIHSS</td>
<td>34</td>
<td>21</td>
<td>2.0 (1.2–3.2)</td>
</tr>
</tbody>
</table>

* Evidence for IV tPA: 12% ARR for improved outcome in 3 months. NNT = 8.33

Sources:
Evidence for IV tPA

- Improvement seen in
  - all ranges of disabilities
  - all causes of stroke

Evidence for IV tPA

- ECASS: European cooperative acute stroke study
- Exclusion of large strokes
- 1.1 mg/kg body weight limited to 100 mg within 360 minutes
- 620 patients (313 treatment) (247-protocol)
- 109 protocol violations

*JAMA.* 1995;274:1017-1025
Evidence for IV tPA

- With protocol adherence: ARR was 8.3% for preventing death or dependency
- NNT ~ 12

Table 3.—Results*

<table>
<thead>
<tr>
<th>End Points</th>
<th>Intention-to-Treat Population</th>
<th>Target Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Placebo</td>
<td>rt-PA</td>
</tr>
<tr>
<td>Barthel Index† Median score</td>
<td>75</td>
<td>85</td>
</tr>
<tr>
<td>P</td>
<td>.99</td>
<td>.16</td>
</tr>
<tr>
<td>Modified Rankin Scale† Median score</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>P</td>
<td>.41</td>
<td>.036</td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scandinavian Stroke Scale, long-term score at day 90±14† Median score (maximum score=56)</td>
<td>36</td>
<td>39</td>
</tr>
<tr>
<td>P</td>
<td>.54</td>
<td>.04</td>
</tr>
<tr>
<td>Combined Barthel Index§ Rankin Scale at day 90±14†‡ Median score</td>
<td>90</td>
<td>97.5</td>
</tr>
<tr>
<td>P</td>
<td>.003</td>
<td>.001</td>
</tr>
<tr>
<td>Mortality at day 30, %§</td>
<td>12.7</td>
<td>17.9</td>
</tr>
<tr>
<td>P</td>
<td>.06</td>
<td>.36</td>
</tr>
<tr>
<td>Relative risk (95% confidence interval)</td>
<td>1.22 (1.02-1.45)</td>
<td>1.17 (0.95-1.46)</td>
</tr>
</tbody>
</table>
Evidence for IV tPA

- ECASS 2
- Corrected dose 0.9 mg/kg within 360 minutes of symptom onset.
- 2 subsets 0-180 and 181-360 minutes
- 810 patients: 409: treatment

Evidence for IV tPA

- Primary outcomes ARR 3.7%: Diluted effect
- NNT = 27
- 27 patients to be treated within 6 hours to prevent one disability

### Evidence for IV tPA

- **Prespecified outcomes with minimal deficits:** no difference
- **Post hoc analysis 0-3 hours:** 8.3% ARR
- **NNT= 12**

#### Endpoint 0-3 h

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>0-3 h</th>
<th>3-6 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>mRS at day 90*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alteplase (n=81)</td>
<td>Placebo (n=77)</td>
<td>Difference (alteplase minus placebo)</td>
</tr>
<tr>
<td>34 (42% [31-54])</td>
<td>29 (38% [27-49])</td>
<td>4</td>
</tr>
<tr>
<td>Median mRS+BI at day 90*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alteplase (n=309)</td>
<td>Placebo (alteplase minus placebo)</td>
<td>Difference (95% CI)</td>
</tr>
<tr>
<td>131 (40.2%; [34.8-45.7])</td>
<td>114 (36.9%; [31.5-42.5])</td>
<td>3.3</td>
</tr>
<tr>
<td>Median change in NIHSS, baseline to day 30*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Evidence for IV tPA

- ECASS 3
- 0.9mg/kg with 90 mg max, 3-4.5 hours after symptom onset
- 821 patients randomized and 375 tPA
- Outcomes: dependency v/s independency

Evidence for IV tPA

- ARR for improved outcome = 3%, best outcome = 2%
- NNT is 33-50.

Lancet. 2012;379(9834):2352-63
Evidence for IV tPA

Lancet. 2010 375(9834):1695-703
2013 AHA/ASA Guidelines on the Early Management of AIS

February 2013

- AHA/ASA guidelines on early management of AIS published in *Stroke*
- Replaces 2007 guidelines and 2009 updates

Intended Audience

- HCPs involved in the emergency identification, evaluation, transport, and management of patients with AIS*

*Includes prehospital care providers, ED physicians and nurses, stroke team members, inpatient nurses, hospitalists, general medicine physicians, hospital administrators, and ancillary healthcare personnel.

2013 AHA/ASA Guidelines on the Early Management of AIS: Overview of Key Highlights by Section

Prehospital Stroke Management

- Rapid patient transport and mobilization of hospital resources prior to patient arrival are emphasized

- < 1/2 of 9-1-1 calls within 1 hour of symptom onset and fewer than 1/2 thought stroke was the cause of symptoms.
- The California Acute Stroke Pilot Registry (CASPR): 3 hr rtPA from 8 – 25%.
- Face, arm weakness or speech difficulty present in 88% of all strokes – FAST acronym
- Only 53% of stroke patients used EMS
Designation of Stroke Centers and Stroke Care Quality Improvement

- More specific recommendations about stroke center designation and quality improvement processes, including greater prominence of telestroke.
Emergency Evaluation and Diagnosis of AIS

- Unchanged recommendation that fibrinolytic treatment should begin within 60 minutes of the patient’s arrival in an ED
- Revised recommendations that various diagnostic tests (electrocardiogram, etc) should not delay administration of IV tPA
2013 AHA/ASA Guidelines on the Early Management of AIS: Overview of Key Highlights by Section (cont.)

Early Diagnosis: Brain and Vascular Imaging
- Similar to the 2009 imaging update statement
  - NON-CONTRAST CT HEAD

General Supportive Care and Treatment of Acute Complications
- Several revisions (eg, cardiac monitoring, supplemental oxygen, blood pressure, hypovolemia, hypoglycemia, hyperglycemia)

IV Fibrinolysis
- Several revisions and new recommendations (eg, DTN within 60 minutes, IV tPA to eligible patients within 3–4.5 hours, and consideration of IV fibrinolysis in mild stroke, RISS, major surgery in the preceding 3 months, and recent MI)

Endovascular Interventions
- Section expanded (combines the previously separate sections of “intra-arterial thrombolysis” and “endovascular interventions”)

DTN=door-to-needle time; RISS=rapidly improving stroke symptoms; MI=myocardial infarction.
IV tPA (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 (Class I; Level of Evidence A). *(Unchanged from 2007 guideline)*

In patients eligible for IV tPA, benefit of therapy is time dependent, and treatment should be initiated as quickly as possible. The door-to-needle time (time of bolus administration) should be within 60 minutes from hospital arrival (Class I; Level of Evidence A). *(New recommendation)*

IV tPA (0.9 mg/kg, maximum dose 90 mg) is recommended for administration to eligible patients who can be treated in the time period of 3 to 4.5 hours after stroke onset (Class I; Level of Evidence B).* *(Revised from the 2009 IV tPA Science Advisory)*

*The eligibility criteria for treatment in this time period are similar to those for people treated at earlier time periods within 3 hours, with the following additional exclusion criteria: patients >80 years old, patients taking oral anticoagulants regardless of INR, patients with a baseline NIHSS score >25, patients with imaging evidence of ischemic injury involving more than one-third of the MCA territory, or patients with a history of both stroke and diabetes mellitus.

INR=international normalized ratio; NIHSS=National Institutes of Health Stroke Scale; MCA=middle cerebral artery.

2013 AHA/ASA Recommendations: IV Fibrinolysis (cont.)

IV tPA is reasonable in patients whose blood pressure can be lowered safely (to below 185/110 mm Hg) with antihypertensive agents, with the physician assessing the stability of the blood pressure before starting IV tPA (Class I; Level of Evidence B). (Unchanged from 2007 guideline)

In patients undergoing fibrinolytic therapy, physicians should be aware of and prepared to emergently treat potential side effects, including bleeding complications and angioedema that may cause partial airway obstruction (Class I; Level of Evidence B). (Upgraded from Level of Evidence C)

IV tPA is reasonable in patients with a seizure at the time of onset of stroke if evidence suggests that residual impairments are secondary to stroke and not a postictal phenomenon (Class IIa; Level of Evidence C). (Unchanged from 2007 guideline)

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2013 AHA/ASA Recommendations: IV Fibrinolysis (cont.)

7. The effectiveness of sonothrombolysis for treatment of patients with acute stroke is not well established (Class IIb; Level of Evidence B). *(New recommendation)*

8. The usefulness of IV administration of tenecteplase, reteplase, desmoteplase, urokinase, or other fibrinolytic agents and the IV administration of ancrod or other defibrinogenating agents is not well established, and they should be used only in the setting of a clinical trial (Class IIb; Level of Evidence B). *(Upgraded to Class IIb from Class III)*

9. The effectiveness of IV treatment with tPA is not well established (Class IIb; Level of Evidence C) and requires further study for patients who can be treated in the time period of 3 to 4.5 hours after stroke but have 1 or more of the following exclusion criteria:
   (1) patients >80 years old;
   (2) those taking oral anticoagulants, even with INR ≤1.7;
   (3) those with a baseline NIHSS score >25; or
   (4) those with a history of both stroke and diabetes mellitus.

*(Revised from the 2009 IV tPA Science Advisory)*
10. Use of IV fibrinolysis in patients with conditions of mild stroke deficits, rapidly improving stroke symptoms, major surgery in the preceding 3 months, and recent myocardial infarction may be considered, and potential increased risk should be weighed against the anticipated benefits (Class IIb; Level of Evidence C). These circumstances require further study. (New recommendation)

11. The IV administration of streptokinase for treatment of stroke is not recommended (Class III; Level of Evidence A). (Revised from 2007 guideline)

12. The use of IV tPA in patients taking direct thrombin inhibitors or direct factor Xa inhibitors may be harmful and is not recommended unless sensitive laboratory tests such as aPTT, INR, platelet count, ECT, TT, or appropriate direct factor Xa activity assays are normal, or the patient has not received a dose of these agents for >2 days (assuming normal renal metabolizing function). Similar consideration should be given to patients being considered for intra-arterial tPA (Class III; Level of Evidence C). Further study is required. (New recommendation)

Hypoglycemia (blood glucose <60 mg/dL) should be treated in patients with acute ischemic stroke (Class I; Level of Evidence C). The goal is to achieve normoglycemia. (Revised from the previous guideline)

Evidence indicates that persistent in-hospital hyperglycemia during the first 24 hours after stroke is associated with worse outcomes than normoglycemia, and thus, it is reasonable to treat hyperglycemia to achieve blood glucose levels in a range of 140 to 180 mg/dL and to closely monitor to prevent hypoglycemia in patients with acute ischemic stroke (Class IIa; Level of Evidence C). (Revised from the previous guideline)
2013 AHA/ASA Guidelines on Blood Pressure Management in AIS

General Supportive Care and Treatment of Acute Complications

- Patients who have elevated blood pressure and are otherwise eligible for treatment with intravenous tPA should have their blood pressure carefully lowered so that their systolic blood pressure is <185 mm Hg and their diastolic blood pressure is <110 mm Hg (Class I; Level of Evidence B) before fibrinolytic therapy is initiated. If medications are given to lower blood pressure, the clinician should be sure that the blood pressure is stabilized at the lower level before beginning treatment with intravenous tPA and maintained below 180/105 mm Hg for at least the first 24 hours after intravenous tPA treatment. (*Unchanged from the previous guideline*)

- Until other data become available, consensus exists that the previously described blood pressure recommendations should be followed in patients undergoing other acute interventions to recanalize occluded vessels, including intra-arterial fibrinolysis (Class I; Level of Evidence C). (*Unchanged from the previous guideline*)

- In patients with markedly elevated blood pressure who do not receive fibrinolysis, a reasonable goal is to lower blood pressure by 15% during the first 24 hours after onset of stroke. The level of blood pressure that would mandate such treatment is not known, but consensus exists that medications should be withheld unless the systolic blood pressure is >220 mm Hg or the diastolic blood pressure is >120 mm Hg (Class I; Level of Evidence C). (*Revised from the previous guideline*)
Evidence from one clinical trial indicates that initiation of antihypertensive therapy within 24 hours of stroke is relatively safe. Restarting antihypertensive medications is reasonable after the first 24 hours for patients who have preexisting hypertension and are neurologically stable unless a specific contraindication to restarting treatment is known (Class IIa; Level of Evidence B). *(Revised from the previous guideline)*

No data are available to guide selection of medications for the lowering of blood pressure in the setting of acute ischemic stroke. The antihypertensive medications and doses included in [the table to the right] are reasonable choices based on general consensus (Class IIa; Level of Evidence C). *(Revised from the previous guideline)*

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

- Labetalol 10–20 mg IV over 1–2 minutes, may repeat 1 time; or
- Nicardipine 5 mg/h IV, titrate up by 2.5 mg/h every 5–15 minutes, maximum 15 mg/h; when desired BP reached, adjust to maintain proper BP limits; or
- Other agents (hydralazine, enalaprilat, etc.) may be considered when appropriate

If BP is not maintained at or below 185/110 mm Hg, do not administer tPA

Management of BP during and after tPA or other acute reperfusion therapy to maintain BP at or below 180/105 mm Hg:

- Monitor BP every 15 minutes for 2 hours from the start of tPA therapy, then every 30 minutes for 6 hours, and then every hour for 16 hours

If systolic BP >180–230 mm Hg or diastolic BP >105–120 mmHg:

- Labetalol 10 mg IV followed by continuous IV infusion 2–8 mg/min; or
- Nicardipine 5 mg/h IV, titrate up to desired effect by 2.5 mg/h every 5–15 minutes, maximum 15 mg/h

If BP not controlled or diastolic BP >140 mm Hg, consider IV sodium nitroprusside
The management of arterial hypertension in patients not undergoing reperfusion strategies remains challenging. Data to guide recommendations for treatment are inconclusive or conflicting. Many patients have spontaneous declines in blood pressure during the first 24 hours after onset of stroke. Until more definitive data are available, the benefit of treating arterial hypertension in the setting of acute ischemic stroke is not well established (Class IIb; Level of Evidence C). Patients who have malignant hypertension or other medical indications for aggressive treatment of blood pressure should be treated accordingly. (*Revised from the previous guideline*)
Intravenous Fibrinolysis

- Intravenous tPA is reasonable in patients whose blood pressure can be lowered safely (to below 185/110 mm Hg) with antihypertensive agents, with the physician assessing the stability of the blood pressure before starting intravenous tPA (Class I; Level of Evidence B). *(Unchanged from the previous guideline)*

Treatment of AIS: IV Administration of tPA

- Infuse 0.9 mg/kg (maximum dose 90 mg) over 60 minutes, with 10% of the dose given as a bolus over 1 minute
- Admit the patient to an intensive care or stroke unit for monitoring
- If the patient develops severe headache, acute hypertension, nausea, or vomiting or has a worsening neurological examination, discontinue the infusion (if IV tPA is being administered) and obtain emergent CT scan
- Measure BP and perform neurological assessments every 15 minutes during and after IV tPA infusion for 2 hours, then every 30 minutes for 6 hours, then hourly until 24 hours after IV tPA treatment
- Increase the frequency of BP measurements if systolic BP is >180 mm Hg or if diastolic BP is >105 mm Hg; administer antihypertensive medications to maintain BP at or below these levels (Table 8)
- Delay placement of nasogastric tubes, indwelling bladder catheters, or intra-arterial pressure catheters if the patient can be safely managed without them
- Obtain a follow-up CT or MRI scan at 24 hours after IV tPA before starting anticoagulants or antiplatelet agents

ACEP/AAN Levels of Evidence

**Level A**
- Generally accepted principles for patient management that reflect a high degree of clinical certainty (i.e., based on strength of evidence Class I or overwhelming evidence from strength of evidence Class II studies that directly address all of the issues)

**Level B**
- Recommendations for patient management that may identify a particular strategy or range of management strategies that reflect moderate clinical certainty (i.e., based on strength of evidence Class II studies that directly address the issue, decision analysis that directly addresses the issue, or strong consensus of strength of evidence Class III studies)

**Level C**
- Other strategies for patient management that are based on Class III studies, or in the absence of any adequate, published literature, based on panel consensus
Case
Case

- Next AM: NIHSS 0
- Extubated: was working on iphone while intubated
- Went back to work in 4 days:
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Certificate of Participation

Will be posted on www.heart.org/swaquality within one week of webinar.

Password: STROKE