CASE STUDIES ON ACUTE STROKE TREATMENT

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SCHOOL OF MEDICINE

FINANCIAL DISCLOSURE INFORMATION

- **Research**: NIH
- **Advisory Board**: Coaxia Inc.
- **Speaker**: Sanofi-Aventis, Boehringer Ingelheim, Bristol Myer Squibbs, Genentech.

CASE STUDY 1

80-Year Old Hispanic Woman
Case Study: Presentation

- 80-Year Old Hispanic Woman
- Past Medical History:
  - Hypertension (controlled)
- Medications:
  - Atenolol 50 mg PO bid
  - Clonidine 0.1 mg PO bid
  - Aspirin 325 mg PO qd

<table>
<thead>
<tr>
<th>History and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient’s husband witnessed her develop difficulty ambulating at 9:00 am, and immediately called 911</td>
</tr>
<tr>
<td>Patient was lethargic, but oriented and understood questions upon arrival at a JC-certified stroke center ED</td>
</tr>
<tr>
<td>When asked to stand, the patient could not do so without a 2-person assist</td>
</tr>
</tbody>
</table>

Case Study: Neurologic Assessment and NIHSS Scoring

What are the NIHSS scores assigned to each of the below symptoms?

<table>
<thead>
<tr>
<th>Symptom</th>
<th>NIHSS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alert and oriented</td>
<td>0</td>
</tr>
<tr>
<td>Able to follow commands</td>
<td>0</td>
</tr>
<tr>
<td>Left arm, some effort against gravity</td>
<td>1</td>
</tr>
<tr>
<td>Mild left leg drift/weakness</td>
<td>1</td>
</tr>
<tr>
<td>Sensation and proprioception intact</td>
<td>0</td>
</tr>
<tr>
<td>Symmetric reflexes</td>
<td>0</td>
</tr>
<tr>
<td>Left visual and tactile extinction</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total NIHSS</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

At your facility, who performs the NIHSS assessment?

Case Study: Physical Exam and Laboratory Test Results

<table>
<thead>
<tr>
<th>Physical Exam</th>
<th>Lab Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP = 150/95 mm Hg</td>
<td>INR = 1.1</td>
</tr>
<tr>
<td>Pulse = regular</td>
<td>PT = 19 secs</td>
</tr>
<tr>
<td>12-lead ECG = no acute change</td>
<td>PTT = 33 secs</td>
</tr>
<tr>
<td>General exam = normal</td>
<td>Glucose = 100 mg/dL</td>
</tr>
</tbody>
</table>

CT scan results are now ready for your review
Case Study: CT Scan Results

What does the scan indicate?
A. Intracerebral hemorrhage
B. Major early ischemic changes
C. Hyperdense MCA sign
D. Normal
E. Chronic small vessel ischemic changes

No early ischemic changes noted
Bitemporal, chronic small vessel ischemic changes

Case Study: Diagnosis and Treatment Considerations

Diagnosis
Probable right MCA ischemic stroke causing left side weakness, visual and tactile extinction

All labs within normal limits:
- INR = 1.1
- PTT = 33 secs
- Blood glucose = 100 mg/dL
- BP = 155/90 mm Hg (on medication)
- Left arm and leg weakness has worsened

Total NIHSS = 6
(up from 4 as assessed 45 minutes ago)

Case Study: Treatment

- Just under 2 hrs have elapsed since symptom onset
- Given her deficits and age, do the potential benefits of IV thrombolytic therapy outweigh the potential risks?\textsuperscript{a,b}
- After discussion of the risks and benefits, the patient and her spouse agree to treatment with t-PA
- t-PA administered 2 hours and 10 mins after symptom onset
- t-PA Rx (0.9 mg/kg; not to exceed 90 mg total dose)
  - Weight: 55 kg
  - Total Dose: 49.5 mg
  - Administered 4.9 mg initial IV bolus over 1 min, 44.5 mg over 60 mins

\textsuperscript{a}The safety and efficacy of treatment with t-PA in patients with minor neurological deficit has not been evaluated. Therefore, treatment of patients with minor neurological deficit is not recommended.
\textsuperscript{b}The risks of t-PA therapy may be increased and should be weighed against the anticipated benefits in certain conditions including advanced age (e.g., over 75 years old).
Case Study: Treatment Outcome and Follow-Up

- The patient is stable and transferred to the ICU
- She is monitored closely due to her age-related increased risk of bleeding
- Day 1:
  - Normal strength in left leg
  - Sensory exam is normal
- At hospital discharge:
  - Symptoms have resolved
  - CT scan is negative
  - Neurologic exam is normal
  - mRS = 0

CASE STUDY 2

78-Year Old Caucasian Woman

Case drawn from hypothetical patient. Individual results may vary.

Case Study: Presentation

78 Year-Old Caucasian Woman

Medical History:
- Diabetes mellitus Type II
- Hypertension
- Hyperlipidemia
- Mild ischemic stroke (2 years ago) with full recovery

Medications:
- Metformin, Hydrochlorothiazide, Simvastatin

History and Symptoms
- At 2:30 pm, the patient’s spouse returned home to find his wife on the floor. He last saw her normal when he left for the store at 1:00 pm.
- The patient showed signs of slurred speech, aphasia and paralysis of the right arm and leg. There were no signs of trauma to the patient.
- EMS was contacted and arrived on scene at 2:40 pm. EMS personnel suspected stroke and took the patient to the nearest hospital.
Case Study: Question for Discussion

Is this patient’s history of prior ischemic stroke (2 years ago) a contraindication to treatment with tPA?
A. Yes
B. No

While a history of ICH is a contraindication for treatment with tPA, history of an ischemic stroke occurring >3 months prior is not.

Case Study: Neurologic Assessment and NIHSS Scoring

What total NIHSS score would you approximate based on the patient’s current symptoms?
A. 19
B. 10
C. 8

<table>
<thead>
<tr>
<th>Symptom</th>
<th>NIHSS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awake and alert</td>
<td>0</td>
</tr>
<tr>
<td>Mixed aphasia and unable to follow any commands or make intelligible speech</td>
<td>7</td>
</tr>
<tr>
<td>Dysarthric</td>
<td>2</td>
</tr>
<tr>
<td>Right facial droop and right hemiplegia (arm and leg)</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total NIHSS</strong></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

Case Study: Physical Exam and Laboratory Test Results

<table>
<thead>
<tr>
<th>Physical Exam</th>
<th>Lab Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>• BP = 190/110 mmHg</td>
<td>• INR = 1.1</td>
</tr>
<tr>
<td>• Pulse = regular</td>
<td>• PTT = 29.3 secs</td>
</tr>
<tr>
<td>• Vitals and physical exam are otherwise unremarkable</td>
<td>• Glucose = 200 mg/dL (11.1 mM)</td>
</tr>
</tbody>
</table>

Would you consider this patient’s blood pressure to be a contraindication for tPA treatment?
A. Yes
B. No

*tPA is contraindicated in patients with severe uncontrolled hypertension or when systolic BP >185 mm Hg and/or diastolic BP >110 mm Hg because of an increased risk of bleeding.*
Case Study: Questions for Discussion

- Do you normally wait to get INR results before deciding on a treatment course for a patient suspected of having an acute ischemic stroke?
  A. Yes
  B. No

- Do you normally wait for CBC results before deciding on a treatment course for a patient suspected of having an acute ischemic stroke?
  A. Yes
  B. No

- Given the patient’s age and history, do the potential benefits of IV tPA outweigh the potential risks?
  A. Yes
  B. No

CT scan results are now ready for your review.

Case Study: CT Scan Results

What does the scan indicate?

A. Intracerebral hemorrhage
B. Subarachnoid hemorrhage
C. Hyperdense left MCA sign
D. Ischemic stroke with extensive early ischemic changes

Case Study: Diagnosis and Treatment Considerations

**Diagnosis**

- Ischemic stroke with left hyperdense MCA sign

- Lab values within normal limits
- BP = 190/110 mm Hg
- NIHSS score = 19
- 2 hours and 30 minutes have elapsed since this patient was last seen normal

Would you treat this patient with IV tPA therapy?

- A. Yes
- B. No

*The risks of tPA therapy may be increased and should be weighed against the anticipated benefits in certain conditions including hypertension (systolic BP ≥ 175 mm Hg or diastolic BP ≥ 110 mm Hg) and severe age (e.g., over 75 years old).*
Case Study: Treatment
- Patient has no contraindication to tPA
  - Blood pressure was controlled with an appropriate IV antihypertensive
- After discussion of the risks and benefits, the patient’s spouse agrees to treatment with tPA
- tPA administered 3 hours after the patient was last seen normal
- tPA Rx (0.9 mg/kg - not to exceed 90 mg total dose)
  - Weight: 61 kg
  - Total Dose: 55 mg

What is the recommended dose regimen for this patient?
A. Administer 15 mg initial IV bolus over 1 min, 40 mg over 30 mins
B. Administer 10 mg initial IV bolus over 1 min, 45 mg over 60 mins
C. Administer 5.5 mg initial IV bolus over 1 min, 49.5 mg over 60 mins

Case Study: Treatment Outcome
- Day 1:
  - Approximately 70 minutes after tPA administration, the patient develops acute hypertension, vomiting and decreased level of consciousness
  - A clinical diagnosis of symptomatic ICH is made and confirmed on CT
  - The patient is treated with 5U random donor platelets and 12U cryoprecipitate and stabilizes
  - The BP is treated with labetalol to keep the SBP <185 mmHg
  - The patient is transferred to the ICU
  - 6 hours later, the patient’s NIHSS is 24 but she is stable

Case Study: Question for Discussion
- In this case study, which of the following factors may have contributed to the patient’s increased risk of sICH?
  A. History of cerebrovascular disease
  B. NIHSS score
  C. Hypertension
  D. Advanced age
  E. Hyperglycemia
  F. A and B
  G. C and D
  H. All of the above
Case Study: Follow-Up

- Day 14: Patient is transferred to inpatient rehabilitation with an NIHSS of 16. She requires short-term placement of a percutaneous enteral gastrostomy (PEG) tube.
- Day 14: CT scan indicates a moderate to large left hemisphere ischemic stroke with associated encephalomalacia. There is expected interval resolution of the ICH.
- Day 14: The cause of stroke is found to be paroxysmal atrial fibrillation, and the patient is anticoagulated with warfarin, aiming for a target INR of 2.5.
- Day 90: NIHSS = 11 and mRS = 4.

CASE STUDY 3

67-Year-Old Caucasian Male

Case drawn from an actual patient. Individual results may vary.

Case Study: Presentation

- 67 year old Caucasian male
- Past medical history: Restless leg syndrome and depression
- Medications: Acetaminophen
- Social history: Smoker
- Wife suspects stroke and dials 911

Patient is somnolent, has left facial droop, and weakness in his left arm and leg.
**Clinical Findings**

- Patient's glucose is 47 mg/dL and EMS provides dextrose
- Patient is transported to a JC-certified stroke center
- Stroke team at bedside 80 min after patient last seen normal
- CT scan is initiated with a door-to-CT time of 20 min

<table>
<thead>
<tr>
<th>Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIHSS = 14</td>
</tr>
<tr>
<td>BP = 132/85 mmHg</td>
</tr>
<tr>
<td>Glucose = 92 mg/dL</td>
</tr>
<tr>
<td>Follows 1-step commands</td>
</tr>
<tr>
<td>Moving all 4 limbs, but with rhythmic shaking thought to be a seizure</td>
</tr>
<tr>
<td>Seizure aborted by providing lorazepam and fosphenytoin</td>
</tr>
<tr>
<td>EEG shows no epileptogenic activity, but there is moderate generalized slowing</td>
</tr>
</tbody>
</table>

**CT Scan**

- Interpretation notes no early ischemic change

**Diagnosis and Treatment**

<table>
<thead>
<tr>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoglycemia mimicking stroke and post-ictal transient hemiparesis that resolved with treatment of seizure</td>
</tr>
</tbody>
</table>

- All labs are WNL with glucose=92 mg/dL
- Patient did not receive tPA because he did not have a stroke
Question

What % of your suspected stroke patients have stroke mimics?

- A. Less than 10%
- B. 10% - 20%
- C. 20% - 30%
- D. More than 30%

Post-treatment Outcome and Follow up

- Day 2: MRI confirms patient did not have a stroke
- Day 4: Patient discharged to home

CASE STUDY 4

65-Year Old Caucasian Male

Case drawn from hypothetical patient. Individual results may vary.
### Symptoms & EMS Response

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Notes and Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:08</td>
<td>Onset of ischemic stroke</td>
<td>A single, 65-yr-old Caucasian male smoker, retired painter has sudden onset of horizontal/oblique diplopia, worse on right lateral gaze, vertigo, dizziness, disequilibrium, ataxia, and clumsiness with his limbs.</td>
</tr>
<tr>
<td>08:53</td>
<td>911 call and EMS dispatched</td>
<td>Housekeeper witnesses the man fall and calls 911.</td>
</tr>
<tr>
<td>09:11</td>
<td>EMS on scene</td>
<td>EMS evaluations:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• BP = 144/90 mmHg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pulse = 96 bpm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Respiratory rate 12/minute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Glucose = 112 mg/dL</td>
</tr>
<tr>
<td>09:20</td>
<td>EMS transport</td>
<td>Patient is transported via EMS helicopter to certified primary stroke center (52 miles), bypassing rural community hospital.</td>
</tr>
</tbody>
</table>

### Evaluation & Stroke Code Called

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Notes and Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:45</td>
<td>Patient arrives at hospital</td>
<td>• RN is first responder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Patient provided own history</td>
</tr>
<tr>
<td>10:00</td>
<td>History and medications</td>
<td>Hypertension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coronary artery disease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coronary artery stenting 5 years earlier</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active smoker</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prostate cancer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aspirin 325 mg/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nitroglycerine SL prn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nifedipine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nebulizer use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dutasteride</td>
</tr>
<tr>
<td>10:15</td>
<td>Stroke team contacted</td>
<td>Neurology resident &amp; stroke neurologist arrive within 20 minutes of patient being admitted to ED</td>
</tr>
</tbody>
</table>

### Physical & Neurological Assessment

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Notes and Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:15</td>
<td>Evaluation</td>
<td>• BP = 120/68 mmHg (no meds given)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pulse = 96 bpm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Respiration rate 12/minute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• GCS score = 15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Symptomatic: double vision, headache, ataxia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Meds provided: none</td>
</tr>
<tr>
<td></td>
<td>Neurological assessment</td>
<td>• Right pupil = 3 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Left pupil = 1 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Paralysis right Horner’s syndrome</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Right homonymous dysphagia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dysarthria</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Complete cranial nerve dysfunction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Right oculomotor dyspraxia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Partial intracranial dyspraxia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Global flap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bilateral symmetrical dysfunction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Skew deviation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• NCS = 11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• mRS = 4</td>
</tr>
</tbody>
</table>

The patient’s BP dropped from 144/88 to 120/68 mmHg without intervention. If BP had not decreased, what would have been your course of action?
Imaging

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Notes and Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30</td>
<td>CT scan initiated</td>
<td>Door-to-CT time is 45 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>108 min.</td>
</tr>
<tr>
<td>10:35</td>
<td>CT scan interpreted</td>
<td>No early ischemic change noted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125 min.</td>
</tr>
</tbody>
</table>

Actual: 60 min. Goal: 30 min.

What protocols does your hospital have in place to ensure timeliness of imaging for acute ischemic stroke patients?

Laboratory

<table>
<thead>
<tr>
<th>Findings</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac enzymes: negative</td>
<td>Hbg = 13.6 g/dL</td>
<td>WBC = 7.1 x 10^9/L</td>
</tr>
<tr>
<td>Potassium = 3.6 mEq/L</td>
<td>Sodium = 134 mmol/L</td>
<td>Calcium = 9.0 mg/dL</td>
</tr>
<tr>
<td>Serum creatinine = 0.7 mg/dL</td>
<td>BUN = 10 mg/dL</td>
<td>INR = 1.15</td>
</tr>
<tr>
<td>PTT: 30.8 sec</td>
<td>Serum glucose = 102 mg/dL</td>
<td>ECG: normal sinus rhythm with right bundle branch block</td>
</tr>
</tbody>
</table>

Diagnosis & Treatment Consideration

<table>
<thead>
<tr>
<th>Event</th>
<th>Notes and Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>Acute posterior circulation ischemic stroke syndrome</td>
</tr>
<tr>
<td>TIA eligibility</td>
<td>Patient had no clinical, radiologic, or laboratory contraindications to tPA</td>
</tr>
<tr>
<td>Нес + 0 mmol/L</td>
<td></td>
</tr>
</tbody>
</table>

 Does the patient’s prophylactic use of aspirin affect your treatment decision?
### Treatment

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Notes and Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:20</td>
<td>Treatment decision</td>
<td>• Patient had no clinical, radiological, or laboratory contraindications to tPA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The patient consented to treatment</td>
</tr>
<tr>
<td>11:28</td>
<td>Activase</td>
<td>• Total dose: 68.1 mg (6.8 mg bolus; 61.3 mg infusion) • Door-to-needle time = 103 minutes</td>
</tr>
</tbody>
</table>

### NIH-Recommended ED Response Times

The “Golden Hour” comparison chart

65-yr-old Caucasian male

- Suspected stroke patient arrives at ED
- 45 Min CT & labs interpreted
- 60 Min tPA given if patient is eligible
- 10 Min Initial MD evaluation
- 15 Min Stroke team notified
- 25 Min CT scan initiated
- Patient eligible, tPA administered

- Recommended Door-to-needle ≤ 60 min
- Actual Door-to-needle ≤ 60 min

### Post-treatment Outcome and Follow-up

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Notes and Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 2</td>
<td>Status</td>
<td>• NIHSS = 1 • Left-sided finger-to-nose dysmetria</td>
</tr>
<tr>
<td>Day 2</td>
<td>TTE</td>
<td>Transoesophageal echocardiography: • LVEF = 65% • No intracardiac thrombus</td>
</tr>
<tr>
<td>Day 2</td>
<td>CT</td>
<td>Negative</td>
</tr>
<tr>
<td>Day 3</td>
<td>Discharge</td>
<td>• NIHSS = 0 • Patient made a full recovery and has returned to recreational painting</td>
</tr>
</tbody>
</table>
**Follow-up CT Scan Post Thrombolysis**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 2</td>
<td>CT scan</td>
<td>No definitive infarction identified in brainstem, cerebellum, or occipital lobes</td>
</tr>
</tbody>
</table>

**NIH-Recommended ED Response Times**

The “golden hour” for evaluating and treating acute stroke

- Door-to-needle time ≤ 60 min

**CASE STUDY-5**

62 Year Old Caucasian Female
Case Study: Presentation

- 62 year old Caucasian female
- Past medical history: CV disease
- Medications: Propafenone, atenolol, aspirin
- Social history: Non-smoker

<table>
<thead>
<tr>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient experiences an acute onset of slurred speech, left facial droop, and paralysis of the left arm and leg at a wedding reception</td>
</tr>
</tbody>
</table>

- An unidentified caller dials 911
- Patient is transported to a JC-certified stroke center

Question

- Does the patient’s use of aspirin affect your treatment decision?
  - A. Yes
  - B. No

Clinical Findings

- Stroke team is at bedside 26 min after patient last seen normal
- Labs are ordered 10 min after stroke team arrival
- CT scan is initiated with a door-to-CT time < 30 min

<table>
<thead>
<tr>
<th>Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIHSS = 14</td>
</tr>
<tr>
<td>BP = 165/104 and 178/109 mmHg (labetalol 20 mg IV administered and BP decreased to 155/95 mm Hg)</td>
</tr>
<tr>
<td>Weight = 75.5 kg</td>
</tr>
<tr>
<td>Left homonymous hemianopsia</td>
</tr>
<tr>
<td>Dysarthria</td>
</tr>
<tr>
<td>Strength: 0/5 left arm, 2/5 left leg</td>
</tr>
</tbody>
</table>
Question

What is the appropriate blood pressure for patients to remain eligible for tPA treatment?

- A. <185/105 mm Hg
- B. <185/110 mm Hg
- C. <175/110 mm Hg
- D. <175/100 mm Hg

CT Scan Results

- Aspect 8/10; early ischemic changes in right insular ribbon and right lentiform nucleus; no hemorrhage
- CT perfusion study showed blood flow decrement exceeding blood volume in anterior right MCA territory; ischemic penumbra existed

Question

In addition to baseline CT, do you commonly perform a CT angio/CT perfusion or MRI before determining whether to treat with tPA?

- A. Yes
- B. No
Diagnosis and Treatment

**Diagnosis**

Hyperacute right MCA territory ischemic stroke; likely cardioembolic

- All labs are WNL including INR=1.12, PTT=29.3 sec, glucose=127 mg/dL
- Patient has no contraindication to tPA
- tPA administered with a door-to-needle time of 47 min

Post-treatment Outcome and Follow up

- **Day 1**: NIHSS = 14 and CT is unchanged
- **Day 3**: NIHSS = 18 and symptomatic sICH with somnolence and worsening hemiparesis
  - No surgical intervention or intubation is necessary
  - Patient is stabilized and monitored closely

Post-treatment Outcome and Follow-up

- **Day 13**: NIHSS = 16 and patient is transferred to inpatient rehabilitation unit
- **Day 24**: CT confirms hemorrhage is resolved
- **Day 30**: Patient is discharged to home
- **Day 90**: NIHSS = 11 and mRS = 4
Case Study:
Presentation

- 50-Year Old African American Man
- Past Medical History:
  - Hyperlipidemia
- Family History
  - Family history of CVD/CHF
- Medications:
  - Atorvastatin 20 mg

History and Symptoms

- At 9:00pm, patient experienced a witnessed, sudden onset of slurred speech, left-sided facial droop and left upper and lower extremity paralysis while watching television with his family.
- EMS was notified and arrived at 9:15pm; patient was taken to the nearest hospital.
- The local hospital did not have on-site stroke/neurology expertise but was a part of a telemedicine network.

Case Study:
Neurologic Assessment and NIHSS Scoring

What total NIHSS score would you approximate based on the patient’s current symptoms?

A. 12
B. 18
C. 8

<table>
<thead>
<tr>
<th>Symptom</th>
<th>NIHSS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal language function</td>
<td>0</td>
</tr>
<tr>
<td>Partial gaze deviation to the right</td>
<td>1</td>
</tr>
<tr>
<td>Left hemispatial visual and sensory neglect</td>
<td>2</td>
</tr>
<tr>
<td>Mild dysarthria</td>
<td>1</td>
</tr>
<tr>
<td>Left facial droop</td>
<td>2</td>
</tr>
<tr>
<td>Left arm plegia but good strength in the leg</td>
<td>5</td>
</tr>
<tr>
<td>Mild left sensory disturbance in the arm</td>
<td>1</td>
</tr>
<tr>
<td>No ataxia</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total NIHSS</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>
**Case Study: Physical Exam and Laboratory Test Results**

<table>
<thead>
<tr>
<th>Physical Exam</th>
<th>Lab Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>• BP = 142/88 mm Hg</td>
<td>• INR = 1.0</td>
</tr>
<tr>
<td>• Pulse = regular</td>
<td>• PTT = 29.3 secs</td>
</tr>
<tr>
<td>• General exam = normal</td>
<td>• Glucose = 110 mg/dL (6.1 mM)</td>
</tr>
</tbody>
</table>

At what point should the local hospital call the stroke/neurology expert within their telemedicine network?
A. As soon as the patient arrives and stroke is suspected
B. After the initial patient evaluation is completed
C. After the CT scan has been read by the on-site radiologist

**Case Study: CT Scan Results**

What do the CT scans indicate?
A. Intracerebral hemorrhage
B. Normal head CT with minor early infarct signs (eg, hypodensity <1/3 MCA]
C. Major early infarct signs (eg, hypodensity >1/3 MCA]
D. Hyperdense MCA sign

**Case Study: Diagnosis and Treatment Considerations**

<table>
<thead>
<tr>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right MCA ischemic stroke</td>
</tr>
</tbody>
</table>

- BP = 142/88 mm Hg
- Labs are within normal limits
- 1 hour and 30 minutes have elapsed since symptom onset

Would you treat this patient with IV tPA therapy?
A. Yes
B. No
**Case Study: Questions for Discussion**

- What key information does the stroke/neurology expert need to know (via telephone) prior to ordering administration of tPA?
  - A. Patient age, history and symptoms
  - B. Definite time of onset
  - C. Patient vitals/physical exam/NHSS score
  - D. Lab results (INR, platelets, glucose)
  - E. CT scan interpretation
  - F. All of the above

- Should the local treating physician begin IV tPA therapy even though the patient will be transferred immediately to a stroke center?
  - A. Yes
  - B. No

**Case Study: Treatment**

- Patient has no contraindication to tPA
  - After discussion of the risks and benefits, the patient agrees to treatment with tPA
  - tPA administered 2 hours and 10 minutes after symptom onset
  - tPA Rx (0.9 mg/kg - not to exceed 90 mg total dose)
    - Weight: 81.1 kg
    - Total Dose: 73 mg
  - Patient was then immediately transferred by ambulance to the telemedicine receiving stroke center
  - Do your average treatment times differ between transferred patients and non-transferred patients?
    - A. Yes
    - B. No

**Case Study: Treatment Outcome**

- Over the subsequent 36 hours, the patient had:
  - some movement in his left arm and leg
  - persistent left facial weakness
  - improving hemispatial neglect
  - NIHSS = 7
- Follow-up MRI shows a right MCA infarct
**Case Study: Follow-Up**

Day 30: Patient entered in-patient rehabilitation and made good progress with physical and occupational therapy; mRS = 3

Day 90: Patient was discharged to home with mild leg weakness and good arm strength; mRS = 2

The referring hospital’s emergency department director contacted the stroke center to follow-up on the patient’s outcome.

Does your hospital/center provide feedback to EMS or ED physicians regarding patient outcomes?

A. Yes

B. No

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**CASE STUDY-7**

31-Year Old Caucasian Man brought in 4 hours 30 minutes from onset of slurred speech, stuporous, dysconjugate gaze

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**Treatments for Ischemic Stroke**

<table>
<thead>
<tr>
<th>Time</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3 Hours (FDA approved)</td>
<td>Clot buster</td>
</tr>
<tr>
<td>3-4.5 Hours (Off-label)</td>
<td></td>
</tr>
<tr>
<td>&lt;8 Hours (FDA approved)</td>
<td>MERCI</td>
</tr>
<tr>
<td>BA thrombosis (&lt;24 hours compassionate)</td>
<td>PENUMBRA</td>
</tr>
<tr>
<td>IA TPA (Off-label)</td>
<td></td>
</tr>
</tbody>
</table>
Pooled analysis of ATLANTIS, ECAS I & II, and NINDS t-PA trials
(Lancet 2004; 363: 768-74)

Baseline Case Study
31 year old male
Baseline NIHSS Score – 10
Symptom Onset to Treatment – 4h 30min

NIHSSS 24 hours 0
30 days 0
mRS 90 days 0
Acute Stroke Treatment Algorithm

Acute Ischemic Stroke <8 h
BA Thrombosis <24 h

<3 h or 3-4.5 h
IV TPA started locally
• 3-4.5 h (off-label)
• Transfer for monitoring
• "Drip and ship"

Outside Hospital
1. AIR TRANSFER
2. GROUND TRANSFER
3. TELEMEDICINE

<6 h non-IV TPA

IV TPA failure

• NIHSS ≥ 4
• Large vessel stroke
• Clinical OR Radiological
• Consent (pt. or NOK)
• Transfer for possible:
  • IA TPA (off-label)
  • MERCi
  • PENUMBRA
  • Others

THANK YOU!