



THE UNIVERSITY OF KANSAS HEALTH SYSTEM

Acute Complications of Ischemic Stroke

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Objectives

- Recognize acute complications of ischemic stroke
- Identify which patients with acute ischemic stroke require intensive neuro-monitoring
- Learn about the management of the acute complications of ischemic stroke

Disclosures

- None

Outline

- Complications associated with acute reperfusion therapy
 - Orolingual angioedema
 - Symptomatic Intracranial hemorrhage
- Malignant cerebral edema
- Venous thromboembolism
- Dysphagia
- Infection

Orolingual edema

Orolingual angioedema

- Incidence: 1 to 8% of patient receiving IVtPA
- Usually mild and transient
- Increased risk in:
 - patients taking ACE inhibitors
 - stroke location in the frontal/ insular cortex
- Timing: Angioedema and anaphylaxis upto 2 hours after IVrtPA infusion, swelling can develop over several hours



West J Emerg Med. 2015 Jan; 16(1): 175–177
Ann Indian Acad Neurol 2008 Jul-Sep; 11(3): 199

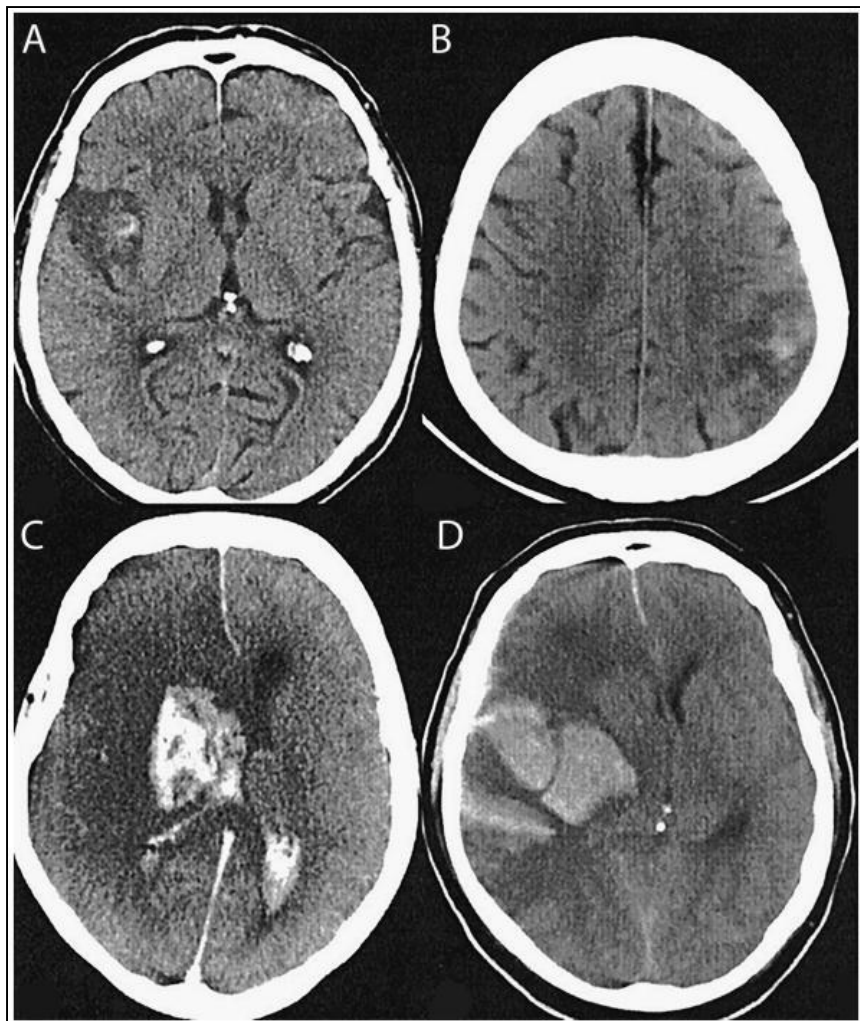
Treatment: Orolingual angioedema

- Milder reactions can be closely monitored without stopping infusion
- Severe angioedema, laryngospasm, hypotension
 - immediate stoppage of infusion
 - IV antihistamines (H1 + H2 blocker). Eg: IV diphenhydramine 50 mg + IV ranitidine 50 mg
 - IV corticosteroids. Eg: IV dexamethasone 10 mg
 - Epinephrine 0.3 mg IM epinephrine
 - Endotracheal intubation as clinically indicated

Symptomatic Intracranial Hemorrhage

Symptomatic Intracranial Hemorrhage

- Hemorrhage seen on CT within 36 hours of treatment and deemed temporally related to neurological decline
- Incidence: 6% of patients receiving IVrtPA
- Usually occur within first 24 hours



Parenchymal hematomas > 30% of the infarct volume are associated with increased risk of early deterioration and mortality

Risk factors

- Higher stroke severity
- Heart disease: CHF, Ischemic heart disease, Atrial fibrillation
- Diabetes mellitus
- Renal failure
- Hypertension in the first 24 hours
- Preceding antithrombotic use
- Thrombocytopenia
- Chronic white matter disease
- Persistent arterial occlusion after IV rtPA infusion

Case 1

- 53 y/o M with history of atrial fibrillation with right sided weakness and facial droop
- IVtPA administered



Case 1

- 8 hours later, sudden decline in mental status



Evaluation and Treatment

- Post treatment protocol: keep SBP < 185 mmHg using IV anti-hypertensives if needed
- If suspected, STOP thrombolytic agent
- If confirmed on imaging, SBP may be managed in accordance with existing ICH guidelines (SBP < 140-160)

- Reversal of tPA may be attempted before considering surgical hematoma evacuation:
 - Cryoprecipitate 10 units
 - Check fibrinogen level after reversal. If level < 150 mg/dl, additional cryoprecipitate can be given
 - Alternatively, IV tranexamic acid 10 mg/kg OR IV aminocaproic acid 5 g
 - Unclear efficacy of PCC, fibrinogen, platelets, FFP

Case 1

- Emergent surgical evacuation of hematoma was performed



Malignant cerebral edema

Malignant cerebral edema

- Incidence: 5-10% of ischemic stroke patients
- Neurologic deterioration often observed between 72 to 96 hours
- Symptoms usually result from tissue swelling and shift of the thalamus and brainstem
 - Increased somnolence
 - Pupillary changes
 - Worsened motor function

[AH]



[PF]

Day 1

[A]



[P]

Day 2

[A]



[P]

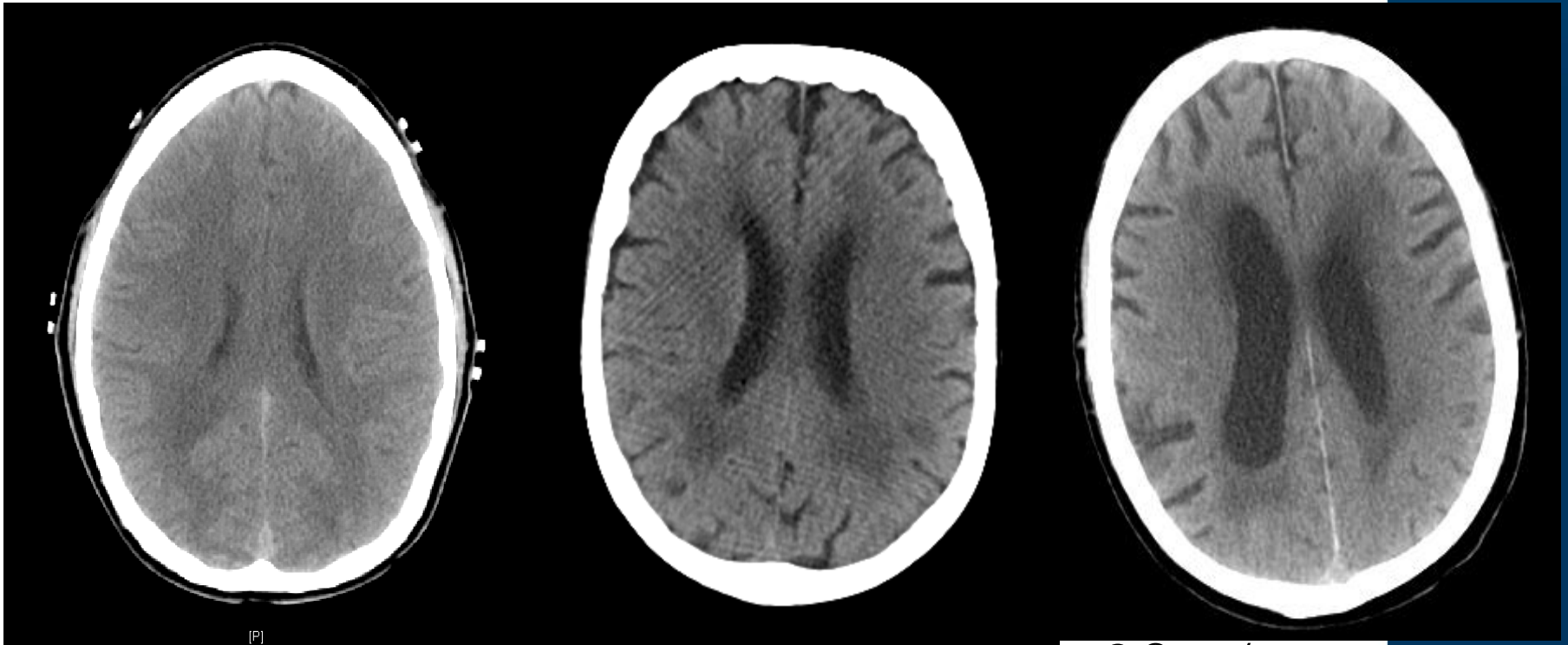
Day 3

- Anticipating high risk patients is important for appropriate triage
- Surveillance at a center with neurologic critical care and neurosurgery is recommended (AHA Class 1, Level C)

Risk factors

- Large vessel occlusion of the terminal carotid or proximal middle cerebral artery
- Large infarct volume ($> 1/3$ of the MCA territory)
- Head CT with frank hypodensity within 6 hours of stroke onset
- Midline shift of 5 mm or more in the first 2 days

Brain atrophy may be protective



19 y/o

76 y/o

90 y/o

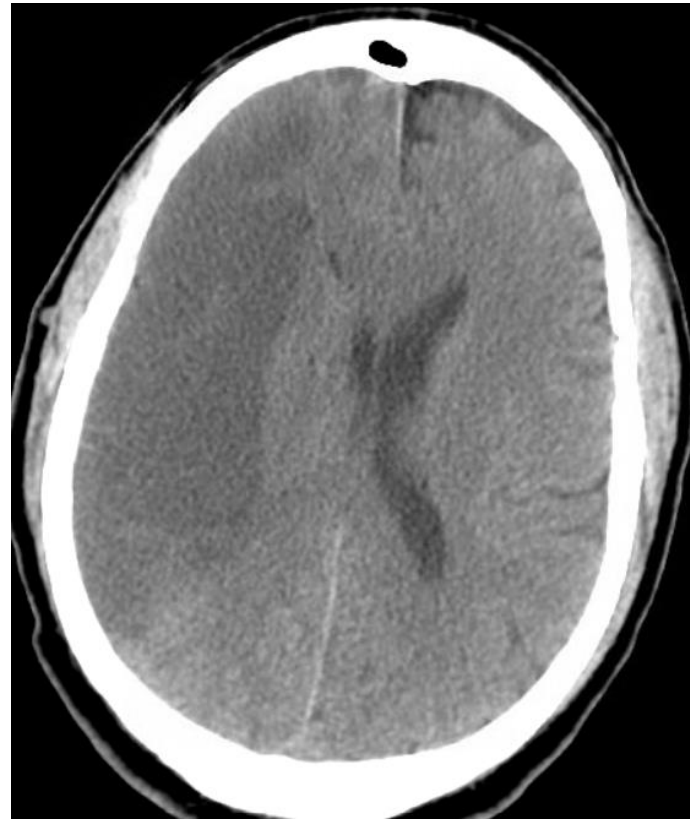
Case 2

- 53 year old male who was found down at home, noted to have left sided weakness



Case 3

- 67 year old male presented with left sided weakness and decreased responsiveness



Management

- Assess airway and consider intubation
- Avoid secondary brain injury from hypoglycemia (goal 140-180 mg/dl) and hypotension
- Maintain normothermia
- Avoid hypercarbia
- Correct hyponatremia

Osmotherapy

- Indicated in patients with clinical or radiographic evidence of swelling
- Mannitol: 0.5 – 1 g/kg IV every 4-6 hours
 - Goal serum osmolarity 310-320 mOsm/L
 - Potential renal toxicity and exacerbation of hypovolemia
- Hypertonic saline (3%, 7.5%, 23.4%)
 - Goal serum sodium 150-155 mEq/l
 - Potential volume overload

Neurosurgical management

- Pooled analysis of 3 RCTs (DECIMAL, DESTINY, HAMLET) of patients aged < 60 years
- Reduced mortality (NNT 2) and increased survival with a modified Rankin Scale of 3 or less (NNT 4)
- No patients had complete freedom from disability

Neurosurgical management

- Early discussions should take place with the care team and patient's decision maker
- “.....Clinicians may discuss with family members that a third of the patients with massive hemispheric infarctions, even after decompressive craniectomy, are severely disabled and fully dependent on care.....”
- “.....The remaining two thirds have potential for recovery after rehabilitation.....”

AHA recommendations 2014

Case 2

- Hypertonic saline 3% solution infused and sodium raised to 158 mmol/L
- Family declined possible surgical intervention
- Continued to have neurological deterioration, loss of brainstem reflexes
- Progressed to brain death on day 2



Case 3

- Hypertonic saline 3% infused and sodium increased to 153
- Neurosurgical consultation: patient and family agreed to hemicraniectomy if needed

Day 3



Day 5



Case 3

- No further decline until day 6 after weaning of 3%
- Transferred out of ICU

Decompressive hemicraniectomy: take home message

- Discussion with family and medical decision makers should include realistic expectations for level of disability following surgery
- Patients < 60 y who deteriorate within 48 hours due to malignant cerebral edema despite medical management should be considered for decompressive hemicraniectomy
- Patients > 60 y, careful selection of those with excellent prior baseline function and few or no major comorbidities can be considered

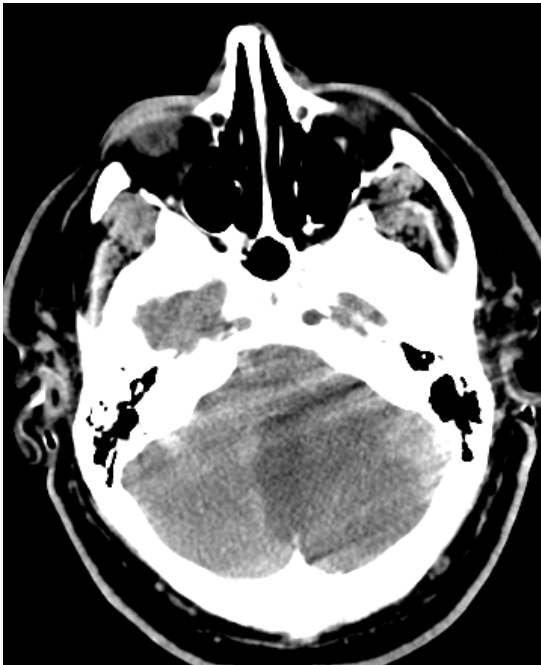
Case 4

- 61 year old man developed sudden onset dizziness, imbalance and nausea



Case 4

- On day 3, he was increasingly somnolent and confused



Case 4

- “Ventriculostomy is recommended in obstructive hydrocephalus after a cerebellar infarct but should be followed or accompanied by decompressive craniectomy....” AHA recommendation 2014
- An External Ventricular Drain (EVD) was placed
- Exam improved to baseline on day 4



Venous thromboembolism

Venous Thromboembolism

- DVT incidence 11% to 15% in the first month. Peak incidence between Day 2 to Day 7 post stroke.
- Half of patients with symptomatic proximal DVT can develop pulmonary embolism.
- 13% to 25% of early deaths after stroke are due to pulmonary embolism. Most commonly encountered between Day 14 to Day 28.

Prophylaxis

- Early mobilization is encouraged in patients who can tolerate activity
- In patients with ischemic stroke with impaired mobility, chemical DVT prophylaxis should be initiated at time of presentation if they do not receive thrombolytic therapy
- LMWH superior to UFH in DVT prevention without increased risk for hemorrhage

Prophylaxis: special considerations

- **In patients receiving IV rtPA**, initiation of heparin prophylaxis is delayed until 24 hours
- **In patients presenting with ICH**, pneumatic compression devices on day 1. Once cessation of bleeding is confirmed, chemical prophylaxis day 2-4
- **Contraindications to heparin use**, intermittent pneumatic compression devices have been shown to be effective
- **Contraindication to compression device**, aspirin is a reasonable alternative

VTE treatment





- Therapeutic anticoagulation is recommended in patients found to have a symptomatic proximal DVT
- Risks of anticoagulation: hemorrhagic transformation, hematoma expansion or recurrence, extracranial hemorrhage
- Risk factors for bleeding: Age, stroke size, renal failure, leukocytosis, hyperglycemia

Dysphagia

Dysphagia

- Formal dysphagia screening protocol with a water swallow test significantly reduces risk of aspiration pneumonia
- Early placement of NG/ND tube significantly reduces risk for death

Dysphagia screen

<p>THE UNIVERSITY OF KANSAS HOSPITAL KUMED 3901 Rainbow Boulevard Kansas City, Kansas 66160 STROKE DYSPHAGIA SCREENING</p>	<p>DO NOT WRITE IN THIS BOX</p> <p>(Bar code)</p>	<p>PATIENT LABEL</p>
<p>Complete prior to any oral intake, including oral meds</p>		
Response		Response
<p>PART I. Admitting diagnosis and past medical history.</p> <p>Swallow eval already ordered by physician? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Suspected Brainstem CVA? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Suspected Bilateral CVA? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Modified diet/liquids before admission? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Aspiration pneumonia? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Dementia/confusion? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Slurred speech? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>History of stroke with swallowing difficulty? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p> If any of the above responses are Yes, STOP the screening and make patient NPO (including meds). Please ask physician to order a formal swallow evaluation by speech-language pathology in order entry.</p>	<p>PART II. Patient evaluation</p> <p>Is the patient alert and able to follow directions? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Is the patient able to be positioned upright? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Is the patient able to cough on request? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Is the patient able to manage saliva (no drooling)? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Is the patient's vocal quality dry (not wet/gurgly)? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p> If any of the above responses are No, STOP the screening and make patient NPO (including meds). Please ask physician to order a formal swallow evaluation by speech-language pathology in order entry.</p>	
<p>PART III. Swallow screen</p> <p>Have the patient swallow the following water amounts without a straw, then ask him/her to say "ah" after each swallow.</p> <p>DOES THE PATIENT HAVE ANY COUGHING, CHOKING, THROAT CLEARING, or a WET/GURGLY VOICE AFTER:</p> <p>1 tsp of water? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>1 ounce of water? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>3 ounces of water? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Did the patient have any coughing, choking, throat clearing, or a wet/gurgly voice 1 minute after any of the water presentations? Yes No <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p> If any of the above responses are Yes, STOP the screening and make patient NPO (including meds). Please ask physician to order a formal swallow evaluation by speech-language pathology in order entry.</p>		
<p> If the patient successfully completes all portions of the screen, a diet may be ordered. The patient's first meal should be supervised. If any change noted in patient's medical or neurologic status, please re-administer the screen.</p>		
<p>Evaluated by: _____ Date: _____ Time: _____</p>		

Infection

Infection

- Most common cause of fever in the first 48 hours after acute stroke is pneumonia
 - Early mobilization and good pulmonary care reduce chances of aspiration, atelectasis
- UTIs occur in 11% to 15% of patients, usually in the first 5 days, up to 3 months. Independent predictor of worse outcomes and prolonged hospitalizations
 - Avoidance or early removal of catheters reduces risk

Key points

- Anticipating risk
- Close neuromonitoring
- Early intervention

Bibliography

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