Anesthesia for Endovascular Treatment of Acute Ischemic Stroke

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Disclosures

I have nothing to disclose.

Acute Ischemic Stroke

- 780,000 per year in USA
  - Fourth leading cause of death
  - Leading cause of chronic disability
  - Costing >$56 billion

Acute Stroke = Medical Emergency!

- Every “MINUTE” destroy
  - 1.9 million neurons
  - 830 billion synapses
  - 12 km of myelinated fibers

- Time to recanalization
  - Survival
  - Neurologic outcome
Stroke is Treatable

- Intracarotid injection of plasmin
- CT scan of the brain widely available
- ECASS-I & NINDS trial of IV t-PA published

1996
- IV t-PA approved for ischemic stroke < 3 hours
- MRI/A, perfusion/diffusion imaging in acute stroke
- PROACT-I: first prospective, randomized IA trial (pro-UK)
- IMS (IV+IA t-PA) “Bridging” trial; other device trials
- CT Angiography, CT Perfusion widely available
- Concentric Merci Retriever receives FDA approval
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IV tissue Plasminogen Activator (t-PA)

- First line therapy
- Rapid start

- Limits:
  - <10% meet current eligibility
  - Resistance to fibrinolysis
  - Risks of hemorrhage

Endovascular Therapies

- An option for patients
  - not eligible for IV tPA
  - no sufficient improvement after IV tPA
  - unlikely to improve with IV tPA alone
- Up to 50% acute stroke due to large vessel occlusion

Neurointerventional Radiology

- Fluoroscopically guided
- Transfemoral arterial catheterization
- Diagnostic cerebral angiograms
- Endovascular treatment
Endovascular Therapies

- Targeted delivery of thrombolytic drugs
- Mechanical manipulation of clots

Limitations of Endovascular Therapy

- Delay in initiation of treatment
- Difficulty navigating the catheter
- Damage to the arterial wall
- Fragmentation and distal embolization
- Systemic and cerebral hemorrhage
- Risks with anesthesia?

“Conscious Sedation”

- Reduce “delays” in treatment
- Allows intra-procedure neurologic assessment
- Avoids hemodynamic perturbation

Limits:
- Oversedation
- Airway obstruction
- Aspiration
- Compromised ventilation
- Patient movement
- Patient discomfort
General Anesthesia

- Protects the Airway
- Optimizes operating conditions
  - Immobility: higher-quality images
  - Facilitates navigation into small vessels
  - Relieves pain and agitation
- Control of physiology: CO₂, Hemodynamics

Limits:
- longer procedure time
- delayed recanalization
- Hemodynamic swings

Anesthesia??

Neurointerventionalists: most prefer GA

Conscious Sedation Versus General Anesthesia During Endovascular Therapy for Acute Anterior Circulation Stroke

- Retrospective, multi-center trial, 980 patients anterior circulation acute ischemic strokes
  - 68% successful recanalization
  - 48% received GA


General Anesthesia versus Sedation

Retrospective chart review of 96 patients with acute strokes presenting for interventions

- 48 patients: GA
- 48 patients: local anesthesia


Extremes of blood pressure

Baseline systolic blood pressure (mmHg)

Blood pressure or End Tidal Carbon dioxide

Association of Intraprocedural Blood Pressure and End Tidal Carbon Dioxide with Outcome After Acute Stroke Intervention

- Retrospective, chart review, 86 patients,
- Single institution


American Heart Association Guidelines

- “The management of arterial hypertension remains controversial... Until more definitive data are available, it is generally agreed that a cautious approach to the treatment of arterial hypertension should be recommended” (Class I, Level of Evidence C)."
- “Patients who have elevated blood pressure and are otherwise eligible for treatment of rtPA may have their blood pressure 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 lytic therapy is started.”
- “It is generally agreed that the cause of arterial hypotension in the setting of acute stroke should be sought. Hypovolemia should be corrected with normal saline, and cardiac arrhythmias that might be reducing cardiac output should be corrected (Class I, Level of Evidence C).”


Blood pressure or End Tidal Carbon dioxide

- BP decreased, but did not correlate with patient outcome.
- Decreases in ETCO2 at 30 and 60 min were associated with 90-day mRS.


Society of Neuroscience for Anesthesia and Critical Care Consensus Statement

- Hemodynamic monitoring and management start early
- SBP >140 mmHg, < 180 mmHg
- Investigate cause of hypotension
- Adjust SBP following recanalization
- Maintain normocarbia PaCO2 35 ~ 45 mmHg
Acute Ischemic Stroke

“Decision points”

- Treatment: IV tPA vs Endovascular
- Anesthesia:
  - Communication
  - Provider
  - Sedation vs GA
  - Pharmacological agents
  - Hemodynamic targets
  - Ventilation target range

- Disaster preparedness

Intra-procedure complications

Cerebral arterial perforation
(Symptomatic intracranial hemorrhage: 1.5 ~ 15%)

- Communicate and confirm
- Reversal of anti-coagulation: protamine, tPA
- Monitor for Cushing response: HR, BP, ICP
- Maintain cerebral perfusion (MAP – ICP)
- Ventriculostomy
- CT scan

Anesthesia disasters

- Patient movement / intolerance
- Deteriorated mental status
- Aspiration / loss of airway
- Hemodynamic instability

Good outcome (mRS 0 to 2)
Mortality at 90 days
ICH at 30 hours after IV tPA
Alive without disability at 90 days

Intra-procedure complications

? tPA ?

- Amicar 5 g in 20 min
- Fibrinogen <100mg/ml → 0.15u/kg
- Platelets <150K → 1 u
  <100K → 2 u
- Repeat levels

Intra-procedure complications

Clot propagation
- Communication
- Hemodynamic goals
- Endovascular treatment

Acute Ischemic Stroke

“Time is Brain”
“Physiology is Brain”

Thank You!

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