Stroke - Intracranial hemorrhage

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Etiology and pathogenesis

- ICH accounts for ~10% of all strokes
- 30 day mortality - 35–45%
- Incidence rates higher in Asians

MAJOR CAUSES

- Hypertension
- Coagulopathy
- Sympathomimetic drugs (cocaine, methamphetamine)
- Cerebral amyloid angiopathy

Other Etiologies

- Advanced age
- Heavy alcohol consumption
- Atherosclerosis
- Bleeding tendency (hemophilia, etc)
- Congenital angiomatous malformation
- Amyloid
- Trauma
- Aneurysm
- Tumor
- Vasculitis (PAN / SLE)

Hypertensive ICH

- ICH usually results from spontaneous rupture of a small penetrating artery deep in the brain.
- The most common sites are

  Basal ganglia (50%)

  Lobar regions (20-50%)

  Thalamus (10-15%)

  Pons (5-12%)

  Cerebellum (1-5%)

Clinical features

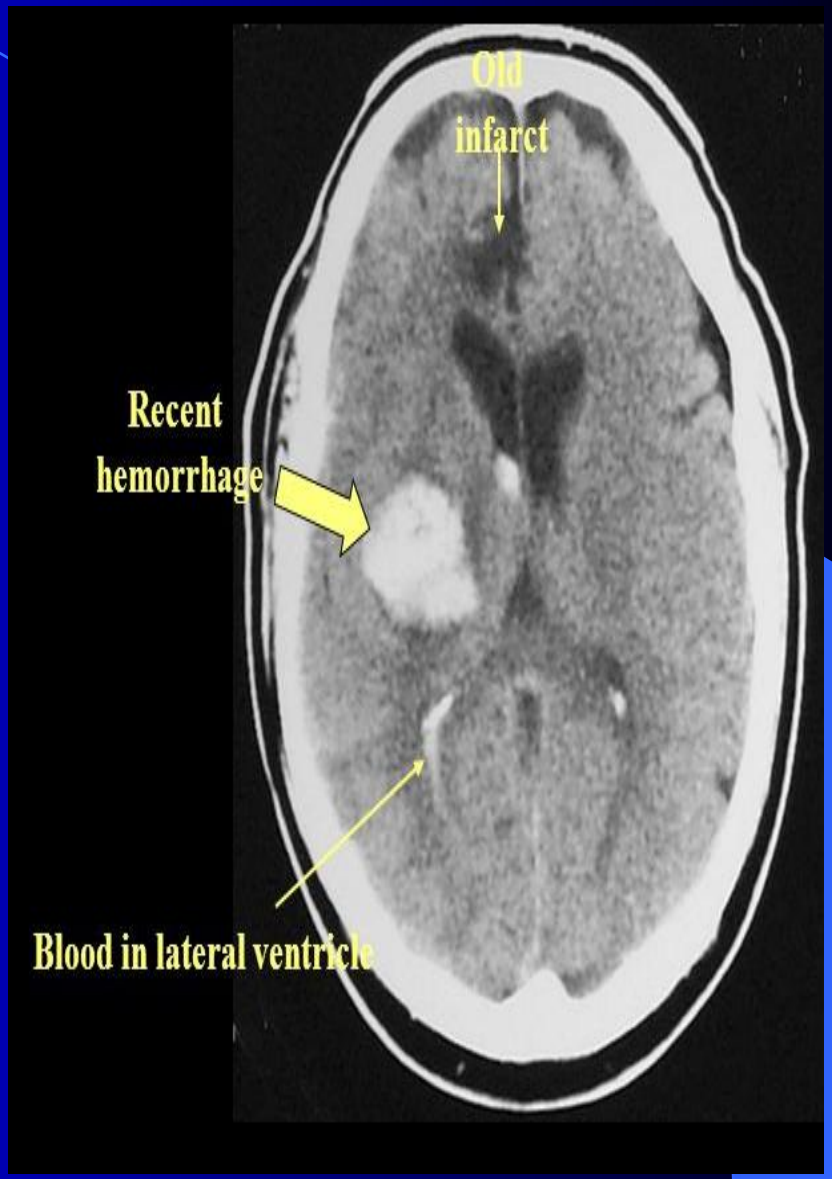
- Abrupt onset of focal neurologic deficit
- Seizures are uncommon
- Clinical symptoms may be maximal at onset
- Diminishing level of consciousness
- Signs of increased ICP such as headache and vomiting
- Focal neurological deficits depending on the location of bleed

Lobar hemorrhage

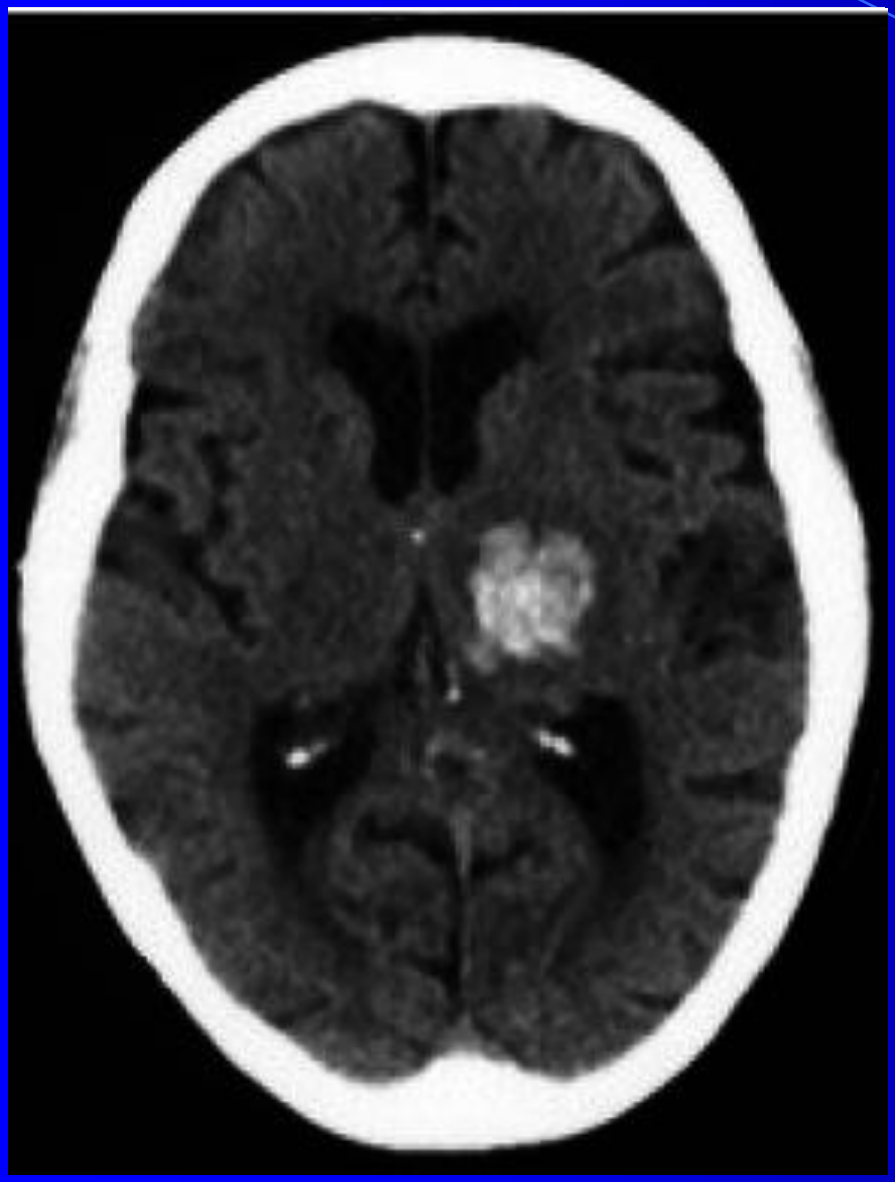
- Penetrating cortical branches of ACA, MCA, & PCA
- Major neurologic deficit
- Occipital hemorrhage - hemianopia
- Left temporal hemorrhage - aphasia and delirium
- Parietal hemorrhage - hemisensory loss
- Frontal hemorrhage - arm weakness
- Large hemorrhages - stupor or coma

Basal ganglia

- Ascending lenticulostriate branches of MCA
- Wide spectrum of severity extending to coma and decerebrate rigidity
- Contralateral hemiplegia, hemianesthesia, and hemianopia
- Eyes are frequently deviated toward the side of the affected hemisphere
- Aphasia if dominant hemisphere is affected
- Ventricular extension carries very poor prognosis



Thalamus



- Ascending thalamogeniculate branches of PCA
- Contralateral hemiplegia, hemianesthesia, and hemianopia
- Deep sensation disturbance
- Ocular signs
- Disturbance of consciousness
- Patients may later develop a chronic, contralateral pain syndrome (Déjérine-Roussy syndrome)
- Abrupt hydrocephalus from aqueductal obstruction from intraventricular clot

Pons

- Paramedian branches of the basilar artery
- Bilateral carries very poor prognosis (coma, quadriplegia, decerebrate posturing, horizontal ophthalmoplegia, pinpoint reactive pupils)

Mild: crossed paralysis

Hyperpnea, severe hypertension, hyperhidrosis are common.

Cerebellum

- Penetrating branches of the PICA, AICA, SCA
- Abrupt onset vertigo, inability to walk in absence of weakness
- Ipsilateral ataxia, horizontal gaze palsy, peripheral facial palsy
- Unpredictable deterioration to coma
- Occipital headache, nystagmus
- Severe cerebellar hemorrhage : coma, compression of brain stem, tonsillar herniation

Other causes

- Anticoagulant related - may continue over 24–48 h
- Hematologic disorders (leukemia, aplastic anemia, thrombocytopenic purpura) - any site, multiple
- Metastatic tumors - Choriocarcinoma, malignant melanoma, renal cell carcinoma, bronchogenic carcinoma
- Cerebral amyloid angiopathy – MC cause in elderly, multiple hemorrhages (& infarcts) over several months or years

Investigation

1. CT
   - First choice
   - High density blood
   - Mass effect and edema

2. MRI
   - Brain stem hemorrhage
   - <24h, not distinguishable with thrombosis

3. DSA
   - Young and with normal blood pressure

4. Platelet count and PT//INR – coagulopathy

Management principals

- Nursing
- Maintain electrolytes and fluid balance
- Control hypertension
- Reduce ICP
- Prevent complications (infection / DVT / etc)
- Prevent fever / seizures
- Timely surgical intervention

BP Management

- BP is elevated on admission in over 2/3 of patients
- Tends to return to baseline 7-10 days post ICH
- How fast should BP be lowered?
  - Rapidly lowering MAP by ≈ 15% does not lower CBF
  - Current guidelines suggest a reduction of ≤ 20% in the first 24 hrs
- Which agents should be used?
  - Short and rapidly acting IV antihypertensive
  - Labetalol, hydralazine, esmolol, nicardipine, enalapril

Raised ICP Management

CSF volume

- Mannitol or hypertonic solution
- External CSF drainage
- Ventricular catheter
- Ventriculo - peritoneal or atrial shunt
- Lumbar drain
- Serial lumbar punctures

Brain volume

- Mannitol or hypertonic saline
- Decompressive craniotomy
- Resection of tumor or other mass lesion

Blood volume

- Mannitol or hypertonic saline
- Hyperventilation
- Hypothermia
- Head elevation, neutral neck position
- Deep propofol or barbiturate sedation ± paralysis

Seizure Control

Coagulopathy Management

- Goal of treatment: fully reverse INR to normal range
- High dose Vitamin K 10-20 mg IV slow infusion
  - Effect takes 12-24hrs
  - Helps achieving sustained reversal of INR
- Fresh frozen plasma 15cc/kg ≈ 4U
  - Volume overload, insufficient factor IX
  - ABO compatibility, thawing, infusion time (30hrs)
- Prothrombin Complex Concentrates (PCC)
  - Combination of II, VII, IX, X, variable protein C and S
  - Dosage dependant on initial INR
  - Smaller volume, correct INR as fast as 30 min
- When ICH is associated with thrombocytopenia (platelet
- count <50,000/μL), transfusion of fresh platelets is indicated

Surgical indications

- Existing data do not support routine surgical evacuation of supratentorial hemorrhages in stable patients
- Putamen, lobar > 50 ml, deteriorating/ brainstem compression/ hydrocephalus
- Cerebellum > 30 ml, diameter > 3cm
- Thalamus - obstructive hydrocephalus →ventricular drainage

Thank You

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