## Intracerebral Hemorrhage

Yousef Mohammad MD., MSc., FAHA Associate Professor of Neurology King Saud University



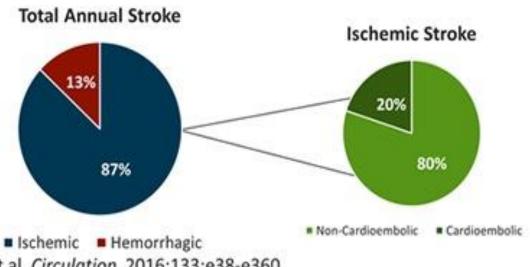
- Introduction
- Etiology
- Pathophysiology
- Clinical presentation
- Diagnosis and Imaging
- Treatment

### Introduction Intracranial hemorrhage Meningeal Intracerebral space hemorrhage hemorrhage Brain IVH EDH SDH SAH parenchyma

# Types of Stroke US Distribution

#### US total stroke annually 800,000

- US ischemic stroke approximately 87% of these are ischemic, 13% are hemorrhagic
  - Of those 87% that are ischemic, about 80% of those are non-cardioembolic



Mozaffarian D, et al. Circulation. 2016;133:e38-e360.

### Epidemiology

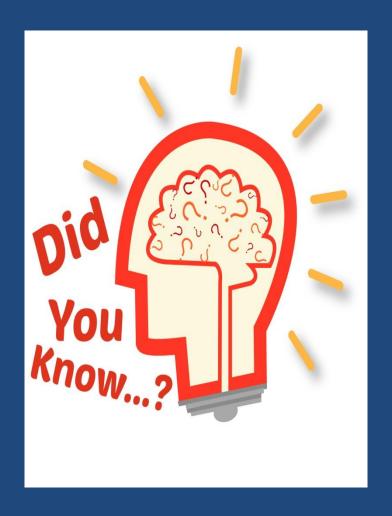
- Asian countries have a higher incidence of intracerebral hemorrhage than other regions of the world.
- A higher incidence of intracerebral hemorrhage has been noted in Chinese, Japanese, and other Asian populations, possibly due to environmental factors (eg, a diet rich in fish oils) and/or genetic factors.

### Mortality and Disability

 Overall, 40% mortality at 1 month and 54% at one year

Only 12-40% are functionally independent long term

 2010 – 62.8 million lost DALYs with ICH compared to 39.4 million in ischemic stroke



### Epidemiology

- Annually, more than 20,000 individuals in the United States die of intracerebral hemorrhage.
- Intracerebral hemorrhage has a 30-day mortality rate of 44%.
- Pontine or other brainstem intracerebral hemorrhage has a mortality rate of 75% at 24 hours.
- Incidence of intracerebral hemorrhage increases in individuals older than 55 years and doubles with each decade until age 80

### Risk Factors

- HTN
- Excessive ETOH use
- Smoking
- Age
- Ethnicity/Race
- Medications
- Sympathomimetics





#### Etiology

- Hypertensive ICH
  - Essential
  - Eclampsia
- Non-hypertensive ICH
  - Vascular malformation: AVM, Aneurysm,
     Cavernous hemangioma
  - Bleeding disorders/anticoagulant
  - Amyloid angiopathy
  - Trauma
  - Tumor
  - Drug abuse: amphetamine, cocaine, PPA

### Pathophysiology

- Primary immediate effect
  - Hemorrhage growth
  - -Increase ICP
- Secondary effect
  - Downstream effect
  - Edema
  - Ischemia

### ICH

- basal ganglia (40-50%),
- lobar regions (20-50%),
- thalamus (10-15%),
- pons (5-12%),
- cerebellum (5-10%),
- other brainstem sites (1-5%).

### Clinical presentation

- Alteration in level of consciousness (approximately 50%)
- Nausea and vomiting (approximately 40-50%)
- Headache (approximately 40%)
- Seizures<sup>[3]</sup> (approximately 6-7%)
- Focal neurological deficits

### Focal neurological deficits

- Putamen Contralateral hemiparesis, contralateral sensory loss, contralateral conjugate gaze paresis, homonymous hemianopia, aphasia, neglect, or apraxia
- Thalamus Contralateral sensory loss, contralateral hemiparesis, gaze paresis, homonymous hemianopia, miosis, aphasia, or confusion

### Focal neurological deficits

- Lobar Contralateral hemiparesis or sensory loss, contralateral conjugate gaze paresis, homonymous hemianopia, abulia, aphasia, neglect, or apraxia
- Caudate nucleus Contralateral hemiparesis, contralateral conjugate gaze paresis, or confusion

### Investigation

- Laboratory studies
  - CBC
  - Coagulogram
  - Electrolyte
  - others
- Imaging
  - CT brain w/o contrast

#### CT-brain

- demonstrates acute hemorrhage as hyperdense signal intensity
- Multifocal hemorrhages at the frontal, temporal, or occipital poles suggest a traumatic etiology.
- Hematoma volume can be approximated by (A x B x C)/2
- Iodinated contrast may be injected to increase screening yield for underlying tumor or vascular malformation.



CTA head/neck – suspect vascular etion

Careful interpreting noncon CT head after CTA

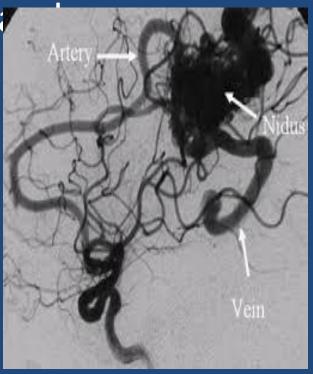
MRI brain – with gado if looking for neoplasm

- MRA/MRV if allergic to CT dye or if looking at venous outhow
- Cerebral angiography

### Other Causes

AVM, aneurysms, and other vascular malformations (venous angiomas)

- CVT
- Intracranial neoplasm
- Amyloid angiopathy
- Moya Moya



### Vessel imaging

 CT angiography permits screening of large and medium-sized vessels for AVMs, vasculitis, and other arteriopathies.



CTA head/neck – suspect vascular etion

Careful interpreting noncon CT head after CTA

MRI brain – with gado if looking for neoplasm

- MRA/MRV if allergic to CT dye or if looking at venous outhow
- Cerebral angiography





- Control BP!!!!
  - Guidelines reduction of SBP to 140
    - Anderson/Qureshi studies Interact 2 and AIACH Z
      - Not clear if SBP > 220
    - Use labetalol and/or nicardipine drip to titrate blood pressure
- Between 15-23% of patients > hematoma expansion in first few hours
- A word about penumbra

### What do we do??

- EBP nursing care
  - Watch for neuro decline
  - Type and cross with your labs!
  - HOB > 30
  - Head midline
  - Prevent vagal maneuvers
  - Control SBP
  - Treat hyperglycemia
  - Treat hyperthermia
  - Seizure prophylaxis
  - DVT prophylaxis



Typically, do not make patients DNR within the first 48 hours

### Cerebral Edema: Sodium and CO2

Use the ventilator to manage CO2

Get the sodium up



 Mannitol/3% or even 23.4% (requires central line) for herniation

## Surgery anyone????

- EVD
  - CLEAR III trial no outcome benefit with ve
- Craniotomy
  - Depends on etiology
  - \*\*Depends on AC/APT status
  - Depends on timing
  - Depends on location
    - STICH II no overall favorable ou
    - MISTIE II MIS techniques
    - MISTIE III underway
  - Cerebellar ICH



tPA



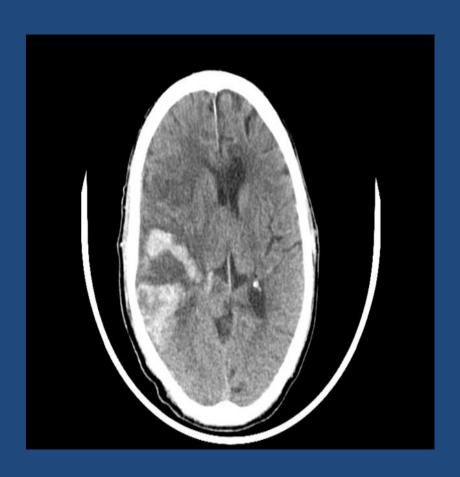
### Subarachnoid Hemorrhage



- Usually due to aneurysm rupture
- Can be perimesencephalic SAH
- Coil/Clip
- NIMOTOP/NIMODIPINE
- Strict BP control
- Hydrocephalus
- Vasospasm
- Sodium
- Urine output

## Hemorrhagic Transformation HI 1/2 – PH 1/2

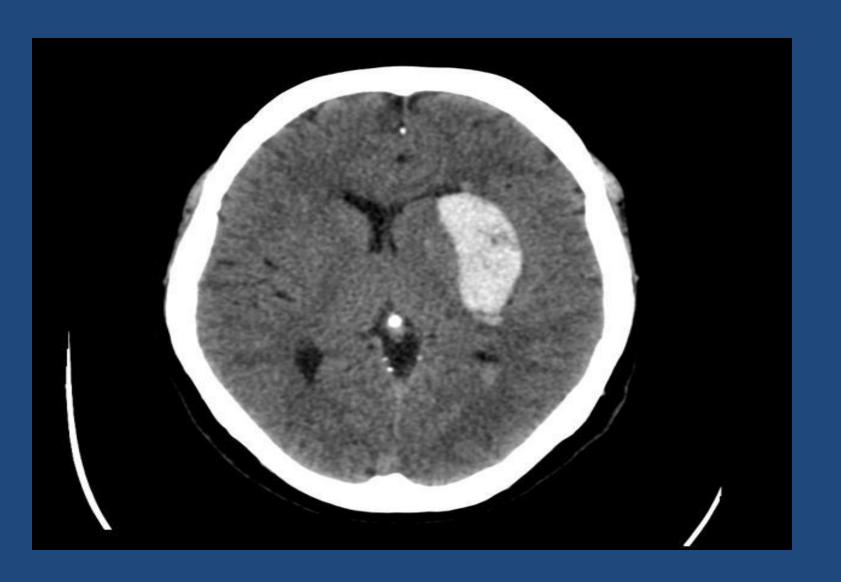
- > 50% have some hemorrhage
  - 0.6%-3% >> untreated patients
  - 6% in treated patients
- Risk Factors
  - Older age
  - larger stroke size
  - cardioembolic stroke etiology¹
  - anticoagulant use
  - fever
  - hyperglycemia
  - low serum cholesterol
  - Acutely elevated systolic blood pressure
  - thrombolytic therapy/recanalization
- Treatment



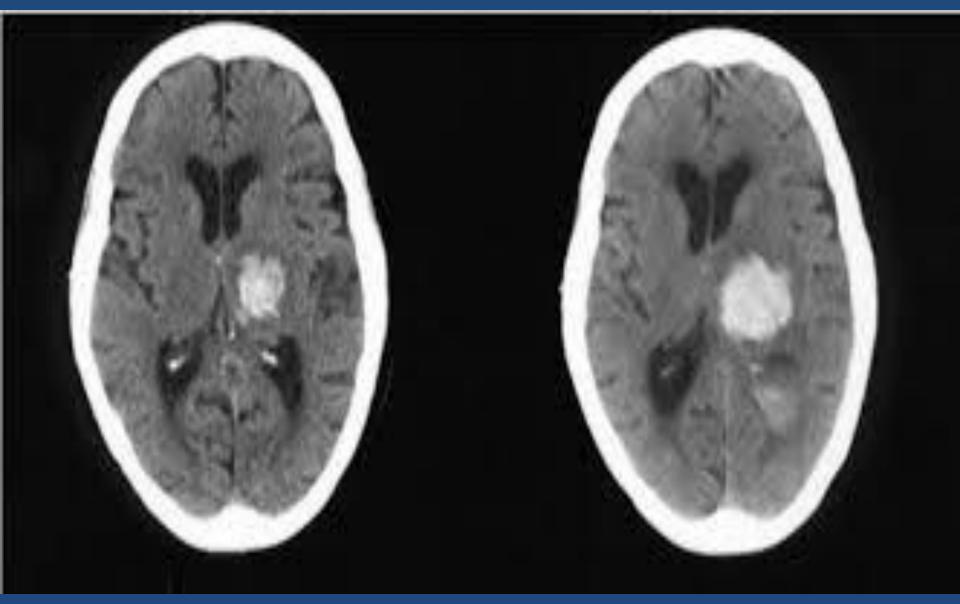
## Hypertensive hemorrhage

- Putamen
- Thalami
- Pontine
- Cerebellum
- Lobar

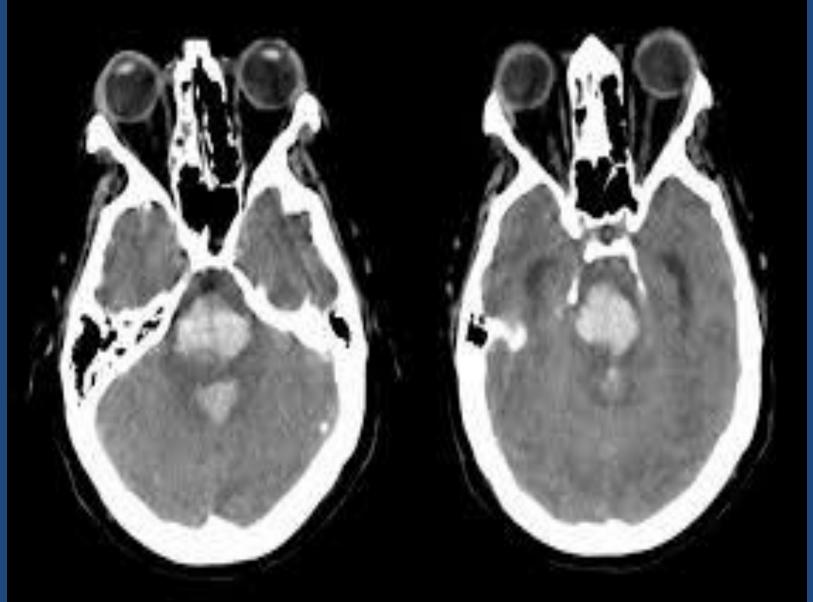
## Putamen Hemorrhage



## Thalamic hemorrhage



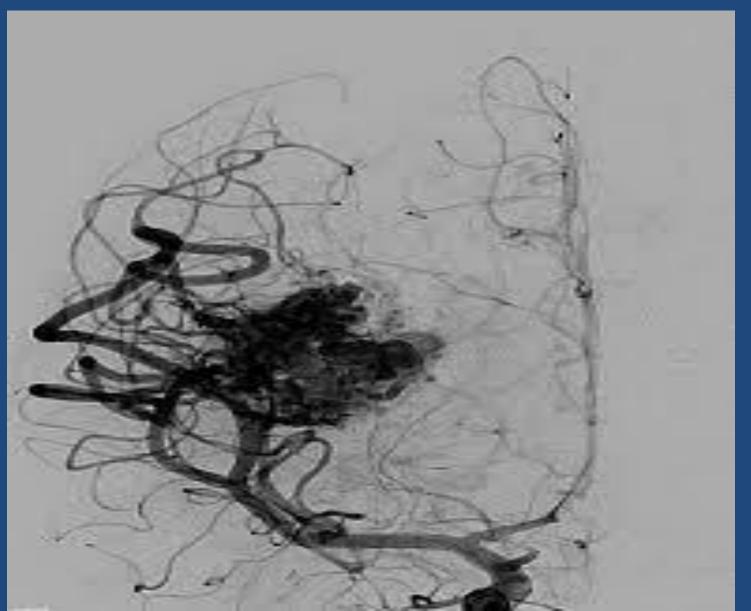
### Pontine hemorrhage



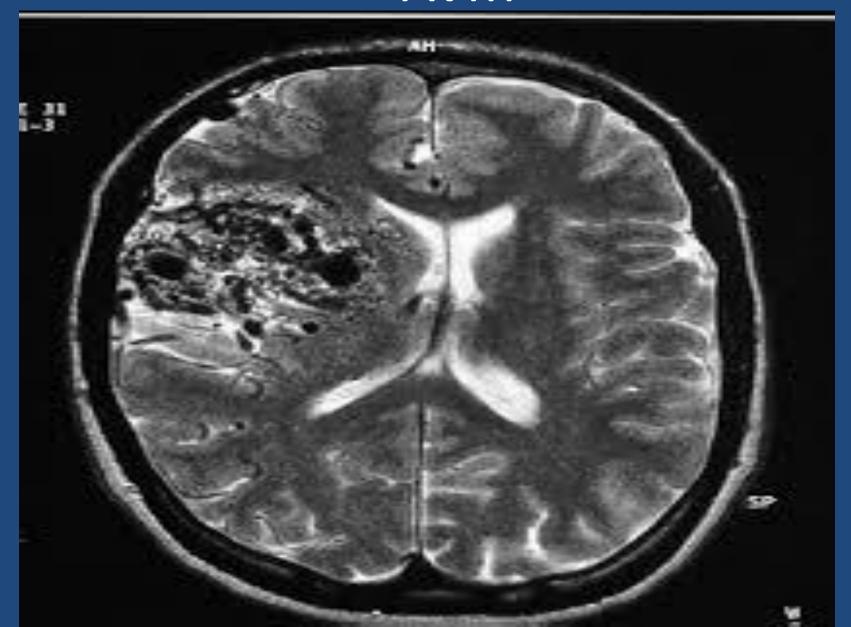
## Cerebellar hemorrhage



## AVM



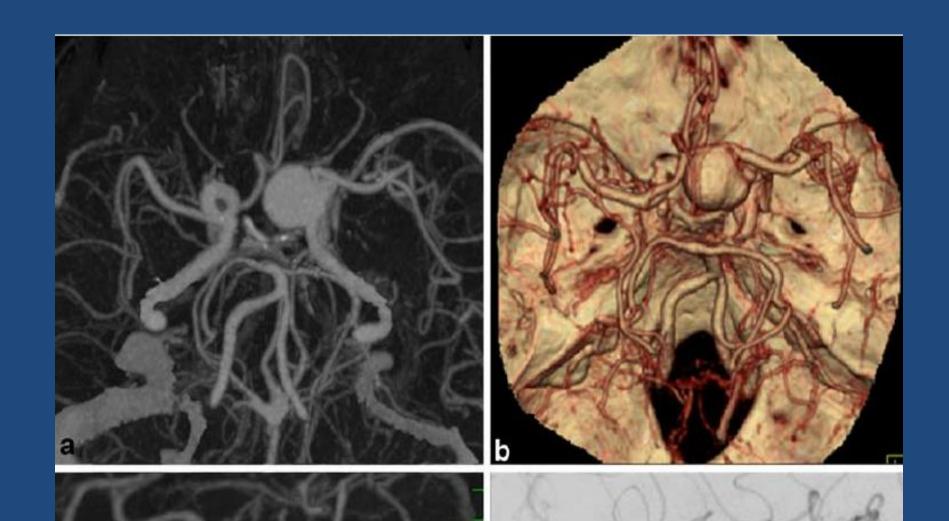
## AVM



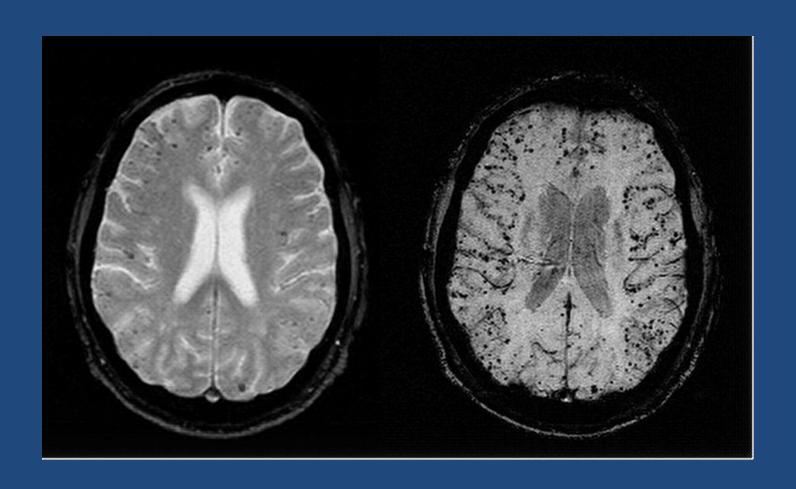
## SAH



## Aneurysm



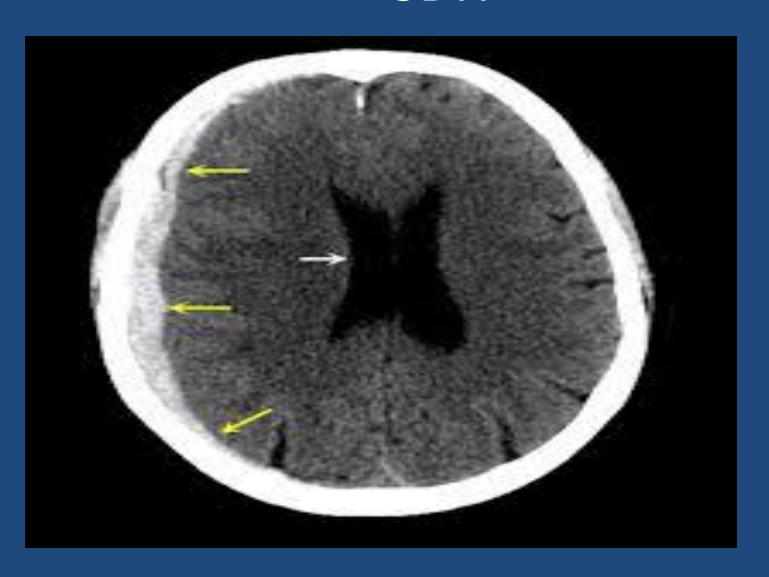
## **Amyloid Angiopathy**



## EDH



## SDH



## Lobar hemorhage



Tumor with ICH

