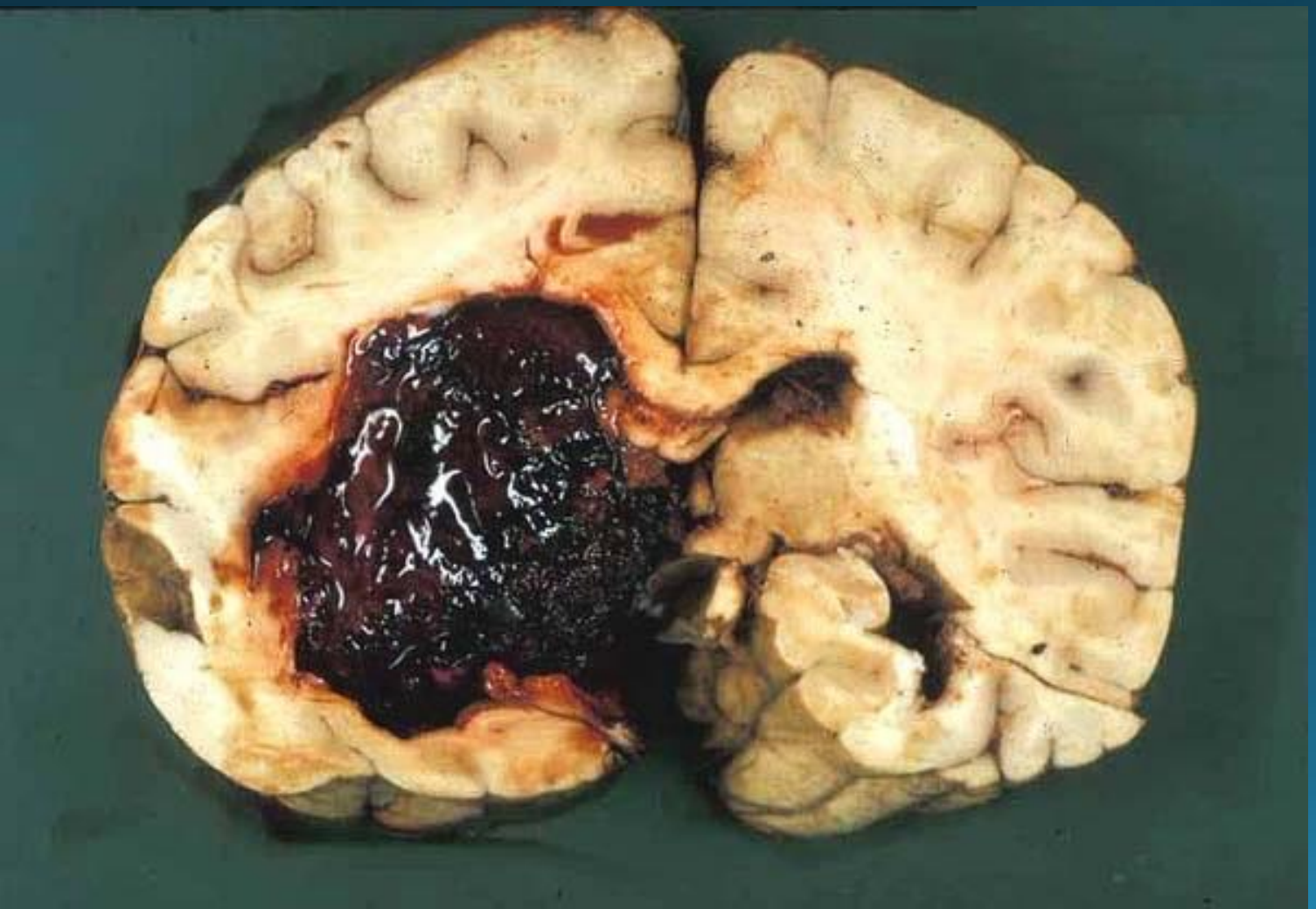
HYPERTENSIVE HAEMORRHAGIC STROKE



To Operate
or not to Operate,
that's the Question…

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F.C.S (Neurosurgery)

CONSULTANT NEUROSURGEON

Spontaneous Intracerebral Haemorrhage (SICH)

is a neurological catastrophe and it remains one of the deadliest and most disabling disease with a high morbidity and mortality rate and a high cost burden

Epidemiology

- 10 - 15% of all strokes
- Mortality rate 40 – 50 %
- Significant morbidity in survivors
- 6 billion US dollars per year

History

- Hypertension
- Prior Stroke
- Recent Head Injury
- Use of antithrombotic /anticoagulant drugs

Clinical Features

- Severe Headache
- Focal Neurological Deficit
- Vomiting
- High Systolic Blood Pressure > 220 mmHg
- Decrease GCS

First diagnosis is intracerebral haemorrhage

Non Hypertensive ICH - Causes

1. **Cerebral Amyloid Angiopathy**

2. **Small Vascular Malformation**
   - Cavernous Angioma
   - Venous Angiomas

3. Brain Tumors

4. Oral Anticoagulants

5. Use of Amphetamine and other Sympathomimetic drugs
   - Vasculitis
   - Necrotising Angiitis

Causes

Intracerebral haemorrhage in young people (<40 years) 200 patients

Arteriovenous Malformation Cavernous Angioma	- 49%
Hypertension	- 11%
Cryptogenic	- 15%
Cerebral Venous thrombosis	- 5 %
Sympathomimetic drugs	- 4%

Most common Risk Factors (<40 years) 200 patients

- Tobacco use > 10/day - 20%
- Hypocholesterolemia
  (S. cholesterol ≤ 160 mg/dl - 35%
- Hypertension (< 40 years) BP > 160/90 - 13%
  (> 40 years) - 54%
- Alcohol use (100g/day) - 10%

Investigations I

CT Scan is the most widely used

- By no means the only neurological examination (CTA, MRA/MRI)
- Safe, non invasive, quick immediately shows bleeding
- Accurate size, location, presence of IVH, presence of SAH or subdural blood or hydrocephalus

Investigations II

3 Variables on CT Scan suggestive of early mortality predictors

- Hematoma Volume > 60 CC
- Intraventricular Extension
- Large Mid Line Shift

ICH Score

ICH Score	Points
GCS score *	
3–4	2
5–12	1
13–15	0
ICH volume **	
≥ 30 cm^3	1
< 30 cm^3	0
IVH ***	
Yes	1
No	0
Infratentorial origin of ICH	
Yes	1
No	0
Age	
≥ 80	1
< 80	0
ICH Total Score	0-6

- The GCS score refers to the GCS score at initial presentation (or after resuscitation); ICH volume, volume on initial CT calculated using the ABC/2 method; IVH, presence of any IVH on the initial CT.
- GCS, Glasgow coma scale; ICH, intracerebral haemorrhage; CT, computed tomography; IVH, intraventricular haemorrhage.
- Adapted from Hemphill JC 3rd, Bonovich DC, Besmertis L, Manley GT, Johnston SC. The ICH score: a simple, reliable grading scale for intracerebral haemorrhage.

(*Stroke* 2001;32:891-897)

ICH Score

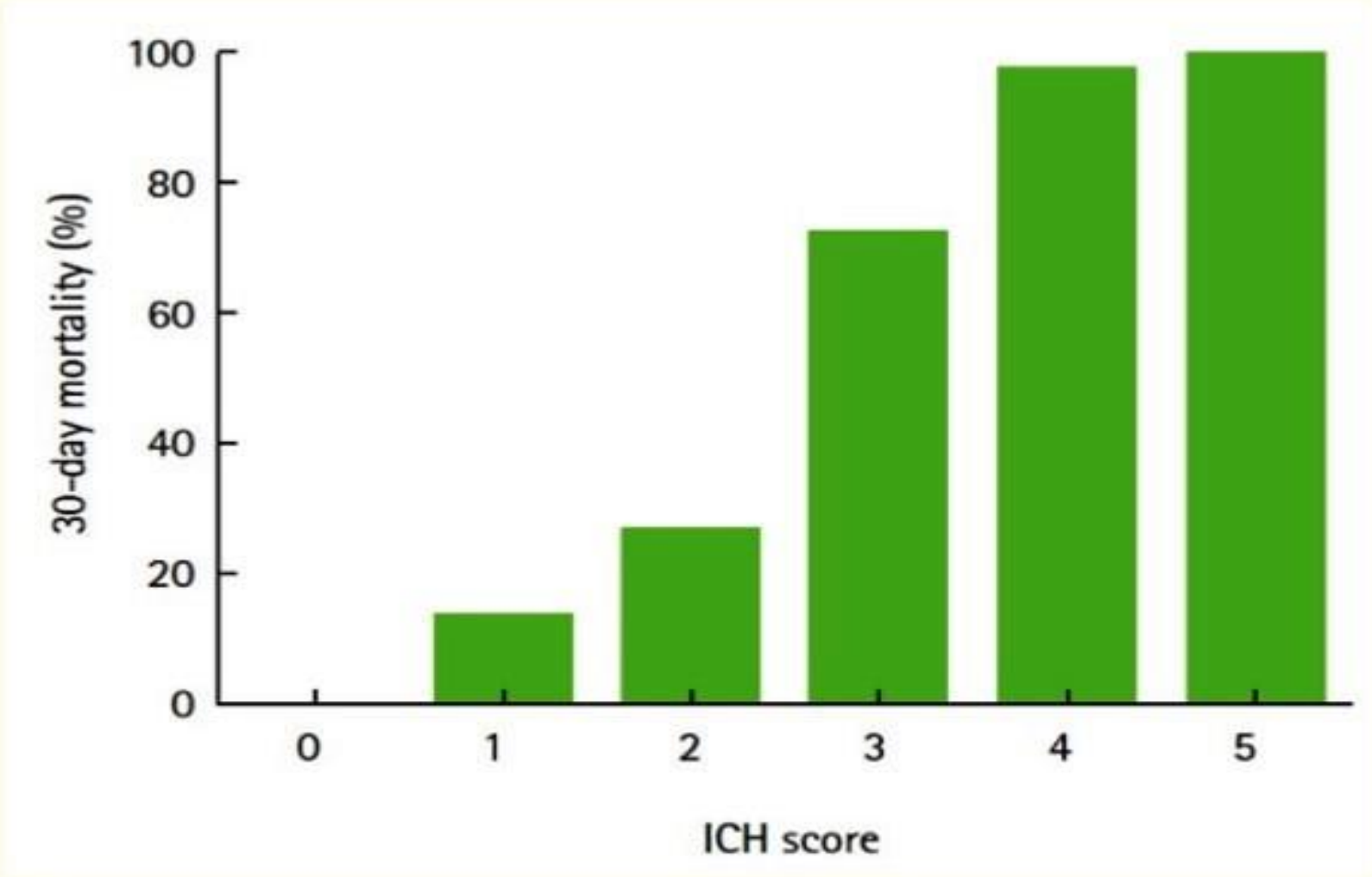


Figure 1.
The ICH Score and 30-day mortality. Data were revised from Hemphill JC 3rd, Bonovich DC, Besmertis L, Manley GT, Johnston SC. The ICH score: a simple, reliable grading scale for intracerebral hemorrhage. *Stroke* 2001;32:891-897. There was no patient with a score of 6 in the cohort, but an ICH score of 6 would be predicted to be associated with a high risk of mortality.

30 day mortality:

- 0 points: 0%
- 1 point: 13%
- 2 points: 26%
- 3 points: 72%
- 4 points: 97%
- 5 points: 100%
- 6 points: 100% (estimated)

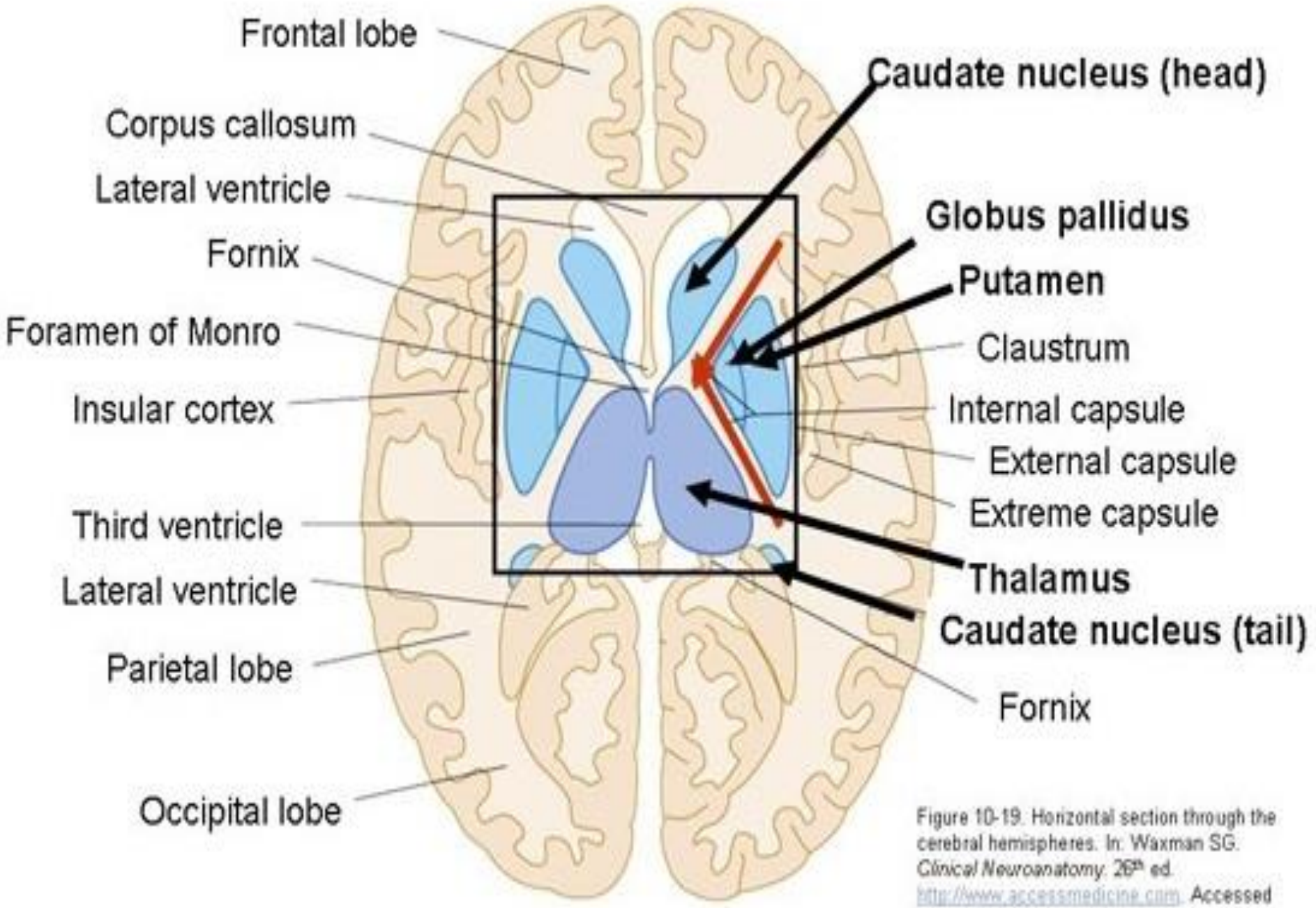
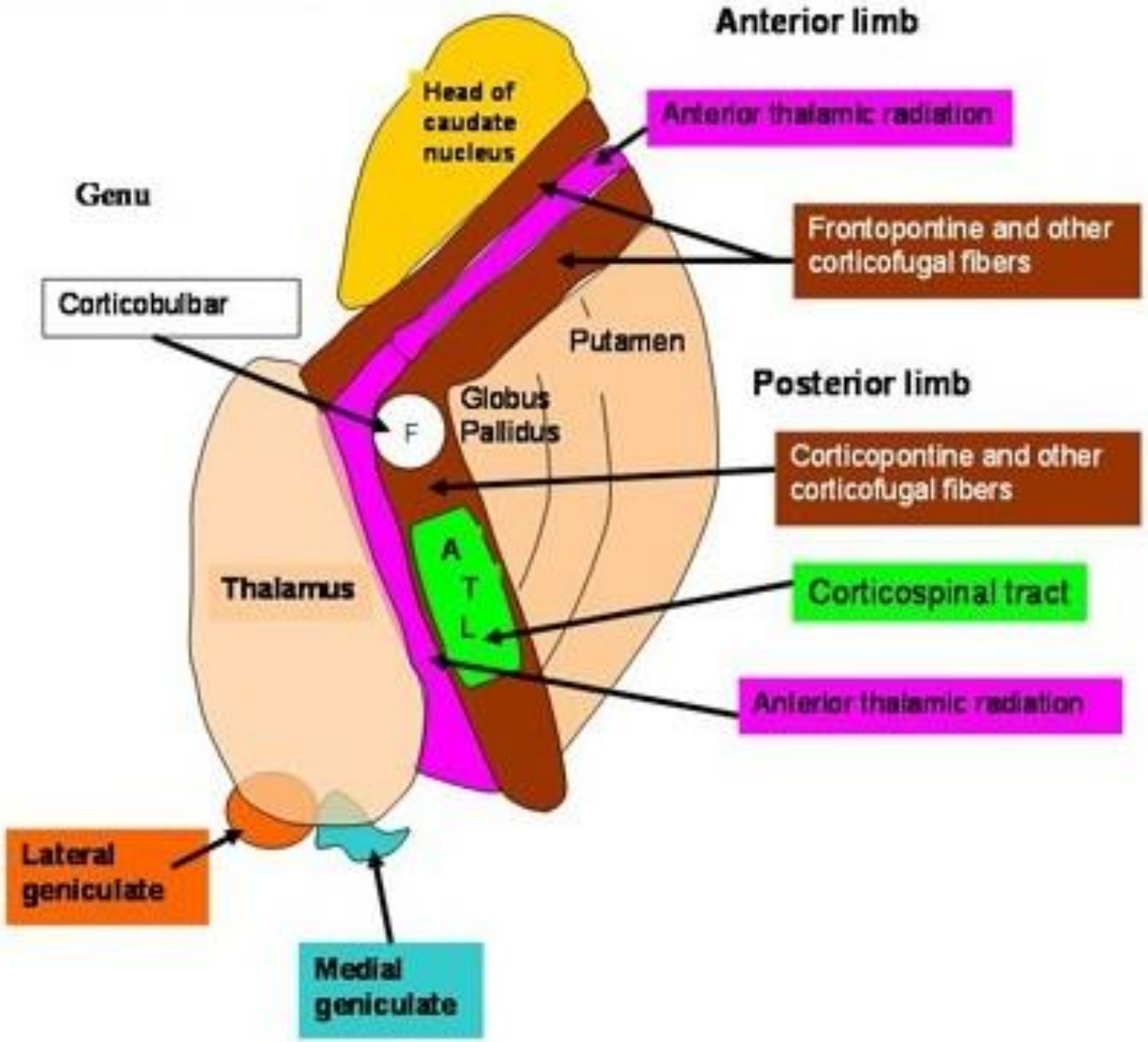


Figure 10-19. Horizontal section through the cerebral hemispheres. In: Waxman SG. *Clinical Neuroanatomy*. 26th ed. http://www.accessmedicine.com. Accessed January 3, 2010.

Internal Capsule Anatomy



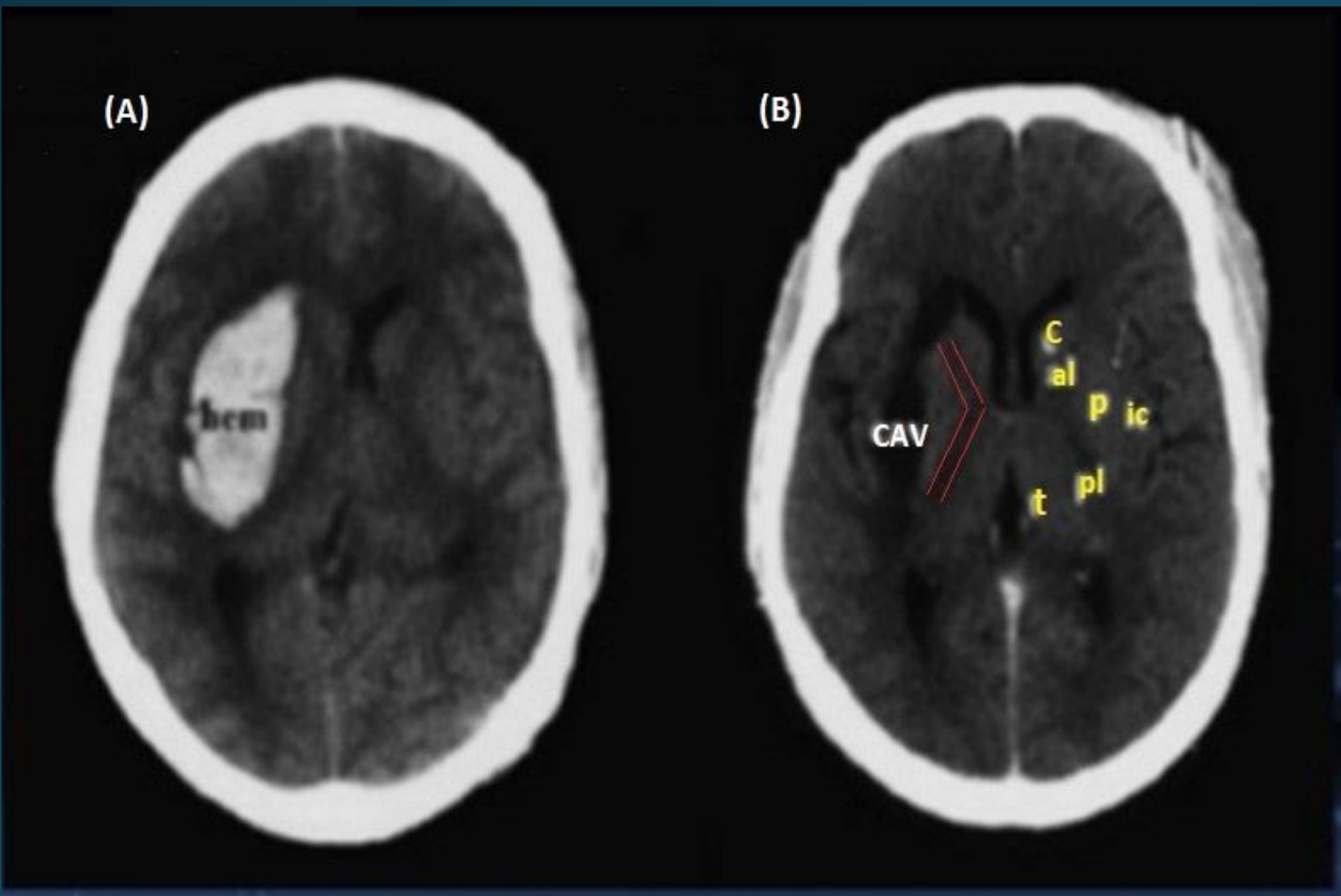
Internal Capsule Anatomy

Location of Hypertensive ICH

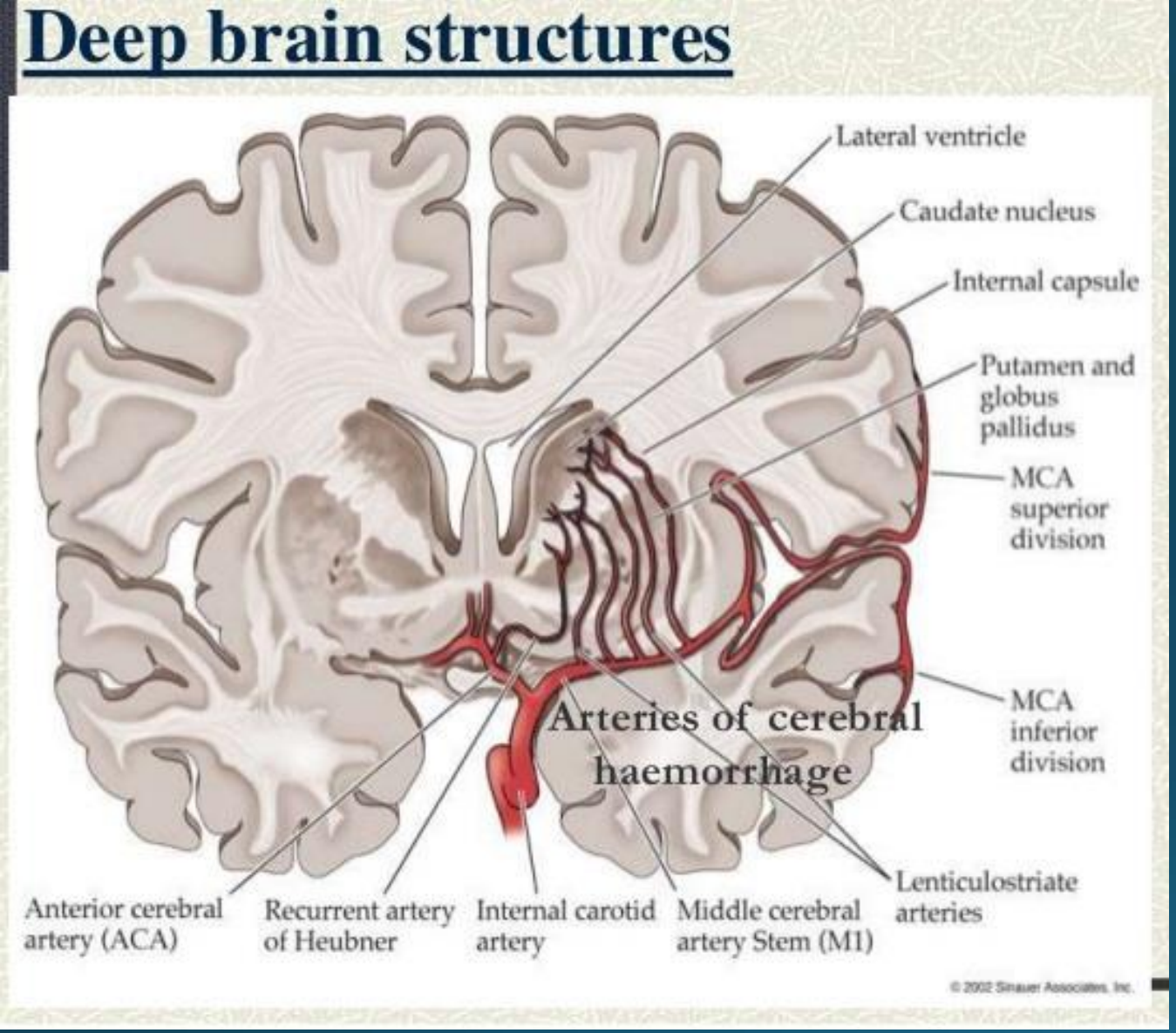
Weiner & Cooper 100 patients

Commonest Basal ganglia	= 55%
Thalamus	= 26%
Cerebral Hemisphere	= 11%
Brainstem	= 8%
Cerebellum	= 7%

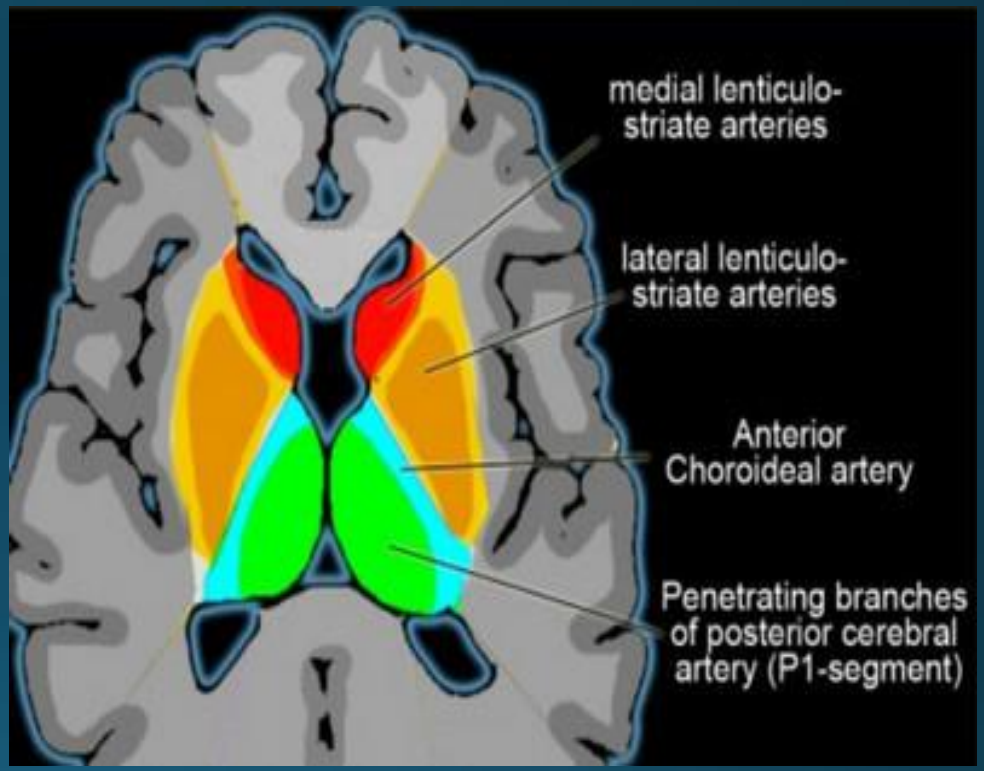
Radiological Anatomy of Basal ganglia (55%)



p: Putamen
c: Caudate
ic: Insular Cortex
al: Ant limb Int Capsule
pl: Post limb Int Capsule
t: Thalamus
hem: Hemorrhage
cav: Post drainage cavity



Perforators of the Basal ganglia



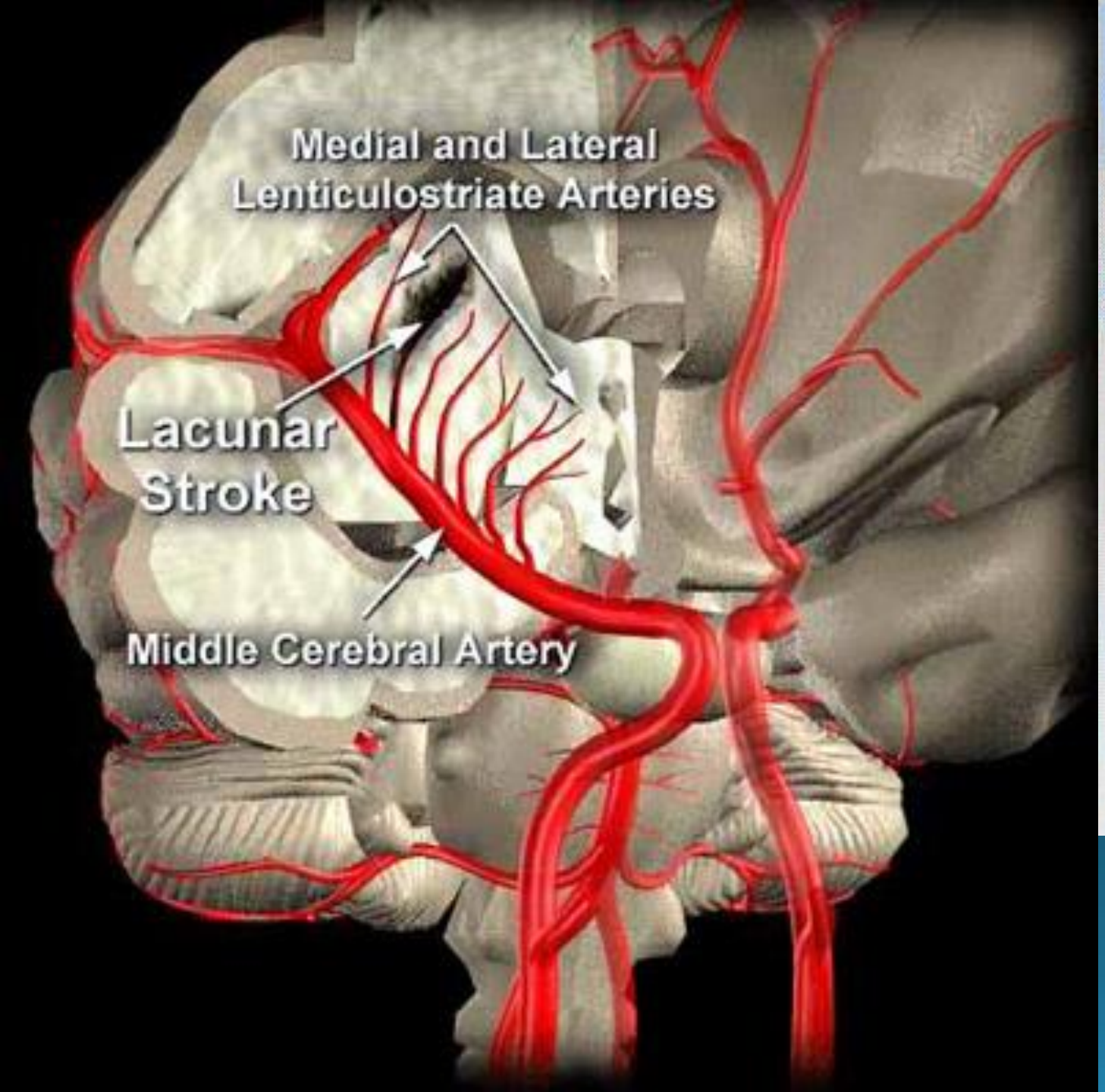
The pathogenesis is thought to involve **lipohyalinosis** or formation of microatheroma within the penetrating vessel.

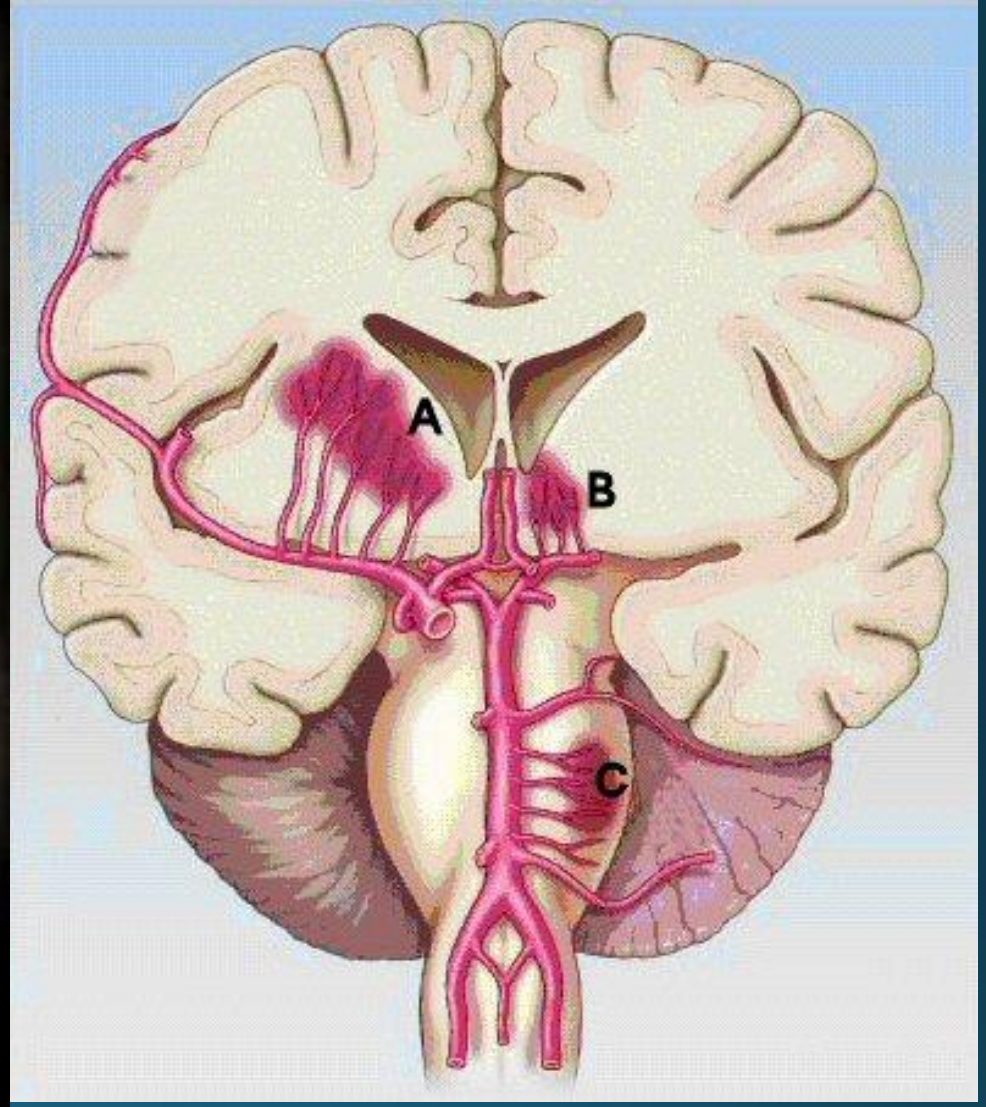
Hypertensive ICH

Arteries Affected are:

- Lentriculostriates arteries
- Thalamogeniculate arteries of PCA
- Paramedian perforators from basilar artery
- Superior and inferior cerebellar arteries

Supply Basal ganglia, Thalamus, Pons and Cerebellum





(A) Lenticulostriate branches of the MCA
(B) Thalamogeniculate arteries of PCA
(C) Paramedian perforators from basilar artery

Hypertensive ICH

- Hemodynamic injury to the perforators which arise directly from major arteries
- Enter the brain at right angles
- Cortical blood vessels have a thicker smooth layer in the Tunica media which protects them from HBP
- Perforators have thinner walls

Aetiology of Hypertensive ICH

Hypertension → High Intraluminal pressure

↓

Alteration of the smooth wall
& endothelial function

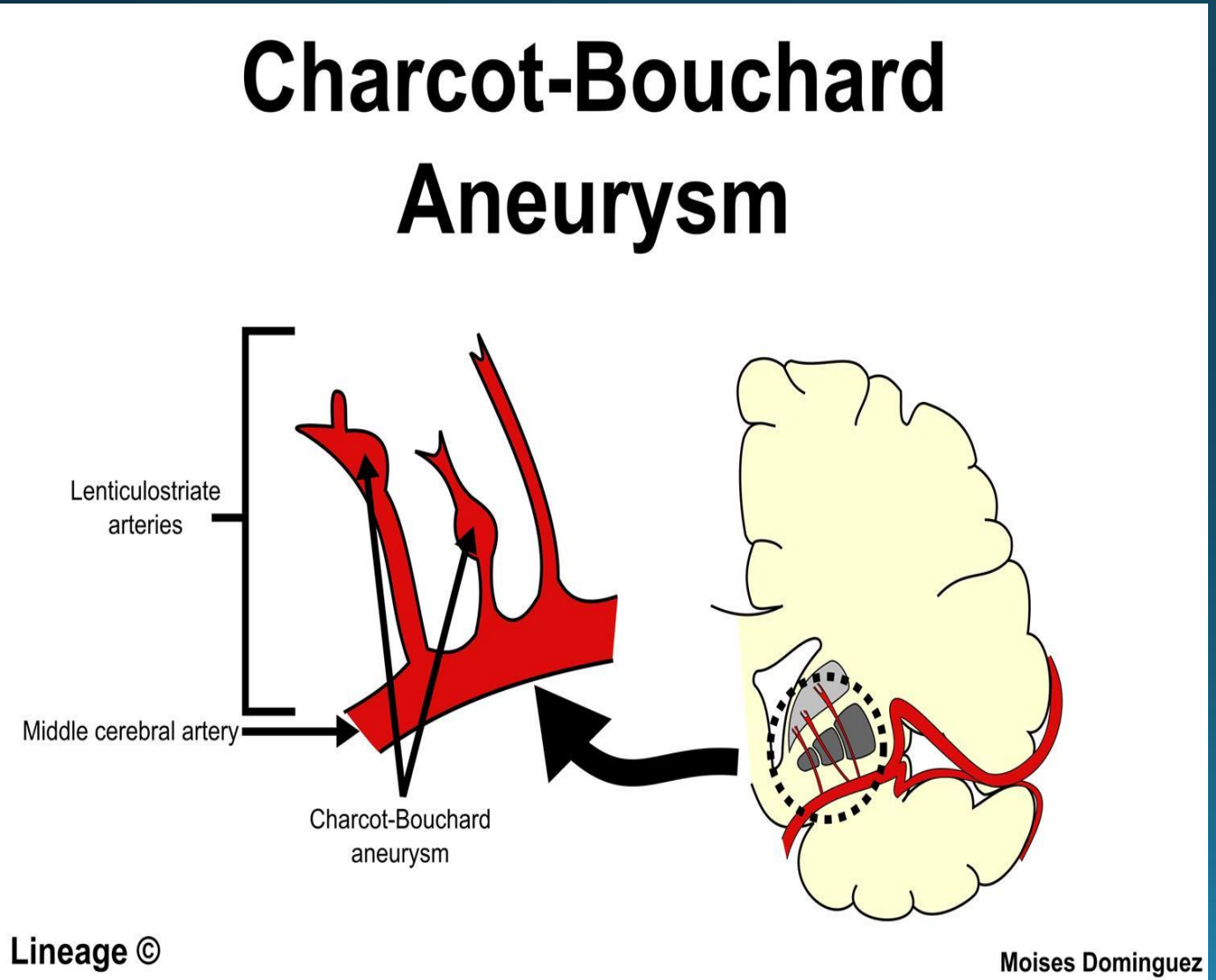
↓

Hyalinosis & lipohyalinosis

↓

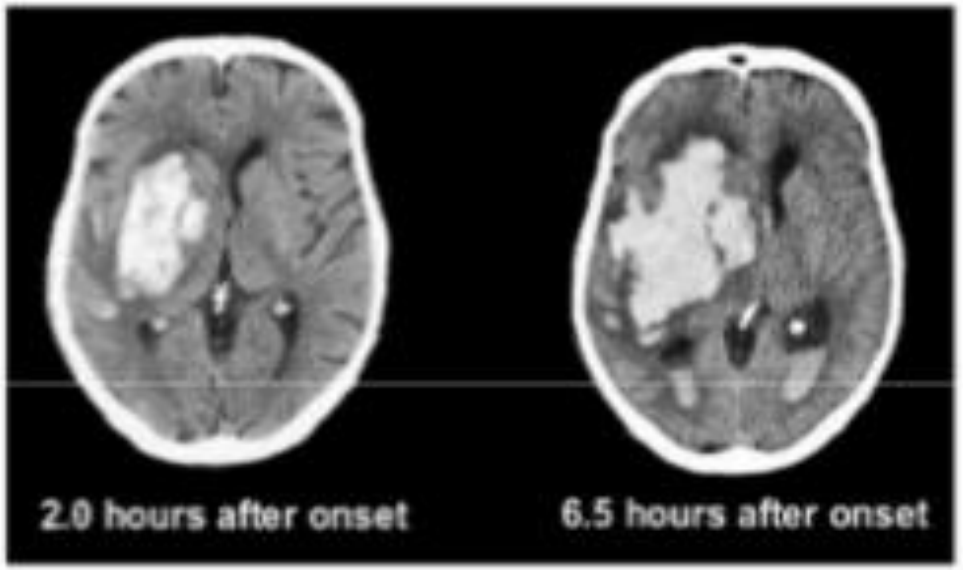
Focal Necrosis of vessel wall
and formation of Charcot Bouchard Aneurysm

Hypertensive Haemorrhage



Pathophysiological features

- Primary-immediate effects
  - Hemorrhage growth
  - Increased ICP
- Secondary effects
  - Edema
  - Ischemia
- Progression of hematoma



- Brott et al:
  - 103 pts → 26% within 1 hours, 38% within 20 hours
- Acute hypertension, local coagulation deficit may be associated

Brott, *Stroke 1997;28:1-5*

Pathophysiology

- **Perilesional hematoma - ↑ ICP → herniation**

Early Phase : Hydrostatic pressure and clot retraction
Movement of serum from the clot into surrounding tissue

Second Phase: Coagulation Cascade → Thrombin production

Third Phase: Erythrocyte lysis
Hemoglobin Toxicity
Heme and Iron
Neurotoxic – Iron catalysed production of reactive oxygen species

Pathophysiology

- Ischemic penumbra OR Primary Reduction of CBF (due to mitochondrial dysfunction because of toxic effect of blood degradation products)

- Theoretically evacuation of the clot mass as much as possible should definitely improve outcome

THIS IS THE MOST IMPORTANT RATIONALE SUPPORTING SURGERY

Ischemic Penumbra or decrease CBF ?

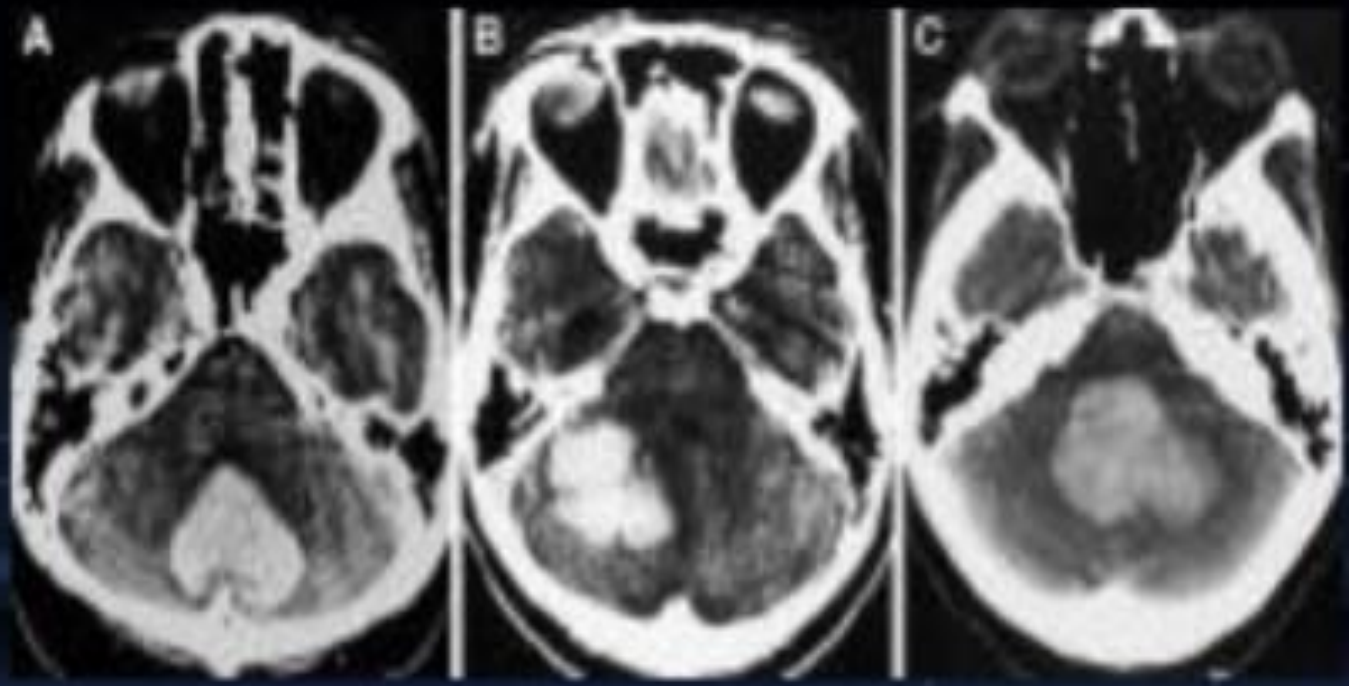
LEGEND

- Normal brain tissues
- Penumbra region
- Dead tissue region

Location

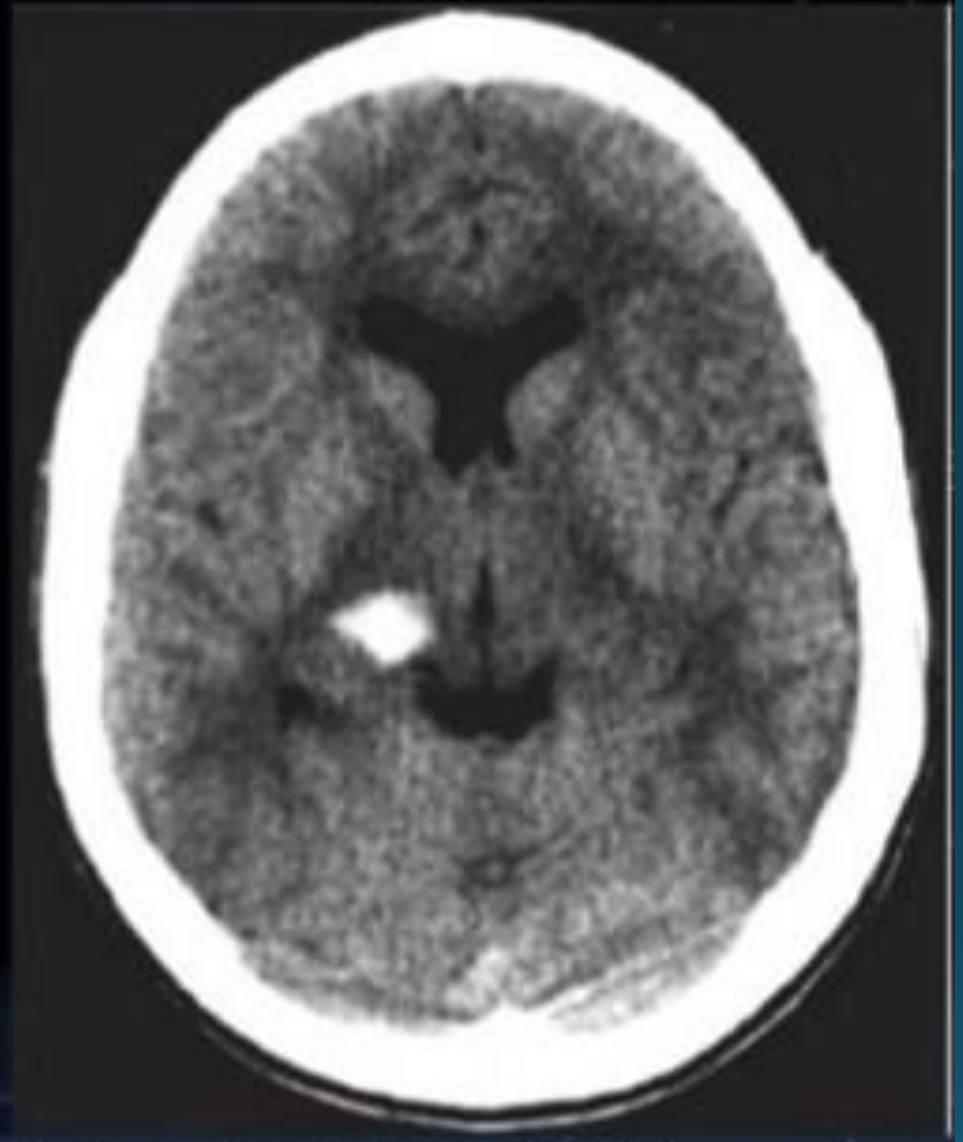
- Cerebellar (7 -10 %)
  - Inability to walk
  - Vomiting
  - Headache, possibly referred to neck or shoulder
  - Neck Stiffness
  - Gaze palsy
  - Facial weakness

- Hydrocephalus



Location

- Thalamic (26%)
  - Hemiparesis
  - Hemisensory loss
  - Aphasia
  - Neglect (nondominant hemisphere)
  - "wrong way eyes"- eyes deviate toward the hemiparesis, as opposed to hemispheric injury



13 year old boy, acute right sided HA
Numbness on L side of body and face
no motor deficit
Hemorrhage in R posterodorsal thalamus involving pulvinar nucleus

Location

Lobar (10%)

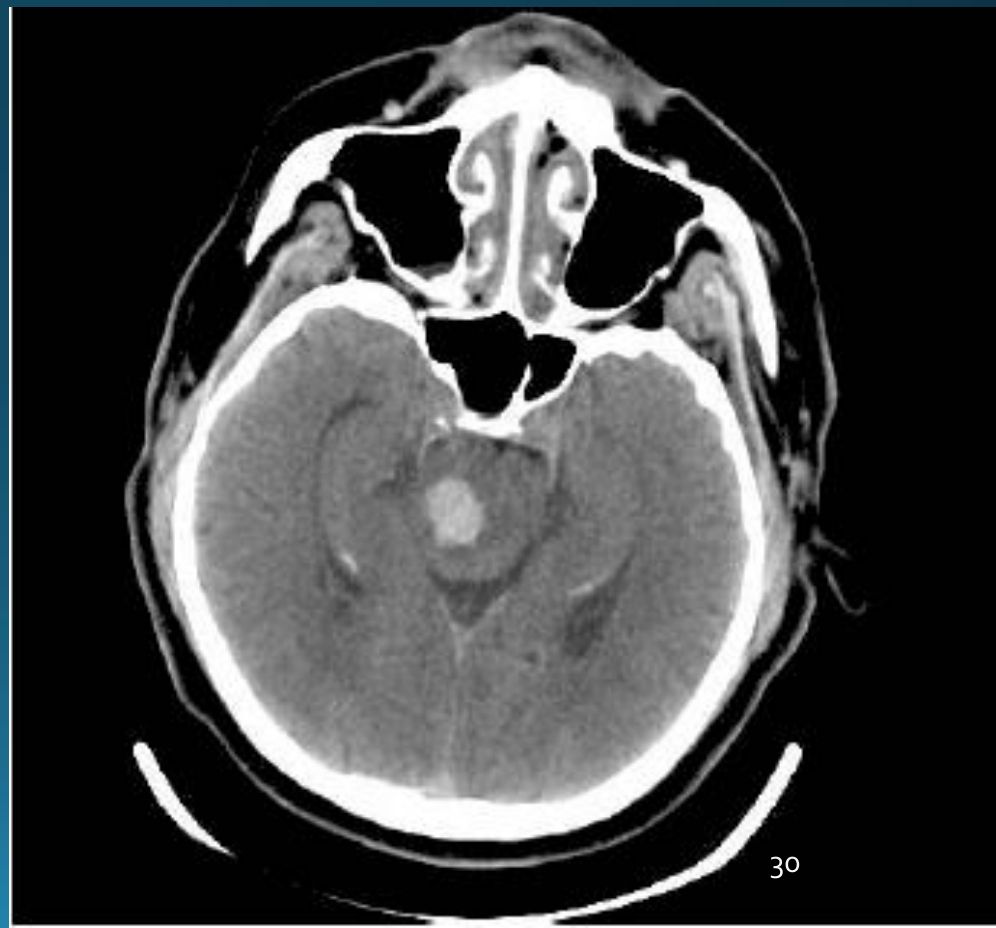
- Most often in parietal and occipital lobes
- Occipital lobes present with contralateral homonymous hemianopsia
- High incidence of seizures
- Frontal region – contralateral plegia or paresis of the leg with arm sparing

Left Occipital Lobe Haematoma

Location

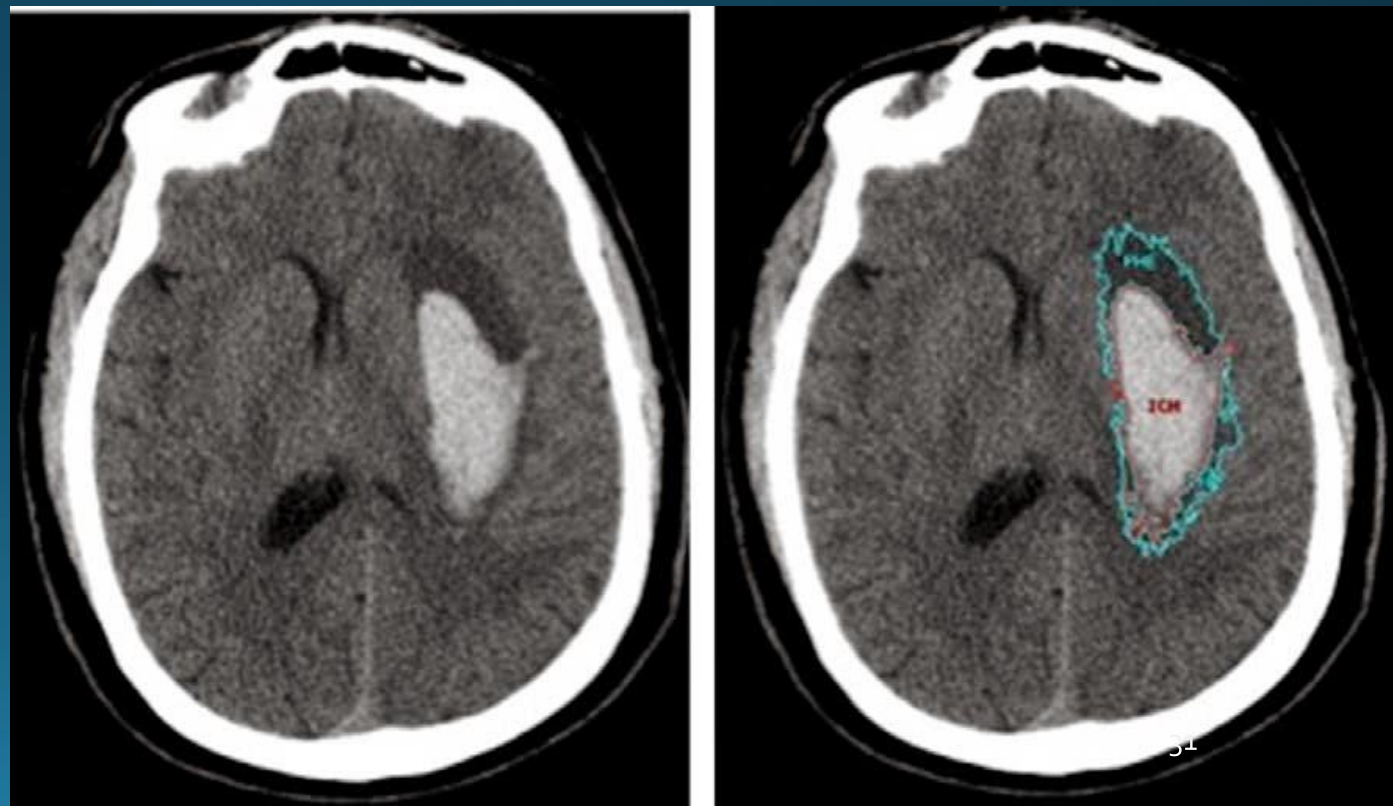
Pontine (8 – 10 %)

- Deep coma within minutes of the haemorrhage, due to disruption of the reticular activating system
- Paralysis
- Pinpoint pupils
- Pyrexia



Progression of mass effect after Intracerebral Haemorrhage (on CT Scan)

- Mid Line Shift
- Ventricular Compression
- Sulcus Effacement
- Obliteration of basal cisterns
- Local tissue pressure effects



Progression of Mass Effect

- Shaw Colleagues ARCH NEUROL 1959. pp 53 -69
- (MCA middle cerebral artery infarct)

  Mid line shifts develop over first 3 days, peak at 3 – 5 days and subsides by 14 days

In ICH - Evolution of mass effect is not fully understood.

Progression of Mass Effect

- Time Course for progression of mass effect in **ICH** does not follow the same pattern as that of **Ischaemic stroke**

- **Bimodal Time Course**
  - Within the first two days (due to hematoma enlargement)
  - 2nd and 3rd week of symptoms onset
    - due to extensive oedema
    - development of new vessels around hematoma with an immature BBB.

Effect of Untreated Hypertension on Haemorrhagic Stroke

- **17 – 28 %** of haemorrhagic stroke among hypertensive patient would have been prevented if they have been on hypertensive treatment
- Treatment of HBP has been demonstrated to be the most important factor in reducing the incidence of STROKE and CARDIOVASCULAR DISEASES
- Hypertension is a significant and independent risk factor for ICH and SAH.
- Even if all hypertensive patients received treatment, there would likely still be an increase risk of stroke.

(Stroke, 2004.35:1703)

Effect of Untreated Hypertension on Haemorrhagic Stroke

One fourth of haemorrhagic strokes would be prevented if all hypertensive patients received treatment *(Stroke, 2004.35:1703).*

Role of Hypertension in Causing Recurrence of Haemorrhagic Stroke

- **Recurrence**

8.9 % in first year

13.7 % in five years

Surgical Treatment and Renal insufficiency was associated with increase recurrence.

Conclusion

Patient with ICH need an aggressive management of hypertension to prevent short term and long term recurrence.

Blood Pressure and Risk of ICH

Leppala et al.

Relative Risk (RR) of ICH :

2.2 for BP 140 – 159 mmHg

3.7 for BP ≥ 160 mmHg

Suh et al.

Relative Risk (RR) of ICH :

2.2 for high normal

5.3 for Stage I Hypertension

10.4 for Stage II Hypertension

33 for Stage III Hypertension

Risk Factors For Recurrent ICH

- Lobar location of initial ICH
- Uncontrolled hypertension
- Older age
- Ongoing anticoagulation
- Greater number of microbleeds on MRI

Treatment - Very Important Advances

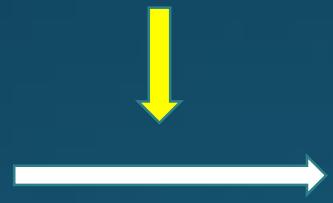
1. Early diagnosis by CT Scan
2. Improved Neuroanaesthesia
3. Neurosurgical Critical care
4. Microscope Guided Surgical Techniques
5. Neuronavigation

Efficacy of surgical treatment of primary ICH is still controversial

Treatment

- **Blood pressure lowering in the single most important predictor of better outcome in patient with hypertensive ICH**

- This is in contrast to acute **ischemic stroke** where BP lowering is not considered In the acute phase



Decrease CPP → Further Ischemia

(INTERACT 2) → Rapid BP Lowering in patient with ICH result in a better functional outcome

Surgical Treatment

Rate and indications for surgery shows significant differences internationally reflecting controversy

STICH (International Surgical Trial in Intracerebral Haemorrhage)

- Conducted to prove :

  Superiority of early hematoma evacuation (within 24 hours) over conservative medical treatment

  1033 patients (83 Centres in 27 countries)

  * 6 Months mortality rate for early surgical group was 36% compared with 37% for Best Medical Management

  * No overall statistically significant difference in the mortality or functional outcome between the early surgery and initial conservative group

2013 STICH II Trial

- Early Surgery V/S Best Medical Management in patient with (10 - 100ml) lobar haemorrhage

- 6 Months mortality rate was 18% in early surgery group and 24% in the BMM

Conclusion of STICH I & II Trials

Two large randomised trials failed to prove clear benefits of early surgical management over Best Medical Management

Treatment

- Surgical Treatment of SICH is not elective but obligatory in a patient who is deteriorating and who has reasonable outcome potential (non dominant cerebral hemisphere)

- Being surgically oriented is very important to achieve successful outcomes in a select group of patients with SICH (in comatose patient GCS $\leq$ 8)

SURGICAL CANDIDATES FOR ICH

Situation	Surgical Management
• Cerebellar hemorrhage with neurological deterioration associated with brainstem compression or hydrocephalus	**HEMATOMA EVACUATION**
• Supratentorial hemorrhage with neurological deterioration	**HEMATOMA EVACUATION**
• Supratentorial hemorrhage with GCS score < 8, significant midline shift and large hematomas, medically intractable ICP	**DECOMPRESSIVE CRANIECTOMY**
• Hydrocephalus with or without IVH	**VENTRICULAR DRAINAGE**

ICH - Intracerebral hemorrhage, GCS – Glasgow Coma Scale, ICP – Intracranial Pressure, ICH – Intraventricular Hemorrhage

Decompressive Craniectomy

Previous studies

- Patient GCS < 8
- Significant Mid line shift
- Large hematoma
- Raised Refractory ICP

MAY BENEFIT FROM DECOMPRESSIVE CRANIECTOMY

- Decompressive craniectomy with or without clot evacuation might be helpful in reducing mortality rate in these specific group

Contra Indication for Surgery

- Brain Stem Haemorrhage
- Elderly patient with GCS < 5
- Small Haemorrhages

Role of Dexamethasone in intra cerebral haemorrhage

Henry Tellez Raymond; Stroke 1973

- No overall statistically significant difference was found between steroids and placebo

Valery Feigin; Stroke 2006, Vol. 37, Pg 1344

- No evidence to support routine use of cortico steroids (did not reduce death or poor outcome at one month)
- Associated with increase risks of adverse effects
  - Infections
  - Exacerbation of DM
  - GIT Bleeding

Role of Dexamethasone in intra cerebral haemorrhage

Shada Fadin Zaden N.; Pak. J Med Sci, Sept 2008, Vol. 24, No. 4

- **Higher Mortality in dexamethasone group**

  (40% v/s 23% in placebo group)

- **Increased adverse effects**
  - Fever
  - Electrolytes imbalance
  - Hypertension
  - Hyperglycemia

Seizures Prophylaxis in SICH

- Currently, there is insufficient evidence to support the routine use of antiseizure medication for the prevention of seizures after SICH

- Phenytoin was associated with more fever and worse outcome after SICH

Increasing Incidence Of Anticoagulant Associated Intracerebral Hemorrhage (AAICH)

- Neurology2007 Jan 9 68(2) 118-121
- 1998-5%
- 1994-9 %
- 1999-17 %

- The incidence of anticoagulant-associated has increased by FIVE times in US between 1988-1999 (same for cardioembolic ischaemic stroke)

So what's the best treatment of SICH?

Best Medical Management (BMM) V/S Surgical Management

Failed Clinical Trials

Primary Prevention

Fear of living or Happiness of Living

BRAIN ATTACK

GOOD HEALTH

HEART ATTACK

Defining optimal brain health in adults (AHA/ASA)

- It is possible to maintain brain health and to prevent stroke and dementia in later life (Seven matrix to define optimum brain health in adults). Health factors can be **M**easured, **M**onitored and **M**odified.

- **FOUR ideal health behaviours**
  - ✓ Smoking, physical activities, healthy diet & body mass index of < 25 kg/m^2

- **THREE ideal health factors**

✓Untreated blood pressure < 120/<80 mm Hg

✓Untreated total cholesterol of < 200 mg/dL

✓Fasting blood glucose of < 100 mg/dL

AHA's Life Simple Seven

Thank you for listening!