Intracerebral haemorrhage:

- 10% of all strokes.10/100000 population per year.
- Trauma is the most common cause of ICH.
- **Causes of spontaneous ICA**

1. Hypertension. The most common cause
2. Aneurysms, AVM, cavernomas, dural AVF.
3. Coagulopathy: (anticoagulants, antiplatlets, liver disease, renal failure, blood disorders such as leukaemia, thrombocytopenia "idiopathic or drug induced"
4. Tumours primary and secondary
5. Structural vascular lesions: vasculitis, Moyamoya, amyloid angiopathy, polyarteritis nodosa, SLE.
6. Haemorrhage in ischemic infarction. Venous infarctions "venous thrombosis"
7. Drugs : amphetamine, cocaine, heroin

- HTN is the most common cause of ICH. Classically the haemorrhage is in the putamen, caudate N, deep white matter, thalamus, brain stem or cerebellum less likely lobar. Hypertensive ICH is related to lipohyalinosis (deposition of fat in the media of small and medium size perforators). 85% of patients with chronic HTN has miliary Charcot-Bouchard aneurysms , however a cause relationship between these aneurysms and ICH was not established
- The risk of ICH in patients on **warfarin** is about **1% per year** and increases in elderly, in patients with HTN and in those on aspirin. ICH secondary to warfarin carries high mortality **65% Fibrinolytic therapy** is associated with **0.5-1.4** % risk of ICH. There is statistically insignificant increase in the risk of ICH haemorrhage secondary to antiplatlets **(0.6%** compared to **0.3% in** general population in one study) and probably at low dose of aspirin 100mg per day the risk is not increased. Drugs (amphetamine and cocaine) can cause haemorrhage by either causing acute HTN or arteritis due to toxicity or hypersensitivity. **Amyloid angiopathy** characterised by deposition of amyloid in the media and adventitia of cortical and subcortical arteries is the most common cause of lobar non hypertensive bleed in patients older than 70 years. It is found in **25-50%** of patients >70 and in **60% in those** > 90 years. The bleeding is usually lobar, affecting parietal and occipital lobes. Another characteristic is multiplicity and recurrence.
- Secondary tumours prone to cause haemorrhage are melanoma, renal cell carcinoma, choriocarcinoma and bronchogenic carcinoma. Primary tumours prone to haemorrhage are GBM, oligodendroglioma, pituitary adenoma.
- The most common causes of ICH in the young patients are AVM, aneurysms, and drugs (amphetamine, cocaine). In the elderly HTN, tumours, coagulopathy and amyloid angiopathy.
- The most common form of ICH is putaminal haemorrhage from lenticulostriate perforators, caudate 7%, and thalamic 10% from thalmoperforators from PCA.
- The most common causes of cerebellar haemorrhage are HTN and coagulopathy
- The most common location of brain stem ICH is the pons from perforating branches of basilar artery
- Presentations: Headaches, vomiting, decrease level of consciousness and focal signs depending on the location

- Investigations : CT head, FBC, coagulation screen, vasculitis screen, MRI/MRA, cerebral angio if aneurysm or AVM are suspected **(associated SAH, proximity to sylvian fissure or circle of Willis, calcification, lobar haematoma and patients <45 years of age**), cardiac echo and carotid U/S if ischemic infarction due to embolism is suspected and Protein S,C antithrombin III, lupus anticoagulant .
- **Management**= investigations and treatment. Investigations as above. Treatment include **control of blood pressure** (the degree to which blood pressure should be controlled is controversial. Theoretically decreasing the BP may prevent haematoma expansion; however overaggressive treatment may decrease CPP and may worsen damage from ischemia in the penumbra area. To balance these 2 theoretical rationales the American heart association recommend lowering BP TO map< 130 in patients with chronic hypertension and to MAP <110 in patients after surgery and if patient had ICP to maintain CPP>70. The recommended drug is sodium nitroprusside at a dose of 0.3-8 Mcg/kg/min (vasodilator). No place for steroids (2 prospective studies). Elevated ICP should be controlled by mannitol, EVD in case of hydrocephalus or surgery to drain the haematoma. **The mortality from ICH** is high a 27-77%. In recent series decreased to **20-30%** (In CT scan era more small haemorrhages are detected) Most studies recommend surgery for infratentorial haematomas greater than 3-4 cm in diameter.
- **Surgery vs. medical treatment is a controversial topic**. Meta-analysis of 7 published prospective studies showed no advantage of surgery over medical treatment. Meta-analysis of the 6 prospective studies in the post CT scan era showed that there is a trend towards better outcome in surgically treated patients, particularly with lobar haematomas, but the difference was statistically not significant. Review of the published retrospective data showed conflicting results due to selection bias and the heterogeneity of the patients included. The decision to operate or not should be individual. Here are some guidelines helping in the decision making.

1. In patients with GCS 13-15, surgery is not required and patients are closely observed. Surgery is offered in case of deterioration
2. Patients with GCS of 3-6 and large haematomas have a very poor prognosis and probably surgery is not indicated, particularly if they are elderly with medical problems and with basal ganglia haematoma.
3. In patients with GCS 6-13 , the decision should be individual taking into account the patient's general medical condition, previous functional status, the location of the haematoma (deep or lobar). Age per se is should not be a factor in decision making, neither the location in dominant VS. Non dominant hemisphere (outcome studies indicate that despite language disability associated with lesions in dominant hemispheric lesions, functional outcome is not necessarily worse).
4. Because of the rapid deterioration of infratentorial haematomas, most authors recommend surgery fro haematomas >3-4 cm in maximal diameter.

- The outcome depends on the

1. **Age** (higher mortality and poorer outcome for patients > 60 years).65% mortality and 65% poor outcome. Independent factor
2. **Volume** of the haematoma (Kwak methodABC/2 or using the formula for ellipsoid). Small haematomas <30ml –good prognosis, moderate 30-100ml –

variable prognosis depending on other factors, massive >200ml-very poor prognosis.

3. **GCS** at presentation.97% sensitive and specific in predicting 30 days mortality. GCS <8 and volume >60ml=90% mortality

- 50% of patients with supratentorial ICH show increase in the size of the haematoma in the first 24 hours and mainly in the first 6 hours, hence the need for strict neuroobservation. Infratentorial haemorrhage tends to progress rapidly and cause death secondary to brain stem compression.

STICH study: prospective randomised Multicenter study comparing surgery with medical treatment for supratentorial ICH. There was no overall benefit from early surgery compared to initial conservative treatment.
Criticism: Selection bias: patient were randomised only if the treating surgeon was unsure which treatment is best which means a young man with ICH and GCS of 8-13 will go for surgery and not be randomised and 80 year old with low GCS and basal ganglia haemorrhage will be treated medically and not be randomised or patient with GCS of 13 and small ICH will be observed and not randomised etc…
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