Intracranial hypertension and headache

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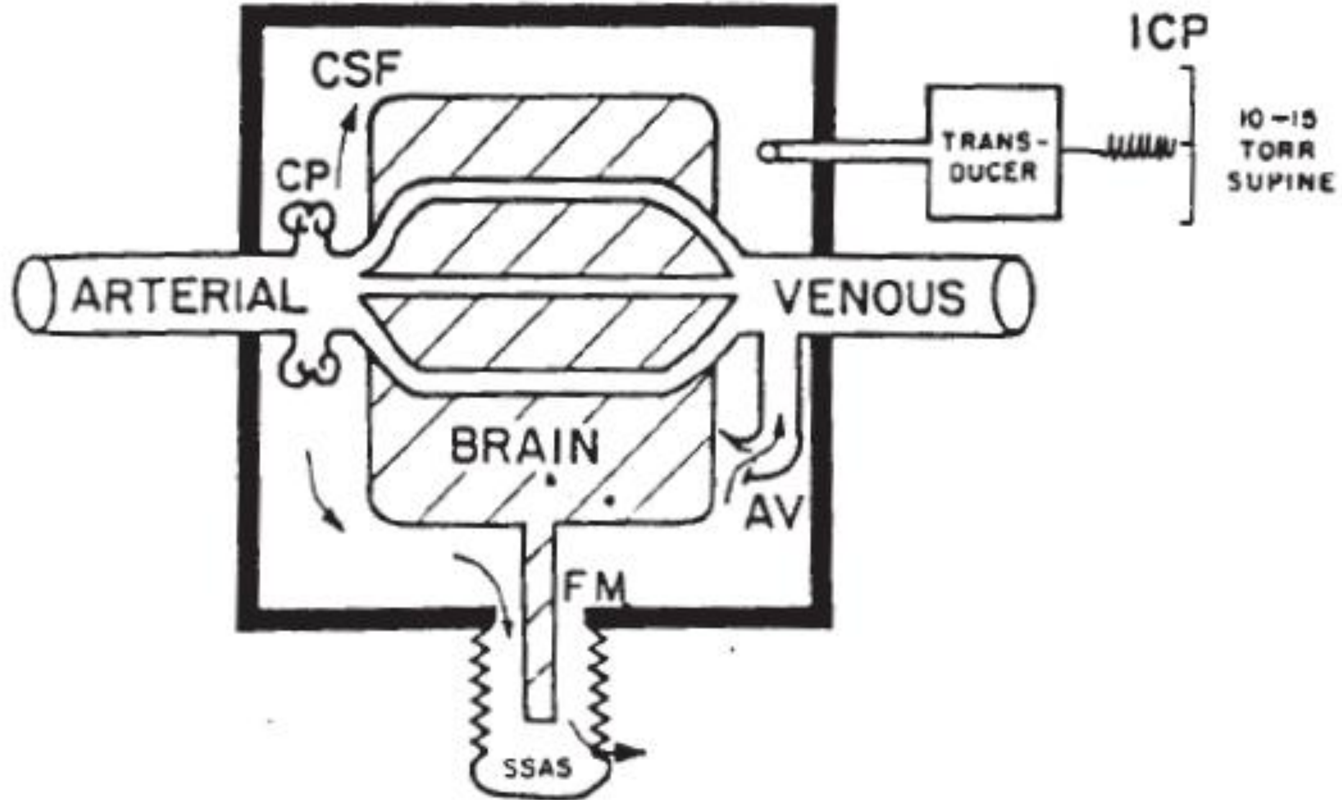
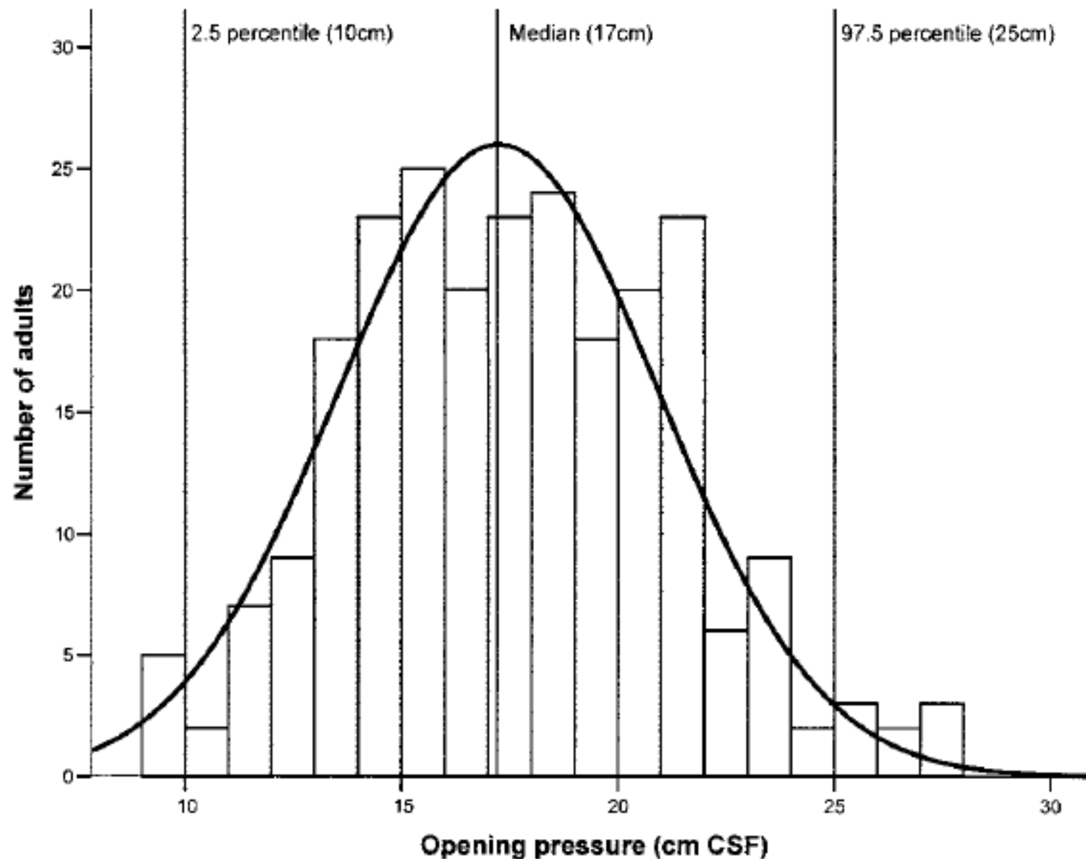
Presentation outline

- ICP physiology
- Increased ICP and headache
- Secondairy causes of increased ICP
- Idiopathic intracranial hypertension (IIH)
- IIH and primary headache syndromes
- Discussion

ICP physiology



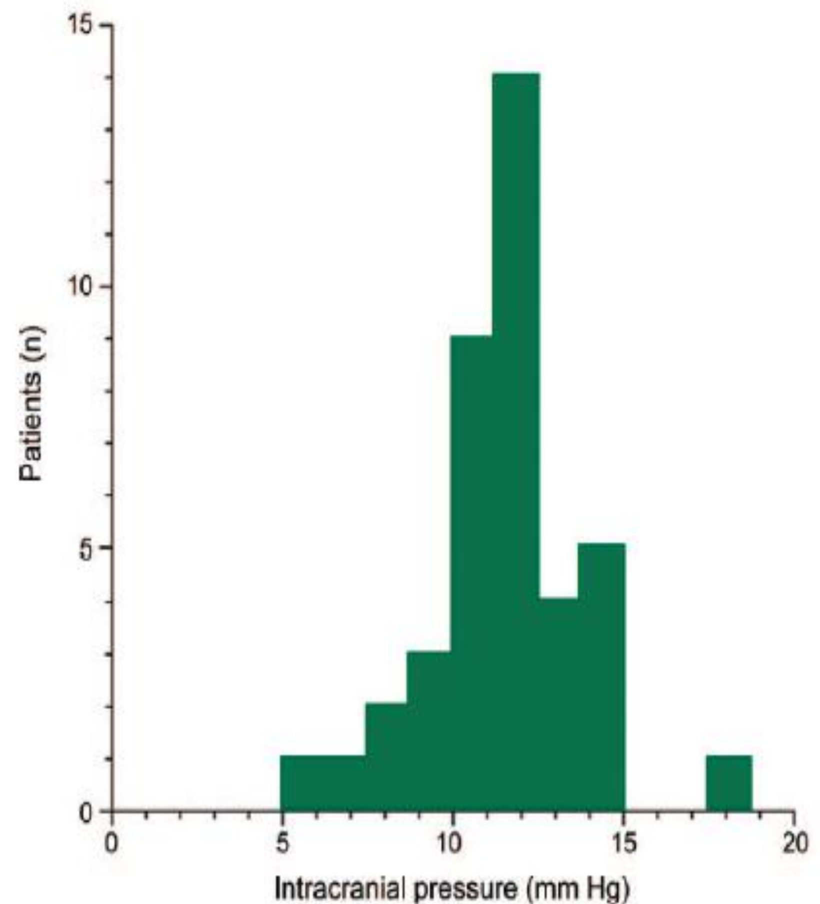
Normal CSF pressure in adults



* Whiteley, Neurology 2006

CSF pressure elderly (n=40)

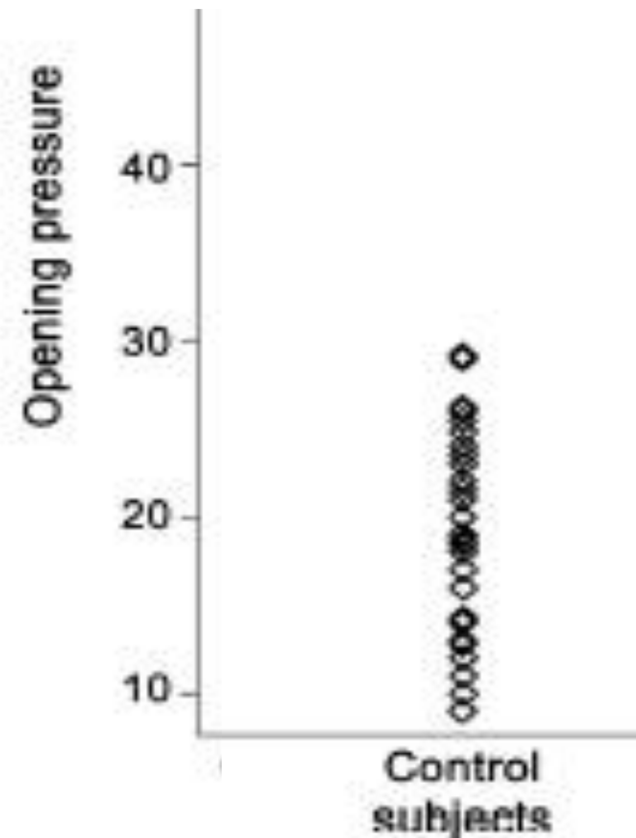
- Median pressure: 11.6
- Mean age: 70
- Median BMI:24.6



* Malm, Neurology 2011

CSF pressure children

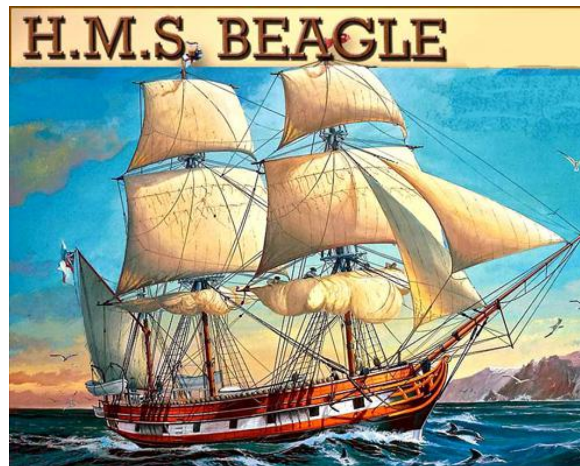
- Median pressure: 18.6
- Mean age: 12
- Median BMI: 21



* Avery, Neurology 2011

Headache due to increased ICP

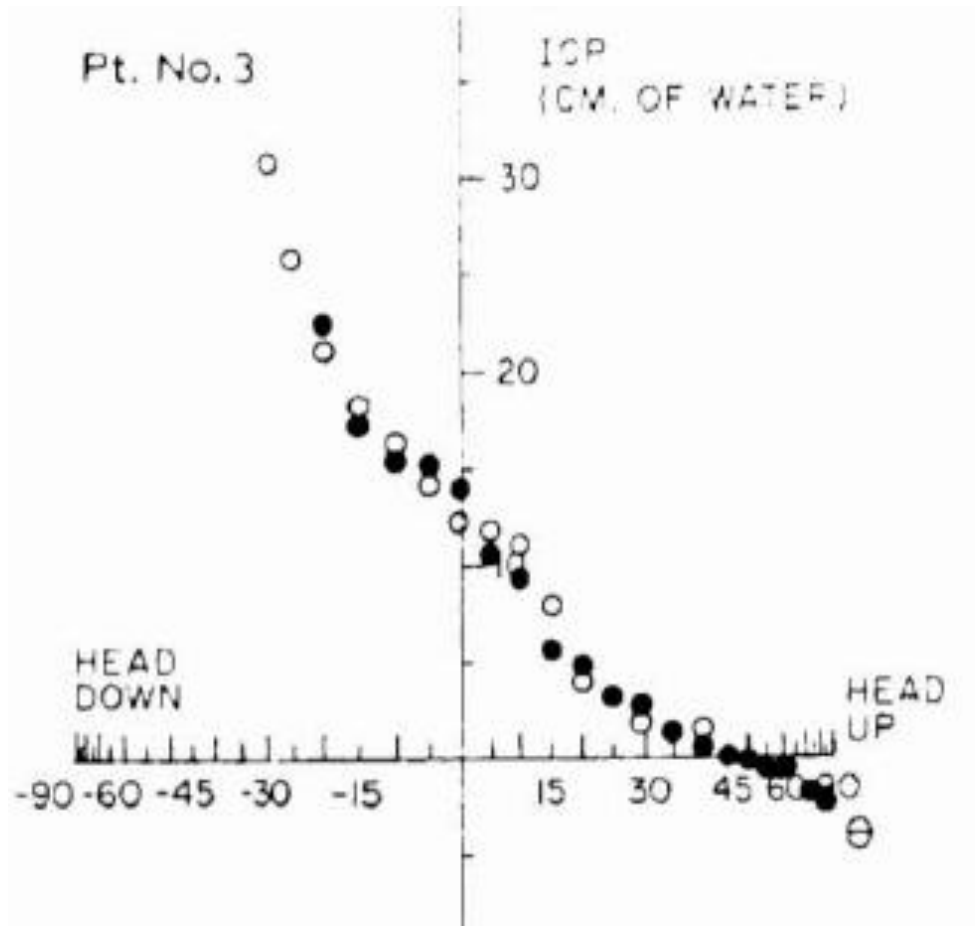
- What are the characteristics of the headache?
- When does ICP increase becomes painful?
- What is the origin of the headache?
- What are the treatment strategies?



Different approaches…

- Experiments
  - Trendelenburg/ Microgravity
  - CSF infusion
- Diseases with increased ICP

Trendelenburg test



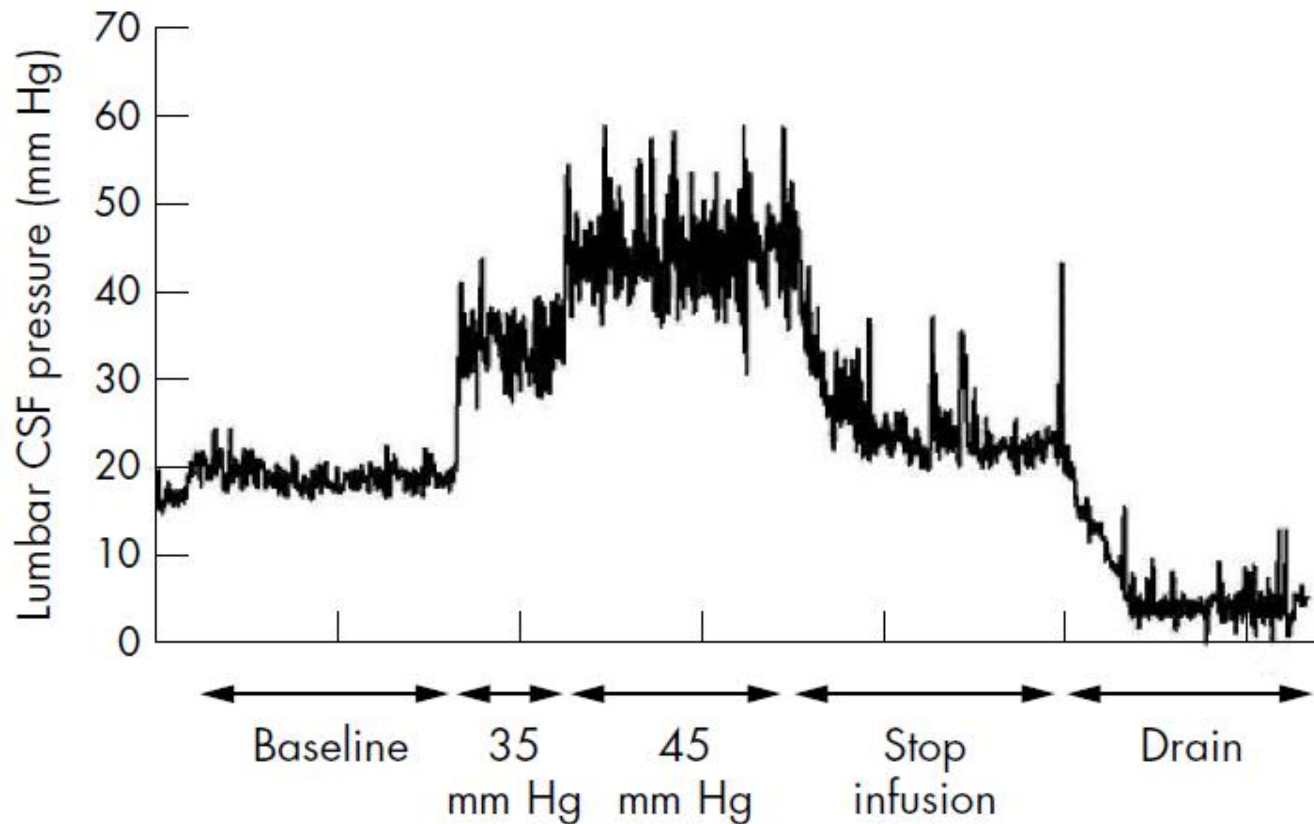
* Chapman, Neurosurgery 1990

CSF infusion studies

- Selection of shunt candidates among NPH
- 2 lumbar needles
- Artificial CSF

* Malm, Acta Neurol Scan 2011

Lumbar pressure profile



* Agren-Wilsson JNNP 2005

Headache during infusion

- No discomfort in 394 out of 474 patients (83%)
- Mild headache, dizziness or nausea (13%)
- Severe headache (4%)
  - Risk factors:?
  - Headache characteristics?

*Malm, Acta Neurol Scan 2011; *

Diseases causing ICP increase

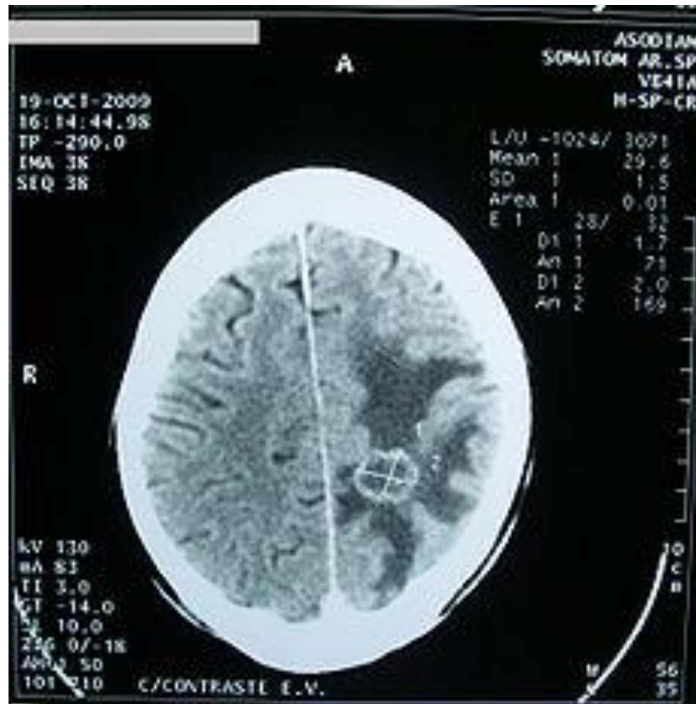
- Secondary
  - Mass leasions
  - Cerebral venous trombosis (CVT)
  - Infections
  - Systemic illness
  - Metabolic disorders
  - other
- Idiopathic

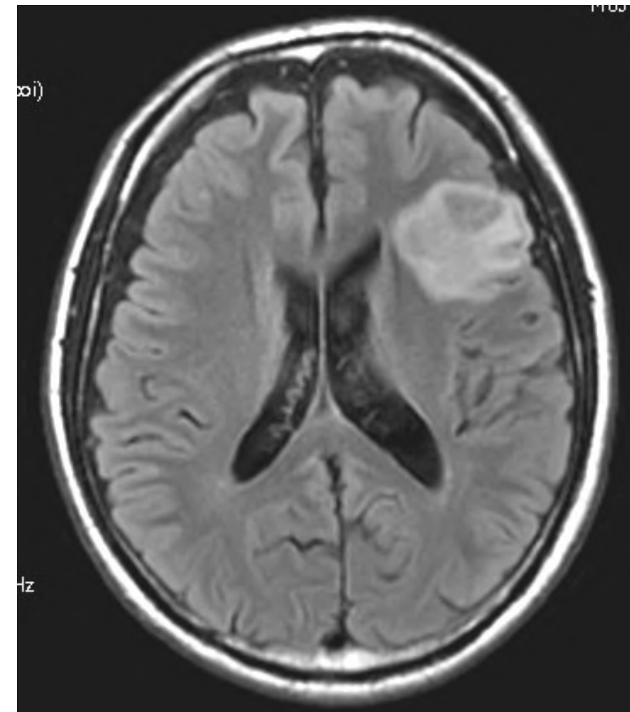
IHCD-II classification

- 7.1.1 Headache attributed to idiopathic intracranial hypertension (IIH)
- 7.1.2 Headache attributed to intracranial hypertension secondary to metabolic, toxic or hormonal causes
- 7.1.3 Headache attributed to intracranial hypertension secondary to hydrocephalus
- Headache due to neoplasm, infection and vascular disorders are coded elsewhere

Q: Brain tumor headache

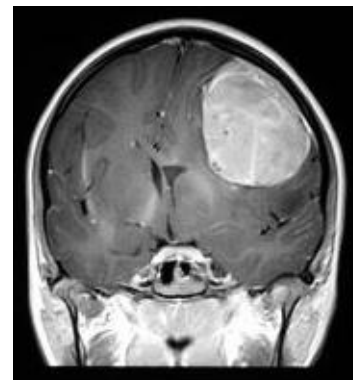
- Which patient is more lickely to have pain?





Brain tumor headache

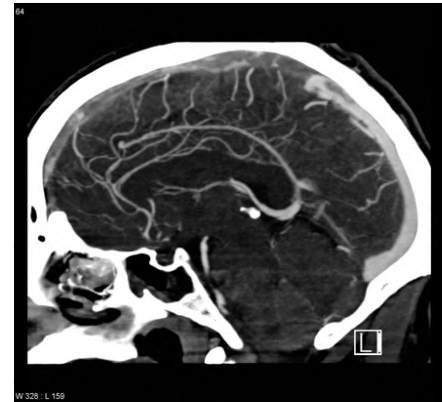
- 30-70% of brain tumor patients have headache
- Infratentorial or intraventricular more frequent
- Association with cerebral edema
- No relation to size of tumor
- Throbbing pain; mimicking migraine
- Progressive headache in weeks/months
- Relation with ICP?
  - 25-35% have morning headaches



*Goffaux Neurosurgery 2010; * Pfund, Cephalalgia 1999

Headache in venous thrombosis

- Prevalence 0.6-7 per 100.000
- 70-80% of CVT patients have headache
- In 17% headache only symptom
- Headache is not related to location thrombus
- ±70% of CVT have ICP> 20cmH2O
- Relation ICP and headache unclear



*Biousse Neurology 1999; *Lin Ophtamlmology 2006; *Cumurciuc JNNP 2005

Idiopathic intracranial hypertension

- Prevalence 1 to 13 per 100.000
- Incidence in females 4-8x higher
- Association with obesity

Modified Dandy criteria

- Symptoms of increased ICP
- No localizing findings in neurological exam
- Awake and alert patient
- Normal CT/MRI findings
- ICP of 250 mm H2O with normal CSF
- No other cause of increased ICP found

* Binder, Neurosurgery 2004

Headache characteristics in IIH

- Occuring in >90% of patients
- Generalized, moderate, pulsatile of pressing
- Worse in the morning
- Aggravation with coughing or straining
- Daily in 75%
- Decrease of pain with ICP normalization

* Dhungana, Acta Neurol Scand 2010; * Mathew, Neurology 1996

Origin of headache in IIH

- Little information...
- Meningen and meningeal bloodvessels are pain sensitive
- Nociceptors are mechanosensitive
- Variation in nociceptor sensitivity in rats
  - ICP of 20mmHg would activate <3% of receptors
  - ICP of 40mmHg around 18%
  - Thresholds might be lower due sensitisation

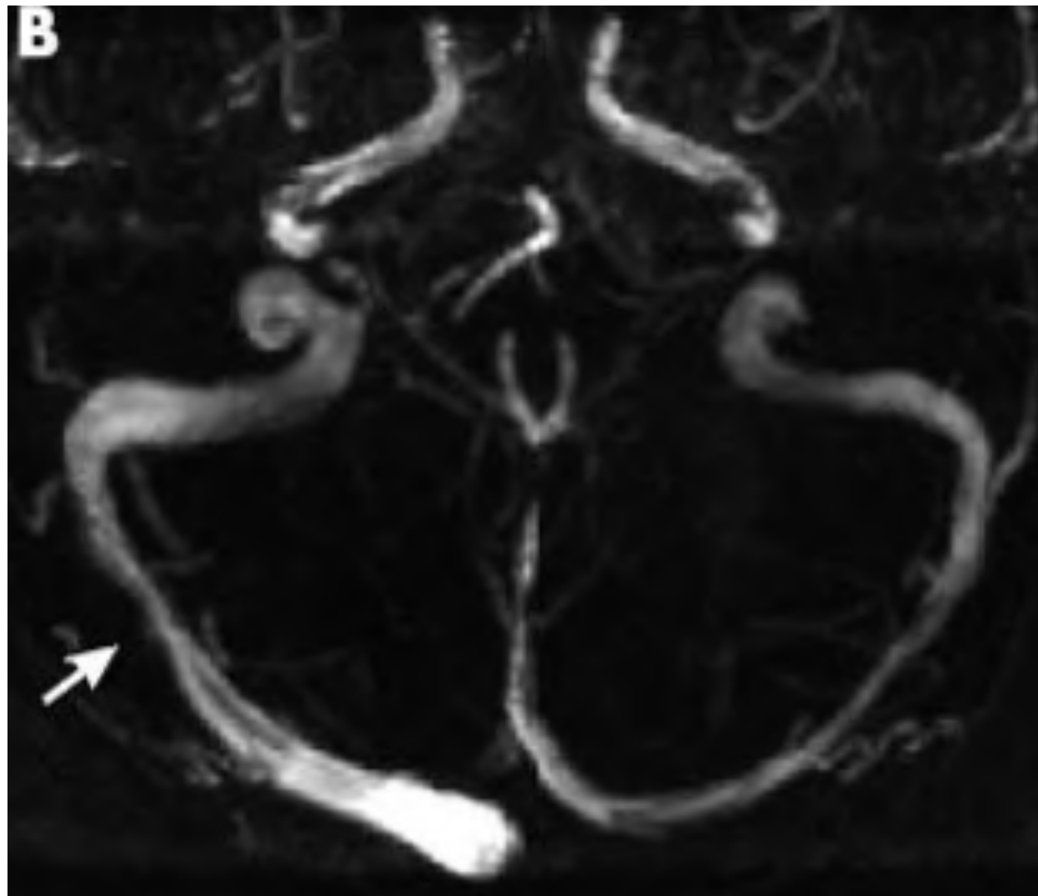
* Strassman, J Neurophysiol 2006

Pathogenesis of ICP increase in IIH

- Altered CSF dynamics; venous stenosis
- Obesity
- Other associated factors:
  - Renal failure
  - Systemic lupus erytematosus
  - Drug induced (hypervitaminosis A, lithium etc)

* Dhungana, Acta Neurol Scand 2010

Q: Venous stenosis… stent?



*Higgins JNNP 2004

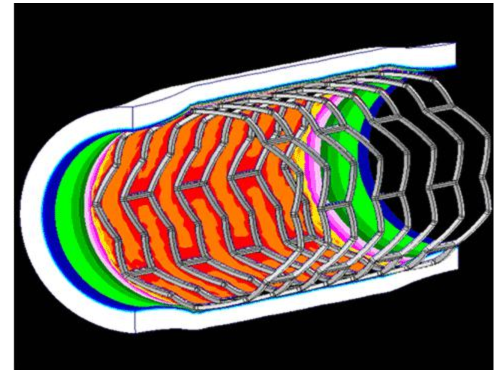
IIH and stenosis of transverse sinus

- MRV studies
- Higgins et al 2004:
  - IIH patients n=20
  - Controls n=40
  - Bilateral stenosis in 13 patients and none in controls
- Increase venous pressure prestenotic

*Higgins JNNP 2004; *Karahalios Neurology 1996

Stenting results in case series

- 9 case series from different countries
- Total 40 published cases
- Transverse sinus
- Outome:
    - Around 45% asymptomatic
    - 35% improvement of symptoms
    - Rest no effect
- Complications such vessel perforation



*Arac Neurosurg focus 2009 (review),; *Bussiere , Am J. Neurorad 2010

Cause or consequence?

- Stenosis seems to bee associated with IIH
- Stenting of the stenotic segment might improve symptoms
- Lowering ICP through medication also does reverse the stenosis

Obesity and IIH

- “Prototype” IIH patient???

Prevalence

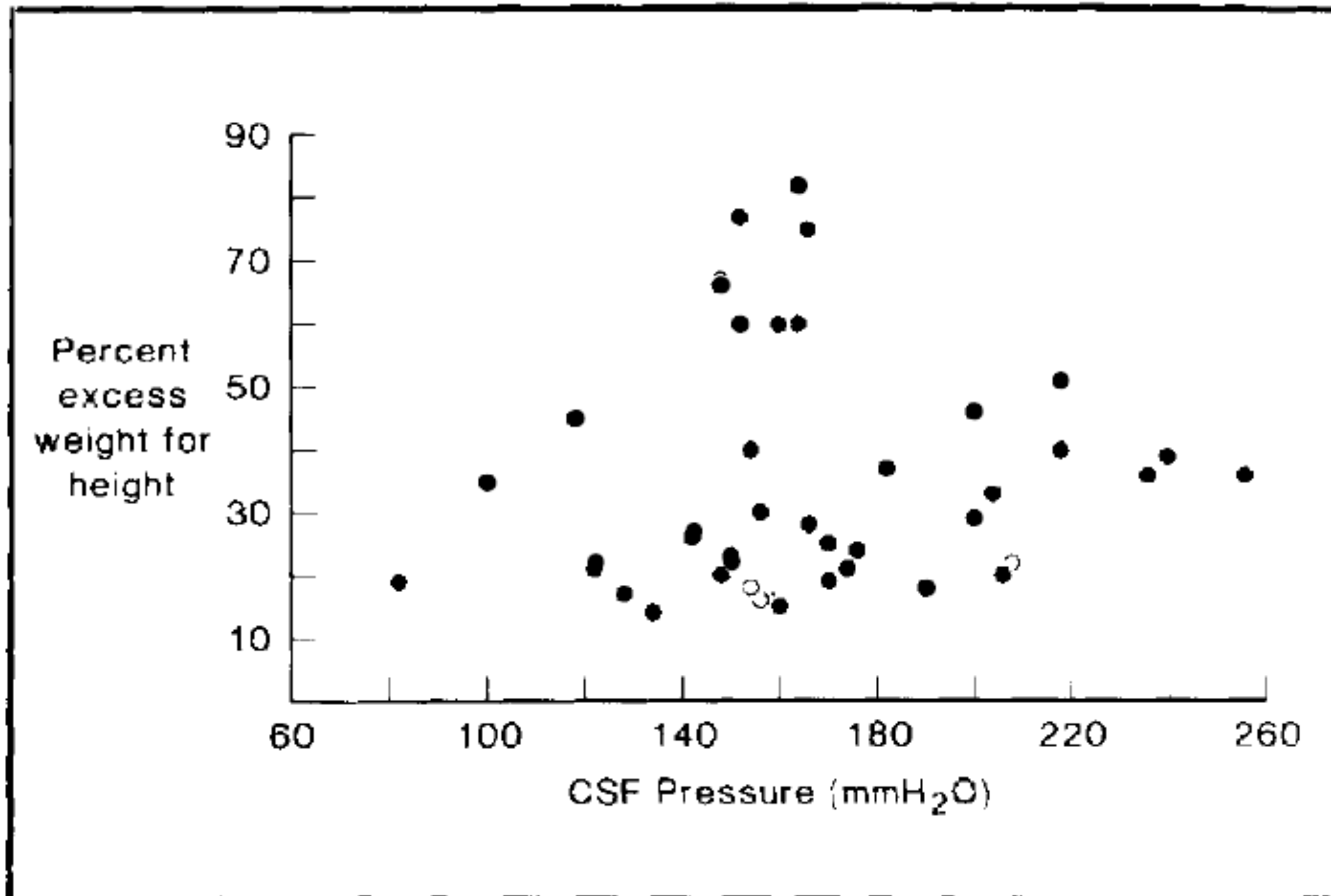
- non-obese: 1/100.000
- >10% above ideal weight: 13/100.000
- >20% above ideal weight: 19/100.000

BMI and ICP

- Study hannerz
  - Randomly selected obese BMI 34-47 kg/m2
  - 79% boven 20 cm H20
  - 42% boven 25 cm H20

*Hannerz, Int J Obese Relat Metab Dis. 1995

Obese without IIH symptoms



*Corbett, Neurology 1983

Treatment of IIH

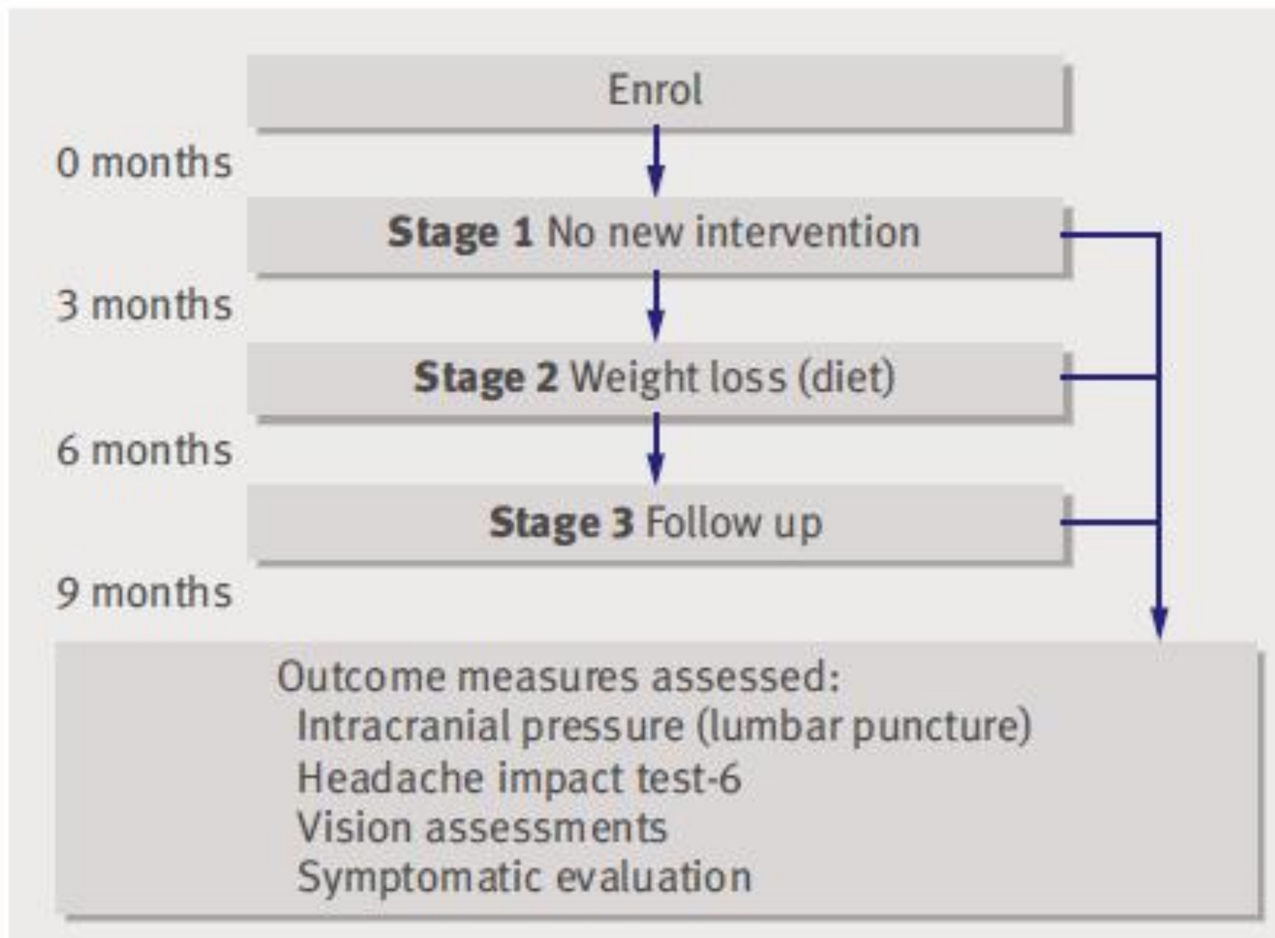
- Weight reduction
- Medication
- Invasive strategies
  - Serial LP
  - Surgery

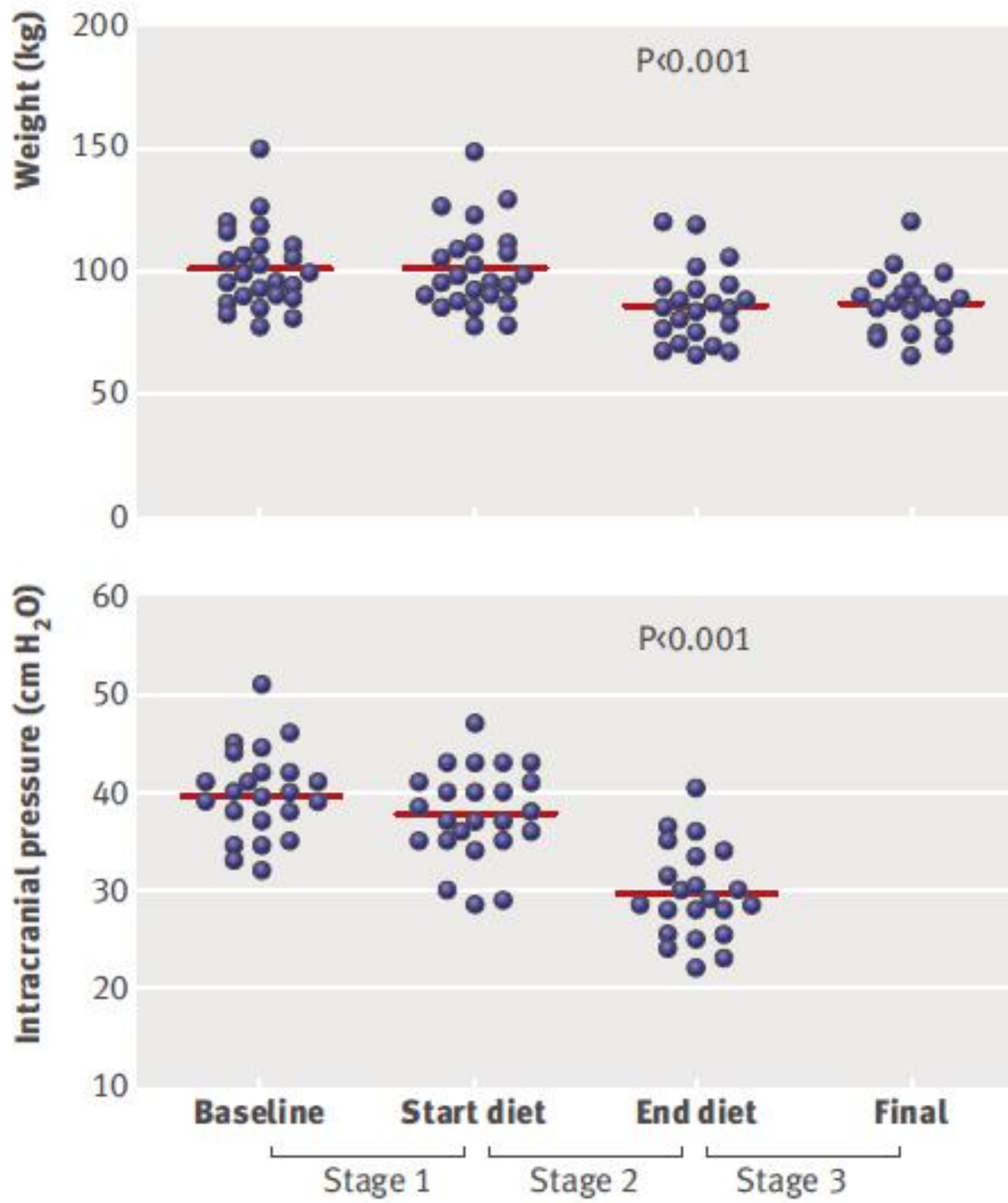
Weight reduction

- No RCT
- Mainly retrospective case series
- One prospective cohort study with 3 month baseline and measurement of ICP
  - N=25

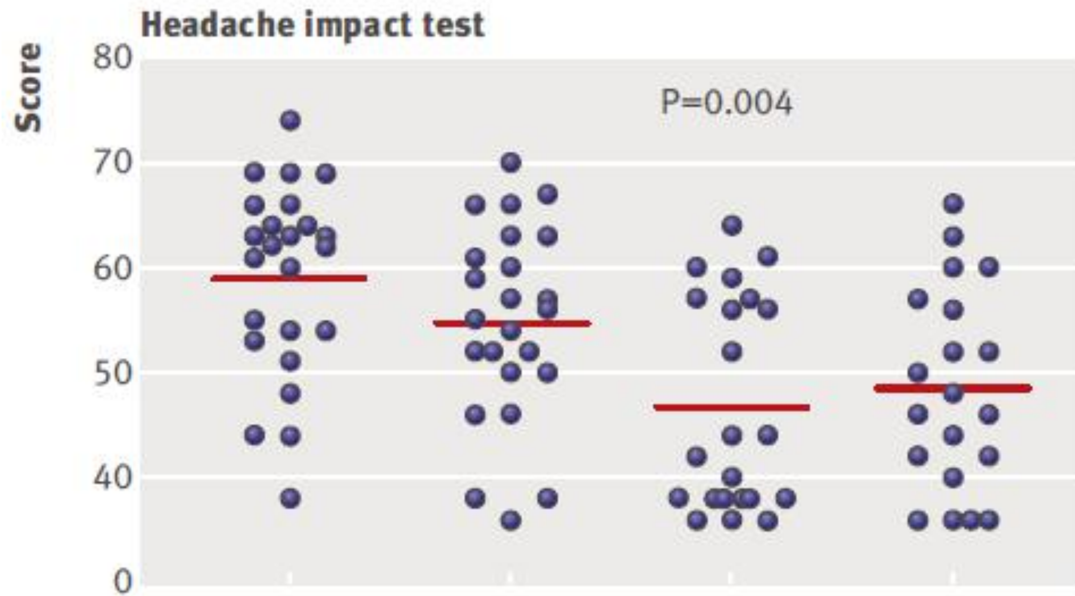
*Sinclair BMJ 2010

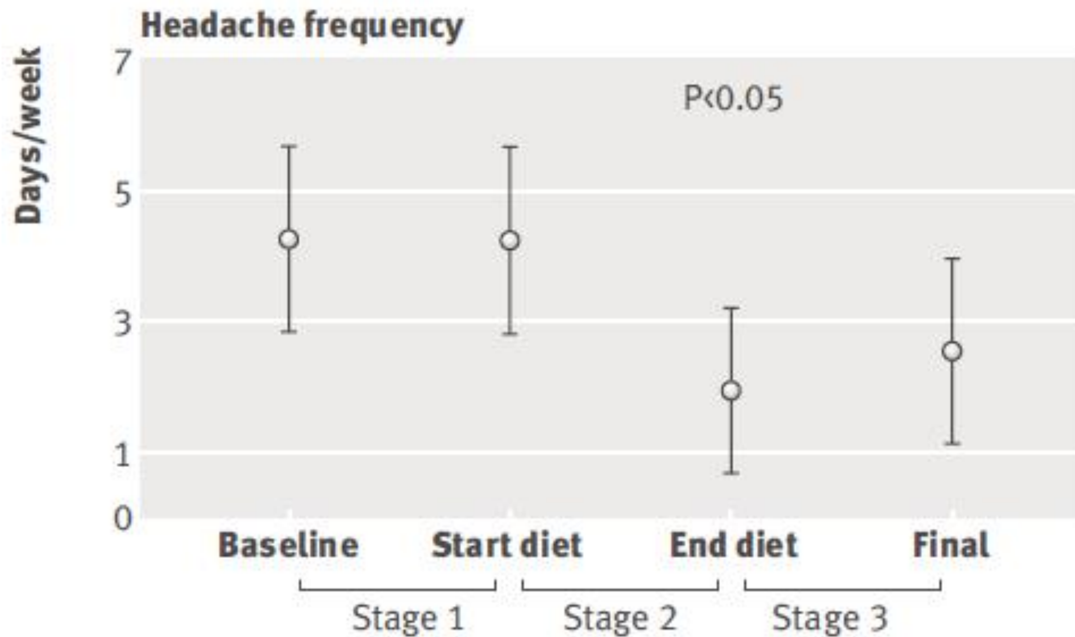
Study design





Weight (kg)
200
150
100
50
0
P<0.001
Intracranial pressure (cm H_2O)
60
50
40
30
20
10
P<0.001
Baseline
Start diet
End diet
Final
Stage 1
Stage 2
Stage 3


Headache impact test
Score
80
70
60
50
40
0
P=0.004


Headache frequency
Days/week
7
5
3
1
0
P<0.05
Baseline
Start diet
End diet
Final
Stage 1
Stage 2
Stage 3

Q: Medication to treat IIH…

- Which would you prescribe and what dose?
  - Azetazolamide
  - Digoxin
  - Furosemide
  - Methylprednisone
  - Octreotide
  - Topiramate

Medication – quiz…

- Which would you prescribe and what dose?
  - Azetazolamide: 500mg 2dd
  - Digoxin: ? 1 study , serious side effect
  - Furosemide: ? Sporadic case reports
  - Methylprednisone ? Sporadic case reports
  - Octreotide max 1mg/day, open label, n=26
  - Topiramate max 100-150mg/day

*

Interventions

- Serial LP
- Optic nerve fenestration
- CSF shunting (LPD or VPD)

- For further details please read review

*Binder, Neurosurgery 2004

IIH and primary headache syndromes

- Clinical overlap with “CDH”
  - 12 out of 85 patients had CSF pressure > 25
  - No difference in headache symptoms
- Case control study IIH (n=25) vs “CDH” (n=60)
  - No difference headache symptoms
  - Tinnitis and obesity associated with IIH

- Rule out IIH in patients with frequent headache

*Mathew, Neurology 1996; * Wang, Neurology 1998

Discussion

DISCUSSING THE WAR IN A PARIS CAFE.
SEE PAGE 304.