The Importance of Head Circumference:

When to reassure, when to monitor, when to refer?

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How to measure the OFC…

Equipment

Head circumference should be measured using a flexible, non-stretchable measuring tape or disposable paper tape

- ensure the tape is clean after each use
- replace the plastic tape at least yearly, or more often if needed.
- 0.5 – 1.0 cm width and 0.1 cm increments

Preparation

Sit the child on the carer's lap facing you. Very young infants may be measured lying down.

Procedure

Place the tape around the head at points just above the eyebrows, above the ears and around the occipital prominence at the back of the head

Pull the tape gently to compress the hair

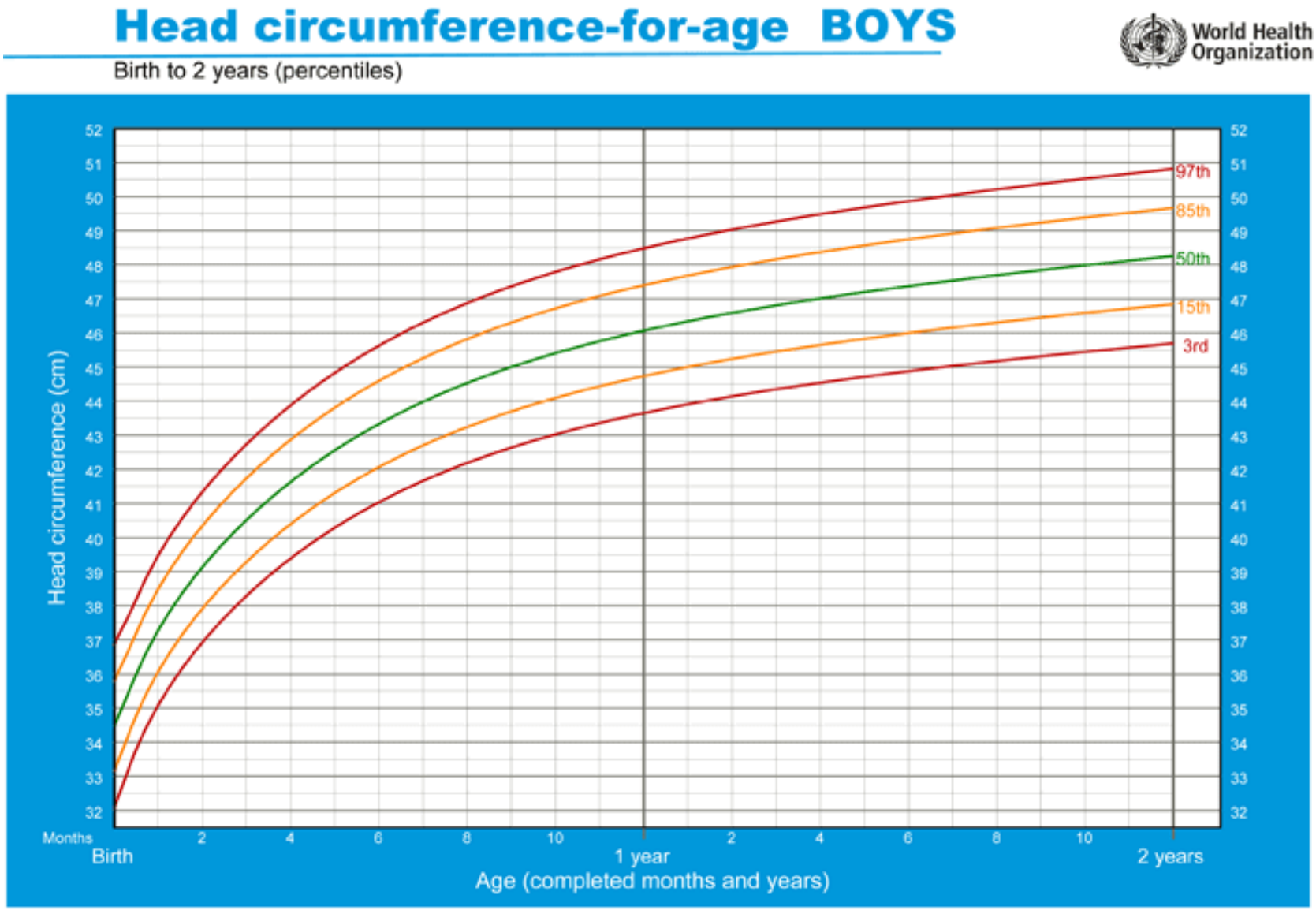
Recording

- Record head circumference to the nearest 0.1 cm
- Plot on the WHO Head circumference growth chart

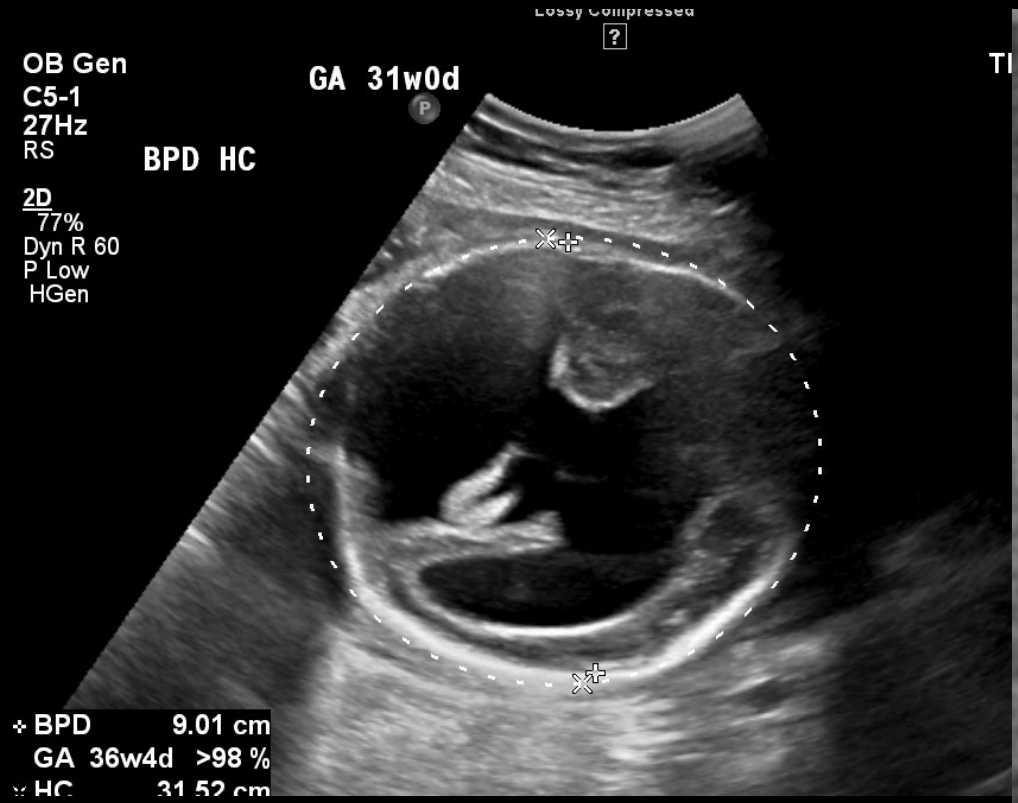
Measurement of OFC

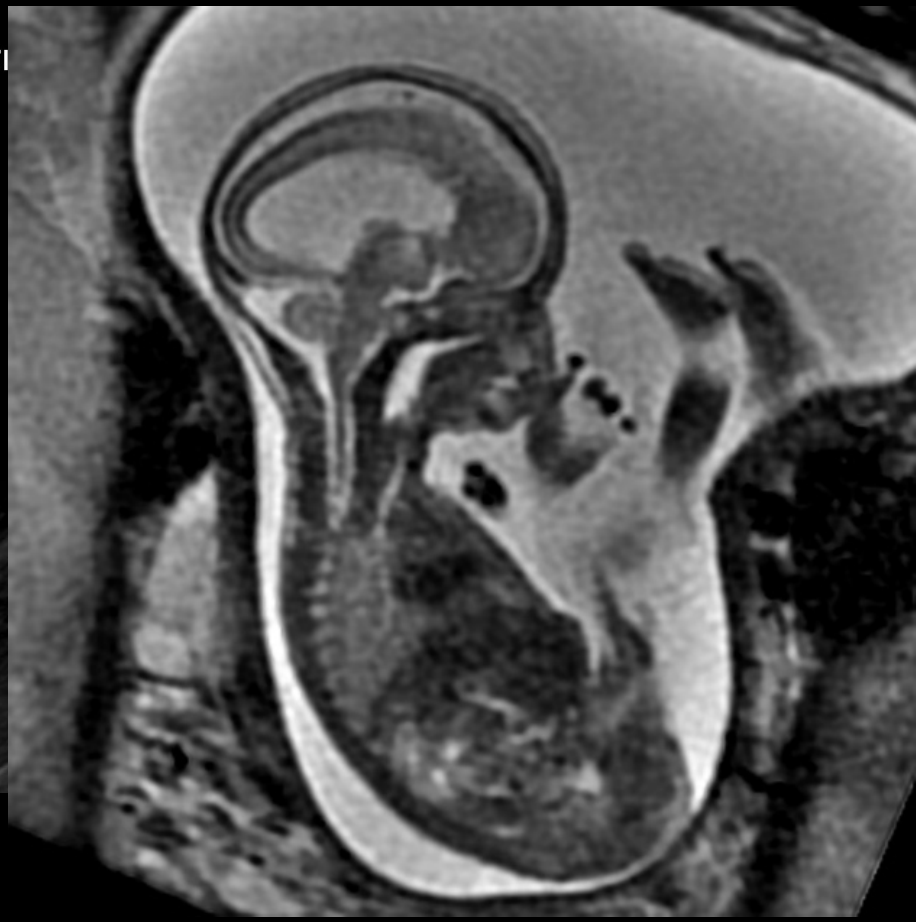
Average OFC at term is 35cm

Plotting OFC



Before Birth…..





Antenatal growth…

- Weight, Length and Head circumference should be measured **at birth**
- Asymmetrical growth restriction – a reflection of ”head sparing”
  - Mild to moderate pre-eclampsia
  - smoking
- Symmetrical growth restriction – more severe IUGR, syndromic or reflect antenatal brain injury

Normal head growth needs…..

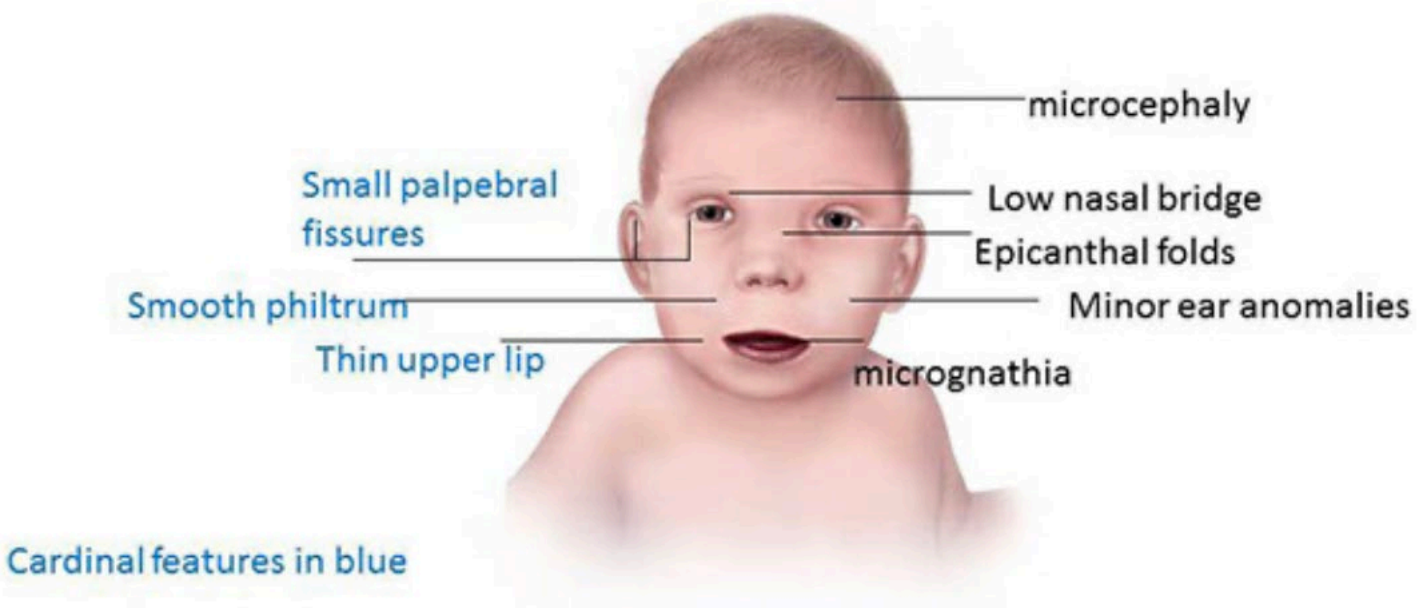
- Good nutrition
- A normal skull
- A normally growing brain
- A normal endocrine profile
- A nurturing environment

The Small Head
Microcephaly – OFC < p2

- Small *at birth*
  - Abnormal brain development
    - anencephaly
  - Antenatal brain insult - haemorrhage
  - Teratogen – EtOH*, smoking
  - Congenital Infection
    - eg. CMV, toxoplasmosis, Zika Virus
  - Severe IUGR – severe placental dysfunction
  - For twins – TTTS
  - Syndromes – Down Syndrome
  - Craniosynostosis

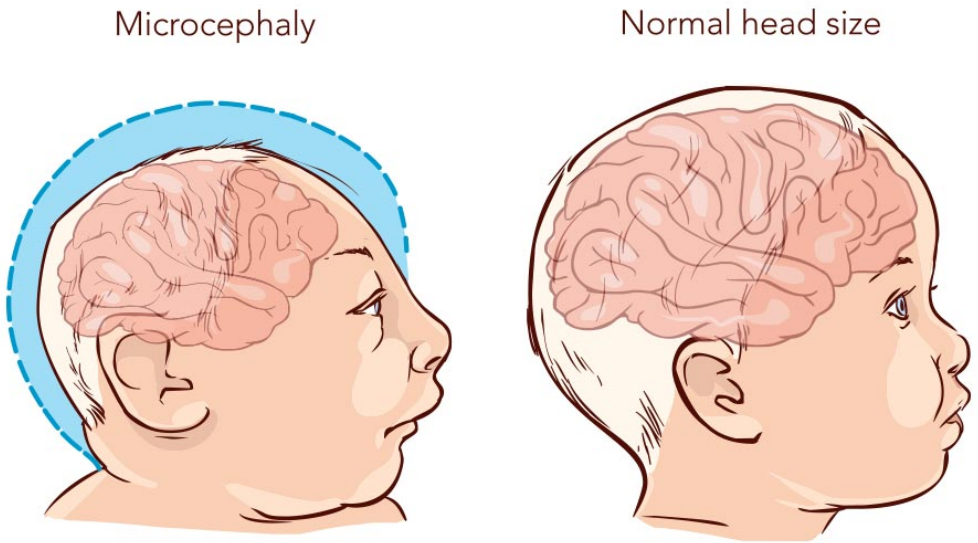
*Fetal Alcohol Syndrome

- Obtain a history of alcohol consumption during pregnancy
- How much is too much?
  - *No amount of EtOH is safe during pregnancy*



Evolving microcephaly *after* delivery

- Insults to the brain at the time of birth, or early in life
  - Hypoxic-ischaemic encephalopathy
  - Meningitis – bacterial or viral
  - Intracranial haemorrhage
  - Trauma
  - RARE causes
    - IEM – PKU
    - Mitochondrial disorders



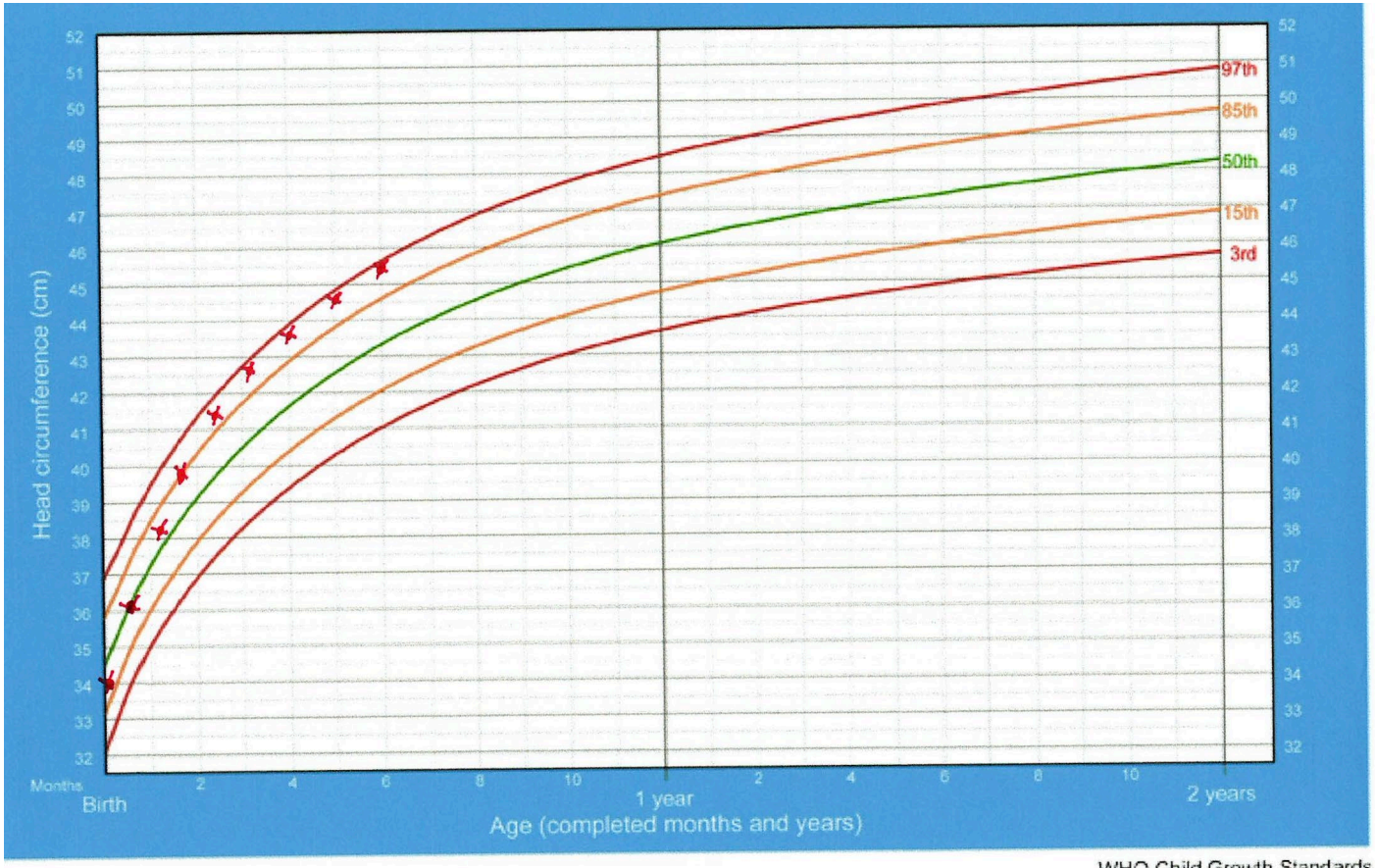
Microcephaly – *General Comments*

- Rare
  - WHO 1 in 25,000 – 300,000
- A minority of children with microcephaly will have normal intelligence
- BUT – most with microcephaly, regardless of cause – will face challenges with neurodevelopment

➢REFER!

The Large Head
Macrocephaly – OFC > p98

- The most common cause is *Familial*
  - *BENIGN!*

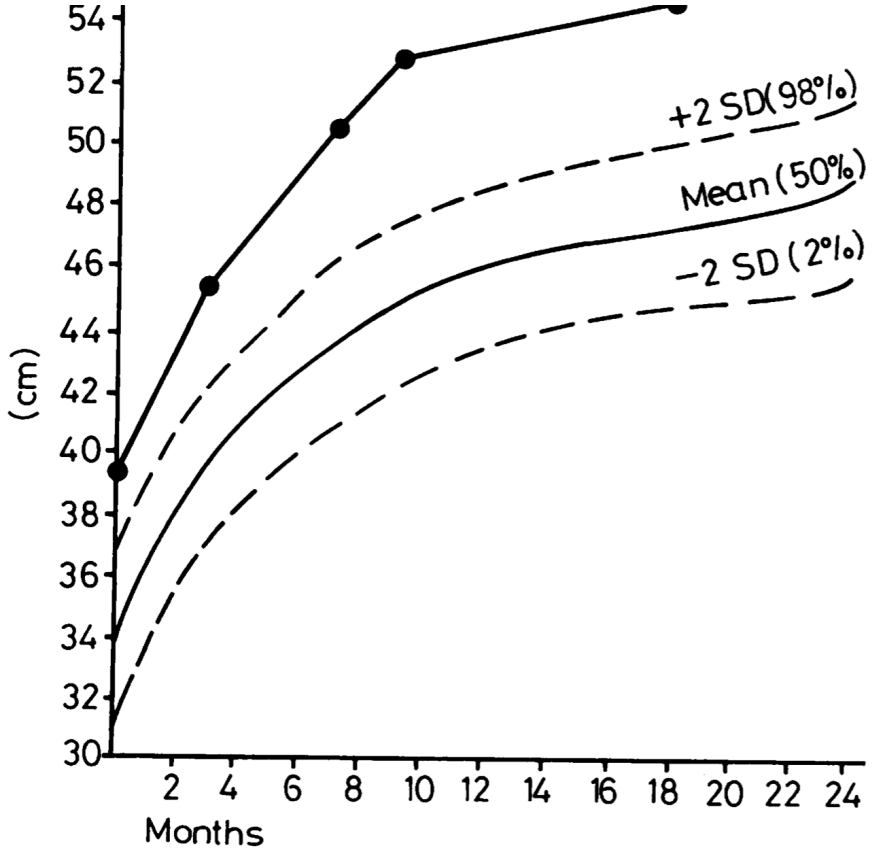


Archives of Disease in Childhood, 1979, **54**, 512–517

Normal children with large heads—benign familial megalencephaly

R. E. DAY AND W. H. SCHUTT

Bristol Royal Hospital for Sick Children



Must measure the parents' OFC

Often the Father will be the offending parent

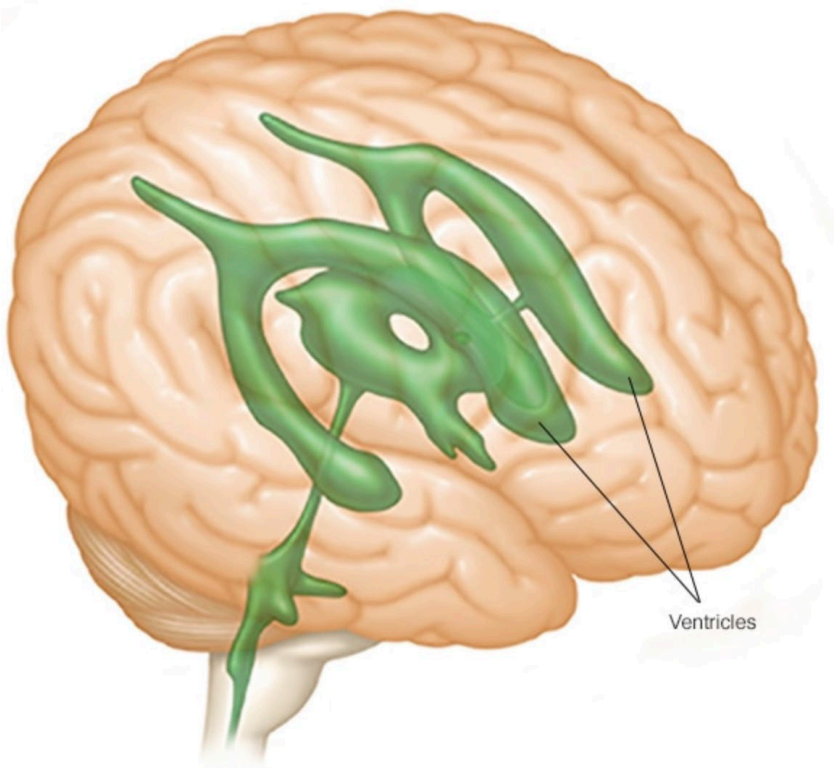
There may be siblings with large heads.

These families can be reassured

BUT IF IN DOUBT……REFER!

Macrocephaly - Hydrocephalus

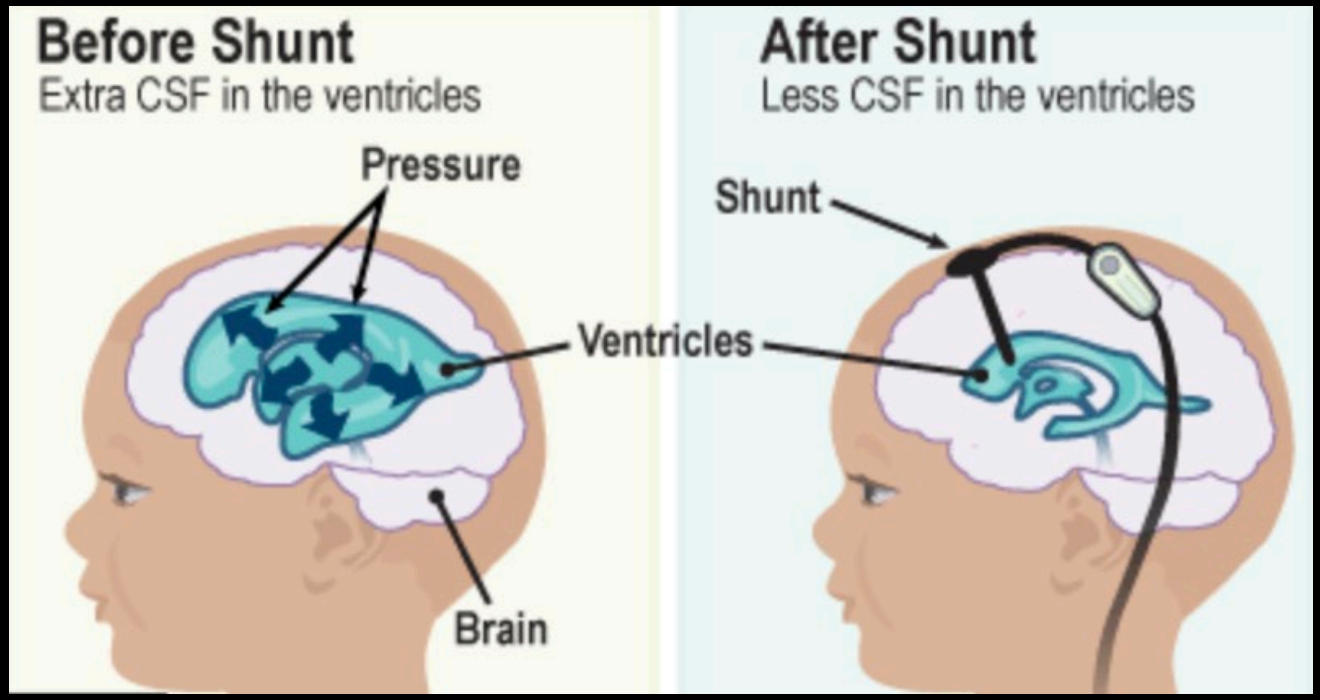
- Caused by an imbalance of CSF production and absorption
- Causes include
  - ↑ Production
    - IVH
  - ↓Absorption
    - Bleeding
    - Obstructed absorption
      - Meningitis
      - Tumor
      - Genetic causes – X-linked
      - Aqueductal stenosis

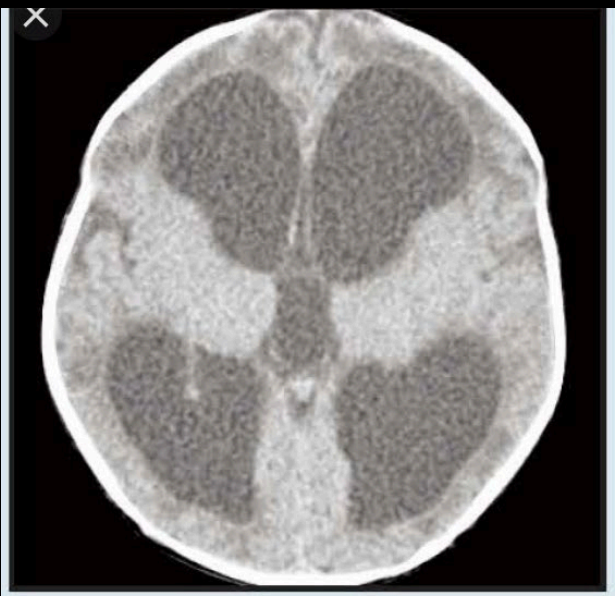


Hydrocephalus

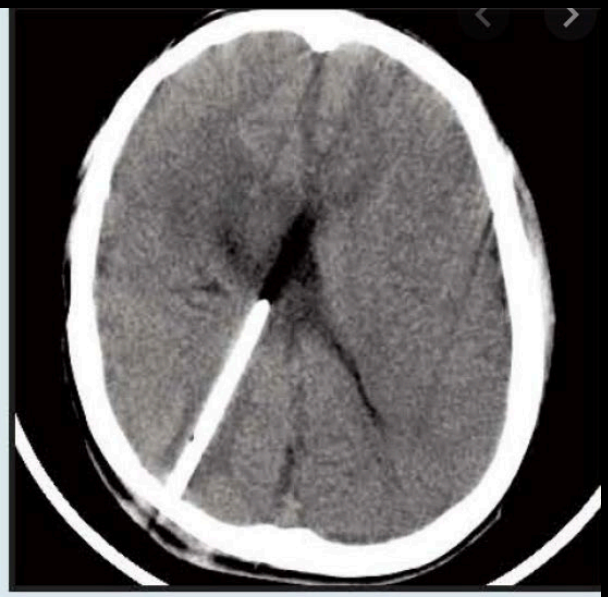
- OFC crossing increasing percentiles
- Deteriorating behavioural cues
  - Increased drowsiness
  - Refusing to wake for feeds
  - Poor suck
  - Irritability
- Increased head lag
- Tense fontanelle

IF CONCERNED…….REFER





Enlarged ventricles



Ventricles after shunt placement

Micro- or Macro- cephaly

The hen's teeth

Neurodegenerative disorders

Grey matter

- regression of milestones
Seizures
blindness
deafness

Microcephaly

- GM 1 Gangliosidosis
  - Gaucher
  - Neimann Pick

Macrocephaly

- GM 2 Gangliosidosis
  - Tay Sach's
  - Sandhoff

White matter

Frequent falls
Gait incoordinance
UMN signs

Microcephaly

- Krabbe's
  - Globoid cells , Thalamus
- Metachromatic Leucodystrophy
  - Tigeroid appearance
- X-linked AdrenoLeucodystrophy
  - Parieto-Occipital

Sparing of Subcortical White matter.

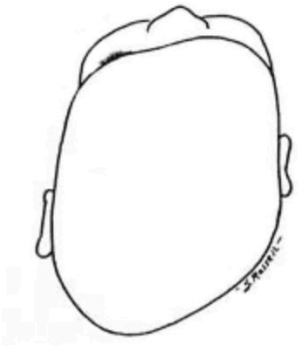
Macrocephaly

- Cannavan's
  - Spongiform
- Alexander's
  - Frontal lobe

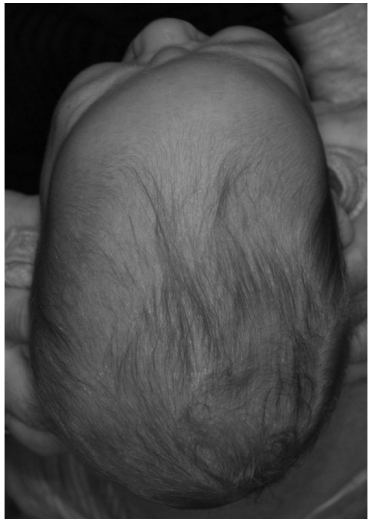
Contrast Enhancement is seen

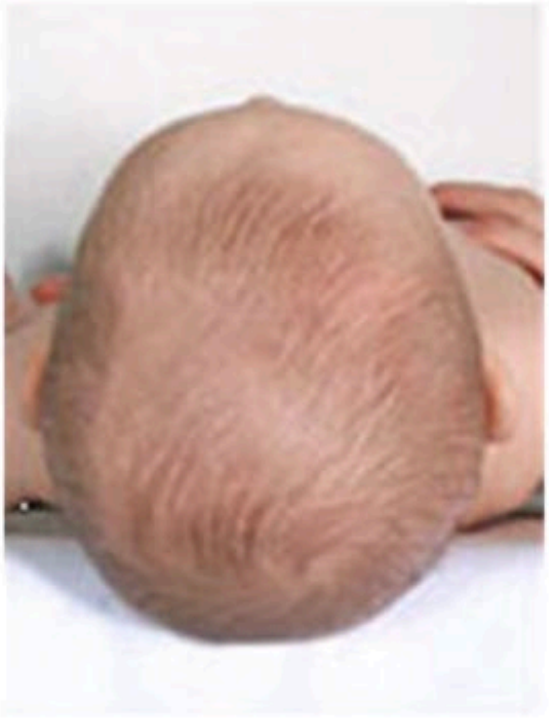
Is it just size that matters? Head Shape

- Positional Plagiocephaly
  - Back to sleep campaign
- Deformational scaphocephaly
  - Prematurity
- Syndromic Head shape
  - Brachycephaly, Down Syndrome

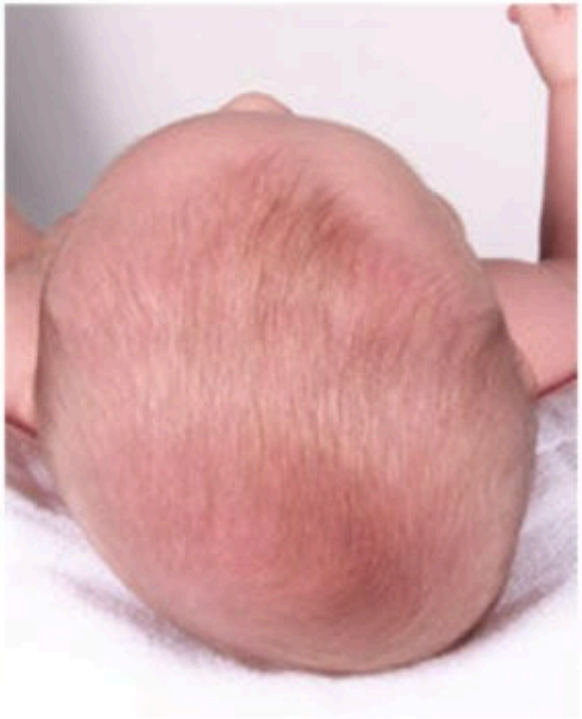


Top of head of child with positional plagiocephaly (drawn by Huang MHS)

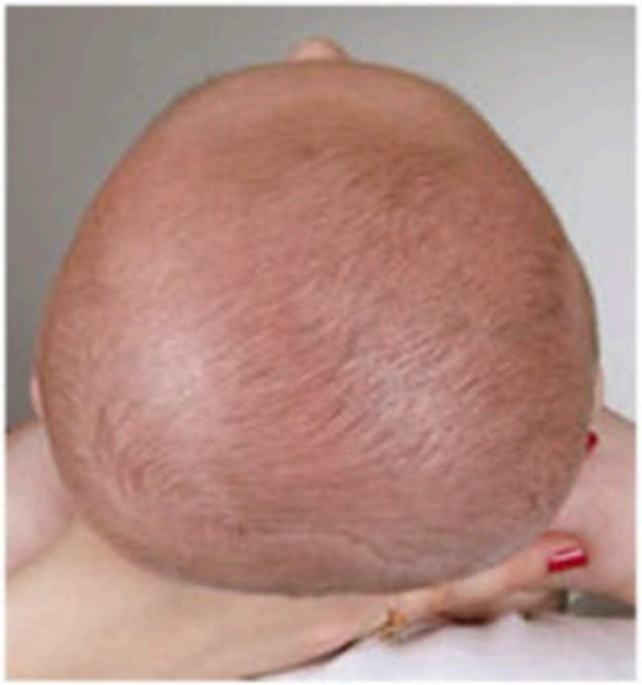




Normal

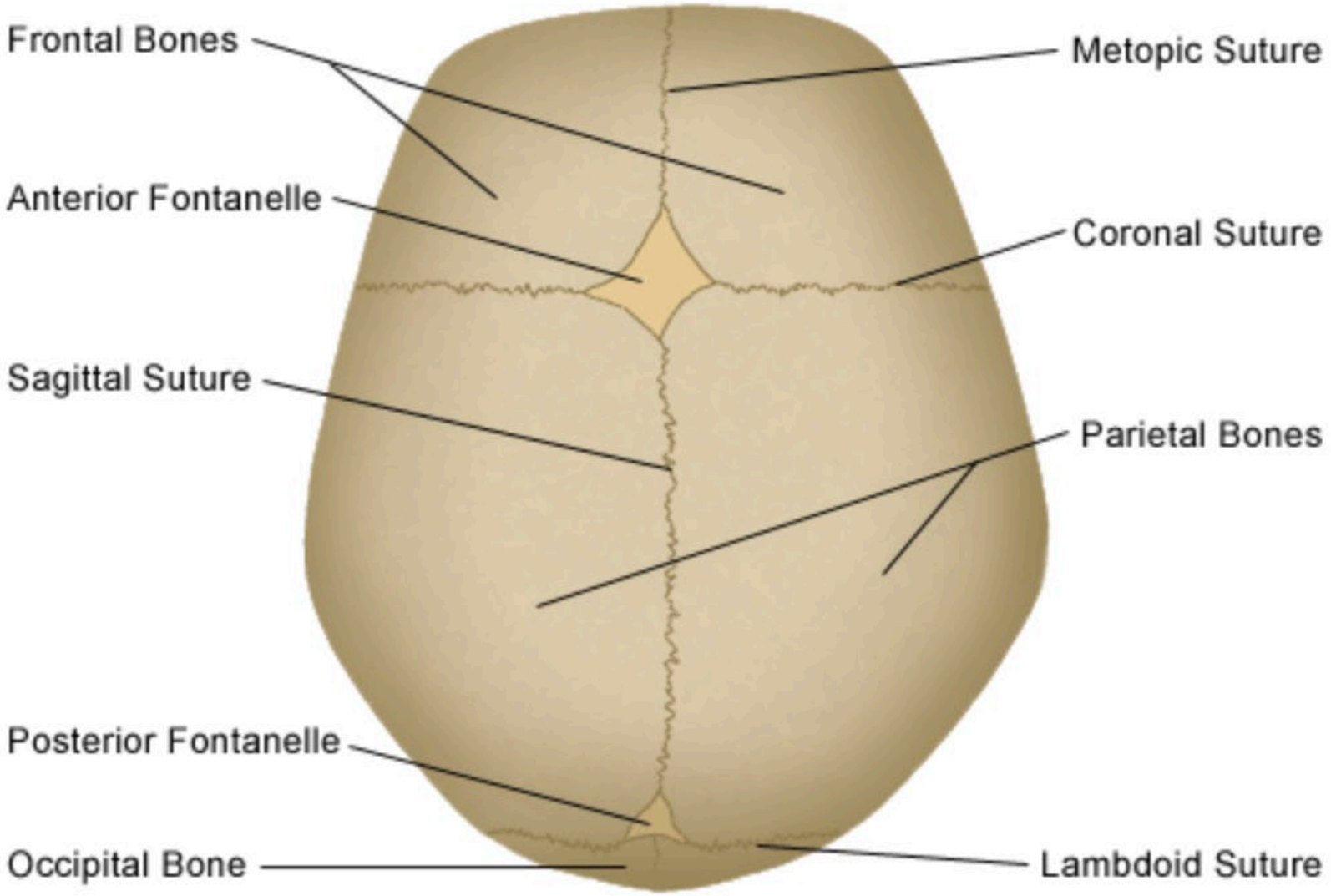


Plagiocephaly



Brachycephaly

Normal Skull of the Newborn



Things to remember

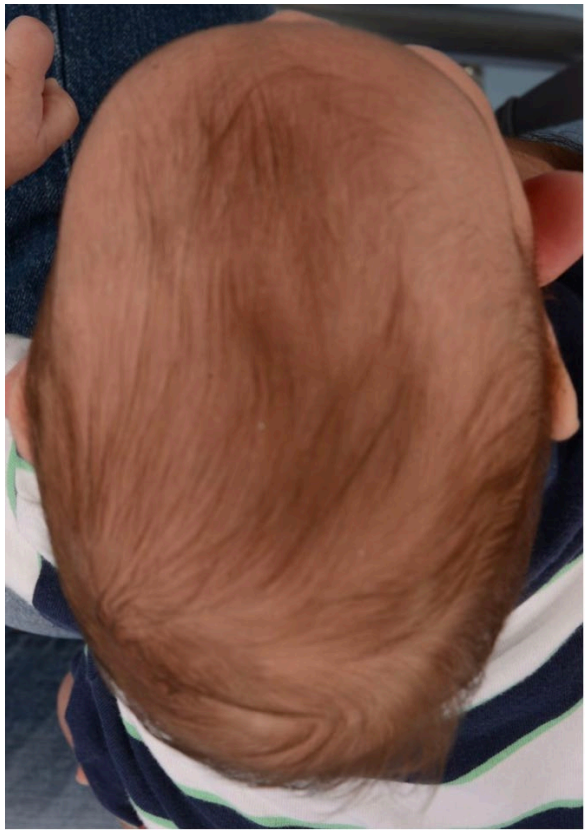
- Growth of the skull bones occurs in a direction that is perpendicular to the sutures
- Overlapping of the sutures may be present in the first week of life (moulding), but not thereafter
  - *ridging or overlap should be monitored closely or referred*
- Timing of closure of the fontanelles is reasonably consistent
  - *6/52 for the posterior fontanelle*
  - *9-18/12 for the anterior fontanelle*
  - *Closure or persistence outside of these times should trigger referral for other conditions.*

Abnormal fusion of sutures *Craniosynostoses*

- Can by non-syndromic or syndromic
- Abnormal/premature fusion of a suture can present as early as birth, but will become more evident with advancing age:
- Symptoms
  - Unusual shaped head
  - Ridging of the suture
  - Poor head growth
  - Rarely, behavioural issues such as poor feeding, irritability

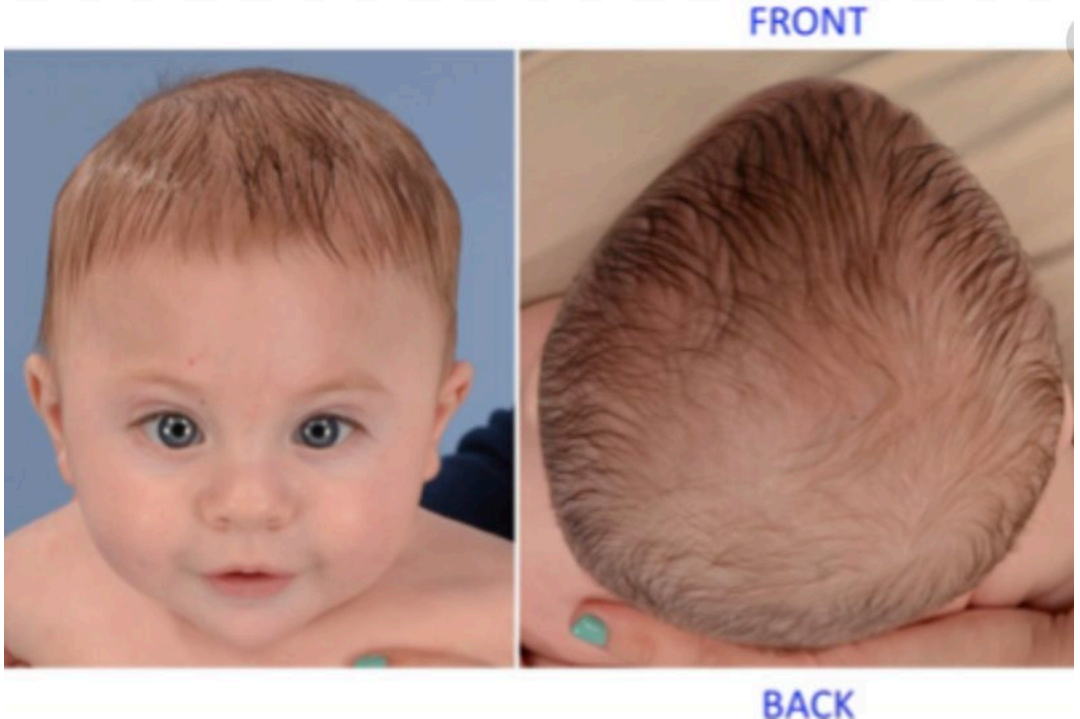
Fusion of the sagittal suture *Scaphocephaly*

- Commonest type of craniosynostosis
- 50-60% of all of these conditions
- Long ‘boat shaped’ head
- May require splitting of the sagittal suture



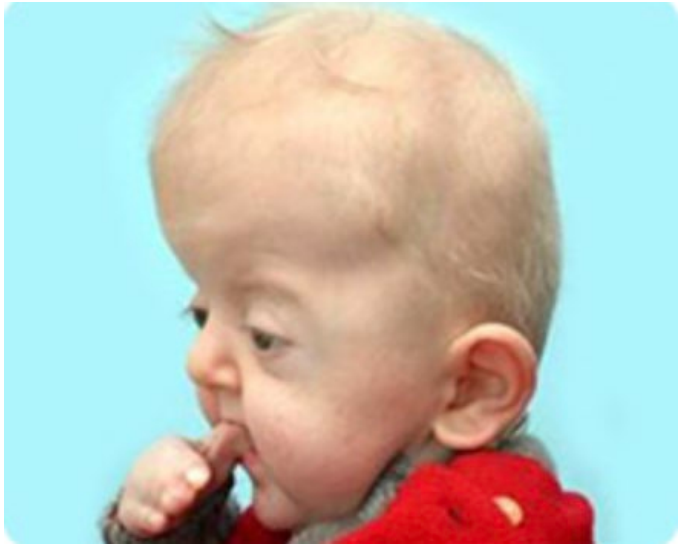
Fusion of the metopic suture
Trigonocephaly

- The metopic suture is the only suture that has completed it's growth contribution by delivery at term
- If fuses early – can ridge, causing a keel shaped forehead



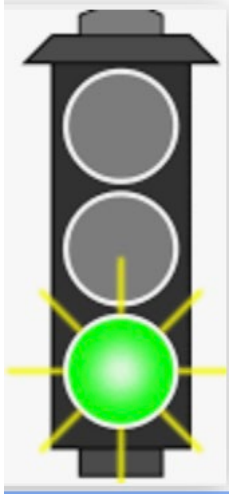
Craniosynostoses *present at birth*

- EG. Aperts Syndrome
  - Abnormal fusion of one or more of the sutures resulting in abnormal head shape
  - Midface hypoplasia with prominent eyes
  - Syndactyly of fingers and toes



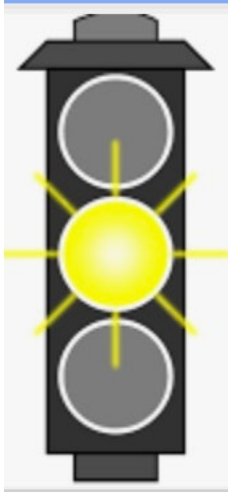
  - Rare: 1 in 60,000 live births

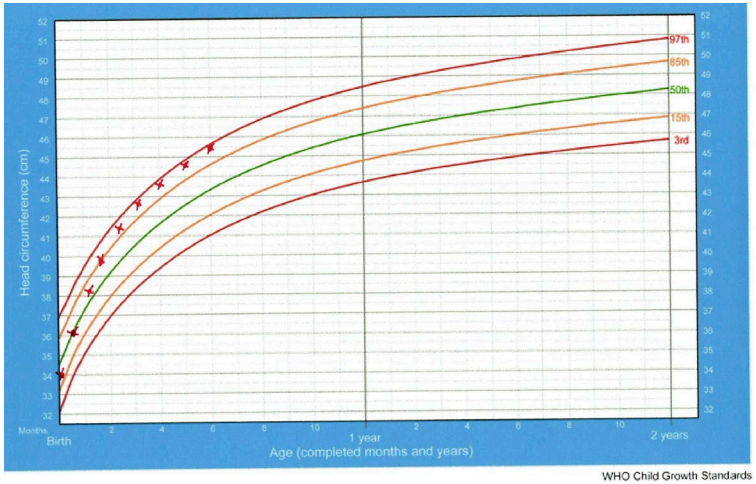
When to reassure, *when to monitor, when to refer?*



- Reassure
  - Head growth that follows percentile lines, in the absence of other signs or symptoms that suggest intracranial pathology
  - Benign familial Macrocephaly
  - Challenges of telehealth
    - Measurement of OFC is not easy
    - Asking parents to perform this task may not be fair
    - Seeing and examining the child is the ideal!

When to reassure, ***when to monitor****,* *when to refer?*

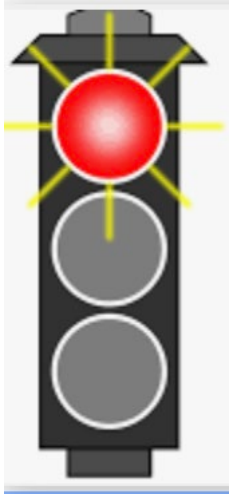




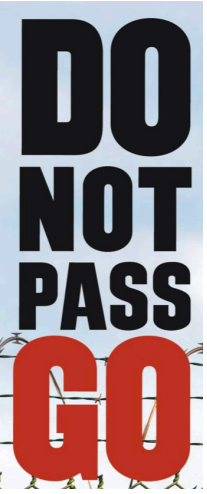
WHO Child Growth Standards

- The head that is crossing increasing percentile lines, in a well baby, for whom the mother's and father's head circumferences are large?
  - Familial macrocephaly
  - Can only be diagnosed if assessment of both parents' head circumference can be made

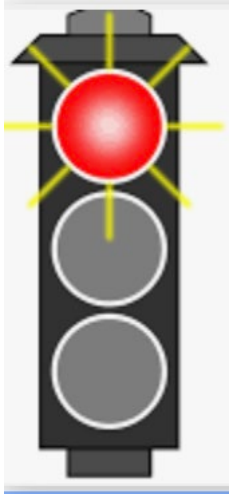
When to reassure, when to monitor, ***when to refer****?*



- The Emergency Department
  - Clinical Gestalt
    - *The brain creates a perception that is more than the sum of available sensory inputs*
  - The expanding head circumference where there are concerning behavioural cues
    - ? Intracranial bleeding, tumor, trauma
    - ? Evolving hydrocephalus
  - Concerning Behavioural cues with a normal OFC
    - Temperature instability, inadequate feeding



When to reassure, when to monitor, ***when to refer****?*



- The GP
  - The OFC that is crossing percentiles in either direction, <u>in the absence of</u>
    - concerning behavioural cues,
    - a good story for benign familial macrocephaly
  - OFC crossing percentiles, with the suggestion of abnormal development
    - Not meeting milestones
    - Regressing
  - Abnormal Head Shape – ridging of sutures

IF IN DOUBT

REFER

Thank you

Questions?