

# Cranial Ultrasound

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1

## Cranial ultrasound tutorial: Aims

- Technique
  - safety
- Germinal matrix haemorrhage
  - prematurity
- Periventricular leukomalacia (PVL)
- Aware of other pathologies
  - Trauma

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## Cranial Ultrasound: Technique

- Anterior fontanelle
  - Mastoid
- Posterior fontanelle
  - Sphenoid
- C9-4 & L18-3
- Consider
  - Transducer pressure
  - Amount of gel

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## Cranial Ultrasound: Artefacts

- Not enough gel
- Too much gel

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## Cranial Ultrasound: Safety considerations

- Potential for focal increase in temperature
- Low power settings
  - Pulsed Doppler only when clinically indicated
- Efficient as possible
  - Monash < 6min scan time
  - Audit
  - Training / education
- Clinical timing of scans

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## Clinical Indications: Timing of Cranial US


Postnatal days (± 1 day)*	≤31/40 + 6 days			32/40 to term
	Low risk	High risk eg. fetal compromise	Intraventricular haemorrhage (IVH)	High risk #
1		✓		
3	✓	✓	✓	✓ (earlier if clinically indicated)
8	✓	✓	✓	
14			✓	
28		✓	If hydrocephalus, may require earlier and more frequent scans depending on progression	✓ if significant fetal compromise
42	✓	✓	✓	

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### Cranial Ultrasound: **Clinical Indications**

- Prematurity
  - Haemorrhage
- Surveillance
  - Hydrocephalus
  - Developing PVL
- Congenital abnormalities
- Clinical concerns
  - Developmental delay
  - Increasing head size
  - Seizures
  - Trauma
  - Infection




DAY 8  
NAL  
OST

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### Commonest indication: **GMH**

- Germinal matrix
  - fragile
  - intricate network of capillaries
  - max volume at 24-26w then rapidly regresses
  - last to involute - caudothalamic groove
- Haemorrhage
  - preterm neonates have impaired cerebral autoregulation
  - fluctuations in cerebral blood flow




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### Commonest indication: **GMH – why?**

- Changes in cerebral blood flow
  - Procedures being performed
  - Respiratory distress
  - Pneumothorax
  - Anaemia
  - Hypoglycemia
  - Seizures
  - Changes in blood volume



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9

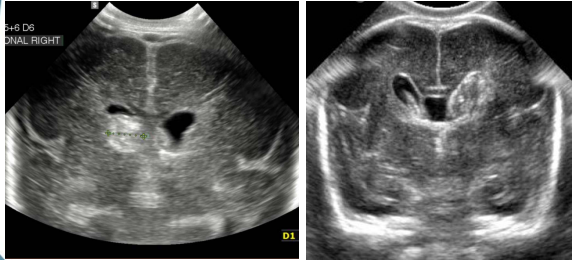
### GMH: **Grading system**

- **Grade 1:** Subependymal Haemorrhage
- **Grade 2:** Intraventricular haemorrhage without ventricle dilatation
- **Grade 3:** Intraventricular haemorrhage with ventricle dilatation
- **Periventricular haemorrhagic infarction:**
  - Venous Infarction (obstruction of the terminal veins by haemorrhage)
  - Previously termed parenchymal extension (Grade 4)

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### GMH: **Progression**

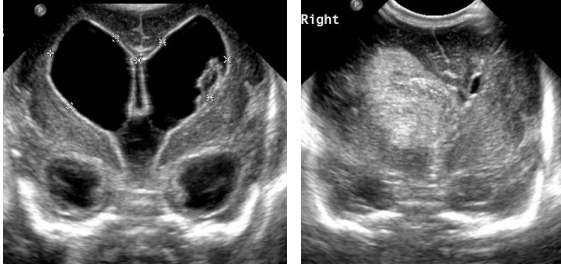


4:3 DG  
NAL RIGHT  
D1

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11

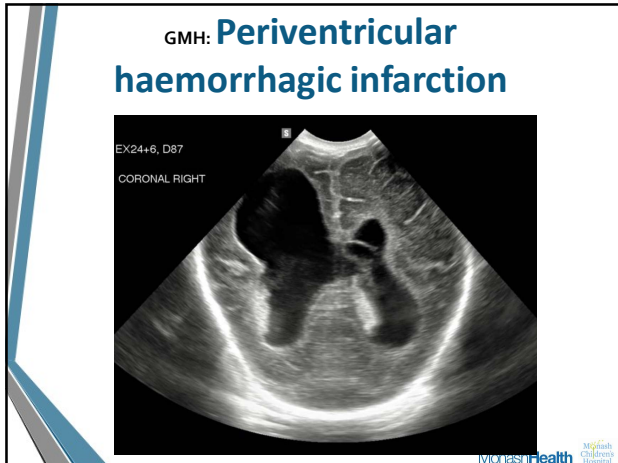
### GMH: **Progression**



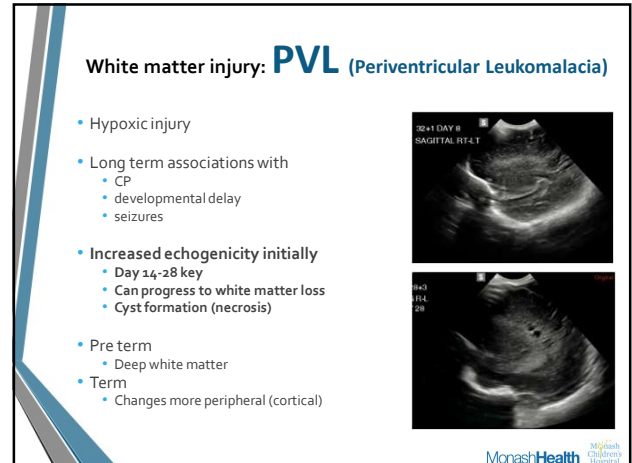
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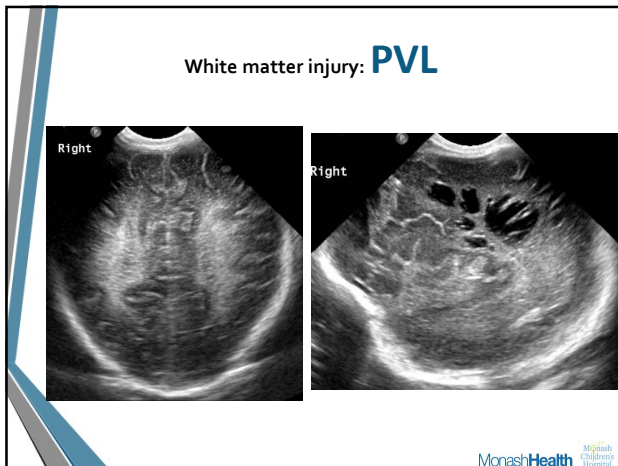
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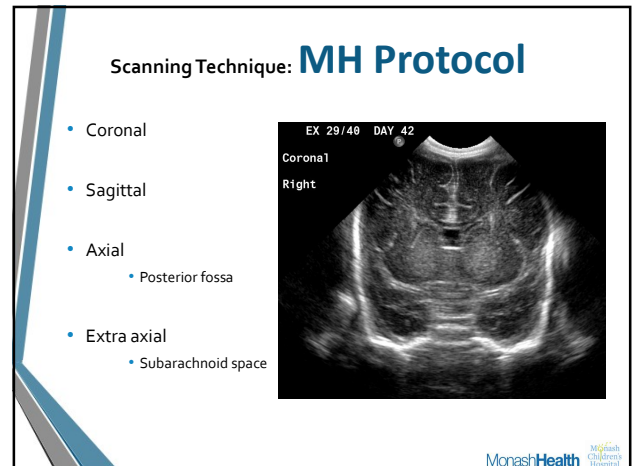
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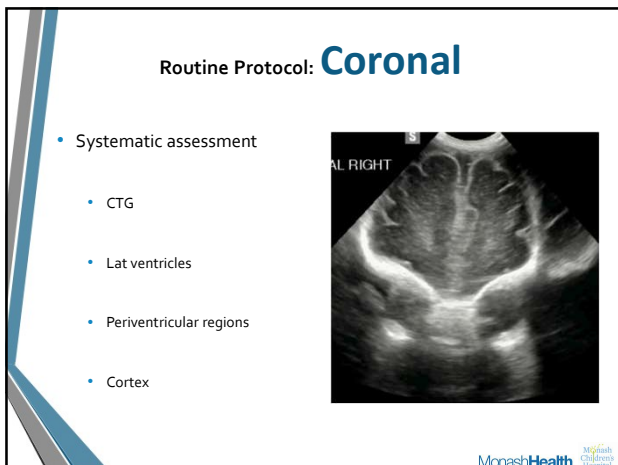
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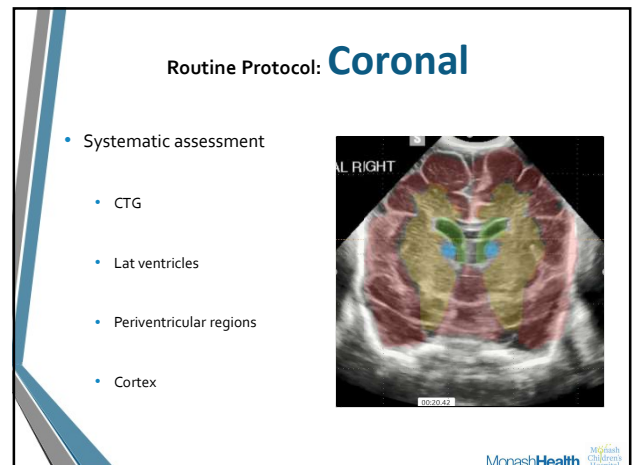
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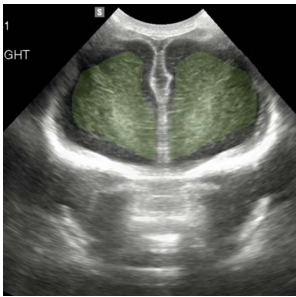
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Coronal Image 1: **Orbital Roof**


- Angled anteriorly
- Frontal lobes
  - Parenchymal changes



19

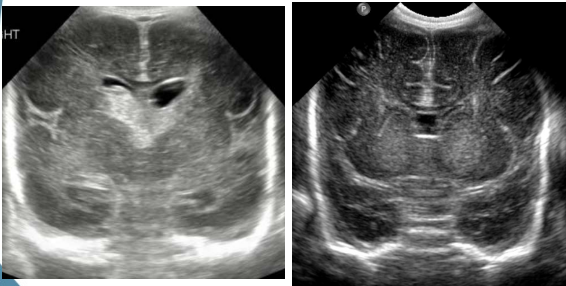
Coronal Image 2: **Circle of Willis**

- Anterior germinal matrix
- Septum pellucidum
- Midline CC
- MCAs
- Temporal lobes



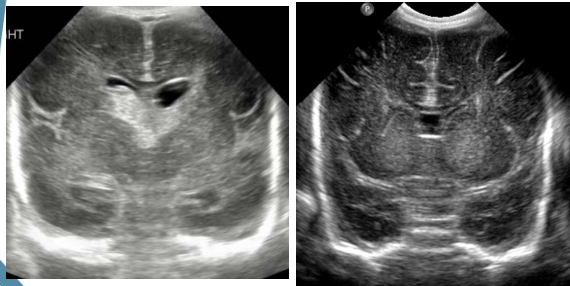
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Coronal Image 2: **Circle of Willis**



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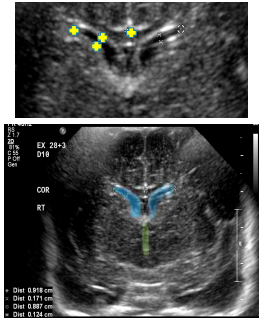
Coronal Image 2: **Circle of Willis**



22

Coronal Image 3: **3<sup>rd</sup> Ventricle**


- Ventricle measurements
  - Anterior horns (foramen of Monro)
    - reproducible
  - Ventricular index
  - Widest ventricular width



Levene (1981), Brouwer et al (2012)

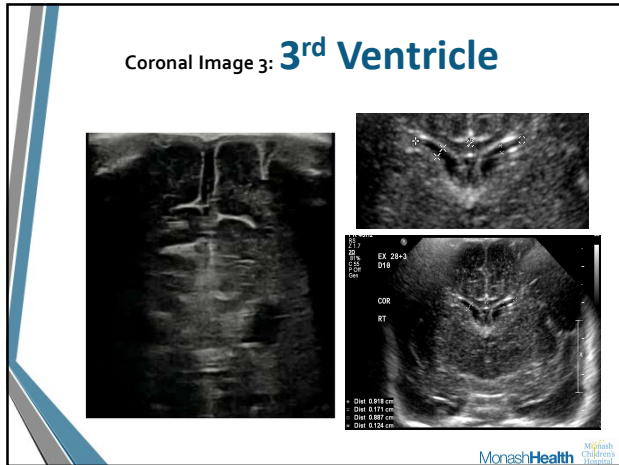
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Coronal Image 3: **3<sup>rd</sup> Ventricle**

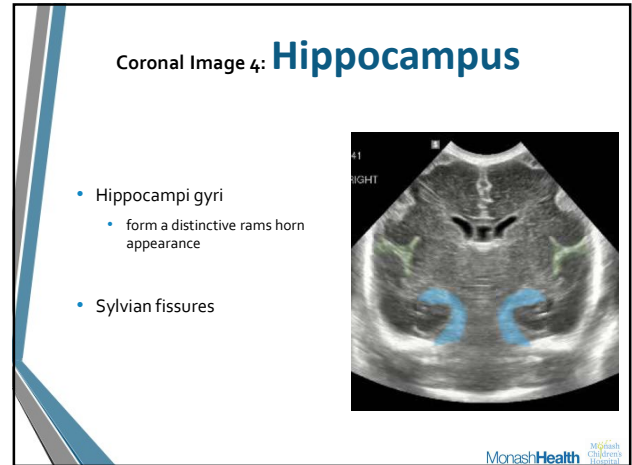


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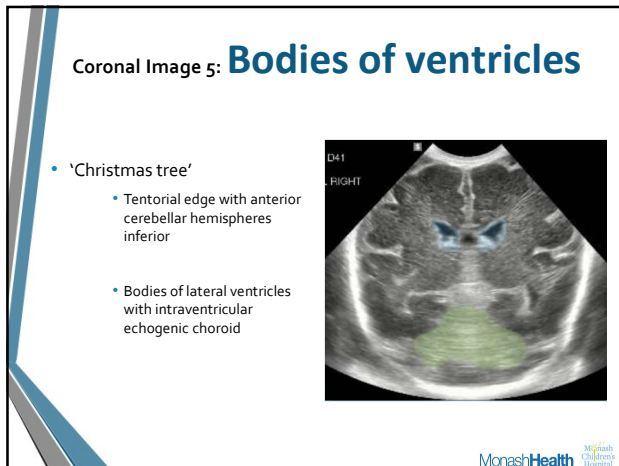




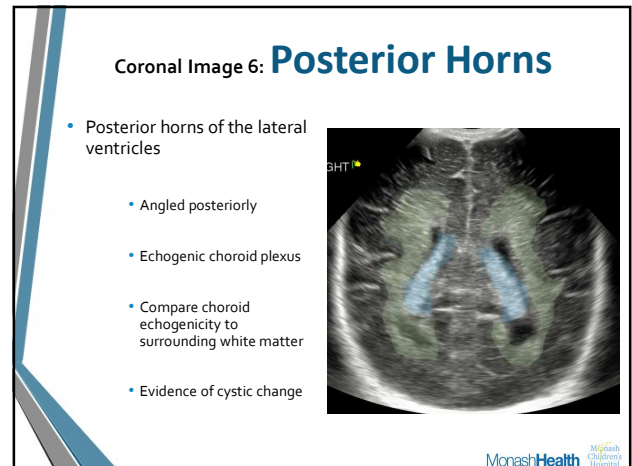
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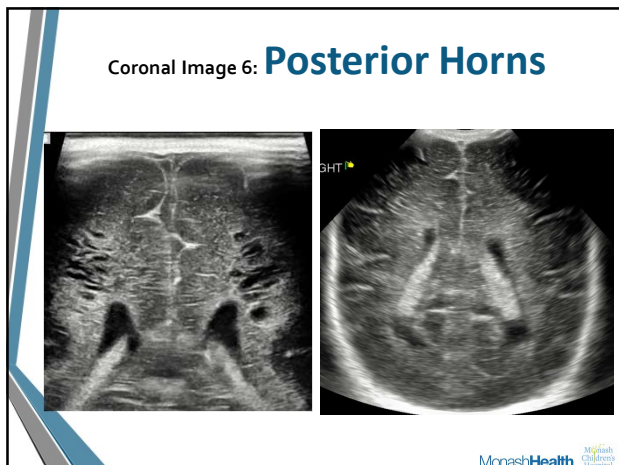
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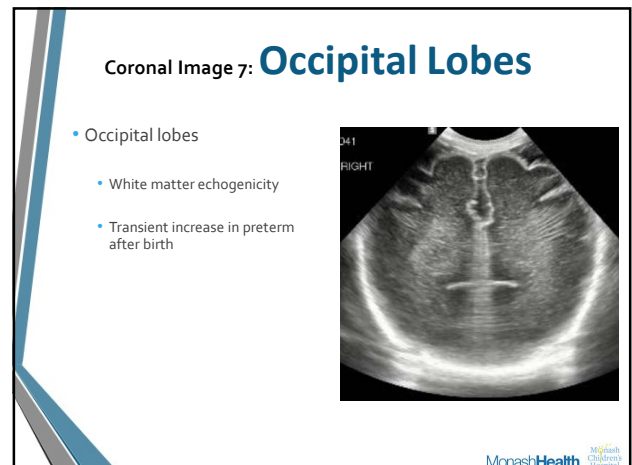
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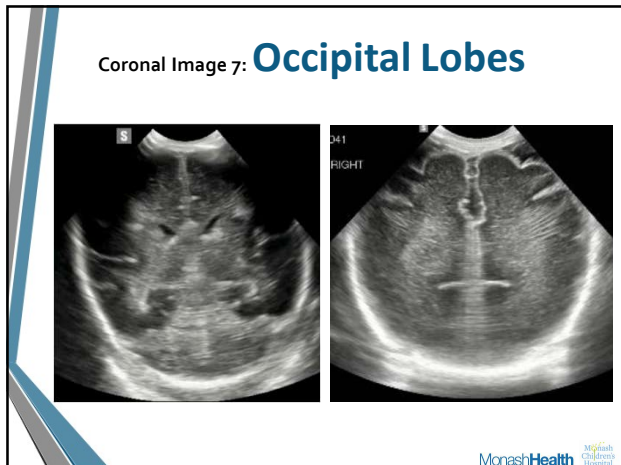
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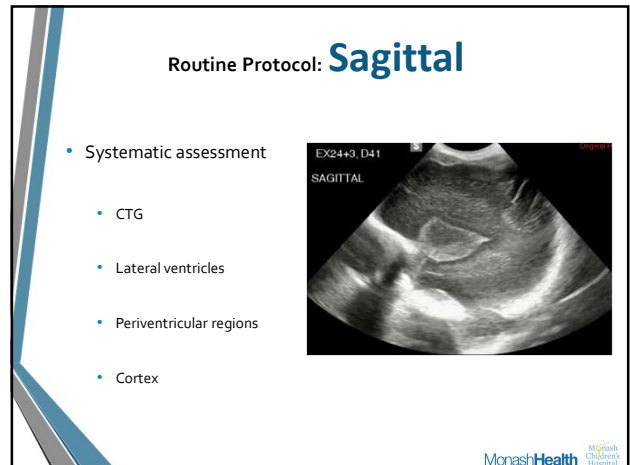
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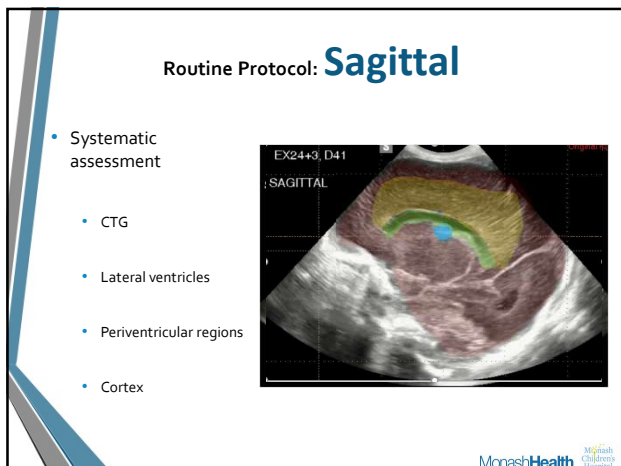
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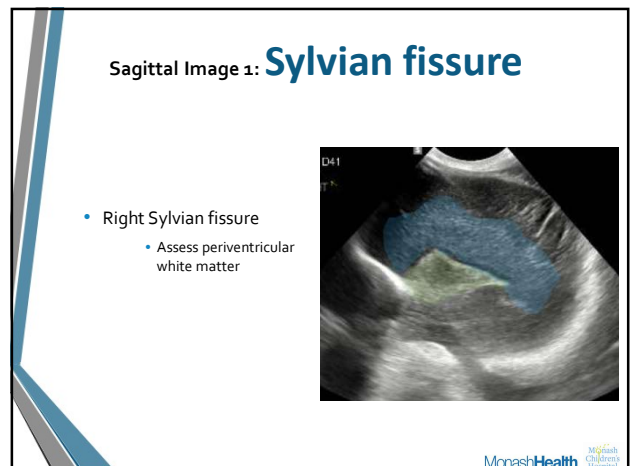
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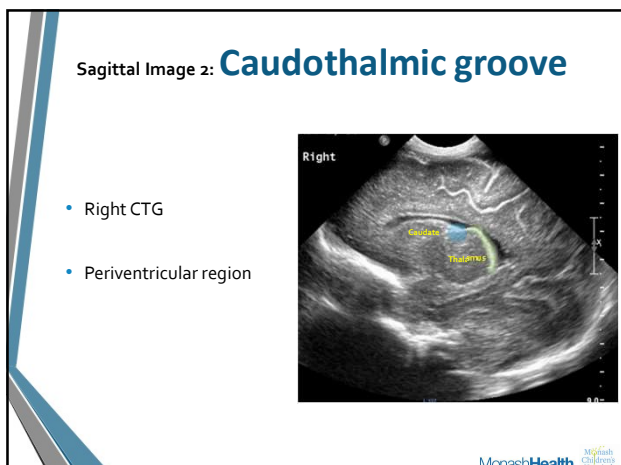
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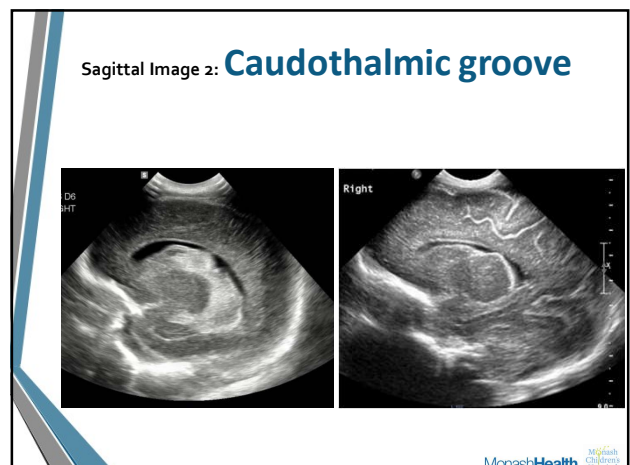
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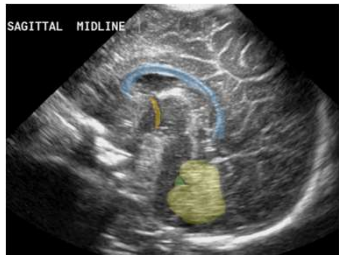
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36

### Sagittal Image 3 & 4: **Midline**

- Midline
  - Corpus Callosum
  - 3<sup>rd</sup> ventricle
  - Cerebellar vermis
  - 4<sup>th</sup> ventricle



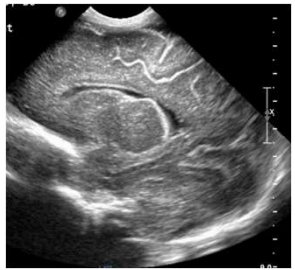
SAGITTAL MIDLINE

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### Sagittal Images 5 & 6: **Sagittal Left**

- Caudothalamic groove
  - Left
- Periventricular region
- Sulcations
- Sylvian Fissure
  - left

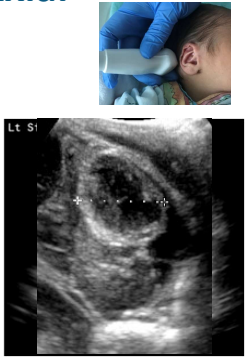


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### Routine Protocol: **Axial**

- Mastoid window
  - Right or left
- Posterior fossa
- Cerebellum
  - Superior, mid & inferior
  - Vermis present

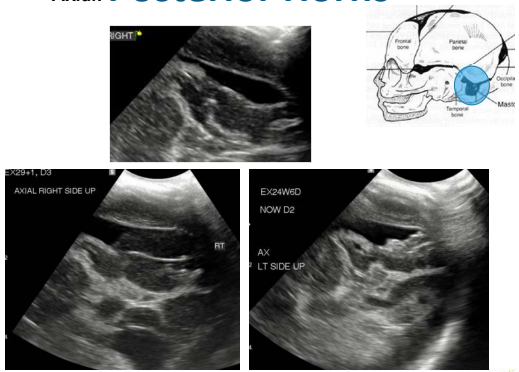


Lt S1

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39

### Axial: **Posterior Horns**



RIGHT

EX24W6D AXIAL RIGHT SIDE UP

RT

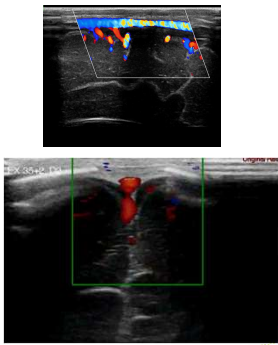
EX24W6D NOW D2 AX LT SIDE UP

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### Routine protocol: **Extra axial**

- Linear transducer
  - L18-3
  - additional detail
- Sagittal Sinus
  - patency
- Extra axial
  - Brain atrophy
  - Subarachnoid space

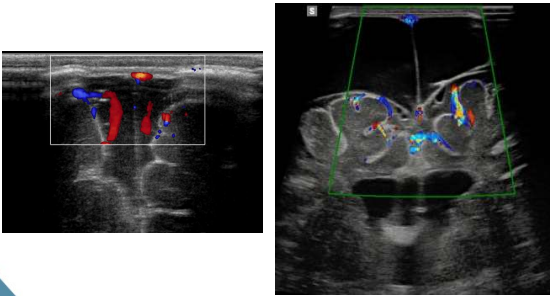


EX24W6D

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### Extra axial: **Subdural haematoma**



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### Linear Transducer: Cerebral cortex

- Cortex
- Extra axial blood

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### Linear Transducer: Beyond the cortex

- Caudothalamic groove
- Ventricles

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### Ultrasound: Use of Doppler

- ACA / MCA Doppler traces
- Raised intracranial pressure
  - RI >0.9 - abnormal
  - Hypoxic injury
  - Hydrocephalus
- Must be considered in context of clinical presentation

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### Ventricles: Hydrocephalus

- Lateral Ventricles
  - Preterm – prominent
  - Term – slit like typically
  - Mild asymmetry – normal variant
    - 20-40% of infants
- If dilated
  - Assess 3<sup>rd</sup> and 4<sup>th</sup> ventricles

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### Trauma: Haematoma

- 'Boggy' swelling
- Subgaleal haematoma
  - Crosses sutures
  - High risk for shock
  - Can be very large
- Cephalohaematoma

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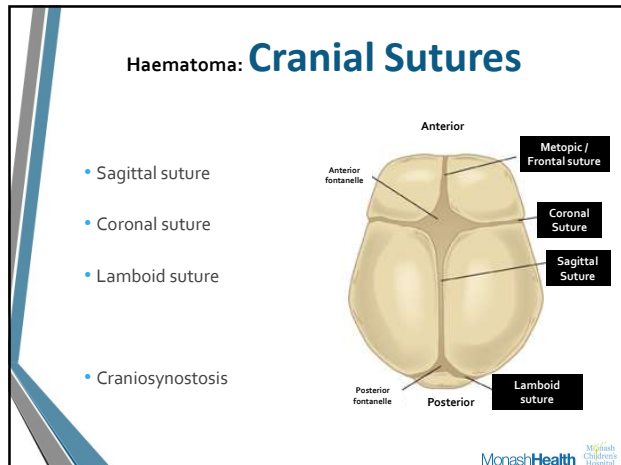
### Trauma: Haematoma

- Cephalohaematoma
- Subgaleal haematoma

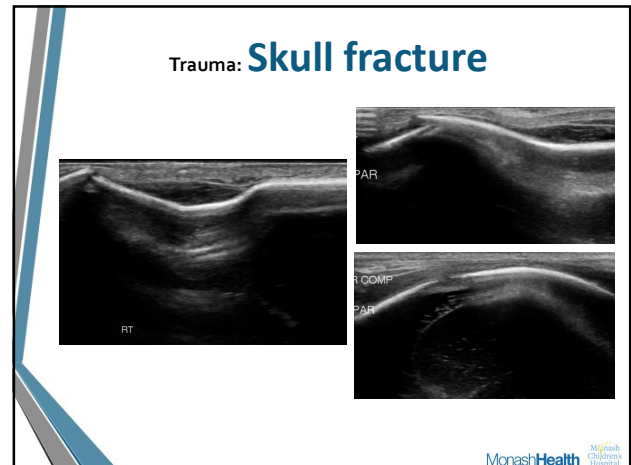
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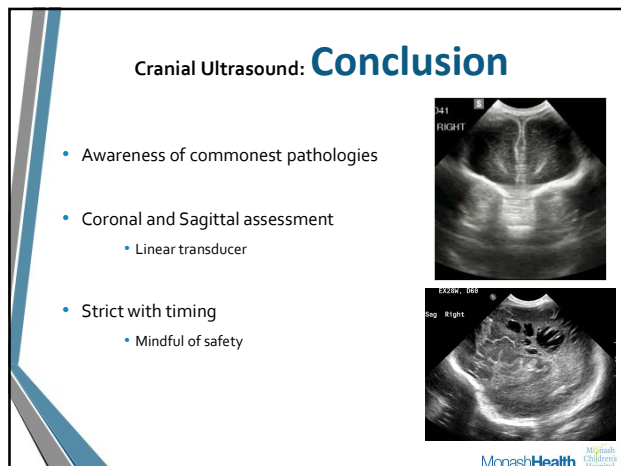




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50



51