ISUOG Basic Training

Distinguishing Between Normal & Abnormal Appearances of the Skull & Brain

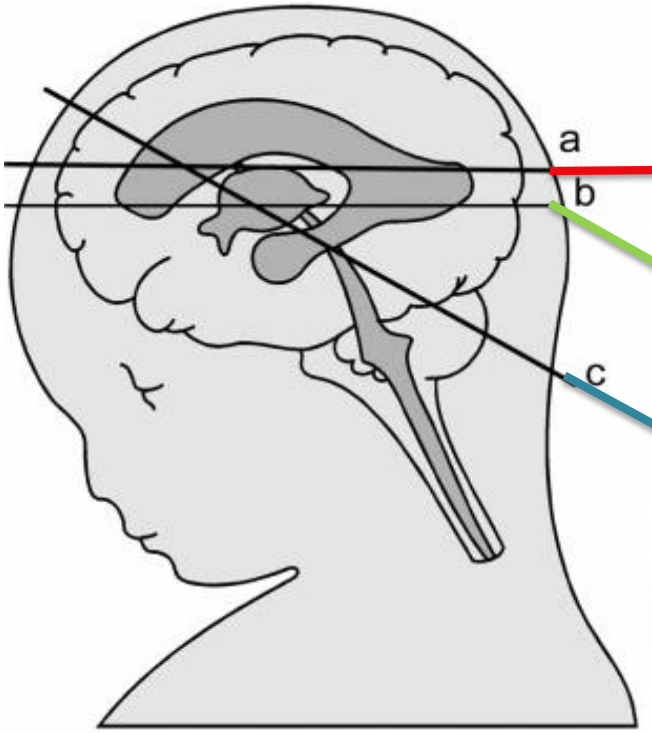
Learning objectives

At the end of the lecture you will be able to:

- Describe how to obtain the 3 planes required to assess, including measuring, the fetal head correctly

- Recognise the differences between the normal & most common abnormal ultrasound appearances of the 3 planes of the fetal brain

Three basic axial planes of the head



TRANS VENTRICULAR — Skull , Falx, CSP, LV

TRANS THALAMIC — BIOMETRY BPD, OFD, HC

TRANS CEREBELLAR — BIOMETRY- TCD Cerebellum/ vermis

Imaging the Head – The three planes technique

1. Identify cervical spine and occipital junction in sag plane
2. Rotate probe 90^0 & identify the cranial vault
3. Gently angulate probe to identify trans ventricular plane and trans thalamic plane
4. Gently rotate probe towards occiput for trans cerebellar plane – ensure CSP is also seen anteriorly

Planes 4, 5 & 6

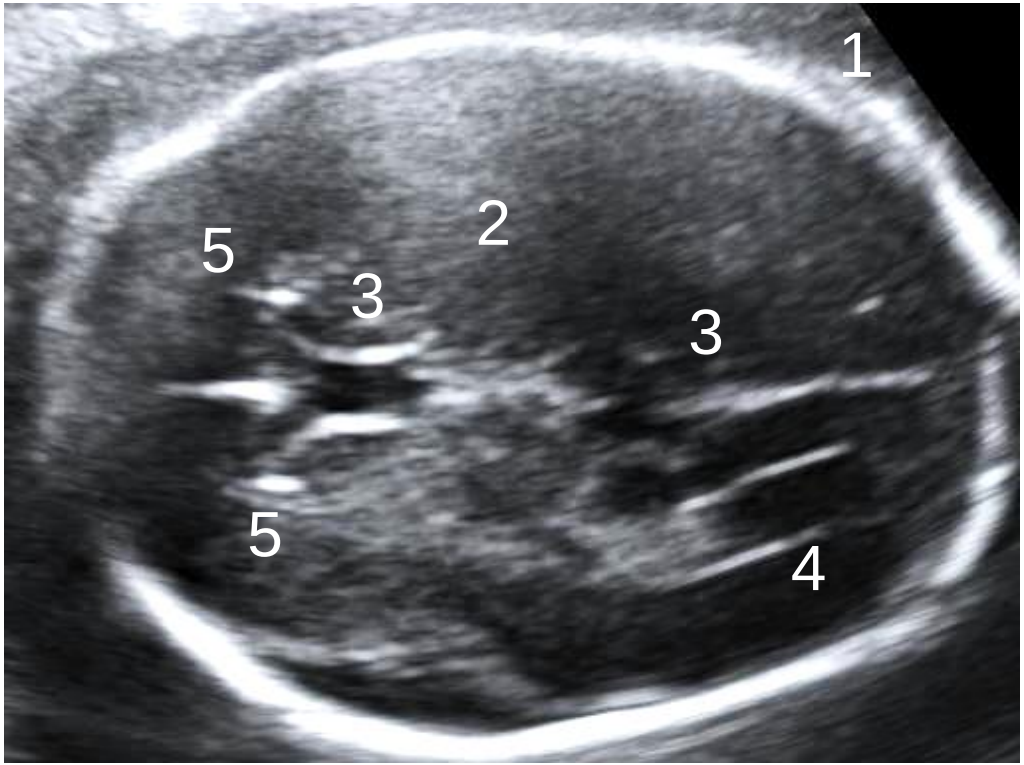
From plane 4 to 5 – (rotate &) slide minimally

From plane 4 to 6 - rotate

From plane 1 or 2 to 4 – Identify junction of cervical spine & occiput - rotate through 90^0

The trans ventricular plane – plane 4/20

The most cephalad of the three planes



1.Integrity: Intactness of skull

2.Bone density : Poor visualization of near field

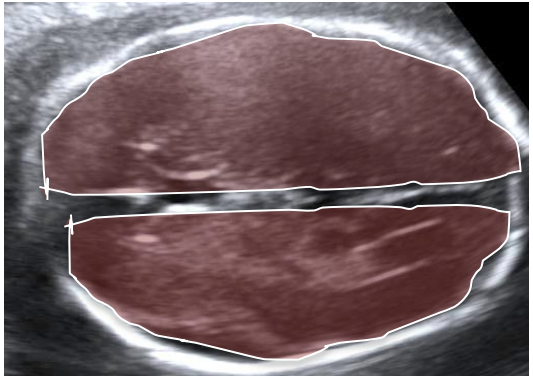
3.Falx : Interrupted by CSP

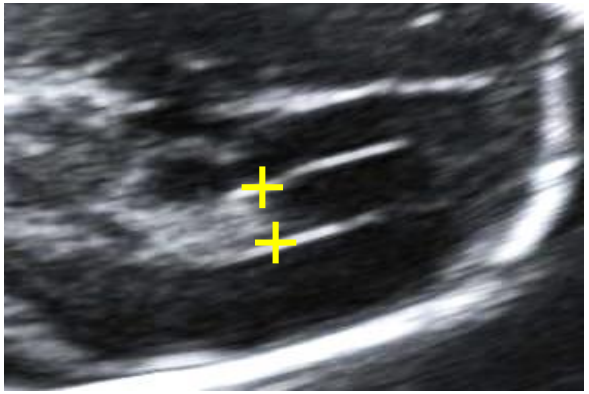
4.Occipital / posterior horn of lower lateral ventricle

5.Frontal horns of BOTH lateral ventricles

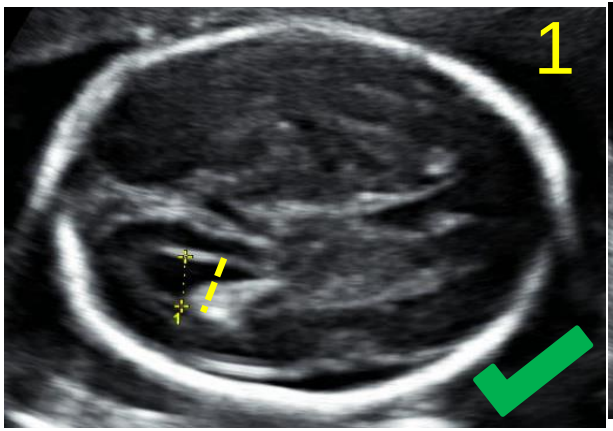
Lateral ventricles - Technique of measurement:

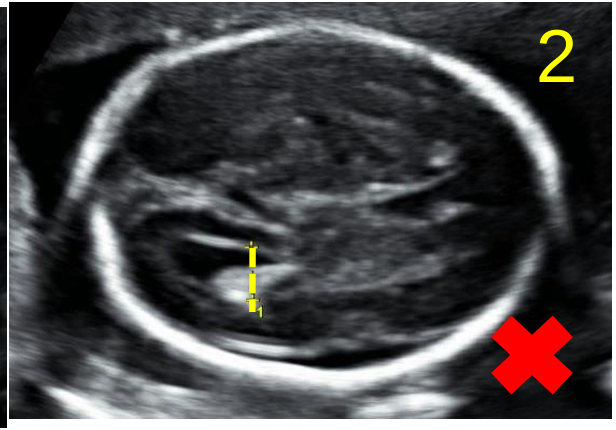
- Symmetrical axial view / Optimal zoom
- Atrium measured at the level of the glomus of choroid plexus, opposite the parieto occipital sulcus
- Calipers placed touching the inner edge of the ventricle wall at its widest part, aligned perpendicular to the long axis of the ventricle

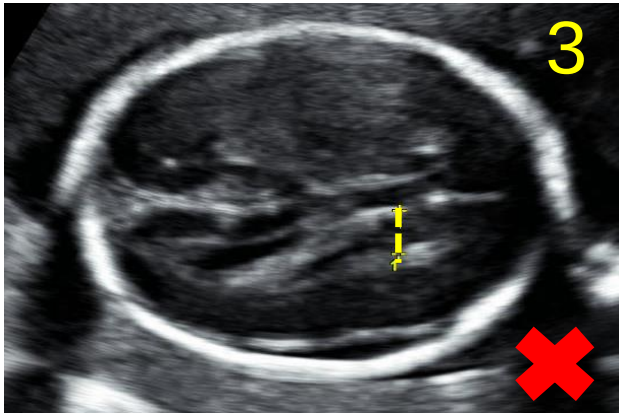




Measurement of lateral ventricles

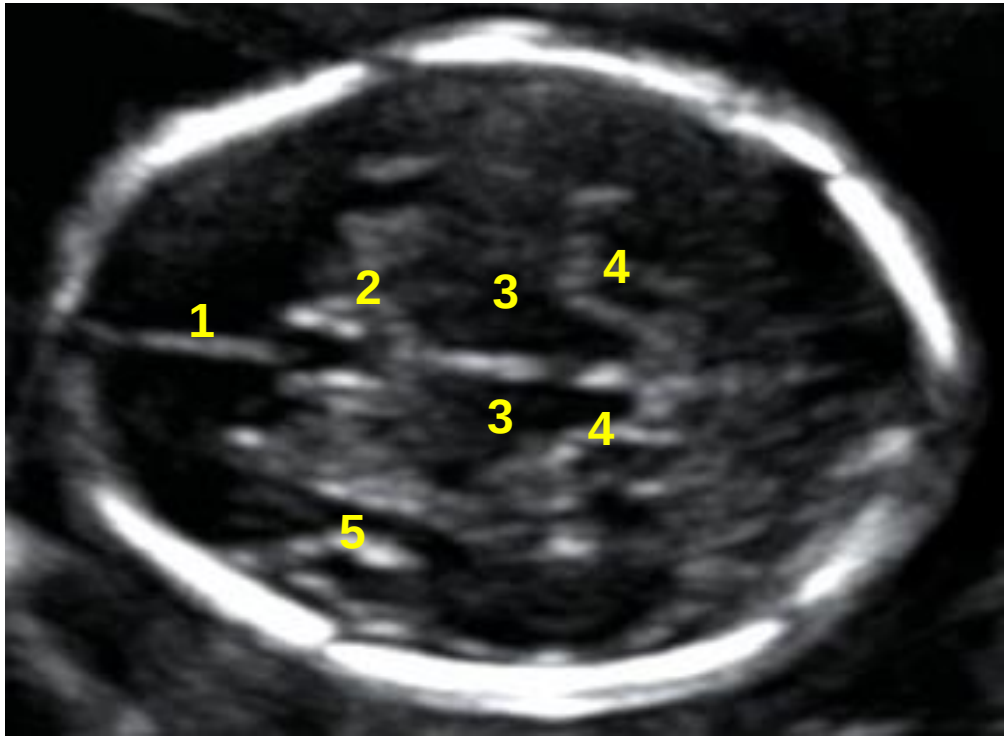






Normal Occipital horn of lateral ventricle < 10mm
Refer if LV size is > 10mm

The transthalamic plane 5/20 - anatomical landmarks



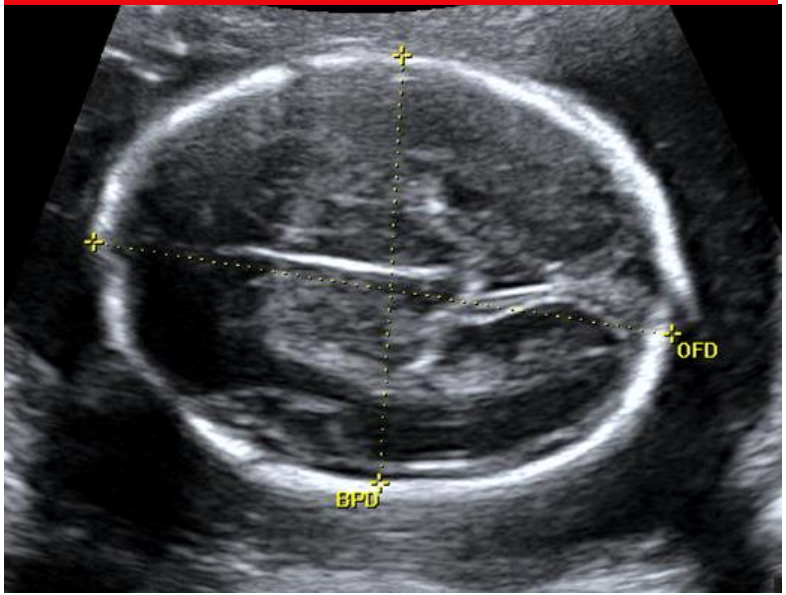
1. Midline falx
2. Cavum septum pellucidum
3. Both thalami in apposition separated by the falx
4. Hippocampal gyri
5. The lateral sulcus

Cranial biometry – BPD & head circumference

1. Trans thalamic plane
2. Angle of insonation 90 deg to midline echoes
3. Symmetric hemispheres
4. Falx with CSP & thalamus

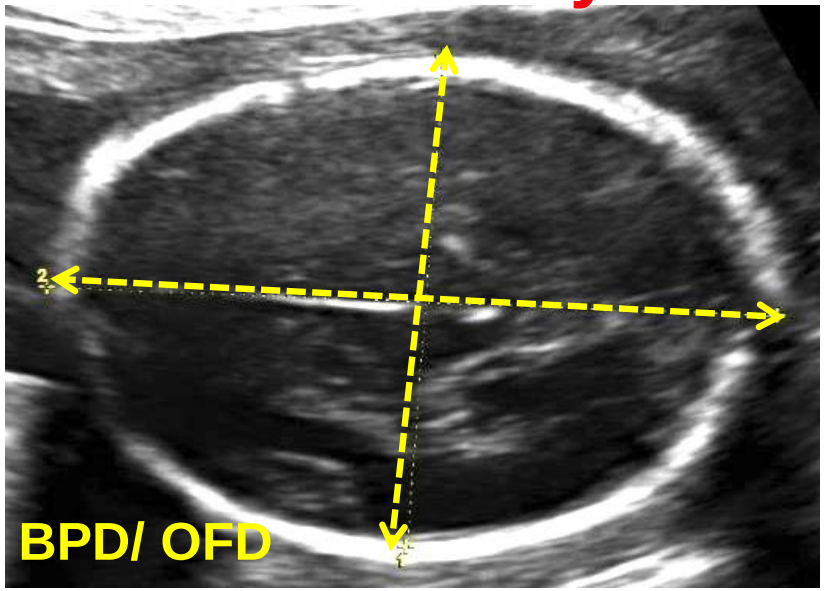
Cerebellum **NOT to be** visualised

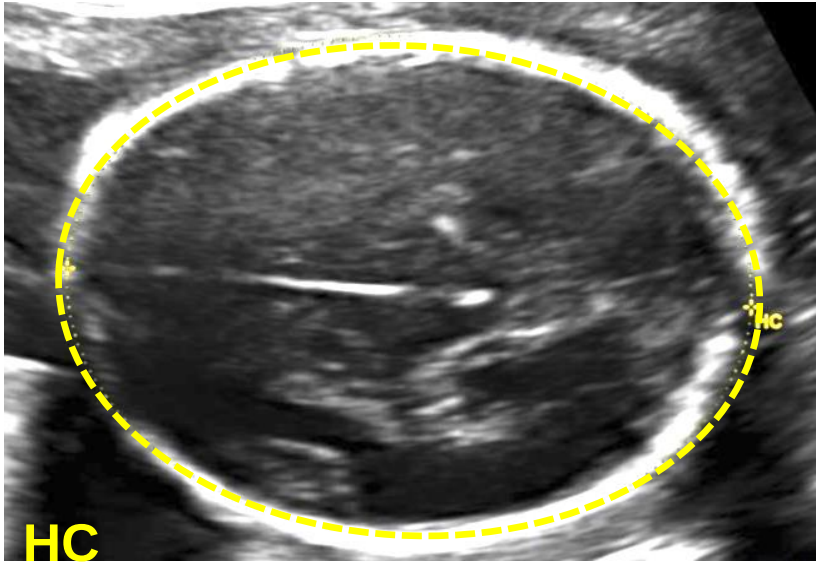
CALIPERS: Outer to inner



Use appropriate charts

Cranial biometry – BPD & head circumference





CEPHALIC INDEX - BPD/OFD X 100

75-85 – Normal

< 75 - Dolicocephaly

>85 - Brachycephaly

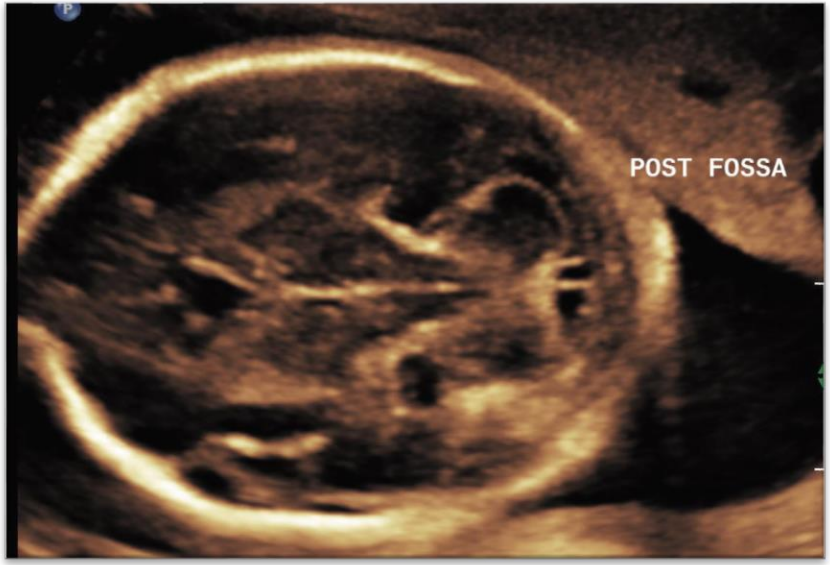
Head circumference chart

Gestational Age (Weeks)	Head Circumference (mm) by Percentile								
	2.5	5	10	25	50	75	90	95	97.5
14	86	88	91	95	100	104	107	110	112
15	97	99	102	106	111	115	119	122	124
16	108	111	114	118	123	128	132	134	137
17	120	123	126	130	135	140	144	147	149
18	132	135	138	143	148	153	157	160	162
19	145	147	150	155	161	166	170	173	175
20	157	159	163	168	173	179	183	186	188
21	169	172	175	180	186	191	196	199	201
22	181	184	187	193	198	204	209	212	214
23	193	196	199	205	210	216	221	224	227
24	204	207	211	216	222	228	233	236	239
25	215	218	222	227	233	239	245	248	251
26	225	228	232	238	244	250	256	259	262
27	234	238	242	248	254	261	267	270	273
28	243	247	251	257	264	270	277	280	283
29	251	256	260	266	273	280	286	290	293
30	259	264	268	274	281	288	295	299	302
31	266	271	275	282	289	296	303	307	311
32	273	278	282	289	296	304	311	315	318
33	279	284	289	295	303	311	318	322	326
34	285	290	295	302	309	317	324	328	332
35	291	296	300	307	315	323	330	335	338
36	296	301	306	313	321	329	336	340	344
37	302	306	311	318	326	334	341	345	349
38	307	311	315	324	332	339	347	350	354
39	313	316	320	329	337	344	352	355	359
40	319	321	325	334	342	350	357	360	363

doi:10.1371/journal.pmed.1002220.t007

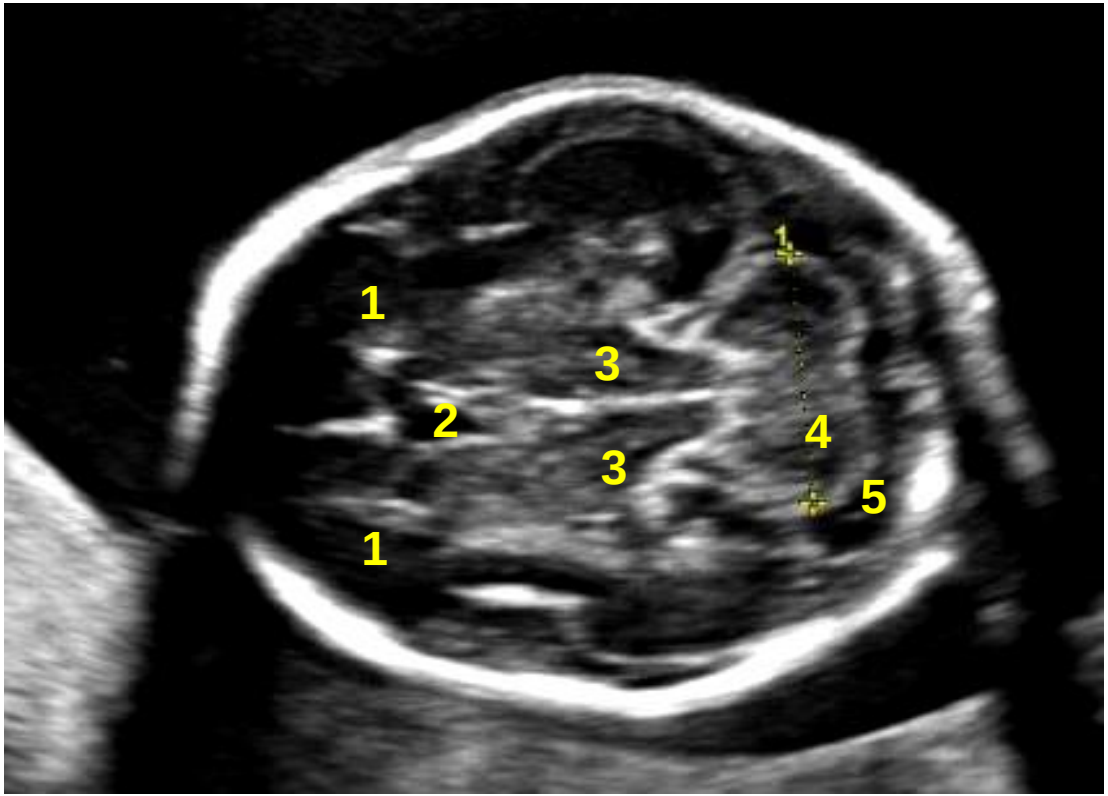
Use standard reference charts
Refer if HC outside normal range for period of gestation

Cranial biometry – cerebellar diameter
Key points



- Ensure complete visualization of CB
- Ensure anatomical landmarks – avoid steep angulation

The trans cerebellar plane – 6/20



1.Frontal horns of both LV

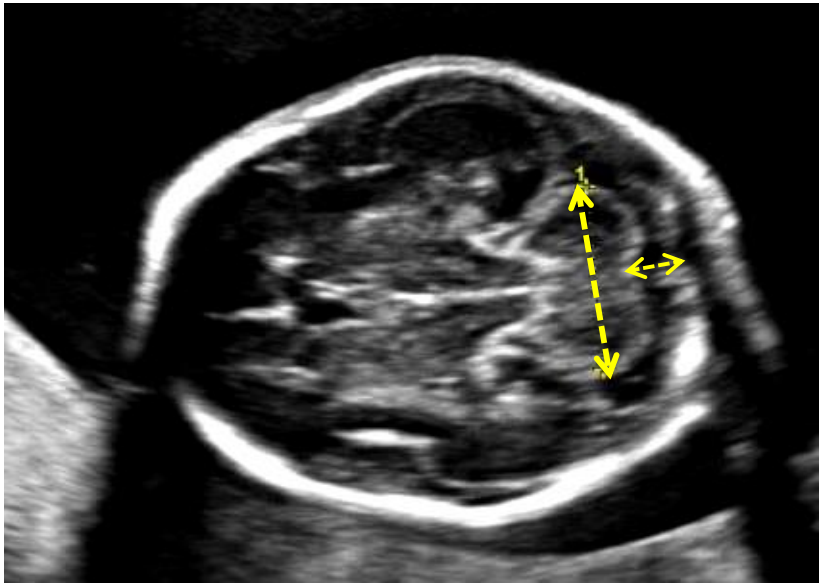
2. Cavum septum pellucidi

3.Thalami

4.Cerebellum

5. Cisterna magna

Trans cerebellar plane biometry



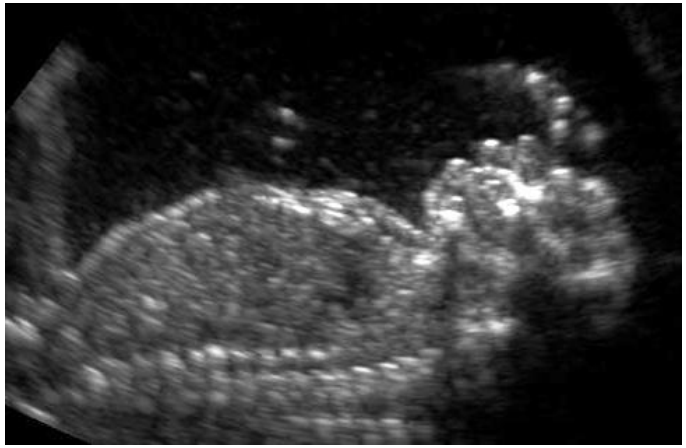
- Trans cerebellar diameter – Maximum Diameter in the correct plane
- Cisterna magna – vermis to inner edge of occipital bone (normal range 2.0-10.0mm)

Refer if :

TCD < 5th centile for period of gestation , Cisterna magna > 10mm
Two cerebellar hemispheres appear separated

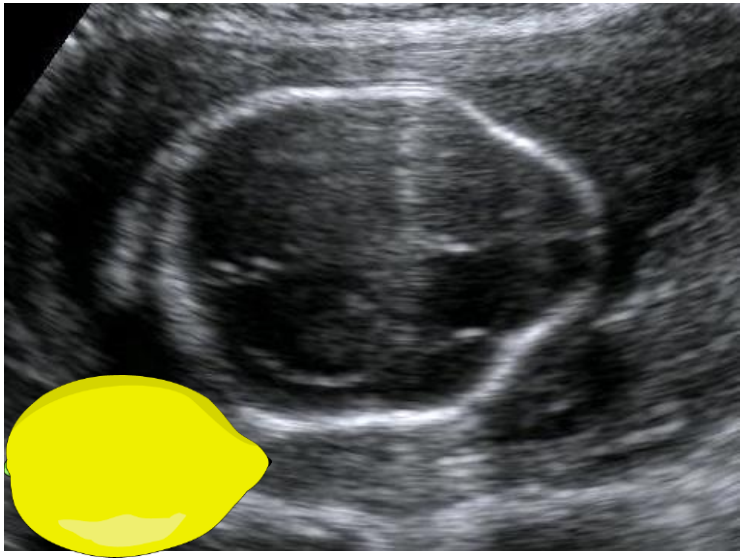
Common abnormalities to be excluded in the three planes
(4, 5 ,6)

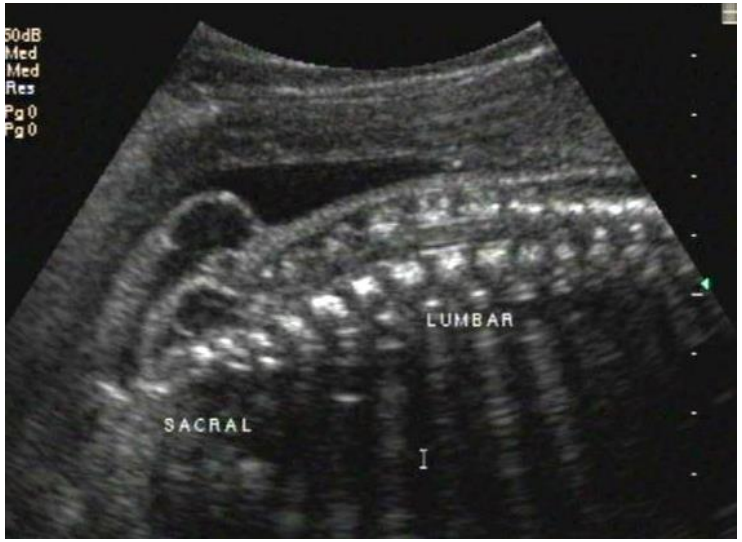
The cranial vault



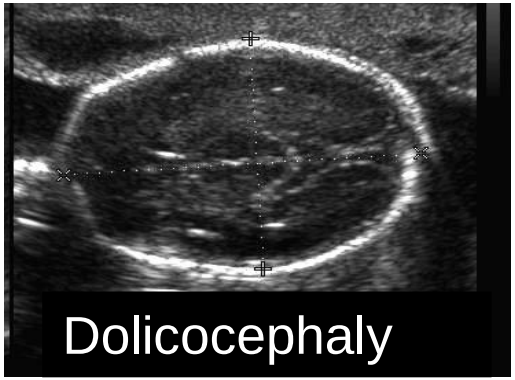
ANENCEPHALY

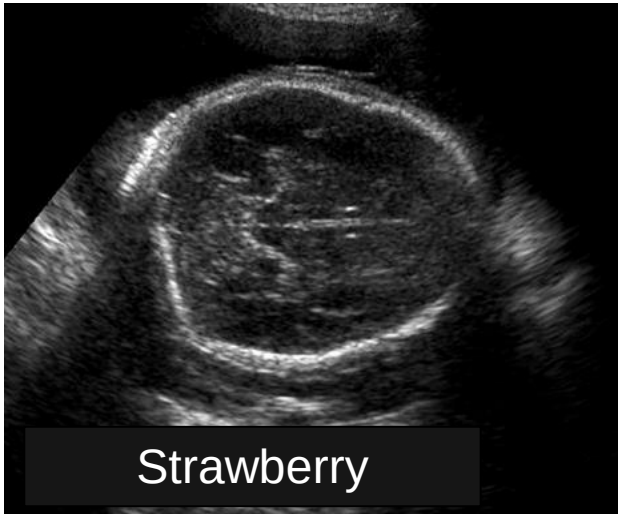
The cranial vault
“lemon” sign of open ntd





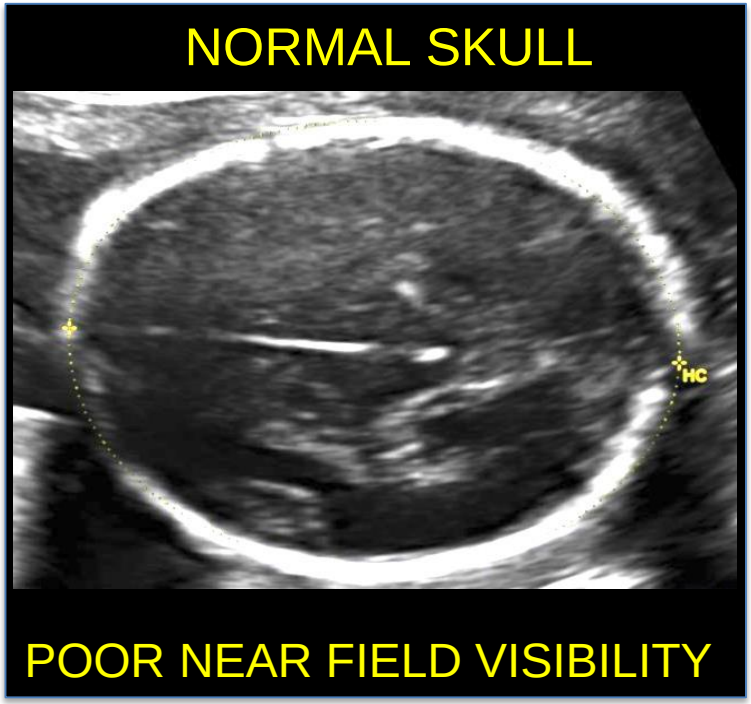
Other head shapes





OSTEOGENESIS IMPERFECTA

POOR MINERALISATION OF SKULL – REDUCED BONE DENSITY

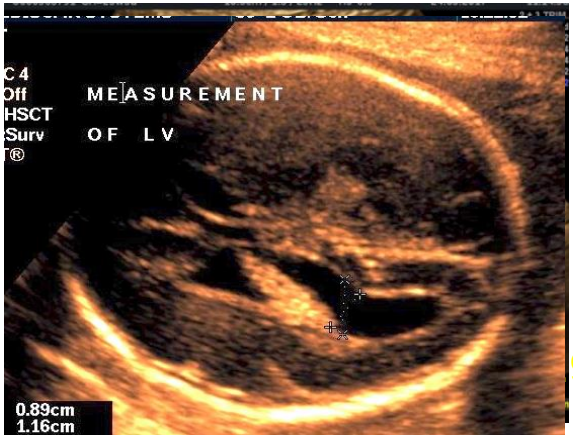


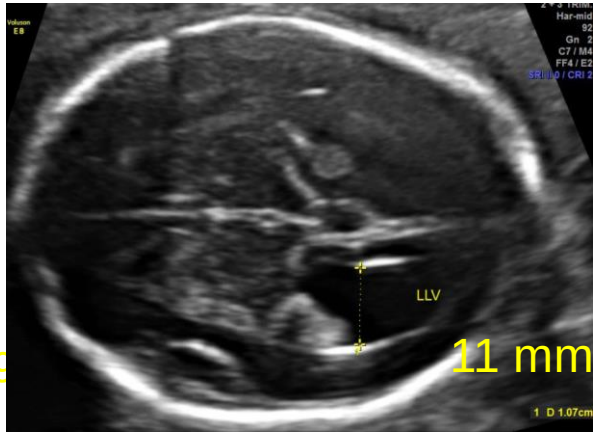
The cranial vault- skull integrity
Cephaloceles

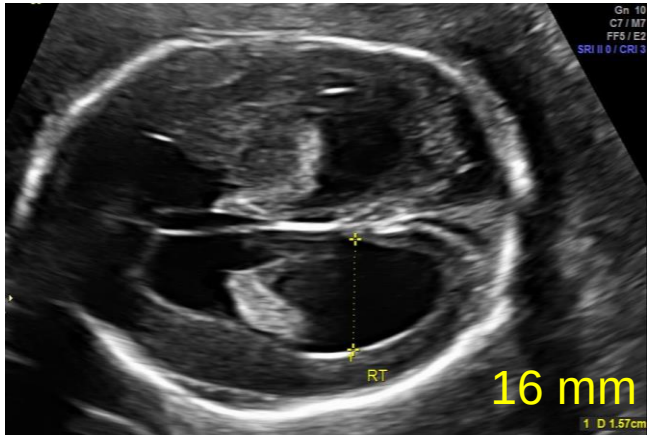


- Can occur anywhere
- Most common in the occipital regaion
- Meningocele / meningo encephalocele
- Varying sizes

Trans thalamic & ventricular planes ventriculomegaly

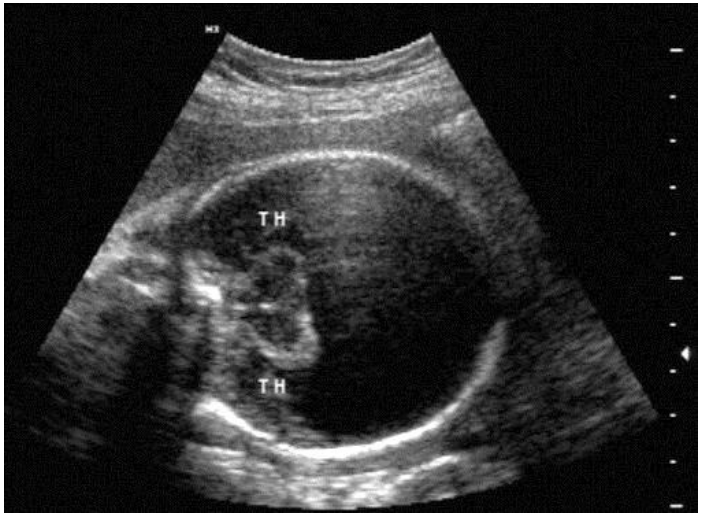


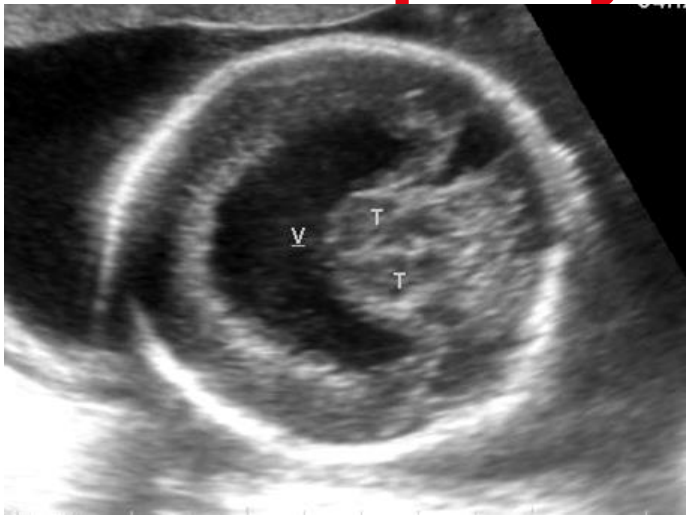




- Post horn >10mm
- Refer if LV size is >10 mm
- Ventricular shape “tear drop” in ACC

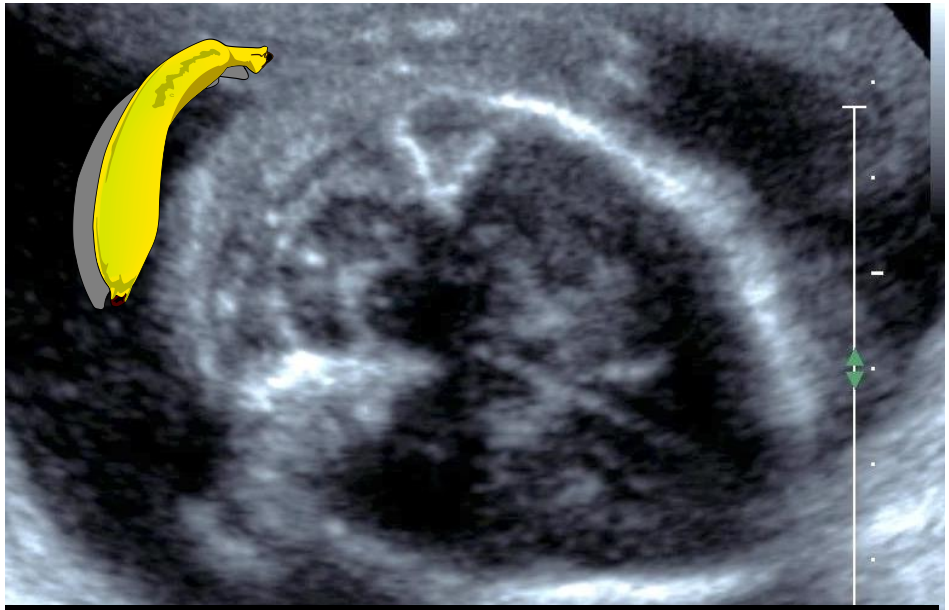
Holoprosencephaly



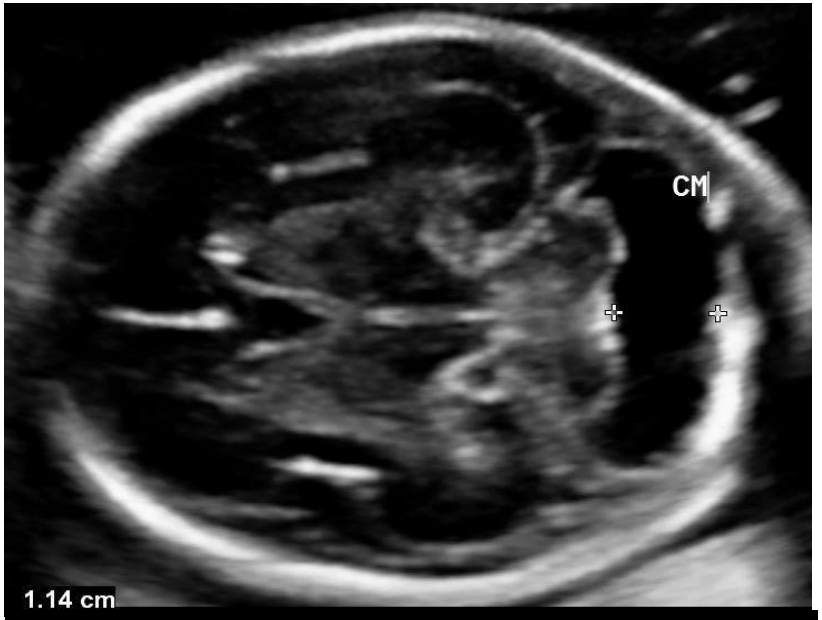


- Several types – Alobar most severe
- Associated anomalies may be present
- Refer if Midline Falx is not visualized and ventricles are fused

Trans cerebellar plane anomalies

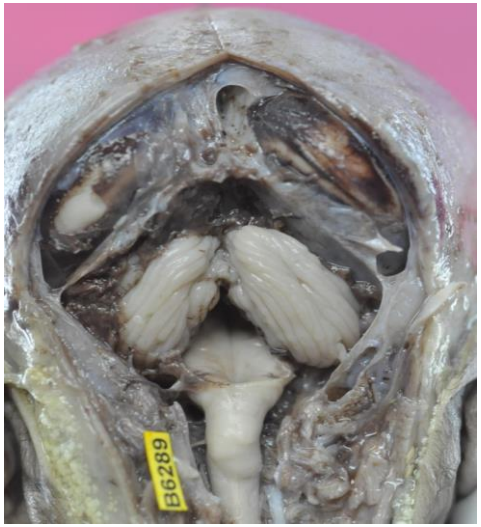


Banana shaped cerebellum in Spina Bifida

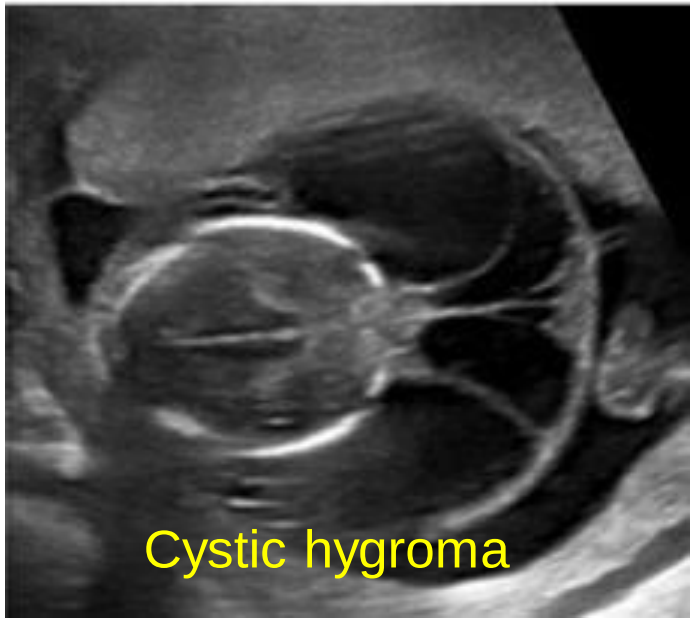


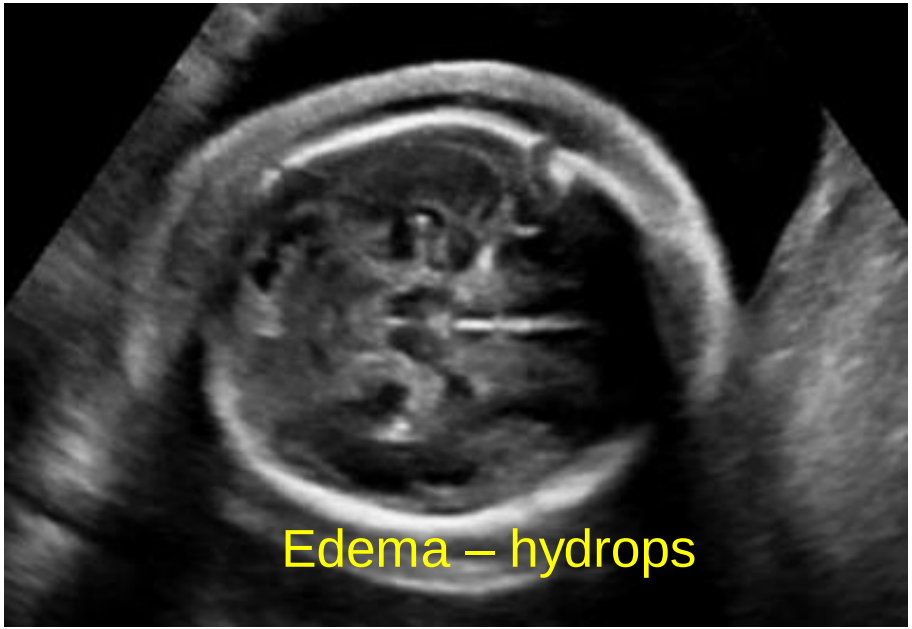
Cisterna Magna > 10 mm – Mega cisterna magna

Trans cerebellar plane anomalies

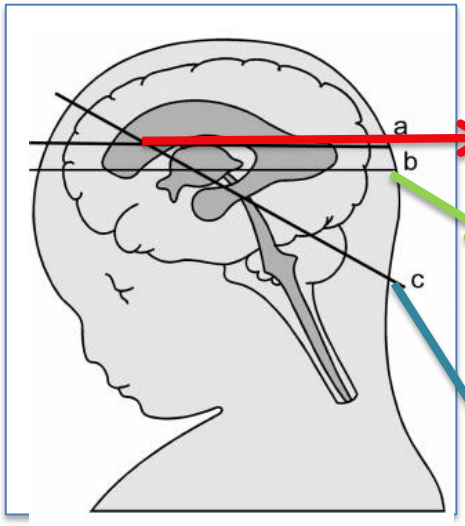


Trans cerebellar plane anomalies





Key features of planes 4, 5 and 6



Plane 4
TRANS VENTRICULAR

Skull , Falx, CSP, LV

Anencephaly, Cephalocele Alobar holoprosencephaly Ventriculomegaly

Plane 5
TRANS THALAMIC

BIOMETRY BPD, OFD, HC

Plane 6
TRANS CEREBELLAR

BIOMETRY- TCD Cerebellum/ vermis

Post fossa cyst Mega cisterna Magna Cystic hygroma Scalp Edema

Key Take Home Points

- Head is imaged in three planes – Lateral ventricular plane , Trans thalamic plane & Trans cerebellar plane
- It is important to identify the specific landmarks
- Any variation in the appearances should raise suspicion of an anomaly
- Lateral ventricle > 10mm, Cisterna magna > 10mm – refer
- Head circumference < 5th centile / > 95th Centile – refer
- Trans cerebellar diameter < 5th centile or altered shape – refer