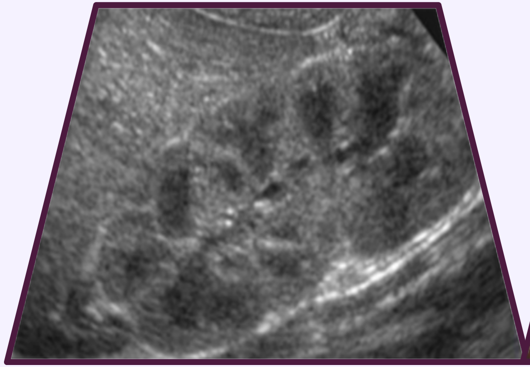
ULTRASOUND SOCIETY OF THE PHILIPPINES

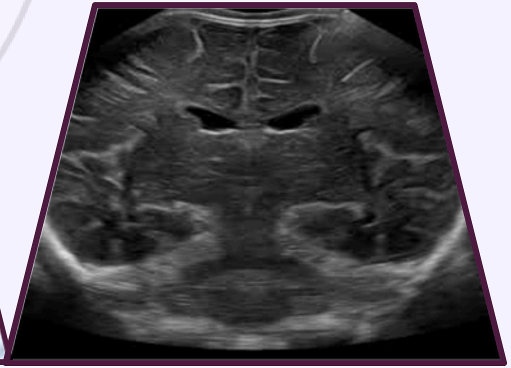
Subspecialty of the Philippine College of Radiology

CASE REVIEW SERIES

PEDIATRIC ULTRASOUND

JUNE 18, 2025





LECTURE SERIES PART 2

Dr. Paul Anthony S. Repolona, MD

Speaker

CRANIAL ULTRASOUND

- Useful toolinidentifyingnormalandpathologic intracranial pathology
- Initial examination of choice for:
  - Hydrocephalus
  - Periventricular, intraventricular, and intracerebral hemorrhage
  - Ischemic lesions
  - Congenital anomalies

CRANIAL ULTRASOUND

Scanning Technique

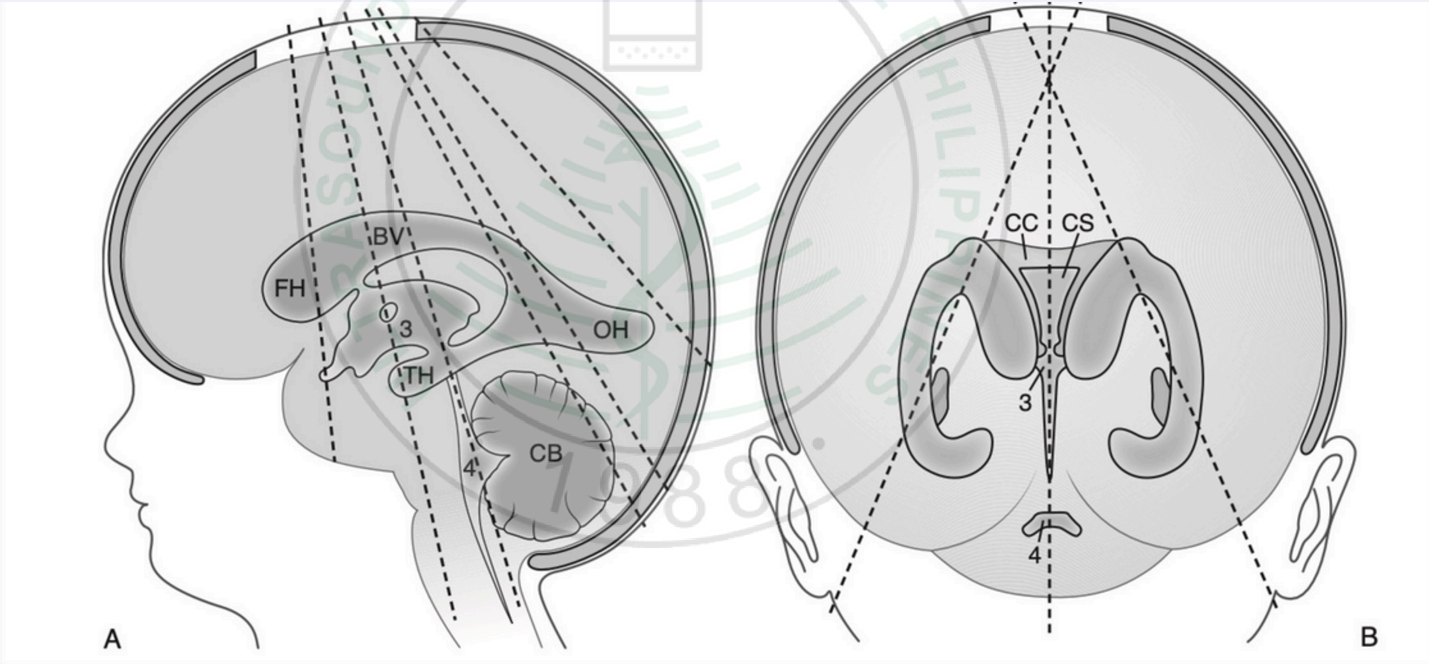


Image taken from: Pediatric Sonography Fourth Edition by Siegel (2011)

CRANIAL ULTRASOUND

Scanning Technique

- Posterior Fontanelle
  - Improved visualization of the occipital horn
- Mastoid fontanelle
  - Improved visualization of the posterior fossa

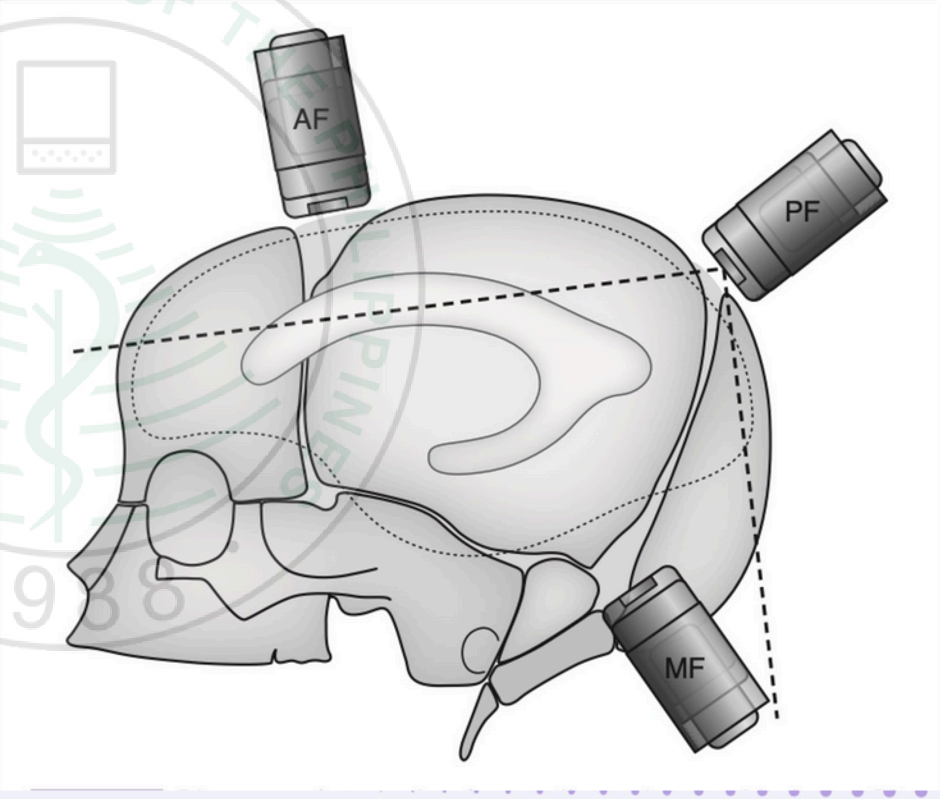


Image taken from: Pediatric Sonography Fourth Edition by Siegel (2011)

CASE #7: GERMINAL MATRIX HEMORRHAGE

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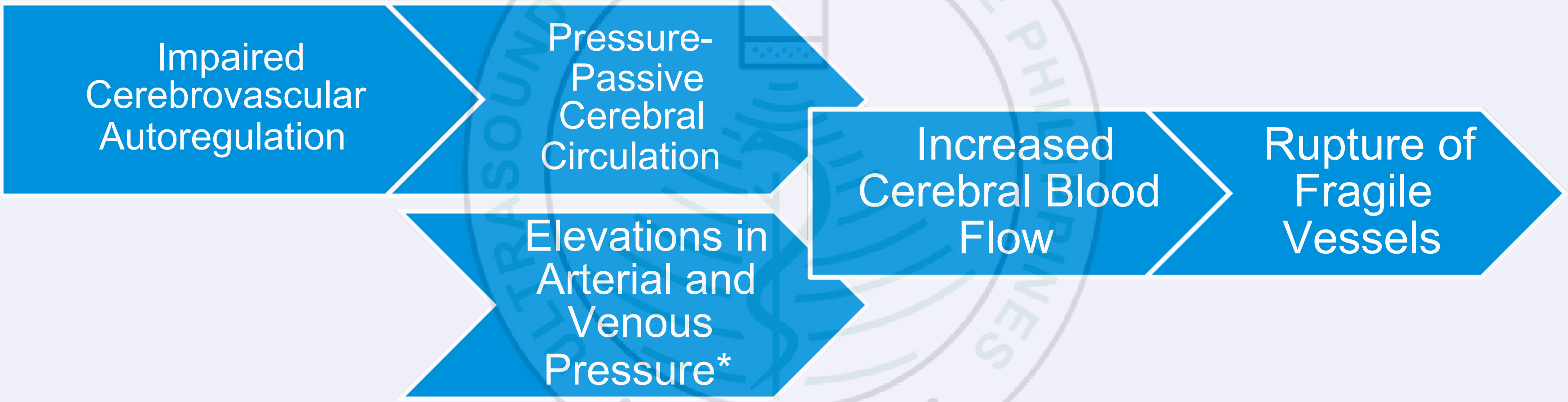
Pathophysiology



*Increase Arterial Pressure: Rapid volume expansion; Hypercarbia; Decreased Hemoglobin
Increase Venous Pressure: Asphyxia, Tension Pneumothorax, CHF, Therapeutic events

CASE #7: GERMINAL MATRIX HEMORRHAGE

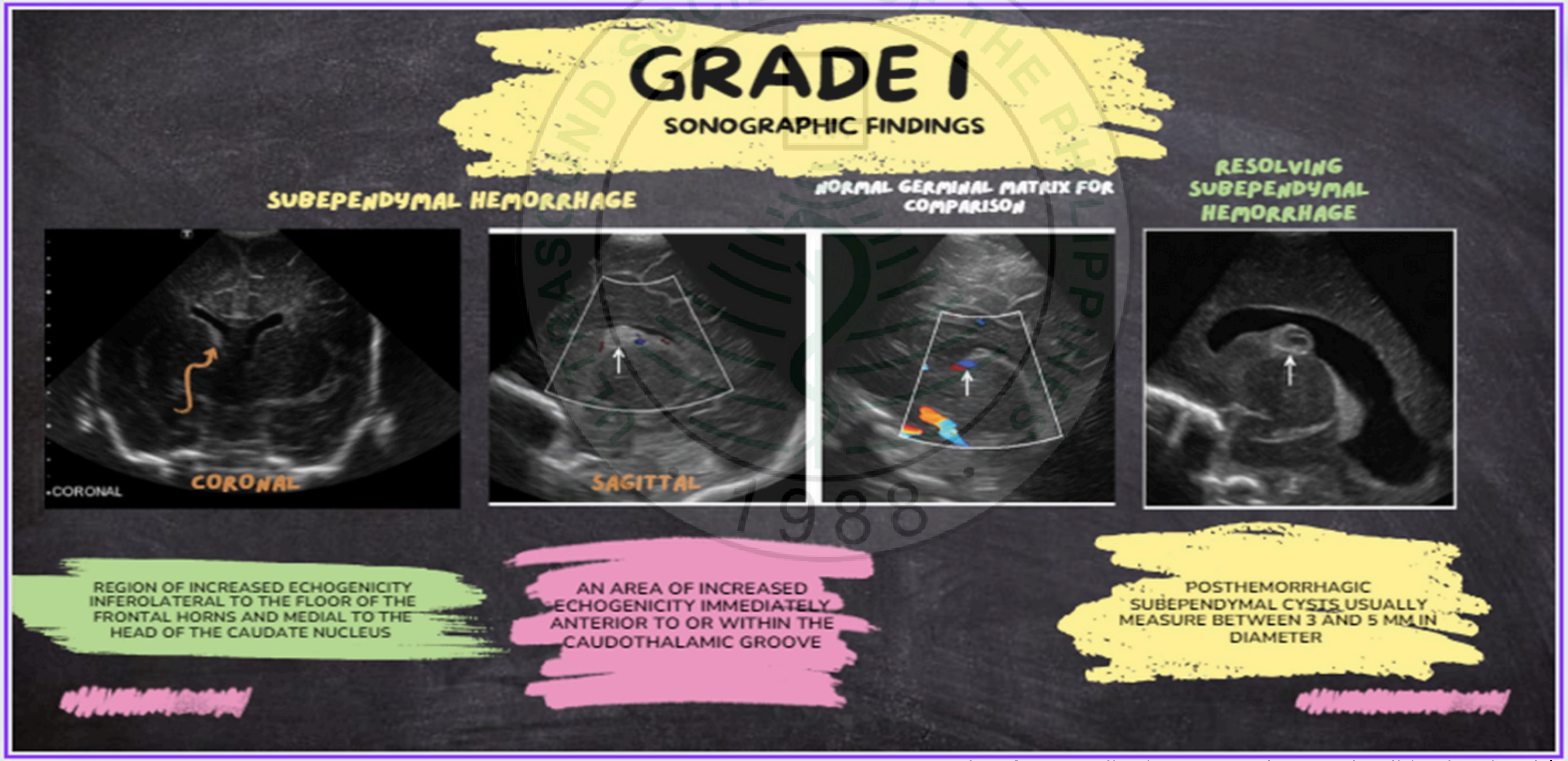
For symptomatic neonates

- Changes in neurologic status, unexplained hematocrit drop and unexplained apnea and bradycardia à**CRANIAL ULTRASOUND**

For asymptomatic neonates

- *SCREENING CRANIAL ULTRASOUND*
  - Less than 1000g birthweight -Day **3rd to 5th**, Day **10th to 14th**then Day **28th**
  - 1000g-1250 g -Day **3rd to 5th** and Day **28th**
  - 1251g-1500g -Day **3rd to 5th** and again **before discharge**

GERMINAL MATRIX HEMORRHAGE



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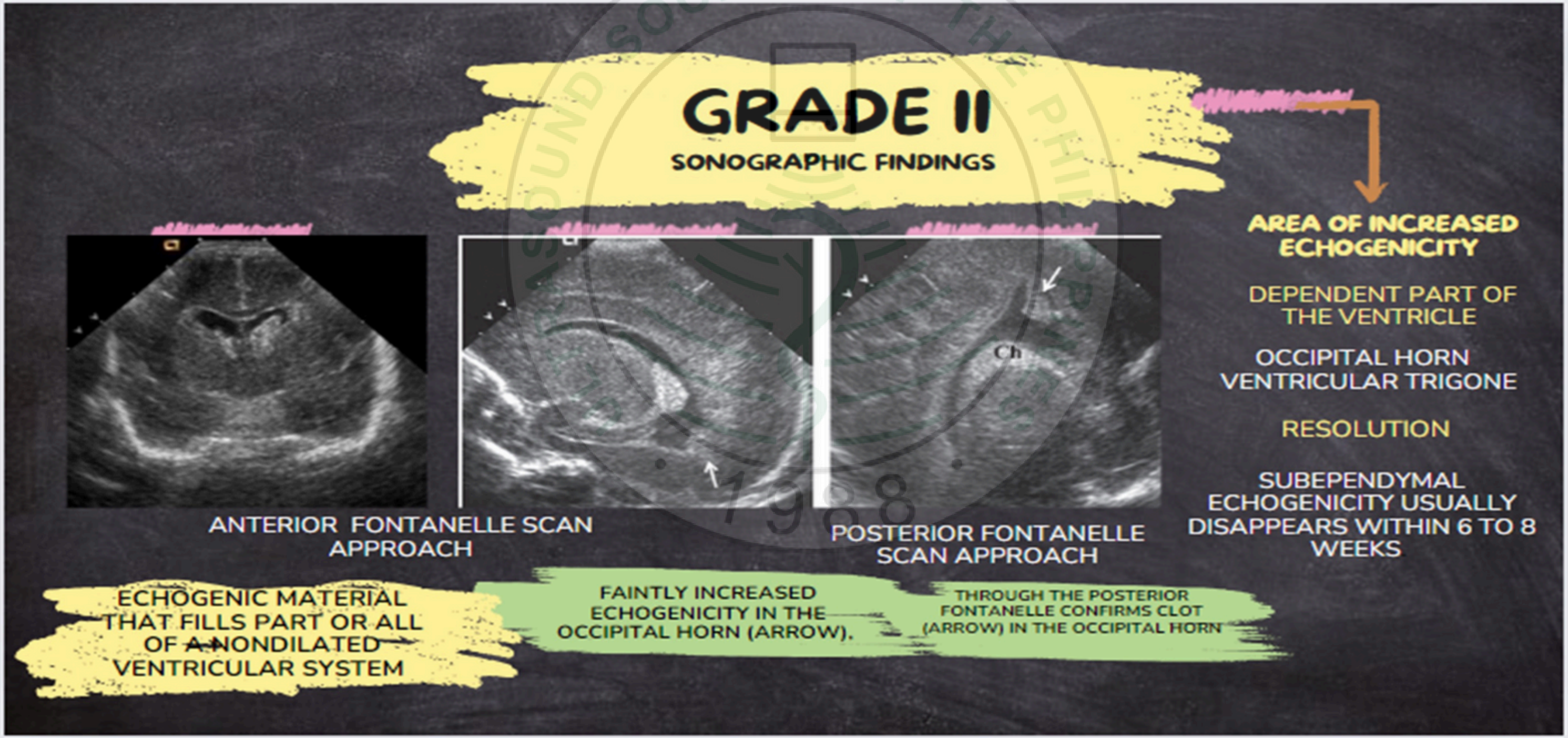
GERMINAL MATRIX HEMORRHAGE



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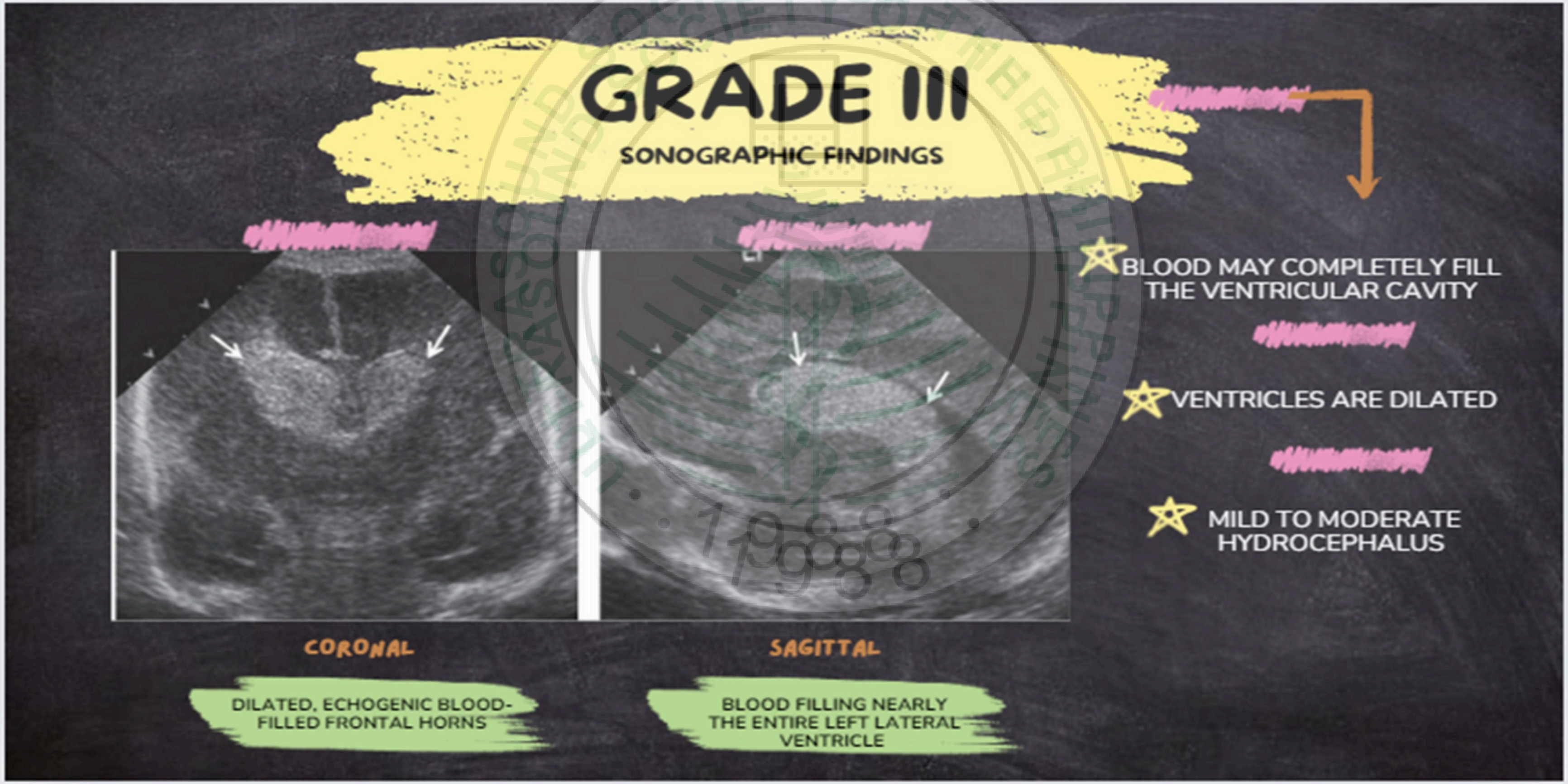

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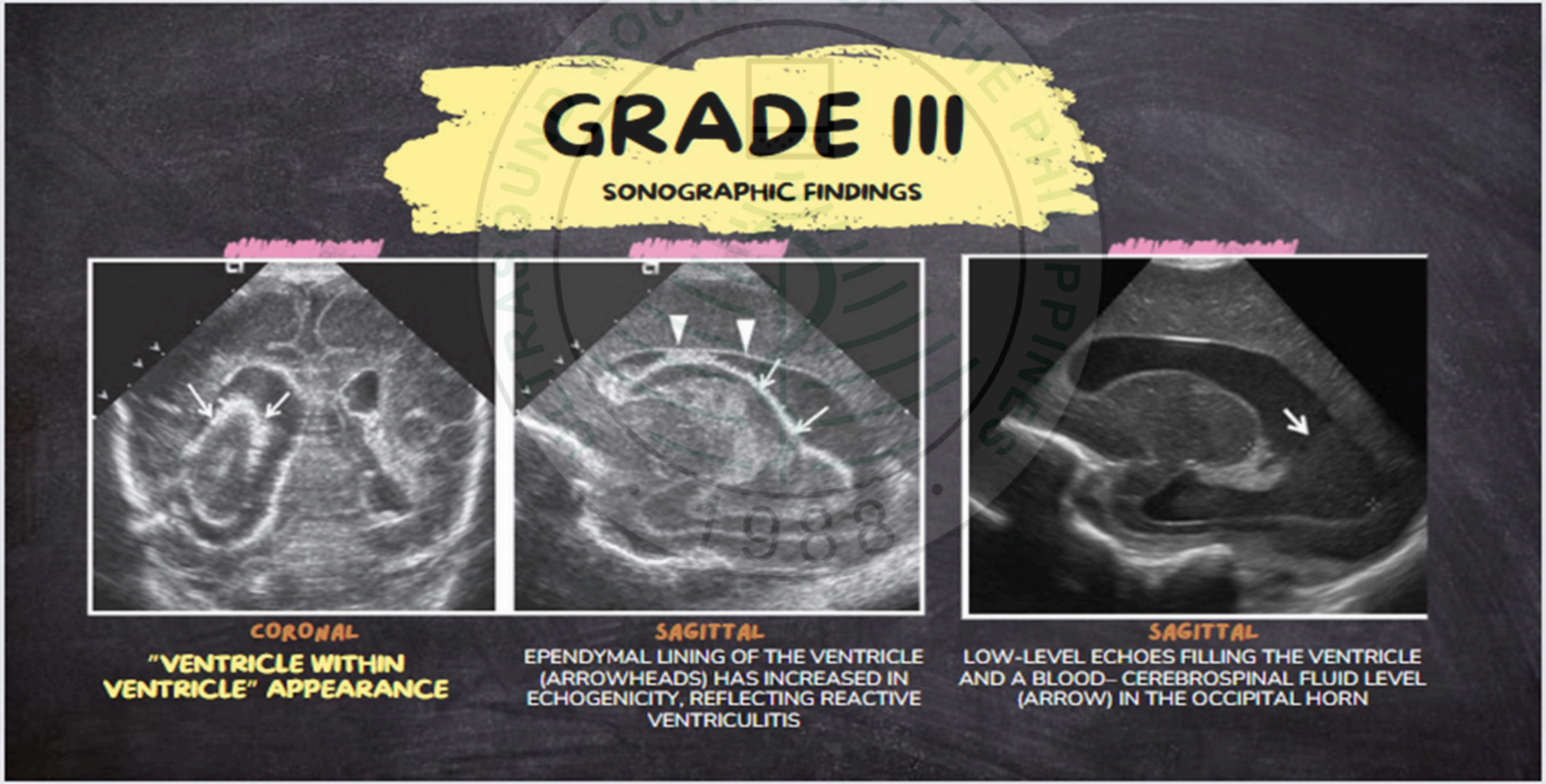

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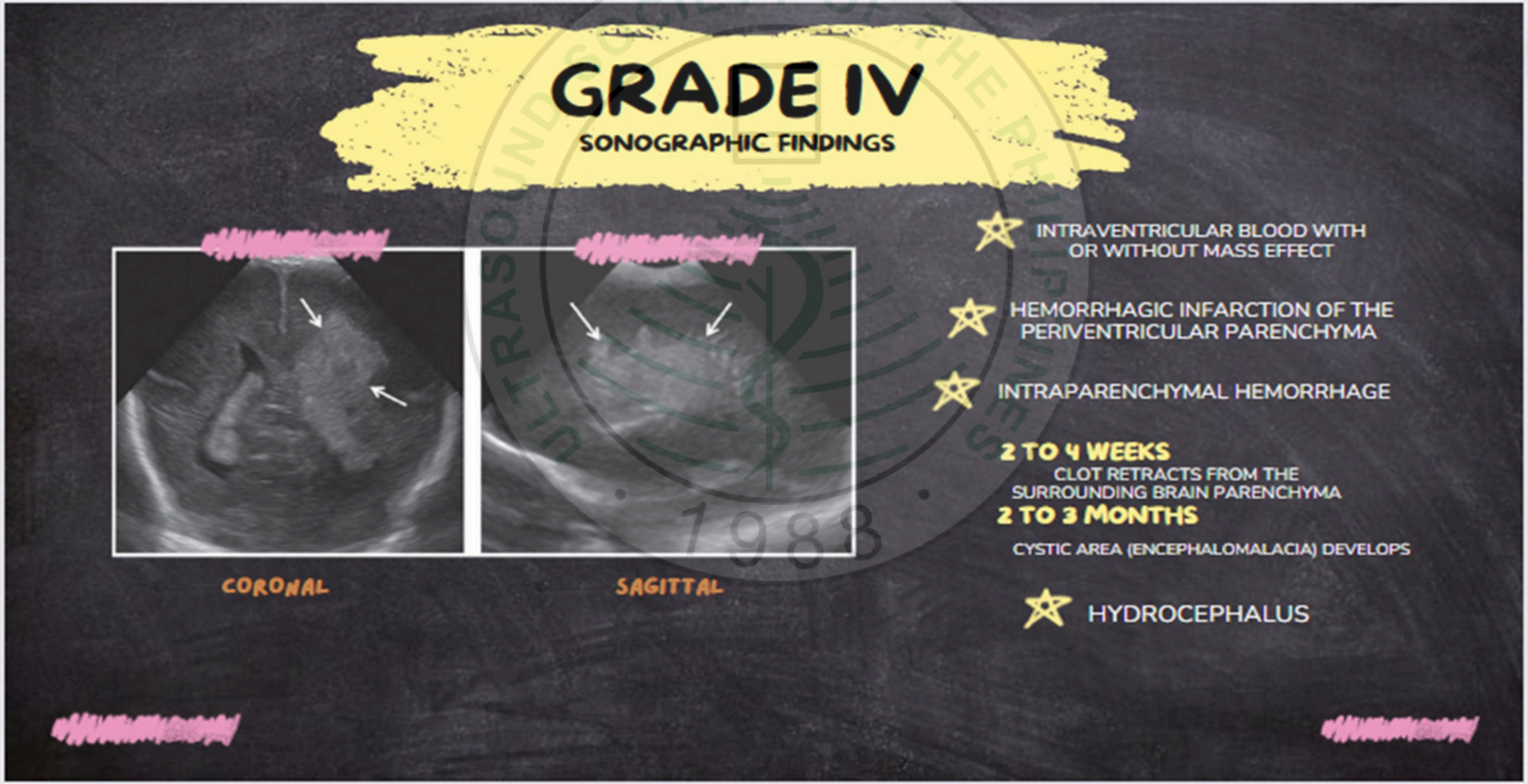
GERMINAL MATRIX HEMORRHAGE



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GERMINAL MATRIX HEMORRHAGE

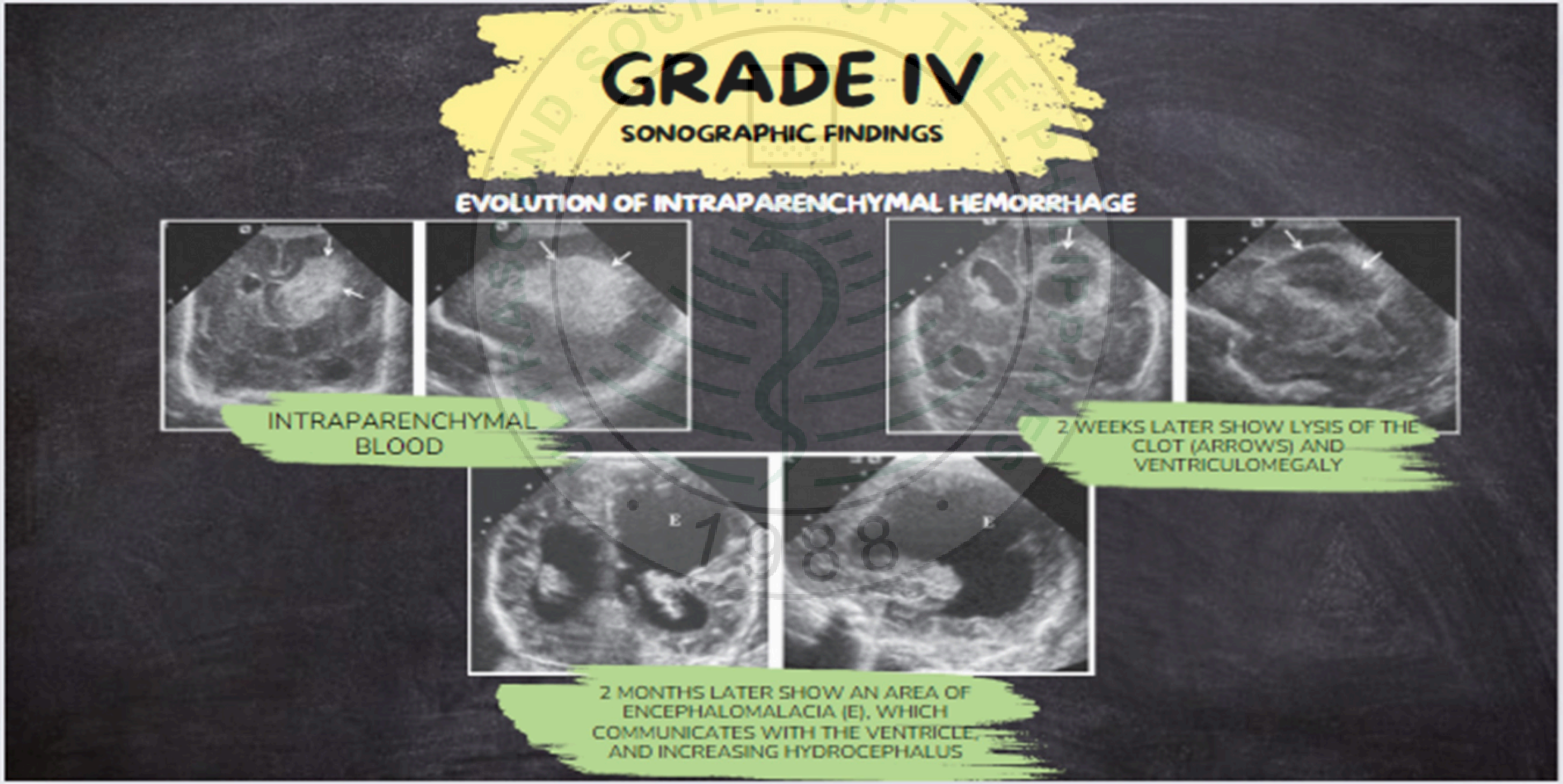

Image taken from: Pediatric Sonography Fourth Edition by Siegel (2011)

CASE #8: PERIVENTRICULAR LEUKOMALACIA

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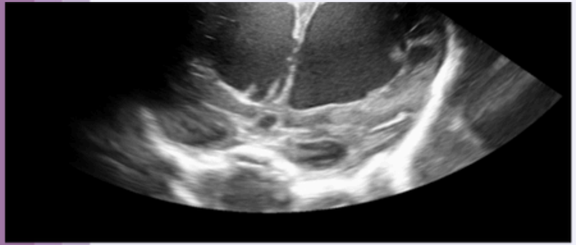
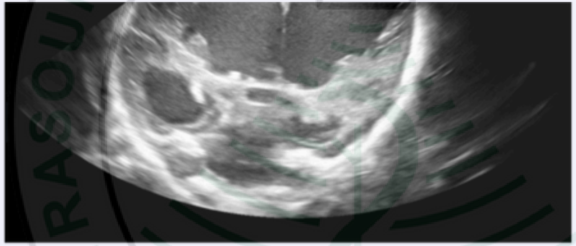
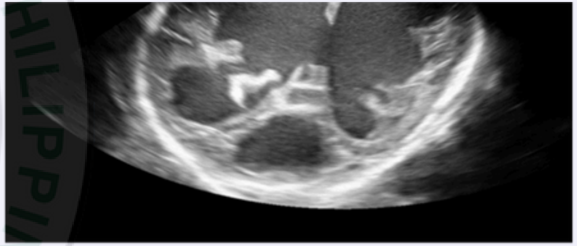
Case

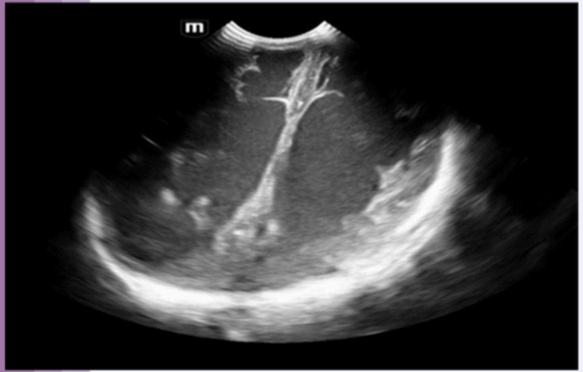
- NB/M
- Born at **33 weeks AOG**
- Small for Gestational Age

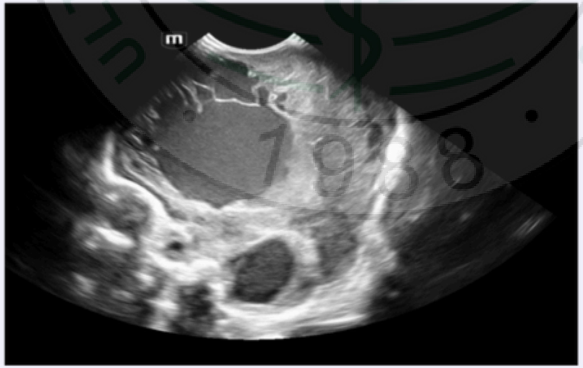
CASE #8: PERIVENTRICULAR LEUKOMALACIA

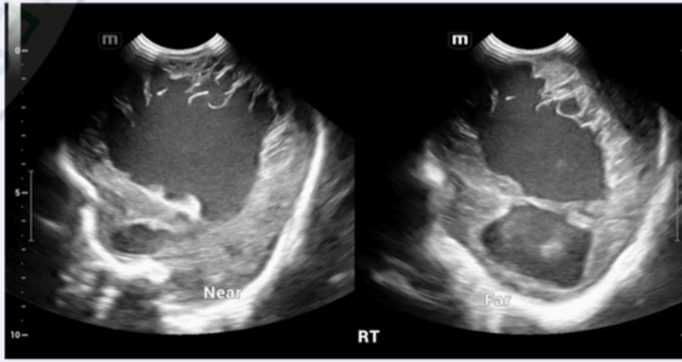












CASE #8: PERIVENTRICULAR LEUKOMALACIA

Overview

- “white matter injury of prematurity”
- Principal **ischemic lesion** of the premature infant
- Risk Factors for ischemic injury:
  - absence of CBF autoregulation
  - immaturity of the cardiovascular system
  - Vulnerability of the white matter oligodendroglia to ischemia

CASE #8: PERIVENTRICULAR LEUKOMALACIA

- In low birth weightinfant (<1000 g) à**25 –40%**
- Associated with Cerebral Palsy and Maternal chorioamnionitis
- Increased risk in:
  - Infants less than 32 weeks AOG
  - Neonatal sepsis
  - Prolonged mechanical ventilation
- Types
  - Cystic type
  - Non cystic type

CASE #8: PERIVENTRICULAR LEUKOMALACIA

Classification

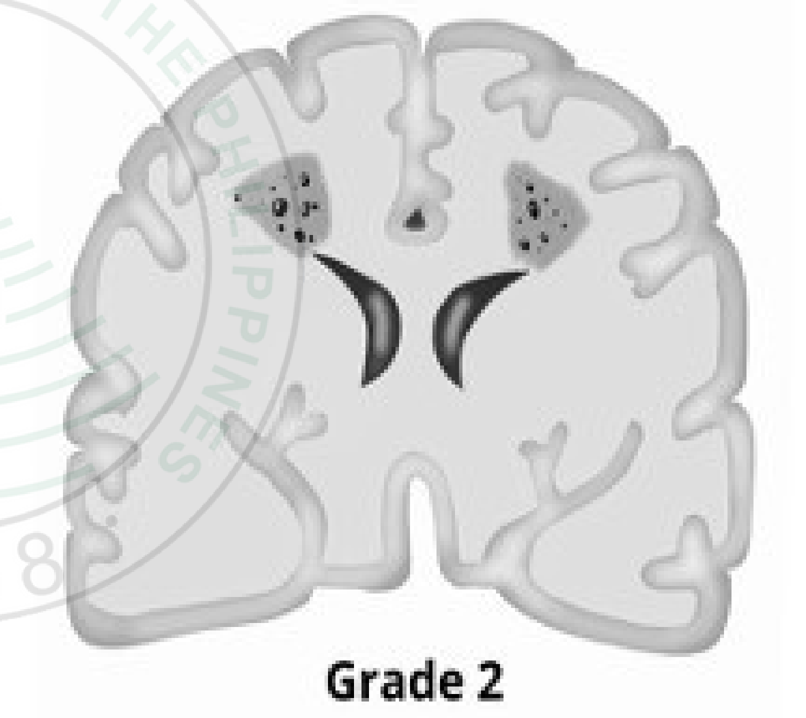
- Grade I
  - Areas of **increased periventricular echogenicity**
  - No cyst formation

Grade 1

CASE #8: PERIVENTRICULAR LEUKOMALACIA

Classification

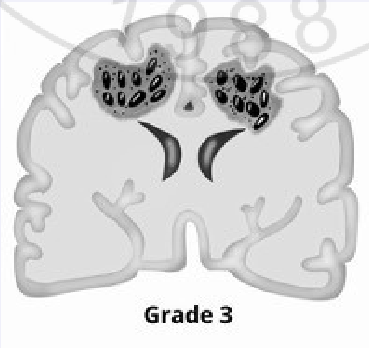
- Grade II
  - Areas of increased periventricular echogenicity developed **small periventricular cysts**



CASE #8: PERIVENTRICULAR LEUKOMALACIA

Classification

- Grade III
    - Developed in to **extensive periventricular cysts** in OCCIPITAL and FRONTOPARIETAL regions

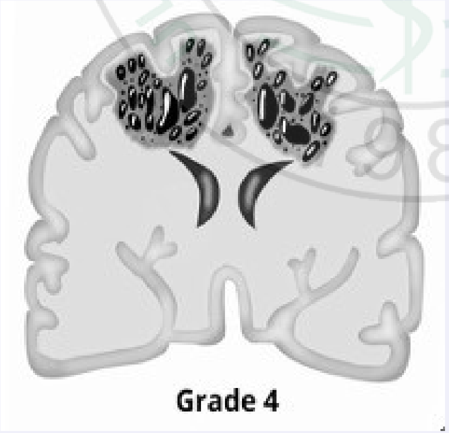


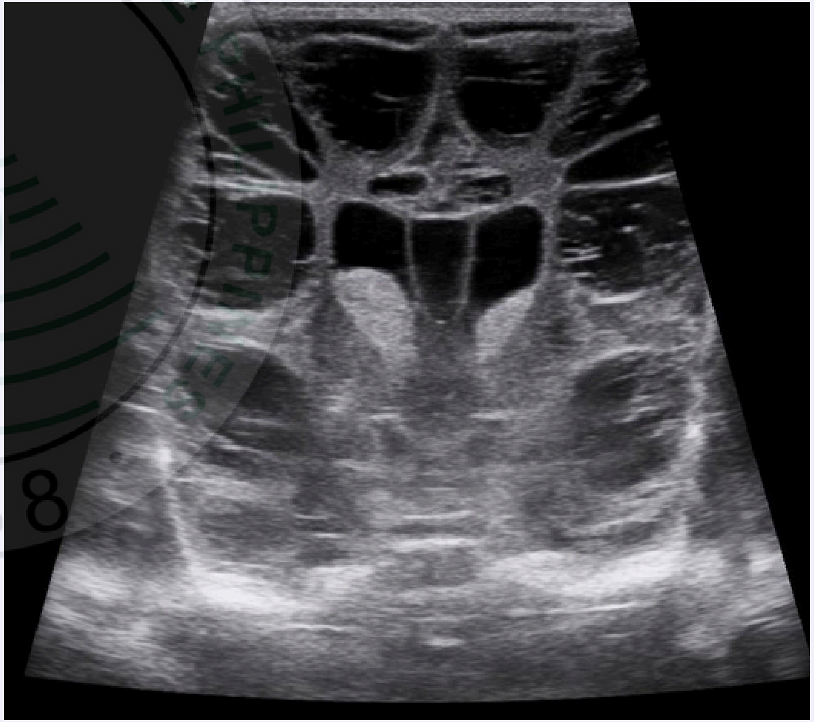
Case courtesy of Youssef Ibrahem, Radiopaedia.org, rID: 173719

CASE #8: PERIVENTRICULAR LEUKOMALACIA

Classification

- Grade IV
  - Developed into **EXTENSIVE SUBCORTICAL** cysts





Case courtesy of ElahehAmani, Radiopaedia.org, rID: 174076

CASE #8: PERIVENTRICULAR LEUKOMALACIA

- Initial sonographic examination à**normal**
- Within weeks of the initial insult à**increase echogenicity** of the periventricular white matter (**greater than the adjacent choroid plexus**)
- **Two to four** weeks after à**cystic**changes may develop in the area of abnormal echogenic parenchyma
- Subsequent sonograms, the cystic lesions may **enlarge or resolve**
- Because the initial ultrasound examination findings are often normal in infants who have sustained a significant hypoxic-ischemic event
    - *late sonograms should be obtained at about 4 weeks after birth to exclude evolving PVL*

CASE #9: HYDRANENCEPHALY

CASE #9: HYDRANENCEPHALY

Pathophysiology

Bilateral occlusion of the internal carotid or middle cerebral artery during fetal development

→ destruction of the cerebral hemispheres

→ membranous sac containing cerebrospinal fluid **+**remnants of cortex

Considered a severe form of porencephaly

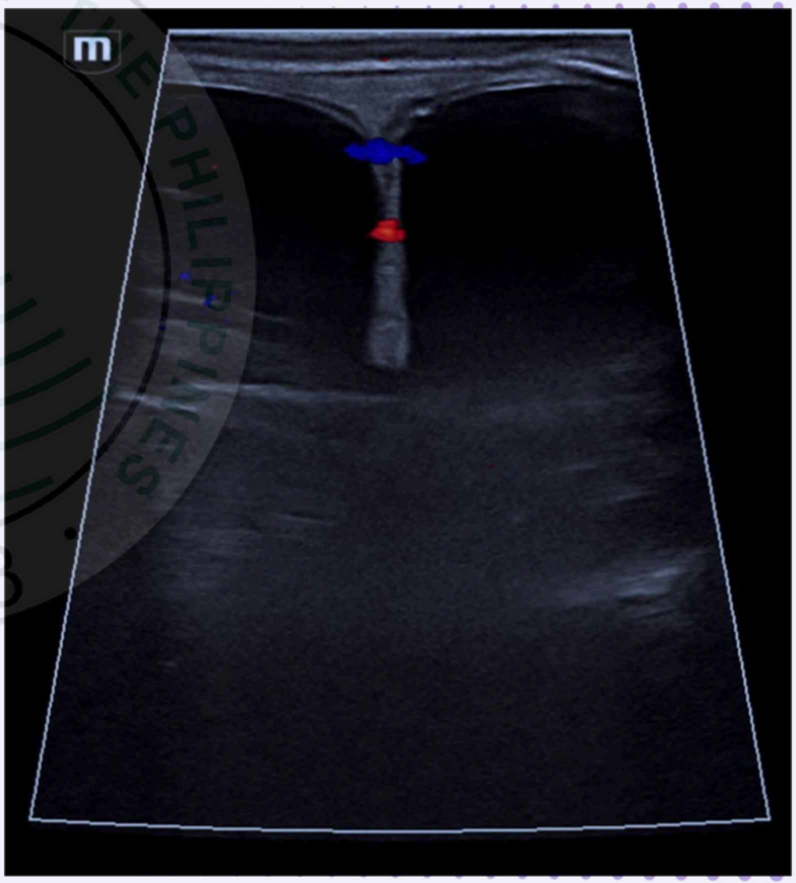
Clinical features

- Occurs in 1 per 5000 pregnancies
- Infants may appear normal at birth but are developmentally delayed at an early age
- Frequently die within the first year of life

CASE #9: HYDRANENCEPHALY

Sonographic features

- CSF-filled calvarium Absent cerebral
- cortex or with
  partial sparing in the distribution of the anterior and posterior cerebral arteries, including portions of the frontal, temporal, and occipital lobes
- Brainstem and cerebellum identifiable
- Falx is present, complete or incomplete
- Posterior fossa structures appear normal
- Absent color or spectral Doppler in the carotid arteries



DM, newborn/ female

Live, Preterm baby GIRL born to a 17 y/o G1P1 (0101) mother via NSD, AS 6,7 ; BS 35, BW 2.297kg, AGA

Birth history:

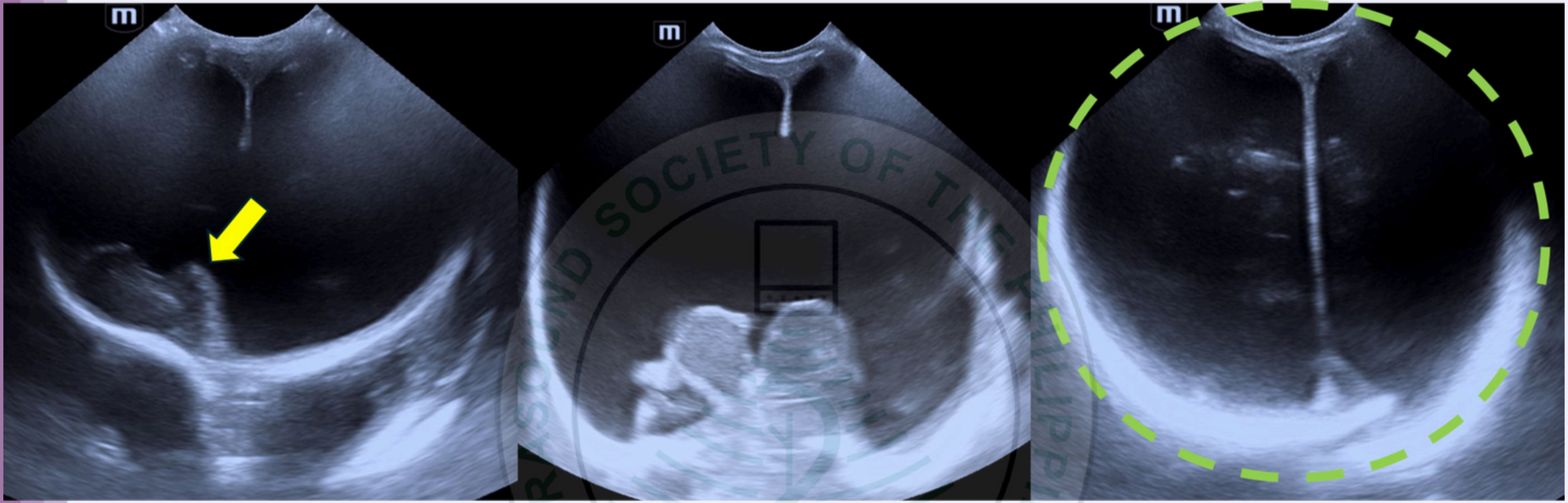
- Delivered via NSD. Upon delivery, preterm looking, non-meconium stained
- At the first minute of life: cyanotic,

  heart rate of < 100 bpm with grimace, minimal reflexes upon stimulation and with irregular respirations.
- Due to bradycardia and irregular

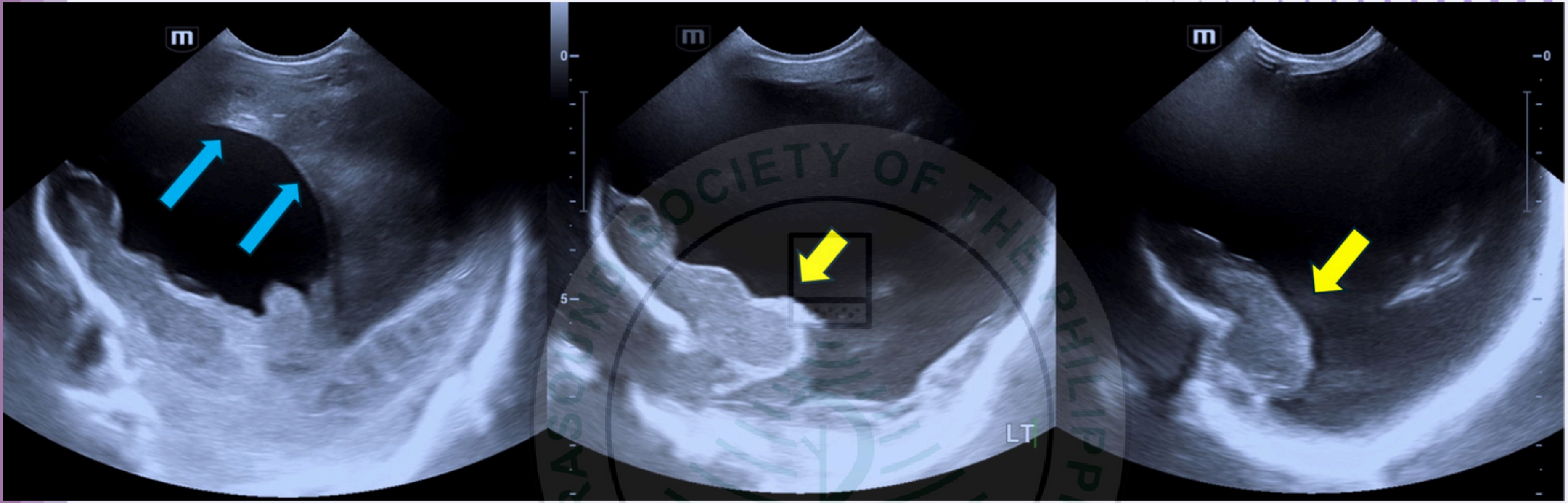
  respiration, patient was intubated.

Maternal Illnesses: (+) URTI -colds (31

weeks AOG; Txt: Cetirizine



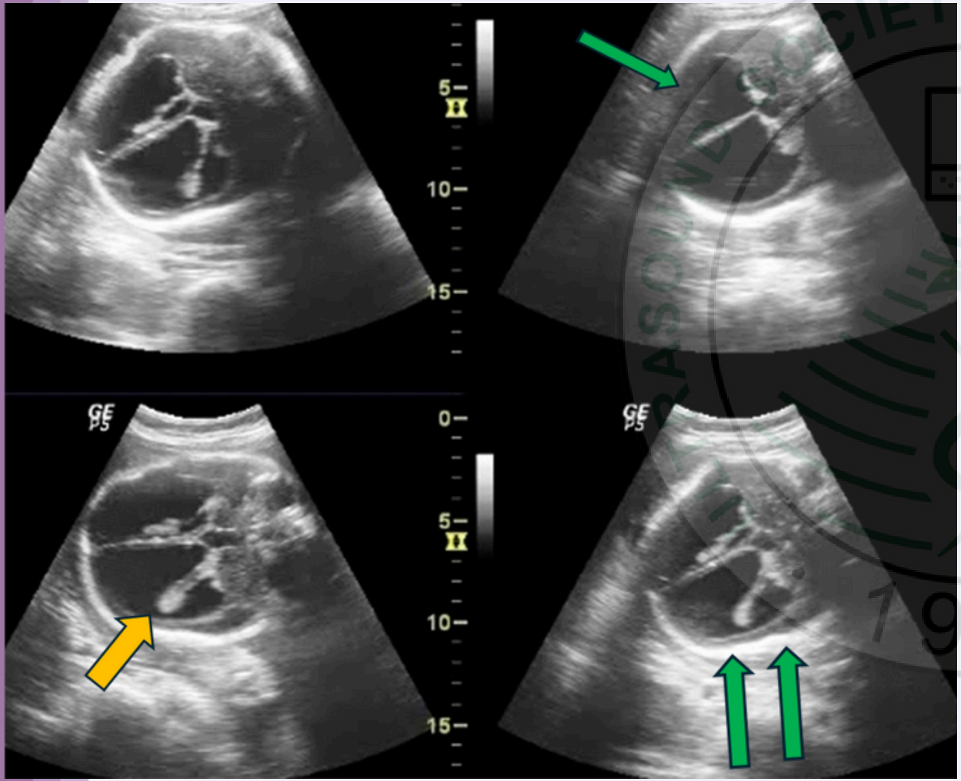
The majority of the cranium is **filled with cerebrospinal fluid.**
Thin regions of residual cortex are seen in the left frontal, left temporal, and bilateral occipital lobes.



Central cerebral tissue (both basal ganglia and thalami) and posterior fossa structures (brainstem and cerebellum) are intact.

Falx is noted in the midline, and it appears intact.

- Findings consistent with hydranencephaly



Ddx: Severe Hydrocephalus

–Pathophysio: CSF production and drainage imbalance; obstruction in the CSF pathway

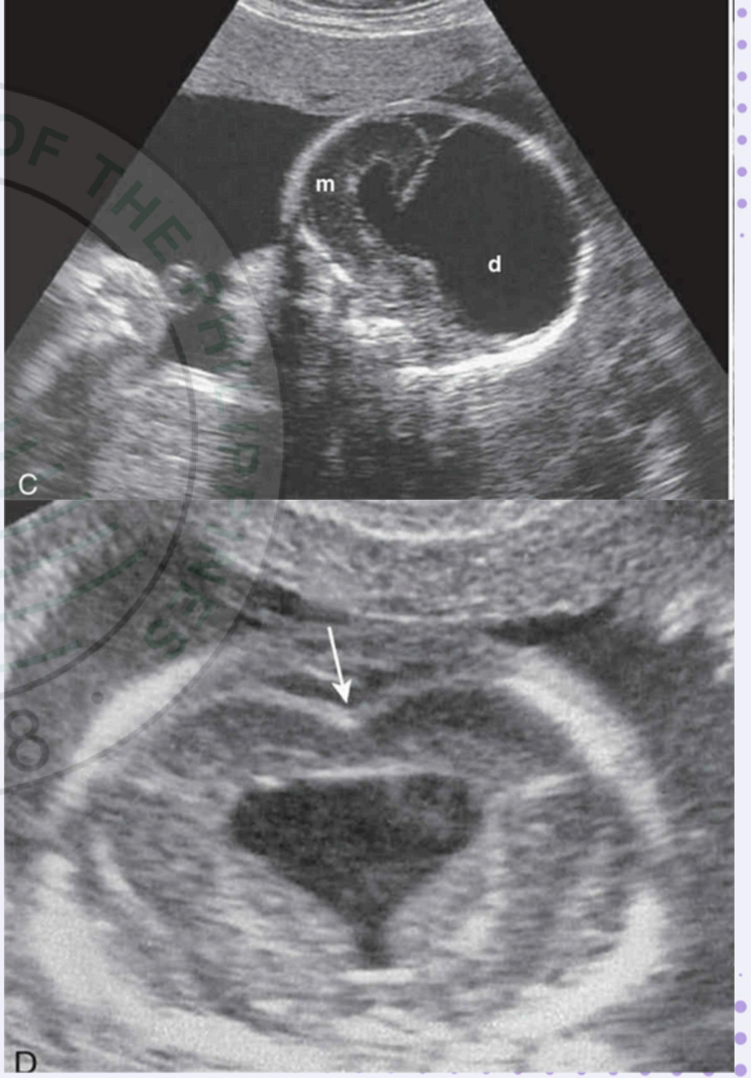
Ultrasound features

- Dangling choroid is present
- Thin rim of peripheral cortex is appreciated

Ddx: Alobar holoprosencephaly
–Pathophysio: failure of cleavage

Ultrasound features:

- monoventricle
- fused thalami
- absent structures:
  - corpus callosum
  - interhemispheric fissure
  - cavum septi pellucidi
  - 3rdventricle
- MCA and ACA may be replaced by tangled branches of internal carotidand basilarvessels



CASE #10: CHIARI II MALFORMATION

CASE #10: CHIARI II MALFORMATION

Overview

- Most common Chiari anomaly in childhood
- Almost always associated with a clinically obvious **myelomeningocele**
- Incidence of **~1:1000 live births**

Pathophysiology

- Pressure gradient across the foramen magnum → cause or hasten the development of hindbrain hernia
- Neural tube defect occurs first

CASE # 10: CHIARI II MALFORMATION

Pathologic Findings

- Small posterior fossa
- Low tentorial attachment
- Caudal descent of cerebellum, cerebellar vermis, pons, medulla, and fourth ventricle into the upper spinal canal

Associated Findings

- **Obstructive hydrocephalus**
- Corpus callosum dysgenesis
- Absent septum pellucidum
- **Fenestration ofthe falx**
- **Tectal beaking**
- Syringohydromyelia
- Luckenschadel skull

CASE #10: CHIARI II MALFORMATION

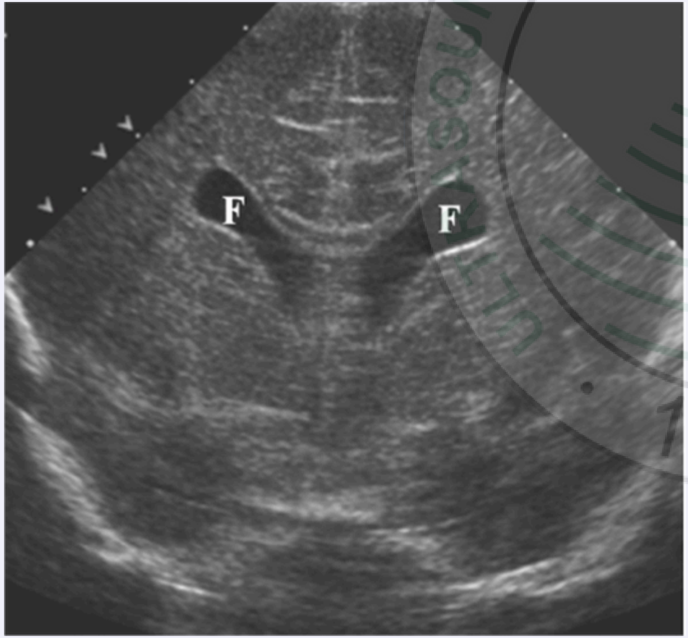
Sonographic Findings

- Supratentorial
  - Enlarged massaintermedia
  - Ventriculomegaly
  - Anterior and inferior angulation of the frontal horn ("Bat-wing" appearance)
  - Colpocephaly
  - Partial or total absence of the corpus callosum

CASE #10: CHIARI II MALFORMATION

Batwing appearanceofthe

Frontal horn



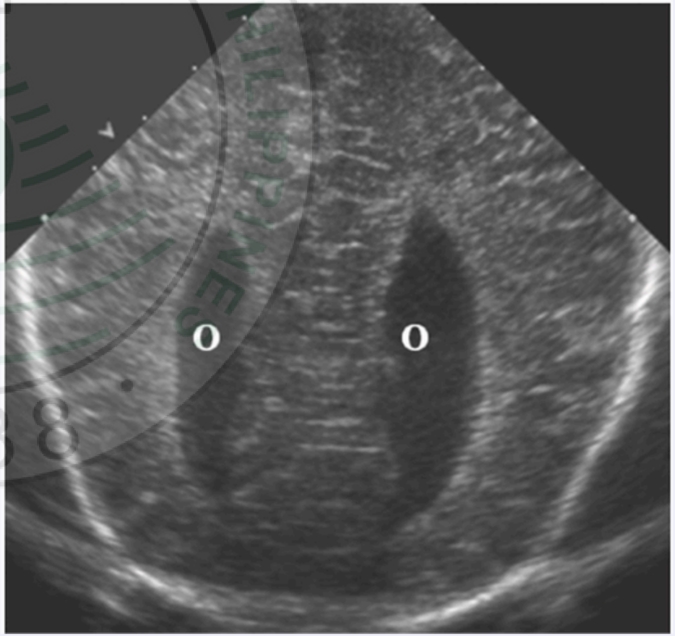


Image taken from: Pediatric Sonography Fourth Edition by Siegel (2011)

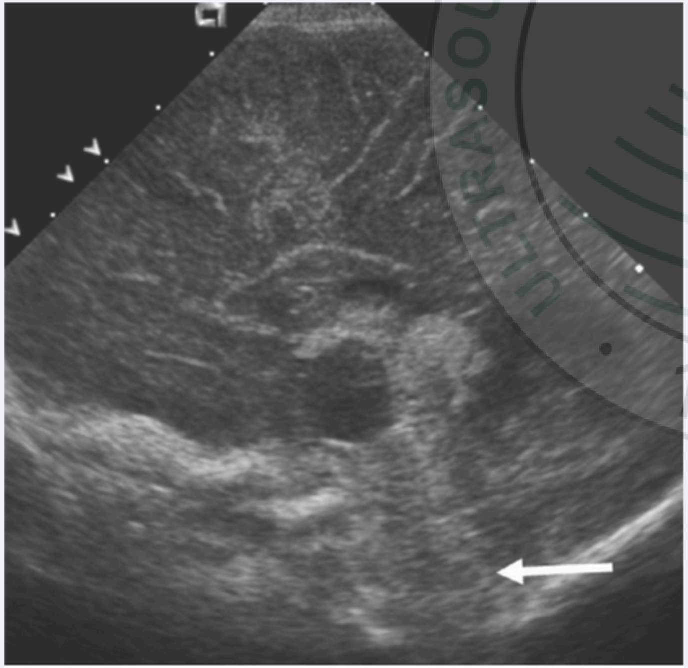
CASE #10: CHIARI II MALFORMATION

Sonographic Findings

- Infratentorial
  - Displacement of the cerebellum and herniation of the vermis into the cervical spinal canal
  - Loss of visualization of the cisterna magna
  - Small or absent fourth ventricle
  - Low-lying tentorium
  - Small posterior fossa
- Lacunar skull

CASE #10: CHIARI II MALFORMATION

Low-lying cerebellar vermis



Lacunar Skull

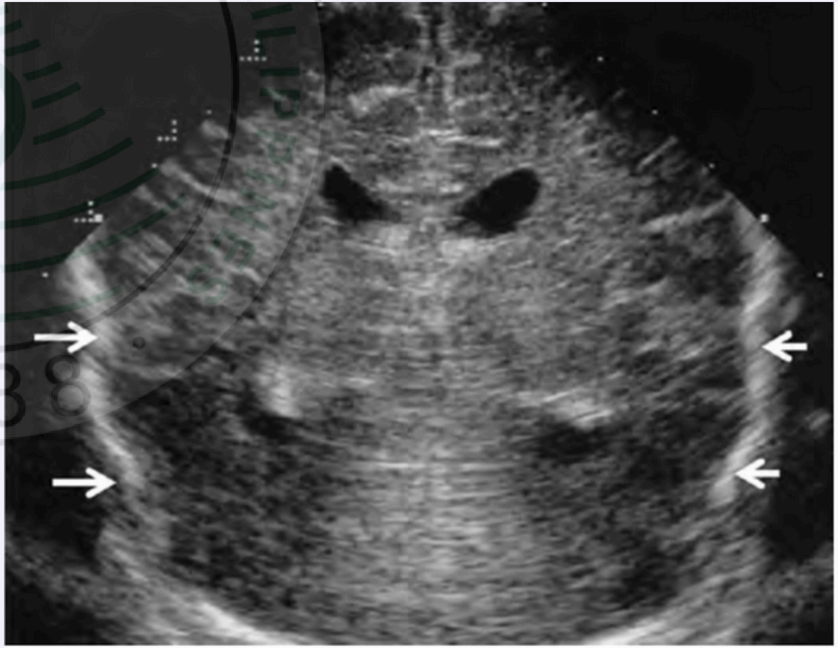


Image taken from: Pediatric Sonography Fourth Edition by Siegel (2011)

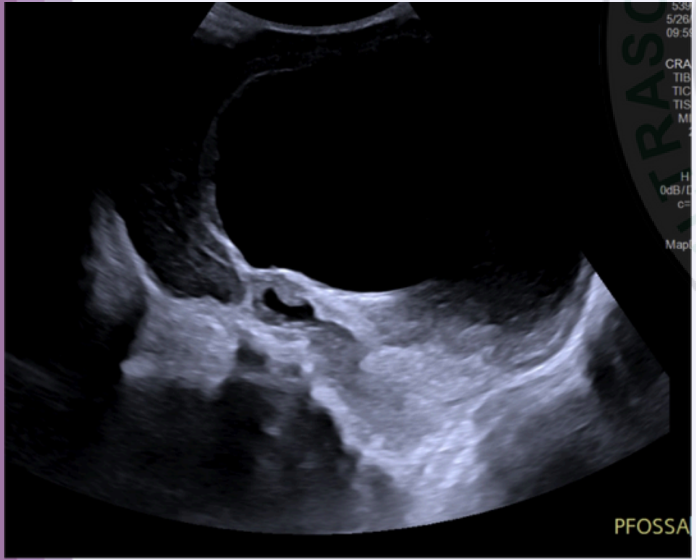
CASE #10: CHIARI II MALFORMATION

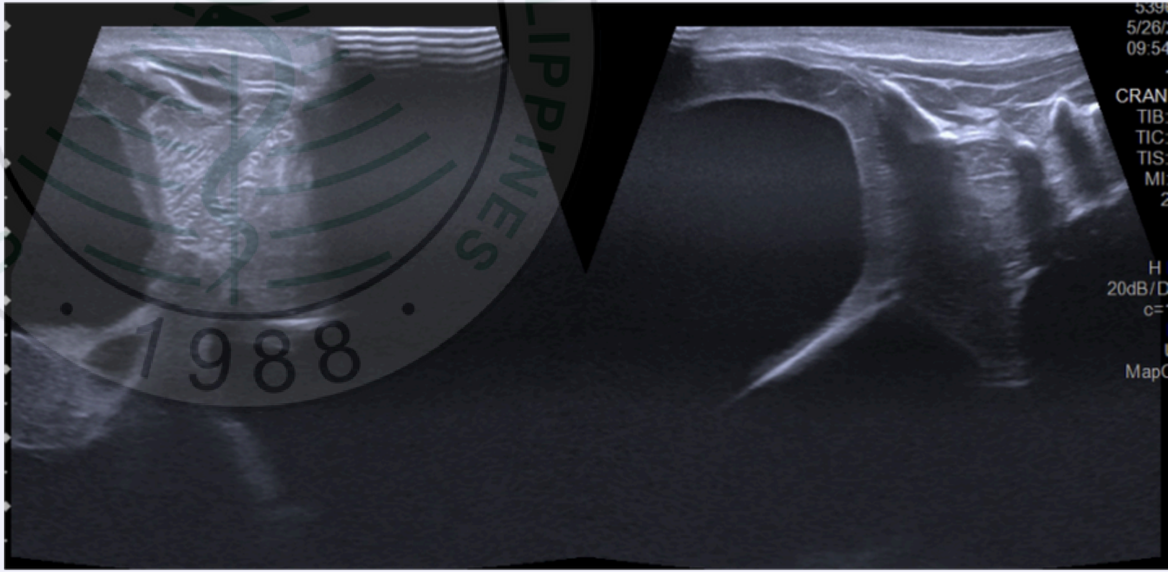
Case

- BD, 2d/M
- Born **preterm**at 36weeks AOG by early ultrasound via CS to a 24 year old G3P1 (1011)
- On CAS: **bilateral severe ventriculomegaly, obliterated cisterna magna, thoracolumbar mass**
- HC: **39 cm**, **bulging fontanelle**, **5 x 4 cm lumbosacral mass**with clear discharge
- A> lumbosacral myelomeningocele; t/c Arnold Chiari II Malformation

CASE #10: CHIARI II MALFORMATION

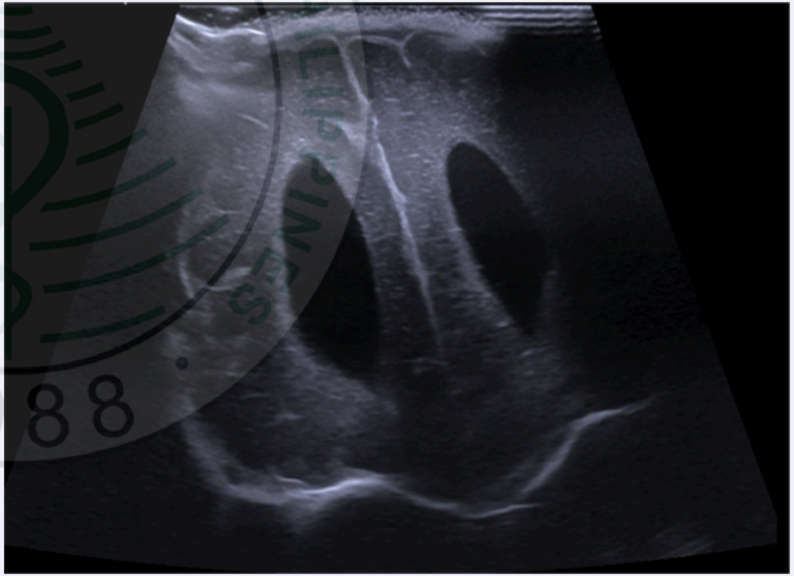
Cranial Ultrasound





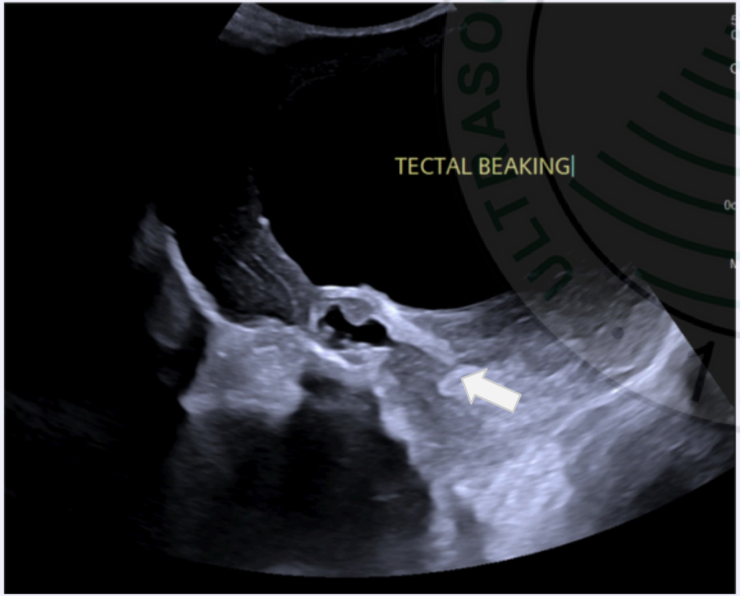
CASE #10: CHIARI II MALFORMATION

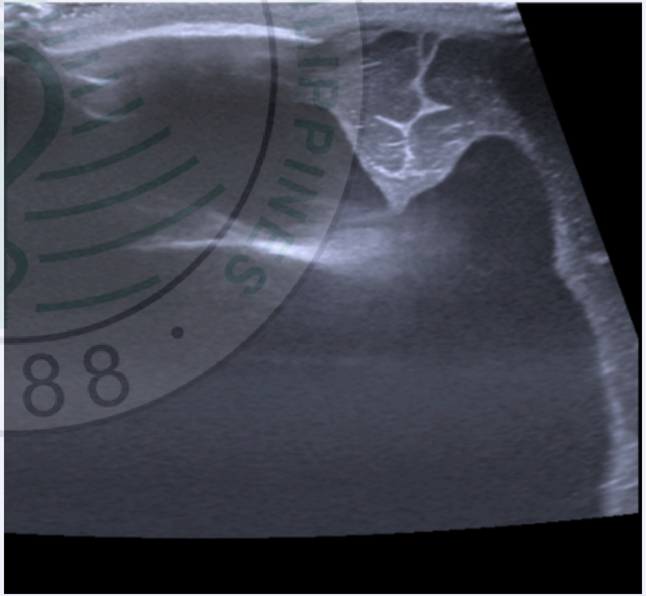
Cranial Ultrasound



CASE #10: CHIARI II MALFORMATION

Cranial Ultrasound





CASE #11: CYSTIC HYGROMA

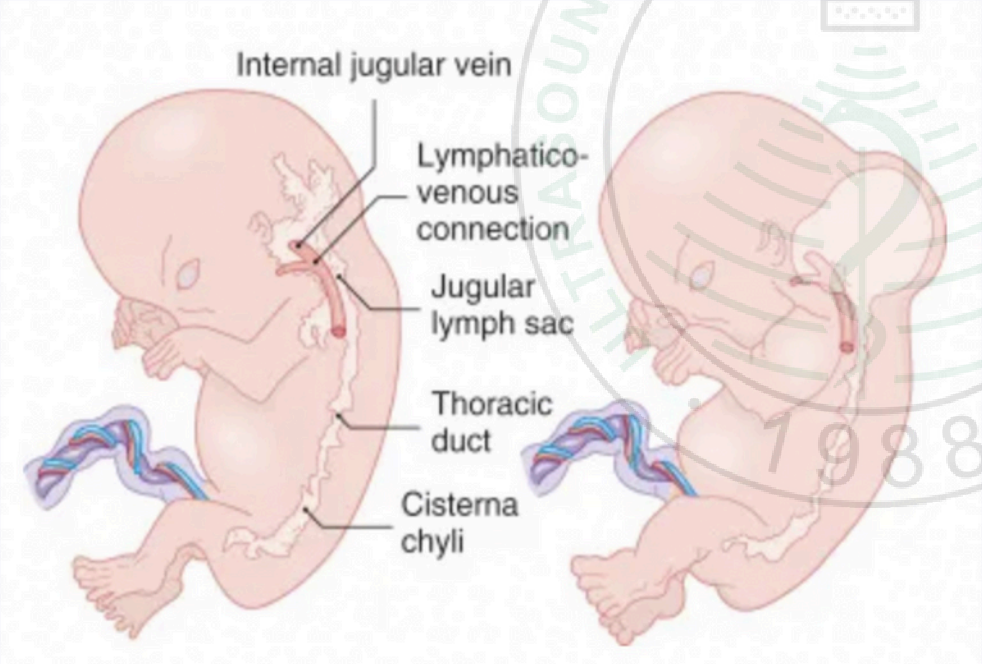
CASE #11: CYSTIC HYGROMA

Commonly known Cystic hygroma
a.k.a cystic/ nuchal lymphangioma

Most up-to-date terminology (ISSVA): Macrocystic lymphatic malformations.

- Birth defect Sac-like structure with a thin
- wall Most commonly occurs in the head and
- neck area. Most frequently observed fetal neck pathology on prenatal ultrasound. Occasionally the tumor can arise primarily
- in the mediastinum (anterior, posterior, and middle mediastinal compartments)

CASE #11: CYSTIC HYGROMA



Etiologyand pathophysiology

- Lymphatic malformationfromfailed lymphaticovenous connection
- Associated: CHD and Chromosomal abnormalities.
  - Turner syndrome-most common (60%)
  - More recent studies-higher prevalence: Down syndrome
  - Others:Autosomaltrisomies, Klinefelter syndrome, partial trisomies, partial monosomies, translocations and mosaicisms.

CASE #11: CYSTIC HYGROMA

Locations of cystic hygroma:

- Neck -~80%
- Axilla
- Extending to the mediastinum - 10%
- Chest -1%

Prevalence and Epidemiology:

True incidence is unknown.
1:6000 -at birth
1:750 -spontaneous abortions

CASE #11: CYSTIC HYGROMA

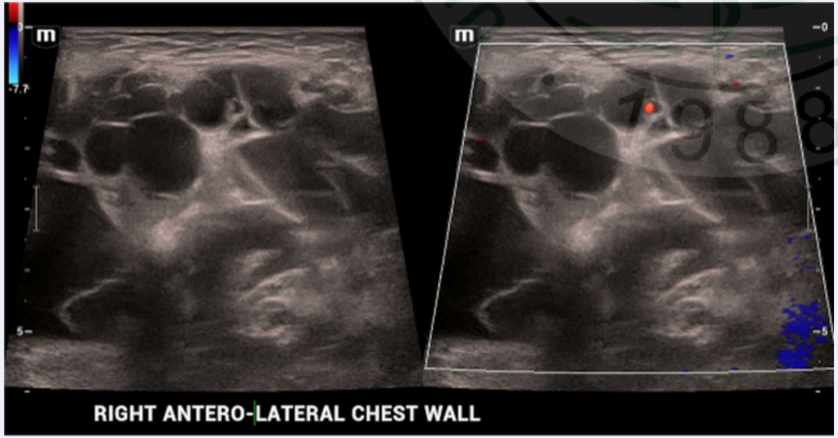
ULTRASOUND FINDINGS:

Classic finding:

Cystic mass with multiple septa

Multiple, asymmetrical, thin-walled cysts

Posterior aspect of the neck.



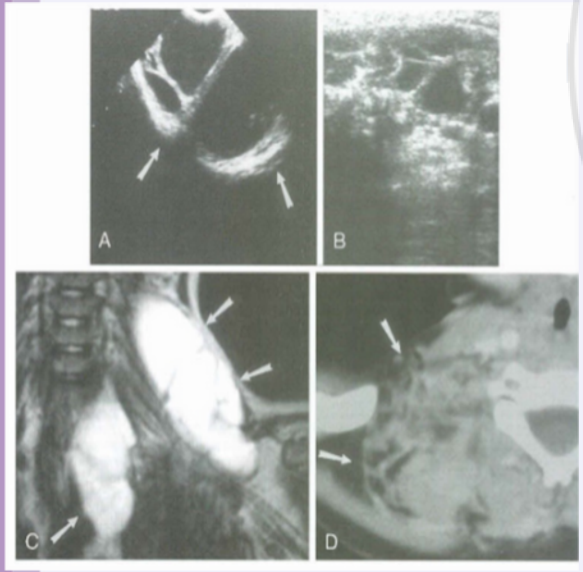
Prenatal Ultrasound:

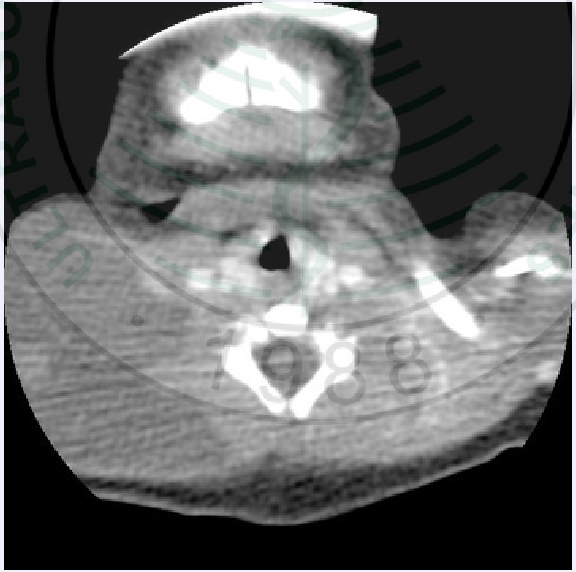
- Nuchal cyst
- Oligohydramnios/ increased
- amniotic fluid

Associated with Other malformations

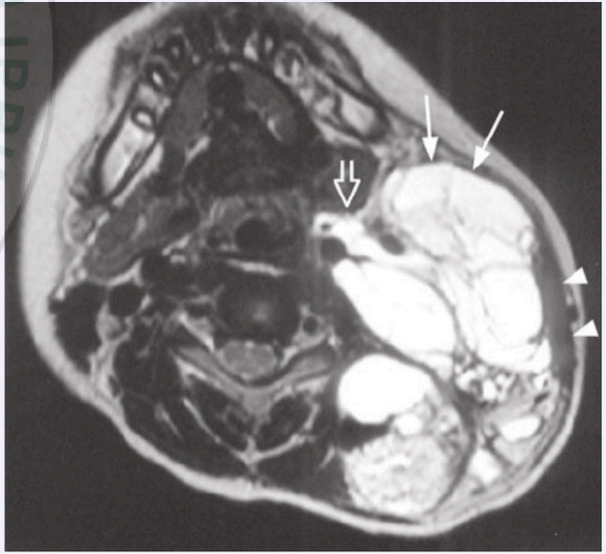
CASE #11: CYSTIC HYGROMA

ULTRASOUND/ CT scan/ MRI:





Case courtesy of The Radswiki, Radiopaedia.org, rID: 11345



Wong, KT., Lee, YYP et al. Imaging Features of Common Non-nodal neck masses in children. 2008, Hongkong journal of Pediatrics

CASE #11: CYSTIC HYGROMA

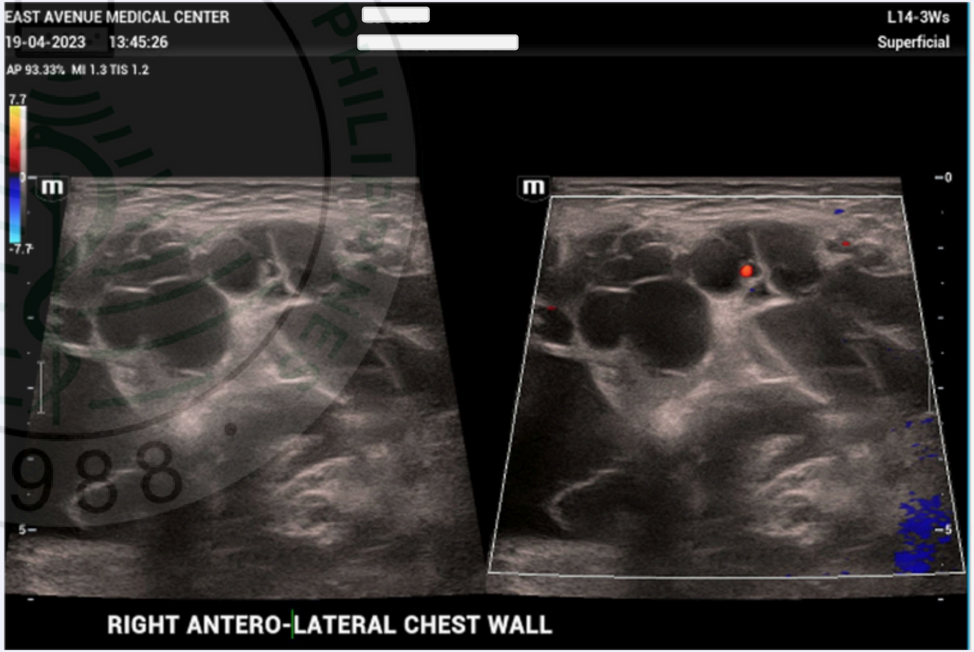
4-year-old male with 2-year history of enlarging mass in the right anterolateral chest wall. No other signs and symptoms.

Physical exam:
The mass is fixed and non-tender, no discoloration and fluctuant.

CASE #11: CYSTIC HYGROMA

Focused ultrasound done in EAMC on April 19, 2023

- A multilobulated, multiloculated cystic lesion
- Right axillary region
- Approximately measuring 6.0 x 7.2 x 7.6 cm (CCxWxAP).
- The medial part of the said lesion slightly abuts the chest wall and displaces the axillary vessels anteriorly.
- Additional color Doppler ultrasound study shows no evident vascularity.

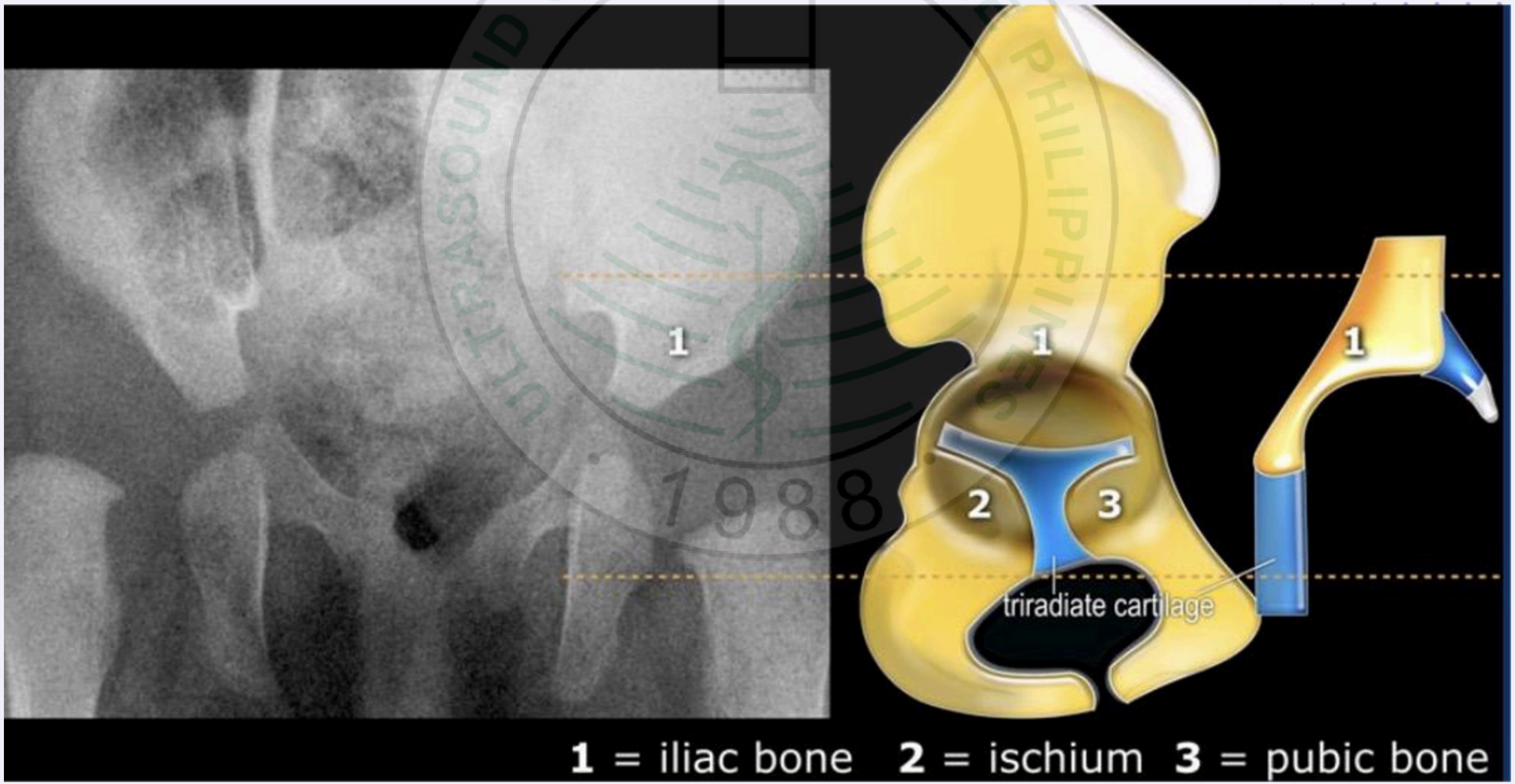


CASE #12: DEVELOPMENTAL DYSPLASIA OF THE HIP

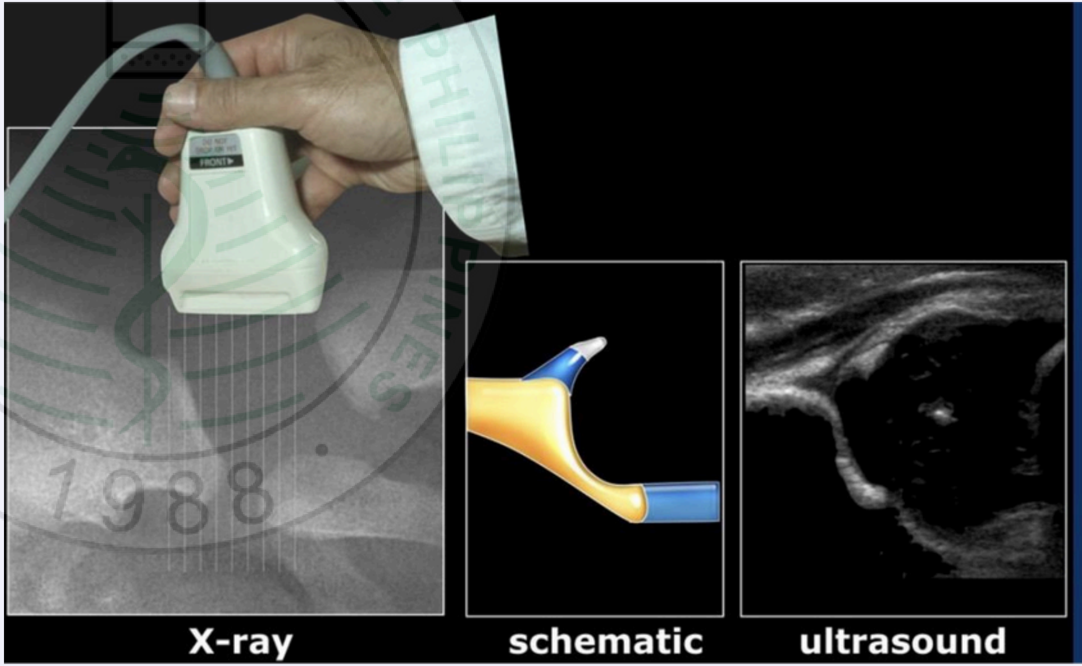
CASE #12: DDH

- Common congenitalconditionwith varying severity, ranging from mild undercoverageto femoral head dislocation. Risk factors: breech
- presentation (MC), female gender, and family history. Early screening and diagnosis,
- ultrasound between 4 to 6 weeks = crucial to prevent premature hip osteoarthritis. Universal screening remains controversial, with clinical
- examination being the primary method recommended.

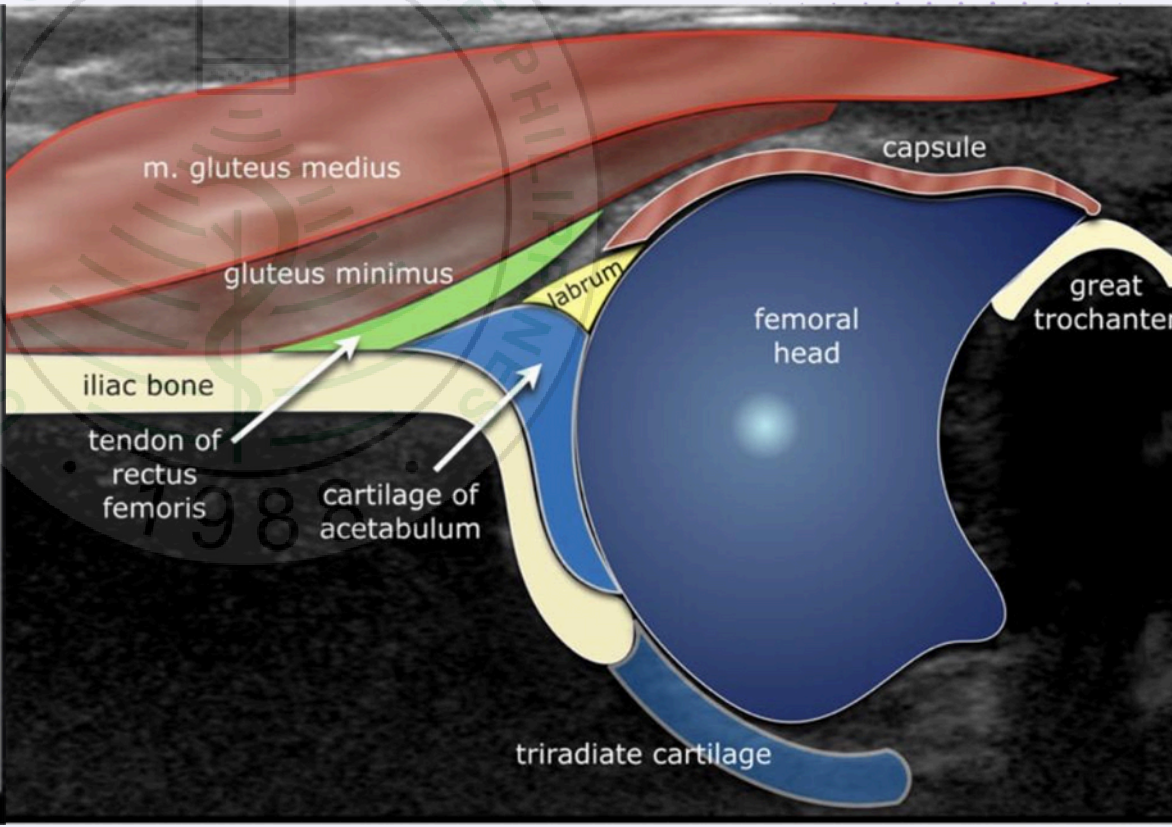
CASE #11: DDH


1
1
1
2
3
triradiate cartilage
1 = iliac bone 2 = ischium 3 = pubic bone

CASE #12: DDH



CASE #12: DDH



m. gluteus medius
capsule
gluteus minimus
labrum
great trochanter
femoral head
iliac bone
tendon of rectus femoris
cartilage of acetabulum
triradiate cartilage

CASE #12: DDH

- Graf Technique
- **Alpha** angle
  - Measured in a neutral hip position to assess acetabular inclination.
  - Normal : **>60 degrees.**
  - Angle between 50-60 degree: physiologically immature hip in infants under 12 weeks.
  - Angles <49 degrees suggest acetabular deficiency and may show subluxation or dislocation

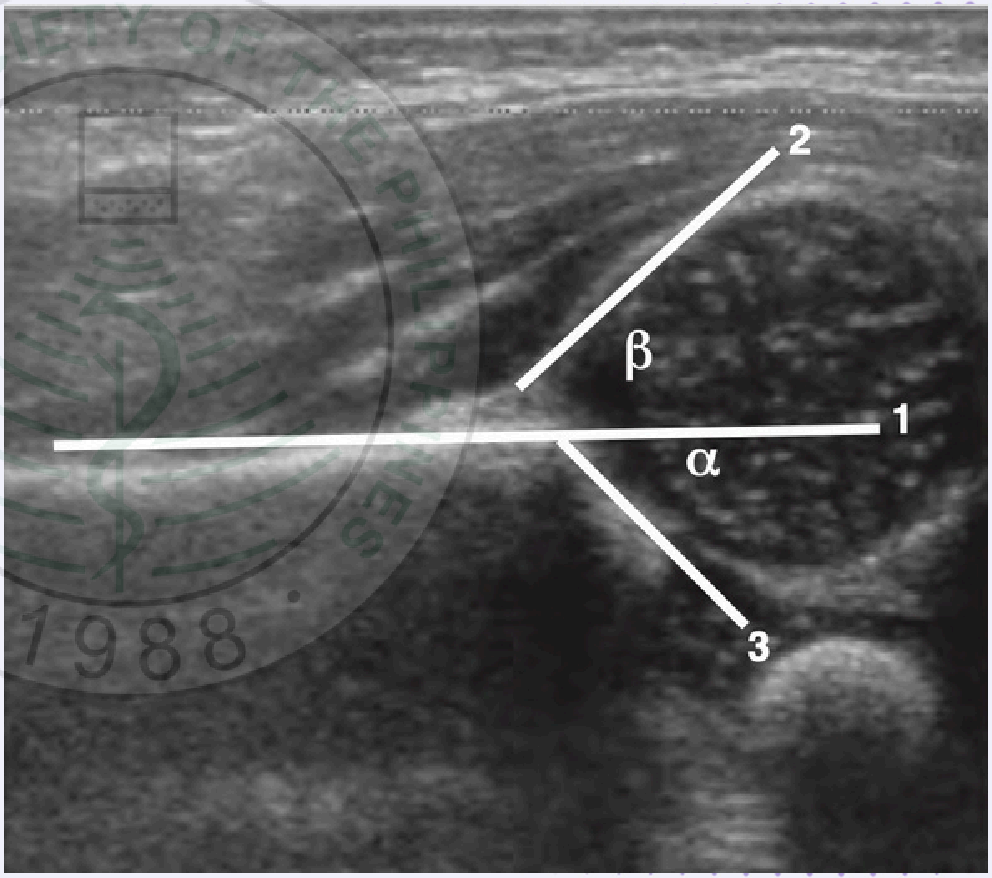


Image taken from: Pediatric Sonography Fourth Edition by Siegel (2011)

CASE #12: DDH

- **Beta** angle
  - lInedrawn from the iliac bone and a line through the echogenic fibrocatilaginous labrum
  - Normal: **55 degrees or less**

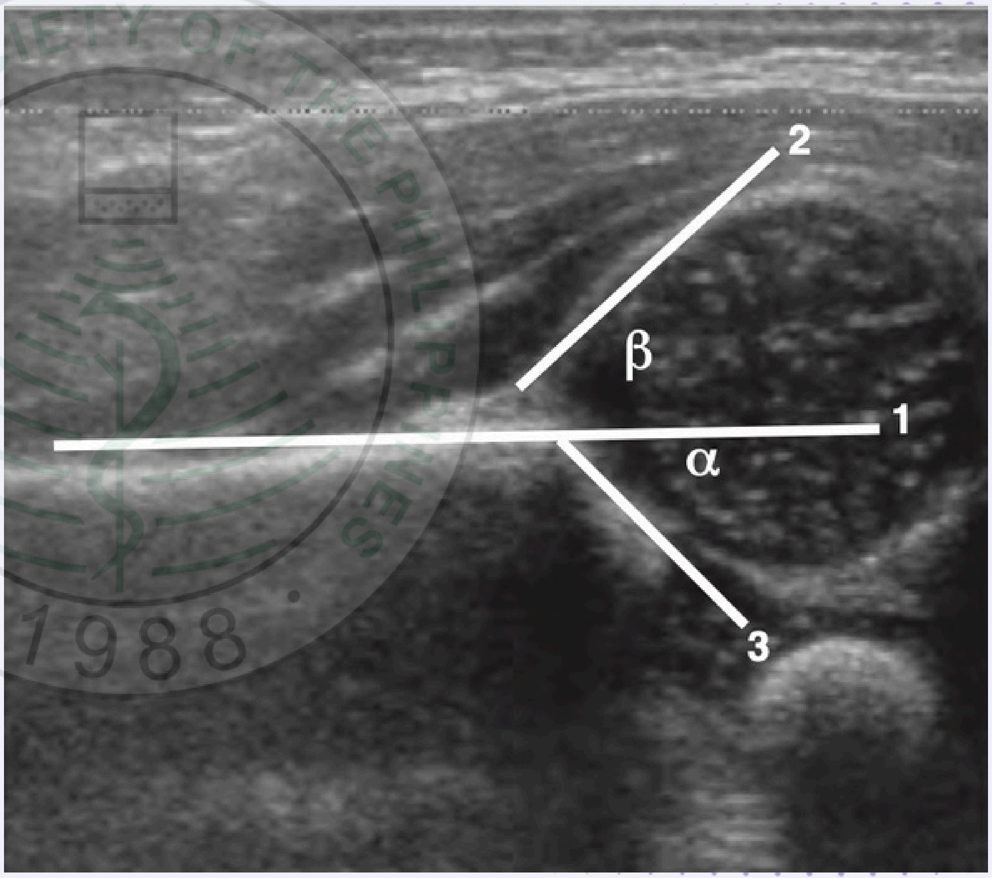


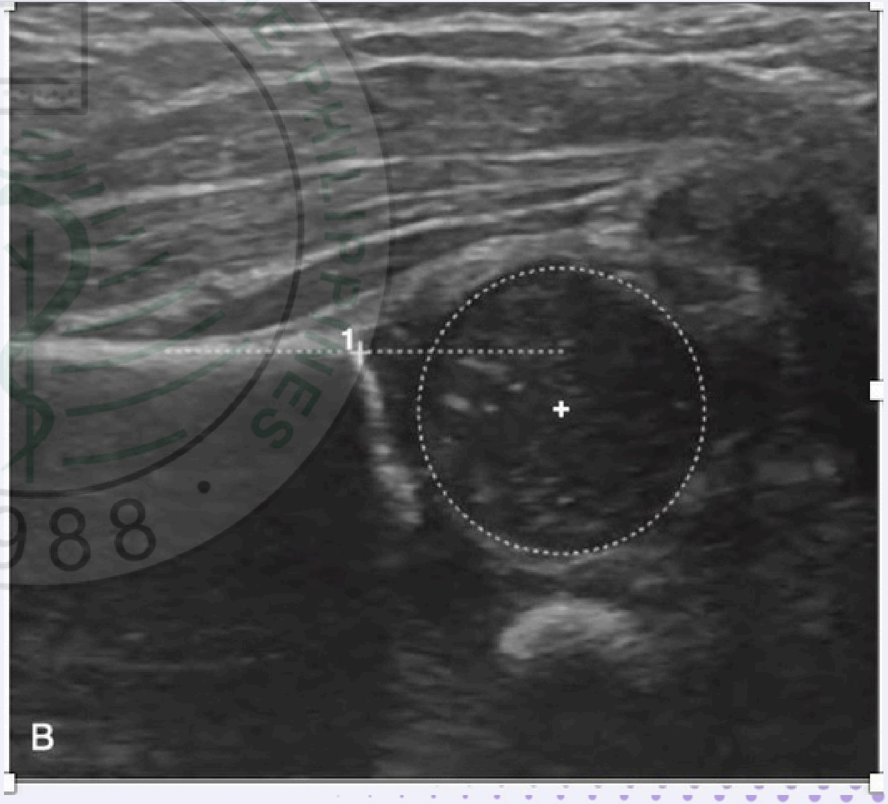
Image taken from: Pediatric Sonography Fourth Edition by Siegel (2011)

CASE #12: DDH

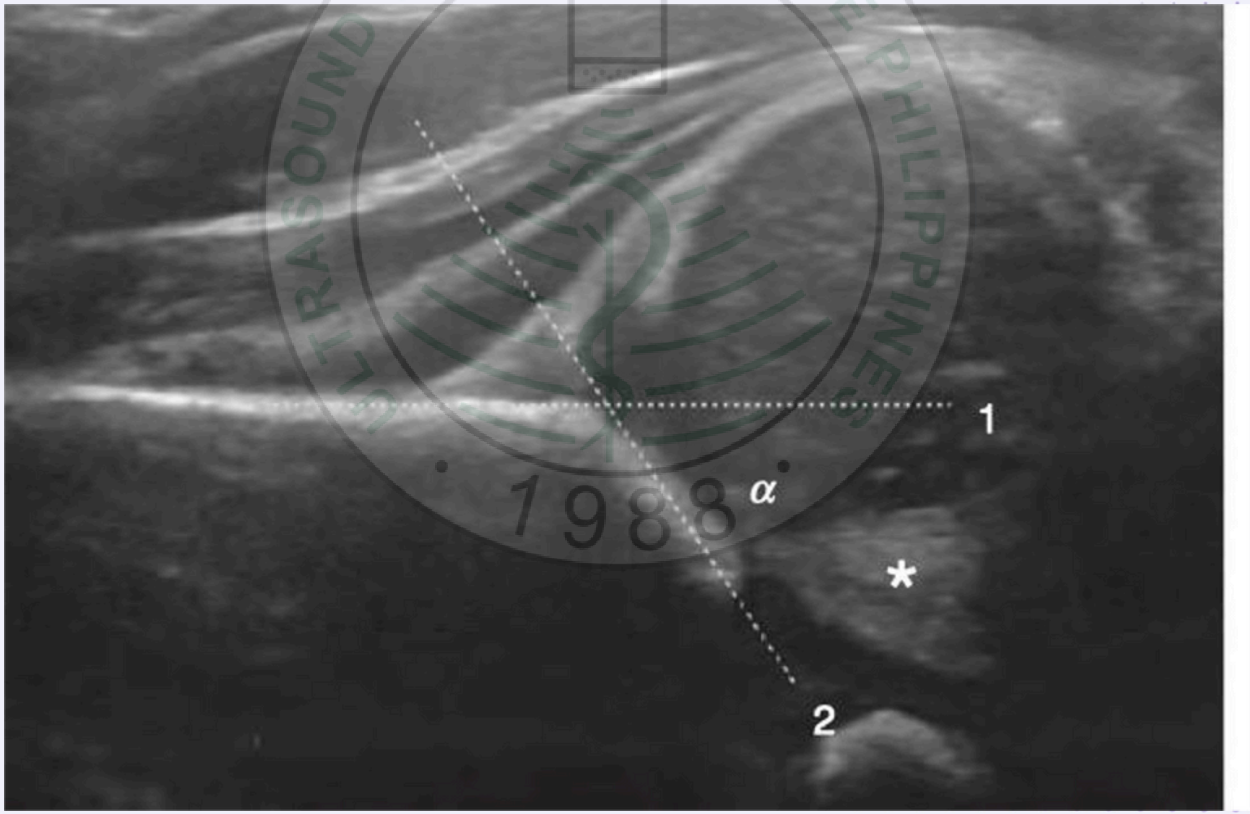
Classification	Alpha angle	Beta angle	Description
1	>60	<55	Normal
2a	50–60	55–77	Immature (<3 mo)
2b	>50–60	55–77	≥3 mo
2c	43–49	>77	Acetabular deficiency
2d	43–49	>77	Everted labrum
3	<43	>77	Everted labrum
4	Unmeasurable	-	Dislocated

CASE #11: DDH

- Femoral head coverage
  - Acetabularroof should cover at least **50%ofthe femoral head** in the coronal plane.
  - Assessed with the following structures in the same plane: **iliac bone, junctionof iliac bone and triradiate cartilage, femoral head, and labrum.**



CASE #11: DDH



CASE #12: DDH

DynamicAssessmentoftheHip

- categorized as normal, lax, subluxated, dislocated and reducible, or dislocated and nonreducible.
- **Barlow Maneuver**
- **Subluxated Hip:**If acetabular coverage decreases to 10-20% under stress, it's a subluxated hip
- **Dislocated Hip:**Complete femoral head uncovering at neutral position or with posterior stress indicates dislocation.

References

- Pediatric Sonography by Siegel 2010 4th Edition
- *Radiopaedia*
- *Radiology assistant*

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