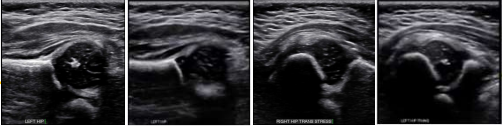



Introduction to Paediatric Hip US for DDH

Monash Health

Keith VanHaltren

1

Introduction


Overview

Background

Screening for DDH

US Assessment

MH Classification

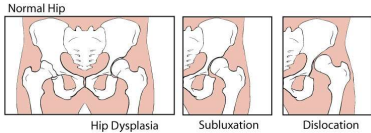


2


DDH

Definition

- What is DDH?
 - Developmental dysplasia of the Hip
 - Spectrum of hip abnormalities
 - Present at birth or develop during infancy



Normal Hip Hip Dysplasia Subluxation Dislocation

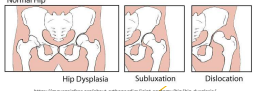


3


DDH

Incidence

- Incidence of 'true' DDH
 - 3-5 per 1000 births
- Unilateral in 80%
- Left DDH is four times more common
 - When unilateral DDH



Normal Hip Hip Dysplasia Subluxation Dislocation

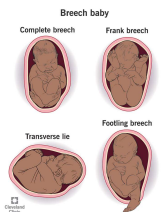


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Screening for DDH

Indications for US


- Selective screening in Australia
 - 6 weeks corrected age
- Risk factors
 - Female
 - Family history (siblings, parent)
 - Breech
 - Oligohydramnios
 - Multiple pregnancy



Breech baby

Complete breech Frank breech

Transverse lie Feetling breech





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Screening for DDH

Clinical indications

- Physical examination for DDH
 - 'Clicky' hips
 - Uneven creases
 - Reduced hip abduction
 - Leg length discrepancy
 - Foot deformities
 - Plagiocephaly (DDH opposite side)

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US Assessment for DDH

Graf classification

- Pioneered by Graf
- Alpha and Beta angles
- Landmarks - important





Fig 3. Checklist 1: Anatomical identification:
 1 – iliofemoral border; 2 – femoral head; 3 – acetabular fold; 4 – joint capsule; 5 – labrum; 6 – cartilaginous roof; 7 – bony roof; 8 – bony rim (acetabular overcoverage)




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US Assessment for DDH

Graf classification

Graf type	Bony roof α angle	Bony rim	Cartilage roof β angle	Age
I Mature hip	$> 60^\circ$	Angular/slightly rounded	Covers femoral head Ia $\beta < 55^\circ$ Ib $\beta > 55^\circ$	Any age
IIa Physiologically immature	Adequate $\alpha = 50-59^\circ$	Rounded	Covers femoral head	0-12 weeks
IIb Delayed ossification	Deficient $\alpha = 50-59^\circ$	Rounded	Covers femoral head	> 12 weeks
IIc	Severely deficient	Rounded to flattened	Covers femoral head	Any age
III Eccentric tip	Poor $\alpha < 43^\circ$	Flattened	Flattened upwards	Any age
IV Eccentric tip	Poor $\alpha < 43^\circ$	Flattened	Flattened downwards	Any age

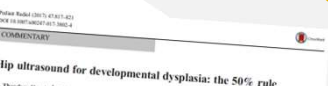


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US Assessment for DDH


Further measurements

- Coverage
 - $> 50\%$ (Terjesen)¹
 - $> 58\%$ (Morin/Harke)²



COMMENTARY
Hip ultrasound for developmental dysplasia: the 50% rule
 H. Thibodeau-Harke¹, H. Probst²

1. Terjesen T, Brødtand T, Bang V. Ultrasound for Hip Assessment in the Newborn. Journal of Bone and Joint Surgery 71-B: 767-773.1989
 2. Morin C, Harke H, MacDuff G. The infant hip: real-time ultrasound assessment of acetabular development. Radiology 157:873-877.1988





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Paed Hip US for DDH

US Assessment at Monash

- Coronal
 - Acetabular morphology
 - Document measurements
- Trans
 - Dynamic assessment

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Our service


Paediatric hips at Monash

- Ultrasound
 - 7000 scans (0-12m)
 - 3 sites
 - 40 sonographers
 - Orthopaedic Clinic for DDH
 - Paed physios & Ortho surgeons
 - 2700 patients
 - 700 new patients
 - Combined DDH Clinic
 - Physio & Sonographer
 - 1 clinic per week

Reproducible

Reliable & Consistent

All ages & Severity of DDH





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Paed Hip US for DDH

US Assessment at Monash

- Coronal
 - Acetabular morphology
 - Document measurements
- Trans
 - Dynamic assessment

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US for DDH

Equipment

- Linear transducer
- Measurement software for paed hips



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US for DDH

Patient Positioning

- Lateral decubitus
- Supine



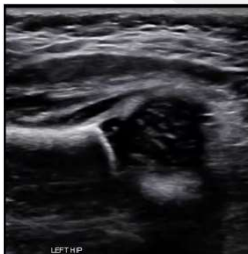
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Paed Hip US for DDH

Coronal (flexion)

- Lat decubitus
- Centre
 - Landmarks
 - 'Modified Graf'



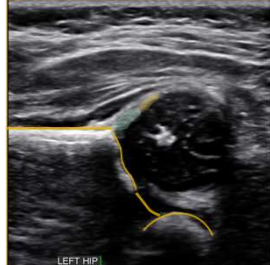
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Paed Hip US for DDH

Coronal (flexion)

- Lat decubitus
- Centre
 - Landmarks
 - 'Modified Graf'

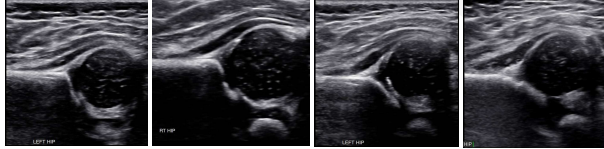


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Paed Hip US for DDH

MH Classification



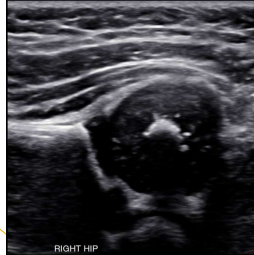
Normal Mild Moderate Severe

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MH Classification of DDH

Normal




- Acetabular margin
- Bony acetabular shape
- Femoral head coverage

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MH Classification of DDH

Mild DDH



RT HIP

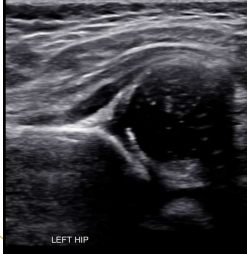
- Acetabular margin
- Bony acetabular shape
- Femoral head coverage

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MH Classification of DDH

Moderate DDH



LEFT HIP

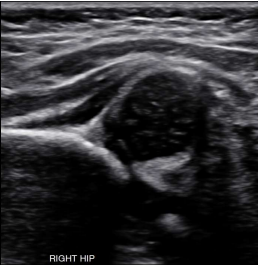
- Acetabular margin
- Bony acetabular shape
- Femoral head coverage

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MH Classification of DDH

Severe DDH



RIGHT HIP

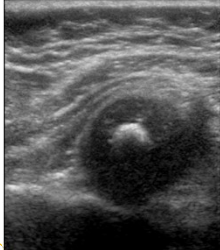
- Acetabular margin
- Bony acetabular shape
- Femoral head coverage

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MH Classification of DDH

Severe DDH (dislocated)



- Acetabular margin
- Bony acetabular shape
- Femoral head coverage

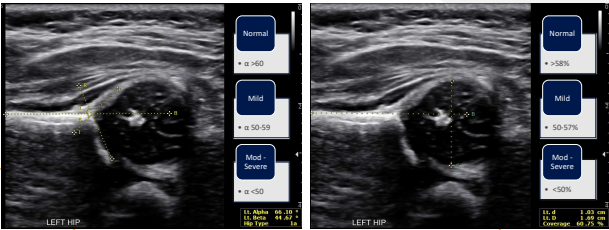
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MH Classification of DDH

Coronal measurements

- Supplement morphology assessment



LEFT HIP

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Paed Hip US for DDH

Landmarks

- Important
- Modified Graf
- Look out for:
 - Curved ilium
 - Missing ischium
 - Missing cartilaginous roof
 - Too 'vertical' bony roof



LEFT HIP

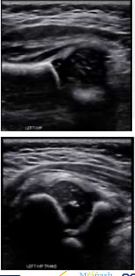
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Paed Hip US for DDH

US Assessment at Monash

- Coronal**
 - Acetabular morphology
 - Document measurements
- Trans**
 - Dynamic assessment




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MH Dynamic Assessment of DDH

Transverse



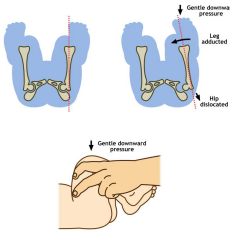
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MH Dynamic Assessment of DDH

Barlow test (stress)

- Barlow test



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MH Dynamic Assessment of DDH

Barlow test (stress)

- Barlow test



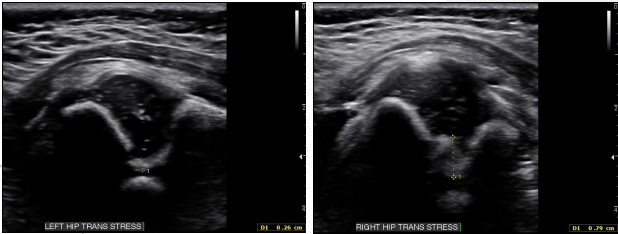
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MH Classification of DDH

Transverse measurements

- Pulvinar



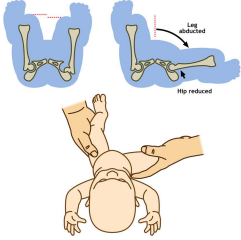
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MH Dynamic Assessment of DDH

Ortolani test (reduction)

- Ortolani test

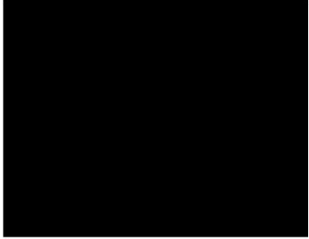



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MH Dynamic Assessment of DDH

Dislocating hip

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Paed Hip US for DDH

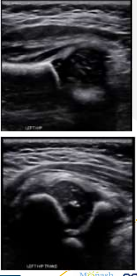

US Protocol at Monash

Coronal

- Image 1 – Image without measurement
- Image 2 – Graf angles
- Image 3 – Coverage

Trans

- Image 4 – Neutral
- Image 5 – Barlow stress & measure pulvinar

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Paediatric hips for DDH

DDH Pathway

• What happens after the ultrasound?

Selective Screening

- Clinically indicated
- Risk factors for DDH

First Scan

- 6 weeks
- Corrected age (premature)
- Suspected dislocation (earlier)

Follow up (Mild)

- Scan 6 weeks
- Follow up until normal

Follow up (Persistent Mild >4m)

- Orthopaedic review
- Scan 6 weeks

Follow up (Moderate/Severe)

- Orthopaedic review
- Scan 6 weeks

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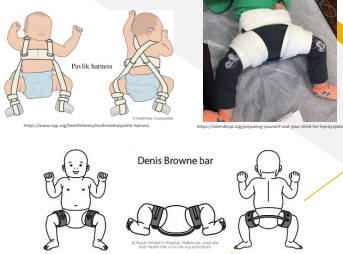

Paediatric hips for DDH

DDH Pathway

• Treatment options

- Pavlik harness
- Dennis Browne bar
- Rhino brace

Be mindful of removing brace
Some unstable hips may be in 24 hrs a day

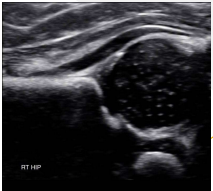




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US for DDH

Take home messages

- US assessment in coronal and trans
- Landmarks very important
- Follow up appropriately

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