Reference Number: UHB 353 **Version Number:** 2	**Date of Next Review:** *2023* **Previous Trust/LHB Reference Number:** N/A

Ultrasound in the Diagnosis of Developmental Hip Dysplasia and Dislocation – A Protocol

Introduction and Aim

- The aim of the protocol is to provide a clear guideline to staff in the UHB regarding the undertaking of hip ultrasound in the diagnosis of developmental hip dysplasia and dislocation.

Objectives

- To improve the efficiency and efficacy of the UHB diagnostic ultrasound in diagnosis of developmental hip dysplasia and dislocation.
- To make best use of the clinical expertise of the Sonographer.
- To encourage and foster the further development of such staff.
- To ensure that such role extension is properly managed and audited in line with sound clinical governance principles.
- To support CPD (continual professional development).

Scope

This protocol applies to all staff undertaking hip ultrasound in the diagnosis of developmental hip dysplasia and dislocation within the Cardiff and Vale University Health Board (CV UHB)

Equality Impact Assessment	An Equality Impact Assessment has been completed as part of a EHIA. It did not appear relevant and proportionate at this time to undertake a full Equality Impact Assessment Equality Statement - Section 1.8 of the protocol document agreed as sufficient information.
Health Impact Assessment	*A Health Impact Assessment (HIA) has been completed as part of the EHIA.*
Documents to read alongside this Procedure	*Standards for the provision of an Ultrasound service* *https://www.rcr.ac.uk/sites/default/files/publication/BFCR%2814%2917_Standards_ultrasound.pdf*

	Standards and recommendations for the reporting and interpretation of imaging investigations by non-radiologist medically qualified practitioners and teleradiologists https://www.rcr.ac.uk/standards-and-recommendations-reporting-and-interpretation-imaging-investigations-non-radiologist
Approved by	Dr Kathleen Lyons, Consultant Radiologist Ms Claire Carpenter, Consultant Orthopaedic Surgeon Mr Sandeep Hemmadi, Consultant Orthopaedic Surgeon Mr Phil Thomas, Consultant Orthopaedic Surgeon

Accountable Executive or Clinical Board Director	Director of Therapies and Health Science
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Disclaimer

If the review date of this document has passed please ensure that the version you are using is the most up to date either by contacting the document author or the Governance Directorate.

Summary of reviews/amendments			
Version Number	**Date of Review Approved**	**Date Published**	**Summary of Amendments**
1	*April 2017*	*June 2017*	*New document*
2	June 2020	August 2020	Revised document

1.0 INTRODUCTION

The early and accurate diagnosis of developmental hip dysplasia and dislocation in young infants remains a significant problem. There are inadequacies in radiologic examination of the hip while the femoral head and portions of the acetabulum remain cartilaginous, and it may be difficult to decide on the basis of clinical signs alone which infants will benefit from treatment. Both under-treatment and over-treatment of this condition can result in morbidity, while early diagnosis and treatment are associated with good results.

Ultrasound examination has played a significant role in improving the display of hip anatomy and dynamics during infancy, and in improving the selection of patients for treatment. All those involved in these studies, or contemplating involvement, should however be aware that the accuracy and reliability of results produced are dependent on the training and experience of those involved. Inadequacy in either the technique of the examination or its interpretation can readily lead to incorrect conclusions and serious long term consequences for the infant.

2.0 EQUALITY STATEMENT

Cardiff and Vale UHB is committed to ensuring that, as far as is reasonably practicable, the way we provide services to the public and the way we treat our staff, patients and others reflects their individual needs and that we will not discriminate, harass or victimise individuals or groups unfairly on the basis of sex, pregnancy and maternity, gender reassignment, disability, race, age, sexual orientation, disfigurement, religion and belief, family circumstances including marriage and civil partnership. These principles run throughout our work and are reflected in our core values, our staff employment policies, our service delivery standards and our Strategic Equality Plan and Equality Objectives. We believe that all staff should have fair and equal access to training as highlighted in both the Equality Act 2010 and the 1998 Human Rights Act. The responsibility for implementing the Plan falls to all employees and UHB Board members, volunteers, agents or contractors delivering services or undertaking work on behalf of the UHB.

The scheme of work categorises the type of report that can be issued by a Sonographer dependent on their agreed level of working. At no time should a Sonographer work outside their agreed Level of Work.

3.0 AIM

3.1 The aim of the protocol is to provide a clear guideline to staff in the UHB regarding the remit of UHB Sonographers performing hip scan for possible DDH

3.2 To outline the method used for diagnosing dysplasia of the hip in the newborn period (birth to six months)

3.3 To outline the reporting pathway for the newborn hips.

4.0 OBJECTIVES

4.1 To make the best use of the clinical expertise of the Sonographer.

4.2 To improve the efficiency and efficacy of the UHB diagnostic ultrasound service.

4.3 To encourage and foster the further development of such staff.

4.4 To ensure that such role extension is properly managed and audited in line with sound clinical governance principles.

4.5 To support CPD (continual professional development).

5.0 ROLES AND RESPONSIBILITLIES

5.1 All Sonographers wishing to undertake hip scanning for the diagnosis and management of developmental dysplasia must be in possession of, or under supervision of a Sonographers who possess the following;

Diploma of the Royal College of Radiographers or BSc in Diagnostic Radiography or equivalent graduate status.

Current State Registration with the Health Professions Council.

Diploma in Medical Ultrasound or postgraduate equivalent approved by The Consortium for the Accreditation of Sonographic Education

Certificate of attendance and completion from the Graf Hip Ultrasound Course.

5.2 Sonographers will be expected to comply with regulations imposed by their own statutory body and to heed the advice given by that professional body.

5.3 Sonographers should hold professional indemnity insurance. The UHB will formally indemnify the sonographer who performs work which has been appropriately delegated and carried out in accordance with the terms of the delegation and the departmental protocols which may be revised from time to time.

6.0 SCOPE

6.1 All babies that are clinically symptomatic at post natal checks (e.g. positive Ortholani test), should be scanned.

6.2 Scanning for DDH will be performed in line with All Wales agreed feral criteria. This includes all babies with one or more the following risk factors;

- Breech presentation in the third trimester
- Oligohydramnious in utero
- Family history of DDH
- Neuromuscular abnormality (e.g. Spina Bifida, arthrogryposis)
- Paediatric or Orthopaedic consultant referral
- Babies over 4.5Kg
- Multiple births
- Syndromic babies
- Plagiocephaly / tortocolis
- Congenital knee dislocation
- Foot abnormalities

6.3 Babies are ideally referred via the electronic CAVUHB Pathway for Neonatal Hip Screening (Appendix 1), however referral via other pathways are also acceptable.

6.4 The optimal time for scanning infant hips is between 2 and 6 weeks of age. Infants up to the age of approx 6 months can be scanned. For infants over 6 months age an x-ray may be indicated (depending of the ossification of the femoral head nucleus)

Babies over 6 months of age (when an ultrasound scan is not possible)

An AP pelvis should be requested as per trust guidelines. This can be requested by a hip sonographer, as agreed by the directorate.

An ultrasound scan may be attempted; its success will however be dependent on baby size, cooperation and hip maturity (bone ossification).

Twins
Both babies should be scanned. It is appropriate that if only one request/ referral form has been received the other baby should also be scanned as a 'walk in' at the given appointment in agreement with the All Wales referral pathway. See 6.2

7.0 CONSENT

7.1 The consent process is a continuum beginning with the referring health care professional who requests the ultrasound examination and ending with the Sonographer who carries it out.

7.2 It is the responsibility of the referring professional to provide sufficient information to the patient or their parent/guardian to enable the latter to consent to the ultrasound examination taking place.

7.3 It is the responsibility of the Sonographer to ensure that the parent/guardian understands the scope of the ultrasound examination prior to giving consent.

8.0 EXAMINATION PREPARATION

8.1 No specific prior patient preparation is required for this scan. The baby will be undressed at the time of their scan to allow access to the hips.

9.0 Decontamination

The machine and transducers should be cleaned in accordance with the UHB SOP as required.
http://www.cardiffandvaleuhb.wales.nhs.uk/sitesplus/documents/1143/Decontamination%20of%20Ultrasound%20Transducers.pdf

10.0 ULTRASOUND SCANNING TECHNIQUE

The Graf technique is a recognised method to obtain reproducible, standardised images of the paediatric hip. This is based on a coronal image and the use of measurements to qualify the coverage of the femoral head.

10.1 The 'Graf Cradle' and probe holder should ideally be used for all examinations. This ensures the baby lies in the correct position and reduces tilting of the probe.

10.2 A linear transducer 5-7.5MHz should be used.

10.3 An incontinence sheet should be used to line the cradle.

11.0 MEASUREMENT TECHNIQUE

Measurements must only be carried out in the Graf method 'Standard Plane' – Measureable images must comply to the Graf anatomical and usability checklists.

11.1 Measurement lines should be drawn on the images using the measurement package on the PACS system or ultrasound machine and saved if possible.

- The bony roof line - drawn from the lower limb of the ilium (using the lower limb as a pivot point). A tangential is placed laterally from the pivot point just touching the bony roof.
- The base line – The uppermost point of the cartilaginous roof (iliac wing) should

be used as the pivot point and a tangential line is drawn cranial to caudal along the echo of the ilium.

The alpha angle is the value of the angle between the bony roof line and the base line

The beta angle can also be measured using the following lines;

- The cartilage roof line is drawn from the turning point/bony rim (point of concavity/convexity) through the middle of the labrum.

The beta angle is the value of the angle between the cartilage roof line and the base line.

- There is no need to measure the angles if the hip is decentred.
- Both hips should be examined
- Each hip image should have an anatomical identifier on it.

12.0 IMAGES TO BE STORED

Ideally at least two coronal images of each hip, (to include the lower limb of the os ilium, plane and labrum), should be stored and saved to PACS. If for any reason the images cannot be stored onto the hard drive/PACS system then thermal images should be printed and scanned into Radis.

13.0 REPORTING

13.1 The report should include;
Patient demographic
A description and measurement of the hip using the Graf classification system
Referral pathway/ further management if necessary.
Where possible the report should follow the agreed All Wales reporting template. An example of this is in Appendix 4.

The report may be recorded using the various departmental systems: -

- RADIS – Radiology Information System.
- CMW

Additional communication of the report may be made verbally to the referring Clinician, parents and/or written in the patient's notes where appropriate in accordance with local policy.

For further information on Sonographer reporting and audit please refer to the Sonographer reporting protocol.

SONOGRAPHER REPORTING PROTCO

http://nww.cardiffandvale.wales.nhs.uk/pls/portal/url/ITEM/24BB366A11EAA332E0500489923C464E

12.2 Sonographer reporting of hip ultrasound examinations

Sonographers performing hip ultrasound scans may provide a report for the examinations depending on their stage in training and experience. Each individual will need to be able to demonstrate such competence to the satisfaction of the UHB and in line with local protocol, and in agreement with the orthopaedic hip ultrasound DDH team and lead Sonographer's.

Those charged with assessing competency must be in possession of either the;

Fellowship of the Royal College of Radiologists (FRCR) and competent in paediatric hip scanning,

Fellowship of the Royal College of Surgeons (FRCS) and competent in paediatric hip scanning

Senior Sonographer with PGDip in Medical Ultrasound who is competent in paediatric hip scanning.

All examinations and reports will be carried out according to departmental protocols.

13.0 STAND ALONE SONOGRAPHER HIP CLINIC

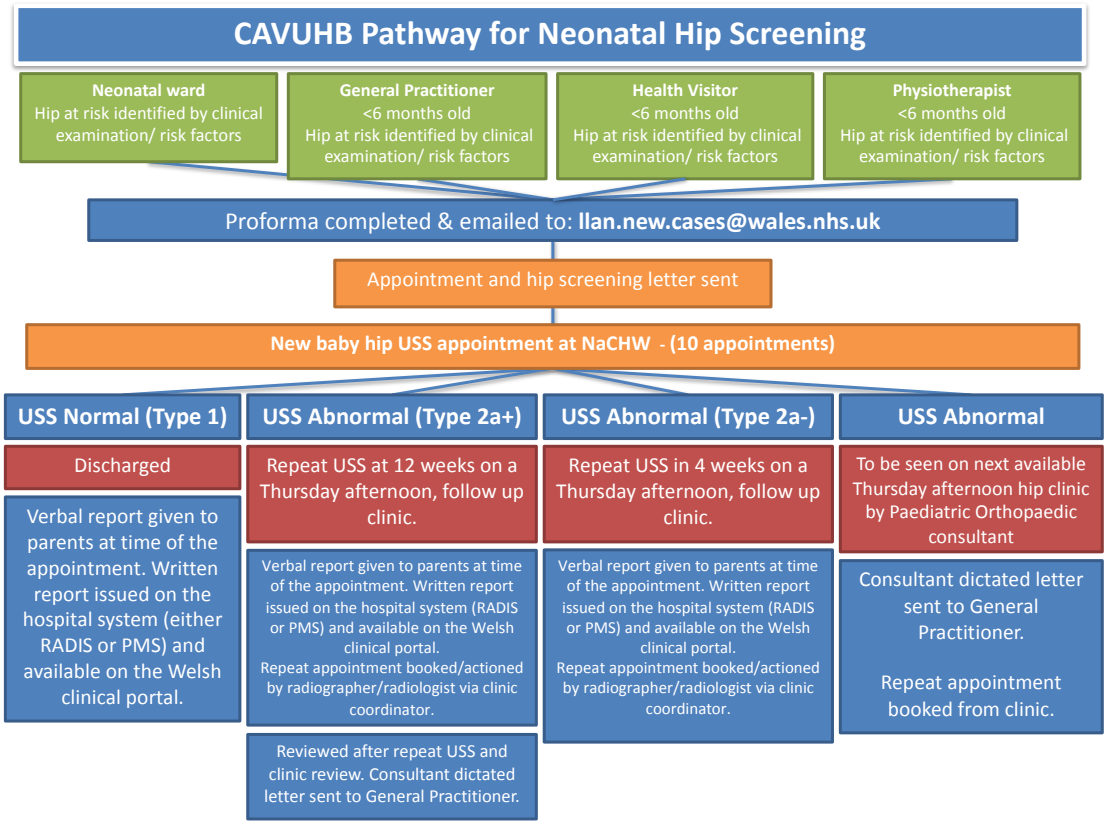
Senior Sonographer led clinic that follows the same working pattern as described above. The reports will be issued in accordance with the above guidelines. Should the baby need urgent consultant review/ treatment the Sonographer will arrange for this to take place in the next orthopaedic consultant clinic.

The same reporting protocol as above applies.

14.0 INCIDENTAL FINDINGS

In the event of a concerning incidental finding being identified the Sonographer will image the finding and seek a second opinion from one of the DDH MDT (Dr. K. Lyons, Dr. T. Micic, Ms. C. Carpenter, Mr. S. Hemmadi, Mr. P. Thomas).

Appendix 1


CAVUHB Pathway for Neonatal Hip Screening
Neonatal ward
Hip at risk identified by clinical examination/ risk factors
General Practitioner
<6 months old
Hip at risk identified by clinical examination/ risk factors
Health Visitor
<6 months old
Hip at risk identified by clinical examination/ risk factors
Physiotherapist
<6 months old
Hip at risk identified by clinical examination/ risk factors
Proforma completed & emailed to: llan.new.cases@wales.nhs.uk
Appointment and hip screening letter sent
New baby hip USS appointment at NaCHW - (10 appointments)
USS Normal (Type 1)
Discharged
Verbal report given to parents at time of the appointment. Written report issued on the hospital system (either RADIS or PMS) and available on the Welsh clinical portal.
USS Abnormal (Type 2a+)
Repeat USS at 12 weeks on a Thursday afternoon, follow up clinic.
Verbal report given to parents at time of the appointment. Written report issued on the hospital system (RADIS or PMS) and available on the Welsh clinical portal.
Repeat appointment booked/actioned by radiographer/radiologist via clinic coordinator.
Reviewed after repeat USS and clinic review. Consultant dictated letter sent to General Practitioner.
USS Abnormal (Type 2a-)
Repeat USS in 4 weeks on a Thursday afternoon, follow up clinic.
Verbal report given to parents at time of the appointment. Written report issued on the hospital system (RADIS or PMS) and available on the Welsh clinical portal.
Repeat appointment booked/actioned by radiographer/radiologist via clinic coordinator.
USS Abnormal
To be seen on next available Thursday afternoon hip clinic by Paediatric Orthopaedic consultant
Consultant dictated letter sent to General Practitioner.
Repeat appointment booked from clinic.

Appendix 2 Graf Grading system

- Graf type I: A mature hip. Alpha angle is greater than 60°. The child is discharged and a report is issued on CWM

- Graf type IIa: An immature hip. Alpha angle is less than 60° before 12 weeks of age
  Baby booked for a rescan in 4 weeks. Report issued on CWM (this can be viewed by referring clinician via the hospital system).

- Graf type IIb: Dysplastic hip. Alpha value is between 50-59° but infant is older than 12weeks. Refer to and book into to the next Paediatric Orthopaedic Consultant clinic. Report issued on CWM (this can be viewed by referring clinician via the hospital system).

- Graf type IIc: Dysplastic hip. Alpha value is between 43-49°. The hip is severely dysplastic. (Note if the beta angle is greater than 77° the hip is close to decentring and is a type D). Refer to the next Paediatric Orthopaedic Consultant clinic. Report issued on CWM (this can be viewed by referring clinician via the hospital system).

- Graf type III: Dysplastic hip. The hip is decentred and the cartilage is displaced upwards. No angle measurements needed. Refer to the next Paediatric Orthopaedic Consultant clinic. Report issued on CWM (this can be viewed by referring clinician via the hospital system).

- Graf type IV: Dysplastic hip. The hip is decentred and the cartilage is displaced downwards. No angle measurements needed. Refer to the next Paediatric Orthopaedic Consultant clinic. Report issued on CWM (this can be viewed by referring clinician via the hospital system).

Appendix 3 Sonographer competency levels for hip scanning

Level 1

- Student hip sonographer
- Hip scans performed under the supervision of a level 3 reporting sonographer.

Level 2

- Completion of the basic Graf hip course.
- Minimum of 50 hip scans performed and a
- Minimum of 6 months training in hip scanning.
- Competency audit completed and signed off by a level 3 reporter.
- Independent practise with proformer reporting.

Level 3

- Completion of the basic and update Graf hip course.
- Competency and reporting audit (50 images) completed and signed off by a level 3 reporter.
- Independent practise and reporting to comply with current agreed remit.

Appendix 4 Hip reporting template

Type 1

Reason for scan :
Age in weeks:
EDD:
Ultrasound of both hips

- The bony roof is good / the bony roof is angular/ the bony roof is rounded
- The cartilaginous roof covers the femoral head and is centred
- Alpha angle: right hip = ***degrees

  left hip = ***degrees
- Beta angle : right hip = ***degrees

  left hip = ***degrees

Conclusion: Normal hip. Type 1 mature hips

Type 2

Reason for scan :
Age in weeks:
EDD:
Ultrasound Right Hip Ultrasound left hip Ultrasound Both hips

- The bony roof is adequate. The superior bony rim is rounded
- The cartilaginous roof covers the femoral head and is centred
- Alpha angle: right hip = ***degrees

  left hip = ***degrees
- Beta angle : right hip = ***degrees

  left hip = ***degrees

Conclusion –
Type IIa = Physiologically immature but appropriate for age (up to 12 weeks of age). Rescan in 4 weeks time.
Type IIb = As this baby is over 12 weeks of age I have arranged for them to be seen in the next available consultant clinic.

Type III

Reason for scan :
Age in weeks:
EDD:
Ultrasound Right Hip Ultrasound left hip Ultrasound Both hips
The bony roof is poor. The superior bony rim is flattened.
The cartilaginous roof is presses upwards.
The femoral head is decentered.

Conclusion – Type III hip.

Type IV

Reason for scan :
Age in weeks:
EDD:
Ultrasound Right Hip Ultrasound left hip Ultrasound Both hips
The bony roof is poor. The superior bony rim is flattened.
The cartilagenous roof is pressed downwards (horizontal).
The femoral head is decentered.

Conclusion – Type IV hip.

Type 1 = >60 degrees
Type 2 a = under 12 weeks of age and an alpha angle between 50-59 degrees (taking into account adjusted age).

The following all need a follow up appt ASAP
Type 2b = over 12 weeks of age (taking into account adjusted age) with an alpha angle between 50-60 degrees
Type 2c = alpha angle between 43-50 degrees with a beta angle less than 76 degrees.
Type D = alpha angle between 43-50 degrees with a beta angle greater than 77 degrees.
Type 3 and 4= alpha angle less than 43 degrees.