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## **ACR PRACTICE GUIDELINE FOR THE PERFORMANCE OF THE ULTRASOUND EXAMINATION FOR DETECTION AND ASSESSMENT OF DEVELOPMENTAL DYSPLASIA OF THE HIP**

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### **PREAMBLE**

These guidelines are an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. They are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care. For these reasons and those set forth below, the American College of Radiology cautions against the use of these guidelines in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the guidelines, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in the guidelines when, in the reasonable judgment of the practitioner, such course of action is indicated by the condition of the patient, limitations on available resources, or advances in knowledge or technology subsequent to publication of the guidelines. However, a practitioner who employs an approach substantially different from these guidelines is advised to document in the patient record information sufficient to explain the approach taken.

The practice of medicine involves not only the science, but also the art of dealing with the prevention, diagnosis, alleviation, and treatment of disease. The variety and complexity of human conditions make it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment. Therefore, it should be recognized that adherence to these

guidelines will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The sole purpose of these guidelines is to assist practitioners in achieving this objective.

### **I. INTRODUCTION**

The clinical aspects contained in specific sections of this guideline (Introduction, Indications/Contraindications, Specifications of the Examination, and Equipment Specifications) were revised collaboratively by the American College of Radiology (ACR) and the American Institute of Ultrasound in Medicine (AIUM). Recommendations for physician requirements, written request for the examination, procedure documentation, and quality control vary between the two organizations and are addressed by each separately.

This guideline has been developed to assist practitioners performing sonographic studies for detecting developmental dysplasia of the hip (DDH). Adherence to the following standard will maximize the probability of detecting most of the abnormalities that relate to hip position, hip stability, and development of the acetabulum.

Ultrasound is the preferred method for diagnostic imaging of the immature hip, when available. It affords direct visualization of the cartilaginous components of the hip joint. The value of ultrasound diminishes as the femoral head ossifies. For patients between 6 months and 1 year of age, radiography becomes more reliable. Usually by 1

year of age the femoral head is sufficiently ossified to prevent good visualization of the acetabulum with ultrasound. If the triradiate cartilage cannot be visualized sonographically, radiography is needed.

## **II. INDICATIONS/CONTRAINDICATIONS AND TIMING**

Indications for ultrasound of the infant hip include, but are not limited to:

1. Abnormal findings on physical or imaging examination of the hip.
2. Monitoring of patients with DDH treated with a Pavlik harness or other splint device.
3. Any family history of DDH.
4. Breech presentation regardless of sex.
5. Oligohydramnios and other intrauterine causes of postural molding.
6. Neuromuscular conditions.

Two of the strongest risk factors for DDH are: a female newborn with frank breech presentation at birth and a family history of both a parent and a sibling with DDH. These patients should undergo ultrasound screening at 3-4 weeks following birth.

There are no absolute contraindications to ultrasound of the infant hip for DDH, but as discussed above, the study becomes less reliable compared to radiography as ossification of the femoral head progresses. Due to the presence of physiologic laxity, hip sonography is not performed on patients less than 3-4 weeks of age, unless there are clinical findings indicative of dislocation or significant instability.

## **III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL**

See the [ACR Practice Guideline for Performing and Interpreting Diagnostic Ultrasound Examinations](#).

## **IV. WRITTEN REQUEST FOR THE EXAMINATION**

The written or electronic request for an ultrasound examination for detecting developmental dysplasia of the hip should provide sufficient information to demonstrate the medical necessity of the examination and allow for its proper performance and interpretation.

Documentation that satisfies medical necessity includes 1) signs and symptoms and/or 2) relevant history (including known diagnoses). Additional information regarding the specific reason for the examination or a provisional diagnosis would be helpful and may at times be needed to allow for the proper performance and interpretation of the examination.

The request for the examination must be originated by a physician or other appropriately licensed health care provider. The accompanying clinical information should be provided by a physician or other appropriately licensed health care provider familiar with the patient's clinical problem or question and consistent with the stated scope of practice requirements. (ACR Resolution 35, adopted in 2006)

## **V. SPECIFICATIONS OF THE EXAMINATION**

The diagnostic examination for DDH incorporates two orthogonal planes. Both hips should be examined. The diagnostic examination should include a coronal view in the standard plane at rest and a transverse view of the flexed hip with and without stress. This enables an assessment of hip position, stability, and morphology when the study is correctly performed and interpreted. When performing a complete examination, if position, stability, and/or morphology cannot be assessed, the report should note the portion not done. A limited examination consists of only one imaging plane and no manipulation. It is acceptable to perform the standard exam with the infant in a supine or lateral position. If the examiner chooses, additional views and maneuvers can be obtained. Morphology is assessed at rest. Stress maneuvers follow those prescribed in the clinical examination of the hip (Barlow and Ortolani tests) and assess femoral stability. If the femoral head is subluxable or dislocatable, reducibility can be assessed. It is important that the infant be relaxed when hips are assessed for instability. Feeding the infant during the examination can increase comfort and cooperation.

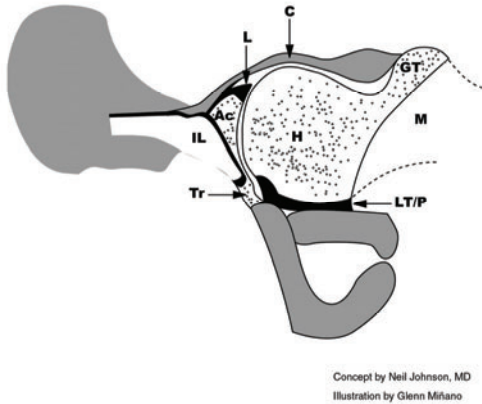
### **A. Coronal View**

The anatomic coronal plane is approximately parallel to the posterior skin surface of an infant. If the superior edge of the transducer is rotated 10-15 degrees (usually posteriorly) into an oblique coronal plane, the ilium will appear straight, and after adjustment to assure that the imaging plane is through the deepest part of the acetabulum, the resulting image will be a coronal view in the standard plane.

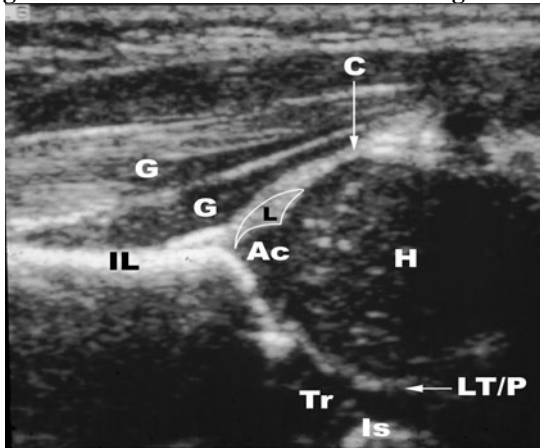
The standard plane is defined by identifying a straight iliac line, the tip of the acetabular labrum, and the transition from the os ilium to the triradiate cartilage (see Figure 1). The coronal view in the standard plane can be performed with the hip in the physiologic neutral (15-20 degree flexion) or flexed position during treatment. Femoral head position and displacement are noted. Acetabular morphology is assessed in this view. Validation by angle and femoral head coverage measurement is optional. Performance of stress in this plane is also optional.

Coronal view of hip joint in the standard plane with the hip in the physiologic neutral position (usually 15-20 degrees of hip flexion).

**Figure 1 - a. Coronal anatomic illustration**



**Figure 1 - b. Coronal ultrasound image**



Ac	Acetabular cartilage
C	Capsule
G	Gluteus muscles
GT	Greater trochanter
H	Cartilaginous femoral head
IL	Ilium
Is	Ischium
L	Labrum
LT/P	Ligamentum teres/pulvinar complex
M	Femoral metaphysis
Tr	Triradiate cartilage

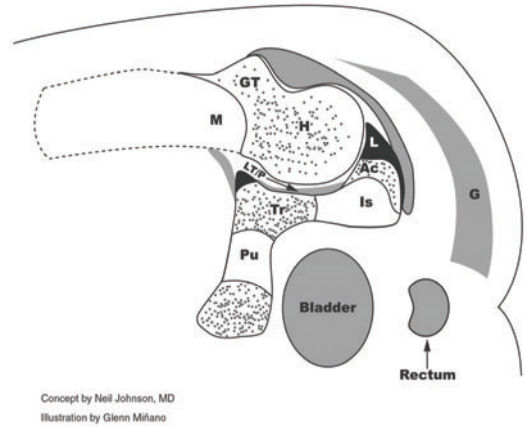
**B. Transverse Flexion View**

The examination is performed with the hip flexed at 90 degrees. The transverse plane is the anatomic transverse or axial plane (similar to the plane of a primary computed tomography (CT) image) (Figure 2). The hip is tested for position at rest with passive abduction and adduction. Next, gentle stress is applied to assess stability. (Caution: application of stress is omitted when hips are being

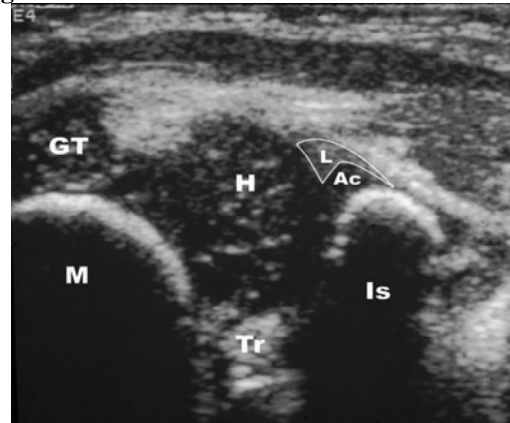
examined in a Pavlik harness or splint device unless otherwise requested by the orthopedic surgeon.) The transducer is posterolateral so that imaging can be accomplished while the hip is abducted and adducted (Ortolani and Barlow maneuvers). If the relationship of the femoral head to the posterior acetabulum changes with gentle stress, the hip is unstable. Other orthopedic stress maneuvers described in the literature are optional.

Transverse view of the hip flexed 90 degrees at the hip.

**Figure 2 - a. Anatomic transverse illustration**



**Figure 2 - b. Transverse ultrasound image**



Ac	Acetabular cartilage
G	Gluteus muscles
GT	Greater trochanter
H	Cartilaginous femoral head
Is	Ischium
L	Labrum
LT/P	Ligamentum teres/pulvinar complex
M	Femoral metaphysis
Pu	Pubis
Tr	Triradiate cartilage

**C. Modification of the Diagnostic Examination**

The supervising physician may modify the examination depending on clinical circumstances, such as during or

following treatment for DDH. In such cases, a coronal view in the standard plane can be performed. If it is abnormal, a complete diagnostic examination is recommended.

## VI. DOCUMENTATION

Adequate documentation is essential for high-quality patient care. There should be a permanent record of the ultrasound examination and its interpretation. Comparison with prior relevant imaging studies may prove helpful. Images of all appropriate areas, both normal and abnormal, should be recorded. Variations from normal size should generally be accompanied by measurements. Images should include the patient identification, facility identification, examination date, hip being imaged, image orientation, and whether stress is being applied. An official interpretation (final report) of the ultrasound examination should be included in the patient's medical record indicating acetabular morphology, position of femoral head, and stability. Retention of the ultrasound examination images should be consistent both with clinical need and with relevant legal and local health care facility requirements.

Reporting should be in accordance with the [ACR Practice Guideline for Communication of Diagnostic Imaging Findings](#).

## VII. EQUIPMENT SPECIFICATIONS

Hip ultrasound for detecting developmental dysplasia of the hip should be performed with the highest frequency transducer, preferably a linear transducer that permits penetration of the soft tissues. Acetabular measurements reported in the literature are made with a linear transducer. Total ultrasound exposure should be kept as low as reasonably achievable (ALARA), while optimizing diagnostic information.

## VIII. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION CONCERNS

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education Concerns appearing elsewhere in the ACR Practice Guidelines and Technical Standards book.

Equipment performance monitoring should be in accordance with the [ACR Technical Standard for Diagnostic Medical Physics Performance Monitoring of Real Time Ultrasound Equipment](#).

## ACKNOWLEDGEMENTS

This guideline was revised according to the process described in the ACR Practice Guidelines and Technical Standards book by the Guidelines and Standards Committee of the Commission on Ultrasound in collaboration with the American Institute of Ultrasound in Medicine (AIUM).

### Collaborative Subcommittee:

#### ACR

Lori L. Barr, MD, Chair  
Carrie Ruzal-Shapiro, MD  
Barbara J. Wolfson, MD

#### AIUM

Harriet Paltiel, MD  
Henrietta Kotlus-Rosenberg, MD  
H. Theodore Harcke, MD

### ACR Guidelines and Standards Committee

Gretchen A. Gooding, MD, Chair  
Mary C. Frates, MD, Vice Chair  
Debra L. Acord, MD  
Ruth B. Goldstein, MD  
Beatrice L. Madrazo, MD  
Michelle L. Melany, MD  
Miriam N. Mikhail, MD  
Laurence Needleman, MD  
Sara M. O'Hara, MD  
Suhas G. Parulekar, MD  
John S. Pellerito, MD  
Philip W. Ralls, MD  
Michelle L. Robbin, MD  
Carol M. Rumack, MD, Chair, Commission

### Comments Reconciliation Committee

Kimberly E. Applegate, MD, MS, Co-Chair, CSC  
Beverly G. Coleman, MD, Co-Chair, CSC  
Lori L. Barr, MD  
Mary C. Frates, MD  
Gretchen A. Gooding, MD  
H. Theodore Harcke, MD  
Alan D. Kaye, MD  
David C. Kushner, MD  
Paul A. Larson, MD  
Lawrence A. Liebscher, MD  
Harriet Paltiel, MD  
David M. Paushter, MD  
Matthew S. Pollack, MD  
Henrietta Kotlus Rosenberg, MD  
Carol M. Rumack, MD  
Carrie Ruzal-Shapiro, MD  
Manrita K. Sidhu, MD  
Ted S. Wen, MD  
Barbara J. Wolfson, MD

## REFERENCES

1. American Academy of Pediatrics. Clinical practice guidelines: early detection of developmental dysplasia of the hip. Committee on quality improvement, subcommittee on developmental dysplasia of the hip. *Pediatrics* 2000;105:896-905. Available at: [http://aappolicy.aappublications.org/practice\\_guidelines/index.dtl](http://aappolicy.aappublications.org/practice_guidelines/index.dtl). Assessed April 6, 2007.
2. Bache CE, Clegg J, Herron M. Risk factors for developmental dysplasia of the hip: ultrasonographic findings in the neonatal period. *J Pediatr Orthop B* 2002;11:212-218.
3. Grissom LE, Harcke HT, Kumar SJ, Bassett GS, MacEwen GD. Ultrasound evaluation of hip position in the Pavlik harness. *J Ultrasound Med* 1988;7:1-6.
4. Harcke HT, Grissom LE. Performing dynamic sonography of the infant hip. *AJR* 1990;155:837-844.
5. Morin C, Harcke HT, MacEwen GD. The infant hip: real-time US assessment of acetabular development. *Radiology* 1985;157:673-677.
6. Morin C, Zouaoui S, Delvalle-Fayada A, Delforge PM, Lecllet H. Ultrasound assessment of the acetabulum in the infant hip. *Acta Orthop Belg* 1999;65:261-265.
7. Roposch A, Moreau NM, Uleryk E, Doria AS. Developmental dysplasia of the hip: quality of reporting of diagnostic accuracy for US. *Radiology* 2006;241:854-860.
8. Roposch A, Wright JG. Increased diagnostic information and understanding disease: uncertainty in the diagnosis of developmental hip dysplasia. *Radiology* 2007;242:355-359.
9. Shipman SA, Helfand M, Moyer VA, Yawn BP. Screening for developmental dysplasia of the hip: a systematic literature review for the US Preventive Services Task Force. *Pediatrics* 2006;117:e557-576.
10. Smergel E, Losik SB, Rosenberg HK. Sonography of hip dysplasia. *Ultrasound Quarterly* 2004;20:201-216.

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