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## **ACR PRACTICE GUIDELINE FOR THE PERFORMANCE OF NEUROSONOGRAPHY IN NEONATES AND YOUNG CHILDREN**

### **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. It should be recognized; therefore, 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 of this guideline (Introduction, Specifications of the Examination, and Equipment Specifications) were developed collaboratively by the American College of Radiology (ACR) and the American Institute of Ultrasound in Medicine (AIUM). Recommendations for physician requirements, documentation, and quality control vary among these organizations and are addressed by each separately.

This guideline has been developed to assist physicians performing sonographic studies of the brain in neonates and young children. Neurosonography should be performed only when there is a valid medical reason, and the lowest possible ultrasonic exposure settings should be used to gain the necessary diagnostic information. In some cases, additional or specialized examinations may be necessary. While it is not possible to detect every

abnormality, adherence to the following guideline will maximize the detection of most abnormalities of the brain in neonates and young children that can be imaged with ultrasound.

For the purpose of this guideline, young children are defined primarily as those who have not had closure of the anterior fontanelle.

## II. QUALIFICATIONS OF PERSONNEL

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

## III. SPECIFICATIONS OF THE EXAMINATION

### Standard Imaging Examination of the Neonate and Young Child

Neonatal sonographic examinations should be performed for a valid reason such as to determine the presence or absence of hemorrhage, parenchymal abnormalities, ventricular dilation, congenital abnormalities, and vascular abnormalities.

Representative coronal views should be obtained from various angulations of the transducer from its position over the anterior fontanelle. On coronal images, right/left orientation should be the same as the orientation used in conventional computed tomography or magnetic resonance imaging, (e.g., the patient's right is on the left side of the image). Coronal views with anterior angulation should include the frontal lobe and frontal horns of the lateral ventricles, as well as portions of the frontal, parietal, and temporal lobes; the basal ganglia; and the body of the lateral ventricles. Posterior coronal views should include the posterior portions of the temporal lobes, the occipital lobes, and the posterior fossa area as well as the posterior portions of the ventricular system. The transducer may be tilted from side to side to image as much of the superficial peripheral surfaces of the cerebral hemispheres as possible. A standoff pad may aid imaging of superior sinus and superficial central structures.

Representative sagittal views with appropriate degrees of left or right angulation should include the Sylvian fissures; each lateral ventricle and its choroid plexus, including the surrounding white matter; and the germinal matrix region, including the caudothalamic groove. A midline sagittal view should include the corpus callosum, the cavum septi pellucidi and cavum vergae extension (if present), the third ventricle, the area of the aqueduct of Sylvius, the fourth ventricle, the vermis of the cerebellum, and the cisterna magna. By convention, the sagittal view should have the anterior brain on the left side of the image.

Additional views, if necessary, may be taken through the posterior or mastoid fontanelles, the foramen magnum, any open suture, or thin areas of temporoparietal bone. The transtemporal approach may also be used to visualize the circle of Willis and its major branches.

## IV. DOCUMENTATION

Adequate documentation is essential for high-quality patient care. A permanent record of the sonographic examination and its interpretation should be included in the patient's medical record. Images of all appropriate areas, both normal and abnormal, should be recorded in an image or storage format. Variations from normal should be assessed and compared with previous examinations, if any. Images are to be appropriately labeled with the examination date, facility name, patient identification and birth date, scan plane, and side of head examined. The sonographer needs to confirm that right is right and left is left with respect to transducer orientation prior to the examination. By convention, sagittal views are obtained with the anterior brain on the left side of the image, while coronal views are taken with the right side on the left side of the image.

Retention of the permanent record of the sonographic examination should be consistent with both clinical need and relevant legal and local healthcare facility requirements.

Reporting should be in accordance with the [ACR Practice Guideline for Communication: Diagnostic Radiology](#).

## V. EQUIPMENT SPECIFICATIONS

Neurosonographic examinations should be conducted with a real-time scanner, preferably with sector or curved linear transducers that can fit within and image through the anterior fontanelle. Linear transducers have been useful in evaluating superficial structures such as the superior sagittal sinus. If the anterior fontanelle is not available, imaging may be performed through other sutural openings or by using a transcranial approach, usually with a lower frequency transducer penetrating the squamosal portion of the temporal bone. The transducer or scanner should be adjusted to operate at the highest clinically appropriate frequency, realizing that there is a trade-off between resolution and beam penetration. With modern equipment, these frequencies range between 5.0 and 7.5 MHz. Occasionally, 10 MHz may be necessary. Doppler sonography or color Doppler sonography may be used to evaluate intracranial blood flow in selected cases. Doppler power output should be as low as reasonably achievable (ALARA) to answer the diagnostic question.

## VI. 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

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