

AIUM Practice Guideline for the Performance of an Antepartum Obstetric Ultrasound Examination



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The American Institute of Ultrasound in Medicine (AIUM) is an educational, scientific, and professional society concerned with the advancement of the art and science of ultrasound in medicine and research. To promote this mission, the AIUM is pleased to publish, in conjunction with the American College of Obstetricians and Gynecologists (ACOG) and the American College of Radiology (ACR), this new Guideline for the Performance of an Antepartum Obstetric Ultrasound Examination. We are indebted to the many volunteers who contributed their time, knowledge, and energy to bringing this document to completion.

The AIUM represents the entire range of clinical and basic science interests in medical diagnostic ultrasound, and, with hundreds of volunteers, the AIUM has promoted the safe and effective use of ultrasound in clinical medicine for 50 years. This document, and others like it, will continue to advance this mission.

Clinical standards and practice guidelines of the AIUM are intended to provide the medical ultrasound community with guidelines for the performance and recording of high-quality ultrasound examinations. The standards and guidelines reflect what the AIUM considers the minimum criteria for a complete examination in each area but are not intended to establish a legal standard of care. AIUM-accredited practices are expected to generally follow the standards with the recognition that deviations from the standards and guidelines will be needed in some cases, depending on patient needs and available equipment. Practices are encouraged to go beyond the standards and guidelines to provide additional service and information as needed by their referring physicians and patients.



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ULTRASOUND IN MEDICINE

14750 Sweitzer Lane, Suite 100
Laurel, Maryland 20707-5906
301-498-4100

I. Introduction

The clinical aspects of this guideline (Specifications of the Examination, and Equipment Specifications) were developed collaboratively by the American Institute of Ultrasound in Medicine (AIUM), the American College of Radiology (ACR), and the American College of Obstetricians and Gynecologists (ACOG). Recommendations for physician requirements, procedure documentation, and quality control vary among these organizations and are addressed by each separately.

This guideline has been developed for use by practitioners performing obstetric sonographic studies. Fetal sonographyⁱ 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. A limited examination may be performed in clinical emergencies or for a limited purpose, such as evaluation of fetal or embryonic cardiac activity, fetal position, or amniotic fluid volume. A limited follow-up examination may be appropriate for reevaluation of fetal size or interval growth or to reevaluate abnormalities previously noted if a complete prior examination is on record.

While this guideline describes the key elements of standard sonographic examinations in the first trimester and second and third trimesters, a more detailed anatomic examination of the fetus may be necessary in some cases, such as when an abnormality is found or suspected on the standard examination or in pregnancies at high risk for fetal anomalies. In some cases, other specialized examinations may be necessary as well.

While it is not possible to detect all structural congenital anomalies with diagnostic ultrasound, adherence to the following guidelines will maximize the possibility of detecting many fetal abnormalities.

ⁱThe consensus of the committee was that the use of the term "ultrasound" or "sonography" is at the discretion of each organization.

II. Classification of Fetal Sonographic Examinations

A. First-Trimester Ultrasound Examination

B. Standard Second- or Third-Trimester Examination

A standard examination is performed during the second and third trimesters of pregnancy. It includes an evaluation of fetal presentation, amniotic fluid volume, cardiac activity, placental position, fetal biometry, and an anatomic survey. If technically feasible, the maternal cervix and adnexa also are examined.

C. Limited Examination

A limited examination is performed when a specific question requires investigation. In an emergency, for example, one could perform a limited examination to evaluate fetal heart activity in a bleeding patient. This evaluation would also be appropriate for verifying fetal presentation in a laboring patient, but in most cases, limited sonographic examinations are appropriate only when a prior complete examination is on record.

D. Specialized Examinations

A detailed anatomic examination is performed when an anomaly is suspected on the basis of history, biochemical abnormalities, or the results of either the limited or standard scan. Other specialized examinations might include fetal Doppler, biophysical profile, fetal echocardiogram, or additional biometric studies.

III. Qualifications and Responsibilities of Personnel

See the AIUM Official Statement: *Training Guidelines for Physicians Who Evaluate and Interpret Diagnostic Ultrasound Examinations* and the *AIUM Standards and Guidelines for the Accreditation of Ultrasound Practices*.

IV. Specifications of the Examination

A. First-Trimester Ultrasound Examination

1. Indications

A sonographic examination can be of benefit in many circumstances in the first trimester of pregnancy, including, but not limited to, the following indications:

- a. To confirm the presence of an intrauterine pregnancy.
- b. To evaluate a suspected ectopic pregnancy.
- c. To define the cause of vaginal bleeding.
- d. To evaluate pelvic pain.
- e. To estimate gestational (menstrualⁱⁱ) age.
- f. To diagnose or evaluate multiple gestations.
- g. To confirm cardiac activity.
- h. As an adjunct to chorionic villus sampling, embryo transfer, and localization and removal of an intrauterine device (IUD).
- i. To evaluate maternal pelvic masses and/or uterine abnormalities.
- j. To evaluate suspected hydatidiform mole.

Comment

A limited examination may be performed to evaluate interval growth, estimate amniotic fluid volume, evaluate the cervix, and assess the presence of cardiac activity.

ⁱⁱFor the purpose of this document, the terms "gestational age" and "menstrual age" are considered equivalent.

2. Imaging parameters

Overall Comment

Scanning in the first trimester may be performed either transabdominally or transvaginally. If a transabdominal examination is not definitive, a transvaginal scan or transperineal scan should be performed whenever possible.

- a. The uterus and adnexa should be evaluated for the presence of a gestational sac. If a gestational sac is seen, its location should be documented. The gestational sac should be evaluated for the presence or absence of a yolk sac or embryo, and the crown-rump length should be recorded, when possible.

Comment

The crown-rump length is a more accurate indicator of gestational age than is mean gestational sac diameter. However, the mean gestational sac diameter should be recorded when an embryo is not identified.

Caution should be used in making the presumptive diagnosis of a gestational sac in the absence of a definite embryo or yolk sac. Without these findings, an intrauterine fluid collection could represent a pseudogestational sac associated with an ectopic pregnancy.

- b. Presence or absence of cardiac activity should be reported.

Comment

With transvaginal scans, cardiac motion is usually observed when the embryo is 5 mm or greater in length. If an embryo less than 5 mm in length is seen without cardiac activity, an additional scan at a later time may be needed to document cardiac activity.

- c. Fetal number should be reported.

Comment

Amnionicity and chorionicity should be documented for all multiple pregnancies when possible.

- d. Evaluation of the uterus, adnexal structures, and cul-de-sac should be performed.

Comment

The presence, location, and size of leiomyomata and adnexal masses should be recorded. The cul-de-sac should be scanned for the presence or absence of fluid.

B. Second- and Third-Trimester Examination

1. Indications

Sonography can be of benefit in many situations in the second and third trimesters, including, but not limited to, the following circumstances: (adapted from National Institutes of Health. Diagnostic Ultrasound Imaging in Pregnancy: Report of a Consensus. NIH Publication 84-667. Washington, DC: US Government Printing Office; 1984).

- a. Estimation of gestational age.
- b. Evaluation of fetal growth.
- c. Vaginal bleeding.
- d. Abdominal/pelvic pain.
- e. Incompetent cervix.
- f. Determination of fetal presentation.
- g. Suspected multiple gestation.
- h. Adjunct to amniocentesis.
- i. Significant discrepancy between uterine size and clinical dates.
- j. Pelvic mass.
- k. Suspected hydatidiform mole.
- l. Adjunct to cervical cerclage placement.

- m. Suspected ectopic pregnancy.
- n. Suspected fetal death.
- o. Suspected uterine abnormality.
- p. Evaluation of fetal well-being.
- q. Suspected amniotic fluid abnormalities.
- r. Suspected placental abruption.
- s. Adjunct to external cephalic version.
- t. Premature rupture of membranes and/or premature labor.
- u. Abnormal biochemical markers.
- v. Follow-up evaluation of a fetal anomaly.
- w. Follow-up evaluation of placental location for suspected placenta previa.
- x. History of previous congenital anomaly.
- y. Evaluation of fetal condition in late registrants for prenatal care.

In certain clinical circumstances, a more detailed examination of fetal anatomy may be indicated.

2. Imaging parameters for a standard fetal examination

- a. Fetal cardiac activity, number, and presentation should be reported.

Comment

Abnormal heart rate and/or rhythm should be reported.

Multiple pregnancies require the documentation of additional information: chorionicity, amnionicity, comparison of fetal sizes, estimation of amniotic fluid volume (increased, decreased, or normal) on each side of the membrane, and fetal genitalia (when visualized).

- b. A qualitative or semiquantitative estimate of amniotic fluid volume should be reported.

Comment

Although it is acceptable for experienced examiners to qualitatively estimate amniotic fluid volume, semiquantitative methods also have been described for this purpose (eg, amniotic fluid index, single deepest pocket, 2-diameter pocket).

- c. The placental location, appearance, and relationship to the internal cervical os should be recorded. The umbilical cord should be imaged, and the number of vessels in the cord should be evaluated when possible.

Comment

It is recognized that apparent placental position early in pregnancy may not correlate well with its location at the time of delivery.

Transabdominal, transperineal, or transvaginal views may be helpful in visualizing the internal cervical os and its relationship to the placenta.

Transvaginal or transperineal ultrasound may be considered if the cervix appears shortened or if the patient complains of regular uterine contractions.

- d. Gestational age assessment

First-trimester crown-rump measurement is the most accurate means for sonographic dating of pregnancy. Beyond this period, a variety of sonographic parameters, such as biparietal diameter, abdominal circumference, and femoral diaphysis length, can be used to estimate gestational age. The variability of gestational age estimations, however, increases with advancing pregnancy.

Significant discrepancies between gestational age and fetal measurements may suggest the possibility of fetal growth abnormality, intrauterine growth restriction, or macrosomia.

- i. Biparietal diameter is measured at the level of the thalami and cavum septi pellucidi. The cerebellar hemispheres should not be visible in this scanning plane. The measurement is taken from the outer edge of the proximal skull to the inner edge of the distal skull.

Comment

The head shape may be flattened (dolichocephaly) or rounded (brachycephaly) as a normal variant. Under these circumstances, certain variants of normal fetal head development may make measurement of the head circumference more reliable than biparietal diameter for estimating gestational age.

- ii. Head circumference is measured at the same level as the biparietal diameter, around the outer perimeter of the calvarium. This measurement is not affected by head shape.
- iii. Femoral diaphysis length can be reliably used after 14 weeks' gestational age. The long axis of the femur shaft is most accurately measured with the beam of insonation being perpendicular to the shaft, excluding the distal femoral epiphysis.
- iv. Abdominal circumference should be determined at the skin line on a true transverse view at the level of the junction of the umbilical vein, portal sinus, and fetal stomach, when visible.

Comment

Abdominal circumference measurement is used with other biometric parameters to estimate fetal weight and may allow detection of intrauterine growth restriction or macrosomia.

e. Fetal weight estimation

Fetal weight can be estimated by obtaining measurements, such as the biparietal diameter, head circumference, abdominal circumference, and femoral diaphysis length. Results from various prediction models can be compared to fetal weight percentiles from published nomograms.

Comment

If previous studies have been performed, interval measurement changes should also be evaluated for growth. Scans for growth evaluation typically can be performed at least 3 weeks apart. A shorter scan interval may result in confusion as to whether anatomic changes truly are due to growth as opposed to variations in the measurement technique itself.

Currently, even the best fetal weight prediction methods can yield errors as high as $\pm 15\%$. This variability can be influenced by factors such as the nature of the patient population, the number and types of anatomic parameters being measured, technical factors that affect the resolution of ultrasound images, and the weight range being studied.

f. Maternal anatomy

Evaluation of the uterus and adnexal structures should be performed.

Comment

This will allow recognition of incidental findings of potential clinical significance. The presence, loca-

tion, and size of leiomyomata and adnexal masses should be recorded. It is frequently not possible to image the normal maternal ovaries during the second and third trimesters.

g. Fetal anatomic survey

Fetal anatomy, as described in this document, may adequately be assessed by ultrasound after approximately 18 weeks' gestational age. It may be possible to document normal structures before this time, although some structures can be difficult to visualize due to fetal size, position, movement, abdominal scars, and increased maternal wall thickness. A second- or third-trimester scan may pose technical limitations for an anatomic evaluation due to imaging artifacts from acoustic shadowing. When this occurs, the report of the sonographic examination should document the nature of this technical limitation. A follow-up examination may be helpful.

The following areas of assessment represent the essential elements of a standard examination of fetal anatomy. A more detailed fetal anatomic examination may be necessary if an abnormality or suspected abnormality is found on the standard examination.

i. Head and neck

Cerebellum
Choroid plexus
Cisterna magna
Lateral cerebral ventricles
Midline falx
Cavum septi pellucidi

ii. Chest

The basic cardiac examination includes a 4-chamber view of the fetal heart.

If technically feasible, an extended basic cardiac exam-

ination can also be attempted to evaluate both outflow tracts.

- iii. Abdomen
 - Stomach (presence, size, and situs)
 - Kidneys
 - Bladder
 - Umbilical cord insertion site into the fetal abdomen
 - Umbilical cord vessel number
- iv. Spine
 - Cervical, thoracic, lumbar, and sacral spine
- v. Extremities
 - Legs and arms (presence or absence)
- vi. Gender
 - Medically indicated in low-risk pregnancies only for evaluation of multiple gestations.

V. Documentation

Adequate documentation of the study is essential for high-quality patient care. This should include a permanent record of the sonographic images, incorporating whenever possible the measurement parameters and anatomic findings proposed in this document. Images should be appropriately labeled with the examination date, patient identification, and, if appropriate, image orientation. A written report of the sonographic findings should be included in the patient's medical record.

Reporting should be in accordance with the *AIUM Standard for Documentation of an Ultrasound Examination*.

VI. Equipment Specifications

These studies should be conducted with real-time scanners, using a transabdominal and/or transvaginal approach. A transducer of appropriate frequency should be used.

Comment

Real-time sonography is necessary to confirm the presence of fetal life through observation of cardiac activity and active movement.

The choice of transducer frequency is a trade-off between beam penetration and resolution. With modern equipment, 3- to 5-MHz abdominal transducers allow sufficient penetration in most patients while providing adequate resolution. A lower-frequency transducer (2 to 2.25 MHz) may be needed to provide adequate penetration for abdominal imaging in an obese patient. During early pregnancy, a 5-MHz abdominal transducer or a 5- to 10-MHz or greater vaginal transducer may provide superior resolution while still allowing adequate penetration.

VII. Fetal Safety

Diagnostic ultrasound studies of the fetus are generally considered to be safe during pregnancy. This diagnostic procedure should be performed only when there is a valid medical indication, and the lowest possible ultrasonic exposure setting should be used to gain the necessary diagnostic information under the as low as reasonably achievable (ALARA) principle.

The promotion, selling, or leasing of ultrasound equipment for making "keepsake fetal videos" is considered by the US Food and Drug Administration to be an unapproved use of a medical device. Use of a diagnostic ultrasound system for these purposes, without a physician's order, may be in violation of state laws or regulations.

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 *AIUM Standards and Guidelines for the*

Accreditation of Ultrasound Practices.
Equipment performance monitoring should be in accordance with the *AIUM Standards and Guidelines for the Accreditation of Ultrasound Practices.*

Acknowledgments

This guideline was developed by the American Institute of Ultrasound in Medicine (AIUM) in collaboration with the American College of Radiology (ACR) and the American College of Obstetricians and Gynecologists (ACOG), according to the process described in the *ACR Practice Guidelines and Technical Standards Book.*

Collaborative Subcommittee

AIUM

Jeanne A. Cullinan, MD
Barbara S. Hertzberg, MD
Wesley Lee, MD

ACOG

Fredric Frigoletto, Jr, MD
John Seeds, MD
Ralph Tamura, MD

ACR

Ulrike M. Hamper, MD
Mindy M. Horrow, MD
Christopher R. B. Merritt, MD

AIUM Clinical Standards Committee

Brian Garra, MD, Chair
Jon Meilstrup, MD, Vice Chair
Bryann Bromley, MS, MD
Terry DuBose, MS, RDMS
Mary Frates, MD
Pat Fulgham, MD
Edward Grant, MD
Kim Gregory, MD
Barbara Hertzberg, MD
Lyndon Hill, MD
Wesley Lee, MD
John McGahan, MD
Michael McNamara, MD
Ellen Mendelson, MD
Laurence Needleman, MD
Karen Ophir, RDMS
Carl Otto, MD
Harriet Paltiel, MD
John Pellerito, MD
Cindy Rapp, BS, RDMS, RDCS

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