AIUM Practice Parameter for Ultrasound Examinations in Reproductive Medicine and Infertility

Prepared in collaboration with the American Institute of Ultrasound in Medicine (AIUM), the American College of Obstetricians and Gynecologists (ACOG), and the Society for Reproductive Endocrinology and Infertility (SREI), an affiliate of the American Society of Reproductive Medicine (ASRM).

The American Institute of Ultrasound in Medicine (AIUM) is a multidisciplinary association dedicated to advancing the safe and effective use of ultrasound in medicine through professional and public education, research, development of parameters, and accreditation. To promote this mission, the AIUM is pleased to publish, in conjunction with the Society for Reproductive Endocrinology and Infertility (SREI), this *AIUM Practice Parameter for Ultrasonography in Reproductive Medicine*. 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 more than 65 years. This document and others like it will continue to advance this mission. Practice parameters of the AIUM are intended to provide the medical ultrasound community with parameters for the performance and recording of high-quality ultrasound examinations. The parameters 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

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parameters with the recognition that deviations from the parameters will be needed in some cases, depending on patient needs and available equipment. Practices are encouraged to go beyond these parameters to provide additional service and information as needed by their referring physicians and patients.

I. Introduction

The clinical aspects contained in specific sections of this practice parameter (Introduction, Indications and Contraindications, Specifications for Individual Examinations, and Equipment Specifications) were developed collaboratively by the American Institute of Ultrasound in Medicine (AIUM), the American College of Obstetricians and Gynecologists (ACOG), and the Society for Reproductive Endocrinology and Infertility (SREI), an affiliate of the American Society of Reproductive medicine (ASRM). Portions of this practice parameter were excerpted from: (1) the *Practice Parameter for the Performance of Ultrasound of the Female Pelvis*, collaboratively developed by the AIUM, American College of Radiology (ACR), ACOG, the Society for Pediatric Radiology (SPR), and the Society of Radiologists in Ultrasound (SRU); and (2) the *Practice Parameter for the Performance of Obstetric Ultrasound Examinations*, collaboratively developed by the AIUM, ACR, ACOG, and SRU. Recommendations for physician qualifications, written request for the examination, procedure documentation, and quality control may vary among the organizations and are addressed by each separately.

This document has been developed to provide assistance to practitioners performing reproductive medicine and infertility ultrasound studies of the female pelvis. In some cases, additional and/or specialized examinations may be necessary. Although it is not possible to detect every abnormality, adherence to the following will maximize the probability of detecting most abnormalities.

II. Qualifications and Responsibilities of the Physician

Physicians who supervise/perform and/or supervise female pelvic ultrasound examinations, obstetric ultrasound examinations, diagnostic sonohysterography, ultrasound-guided follicular aspiration, or embryo transfer should be skilled in ultrasonography as well as in appropriate

placement of catheters and ultrasound-guided needle placement. They should understand the indications, limitations, and possible complications of the procedure.

See www.aium.org for AIUM Official Statements, including *Standards and Guidelines for the Accreditation of Ultrasound Practices* and relevant Physician Training Guidelines.

III. Written Request for the Examination

The written or electronic request for an ultrasound examination should provide sufficient information to allow for the appropriate performance and interpretation of the examination. The request for the examination must be originated by a physician or other appropriately licensed health care provider or under the provider's direction. The accompanying clinical information should be provided by a physician or appropriate health care provider familiar with the patient's clinical situation and should be consistent with relevant legal and local health care facility requirements.

IV. Classification of Reproductive Medicine and Infertility Examinations

A. Ultrasound Examination of the Female Pelvis for Infertility and Reproductive Medicine

B. Limited (Focused) Examination

C. Ultrasound-Guided Procedures

D. Ultrasound Examination of the Female Pelvis in the First 10 Weeks (Embryonic Period) of Pregnancy

E. Sonohysterography in Reproductive Medicine

F. Sonosalpingography

V. Specifications for Individual Examinations

A. Ultrasound Examination of the Female Pelvis for Infertility and Reproductive Medicine

The following sections detail the examination to be performed for each organ and anatomic region in the female pelvis. All relevant structures should be identified by the transabdominal and/or transvaginal approach. A transrectal or transperineal approach may be useful in patients who are not candidates for introduction of a vaginal probe and in assessing the patient with pelvic organ prolapse. More than 1 approach may be necessary.[1,2]

1. General Pelvic Preparation

For a complete transabdominal pelvic sonogram, the patient's bladder can be distended if necessary to displace the small bowel from the field of view. Occasionally, overdistention of the bladder may compromise the evaluation. When this occurs, imaging may be repeated after partial bladder emptying. If an abnormality of the urinary bladder is detected, it should be documented and reported.

For a transvaginal sonogram, the urinary bladder is preferably empty. The patient, the sonographer, or the physician may introduce the vaginal transducer, preferably under real-time monitoring. Consideration of having a chaperone present should be in accordance with local policy.[3]

2. Uterus

The vagina and uterus provide anatomic landmarks that can be used as reference points for the other pelvic structures, whether normal or abnormal. In examining the uterus, the following should be evaluated: (1) the uterine size, shape, and orientation; (2) the endometrium; (3) the myometrium; and (4) the cervix. The vagina may be imaged as a landmark for the cervix. The overall uterine length is evaluated in a sagittal view from the fundus to the cervix (to the external os, if it can be identified). The depth of the uterus (anteroposterior dimension) is measured in the same sagittal view from its anterior to posterior walls, perpendicular to the length. The maximum width is measured in the

transverse or coronal view. If volume measurements of the uterine corpus are performed, the cervical component should be excluded from the uterine length measurement.

Abnormalities of the uterus should be documented.[4]

The myometrium and cervix should be evaluated for contour changes, echogenicity, masses, and cysts. Masses that may require follow-up or intervention should be measured in at least 2 dimensions, acknowledging that it is not usually necessary to measure all uterine fibroids. The size and location of clinically relevant fibroids should be documented.

The endometrium should be analyzed for thickness, focal abnormalities, echogenicity, and the presence of fluid or masses in the cavity. The thickest part of the endometrium should be measured perpendicular to its longitudinal plane in the anteroposterior diameter from echogenic to echogenic border (Figure 1). The adjacent hypoechoic myometrium and fluid in the cavity should be excluded (Figure 2). Assessment of the endometrium should allow for variations expected with phases of the menstrual cycle and with hormonal supplementation.[5,6]

It should be reported if the endometrium is not adequately seen in its entirety or is poorly defined. Sonohysterography may be a useful adjunct to evaluate the patient with abnormal uterine bleeding or to further clarify an abnormally thickened endometrium.[7-9]

(See the AIUM *Practice Parameter for the Performance of Sonohysterography*.) If the patient has an intrauterine contraceptive device, its location should be documented.

Whenever possible, all relevant structures should be identified by the vaginal approach. When a transvaginal scan fails to image all areas needed for diagnosis, a transabdominal scan should be performed. In some cases, both a transabdominal and a transvaginal scan may be needed. The addition of 3-dimensional to 2-dimensional ultrasound (transabdominal, transvaginal, transperineal, and/or transrectal) can be helpful in many circumstances, including but not limited to evaluating the relationship of masses with the endometrial cavity, identifying uterine congenital anomalies and a

thickened and/or heterogeneous endometrium, and evaluating the location of an intrauterine device and the integrity of the pelvic floor.[10]

3. Adnexa, Including Ovaries and Fallopian Tubes

When evaluating the adnexa, an attempt should be made to identify the ovaries first, since they can serve as major points of reference for assessing the presence of adnexal pathology. The ovarian size may be determined by measuring the ovary in 3 dimensions (width, length, and depth) on views obtained in 2 orthogonal planes.[11]

Any ovarian abnormalities should be documented.[12–15]

The ovaries may not be identifiable in some patients. This occurs most frequently before puberty, after menopause, or in the presence of a large leiomyomatous uterus. The adnexal region should be surveyed for abnormalities, particularly masses and dilated tubular structures.

If an adnexal abnormality is noted, its relationship with the ovaries and uterus should be assessed. The size and sonographic characteristics of adnexal masses should be documented.

Spectral, color, and/or power Doppler ultrasound may be useful to evaluate the vascular characteristics of pelvic lesions.[15,16]

4. Cul-de-Sac

The cul-de-sac and bowel posterior to the uterus may not be clearly defined. This area should be evaluated for the presence of free fluid or a mass. If a mass is detected, its size, position, shape, sonographic characteristics, and relationship to the ovaries and uterus should be documented. Differentiation of normal loops of bowel from a mass may be difficult if only a transabdominal examination is performed. A transvaginal examination may be helpful to distinguish a suspected mass from fluid and feces within the normal rectosigmoid colon.

See http://www.aium.org/resources/guidelines/femalePelvis.pdf for the most up-to-date version of the *AIUM-ACR-ACOG-SPR-SRU Practice Parameter for the Performance of Ultrasound of the Female Pelvis*, V. Specifications of the Examination.

B. Limited (Focused) Examination

A focused pelvic ultrasound examination is appropriate when monitoring ovarian stimulation (eg, an ovarian folliculogram study or determining endometrial qualities before embryo transfer). A comprehensive examination should have previously been performed in the preceding 4 to 6 months to rule out other gynecologic pathology. The limited examination can be restricted to the organ or measurements of interest. In the case of an ovarian folliculogram, the following should be documented: ovarian follicle number in each ovary, endometrial thickness, and endometrial morphologic appearance. Endometrial thickness is measured from outside to outside in an anteroposterior view at the widest point. In addition, follicular diameters in 2 dimensions for each follicle larger than 10 mm should be recorded. A single recorded value representing the mean of 2 diameter measurements performed at right angles is also acceptable. Permanent recorded images should be obtained and stored in accordance with local, state, and federal regulations. Pertinent clinical information should be recorded in the patient record.

See http://www.aium.org/resources/guidelines/reproductiveEndo.pdf for the most up-to-date version of *the AIUM-ACNM-ACOG-ACOOG-ASRM-SREI Practice Parameter for the Performance of a Focused Reproductive Endocrinology and Infertility Scan,* V. Specifications of the Examination.

C. Ultrasound-Guided Procedures

1. Follicle Puncture

Ultrasound-assisted (transvaginal or transabdominal) follicle puncture for retrieving eggs for in vitro fertilization (IVF) is appropriate in the following circumstances:

a. The patient has undergone comprehensive sonographic evaluation of the pelvis within 6 months to the start of hormonal stimulation of the ovaries.

b. Real-time continuous ultrasound guidance is available, and the image demonstrates a safe approach for the needle path.
c. The ovaries can be brought in close proximity to the ultrasound transducer, thus avoiding the puncture of vital structures (eg, bowel and blood vessels).

2. Cyst Aspiration

Ultrasound-assisted (transvaginal or transabdominal) ovarian cyst puncture and aspiration are appropriate in patients who have a diagnosis of a persistent ovarian cyst and who meet the following criteria:

a. Failed resolution of the cyst after observation and/or hormonal manipulation.
b. The cyst is unilocular and thin walled without internal excrescences or septations.
c. Real-time continuous ultrasound guidance is available, and the image demonstrates a safe approach for the needle path.
d. The cyst can be brought in close proximity to the ultrasound transducer, thus avoiding the puncture of vital structures (eg, bowel and blood vessels).

3. Embryo Transfer

Ultrasound-assisted embryo transfer is appropriate in patients undergoing a “fresh” IVF cycle or after embryo cryopreservation or embryo/egg donation. If an abdominal ultrasound examination is performed, the bladder should be full to facilitate visualization of the endometrium and the transfer catheter.[17,18]

4. Other Procedures

Ultrasound assistance is helpful for several other procedures in reproductive medicine, infertility, and gynecology. Examples include:

a. During and/or after suction dilation and curettage (D&C)/dilation and evaluation (D&E) to assist in the procedure and/or confirm that the uterus is empty.
b. Placement of a catheter through a tortuous cervical canal.[19]
c. Cervical dilation of a stenotic cervical os.
d. Intrauterine device placement.[20]

e. Intraoperative hysteroscopic procedures (eg, septoplasty, surgical treatment of Asherman syndrome, and retrieving a foreign body).[21–23]

f. Aspiration of hydrosalpinx.[24]

D. Ultrasound Examination of the Female Pelvis in the First 10 Weeks (Embryonic Period) of Pregnancy

1. Indications

Indications for first-trimester sonography include but are not limited to:

a. Confirmation of the presence of an intrauterine pregnancy.

b. Evaluation of a suspected ectopic pregnancy.[25]

c. Defining the cause of vaginal bleeding.

d. Evaluation of pelvic pain.

e. Estimation of gestational (menstrual) age.

f. Diagnosis or evaluation of multiple gestations.

g. Confirmation of cardiac activity.

h. Imaging as an adjunct to embryo transfer and localization and removal of an intrauterine device.

i. Evaluation of maternal pelvic masses and/or uterine abnormalities.

j. Evaluation of a suspected hydatidiform mole.

Comment

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

2. *Imaging Parameters*

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.[25]

a. The uterus (including the cervix) 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.[8]

Comment

A definitive diagnosis of intrauterine pregnancy can be made when an intrauterine gestational sac containing a yolk sac or embryo/fetus with cardiac activity is visualized. A small, eccentric intrauterine fluid collection with an echogenic rim can be seen before the yolk sac and embryo are detectable in a very early intrauterine pregnancy.[26] In the absence of sonographic signs of ectopic pregnancy, the fluid collection is highly likely to represent an intrauterine gestational sac.[26,27] Follow-up sonography and/or serial determination of maternal serum human chorionic gonadotropin levels are/is appropriate in pregnancies of undetermined location to avoid inappropriate intervention in a potentially viable early pregnancy.[25]

The crown-rump length is a more accurate indicator of gestational (menstrual) age than is the mean gestational sac diameter. However, the mean gestational sac diameter may 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.[27] Without these findings, an intrauterine fluid collection could represent irregular fluid collected within the endometrial cavity and may be associated with an ectopic pregnancy.[27]

b. The presence or absence of cardiac activity should be documented with a 2-dimensional video clip or M-mode imaging.

Comment

With transvaginal scans, although cardiac motion is usually observed when the embryo is 4 to 5 mm or greater in length,[28,29] if an embryo of less than 7 mm in length is seen without cardiac activity, a subsequent scan in at least 1 week is recommended to ensure that the pregnancy is nonviable.[30]

c. Fetal number should be documented.

Comment

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

For practitioners performing sonographic studies only during the first 10 weeks of pregnancy, see relevant portions of the *AIUM-ACR-ACOG- SRU Practice Guideline for the Performance of Obstetric Ultrasound Examinations* for indications, fetal safety statements, and specifications of the examination. Although this document describes key elements of standard sonographic examinations in the first 10 weeks of pregnancy, in some cases other specialized examinations may be necessary as well.

A limited examination may be performed in clinical emergencies or in specific clinical scenarios, such as evaluation of embryonic cardiac activity. A limited follow-up examination may be appropriate if a complete prior examination is on record.

See http://www.aium.org/resources/guidelines/obstetric.pdf for the most up-to-date version of the *AIUM-ACR-ACOG-SRU Practice Parameter for the Performance of an Obstetric Ultrasound Examinations,* V. Specifications of the Examination, A. First-Trimester Ultrasound Examination.

E. Sonohysterography in Reproductive Medicine

1. Indications

Indications include but are not limited to evaluation of:

a. Abnormal uterine bleeding.[31]

b. Uterine cavity, especially with regard to uterine myomas, polyps, and synechiae.[32]

c. Abnormalities detected on endovaginal sonography, including focal or diffuse endometrial or intracavitary abnormalities.

d. Congenital or acquired abnormalities of the uterus.[33]

e. Infertility.[34–36]

f. Recurrent pregnancy loss.

g. Suboptimal visualization of the endometrium on endovaginal sonography.

2. Contraindications

Sonohysterography should not be performed in a woman who is pregnant or who could be pregnant. This is usually avoided by scheduling the examination in the follicular phase of the menstrual cycle, after menstrual flow has essentially ceased but before the patient has ovulated.[37] In a patient with regular cycles, sonohysterography should not in most cases be performed later than the 10th day of the menstrual cycle. Sonohysterography should not be performed in patients with a pelvic infection or unexplained pelvic tenderness, which could be due to pelvic inflammatory disease. Active vaginal bleeding is not a contraindication to the procedure but may make the interpretation more challenging.

3. Patient Preparation

Pelvic organ tenderness should be assessed during the preliminary transvaginal sonogram. If the patient's history or physical examination is concerning for active pelvic inflammatory disease, the examination should be deferred until an appropriate course of treatment has been completed. In the presence of nontender hydrosalpinges, consideration may be given to administering antibiotics at the time of the examination; in this case, it is prudent to discuss the antibiotic regimen with the referring physician. A pregnancy test is advised when clinically indicated. Patients should be questioned about a latex allergy or a reaction to a povidone-iodine solution or other topical antiseptic before use of these products. Sonohysterography should be performed in the early follicular phase, as close to the end of the menstrual period as possible.

4. Procedure Specifications

A previous transvaginal sonogram is useful for measurement of the endometrium and evaluation of the uterus, ovaries, and pelvic free fluid. A speculum is used to allow visualization of the cervix.[38] The presence of unusual pain, lesions, or purulent vaginal or cervical discharge may require rescheduling the procedure pending further evaluation. Before insertion, the catheter should be flushed with sterile fluid to avoid introducing air during the study. After cleansing the external os, the cervical canal and/or uterine cavity should be catheterized using an aseptic technique, and appropriate sterile fluid should be instilled slowly by means of manual injection under real-time sonographic imaging. Imaging should include real-time scanning of the endometrial and cervical canal. Imaging may include evaluation of fallopian tube patency if indicated.

5. Contrast Agent

Appropriate sterile fluid such as normal saline should be used for sonohysterography. If the requesting physician is interested in tubal patency, then a sonosalpingogram can be offered using agitated saline.

6. Images

Precatheterization images should be obtained and recorded, in at least 2 planes, to show normal and abnormal findings. These images should include the thickest bilayer endometrial measurement, which includes the anterior and posterior endometrial thicknesses, obtained in a sagittal view.

Once the uterine cavity is filled with fluid, a complete survey of the uterine cavity should be performed and representative images obtained to document normal and abnormal findings. If a balloon catheter filled with saline is used for the examination, images should be obtained at the end of the procedure with the balloon deflated to fully evaluate the endometrial cavity, particularly the cervical canal and lower portion of the endometrial cavity.

Color Doppler sonography may be helpful in evaluating the vascularity of an intrauterine abnormality and tubal patency.

Three-dimensional imaging, in particular, reconstructed coronal plane imaging, is useful in the assessment of müllerian duct anomalies and for preoperative mapping of myomas.

7. Postprocedure Care

The imaging or referring physician should discuss the sonohysterographic findings with the patient. The patient should be instructed to contact her physician if she develops fever, persistent pain, or unusual bleeding after the procedure. The patient should be told to expect leaking of fluid after the procedure, which may be blood-tinged or may have a similar color as the cleaning solution.

See http://www.aium.org/resources/guidelines/sonohysterography.pdf for the most up-to-date version of the *AIUM-ACR-ACOG-SRU Practice Parameter for the Performance of Sonohysterography* for indications, contraindications, and specifications for this examination.

F. Sonosalpingography

Sonosalpingography (SS) is a new term that specifically addresses the use of ultrasound and sterile fluid to determine whether the tubes are patent. For infertility patients, determining tubal patency may be desired. Tubal patency may be identified by ultrasound (termed SS) in 1 of the following methods:

1. Indirect Determination

During the preliminary sonogram, the posterior cul-de-sac and pelvis should be evaluated for the presence of free fluid. If none is present before injection of fluid and it is present after fluid injection, then one can state that at least 1 tube is patent.

2. Saline Infusion With Color/Power Doppler Assessment

The transvaginal transducer is positioned to evaluate 1 uterine cornua at a time. Color/power Doppler imaging is activated and passing through the fallopian tubes. Free fluid is seen near the ovaries or cul-de-sac.

3. Air-Saline Contrast Agent

The transvaginal transducer is positioned to visualize the uterine cornua. Sterile fluid (normal saline or water) is mixed with 1 to 2 cc of air. This air-fluid mixture is injected into the uterus. When bubbles are seen passing through the proximal tube and the distal tube with a fluid collection in the adnexal area, then the fallopian tube is reported as patent.

4. Other Contrast Agents

Other contrast agents are not approved by the US Food and Drug Administration.

VI. Documentation

Adequate documentation is essential for high-quality patient care. A permanent record of the ultrasound examination and its interpretation should be kept by the facility performing the study. Images of all appropriate areas, both normal and abnormal, should be recorded. Variations from normal size should be accompanied by measurements. Images are to be appropriately labeled with the examination date, facility name, patient identification, and image orientation and/or organ imaged when appropriate. A report of the ultrasound findings should be included in the patient's medical record. Urgent or clinically important unexpected results should be communicated verbally to any referring and/or treating physician and this communication documented in the report. Retention of the permanent record of the ultrasound examination should be consistent both with clinical needs and with the relevant legal and local health care facility requirements.

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

VII. Equipment Specifications

See Equipment Specifications in the relevant Practice Parameters posted on the AIUM website.

VIII. Quality Control and Improvement, Safety, Infection Control, and Patient Education

Policies and procedures related to quality control, 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*.

IX. ALARA Principle

The potential benefits and risks of each examination should be considered. The ALARA (as low as reasonably achievable) principle should be observed when adjusting controls that affect the acoustic output and by considering transducer dwell times. Further details on ALARA may be found in the AIUM publication *Medical Ultrasound Safety,* Third Edition.

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