

## ISUOG Education Committee recommendations for basic training in obstetric and gynecological ultrasound

The International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) is an organization that encourages best practice, teaching and research in the field of imaging in women's healthcare. Ultrasound is considered as the first-line imaging method of choice in women's health. It is a simple, accurate and safe technique, making it amenable to use in both developed and underdeveloped countries. Ultrasonography is used both for screening and as a diagnostic tool in the presence of clinical symptoms.

The accuracy of ultrasonography is linked to several technical factors, including those associated with both patient and machine. However, it is dependent primarily on the skill of the operator in using the equipment in order to obtain and interpret representative images. The teaching and training of medical health professionals performing ultrasonography is, therefore, crucial. It is the view of the ISUOG Education Committee that systematic training in ultrasonography can increase the efficiency of the learning process.

These revised<sup>1</sup> recommendations for basic training in obstetric and gynecological ultrasound are offered as guidance for national bodies responsible for establishing criteria and requirements for teaching and assessing the competence of trainees in obstetric and gynecological ultrasonography. Accordingly, they should be regarded as educational recommendations to provide a consensus-based approach to ultrasound training as applied in obstetrics and gynecology. Although they reflect what ISUOG currently considers to be best practice, they are not intended to establish a legal standard of care because some deviations are inevitable depending on individual circumstances and available resources. Approved guidelines and recommendations can be distributed freely with the permission of ISUOG (info@isuog.org).

### TARGET AUDIENCE

The person performing ultrasonography in obstetrics and gynecology varies. In some countries ultrasound scans are performed mainly by medically trained staff such as obstetricians and gynecologists or radiologists; in others, the majority are performed by technicians, ultrasonographers and midwives.

Ideally, in every country, the bodies responsible for setting levels of competence in obstetric and gynecological

ultrasonography should determine which format is used for theoretical and practical training (e.g. training at local level, online courses, diplomas by existing organizations, locally recognized ultrasound schools), as well as the method chosen to assess the competence of trainees. Whichever format is chosen, the teaching of a trainee should be supervised locally by an experienced specialist and care should be taken to meet the requirements set out by these recommendations. There may be a difference between the theoretical and practical training components, as trainees do not have to accomplish everything in practice that is taught in theory.

The trainee should understand that there are different levels of ultrasound skills and that an abnormal finding on a basic scan can lead to a referral for a comprehensive examination performed by a specialist. We would also expect the trainee to have a basic knowledge of the following areas: female pelvic anatomy, embryology, dysmorphology, genetics and the physiology and pathophysiology of pregnancy.

### THREE STEPS FOR LEARNING ULTRASOUND

Formal basic ultrasound teaching should include three steps: theoretical training, practical training and examination.

#### Step 1: Theoretical

The trainee should participate in a course on basic ultrasonography, either in the form of lectures in a dedicated meeting or using online learning modules. Both should be complemented by reading textbooks and scientific articles or by multimedia learning. ISUOG guidelines on different aspects of obstetric and gynecological ultrasound<sup>2,3</sup> should form part of this theoretical teaching.

#### Step 2: Practical

Under formal supervision the trainee should learn how to perform ultrasound examinations and how to document and report findings. This step must include completion of a log book and/or an audit to document that the

ultrasound examinations were performed and reported in a standardized way.

### Step 3: Examination

The trainee should undergo an examination to assess their theoretical knowledge and it is recommended that they undertake a practical assessment of the technical skills learnt in Steps 1 and 2.

## THEORETICAL TRAINING CURRICULUM

In theoretical training, the basics of diagnostic ultrasonography applicable to both obstetrics and gynecology should be explained comprehensively. Aspects specific to obstetric and gynecological ultrasonography should be presented separately. It is essential to stress that patients should be informed in advance about the goals of any ultrasound examination and that verbal consent should always be obtained; this is particularly important when the examination is carried out transvaginally. For medico-legal reasons, it is mandatory in many countries to have an additional person present in the room (a chaperone) when a transvaginal examination is performed.

### Basic physical principles

Relevant basic principles of the following topics should be covered:

- Acoustics
- Effects on tissues of pulsed- and continuous-wave ultrasound beams: biological, thermal and non-thermal (mechanical)
- Safety of diagnostic ultrasound and the ALARA principle, including familiarity with ISUOG statements on safety aspects of ultrasound
- Transducer technology
- Two-dimensional gray-scale ultrasound and signal processing (gray-scale, time gain compensation, gain, dynamic range and focus, acoustic output)
- Ultrasound artifacts
- Doppler ultrasound
- Three-dimensional or 'volume' ultrasound

### Theoretical teaching of the basics of diagnostic ultrasound

The following topics should be covered:

- Patient information required in order to obtain informed consent for an ultrasound examination
- Statistical tests that can be used to describe the performance of screening and diagnostic tests
- Sonographic biometry (linear, circumference, area and volume)
- Image recording, storage and analysis
- Medico-legal aspects of ultrasound
- Quality control processes (qualitative and/or quantitative)

### Theoretical teaching of obstetric ultrasound

Ultrasound can be applied from early gestation to the delivery room and puerperium. The trainee should be taught about the following:

#### First trimester

- Ultrasound features of normal early pregnancy: description of the intrauterine gestational sac, yolk sac and embryo
- How to recognize fetal viability and criteria used to diagnose definitively non-viability (miscarriage)
- Diagnosis of tubal and non-tubal ectopic pregnancy and the principle of a pregnancy of unknown location (PUL)
- How to interpret serum human chorionic gonadotropin (hCG) levels and progesterone in the event of a PUL
- Ultrasound features of molar pregnancy
- Early pregnancy biometry e.g. crown-rump length (CRL) and mean gestational sac diameter (MSD)
- Chorionicity and amnionicity in multiple pregnancies
- Gross fetal malformations that can be recognized during the first trimester
- Association between thickened nuchal translucency and fetal chromosomal anomalies (at the end of the first trimester)

#### Second and third trimesters

- Determination of fetal position
- Assessment of fetal wellbeing, including fetal movements
- Amniotic fluid volume estimation and conditions associated with abnormal amniotic fluid volume
- Placental assessment, including relation to the internal cervical os
- Standard fetal biometry (biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femur diaphysis length (FL)) and estimated fetal weight calculation
- Fetal growth and typical causes of abnormal fetal growth
- Fetal head (intact cranium, head shape, midline falx, cerebral ventricles, cavum septi pellucidi, cerebellum, cisterna magna) and typical anomalies
- Fetal face (orbits, nose and mouth in different planes) and typical anomalies
- Fetal thorax (lung morphology and relationship to heart size) and typical anomalies
- Fetal heart (situs, four-chamber view, outflow tracts, three-vessel view) and typical anomalies
- Fetal abdomen (stomach, liver with umbilical vein, kidneys and urinary bladder, diaphragm, bowel, abdominal wall and cord insertion) and typical anomalies
- Fetal spine in longitudinal and transverse planes and typical anomalies
- Fetal limbs (arms, hands, legs, feet) and typical anomalies
- Umbilical and uterine artery Doppler

## Theoretical teaching of gynecological ultrasound

Ultrasound has become the main imaging modality to examine the female pelvis and is an intrinsic part of many gynecological visits. Gynecological ultrasonography is often better performed by the transvaginal than the transabdominal approach as this provides higher-resolution images. Transabdominal ultrasound, however, may complement the transvaginal approach when the pelvic organs are enlarged and at later stages of the first trimester.

The trainee should be taught about the following:

- Age-related differences in normal female pelvic anatomy (adolescent, reproductive age, postmenopausal).
- How to recognise and describe myometrial abnormalities, e.g. fibroids and adenomyosis
- How to describe endometrial pathology (global and focal) including a knowledge of international endometrial tumor analysis (IETA) terminology<sup>4</sup>
- How to describe and recognize common adnexal pathology, including knowledge of international ovarian tumor analysis (IOTA) terminology and rules<sup>5</sup>
- How to understand when to refer women with abnormal uterine and ovarian pathology for further specialist opinion
- How to recognize the presence of peritoneal fluid and its potential sources
- The appearance of intrauterine contraceptive devices (IUDs) and their correct placement

## PRACTICAL TRAINING CURRICULUM

A standardized, systematic examination technique is mandatory. A comprehensive examination should include the different points summarized in the checklists in Tables 1 and 2.

**Table 1** Information to be obtained at most basic obstetric ultrasound scans

### General checklist for basic obstetric ultrasound scan

Fetal viability and fetal movements  
 Demonstration of presence of a singleton or multiple pregnancy  
 Assessment of gestational age and comparison of biometric values with gestational age  
 Assessment of fetal size by recording biometric measurements  
 Descriptive evaluation of amount of amniotic fluid  
 Evaluation of placental appearance and location  
 Fetal lie

**Table 2** Information to be obtained at most basic gynecological ultrasound scans

### General checklist for basic gynecological ultrasound scan

Visualization of uterus in longitudinal and transverse planes  
 Measurement of endometrial thickness  
 Assessment of size and morphology of ovaries  
 Evaluation of presence or absence of fluid in the pelvis  
 Description of any abnormality

## General skills

During ultrasound training the following general skills should be acquired:

- Awareness of consent and what information to give to a patient to obtain consent
- Awareness of latex sensitivity/allergy and the cleaning/disinfection of transducers
- How to enter patient-identification data into the ultrasound machine
- Understanding ultrasound systems, the various transducers used and techniques required to optimize images
- Experience in selecting and manipulating the various transducers to achieve optimal views
- Interpretation of the resultant ultrasound images
- Experience in measuring distances and areas and recording these
- Experience in storing a set of standard images and sending measurements and images to an associated database where available
- Structured reporting of the ultrasound examination
- Counseling the patient before, during and after an ultrasound examination
- Knowing when supervision or a second opinion for confirmation of findings is required
- Being aware of referral routes to second- and third-level centers for additional investigations when these are not immediately available

## Practical obstetric ultrasound training

During practical training the following aspects of obstetric ultrasound should be learned:

### First trimester

- Recognize the features of an intrauterine pregnancy (gestational sac, yolk sac and embryo)
- Recognize fetal viability and non-viability
- Adequately measure MSD, CRL and BPD (if applicable)
- Ascertain if multiple gestation and, if so, determine chorionicity
- Understand how to calculate or correct gestational age estimation from CRL
- Recognize the features of an extrauterine (ectopic) pregnancy
- Understand the concept of a PUL and how to interpret serum biochemistry to assign risk

### Second and third trimesters

- Obtain standardized planes for anatomical and biometric evaluation (e.g. BPD, HC, AC, FL, cervical length)
- Understand the interpretation of measurement deviations (e.g. for calculating gestational age, recognizing growth restriction)
- Recognize, subjectively or objectively, normal and abnormal amniotic fluid volume

- Recognize placental location in relationship to the lower uterine segment and cervix (recognizing and reporting placenta previa)
- Recognize the umbilical cord and its insertions on the placenta and the fetal abdominal wall
- Recognize fetal anatomical landmarks and identify possible abnormal findings

### Practical gynecological ultrasound training

During practical training the following aspects of gynecological ultrasound should be learned (using both transabdominal and transvaginal routes):

- Assessment of the uterus in both its longitudinal and transverse planes
- Measurement of endometrial thickness and description of endometrial morphology<sup>4</sup>. Recognizing and describing focal intracavitary pathology (polyps and submucous fibroids)
- Examination of the myometrium for evidence of fibroids and adenomyosis
- Examination of the ovaries, and how to describe their morphology and size. Pathology should be reported in terms of its appearance and dimensions using a standardized approach. This should include knowledge of IOTA terminology<sup>5</sup>.
- Examination of the pelvis for the presence of fluid.

### EXAMINATION/CERTIFICATION

Theoretical knowledge should be tested, either by oral examination or by written multiple-choice examination, and should involve a test of general knowledge about ultrasonography and the evaluation of ultrasound images to recognize the presence of pathology. This may be complemented by a practical examination on a patient.

#### Certification

It is difficult to define the optimal time needed for learning how to perform an ultrasound scan safely or the minimum number of examinations required before a trainee is able to perform ultrasonography without supervision, as this may vary greatly according to the predisposition of the individual. However, the ISUOG education committee thinks that the recommended numbers below can serve as a general indication to enable the certification of a trainee in ultrasound:

A minimum of 100 hours of supervised scanning, to include:

- A minimum of 100 obstetric scans covering a wide spectrum of obstetric conditions
- A minimum of 100 gynecological examinations, some of which involving early pregnancy complications

### Logbook

A good way of teaching trainees to use a systematic approach to obtaining ultrasound images is for them to compile logbooks. We recommend, prior to any practical examination, that each candidate complete a logbook that includes a set of standard ultrasound images obtained from scans they themselves have performed, and that also documents patient history, indication and findings and includes a formal ultrasound scan report.

### REFERENCES

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5. Timmerman D, Valentin L, Bourne TH, Collins WP, Verrelst H, Vergote I; International Ovarian Tumor Analysis (IOTA) Group. Terms, definitions and measurements to describe the sonographic features of adnexal tumors: a consensus opinion from the International Ovarian Tumor Analysis (IOTA) Group. *Ultrasound Obstet Gynecol* 2000; 16: 500–505.

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The International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) has published guidelines<sup>2,3</sup> which can be used to complement the teaching of ultrasound in obstetrics and gynecology. The theoretical component can incorporate or be based on multimedia teaching material such as in the educational section of ISUOG's website, [www.isuog.org](http://www.isuog.org).