Obstetric and gynecologic ultrasound curriculum and competency assessment in residency training programs: consensus report

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Ultrasound imaging has become integral to the practice of obstetrics and gynecology. With increasing educational demands and limited hours in residency programs, dedicated time for training and achieving competency in ultrasound has diminished substantially. The American Institute of Ultrasound in Medicine assembled a multisociety task force to develop a consensus-based, standardized curriculum and competency assessment tools for obstetric and gynecologic ultrasound training in residency programs. The curriculum and competency assessment tools were developed based on existing national and international guidelines for the performance of obstetric and gynecologic ultrasound examinations and thus are intended to represent the minimum requirement for such training. By expert consensus, the curriculum was developed for each year of training, criteria for each competency assessment image were generated, the pass score was established at, or close to, 75% for each, and obtaining a set of 5 ultrasound images with pass score in each was deemed necessary for attaining each competency. Given the current lack of substantial data on competency assessment in ultrasound training, the task force expects that the criteria set forth in this document will evolve with time. The task force also encourages use of ultrasound simulation in residency training and expects that simulation will play a significant part in the curriculum and the competency assessment process. Incorporating this training curriculum and the competency assessment tools may promote consistency in training and competency assessment, thus enhancing the performance and diagnostic accuracy of ultrasound examination in obstetrics and gynecology.

Key words: quality control, residency programs, simulation, sonographic images, ultrasound competency, ultrasound curriculum, ultrasound training

Introduction

Ultrasound imaging is integral to the practice of obstetrics and gynecology, as it allows comprehensive anatomic and physiologic evaluation of the fetus and detailed assessment of the maternal pelvic organs. Ultrasound imaging has significant advantages over other imaging modalities. The technology is portable, is relatively inexpensive, and does not involve ionizing radiation. In the gynecologic patient, the real-time aspect of this modality allows the operator to use transducer pressure to palpate as the patient is imaged, thus localizing the anatomic source of pelvic pain, and to examine for the sliding of organs over each other and over the pelvic wall. Ultrasound imaging is also used widely in obstetrics, with current data suggesting that pregnant women in the United States receive on average about 4.5 ultrasound examinations per pregnancy.[1]

To a much greater extent than computed tomography or magnetic resonance imaging, ultrasound imaging is operator-dependent. Adequate technical skills and a good understanding of anatomy are essential to the performance of the ultrasound examination. The quality of ultrasound images is dependent on several factors, including the operator having a basic

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Disclosure: W.L. received honoraria from GE Healthcare as a faculty speaker, and limited research funding from Samsung. N.C.R. received support from the National Institutes of Health as an investigator; honoraria for an ethics grant in prenatal development from the Hastings Center for Bioethics; and compensation from the Texas Department of Health for lecture series for circulating cell-free DNA. The remaining authors report no conflicts of interest.

This paper is being simultaneously published in American Journal of Obstetrics & Gynecology, Journal of Ultrasound in Medicine, and Ultrasound in Obstetrics and Gynecology.

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0002-9378/$36.00 • • https://doi.org/10.1016/j.ajog.2017.10.016

understanding of ultrasound physics and familiarity with the ultrasound machine control panel, as well as on their skills and competency in performing the examination. Obstetric ultrasound imaging is particularly challenging, given the small size of fetal organs and the variable fetal position in the uterus, which occasionally obscures target anatomic regions.

With the increasing educational demands and limited hours in residency training programs, dedicated time for training and achieving competency in ultrasound has diminished substantially. Data from the Accreditation Council for Graduate Medical Education on ultrasound performance in obstetric and gynecologic residency programs indicate that currently the number of ultrasound procedures performed as part of many training programs falls short of the minimum threshold required for physician qualification for the performance of obstetric and gynecologic ultrasound examinations, as defined by the American Institute of Ultrasound in Medicine (AIUM).[2,3]

Given the clinical importance and widespread use of ultrasound imaging in obstetrics and gynecology, the AIUM assembled a multisociety task force to develop a standardized consensus-based curriculum and competency assessment tools for the performance of the basic obstetric and gynecologic ultrasound examination, intended to be used in residency programs. Task force participants included representatives from the AIUM, Society for Maternal-Fetal Medicine (SMFM), American Congress of Obstetricians and Gynecologists (ACOG), American College of Osteopathic Obstetricians and Gynecologists (ACOOG), American College of Radiology (ACR), International Society of Ultrasound in Obstetrics and Gynecology (ISUOG), and Society of Radiologists in Ultrasound (SRU).

Procedure: curriculum and competency development

The process of developing the document included multiple telephone conference calls and one face-to-face meeting between members of the task force. The curriculum was developed based on existing national and international guidelines for the performance of obstetric and gynecologic ultrasound examination[4-6] and is intended to provide fundamental ultrasound education in the first and second years, with more advanced ultrasound knowledge in the third and fourth years, of residency training. A competency assessment process was developed for obtaining specific ultrasound images that are part of the basic obstetric and gynecologic ultrasound examinations. In addition, writing an ultrasound report, assessing ultrasound components of the biophysical profile, and performing third-trimester amniocentesis were included. By expert consensus, the curriculum was developed for each year of training, criteria for each competency assessment image were generated, the pass score was established at or close to, 75% for each, and obtaining a set of 5 ultrasound images with pass score in each was deemed necessary for attaining each competency. Some competencies, such as measurement of the uterus, require >1 image to be obtained and the pass score was established taking into account the criteria of all required images. The consensus decision to establish competency on the basis of 5 image submissions was supported by data (albeit limited) in the literature. In a study assessing performance measures and learning curves for use of an ultrasound simulator, novices reached the level of an expert with a median of 5 iterations.[7] In another prospective cohort study on the usability of simulation training in obstetric ultrasonography, measurements of crown-rump length, head circumference, and femur diaphysis length were attained consistently with ≥5 iterations.[8]

Given the current lack of substantial data on competency assessment in ultrasound training, the task force expects that the criteria set forth in this document will evolve with time. The task force encourages use of ultrasound simulation in residency training and expects that simulation will be a significant part of the curriculum and the competency assessment process. In a recent study, the validity of an obstetric ultrasound simulator as a tool for evaluating trainees following structured training was compared to using standardized ultrasound planes obtained from volunteers.[9] Images obtained from the simulator and from the volunteer subjects were scored according to previously established quality criteria. Scores obtained from the obstetric ultrasound simulator were significantly higher than those obtained by volunteers. The study showed that an obstetric ultrasound simulator is as effective as volunteer-based examination for evaluating practical skills of trainees following structured training in obstetric ultrasound.[9]

It is important to note that the competency assessment aspect of this document requires the trainee to obtain personally the respective images for review and evaluation. For specialties and practices such as radiology practices, in which the primary mode of ultrasound training is based on interpretation of images acquired by sonographers, the competencies can be adapted to reflect this.

Curriculum

Objectives of the curriculum are organized around essential topics, including basic principles of medical ultrasound and characteristics of the equipment, aspects of the ultrasound examination, and ultrasound examination performance throughout the stages of pregnancy and in gynecology. The objectives are presented within a level-based framework that will allow trainees to progress along a continuum toward increasing competence.

Level 1 (year 1)

Basic principles of medical ultrasound

- Basic principles of ultrasound physics.
- Ultrasound modes (B-mode, M-mode, Doppler, 2-dimensional [2D] and 3-dimensional [3D]).
- Bioeffects of ultrasound (mechanical and thermal effects: as low as