Impact of High-Fidelity Transvaginal Ultrasound Simulation for Radiology on Residents' Performance and Satisfaction

Rani Ahmad, MD, Ghufran Alhashmi, MD, Amr Ajlan, MD, Bassem Eldeek, MD

Rationale and Objectives: Because of the intimate and uncomfortable nature of transvaginal ultrasound, training residents to perform this type of examination is a difficult task. As a consequence, residents may receive inadequate training that leads to a lack of the skills and confidence needed to perform this examination. The aim of the study was to assess the effectiveness of using simulation sessions to teach residents how to perform transvaginal ultrasound, enabling them to diagnose obstetric and gynecologic emergencies and helping them survive on-calls alone while keeping their patients safe.

Materials and Methods: We used an experimental study design to compare the confidence levels of 20 senior residents who received clinical training only to those of 25 junior residents who were enrolled in a simulation-based teaching session. We also compared the junior residents' levels of performance and confidence using transvaginal ultrasound before and after the sessions.

Results: The performance of transvaginal ultrasound by the junior residents and their confidence levels significantly improved after they attended the simulation sessions. They had higher levels of confidence than the senior residents who did not attend the session. It was also observed that the number of nondiagnostic transvaginal ultrasounds performed by the on-call resident that needed to be repeated the next day had significantly dropped.

Conclusions: Simulation-based teaching sessions are an effective method of education, which improve trainees' skills and confidence levels and improve patient safety.

Key Words: Transvaginal ultrasound; simmulation; postgraduate; residency program; high fidelty.

©AUR, 2015

With advances in computer technology, hardware, and software, ultrasound has become the modality of choice for many medical specialties, such as obstetrics and gynecology (1). Transvaginal ultrasound has been found to be the most extensively used imaging examination in this specialty (2). However, users face many difficulties in learning to use the tool as patients cannot tolerate the examination being extended because of the inexperienced operators. Additionally, training experience is limited due to the restrictions of many hospital policies (3) and the shortage of sonographers (4). The development of high–fidelity mannequins provides an educational environment that fosters training in pelvic ultrasound simulation (5).

Simulation is now a well–established educational tool that fosters the learning process of health providers. It can be defined as an artificial replication of sufficient components of the real–world situation to achieve certain goals (6). It imitates many physical appearances, medical procedures, and clinical scenarios that allow trainees to obtain the necessary knowledge or skills without the need for real patients. Simulation offers the learner opportunities to become engaged in experiential learning (7). In comparison to learning that is not experiential in nature, simulation is acknowledged to be more effective (8). Furthermore, in correlation with patient safety, simulation provides new methods of teaching error management and promoting a culture of safety. It also offers ethical benefits, increasing the precision and relevance of training as well as competency assessment (9). Transvaginal ultrasound simulation has been shown to increase the confidentiality of trainees and has the potential to replace the initial clinical training on real patients (2).

The objectives of this study are to evaluate the skill acquisition and satisfaction of junior Saudi's Radiological Residents using the newly introduced simulated session on transvaginal ultrasound to obtain anatomic landmarks of the female pelvis

TABLE 1. McGaghie Mastery Learning Conceptual Framework

Element	Action Performed
Baseline or diagnostic testing	Presession assessment was performed
Clear learning objectives, sequenced as units in increasing difficulty	The required psychomotor skill in obtaining the images of the female pelvic landmarks was clearly identified by the expertise
Engagement in educational activities (eg, skills practice, data interpretation, reading, and focused on reaching the objectives)	Simulation sessions were conducted focusing on the required skills only
A set minimum passing standard (eg, test score) for each educational unit	Each anatomic landmark is clearly identified
Formative testing to gauge unit completion at a preset minimum passing standard for mastery	Assessment within the sessions was performed with immediate feedback
Advancement to the next educational unit gave a measured achievement at or above the mastery standard	The expected common radiologic appearance of common pathology was discussed briefly in the sessions
Continued practice or study on an educational unit until the mastery standard is reached	Postsession assessment was performed after 2–3 months

and to compare its effectiveness to self-evaluations of the senior residents who have never had any simulation training.

MATERIALS AND METHODS

Context

The study was performed on the radiology residents under the Saudi Residency Program of the western region, which comprises about half of the Saudi's residents. The program's residents are divided into two types: junior and senior. Junior residents are candidates who are in the first 2 years of the program, whereas seniors are in the last 2 years. There are no major differences between the programs of different regions, as they all share the same curriculum, major educational events, and examinations. Junior residents receive 3 months of training in using ultrasound before they become seniors and receive an additional 2 months of training.

Study Design

The study is an experimental study test to evaluate the effectiveness and satisfaction of transvaginal ultrasound simulation sessions for radiology residents. Two conceptual frameworks were chosen; one for the designing of the sessions and the other for the evaluation of their outcomes. McGaghie mastery learning conceptual framework (10) is well recognized as the best practice framework for designing simulation sessions. It has seven operational elements, which are listed in Table 1. The outcome of the introduction of this educational intervention was evaluated based on the four levels of evaluation described by Kirkpatrick and Kirkpatrick (11). This framework is considered a standard practice for evaluating educational programs. The first two levels (reaction and learning) will be evaluated during the sessions by using immediate feedback from the participants in the form of a happy-face evaluation sheet after each session along with assessments before and after the sessions. The third level (behavior) was evaluated by the number of calls asking supervisors of the residents to come from home to perform transvaginal ultrasound examinations because residents did not have the confidence to do the initial scanning. This was measured during on-call times in which there was no sonographer on call. The result (the fourth level) was evaluated by checking the rate of the cases that had to be repeated due to inappropriate technique.

Formulation of the Assessment Tools

The study aims to assess the performance of junior residents' presessions and postsessions and to compare their self-assessments of satisfaction with the procedure to the self-assessments of junior residents. Three evaluation forms were generated by the authors. The first was for performance rating, the second was for self-assessment (perception of the residents of their quality in performing the procedure), and the third was for their satisfaction with performing the procedure as a daily practice. The assessment forms were developed through collaborative work between the radiology and the medical education departments at King Abdulaziz University, which has a leader in medical simulation. The performance and self-assessment forms contained a checklist with a scale from zero to nine to evaluate how correctly the residents used the transvaginal ultrasound probe to obtain standard views of the normal anatomic female pelvic structures. The satisfaction form is a checklist with a five-point Likert scale evaluating the resident's level of confidence, perceived safety level while performing the transvaginal ultrasound on real patients, satisfaction with the quality of images obtained, and with the time needed to complete the study. Piloting of the assessment forms was performed to ensure their validity. To ensure the content validity, the checklist was evaluated by four experts; two from the radiology department and two from the gynecology department. To ensure face validity, the tools of assessment