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ULTRASOUND PHANTOMS IN 3-DIMENSIONAL ENDOVAGINAL AND ENDOANAL PELVIC FLOOR IMAGING: A STEP FORWARD IN TEACHING HANDS-ON PELVIC FLOOR IMAGING TO A LARGE GROUP OF PARTICIPANTS.

Hypothesis / aims of study

The aim of this study was 1) to create pelvic floor phantoms for 3D ultrasound imaging, 2) measure reliability of four ultrasound phantoms for Anterior, Posterior, Levator ani, and Endoanal imaging, and 3) to test ultrasound workshop participants' knowledge before and after completion of structured modules using the phantoms.

Study design, materials and methods

Four ultrasound phantoms were created each with a specific function. The phantoms simulated 1) Anterior, 2) Posterior (Figure 1), 3) Levator ani, and 4) Endoanal compartments. A 40 question internet based interactive test using ultrasound images simulating normal anatomy (Figure 2) from the phantoms was administered to six 3D ultrasound imaging experts (2 UROGYN, 2 radiologists, one sonographer, and one colorectal). For each of four phantoms, the accuracy of the model was calculated by taking the correct answers by all readers and dividing them by total number of questions. For each question >67% (4/6 readers) agreement amongst experts was deemed as successful simulation of normal anatomy. The phantom specific agreement was calculated by dividing the total number of agreements by total number of questions for each phantom. Interclass coefficient was determined to assure consistency amongst readers. A full day structured course was given to 32 course participants. The course involved pelvic anatomy and ultrasound imaging lectures. The participants rotated through 10 stations, four of which were hands-on ultrasound stations utilizing phantoms, four of which were computer stations demonstrating normal 3D ultrasound anatomy in Anterior, Posterior, Levator ani, and Endoanal compartments as shown in the phantoms. The two remaining computer stations demonstrated 3D ultrasound endoanal and endovaginal pathology. A pre and post-test was administered to the participants. The test included 40 questions pertaining to four compartments tested in the phantoms, and 20 additional questions that pertained to endoanal and endovaginal pathology. Student t test was used to compare pre and post test responses. A p of 0.05 was deemed as significant.

Results

The accuracy and agreements for each phantom is reflected in Table 1. The total agreement where 4/6 readers agreed was 38/40 (95%). The total agreement where 5/6 readers agreed was 33/40 (83%). The endovaginal posterior compartment phantom performed less robustly than other phantoms. In this phantom the internal and external anal sphincter recognition had 50% agreement amongst readers. Interclass coefficient amongst the experts was 0.995 signalling significant agreement between the readers. 23/32 (72%) participants filled the questionnaire. Three participants were excluded because of incomplete questionnaires giving a 20/32 (62%) complete response rate. Mean age was 41 (25-60), all the respondents were physicians, and 16/20 (80%) were female. The majority were gynecologists with the exception of one radiologist, one urologist and one anesthesiologist. Amongst the respondents, 5/20 (25%) had prior levator ani imaging experience, 5/20 (25%) had prior urethral imaging experience, and 7/20 (35%) had prior endoanal imaging experience. The individual mean pre-test and post-test scores were 34 (SD 13) and 53 (SD 10) from possible 60 points (p=.01). The domain in which participants did not perform well on was endoanal imaging of endoanal pathology. The cumulative score for this domain rose from 104 to 140, however 5/9 questions did not show statistically significant improvement (P =0.2-0.4). Anterior, Posterior, Levator Ani, Endoanal, and Endovaginal pathology modules showed statistically significant improvements in post- test scores (P <.05).

Interpretation of results

The results of this study indicates that: 1) pelvic floor phantoms for ultrasound imaging can be made, 2) Anterior, Posterior, Levator ani, and Endoanal imaging phantoms perform reliably, 3) pelvic floor ultrasound phantoms can be utilized to teach ultrasound to a large number of participants. The participants' knowledge is enhanced after completion of structured modules using the phantoms.

Concluding message

Traditionally it has been cumbersome to teach endovaginal and endoanal sonography. The workshops involving patients or live models are expensive, embarrassing for those involved and inefficient because the participants do not obtain sufficient hands-on experience. The pelvic floor ultrasound phantoms described here remove some of the barriers to teaching 3D pelvic floor ultrasonography.

Figure 1. Endovaginal posterior compartment 3D ultrasound imaging phantom

Figure 2. Endovaginal 3D Ultrasound Anterior compartment imaging phantom. A. Transducer, B. Urethra, C. Anterior, D. Pubic bone, E. Bladder, F. Rhabdomyosphincter, G. Cephalad (Copyrighted material)

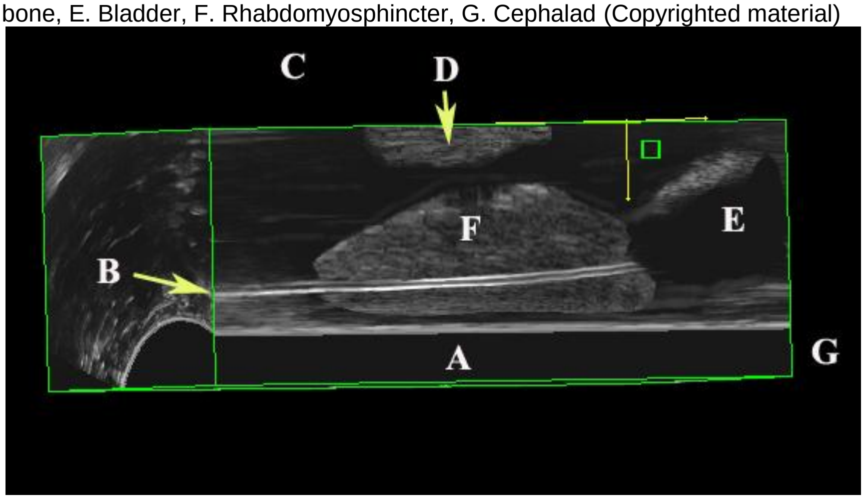

Table 1.

Phantom	Test accuracy	Agreement
Anterior	84/90 (93%)	15/15 (100%)
Posterior	59/72 (82%)	10/12 (83%)
Levator ani	36/36 (100%)	6/6 (100%)
Endoanal	38/42 (90%)	7/7 (100%)

References

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Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**The University of Oklahoma Institutional Review Board #15140**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**No**