ORIGINAL RESEARCH ARTICLE

Evaluation of the Role of Simulation Training in Nuchal Translucency Measurement

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A B S T R A C T

Introduction: Chromosomal aberrations are the most frequent and significant disorders, the forms of which vary widely. It is a well-established fact that ultrasound-based screening for chromosomal anomalies in the first trimester should include NT measurement. Study objective was to see the effect of simulation based ultrasonography training compared with conventional training only, on performance of first year radiology residents in nuchal translucency (NT) measurement.

Material and methods: This is a comparative study between two 1st year radiology residents. The study is a single center, randomized observer-blind trial. One of the resident was trained in the conventional method. The other resident received simulation based ultrasonography training (for 2 week) in NT scan. Following the training modules, both the participants performed NT scan on 100 pregnant women using Philips Affinity 50 machine. Subsequently, those images was evaluated by a blinded experienced radiologist who scored them based on specific criteria.

Results: The results showed a distinct difference in the performance of the two study participants. The participant trained in simulation fared better with higher total mean score (p value 0.009). Statistically significant difference was found between certain evaluation criteria.

Conclusion: Accurate NT measurement is a demanding process. Traditional ultrasound teaching is a time consuming process using human models, direct faculty time, and a dedicated ultrasound machine. Our study is one of the first to examine skills transfer after simulation-based ultrasound training. It demonstrates that, compared with conventional training only, simulation-based ultrasound training during residency has a better immediate impact. The study showed that the use of an ultrasound simulator is an effective instrument of learning for residents. It can have reaching impact if integrated into the teaching curriculum to supplement the conventional training.

Keywords: Nuchal Translucency, Simulation, Ultrasonography

INTRODUCTION

Chromosomal aberrations are the most frequent and significant disorders, the forms of which vary widely from the clinically silent to the ones with fatal outcome (trisomy 13,18). As the consequences for the affected families are grave, diagnosis of chromosomal anomalies has been the main aim of prenatal screening.[1]

It is a well-established fact that ultrasound-based screening for chromosomal anomalies in the first trimester should include NT measurement.[2,3] The sensitivity of this method for detecting Downs syndrome is 70-80% with a 5% rate of false positive findings.[1] The efficiency of the screening is further enhanced by use of biochemical markers, like free beta or total human chorionic gonadotropin (hCG) and pregnancy-associated plasma protein-A (PAPP-A) which raises the sensitivity to 90%.[1,4]

Most experts recommend that NT should be measured between 11 and 13+6 weeks, corresponding to a CRL measurement of between 45 and 84 mm. This is because NT as a screening test performs optimally and fetal size allows diagnosis of major fetal abnormalities, thus providing women who are carrying an affected fetus with the option of option of an early termination of pregnancy.[5]

Optimal NT implementation requires suitable equipment as well as well trainedsonologists.[6] The use of uultrasonography use is highly operator-dependent.[7] The lack of sufficient operator skills can lead to diagnostic errors that may compromise patient safety due to unnecessary tests or interventions.[8] However, ultrasound training is associated with long learning curves and is therefore time-consuming and requires extensive teaching resources.[9,10] Consequently, some residents may never acquire the basic skills and knowledge needed for independent practice.[11]

The use of simulators as educational tools for medical procedures is spreading rapidly. Recent studies of usage of ultrasound simulators have shown, that the confidence of using sonography and in image interpretation skills there were no difference in groups who have been trained using

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patient or those who have been trained using simulators.[12-14] Simulation-based medical education (SBME) has been suggested as an adjunct to early ultrasonography training[11,15-20] but there is limited evidence of skill transfer from simulation to performance.[21]

Study objective was to see the effect of simulation based ultrasonography training compared with conventional training only, on performance of first year radiology residents in nuchal translucency (NT) measurement.

MATERIAL AND METHODS

This is a comparative study between two 1st year radiology residents. The primary investigator is responsible for the selection of participants randomly using lottery chit method. The study is a single center, randomized observer-blind trial. The exclusion criteria are: any formal ultrasound training in NT scan and prior virtual-reality simulation experience. Participation is voluntary, and informed consent will be obtained from both participants. One of the resident (Candidate 1) was trained in the conventional method as followed in our department by observation of NT scans by staff radiologists for a period of 2 weeks. The other resident (Candidate 2) received simulation based ultrasonography training (for 2 week) in NT scan in the simulation Centre at Father Muller Medical college and Hospital in the presence of an instructor. The simulation sessions was of 1hour duration spread over 2 weeks. The simulation system used was Vimedix (CAE Healthcare) Simulation system which consists of a torso model mannequin, a TAS probe and a monitor. Both participants received a standardized, introductory 30minute lecture on the use of ultrasound, NT basics and measurement techniques. Following the training modules, both the participants performed NT scan on 100 pregnant women using Philips Affinity 50 machine.

The scan images and measurements obtained by both participants were saved in the ultrasound machine. If more than one measurement meeting all the criteria was obtained, the maximum one was recorded.

Subsequently, those images was evaluated by a blinded experienced radiologist who scored them based on specific criteria.

The fulfillment of the following criteria was assessed during evaluation and will be rated as follows:

1. Appropriate magnification to include only the fetal head and upper thorax in the whole screen. (0= absent 1= present).
2. Identification of the amniotic membrane separately from the fetus. (0= correct 1= incorrect).
3. The presence of the echogenic tip of the nose, (0= not seen 1= partially seen 2=optimally seen).
4. rectangular shape of the palate anteriorly, 0= not seen 1= partially seen 2=optimally seen).
5. the translucent diencephalon in the center. (0= not seen 1= partially seen 2=optimally seen).
6. Proper placement of calipers (on-on) to measure NT as the maximum distance between the nuchal membrane and the edge of the soft tissue overlying the cervical spine. (0= improper 1=proper)

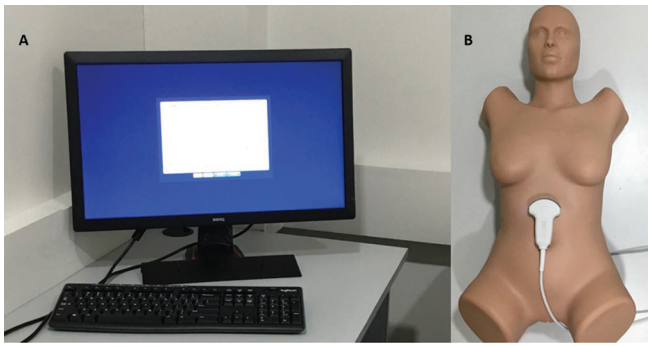

Figure-1: The Vimedix simulation monitor and Mannequin

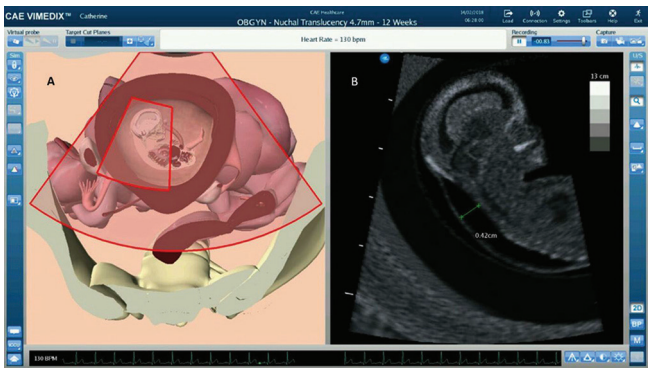

Figure-2: Representative simulation image of normal NT scan in Vimedix

The data was analyzed using Mean and Wisconsin signed rank tests.

RESULTS

A total of 2 participants were tested in this study who performed 100 NT scans each on the same pregnant women. The resident trained with simulation is denoted as candidate 1 and the resident trained in conventional method is denoted as candidate 2 in the tables 1,2.

The results showed a distinct difference in the performance of the two study participants. The participant trained in simulation fared better with higher total mean score (p value 0.009). Statistically significant difference was found between certain evaluation criteria like visualization of Diencephalon, hard palate and nasal bone.

DISCUSSION

Simulation based medical education (SBME) has proven to be effective in improving knowledge, skill and behaviour of health care professionals. Simulation has been effectively used to teach procedural skills, surgical skills and crises resource management. There is evidence of simulation being used to train individuals, teams, environments, technical factors, system factors and patient factors.[6-8]

The use of simulation teaching learning tool is known to impart learning among students through Experiential learning with reflection on action. Majority of the existing literature is from the western world who have been using simulation as a modality to teach, assess, for research. The Medical Council of India (MCI) has proposed its new Competency Based Medical Education (CBME) with

Participant	Mean	STD	WilcoxonSigned Rank Test (z value)	25 th	50th	75th
1 (Simulation)	**8.9**	2.2	2.609	7.00	8.50	11.25
2 (conventional)	**4.4**	2.6		2.000	4.0	7.0

Table1: Overall mean scores of the participant 1(trained in simulation) and participant 2(trained in conventional method). Pvalue0.09

PARAMETER	Median	25th CENTILE	75th CENTILE	Wilcoxonsigned rank test z value	p value
DIENCEPHALON 1 2	 1.00 0.00	 0.75 0.00	 2.00 1.00	-2.305	**0.02**
HARD PALATE 1 2	 1.50 0.50	 1.00 0.00	 2.00 1.00	-2.428	**0.01**
NASAL BONE 1 2	 1.00 0.00	 1.00 0.00	 2.00 1.00	-2.126	**0.03**
CORRECT NT IDENTIFICATION 1 2	 2.00 1.00	 1.00 0.75	 2.00 2.00	-1.897	0.05
CALIPER PLACEMENT 1 2	2.00 2.00	2.00 1.00	2.00 2.00	-1.633	0.10
IMAGE ZOOM 1 2	 2.00 0.00	 0.75 0.00	 2.00 1.25	-1.732	0.08

Table-2: Mean scores of individual parameters between the two participants; 1= Candidate 1 2= Candidate 2

Attitude, ethics and communication (AETCOM) module from August 2019 for all undergraduate and postgraduate curriculum. For CBME to be implemented skills and simulation centres will play a vital role in achieving mastery level.

Accurate NT measurement is a demanding process requiring sufficient time, clinical practice and experience. Traditional ultrasound teaching is a time consuming process using human models, direct faculty time, and a dedicated ultrasound machine. Our study one of the first to examine skills transfer after simulation-based ultrasound training. The limitations of the study is that it compares the performance of only two individuals rather than catering to a wider spectra.[9-11]

CONCLUSION

Our study demonstrates that, compared with conventional training only, simulation-based ultrasound training during residency has a better immediate impact. The study showed that the use of an ultrasound simulator is an effective instrument of learning for residents. It can have reaching impact if integrated into the teaching curriculum to supplement the conventional training.

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