The Clinical Usefulness of Volume NT™ Using Three-dimensional (3D) Ultrasound (US)

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INTRODUCTION & OBJECTIVES

Nuchal translucency (NT) is a highly sensitive screening tool for both fetal aneuploidy and congenital structural anomalies including congenital heart defects; it is gaining in popularity and acceptance among both patients and clinicians.¹ In combination with maternal serum, PAPP-A and free beta-hCG, increased NT have been demonstrated to provide efficient Down's syndrome risk assessment, with a detection rate of 80-87% (5% false-positive rate), and it also allows earlier diagnosis of fetal aneuploidy.²⁻³

A correct NT measurement is determined by the quality of the image, the magnification, the angle of insonation, the B-mode image (gray scale) settings, and proper placement of the calipers.⁴ Simple errors in measurement may have a significant effect on risk assessment. Therefore, to preserve the high efficacy of NT as a risk assessment tool, the ability and accuracy of operators in order to acquire a reliable measurement of NT is important.⁵

In this study, we used three-dimensional (3D) ultrasound (US) for the detection of the mid-sagittal section. The purposes of this study are to evaluate the clinical usefulness of semi-automated measurement of NT using 3D US and to investigate whether the clinical experience of the operators has an effect on the accuracy of the measurement of NT.

METHODS

Between July and November 2010, ultrasound examination was performed on 107 pregnant patients at 11-13⁺⁶ weeks' gestation. Two experienced operators participated in this study. Each operator manually measured the nuchal translucency and also automatically using Volume NT™ software. One inexperienced operator then examined 10 of the pregnant patients. Each operator was blinded to any pre-existing measurements, all of which had been acquired trans-abdominally using an Accuvix V20 Prestige v2.03 with the V4-8 probe (Samsung Medison Co., Ltd, Seoul, Korea).
The identical protocol was performed by each operator. Manual measurement of the NT was performed according to the FMF guidelines.

Automatic measurement of the NT with Volume NT™ from on to on of the two echogenic lines delineating the nuchal translucency, is demonstrated in Figure 1.

In an approximated, mid-sagittal section determined by conventional B-mode ultrasound, the operator pressed on the Volume NT button, after which the 3D volume data was obtained by a sweep of the transducer. When the most representative mid-sagittal section appeared, the operator placed the ROI box in the nuchal area and the scanner automatically selected the best measurement. The upper caliper was then placed automatically on the inner border of the upper echogenic line. The lower caliper was then placed automatically on the inner border of the lower echogenic line (on to on measurement).

The nuchal translucency was measured using 2D harmonic, 2D non-harmonic, 3D harmonic, and 3D non-harmonic US. Three attempts were made to obtain each nuchal translucency measurement (for a total of twelve measurements per patient). The mean and maximum of both the two- and three-dimensional measurements were then compared. The intraclass correlation coefficient (ICC) was used to assess the reliability and repeatability.

RESULTS

1. The correlation coefficient for the max 2D and 3D harmonic measurements was 0.847 ($p < .001$); for the max 2D and 3D non-harmonic measurements it was 0.887 ($p < .001$) (Fig. 2).

2. The nuchal translucency using three-dimensional ultrasound was significantly greater than that using two-dimensional ultrasound (Table 1).

3. The intra-operator repeatability was assessed using intraclass correlation coefficients (ICC) varying from 0.941 to 0.967 for the experienced operators (Table 2).

4. The inter-operator difference in nuchal translucency for the experienced operator and the inexperienced operator was significant using two-dimensional ultrasound ($0.072 \pm 0.081$ vs. $0.131 \pm 0.065$, $p = 0.023$), unlike that using three-dimensional ultrasound ($0.191 \pm 0.106$ vs. $0.166 \pm 0.071$, $p = 1.0$) (Table 3).
In this study, the results of the measurements were highly correlated. However, a significant difference in the means and the max between the 2D and 3D results was observed. This suggests that the Volume NT™ provides a more accurate, mid-sagittal section and detects the deepest pocket of NT.

The intra- and inter-operator reproducibility of Volume NT™ is high. Therefore, automation of the nuchal translucency measurement may substantially reduce the within and between operator variation in the measurement of NT achieved using the traditional, manual approach. In particular, it may be useful for inexperienced operators in order to improve the intra- and inter-operator reliability.

**REFERENCES**


