Comparative Studies of Two Dimensional and Three Dimensional Ultrasonic Nuchal Translucency in Trisomy Assessments

LAI KWEE1,2, HUM Y. CHAI2, SHARUL R. BIN SAMSURY2, NAIZAITHULL F. BINTI MUJAMIL2 and EKO SUPRIYANTO1,2

1Biotechnology Research Alliance, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
2Department of Clinical Science and Engineering, Faculty of Health Science and Biomedical Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
3Materials and Manufacturing Research Alliance, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia

Manuscript received on June 29, 2011; accepted for publication on March 5, 2012

ABSTRACT

Current two-dimensional (2D) ultrasonic marker measurements are inherent with intra- and inter-observer variability limitations. The objective of this paper is to investigate the performance of conventional 2D ultrasonic marker measurements and proposed programmable interactive three-dimensional (3D) marker evaluation. This is essentially important to analyze that the measurement on 3D volumetric measurement possesses higher impact and reproducibility vis-a-vis 2D measurement. Twenty three cases of prenatal ultrasound examination were obtained from collaborating hospital after Ethical Committee’s approval. The measured 2D ultrasonic marker is Nuchal Translucency or commonly abbreviated as NT. Descriptive analysis of both 2D and 3D ultrasound measurement were calculated. Three trial measurements were taken for each method. Both data were tested with One-Sample Kolmogorov-Smirnov Test and results indicate that markers measurements were distributed normally with significant parametric values at 0.621 and 0.596 respectively. Computed mean and standard deviation for both measurement methods are 1.4495 ± 0.46490 (2D) and 1.3561 ± 0.50994 (3D). ANOVA test shows that computerized 3D measurements were found to be insignificantly different from the mean of conventional 2D at the significance level of 0.05. With Pearson’s correlation coefficient value of R = 0.861, the result proves strong positive linear correlation between 2D and 3D ultrasonic measurements. Reproducibility and accuracy of 3D ultrasound in NT measurement was significantly increased compared with 2D B-mode ultrasound prenatal assessment. 3D reconstructed imaging has higher clinical values compare to 2D ultrasound images with less diagnostics information.

Key words: three dimensional (3D), ultrasound, nuchal translucency (NT), fold thickness, Trisomy, Down Syndrome.

INTRODUCTION

Medical literature has proven that a fetus with congenital disease such as Down syndrome, heart disease and bone disease will have thicker transparent layer of subcutaneous fetal neck or called Nuchal Translucency. The term Nuchal Translucency was termed by Nicolaides KH, pioneer in prenatal Trisomy 21 early assessment at Fetal Medicine Foundation (FMF), UK (Nicolaides et al. 1992). The formation of this transparent layer