Creation and Validation of the Singapore Birth Nomograms for Birth Weight, Length and Head Circumference Based on a 12-year Birth Cohort

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Abstract

Introduction: Both gestation and birth weight have significant impact on mortality and morbidity in newborn infants. Nomograms at birth allow classification of infants into small for gestational age (SGA) and large for gestational age (LGA) categories, for risk stratification and more intensive monitoring. To date, the growth charts for preterm newborn infants in Singapore are based on the Fenton growth charts, which are constructed based on combining data from various Western growth cohorts. Hence, we aim to create Singapore nomograms for birth weight, length and head circumference at birth, which would reflect the norms and challenges faced by local infants. Materials and Methods: Growth parameters of all babies born or admitted to our unit from 2001 to 2012 were retrieved. Following exclusion of outliers, nomograms for 3 percentiles of 10th, 50th, and 90th were generated for the gestational age (GA) ranges of 25 to 42 weeks using quantile regression (QR) combined with the use of restricted cubic splines. Various polynomial models (second to third degrees) were investigated for suitability of fit. The optimum QR model was found to be a third degree polynomial with a single knotted cubic spline in the mid-point of the GA range, at 33.5 weeks. Check for goodness of fit was done by visual inspection first. Next, check was performed to ensure the correct proportion: 10% of all cases fall above the upper 90th percentile and 10% fall below the lower 10th percentile. Furthermore, an alternative formula-based method of nomogram construction, using mean, standard deviation (SD) and assumption of normality at each gestational age, was used for counterchecking. Results: A total of 13,403 newborns were included in the analysis. The new infant-foetal growth charts with respect to birth weight, heel-crown length and occipitofrontal circumference from 25 to 42 weeks gestations with the 10th, 50th and 90th were presented. Conclusion: Nomograms for birth weight, length and head circumference at birth had significant impact on neonatal practice and validation of the Singapore birth nomograms against Fenton growth charts showed better sensitivity and comparable specificity, positive and negative predictive values.


Key words: Fenton, Percentile, Prematurity, Preterm growth charts, Very low birth weight

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