

Prediction of the state of the newborn by mathematical analysis of the fetal heart rate deceleration

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This study was undertaken in order to determine a set of parameters describing the fetal heart rate (FHR) decelerations, to ensure optimal prediction of one and five minute Apgar scores. The population studied included 50 patients with high risk pregnancies. Different types of decelerations areas as well as different time dependent parameters of deceleration were measured. We analysed 37 parameters in five time periods (10, 20, 30, 60 and 120 minutes) immediately preceding delivery (1). Mathematical evaluation was made by computing the linear and the third degree correlations as well as multidimensional analysis. The optimal set of deceleration parameters was chosen using the method of Hellwig (2).

Optimal set of parameters, describing in the best way the variability of the Apgar score includes: 1. the mean value of the coefficient of recuperation, defined as the ratio of the time between the minimum of the deceleration and the end of the deceleration to the amplitude of the deceleration, 2. the sum of the recuperation areas and 3. the mean value of the residual areas.

The maximal values of the multidimensional coefficients of regression between Apgar scores and the set of the deceleration parameters were 0.66 and 0.68 for scores at one and at five minutes ($p \leq 0.001$). These values are reached for the optimal set of the deceleration parameters measured for all deceleration from 30 minutes preceding delivery. The corresponding values for linear and third degree correlations were respectively -0.50 and 0.54 for first minute and -0.49, 0.55 for fifth minute.

Assuming that the values of Apgar score smaller than 7 characterized a bad state of the neonate, whereas the values equal or greater than 7 a good one, we estimated the accordance between the values calculated and these given by a

pediatrician. It was 84% for one minute Apgar score and 90% for five minute Apgar score. The mean error of the prediction (difference between values estimated and calculated) for one minute Apgar score was 1.02 ± 1.03 and 0.68 ± 0.79 for five minute Apgar score.

We hope, that including other parameters from the FHR pattern, would make it possible to improve the prediction of the state of the neonate.

Bibliography

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