The SisPorto automated analysis

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Computer analysis of cardiotocograms provides a reproducible and quantifiable interpretation of FHR tracings, and may have particular advantages in the evaluation of parameters that are difficult to analyse by the human eye, such as short- and long-term variability. It also allows for an easier and non-degradable storage of tracings, an aspect that has the potential to reduce the methods' costs.

After preliminary evaluation of the SisPorto prototype, a more user-friendly version was developed (SisPorto® 2.0) with the objective of performing a wide scale evaluation of the system. This version is able to perform on-line analysis of antepartum and intrapartum tracings from single and twin gestations. As a preliminary evaluation of the program, the assigned FHR baseline was compared with that estimated by a consensus of three clinicians in 150 antepartum and 150 intrapartum tracings. An excellent overall agreement was found (kappa=0.82, 95%CI 0.78-0.87), but this was significantly higher in the antepartum (kappa=0.94, 95%CI 0.87-1.00) than in the intrapartum (kappa=0.71, 95%CI 0.65-0.78), and some relevant disagreements were found in the latter.

SisPorto® 2.0's capacity to predict neonatal outcome was studied in a multicentre validity study, involving 14 centres in Europe and Australia. A total of 345 antepartum and 241 intrapartum cases were selected after exclusion of fetal malformations, multiple pregnancies, tracings with less than 30 minutes or more than 15% signal loss. Specific criteria were adopted in order to minimise the interval between FHR monitoring and delivery. In the antepartum, all cases were delivered by caesarean section in the absence of labour, within 4 hours of FHR monitoring. Difficult fetal extractions and anaesthetic complications were considered exclusion criteria. In the intrapartum, all cases were monitored until the 5 minutes preceding vaginal delivery birth or the 30 minutes before caesarean birth. Internal FHR monitoring was considered necessary during the second stage of labour and cases with anaesthetic complications, difficult caesarean extraction or shoulder distocia were excluded.

In antepartum cases, parameters related with the quantification of accelerations and variability showed a good discriminative capacity to predict 1-min Apgar score (areas under the ROC curve 0.96-1.00), 5-min Apgar score (areas under the ROC curve 0.81-0.89) and hypoxic-ischemic encephalopathy (100% sensitivity) but not umbilical artery acidemia. In the intrapartum, none of the cardiotocographic parameters, evaluated individually, allowed for an adequate prediction of neonatal outcome. Combinations of parameters provided more promising results (50% sensitivity, 94% specificity in prediction of 1-min Apgar score ≤4), but this path was not pursued further as important shortcomings were found in some aspects of SisPorto® 2.0' analysis.

Based on the results obtained in these studies, an optimisation of the system's algorithms for baseline estimation, detection of decelerations and evaluation of mean variability was performed and this experience was integrated into a version developed for clinical application (SisPorto® 3.0 – multichannel). The latter allows the simultaneous on-line monitoring and automated analysis of nine patients on the same computer screen.