

sonicaid™ FetalCare

Bibliography:



Street et al. (1991)

Street P, Dawes GS, Moulden M, Redman CWG "Short-term variation in abnormal antenatal fetal heart rate records." American Journal of Obstetrics & Gynecology, September 1991, 165(3):515-523.

*** Retrospective UK study in which numerical analysis of 7,396 antepartum recordings from 2,582 high-risk pregnancies identified 78 fetuses with LTV<20ms in at least one recording. In this group there were 9 intrauterine or neonatal deaths and 8 fetuses with metabolic acidemia at delivery, as defined by an umbilical artery pH < 7.12 and a base deficit > 12mmol/L. However, LTV failed to detect terminal recordings in which a slow sinusoidal rhythm was superimposed on an otherwise flat FHR trace. A new index of FHR variability called STV was therefore investigated and shown to be strongly correlated with LTV. The ratio of STV to LTV averaged over 3,074 recordings was 0.183±0.024 (mean±SD) and this can be used to calculate the expected value of STV given the LTV. It was then shown that STV > 2 SDs below its expected value is indicative of a sinusoidal rhythm. The authors conclude that STV is a better predictor of intrauterine death or metabolic acidemia at delivery.*

Schneider et al. (1991)

Schneider E, Schulman H, Farmakides G, Paksima S "Comparison of the interpretation of antepartum fetal heart rate tracings between a computer program and experts." Journal of Maternal-Fetal Investigation, 1991, 1:205-208.

*** US study of 20 antepartum recordings analysed by System 8000 and visually assessed by three independent observers who then gave their recommendations for management. The interval between recording and delivery was two weeks or less. 12 recordings had normal outcome and 8 had abnormal outcome, including one case of fetal acidemia and one fetal death due to abruptio placentae. Inter-observer agreement was 35% for CTG interpretation and 40% for management recommendations. Only System 8000 successfully differentiated normal and abnormal outcomes.*

Blumofe et al. (1992)

Blumofe KA, Broussard PM, Walla CA, Platt LD "Computerized versus visual analysis of fetal heart rate – a reduction in testing time." American Journal of Obstetrics & Gynecology, January 1992, 166(1, Pt 2):415.

** US study comparing System 8000 analysis of 152 antepartum recordings from 81 high-risk pregnancies with visual assessment. The authors conclude that while both methods perform comparably, System 8000 reduces monitoring time from a mean of 35 minutes using visual assessment to a mean of 16 minutes using System 8000.*

Dawes et al. (1992a)

Dawes GS, Moulden M, Redman CWG "Short-term fetal heart rate variation, decelerations, and umbilical flow velocity waveforms before labour." *Obstetrics & Gynecology*, October 1992, 80(4):673-678.

** UK study of 15,702 antepartum recordings from 3,563 high-risk pregnancies and 2,441 umbilical artery Doppler velocimetry waveforms from 991 of these women. Analysis of the antepartum recordings by System 8000 identified 89 fetuses with STV \geq 3ms in at least one recording. These fetuses either died in utero or were delivered by caesarean section without labour, whereupon umbilical artery blood gas analysis was performed. 34% of the fetuses with STV $<$ 2.6ms in the last recording either died in utero or had metabolic acidemia on delivery, as defined by an umbilical artery base deficit $>$ 12mmol/L. Results also revealed that a reduction in STV is superior to decelerations as a predictor of outcome and a more comprehensive measure of fetal compromise than umbilical artery Doppler velocimetry, which only detects fetal compromise due to impairment of umbilical blood flow.*

Dawes et al. (1992c)

Dawes GS. "Computerized measurement of fetal heart rate variation antenatally and in labour." In: Bonnar J, editor. *Recent Advances in Obstetrics and Gynaecology*, Volume 17, London: Churchill Livingstone; 1992, pp.57-68.

Schneider et al. (1992)

Schneider EP, Schulman H, Farmakides G, Chan L "Clinical experience with antepartum computerized fetal heart rate monitoring." *Journal of Maternal-Fetal Investigation*, 1992,2:41-44.

** Authors report their experience with using System 8000 to analyse 3,006 antepartum recordings from 1,000 women and conclude that System 8000 should receive widespread consideration.*

Hiatt et al. (1993)

Hiatt AK, Devoe LD, Youssef A, Gardner P, Black M "A comparison of visual and automated methods of analyzing fetal heart rate tests." *American Journal of Obstetrics & Gynecology*, May 1993, 168(5):1517-1521.

*** US study comparing System 8000 analysis of 575 antepartum recordings from high-risk pregnancies at 28–42 weeks gestation with visual assessment by two observers (Hiatt and Devoe). This revealed good agreement between System 8000 and the visual consensus for normal recordings but poor agreement for abnormal recordings, although abnormal outcomes were predicted by both methods with similar accuracy. System 8000 would have led to additional tests or intervention in 9% of the recordings compared with 49% of the recordings using visual assessment. Nine recordings would have led to intervention based on their System 8000 analysis, although these were only recommended for additional tests using visual assessment. Five subsequently underwent caesarean deliveries with one neonatal death. Visual assessment would have led to intervention in two recordings, both of which progressed to normal vaginal deliveries of viable infants without complications. Neither recording would have led to intervention based on its System 8000 analysis.*

Weiner et al. (1994b)

Weiner Z, Farmakides G, Schulman H, Kellner L, Plancher S, Maulik D "Computerized analysis of fetal heart rate variation in post term pregnancy – prediction of intrapartum fetal distress and fetal acidosis." American Journal of Obstetrics & Gynecology, October 1994, 171(4):1132-1138.

*** US study in which System 8000 was used to analyse 610 antepartum recordings from 337 post-term pregnancies. Results revealed that LTV is superior to both amniotic fluid index and umbilical artery Doppler velocimetry at predicting fetal distress during labour and fetal acidosis at delivery.*

Burch (1994)

Burch D "Computerised measurement of fetal heart rate variation in a case of fetomaternal haemorrhage." British Journal of Obstetrics & Gynaecology, December 1994, 101(12):1089-1090.

*** UK case report of a 30 year-old woman who presented at 31 weeks gestation with absent fetal movements. Visual assessment of a 60-minute recording concluded that the recording was normal and this was supported by Doppler velocimetry of the umbilical artery, which was also normal. However, computerised analysis using a System 8002 prototype revealed an STV of only 2.4ms and fetal compromise was subsequently confirmed by cordocentesis. Analysis of maternal blood following delivery by caesarean section revealed 3% of the red blood cells to be of fetal origin, consistent with a fetomaternal transfusion of 150ml. The author concludes that computerised FHR analysis can detect reductions in FHR variation not noticed by visual assessment and thus alert the clinician to otherwise unsuspected fetal compromise.*

Dawes et al. (1994)

Dawes G, Meir YJ, Mandruzzato GP "Computerized evaluation of fetal heart rate patterns." Journal of Perinatal Medicine, 1994, 22(1):491-499.

*** Excellent description of System 8000 and its clinical validation.*

Farmakides and Weiner (1995)

Farmakides G, Weiner Z "Computerized analysis of the fetal heart rate." Clinical Obstetrics & Gynecology, March 1995, 38(1):112-120.

*** Excellent review of the literature on computerised FHR analysis and System 8000 in particular, including comparisons with visual assessment and correlations with fetal status. The authors conclude that computerised FHR analysis resolves many of the problems associated with visual assessment.*

Devoe (1996)

Devoe LD "Computerized fetal heart rate analysis and neural networks in antepartum fetal surveillance." Current Opinion in Obstetrics & Gynecology, April 1996, 8(2):119-122.

*** Excellent review of the literature on computerised FHR analysis and System 8000 in particular.*

Dawes et al. (1996)

Dawes GS, Moulden M, Redman CWG "Improvements in computerized fetal heart rate analysis antepartum." *Journal of Perinatal Medicine*, 1996, 24(1):25-36.

*** Excellent description of System 8002.*

Nijhuis et al. (1998)

Nijhuis IJM, ten Hof J, Mulder EJH, Nijhuis JG, Narayan H, Taylor DJ, Westers P, Visser GHA "Numerical fetal heart rate analysis – nomograms, minimal duration of recording and intrafetal consistency." *Prenatal and Neonatal Medicine*, 1998, 3(): 314-322.

Bracero et al. (1999)

Bracero LA, Morgan S, Byrne DW "Comparison of visual and computerized interpretation of nonstress test results in a randomized controlled trial." *American Journal of Obstetrics & Gynecology*, November 1999, 181(5 part 1):1254-1258.

*** US study in which 404 antepartum recordings were randomly assigned for either visual assessment or System 8000 analysis and the results compared against perinatal outcome. This revealed that analysis by System 8000 results in shorter recordings and significantly fewer referrals for additional tests (biophysical profiles). The morbidity rate was slightly lower using System 8000, as was the number of admissions to, and average length of stay in, the neonatal intensive care unit. In women with diabetes the morbidity rate was 26.3% using visual assessment and 17.4% using System 8000. Without diabetes the morbidity rate was 6.1% using visual assessment and 1.9% using System 8000. There were two perinatal deaths in the visual assessment group and none in the System 8000 group. In the latter group 2 of the 7 recordings for which the Dawes/Redman criteria were not met had LTV<20ms and underwent caesarean delivery without labour. Umbilical artery blood gas analysis revealed that both fetuses had acidosis (arterial pH < 7.20). A limitation of the study is that recordings were not allowed to continue beyond 40 minutes, whereas up to 60 minutes may be required to differentiate a non-reactive recording from an episode of quiet sleep. Despite this the authors were able to conclude that their results support the hypothesis by Hiett et al. (1993) that visual assessment leads to five times as many additional tests or interventions as System 8000.*

Tincello et al. (2001)

Tincello D, White S, Walkinshaw S "Computerised analysis of fetal heart rate recordings in maternal type I diabetes mellitus." *British Journal of Obstetrics & Gynaecology*, August 2001, 108(8):853-857.

*** Prospective UK study comparing System 8002 analysis of 131 recordings from 26 women with insulin-dependent (type I) diabetes mellitus at 28–39 weeks gestation with published System 8002 results for normal pregnancies. Results confirm the work by Tincello et al. (1998) that fetuses of diabetic women have significantly fewer episodes of high variation although this is not related to abnormal outcome and thus cannot be regarded as pathological. The authors conclude that STV appears to remain a valid indicator of fetal well-being in diabetic pregnancies.*

Roberts et al. (2001)

Roberts D, Kumar B, Tincello D, Walkinshaw S "Computerised antenatal fetal heart rate recordings between 24 and 28 weeks of gestation." *British Journal of Obstetrics & Gynaecology*, August 2001, 108(8):858-862.

*** UK study in which System 8000 analysis of 60-minute recordings from 112 normal pregnancies at 24–28 weeks gestation revealed that STV, the number of accelerations, and the duration of episodes of high variation all increase with gestation, although no relationship was found between basal heart rate and gestation. Episodes of high variation were absent in 13% of the recordings although this was not related to abnormal outcome. The authors conclude that the absence of accelerations and/or episodes of high variation in early gestation is not abnormal, and further conclude that STV appears to be a valid indicator of fetal well-being in early gestation.*

Hecher et al. (2001)

Hecher K, Bilardo CM, Stigter RH, Ville Y, Hackeloer BJ, Kok HJ, Senat MV, Visser GHA "Monitoring of fetuses with intrauterine growth restriction – a longitudinal study." *Ultrasound in Obstetrics & Gynecology*, December 2001, 18(6):564-570.

*** Prospective multicentre study of 93 growth-restricted fetuses at 24–34 weeks gestation in which each patient was monitored on at least three occasions and the last occasion was less than 24 hours prior to delivery or intrauterine death. Each monitoring session involved System 8002 analysis of an FHR recording, Doppler blood flow velocity waveforms, and calculation of the amniotic fluid index. The authors conclude that in severely premature (<32 weeks) fetuses STV and ductus venosus pulsatility index reflect acute changes in fetal condition and are important indicators for the optimal timing of delivery. They add that delivery should be considered if either of these parameters becomes persistently abnormal.*

Pardey et al. (2002)

Pardey J, Moulden M, Redman CWG "A computer system for the numerical analysis of nonstress tests." *American Journal of Obstetrics & Gynecology*, May 2002, 186(5):1095-1103.

*** The development and clinical validation of Sonicaid FetalCare is reviewed and recent improvements are reported.*

