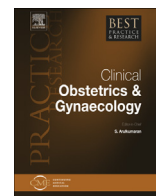




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Computer analysis of foetal monitoring signals



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Five systems for computer analysis of foetal monitoring signals are currently available, incorporating the evaluation of cardiotocographic (CTG) or combined CTG with electrocardiographic ST data. All systems have been integrated with central monitoring stations, allowing the simultaneous monitoring of several tracings on the same computer screen in multiple hospital locations. Computer analysis elicits real-time visual and sound alerts for health care professionals when abnormal patterns are detected, with the aim of prompting a re-evaluation and subsequent clinical action, if considered necessary. Comparison between the CTG analyses provided by the computer and clinical experts has been carried out in all systems, and in three of them, the accuracy of computer alerts in predicting newborn outcomes was evaluated. Comparisons between these studies are hampered by the differences in selection criteria and outcomes. Two of these systems have just completed multicentre randomised clinical trials comparing them with conventional CTG monitoring, and their results are awaited shortly. For the time being, there is limited evidence regarding the impact of computer analysis of foetal monitoring signals on perinatal indicators and on health care professionals' behaviour.

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Introduction

The development of computer analysis of foetal heart rate (FHR) and uterine contraction signals began in the 1980s [1–4], in an attempt to overcome the well-demonstrated subjectivity of visual analysis [5–7]. The first of these systems was only suitable for the analysis of antepartum cardiotocography (CTG) [1], where reduced baseline instability, limited signal loss and artefacts and smaller tracing length pose much lesser challenges for signal processing and algorithm development.

Over the last two decades, several systems have been developed for the analysis of intrapartum signals, and many of them have been commercialised, usually in association with foetal central monitoring stations [8]. Continued improvements in computer memory and processing speed have allowed real-time display and analysis of several tracings on the same computer screen, usually for the whole labour ward. Systems have also incorporated real-time visual and sound alerts for the health care professionals, based on the results of computer analysis, in order to raise attention to specific findings, thus promoting tracing re-evaluation and subsequent intervention, if considered necessary.

In this article, we provide an overview of the existing systems for computer analysis of foetal monitoring signals, with particular emphasis on the published research conducted to evaluate them (Table 1).

IntelliSpace Perinatal® (Philips Healthcare®, Eindhoven, the Netherlands)

Housing a central foetal monitoring station that was previously called OBTraceVue, this obstetric database system was developed by Philips Medical® in collaboration with the Department of Obstetrics and the Laboratory of Computer Science of the Massachusetts General Hospital, MA, USA. In addition to the foetal monitoring software, there is an electronic patient database for all aspects of obstetric care.

For foetal monitoring, computer algorithms detect changes in baseline, variability, accelerations and number and type of decelerations and contractions, using criteria based on the National Institute of Child Health and Human Development (NICHD) guidelines [9]. Alarms are elicited for foetal tachycardia, bradycardia, signal loss, abnormal variability, decelerations and detection of coincidences between foetal and maternal heart rates (Fig. 1). (http://www.healthcare.philips.com/main/products/patient_monitoring/products/intellispace_cca/obstetrics/. Accessed 3 December 2014.)

Table 1

Current systems for computer analysis of fetal monitoring signals, with a brief description of the display of other data, alerts, guidelines used to develop the algorithms and published research evaluating their performance. STV = short-term variability, LTV = long-term variability, NICHD = the National Institute of Child Health and Human Development, FIGO = International Federation of Obstetrics and Gynecology.

System	Display of other Data	Real-time alerts	FHR guidelines	Refs.
IntelliSpace Perinatal® (Philips Healthcare®, Eindhoven, the Netherlands)	Maternal vital signs, electronic partogram, ST events	Fetal tachycardia, bradycardia, signal loss, abnormal variability, decelerations	NICHD	[10]
Omniview-SisPorto® (Speculum®, Lisbon, Portugal)	Maternal vital signs, electronic partogram, foetal oxymetry, ST events	Combined CTG + ST colour- coded alerts: blue, yellow, orange and red	FIGO and STAN	[2,11,12, 15–19]
PeriCALM™ (LMS Medical systems, Montreal, Canada and PeriGen, Princeton, USA)	Maternal vital signs, electronic partogram	Colour-coded FHR alerts: blue, yellow, orange and red	NICHD	[3,20–22]
INFANT® (K2 Medical Systems™, Plymouth, UK)	Maternal vital signs, electronic partogram, FBS	Colour-coded FHR alerts: blue, yellow and red	—	[4,23,24]
Trium CTG Online® (Trium Analysis Online GmbH, Munich, Germany)		Baseline changes, reduced variability, decelerations and signal loss	FIGO	[25,26]

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