

FETAL HEART MONITORING IN LABOUR: FROM PINARD TO ARTIFICIAL INTELLIGENCE

Evaluating the fetal heart activity during pregnancy and delivery has been the focus of interest for generations of obstetricians and midwives. Jacques Le Jumeau de Kergardec (1787-1877), a French obstetrician, is accredited for the first detailed description, in 1822, of the fetal heart sounds (Whitfield, *Ulster Med J.* 1966;35:1:75-82). It took nearly another century for obstetricians to establish a relationship between fetal bradycardia and poor fetal outcome.

One of the oldest known tools used to listen to the fetal heart rate is the stethoscope and Adolphe Pinard (1844-1934), another French obstetrician, is credited for having designed in 1895, a stethoscope still regularly used, primarily by midwives, in many European countries and in most developing countries (Byaruhanga et al., *BMJ open.* 2015;5:1:e006867). The trumpeted-shaped Pinard horn, formally called a fetoscope, is made of wood or metal which transmits efficiently the sound made by the fetal heart to the listener's ear. It allows intermittent assessment of the fetal heart rate and it is used mainly during labour to detect fetal bradycardia.

In 1906, Max Cremer (1865-1935), a German Physiologist, used a galvanometer to obtain the first recording of electric fetal heart activity (Whitfield, *Ulster Med J.* 1966;35:1:75-82). This was obtained indirectly by placing an electrocardiogram lead on a maternal limb. In 1938, George H. Bell, a physiologist and obstetrician from Glasgow, described a valve electrocardiograph using two metal electrodes placed over the uterine fundus and the above the pubis, respectively (Bell GH, *J Obstet Gynaecol Br Emp.* 1938;45:802-809). His "apparatus" produced the best recording made up to that time (Figure 1).

The development of the modern cardiotocograph (CTG), which allows the continuous recording of both fetal heart rate and uterine activity, is the result of 40 years of medical engineering research. The CTG was first introduced into maternity care in the late 1960s and is now routinely used for fetal assessment before and during labour. Since its introduction, there has been a constant professional debate on its efficacy. In particular, CTG has a relatively low specificity for identifying fetal hypoxia and associated complications, which can be attributed in part to the variability in interpretation of fetal heart rate traces. (Lutomski JE et al., *Cochrane Database Syst Rev.* 2015;4:CD010708). Standardized nomenclatures for use in interpreting CTG recordings have been issued by most professional organizations over the last decade. However, as highlighted by Ugwumadu et al (*BJOG.* 2015), there is still a need to optimize and enforce training in interpretation of intrapartum CTG.

One proposed solution to address the issue of human variability in the interpretation of the CTG has been the development of digital computer-based expert systems (Lutomski JE et al., *Cochrane Database Syst Rev.* 2015;4:CD010708). However, so far only a couple of trials comparing computerised CTG to intermittent auscultation have been performed and are underpowered to reach any conclusions. Within this context, the old Pinard

stethoscope has still a role to play for the vast majority of women in this world who deliver in low resources countries.

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Disclosure of interests

We declare no conflicts of interest.

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Fig 1: Tracing of three fetuses at term obtained by GH Bell in 1937. The arrows indicate the fetal heart activity (deflection) from which, he calculated the fetal heart rate. M indicates the maternal heart activity.

