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Robinson's crown–rump length curve: a major step towards human embryonic health evaluation

NIEK EXALTO AND **ERIC AP STEEGERS**, ERASMUS MEDICAL CENTRE, ROTTERDAM, THE NETHERLANDS

Huch P. Robinson was the first to publish on crown–rump length (CRL) under 'preliminary communications' (*BMJ* 1973;4:28–31). This was only 10 years after Ian Donald introduced ultrasound and the full bladder technique in obstetrics and gynaecology. For his study in Glasgow, Robinson used a Diasonograph NE 4102 (Nuclear Enterprises), a so-called mechanical sector B-scan. This was a 'black and white' scan, before the introduction of greyscale and long before real-time ultrasound. A total of 214 examinations were performed on 80 women (between 6 and 14 weeks of gestation) with certain dates of the last menstrual period and a regular menstrual cycle. In 20 cases of embryonic death, the 'in utero' CRL was compared with 'in vivo' measurements directly after the miscarriage. A highly significant correlation between these values was observed.

Two years later, in 1975, Robinson and Fleming published their revised CRL curve based on 334 measurements, critically evaluating potential sources of random errors (*Br J Obstet Gynaecol* 1975;82:702–10). These sources included operator judgement, machine settings and measurement from photographs, which was the common procedure in those days. The precision of Robinson's measurements is remarkable in the light of the tremendous improvement of the technique since 1975 (Figure 1). It is furthermore amazing that the Robinson Curve has been chosen as one of the four studies with the highest methodological quality scores in a systematic review of charts (Napolitano et al. *BJOG* 2014;121:556–65).
Between 1972 and 1979, Robinson was the first to publish on early pregnancy fetal heart rate, 'gestation sac' volume, empty sacs, early fetal death, hydatidiform moles and comparisons of CRL measurements by real-time and conventional B scanners. Robinson can be regarded as the founder of early pregnancy ultrasound and for initiating Embryonic Medicine.

Encouraged by Robinson, others also published on this topic. Mantoni and Pederson were the first to describe embryonic growth delay before early fetal death in eight cases of miscarriage (*Br J Obstet Gynaecol* 1982;89:525–7). Many other studies on the relationship between a small CRL and a higher risk of miscarriage and of structural and chromosomal abnormalities followed. Measurement of CRL became the worldwide method of choice for pregnancy dating as last menstrual period data have always been subject to recall errors.

In recent Embryonic Health programme studies, using sophisticated CRL measurement tools like V-Scope 3D-Virtual Reality – allowing very precise calliper positioning – differences were found between early and late first-trimester embryonic growth coinciding with changes in uterine nourishment from histiotrophic to haemochorial (van Uitert et al. *Hum Reprod* 2013;28:1753–61) Within this Rotterdam periconception cohort (Predict Study), it was also demonstrated with these techniques that periconceptional characteristics also influence embryonic growth. Larger embryos were seen in older mothers, and where there was strong adherence to an energy-rich diet; smaller embryos were seen in the presence of smoking, alcohol use, an adverse cardiovascular risk profile and no folic acid supplementation.

Robinson probably was not aware of the tremendous impact his scientific work would have on contemporary knowledge of early pregnancy physiology and its pivotal impact on optimising prenatal care.

Disclosure of interests

None declared. Completed disclosure of interests form available to view online as supporting information. ■

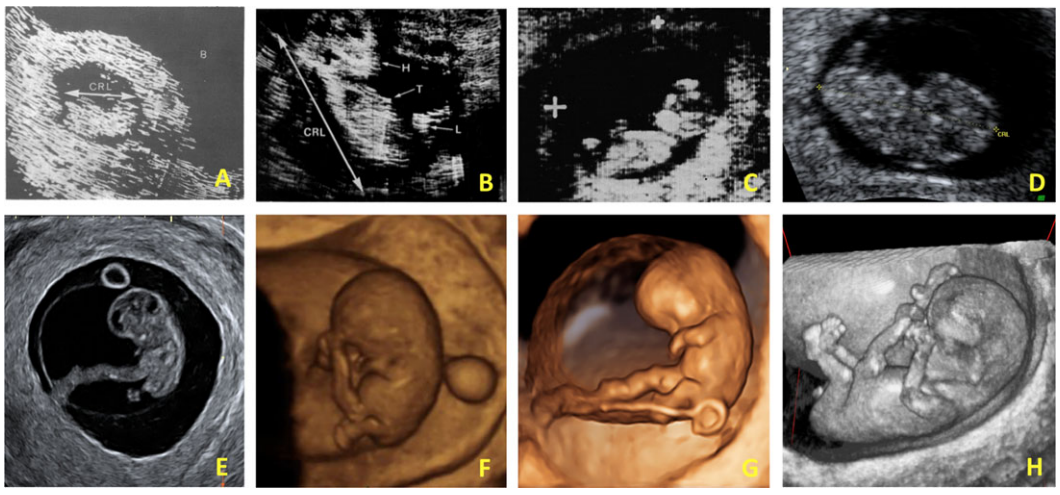

Figure 1. Technical improvements in first-trimester ultrasound. (A) Robinson 1973 *BMJ*, sector B-scan, 9 weeks; (B) Robinson 1975 *BJOG*, sector B-scan, 14 weeks; (C) linear array; (D) greyscale; (E) phased array; (F) 3D/4D view; (G) HD live; (H) V-Scope virtual reality.