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Review

Review: Systematic review of the utility of the fetal cerebroplacental ratio measured at term for the prediction of adverse perinatal outcome

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ABSTRACT

Aim: This systematic review evaluates the utility of the fetal cerebroplacental ratio (CPR) when assessed at term (from 37 + 0 weeks gestation) as a predictor of adverse obstetric and perinatal outcomes.
Data sources and search strategy: An electronic search of Pubmed and Embase using variations of 'cerebroplacental ratio' and 'cerebroumbilical ratio' was conducted by two independent reviewers. Full text studies written in English that reported on low CPR and its correlation with relevant obstetric and perinatal outcomes were included.
Results: Twenty one studies satisfied inclusion with 13 prospective and eight retrospective analyses. Fetal CPR was predictive of caesarean section for intrapartum fetal compromise, small for gestational age and fetal growth restriction and neonatal intensive care unit admission. Low CPR was also significantly associated with abnormal fetal heart rate pattern, meconium stained liquor, low Apgar score, acidosis at birth and composite adverse perinatal outcome scores. The CPR when taken at term had comparable if not better predictive value than that when taken at pre-term. Most studies included small for gestational age fetuses and postdate pregnancies. Subtle variation existed in the threshold for low CPR.
Conclusion: The CPR at term has a strong association with adverse obstetric and perinatal outcomes. This review suggests the predictive utility of CPR at term is promising however there is insufficient evidence to demonstrate its value as a stand-alone test. Inclusion of CPR as a component of clinical care may help better identify fetuses at risk of adverse outcome, and this should be tested with randomised control trials.

Contents

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1. Introduction

For the majority of pregnancies, the placenta provides adequate metabolic and oxygen supply to the fetus through to birth without any detrimental effects on growth or wellbeing. However, when placental function is suboptimal impaired fetal growth can supervene. In late pregnancy, this is a major risk factor for stillbirth and other adverse obstetric and perinatal outcomes [1–3]. For the neonate, there is also a much greater likelihood of longer term neurological and neurodevelopmental morbidity [4–6], as well as cardiovascular disease and other metabolic conditions later in life [7–10]. There is also evidence that even in a cohort of fetuses that are appropriately grown (AGA) with estimated weights above the 10th centile, some demonstrate circulatory changes consistent to that seen in a fetus with obvious growth restriction. These AGA fetuses are also at increased risk of adverse obstetric and perinatal outcomes [11–14].

The fetal cerebroplacental ratio (CPR) is the ratio of the fetal middle cerebral artery (MCA) pulsatility index (PI) to umbilical artery (UA) PI. It is believed to be a proxy for suboptimal fetal growth [15,16] given it quantifies both suboptimal placental function and subsequent fetal circulatory adaptations [17]. It is believed that the CPR better predicts adverse perinatal outcomes than its individual components [18–23] and better than conventional anthropometric models [13].

2. Objective

The aim of this systematic review was to evaluate the utility of CPR when assessed at term (≥37 + 0 weeks) as a predictor for adverse perinatal outcomes.

2.1. Data sources and methodology

An online database search of PubMed and Embase for all relevant publications from the past 30 years was undertaken by the authors and institutional research librarian in September 2016. Search terms were variations of 'cerebroumbilical ratio' and 'cerebroplacental ratio'.

The population of interest was pregnant women who had a CPR evaluated from 37 + 0–42 + 0 weeks gestational age compared to those with normal CPR or a control group as described by the authors. Studies were eligible for inclusion if they reported relevant obstetric and perinatal outcomes and their association with the CPR (regardless of blinding).

An initial title and abstract review was conducted on all publications from the search to exclude duplicated and ineligible manuscripts. A revised short-list of full-text manuscripts written in English that were available electronically were then reviewed in detail. A manual search of the reference lists of short-listed articles was also carried out to identify relevant articles not captured in the initial electronic searches. These reviews were conducted independently by authors LD and HS.

Systematic and expert reviews, case series and reports, abstracts, book chapters, opinion pieces and guidelines were excluded. Publications were also excluded if they investigated the influence of an intervention on the CPR. Relevant standards of reporting for each publication type [24] were referenced, as was the Preferred Reporting for Systematic Reviews and Meta-Analyses statement [25].

3. Results

The flow of identification of relevant studies is shown in Fig. 1. Four hundred and seventeen publications were initially retrieved using the abovementioned methodology and 31 full text articles were then reviewed. The final number of eligible manuscripts was 21 and includes 13 prospective observational [11,14,16,23,26–34] and eight retrospective [12,13,15,35–40] studies.

Data on maternal and fetal characteristics, number of participants that had a CPR evaluated, individual CPR components and abnormal CPR cut off threshold, gestational age at which the CPR was obtained and CPR to delivery interval are presented in Table 1. Obstetric (mode of, and indication for birth, meconium stained liquor (MSL), fetal heart rate (FHR) abnormalities) and perinatal (birthweight, Apgar scores, acidosis at birth, neonatal intensive care unit (NICU) admission) outcomes are presented in Table 2. Sensitivities, specificities, negative predictive values (NPV), positive predictive values (PPV) and other predictive ratios for various outcomes are presented in Table 3. Not all outcomes relevant to this

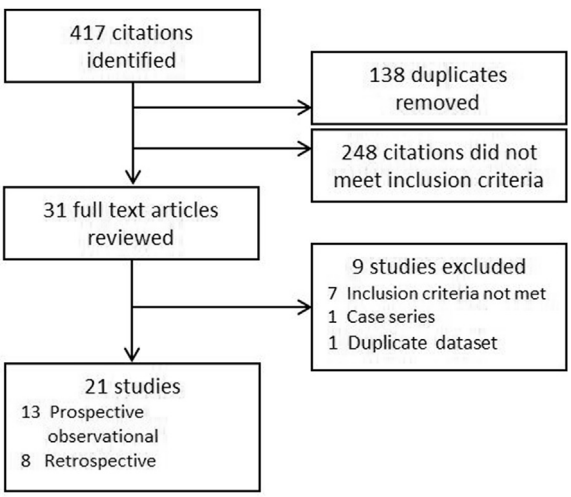

Fig. 1. Selection of studies.

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