INPLASY

INPLASY202660107

doi: 10.37766/inplasy2026.6.0107

Received: 22 June 2026

Published: 22 June 2026

Corresponding author:
Ni Chen

scdxcskcn@163.com

Author Affiliation:
West China Second Hospital of Sichuan University.

Diagnostic accuracy of the cerebro-placental-uterine ratio (CPUR) versus the cerebroplacental ratio (CPR) for predicting adverse perinatal outcomes: a systematic review and meta-analysis of diagnostic test accuracy

Chen, N; Qiu, L; Luo, H.

ADMINISTRATIVE INFORMATION

Support - None. This review received no specific funding.

Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202660107

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 22 June 2026 and was last updated on 22 June 2026.

INTRODUCTION

Review question / Objective In singleton pregnancies undergoing third-trimester Doppler ultrasound, what is the diagnostic accuracy of the cerebro-placental-uterine ratio (CPUR) compared with the cerebroplacental ratio (CPR) for predicting adverse perinatal outcomes, and do CPR and CPUR provide incremental diagnostic value over umbilical artery Doppler (UA-PI) alone, the established clinical benchmark?

Rationale The cerebroplacental ratio (CPR) is widely used in third-trimester fetal surveillance but, on individual-participant meta-analysis, adds little predictive value beyond umbilical artery Doppler for adverse perinatal outcome. The cerebro-placental-uterine ratio (CPUR) integrates maternal uterine artery information and has been proposed as a more sensitive index, but no quantitative synthesis exists. This is, to our knowledge, the first systematic review and meta-analysis to quantify the diagnostic accuracy of CPUR, to compare it head-to-head with CPR, and to assess whether either adds incremental value over umbilical artery Doppler (UA-PI), the established benchmark.

Condition being studied Third-trimester fetal surveillance and prediction of adverse perinatal outcomes in singleton pregnancies, including pregnancies affected by fetal growth restriction (FGR) / small-for-gestational-age (SGA), hypertensive disorders of pregnancy, and diabetes.

METHODS

Search strategy Full line-by-line search strategies for each database are documented and will be provided as a supplementary file. PubMed core strategy: ("cerebral placental uterine ratio" OR CPUR OR "cerebro-placental-uterine ratio" OR "uteroplacental cerebral ratio" OR "CPU ratio") [tiab] OR (("cerebroplacental ratio" OR CPR OR "umbilicocerebral ratio" OR UCR)[tiab] AND ("uterine artery"[tiab] AND (Doppler OR "pulsatility index" OR PI)[tiab])).

Participant or population Singleton pregnancies undergoing third-trimester (>=28 weeks) Doppler ultrasound assessment, including low-risk, suspected FGR/SGA, hypertensive disorders of pregnancy, and pre-gestational or gestational diabetes. Excluded: multiple pregnancies (twins, triplets, etc.) and pregnancies with major fetal structural or chromosomal anomalies.

Intervention Index tests: the cerebro-placental-uterine ratio (CPUR = CPR / mean uterine artery PI) and mathematically equivalent variants (uteroplacental-cerebral ratio [UPCR]; CPU ratio).

Comparator Comparator tests: (a) the cerebroplacental ratio (CPR = middle cerebral artery PI / umbilical artery PI) used alone; and (b) umbilical artery Doppler (UA-PI) used alone, included as the established clinical reference benchmark against which the incremental value of CPR and CPUR is judged. Reference standard / target condition: adverse perinatal outcomes as predefined by each included study (e.g., composite adverse perinatal outcome, SGA, NICU admission, neonatal acidaemia, emergency caesarean for fetal distress, 5-minute Apgar < 7, perinatal mortality).

Study designs to be included Included: prospective or retrospective cohort studies, cross-sectional diagnostic accuracy studies, and case-control studies reporting diagnostic accuracy data (a 2x2 table, or sensitivity/specificity/AUC) for CPUR and CPR. Excluded: case reports; conference abstracts only; letters; editorials; narrative reviews; studies reporting CPUR without CPR (for the head-to-head analysis; retained for any single-test sensitivity analysis).

Eligibility criteria Inclusion: third-trimester (>=28 weeks), singleton pregnancies; studies reporting diagnostic accuracy data for CPUR (or variants) AND CPR against a predefined adverse perinatal outcome; any language (non-English translated). Exclusion: multiple pregnancies; major fetal anomalies; CPUR-without-CPR (kept for single-test sensitivity analysis); case reports / abstracts only / letters / editorials / narrative reviews.

Information sources MEDLINE (via PubMed and Ovid), Embase, the Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science Core Collection, Scopus, and CNKI, from database inception to [search date]. Trial registers (ClinicalTrials.gov, WHO ICTRP) and preprint servers (medRxiv, Research Square) will be searched for unpublished studies; reference lists of included studies and relevant reviews will be hand-searched.

Main outcome(s) Diagnostic accuracy of CPUR and CPR for predicting a composite adverse perinatal outcome, and their incremental value over umbilical artery Doppler (UA-PI). Measures: pooled sensitivity, specificity, positive and negative likelihood ratios, diagnostic odds ratio, and area under the summary ROC curve, each with 95% confidence intervals.

Additional outcome(s) Small-for-gestational-age birthweight; NICU admission; neonatal acidaemia; caesarean for fetal distress; 5-minute Apgar < 7; perinatal mortality. The same measures of diagnostic accuracy will be applied.

Data management Two reviewers will independently extract data using a piloted standardized form, including study characteristics, population, index test and threshold, reference standard, and 2x2 counts (TP/FP/FN/TN) for CPUR, CPR and — where reported — umbilical artery Doppler (UA-PI). Where a 2x2 table cannot be reconstructed, corresponding authors will be contacted. UA-PI is a mathematical component of CPR/CPUR and is captured within the same studies; it is extracted at this stage rather than searched separately.

Quality assessment / Risk of bias analysis Two reviewers will independently assess risk of bias and applicability using QUADAS-2, and QUADAS-C for the comparative (head-to-head) accuracy of CPUR, CPR and UA-PI. Disagreements resolved by discussion or a third reviewer. Intervention tools (RoB 2, ROBINS-I) are not applicable. Reporting/publication bias: Deeks funnel-plot asymmetry test, only when a test has >= 10 studies.

Strategy of data synthesis For each test (CPUR, CPR, UA-PI), pooled sensitivity and specificity will be estimated using the bivariate random-effects model with hierarchical summary ROC (HSROC) curves, applying a pre-specified model-downgrading rule by number of studies per test: >=10 studies, full bivariate model; 5-9 studies, a simplified/symmetric HSROC or univariate logistic model, or a Bayesian bivariate model; <=4 studies, descriptive synthesis only. Umbilical artery Doppler (UA-PI) will be pooled in parallel as the reference benchmark, and the incremental value of CPR and CPUR over UA-PI - together with the CPUR-versus-CPR comparison - will be assessed primarily within the subset of studies reporting these indices in the same participants. Given the typically small comparative subset, the primary

comparison will be descriptive (summary sensitivity/specificity, difference in AUC, overlaid SROC curves), with a formal test-type-covariate bivariate model as an optional exploratory analysis; any across-study indirect comparison will be exploratory, and UA-PI's overall accuracy will additionally be referenced to published large umbilical artery Doppler meta-analyses. Certainty of evidence will be rated with GRADE adapted for diagnostic test accuracy, separately for sensitivity and specificity. Analyses will use R (mada, meta4diag, metafor) or Stata (midas, metandi). Reporting will follow PRISMA-DTA 2018.

Subgroup analysis Pre-specified exploratory subgroups, data permitting: (1) population risk level (high-risk [FGR/SGA, hypertensive disorders, diabetes] vs low-risk); (2) cut-off determination method (ROC-derived vs fixed percentile/MoM).

Sensitivity analysis Excluding high-risk-of-bias studies (QUADAS-2); excluding case-control studies; excluding studies with <100 participants; leave-one-out analysis; and inclusion of studies with AUC/cut-off-only data.

Language restriction None. No language restriction; non-English articles will be translated.

Country(ies) involved China.

Keywords Cerebro-placental-uterine ratio; cerebroplacental ratio; uterine artery Doppler; umbilical artery Doppler; adverse perinatal outcome; diagnostic test accuracy; fetal growth restriction; meta-analysis.

Dissemination plans Findings will be submitted for publication in a peer-reviewed journal and may be presented at scientific meetings.

Contributions of each author

Author 1 - Ni Chen.
Email: scdxcskcn@163.com
Author 2 - LI Qiu.
Email: 18681648039@163.com
Author 3 - Hong Luo.
Email: luohongcd1969@126.com