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 2 July 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), Embase (via Ovid), the Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science Core Collection, Scopus, and CNKI, from database inception to the date the searches are conducted. 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 will be 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