

OBJECTIVES

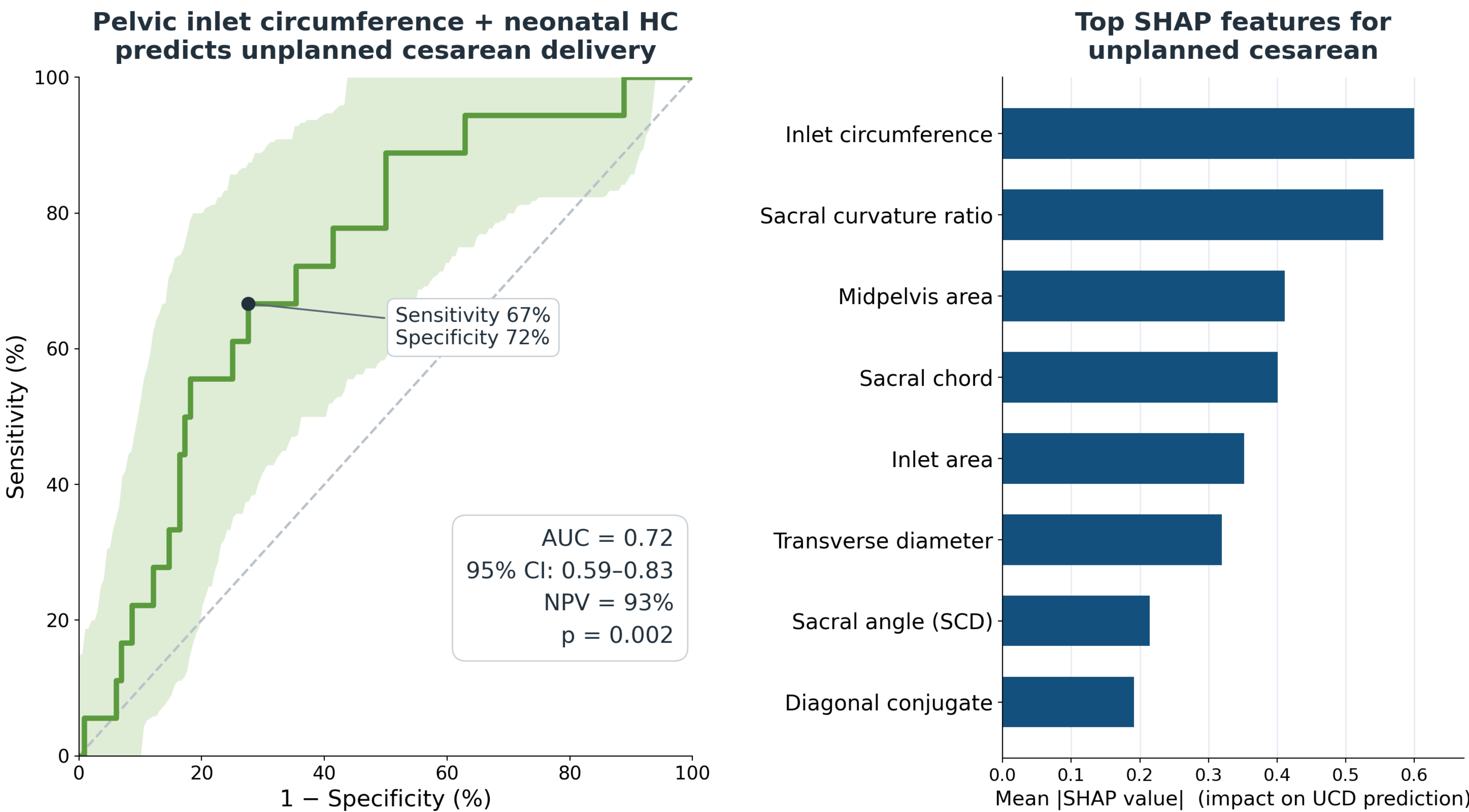
Unplanned cesarean delivery (UCD) accounts for significant maternal morbidity. Cephalopelvic disproportion (CPD) is one of its leading causes, yet it cannot be reliably predicted before labor onset. We aimed to determine whether automated MRI pelvimetry combined with neonatal head circumference (HC) can predict UCD, and whether UCD and instrumental delivery (IVD) involve distinct pelvic profiles.

METHODS

Retrospective analysis of 170 women who underwent pelvic MRI for unrelated indications. Sixteen pelvimetric parameters were extracted from T1 and T2 sequences using a validated landmark pipeline, averaged across sequences. Of these, 140 (121 NVD, 19 UCD) and 145 (121 NVD, 24 IVD) were included in respective analyses. Feature selection used SHAP analysis. Logistic regression was evaluated via leave-one-out cross-validation, bootstrap CI and permutation tests (n=1000).

The pelvis carries a measurable signature of cesarean risk

Pelvic inlet circumference and neonatal head circumference together predict unplanned cesarean delivery (AUC 0.72, NPV 94%)



Predictive model built from pelvic inlet circumference and neonatal head circumference (left); SHAP feature importance for the same model, ranking which pelvimetric measurements drive the UCD prediction (right).

RESULTS

Pelvic inlet circumference combined with HC predicted UCD with AUC 0.72 (95% CI 0.60–0.84, p=0.001). At optimal threshold, sensitivity was 67%, specificity 72%, PPV 27% and NPV 94%, meaning nearly all women classified as low-risk delivered vaginally. UCD was driven by smaller inlet dimensions (p=0.003), while IVD was associated with HC relative to transverse diameter (AUC 0.61), revealing different anatomic profiles.

CONCLUSIONS

A two-variable model combining automated pelvimetry with HC can identify women at risk of UCD. Its high NPV supports clinical utility as a reassurance tool. UCD and IVD exhibit distinct anatomic signatures, suggesting different obstruction mechanisms. These findings motivate prospective studies in larger cohorts as the next step toward integrating pelvimetry into personalized delivery planning.

Predicting unplanned cesarean delivery with automated MRI pelvimetry

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