

Preoperative hemodynamic predictors and composite risk modeling for fetal mortality after modified sequential FLP in TTTS

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Objectives: To identify preoperative hemodynamic predictors of fetal mortality and to develop composite risk scoring systems for recipient and donor fetuses.

Methods

Retrospective cohort study; MCDA twin pregnancies complicated by TTTS undergoing FLP between January 2022 and December 2025 (N = 100 pregnancies)

Exclusion criteria

- higher-order multiple gestations
- fetuses with confirmed chromosomal anomalies, major structural defects
- incomplete perioperative medical records, suboptimal ultrasound quality

Preoperative assessments

Pregnancy characteristics

Doppler parameters

Standard Doppler
(UA-PI, MCA-PI, CPR,
MCA-PSV, DV-PI)

Detailed DV analysis:
%S1, %S2, %D, S/D
(time intervals and VTI)
(Figure 1)

Primary outcome

Fetal death within 14 days post-operation

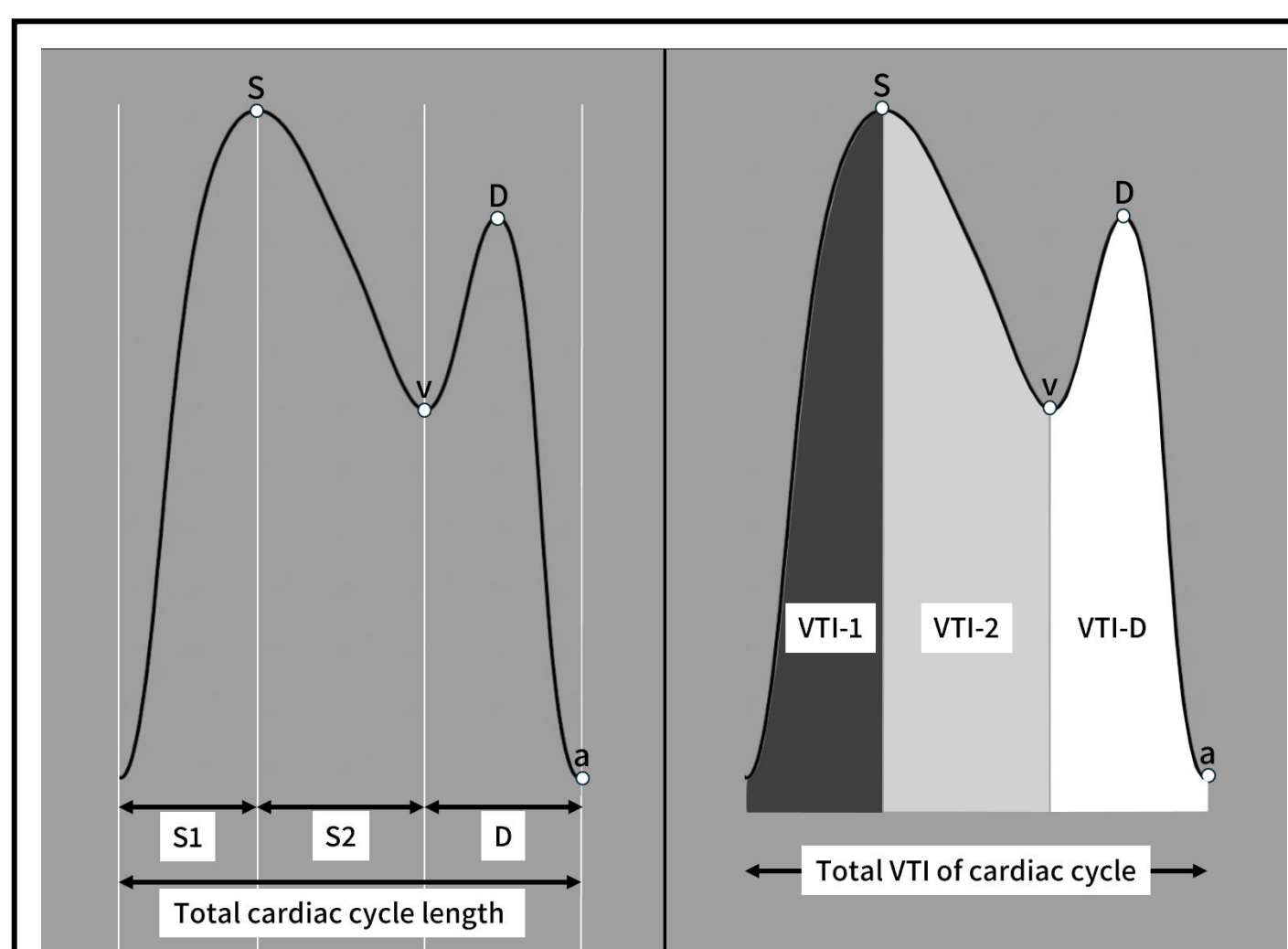


Figure 1. Schematic of DV waveform decomposition: time intervals (left) and velocity-time integrals (VTI) (right)

Results

Recipient twin (Mortality: 7%)

Key predictors:

- Absent/reversed UA-EDF
- ↑ MCA-PSV
- ↓ DV D-phase VTI (%)
- ↑ DV VTI S/D ratio

Composite risk model:

- MCA-PSV >1.43 MoM and DV D-phase VTI (%) <0.16
- Predicted mortality: AUC 0.86 (95% CI 0.70–1.00), sensitivity 85.7%, NPV 98.6% (Figures 2 and 3)

Donor twin (Mortality: 11%)

Key predictors:

- Coexisting sFGR
- ↓ CPR
- ↑ DV S2-phase time & VTI (%)

Composite risk model:

- CPR <0.72, DV S2-phase VTI (%) >0.44, and sFGR
- Predicted mortality: AUC 0.91 (95% CI 0.83–0.98), sensitivity 100%, NPV 100% (Figures 2 and 3)

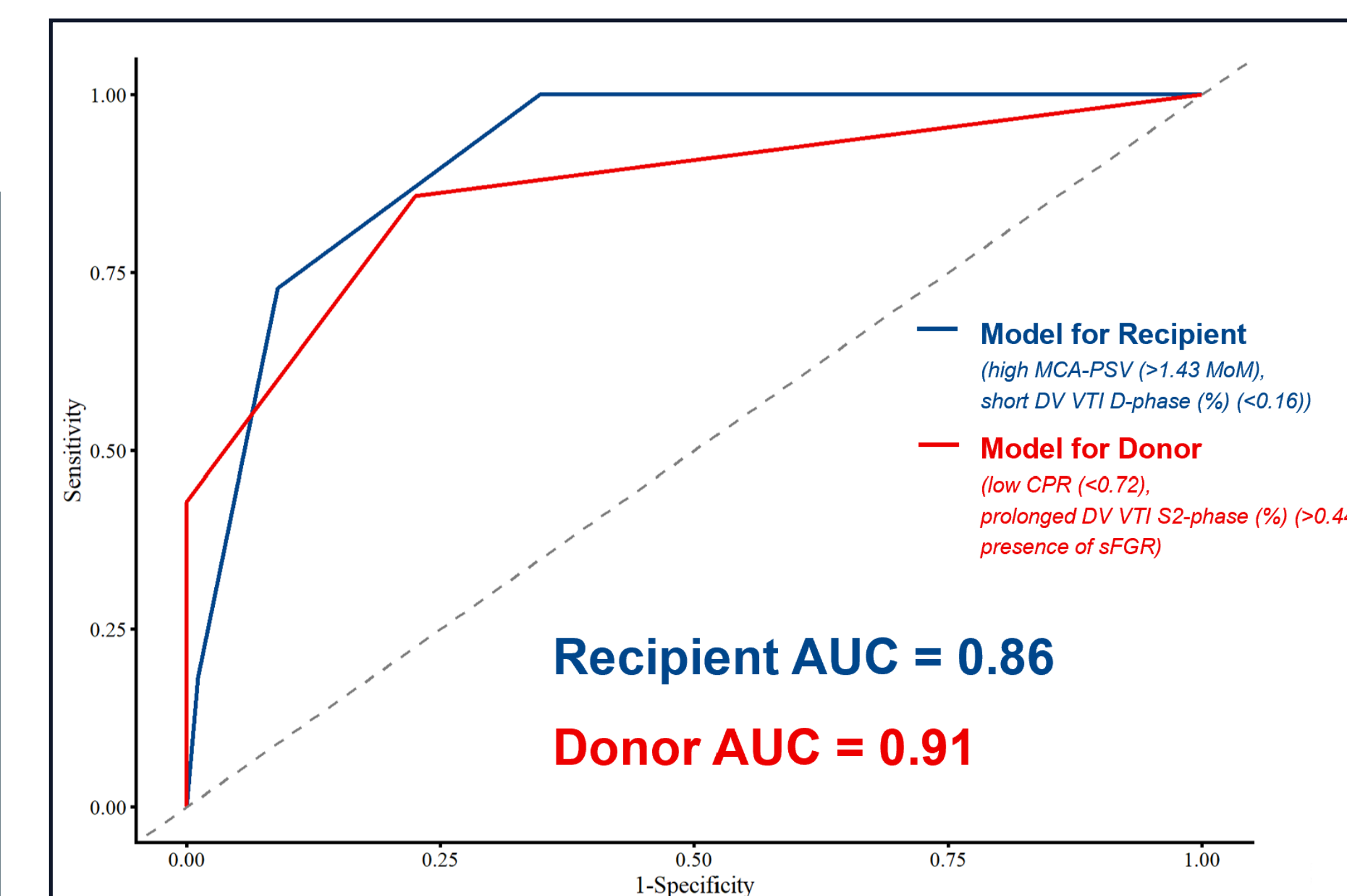


Figure 2. ROC curves demonstrating the predictive performance of the composite risk models for fetal mortality in recipient and donor fetuses

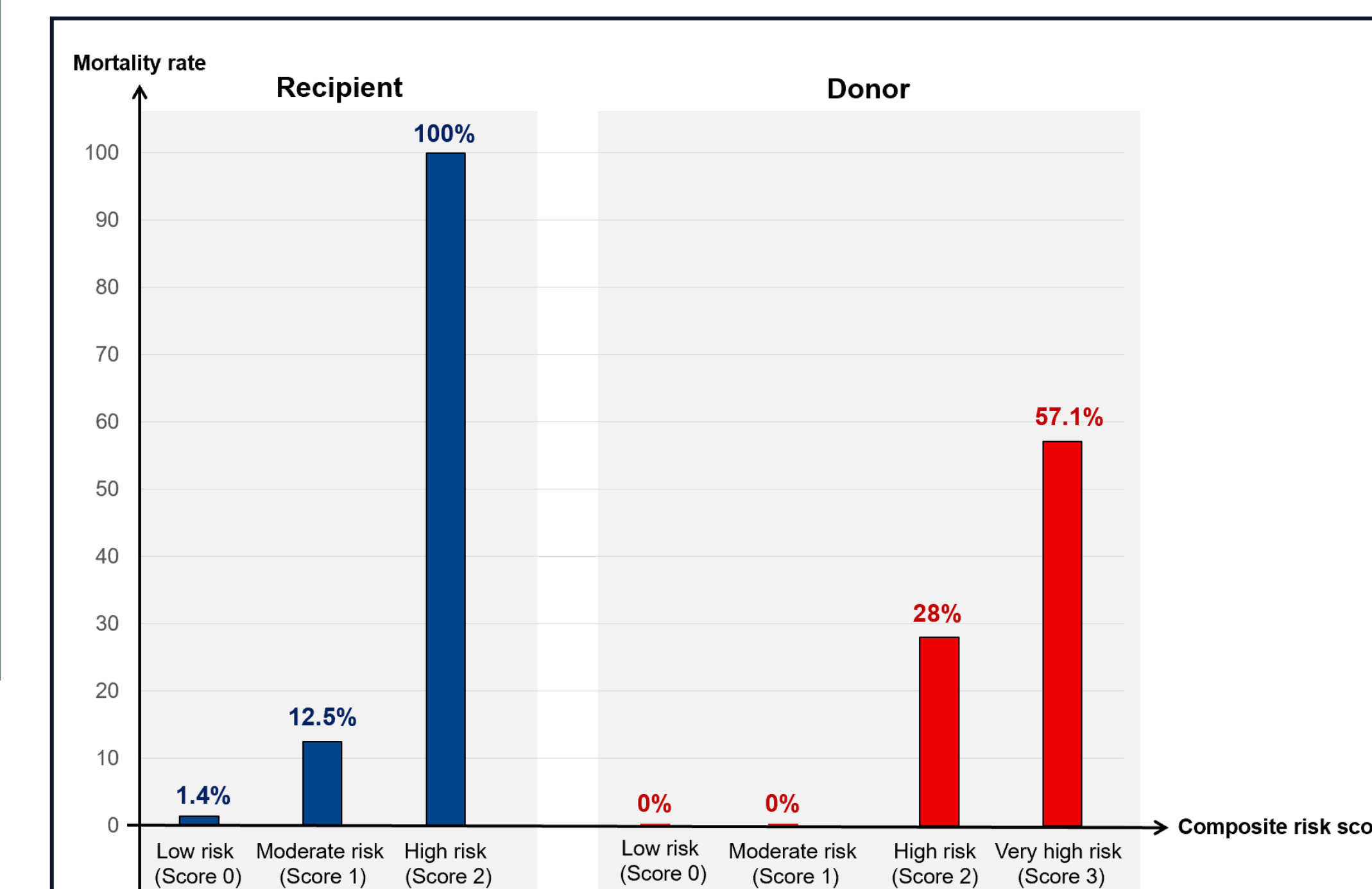


Figure 3. Fetal mortality rates stratified by composite risk scores in recipient and donor fetuses

Conclusion:

- Key preoperative hemodynamic predictors were identified, enabling internally validated composite risk models for fetal mortality following modified sequential FLP.
- These models may facilitate preoperative risk stratification, individualized counseling, perioperative clinical decision-making in TTTS.