

isuog2026.31d0498

Cervical Elastography as an Innovative Tool for Assessing Cervical Biomechanics and Predicting Preterm Birth

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Objectives

To evaluate the relationship between cervical stiffness assessed by elastography, cervical length, and the risk of preterm birth across pregnancy.

Methods

In this prospective cohort study, 90 singleton pregnancies (30 per trimester; 4–40 weeks) without major complications were enrolled. Cervical biomechanics were assessed using transvaginal strain elastography with standardized acquisition and minimal probe compression. Elastographic patterns were classified as soft, moderate, or hard based on relative strain. Cervical length was measured according to established transvaginal ultrasound criteria. Correlation between cervical stiffness and cervical length was evaluated using Pearson analysis. Logistic regression assessed the association between cervical stiffness and preterm birth risk, adjusting for gestational age. Predictive performance was evaluated using receiver-operating characteristic (ROC) analysis.

Results

Elastography demonstrated a strong inverse correlation between cervical stiffness and cervical length ($r = -0.72$; $p < 0.001$). Logistic regression identified cervical stiffness as a significant predictor of preterm birth (OR 3.14; 95% CI 2.09–4.72). ROC analysis showed excellent predictive accuracy (AUC = 0.89). **Across trimesters, progressive cervical stiffening was observed with decreasing proportions of soft tissue and increasing stiffness transitions.**

Conclusions

Cervical elastography is a robust, noninvasive method for assessing cervical biomechanics and predicting preterm birth risk across pregnancy. Its strong correlation with cervical length and high predictive accuracy support its potential as a valuable adjunct to conventional cervical assessment in obstetric practice.

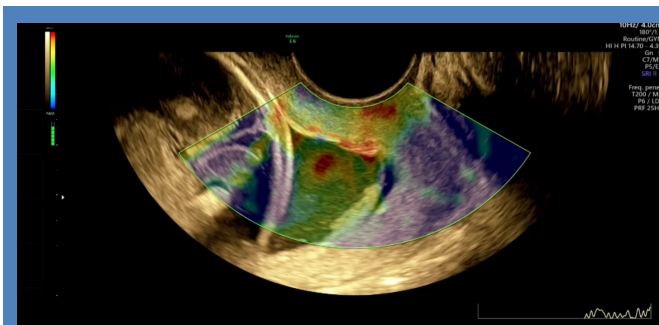


Figure 1. Cervical softening is characterized by a predominant shift toward yellow and red on elastography, particularly in the anterior cervical lip.

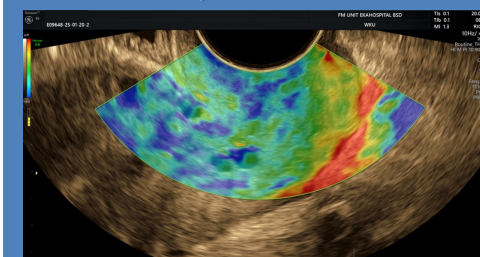


Figure 2. A normal-length cervix shows predominantly blue and green colors on ultrasound elastography, indicating relatively greater cervical stiffness.

Blue → Green → Yellow → Red

- Blue = stiffest/hardest tissue, low strain
- Green = intermediate stiffness, relatively firm
- Yellow = relatively soft
- Red = softest/most elastic tissue, high strain

Figure 3. Colors in strain elastography, using the commonly applied color map, the order from stiffest/hardest to softest/most elastic.