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Three-dimensional cervical volume as a predictor of preterm delivery in twin pregnancies

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Objective

The aim of this study was to assess the effectiveness of mid-trimester cervical volume measurement by three-dimensional (3D) sonography in the prediction of spontaneous preterm birth (sPTB) in twin pregnancies and evaluate its intraobserver and interobserver reliability.

Methods

This was a prospective observational study including patients with a dichorionic (DC) or monochorionic diamniotic (MCDA) twin pregnancy from a tertiary hospital, during a year period (January 2021 to January 2022). Exclusion criteria were: twin-to-twin transfusion syndrome, major structural or chromosomal anomalies or intrauterine fetal demise of one of the twins before recruitment. Patients meeting inclusion criteria were recruited between 18^{+0} and 24^{+6} weeks of pregnancy during the second-trimester ultrasound scan examination. All ultrasound cervical examinations were carried by a single trained sonographer. Cervical length measurement was obtained according to universal guidelines criteria. After that, and using the same sagittal plane, the system was turned on to three-dimensional mode and the acquired volume was stored for offline analysis. VOCAL software was used to calculate the cervical volume. Each 3D volume was calculated twice by the same sonographer and also by a second blinded examiner, to determine the intraobserver and interobserver reliability, respectively. Primary outcome was sPTB, which was defined as delivery $<37^{+0}$ weeks in DC twins or $<36^{+0}$ weeks in MCDA twins due to spontaneous onset of labor or PPROM.

Results

A total of 55 women were included during the study period. There were 15/55 (27.3%) patients who presented a spontaneous preterm delivery. Demographic and gestational characteristics between groups are shown in Table 1. There were no statistically significant differences in cervical length or cervical volume between patients who delivered preterm from those who delivered at term. The AUC of the cervical volume to predict sPTB was 0.45 (95%CI, 0.29–0.61). The intraobserver reliability for cervical volume measurement showed a moderate to poor consistency of agreement [Intraclass correlation coefficient (ICC) 0.62 (95%CI; 0.03-0.89) p=0.02]. Furthermore, the interobserver reliability also showed a moderate to poor consistency of agreement [ICC 0.64 (95%CI; 0.46-0.77) p<0.0001], with a poor absolute agreement [ICC 0.22 (95%CI; 0.07-0.56) p<0.0001] between examiners.

Conclusion

Our results suggest that mid-trimester cervical volume measurement shows a poor correlation with spontaneous preterm birth in twin pregnancies with low to moderate intra and interobserver reliability. This may preclude its clinical use as a predictor of preterm delivery in twins.

Demographic characteristics and gestational outcomes

	sPTB* (n=15)	No sPTB (n=40)	p-value
Maternal Age (years)	34.8 (30.9-37.4)	36.4 (32.4-38.8)	0.416
Nulliparity	10 (66.6)	31 (77.5)	0.411
Ethnicity			0.491
- Caucasian	10 (66.6)	29 (72.5)	
- Maghreb	1 (6.7)	0 (0)	
- Hispanic	3 (20)	9 (22.5)	
- Asian	1 (6.7)	2 (5)	
Previous sPTB	1/5 (20)	1/9 (11.1)	>0.99
Chorionicity			0.213
- Dichorionic	12 (80)	24 (60)	
- Monochorionic	3 (20)	16 (40)	
ART*	5 (33.3)	20 (50)	0.269
GA at recruitment*	20.7 (20.1-21.7)	21.2 (20.5-21.8)	0.465
Cervical length (mm)	39 (36-41)	42 (37-46.5)	0.118
Cervical volume (cm^3)	22.4 (17.5-26.1)	22.1 (18.1-32.8)	0.762
PPROM*	11 (73.3)	0(0)	<0.0001
PTL*	7 (46.7)	0 (0)	<0.0001
GA at delivery	35.5 (34.5-36.4)	37 (36.6-37.4)	<0.0001

Continuous variables were compared using non-parametric Wilcoxon-test and presented as median (25th;75th percentile). Categorical variables were compared using Chi-squared or Fisher exact tests and presented as number (percentage).

*sPTB (Spontaneous Preterm Birth), ART (Assisted Reproductive Technology), GA (Gestational Age), PPROM (Preterm Prelabor Rupture of Membranes), PTL (Preterm Labor).