Full length article

Midtrimester transvaginal ultrasound cervical length screening for spontaneous preterm birth in diamniotic twin pregnancies according to chorionicity

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A B S T R A C T

Objective: To compare the mean transvaginal ultrasound (TVU) cervical length (CL) at midtrimester screening for spontaneous preterm birth in asymptomatic monochorionic diamniotic versus dichorionic diamniotic twin pregnancies

Study design: This was a multicenter retrospective cohort study. Study subjects were identified at the time of a routine second trimester fetal ultrasound exam at 18 0/7–23 6/7 weeks gestation. We excluded women that received progesterone, pessary, or cerclage. Distribution of CL was determined and normality was examined. Mean of TVU CL were compared between monochorionic diamniotic and dichorionic diamniotic pregnancies. The relationship of TVU CL with gestational age (GA) at delivery and incidence of spontaneous preterm birth (SPTB) at different TVU CL cut offs were assessed. Incidence of short TVU CL, defined as TVU CL ≤30 mm, was also calculated in the two groups.

Results: 580 women with diamniotic twin pregnancies underwent TVU CL screening between 18 0/6 and 23 6/7 weeks. 175 (30.2%) were monochorionic diamniotic pregnancies, and 405 (69.8%) were dichorionic pregnancies. The demographic characteristics were similar on both groups. The mean GA at TVU CL was about 20 week in both groups. The mean TVU CL was significantly lower in the monochorionic diamniotic (32.8 ± 10.1) compared to the dichorionic (34.9 ± 8.6) group (MD −2.10 mm, 95% CI −3.91 to −0.29). TVU CL ≤30 mm was 16.6% (29/175) in the monochorionic group, and 11.9% (48/405) in the dichorionic group (aOR 1.48, 95% CI 1.03–2.43). Twins with a monochorionic diamniotic pregnancy had a significantly higher incidence of SPTB (53.1% vs 44.9%; aOR 1.22, 95% CI 1.22–1.79). For any given CL measured between 18 0–7 and 23 6/7 weeks, gestational age at delivery for monochorionic diamniotic pregnancies was about 2 weeks earlier compared to dichorionic pregnancies (MD -2.1 weeks; ANCOVA P < 0.001).

Conclusion: Monochorionic diamniotic twin pregnancies had a higher rate of spontaneous preterm birth than dichorionic diamniotic pregnancies. The higher rate of spontaneous preterm delivery in monochorionic pregnancies is associated with lower midtrimester TVU CL when compared to dichorionic pregnancies.

Introduction

Preterm birth (PTB) is a leading cause of perinatal morbidity and mortality [1]. Over the last few years, cervical assessment has moved from digital examination to ultrasound evaluation, and ultrasound of the cervix has been the focus of much research [2–6].

Transvaginal ultrasound (TVU) cervical length (CL) has been assessed in several populations (e.g. women with and without symptoms of preterm labor or premature rupture of membranes) to evaluate the risk of spontaneous PTB (SPTB) [7], in women before induction of labor to predict induction outcome [8], and at term to predict the onset of spontaneous labor with moderate degree of accuracy [9]. A short TVU CL has been shown to be a good predictor of SPTB in both singletons and twins [4]; and has been shown to be more accurate than digital examination and fetal fibronectin in the prediction of SPTB [4,10].

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Twin gestations are at increased risk of both SPTB and indicated PTB (either maternal or fetal indications) [1]. For example, the overall rate of PTB at < 37, <34 and <32 weeks in twin pregnancies has been shown to be 56%, 17% and 9%, compared with about 9.8%, 2% and 1% in singleton pregnancies, respectively [1].

Over the past decades the incidence of twin pregnancies in the USA has increased, reaching a new high for the nation of 33.7 per 1000 total births in the 2015 [1]. Monochorionic pregnancies comprises 20–33% of all twin gestations they have inherently different complication rates when compared with dichorionic pregnancy, including higher risk of fetal demise, congenital anomalies, intrauterine growth restriction, twin anemia polycythemia sequence, twin-twin transfusion syndrome, and higher risk of spontaneous preterm birth [11,12]. However, data regarding TVU CL in twin pregnancies stratified by chorionicity, and specifically studies assessing whether the risk of spontaneous PTB in monochorionic compared to dichorionic twins can be predicted by a difference in TVU CL, are limited [13].

Objective

The aim of this study was to compare the TVU CL at midtrimester in screening for SPTB in asymptomatic twins in monochorionic diamniotic compared to dichorionic diamniotic pregnancy.

Methods

Study population

This was a multicenter retrospective cohort study. Data on all consecutive asymptomatic twin pregnancies who underwent TVU CL screening at University of Naples Federico II (Naples, Italy), at Division of Maternal Fetal Medicine Thomas Jefferson University Hospital (Philadelphia, PA), and at Division of Maternal Fetal Medicine University of Pennsylvania (Philadelphia, PA) at the time of routine second trimester fetal ultrasound exam at 18 0/7–23 6/7 weeks from January 2014 to January 2017 were included in a dedicated database

Monoamniotic twins, twin pregnancies with twin-twin transfusion syndrome, use of vaginal progesterone, pessary or cerclage in place, as well as major fetal malformations or genetic anomalies at the time of the TVU CL were excluded. Fetal demise or selective reduction of any of the twins before delivery were also excluded from the analysis. Therefore the analyzed cohort included all consecutive asymptomatic twin pregnancies with normal, viable twins at the time of delivery who underwent midtrimester TVU CL screening. Women were divided in two groups according to chorionicity: monochorionic and dichorionic. To avoid selection bias all consecutive twin pregnancies who received TVU CL screening were included and analyzed.

Potential study subjects were identified at the time of a routine second trimester fetal ultrasound exam at 18 0/7–23 6/7 weeks gestation. Only TVU screening was employed for cervical screening; and only one TVU CL measurement was performed. Physicians and sonographers who performed TVU CL screening were certified through the Fetal Medicine Foundation (FMF) or through CLEAR. Briefly, the measurement of CL was performed in the sagittal plane, visualizing the full length of the cervical canal from the internal os to the external cervical os. At least 3 measurements were obtained and the shortest was recorded [14,15]. Chorionicity was assessed using the lambda sign in the first trimester and confirmed with placental analysis at the time of delivery [11]. Women that received pessary, cerclage, or progesterone were excluded [16]. According to our protocol, delivery was planned at 37 0/7–38 6/7 weeks for dichorionic twins, and at 36 0/

7–37 6/7 weeks for monochorionic twins [17,18]. Indication for delivery was recorded.

Outcomes

The primary outcome was the mean of TVU CL stratified by chorionicity. Distribution of CL, normality, and incidence of short cervix in several cutoffs ($\leq$30, $\leq$25, $\leq$15, $\leq$10, and $\leq$5 mm) in both group were calculated. Receiver-operating characteristics (ROC) curve was used to assess the CL value predictive for SPTB < 32 weeks. Sensitivity, specificity, positive and negative likelihood ratio (LR + and LR-, respectively) were calculated for the each cutoff point (30, 25, 15, 10, and 5 mm). We also assessed the relationship of TVU CL with gestational age at delivery between monochorionic diamniotic and dichorionic pregnancy.

Secondary outcomes were gestational age at delivery, incidence of PTB and of SPTB < 37, <34, <32 and <28 weeks, and indication for delivery.

Data on pregnancy outcomes were obtained from hospital maternity records. In case of PTB, records were examined to determine whether the delivery was medically indicated or spontaneous PTB. SPTB included either spontaneous onset of preterm labor or PPROM.

Data analysis

Data are shown as means $\pm$ standard deviation (SD), or as number (percentage). Univariate comparisons of dichotomous data were performed with the use of the chi-square or Fisher exact test. Comparisons between groups were performed with the use of the Mann—Whitney U test, to test group medians; and with the use of the T-test to test group means with SD. Outcomes were estimated with multivariate analyses.

Logistic regression, presented as unadjusted odds ratio (crude OR) or adjusted odds ratio (aOR) or as mean difference (MD) with the 95% of confidence interval (CI), was performed. Adjusted analysis was performed to correct data for relevant baseline characteristics. All potentially relevant baseline characteristics were added to the model as covariates. Relevant baseline characteristics included: age, body mass index (BMI), parity, history of SPTB, and smoking. This analysis was performed to show robustness of our results [19].

Distribution of cervical length was determined and normality was examined by the Kolmogorov-Smirnov test. We also planned to assess the incidence of TVU CL $\leq$30 mm in subgroup analysis in women with and without prior SPTB.

ROC curve to assess the CL value predictive for SPTB < 32 weeks was plotted for both monochorionic diamniotic and dichorionic pregnancies. The area under the curve (AUC) was computed to evaluate the overall performance of the diagnostic test accuracy in prediction of SPTB < 32 weeks [9,20]. The AUC of a ROC curve is a measure of the overall performance of a diagnostic test in accurately differentiating those cases with and those without the condition of interest [9,20]. Difference between the AUC of the ROC curve for the monochorionic diamniotic twins and the AUC of the ROC curve for the dichorionic twins were calculated by using the DeLong nonparametric test [20]. The DeLong test assessed the standard error of the AUC and the difference between the two AUCs [20].

The correlation between CL and gestational age at delivery in monochorionic diamniotic pregnancies and dichorionic pregnancies was assessed with the use of the Spearman's correlation coefficient. Comparison of coefficients was done by using the Fisher's Z-transformation. ANCOVA analysis of covariance was used to plot the general linear model for the relationship between CL and gestational age at delivery and the MD in weeks between