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Original Research Article

Role of transvaginal ultrasound in predicting preterm labor in singleton pregnancies

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ABSTRACT

Background: Preterm delivery (PTD) is a major cause of perinatal morbidity and mortality. Objective of present study was to identify the women at risk of preterm delivery with the help of trans-vaginal ultrasound by assessing cervical length changes, funneling of lower uterine segment, cervical dilatation.
Methods: A prospective study was carried out over a period of 2 years on 50 patients with 24-36 weeks of gestation who clinically presented with signs of threatened preterm labor and were subjected to transvaginal sonographic measurement of cervical length.
Results: Prediction of spontaneous preterm birth at <37 weeks of gestation with cervical length to be 2.75 cm has sensitivity of 95%, specificity of 96.5%, positive predictive value of 86.36% and negative predictive value of 98.7%.
Conclusions: Transvaginal ultrasonography is the reliable, reproducible and objective method to assess cervix and to predict the risk of preterm delivery.

Keywords: Cervical, Delivery, Preterm, Transvaginal

INTRODUCTION

Preterm delivery (PTD) is a major cause of perinatal morbidity and mortality.[1-7] Preterm delivery is associated with a high prevalence of severe neurological deficits and developmental disabilities and is a leading cause of infant and neonatal mortality.[8-9] Considering the magnitude of the problem, it is necessary to minimize the negative consequences involved in preterm labor. This can be reasonably achieved by timely prediction of preterm labor and appropriate management.

The exact mechanism of preterm labor is largely unknown but is believed to include decidual hemorrhage (e.g., abruption, mechanical factors such as uterine over-distension from multiple gestation or polyhydramnios), cervical incompetence (e.g. cone biopsy), müllerian duct abnormalities, fibroid uterus, cervical inflammation (e.g. resulting from bacterial vaginosis, trichomonas), maternal inflammation and fever (e.g., urinary tract infection), hormonal changes (e.g., mediated by maternal or fetal stress), and utero-placental insufficiency (e.g., hypertension, insulin-dependent diabetes, drug abuse, smoking, alcohol consumption). Each of these underlying causes can initiate the cascade of events that ultimately lead to uterine activity and cervical dilation. Thus, a reduction in the spontaneous preterm delivery rate may require not only accurate identification of patients at risk for preterm delivery but also effective treatment strategies aimed at correcting the underlying causes of preterm labor.[10,11-17] Methods used for predicting preterm birth include risk scoring system, assessment of salivary estriol, fetal fibronectin (FFN), maternal serum alpha fetoprotein (MS-AFP), cervicovaginal intracellular

adhesion molecule-1 (ICAM-1), phosphorylated insulin-like growth factor binding protein-1 (phIGFBP-1), cervicovaginal beta-human chorionic gonadotropin (β-hCG), and the cervical morphology and biometry.[18-19] Ultrasonographic measurement of cervical length is the better predictive tool, as it not only helps in prediction of preterm labor in symptomatic women but also in asymptomatic women. Hence, can be used in high risk group also for prediction of preterm birth in advance. It is also widely available, cost effective, easy to perform and reproducible. Thus, it can act as a best screening modality in low income settings.

METHODS

A prospective study was carried out over a period of 2 years on 50 patients in study group comprising of pregnant women who clinically presented with signs of threatened preterm labor which was taken as presence of regular uterine contractions with cervical changes: dilatation of less than 1 cm with or without effacement. Fifty asymptomatic low risk antenatal women of gestational age 18-37 weeks were taken as controls. Antenatal women with; multiple gestation, advanced preterm labor i.e. dilatation ≥3 cm, cervical incompetency, history of cervical procedures like conization, LEEP, etc and PPROM, were excluded from the study. All cases presenting with features of threatened preterm labor (painful uterine contractions) at 24-36 weeks of gestation, transvaginal sonographic measurement of cervical length was done. Women in active labor, defined by presence of cervical dilatation of ≥3cm and those with ruptured membranes were excluded.

Analysis of demographic data and baseline characteristics was done using percentage for categorical data and mean and standard deviation for continuous data. The effect of various variables including cervical length on preterm delivery was investigated using logistic regression analysis. Student t-test and chi square test was used for statistical analysis.

RESULTS

Table 1 shows that mean gestational age at diagnosis of preterm labor was 31.28 ± 3.55 weeks. Maximum number of cases presented between 32-36 weeks of pregnancy (40.0%).

Table 1: Gestational age (weeks) at diagnosis of preterm labor.

Gestational age in weeks	N	%
20-24	2	4.0
24-28	11	22.0
28-32	17	34.0
32-36	20	40.0
Total	50	100.0
Mean±SD	31.28±3.55	

Table 2: Distribution of funnelling in cases and controls.

Presence of funneling	Cases		Controls		P value
	N	%	n	%	
Yes	7	14.0	0	0.0	0.012
No	43	86.0	50	100.0	
Total	50	100.0	50	100.0	

Seven cases (14.0%) and none in control group (0%) had funnelling. The difference is statistically significant (p value<0.05).

Table 3: Distribution of open internal in the study group and controls.

Internal OS dilatation >5mm	Cases		Controls		P value
	N	%	n	%	
Open	11	22.0	0	0.0	0.001
Closed	39	78.0	50	100.0	[Sig]
Total	50	100.0	50	100.0	

Eleven cases (22.0%) and none (0%) in controls had open internal Os. Whereas 39 (78.0%) had closed internal OS in cases and none among the controls had closed internal OS. The difference is statistically significant (P value <0.05).

Table 4: Distribution of cases and controls in relation to cervical length.

Cervical length in (cm's)	Study		Control		P value
	N	%	n	%	
≤1.5	3	6.0	0	0.0	≤0.0001
1.5-2	6	12.0	0	0.0	
2-2.5	11	22.0	0	0.0	
2.5-3	8	16.0	2	4.0	
> 3	22	44.0	48	96.0	
Total	50	100.0	50	100.0	
Mean±SD	2.80±0.725 cm		3.6±0.26 cm		

Twenty five (50%) cases, had cervical length between 1.5-2.5cm and only 3 cases (6.0%) had cervical length ≤1.5cm and 22 cases (44.0%) were having cervical length of >3cm. In control group 2 cases (4.0%) had cervical length between 2.5-3cm. Mean cervical length in cases was 2.80±0.725cm and in controls was 3.6±0.26cm. The difference is highly significant with P-value of (≤0.0001).

In 19 cases (38.0%) and none among the controls the tocolytics were used. Use of tocolysis was based on cervical length using TVS. Tocolysis was given if cervical length was < 2.5cm. Thus, with the help of TVS unnecessary administration of tocolysis is avoided.

Table 5: Tocolysis in the study group.

Tocolysis given	Cases		Controls		P value
Yes	N	%	n	%	0.000 [Sig]
	19	38.0	0	0.0	
No	31	62.0	50	100.0	
Total	50	100.0	50	100.0	

Out of 50 cases in the study group 20 cases (40.0%) delivered preterm and among these, 3 cases (6.0%) delivered within 7 days of presentation of symptoms and 17 cases (34%) delivered after 7 days of presentation. Thus, from above results it gets clarified that duration of delivery interval depends on cervical length and tocolysis increases delivery interval.

All controls were delivered at term.

Figure 1 shows ROC curve, area under the curve is 0.984, hence TVS documented cervical length had excellent accuracy in predicting preterm labor in threatened preterm. The cut off value for cervical length in this curve is 2.75cm. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) at this cut off is 95%, 96.5%, 86.36%, 98.7% respectively.

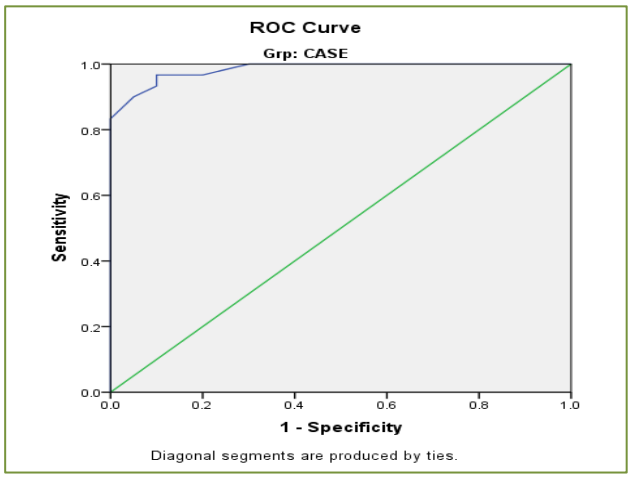

Figure 1. ROC curve.

DISCUSSION

Preterm labor is not a rare condition and is associated with severe fetal complications in early perinatal period as well as in later life. This present study included 50 patients in study group comprising of pregnant women who clinically presented with signs of threatened preterm labor and 50 asymptomatic low risk antenatal women of gestational age 18-37 weeks were taken as controls. All cases were subjected to transvaginal sonographic measurement of cervical length. Women in active labor, defined by presence of cervical dilatation of ≥3cm and those with ruptured membranes were excluded.

In present study group mean gestational age at diagnosis of preterm labor was 31.28±3.55 weeks. Maximum number of cases presented between 32-36 weeks of pregnancy (40.0%). Study done by Murakawa H et al had also mean gestational age of presentation 31.6 weeks with the range of 24-35 weeks.[20] In a study done by Tosi. E et al mean gestational age of presentation was 32 weeks with a range of 24-36 weeks.[22] In the study by Handono et al mean gestational age of presentation was 32.8 weeks with the range of 27-35 weeks.[21]

In present study group 7 cases (14.0%) were having funnelling and none in control group. Mean cervical length in patients with funneling was 2.085±0.790 and those without funneling were 2.925±0.65. Similarly, in the study by Handono et al, mean cervical length (2.25±0.50cm) in funneling positive group was less than funneling negative group (2.37±0.54cm), suggesting that funneling increases the risk of preterm delivery.[21]

In the study group 11 cases (22.0%) had open internal OS and 39 (78.0%) had closed internal OS. In controls all had closed internal OS. Similarly, in the study by Murakawa et al, internal OS was open in 11 cases (33.0%) with mean dilatation of 1cm.[20] The P value was <0.05, hence statistically significant.

In our study group mean cervical length in cases was 2.80±0.725cm and in controls was 3.6±0.26cm. Similarly, in the study by Tosi E et al 43 cases (20.0%) were having cervical length ≤1.5cm with a mean cervical length of 2.4cm and 80.0% cases were having cervical length ≥1.5cm with P value of <0.0001.[22] In the study by Murakawa et al mean cervical length in study group was 2.3cm and in control group the mean cervical length was 3.2cm with P value of <0.001.[20]

In the study group 19 cases (38.0%) were given tocolysis. Use of tocolysis was based on cervical length using TVS. Tocolysis was given if cervical length was <2.5cm. Thus, with the help of TVS unnecessary administration of tocolysis is avoided. Similarly, in study by Tosi E et al 25.0% of cases received tocolysis.[22] Tocolysis was given only in cases with cervical length of <2.5cm. Thus according to Tosi E et al transvaginal documented cervical length helps in distinguishing true labor from false labor and prevents unnecessary administration of tocolysis.[22] Similarly, in the study by Vafai H et al transvaginal documented cervical length prevented unnecessary administration of tocolysis.[24]

In present study out of 50 cases in the study group 20 cases (40.0%) delivered preterm and among these, 3 cases (6.0%) delivered within 7 days of presentation of symptoms and 17 cases (34%) delivered after 7 days of presentation. Thus, from above results it gets clarified that duration of delivery interval depends on cervical length and tocolysis increases delivery interval. All controls were delivered at term. In the study by Murakawa et al 11 out of 33 cases (34.3%) delivered

preterm, which is consistent with present study.[20] In the study by Tosi E et al 43 out of 216 cases (20%) delivered preterm and among them 17 cases (7.8%) delivered within 7 days.[22] 173 out of 216 (80.0%) delivered full term. The difference in the rates of preterm delivery can be due to ethnic difference and small sample size comparative to Tosi E et al.[22]

In this study, ROC curve has been developed to predict spontaneous preterm birth at <37 weeks of gestation, revealing the best cut- off for cervical length to be 2.75cm with sensitivity of 95%, specificity of 96.5%, positive predictive value of 86.36% and negativpredictive value of 98.7%. In the study by Vafai H et al 2.8cm was cut-off to predict preterm delivery with sensitivity of 93.75% and specificity of 92.74%, hence consistent with present study.[24] In the study by Bagga et al ≤2.5 cms was cut-off with sensitivity of 88.3% and specificity of 60.0%.[25] In the study by Leung et al ≤2.7cm was cut-off.[26] In the study by Ekaputri P et al 2.65 cm was the cut-off with sensitivity of 94.4% and specificity of 65.4%.[23]

CONCLUSION

In present study it was found a very strong correlation between cervical changes and preterm labor. Transvaginal ultrasonography is the reliable, reproducible and objective method to assess cervix and to predict the risk of preterm delivery. This may help in determining the outcome of pregnancy, counseling the patients, planning appropriate management for patient and neonate, referring the patients to higher centers where NICU facilities are available. Thus, it may help in decreasing perinatal morbidity and mortality.

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