Prediction of latency interval of labour in preterm premature rupture of membranes by 2D ultrasound : Case control study

Original Article

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ABSTRACT

Introduction: PPROM occurs in 3% of pregnancies and is responsible for about 30% of preterm births. So, the prediction of latency interval is helpful to the patient and obstetrician to allow possible interventions and proper management.

Aim: This study aimed to assess the relation between the myometrial thickness, cervical length, amniotic fluid index and membrane thickness (measured by transabdominal ultrasound) and latency interval of labor in cases of preterm premature rupture of membranes (PPROM).

Patients and Methods: This was a case control study that was conducted at Al-zahraa University Hospital and Shebin El-Kom Teaching Hospital. One hundred pregnant women (28-34 weeks gestation) were divided into two groups: The first group (fifty cases of PPROM) and the second group (control group = fifty cases with no PPROM), they were subjected to routine transabdominal ultrasound examination to assess fetal biometry, amniotic fluid index, thickness of fetal membranes, cervical length, and the myometrial thickness in 4 areas (the lower uterine segment, mid-anterior uterine wall, uterine fundus, and posterior uterine wall).

Results: The myometrial thickness of the anterior wall and LUS was significantly thinner, cervical length showed significant shortening, AFI was significantly decreased and the membrane thickness was significantly thicker in PPROM cases than in controls. The latency interval showed a significant inverse correlation with gestational age and a significant direct correlation with myometrial thickness, cervical length and AFI.

Conclusion: There was a significant thinning in the anterior and LUS myometrial thickness in addition to shortening of cervical length, decrease in amniotic fluid index and increase in membrane thickness. Also, the myometrial thickness, the cervical length and the AFI were directly correlated with latency interval.

Key Words: Latency interval, LUS, membrane thickness cervical length, myometrial thickness, PROM.

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INTRODUCTION

Prelabour, premature rupture of membrane would better (PPROM) means spontaneous rupture of the fetal membranes before the signs of delivery are evidenced and before the 37th week of pregnancy. The actual cause of PPROM is unknown[2], but it has many risk factors some of which are maternal such as previous history of PPROM in a prior pregnancy, direct abdominal trauma, cigarette smoking and others are uteroplacental factors such as uterine anomalies as uterine septum, placental abruption, uterine overdistension as in polyhydramnios and multiple pregnancy, intra-amniotic infection (chorioamnionitis)[3]. The measurement of myometrial thickness may be helpful in the management of pregnant with preterm premature rupture of membranes and threatened preterm labor because it may help in prediction of latency interval of labor[4] .

Latency period means the time interval between rupture of membranes to the onset of active labor[4]. .

Ultrasonography is an accurate tool that is used to measure the cervical length which help to determine the risk of preterm delivery in pregnancies with intact membranes by[5]. So, ultrasongraphic measurements of the length of the cervix might predict the latency period in cases of PPROM[6].

Oligohydramnios in PPROM is related to shorter latency interval compared to PPROM without oligohydramnios as decreased amniotic fluid volume is involved in microbial invasion and causes fetal inflammatory response syndrome.

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Amniotic fluid index (≤ 5 cm) is associated with shorter latency[7].

The prediction of the latency interval in PPROM is important for minimizing maternal and neonatal adverse outcome by appropriate timed administration of magnesium sulfate and steroids[8].

AIM OF THE STUDY

This study was designed to assess the relation between the myometrial thickness, cervical length, amniotic fluid index and membrane thickness (measured by transabdominal) ultrasound and latency interval of labor in cases of preterm premature rupture of membranes (PPROM).

MATERIALS AND METHODS

Study Design: Case-control study.

Study Setting:

The study was conducted in the Department of Obstetrics and Gynecology in Al-Zahraa University Hospital and Shebin EL-Kom Teaching Hospital during the period between November 2017 till December 2018. Ethical approval was obtained from the Obstetrics and Gynecology Department of Al-Zahraa University Hospital and all cases were subjected to informed verbal consent.

Cases were divided into two groups: The first group (PPROM group) included fifty cases of PPROM. The second group (control group) included fifty cases with no PPROM. Inclusion criteria were: Women with singleton pregnancy, confirmed gestational age (either by last normal menstrual period (LNMP) or early ultrasound). Exclusion criteria were fetal anomalies, intrauterine growth restriction and macrosomia, suspicion of chorioamnionitis (Fever-maternal tachycardia-offensive purulent vaginal discharge-abdominal tenderness –non reassuring CTG), active labor, abnormalities of placentation (Low lying placenta-abruptio placenta), previous uterine scar, congenital uterine malformation, serious illness as DM, HTN or others. All women were subjected to complete history taking, general examination, abdominal examination and vaginal examination (using dry sterile speculum (Cusco's speculum) for assessment of any vaginal discharge and diagnosis of PPROM. Cases in the first group were subjected to laboratory investigation including total leucocytic count (TLC) and CRP were done twice weekly.

All cases were subjected to the routine abdominal ultrasound examination within 24 hours from PROM using (G.E LOGIQ V5 in Al-Zahraa University Hospital and G.E Voluson S6 in Shebin EL-Kom Teaching Hospital), with a 3.5 or 5.0 MHz transabdominal probe. The foetal biometry, estimated fetal weight and placental localization were determined. The amniotic fluid volume was measured using the 4- quadrant technique, the uterine cavity was divided into four quadrants by a vertical and horizontal lines running through the umbilicus, amniotic fluid index was obtained by adding these four measurements. Then, the myometrial thickness was identified as the echogenic homogenous layer between the serosa and the decidua. The myometrial thickness was measured at four different sites in millimeters (mm): Lower uterine segment (LUS) (approximately 2cm above the reflection of urinary bladder), Mid-anterior uterine wall (1 cm above the maternal umbilicus "point standerdization was feasible as all estational ages above 24 weaks and fundal height crossed the umbilicus"). Uterine fundus (it was measured by keeping the scan probe above the uterine fundus). Posterior uterine wall (it was demarcated by using pulsations of maternal abdominal aorta as anatomic marker), this was the most difficult of all the four parameters as it was the furthermost measurement from the abdominal probe and obscured by fetal shadowing. Each measurement for the four sites was measured three times and the mean was obtained. Also, cervical Length was measured after visualizing the endocervical canal with semifullness of maternal urinary bladder, calipers were placed where the anterior and posterior walls of the cervix opposed (we preferred transabdominal sonography with its known limitations due to presence of PROM with the risk of chorioamnionitis). Also, the thickness of fetal membranes was measured 3 cm from the insertion of the umbilical cord, the transducer was put perpendicular to the maternal abdominal wall.

Cases with absence of signs or symptoms of chorioamnionitis and/or abnormalities of CTG were managed expectantly. They were admitted in the obstetrics ward and were given the expectant management, which included bed rest, antibiotics (Erythromycin oral 250mg/4times per day for 10 days or until the woman was in active labour whichever was sooner), Two doses of dexamethasone 12mg was taken intramuscularly to promote the maturation of fetal lung.

Follow up was done to assess the latency interval (the period from the onset of membrane rupture reported by the patient to the onset of delivery), mode of delivery and foetal outcomes.

Statistical methods: Data were analyzed using IBM© SPSS© Statistics version 23 (IBM© Corp., Armonk, NY, USA). Continuous numerical variables were presented as mean and standard deviation (SD) and intergroup differences were compared using the independent-samples t-test. Ordinal data were presented as number and percentage and differences were compared using the chi-squared test for trend. Correlations were tested using the Pearson correlation. The correlation coefficient (Pearson r) is interpreted as follows:

Correlation coefficient	Strength of correlation
<0.2	Very weak
0.2 – 0.39	Weak
0.4 – 0.59	Moderate
0.6 – 0.79	Strong
0.8 – 1.0	Very strong

Multivariable regression analysis was used to determine predictors of the latency interval. Two-sided *p*-values <0.05 were considered statistically significant and *p*-values >0.05 were considered statistically non-significant.

RESULTS

One hundred pregnant women between 28-34weeks gestation were included, they were divided into two groups: the first group (PPROM group) included: fifty cases of PPROM. And, the second group (control group) included: fifty cases with no PPROM. Table 1 shows that there was no significant difference in demographic data in relation to age, maternal weight, gravidity, parity and number of previous abortions between both groups.

Table 1: Comparison of demographic characteristics between PPROM and control groups.

Variable	PPROM (n=50)	Control (n=50)	Difference	95% CI	*P*-value
Age (years) Mean±SD	26 ± 5.5	27.3 ± 6.1	-1.3	-3.6 to 1.0	0.279
Maternal weight (kg) Mean±SD	70.4 ± 8.6	70.1 ± 8.5	0.3	-3.1 to 3.7	0.843
Gravidity Mean±SD	2.2 ± 1.3	2.4 ± 1.2	-0.2	-0.7 to 0.3	0.479
Parity Mean±SD	1.1 ± 1.3	1.3 ± 1.1	-0.1	-0.6 to 0.4	0.621
Number of previous abortions Mean±SD	0.16 ± 0.47	0.20 ± 0.49	-0.04	-0.23 to 0.15	0.679

Data are mean and standard deviation (SD) -95% CI = 95% confidence interval *Unpaired t test.

Table 2 shows that the anterior wall myometrial thickness and LUS myometrial thickness were significantly thinner in PPROM cases than in controls. However, there was no significant difference as regarding posterior wall and fundal myometrial thickness between the two groups. Also, cervical length, membrane thickness and AFI were significantly decreased in PPROM cases than in controls.

Table 2: Comparison of US measures of myometrial thickness, cervical length, AFI and membrane thickness between PPROM group and control group.

Variable	PPROM (n=50)		Control (n=50)		Difference	95% CI	*P*-value
	Mean	SD	Mean	SD			
Myometrial thickness							
LUS (mm)	4.4	1.9	5.1	1.6	-0.7	-1.4 to -0.004	0.049
Anterior wall (mm)	5.9	1.8	6.6	1.5	-0.7	-1.4 to -0.1	0.030
Fundus (mm)	8.3	1.9	8.9	2.1	-0.6	-1.4 to 0.2	0.127
Posterior wall (mm)	6.0	1.7	6.6	1.7	-0.5	-1.2 to 0.1	0.116
Average (mm)	6.1	1.7	6.8	1.4	-0.6	-1.3 to -0.02	0.043
Cervical length (cm)	2.8	0.6	3.2	0.7	-0.4	-0.7 to -0.2	0.001
AFI (cm)	7.1	3.6	15.0	3.7	-7.9	-9.4 to -6.5	<0.0001
Membrane thickness (mm)	2.6	0.6	2.4	0.6	0.3	0.03 to 0.5	0.028

*Unpaired t test.

Table 3 shows that there was significant inverse correlation between gestational age and latency interval while other variables including myometrial thickness, cervical length and AFI show significant direct correlation with latency interval. Table 4 shows the results of multiple regression for prediction of latency interval. Average myometrial thickness (*p*-value <0.0001), gestational age (*p*-value <0.0001) and cervical length (*p*-value = 0.004) were independent predictors of latency interval. The regression model had excellent predictive value with a coefficient of determination (R2) of 0.83. There was strong correlation between the predicted and actual values of latency interval (r = 0.911 Figure 3) and no correlation between the predicted latency interval and residuals (r = 0.000 Figure 4) denoting excellent goodness of fit of the regression model.

Table 3: Correlation between latency interval and other numerical variable in PPROM group and control group.

Variables		Latency interval		
		All	PPROM (n=50)	Control (n=50)
Age	Pearson r	-0.058	-0.156	-0.041
	p-value	0.568	0.278	0.779
Gestational age	Pearson r	0-.540**	-.597**	0-.618**
	p-value	<0.001	<0.001	<0.001
Maternal weight	Pearson r	0.166	0.277	0.042
	p-value	0.098	0.052	0.773
Myometrial thickness: LUS	Pearson r	0.719**	0.855**	0.426**
	p-value	<0.001	<0.001	0.002
Myometrial thickness: anterior wall	Pearson r	0.835**	0.880**	0.787**
	p-value	<0.001	<0.001	<0.001
Myometrial thickness: fundus	Pearson r	.633**	0.712**	0.576**
	p-value	<0.001	<0.001	<0.001
Myometrial thickness: posterior wall	Pearson r	0.819**	0.886**	0.827**
	p-value	<0.001	<0.001	<0.001
Myometrial thickness: Average	Pearson r	0.839**	0.895**	0.776**
	p-value	<0.001	<0.001	<0.001
Cervical length	Pearson r	0.504**	0.630**	0.254
	p-value	<0.001	<0.001	0.076
AFI	Pearson r	0.418**	0.385**	-0.006
	p-value	<0.001	0.006	0.965
Membrane thickness	Pearson r	0.048	0.169	0.114
	p-value	0.634	0.241	0.431

**Correlation is significant at the 0.01 level (2-tailed).

Table 4: Multiple regression analysis for prediction of latency interval in PPROM group.

Regression model						
Independent variables	B	SE	T	P-value	r partial	VIF
Constant	45.546					
PPROM (=1)*	-9.978	3.013	-3.312	0.001	-0.323	0.141
Gestational age (weeks)	-2.640	0.495	-5.328	<0.0001	-0.482	0.227
Average myometrial thickness (mm)	9.799	0.712	13.770	<0.0001	0.818	0.585
Cervical length (cm)	5.171	1.759	2.940	0.004	0.290	0.125
AFI	-0.143	0.294	-0.487	0.627	-0.050	0.021

Regression Equation

Latency interval (days) = 45.546 - 9.978 * PPROM - 2.640 * gestational age (weeks) + 9.799 * average myometrial thickness (mm) + 5.171 * cervical length (cm) - 0.143 * AFI

Analysis of Variance

Source	DF	SS	MS
Regression	5	46440.492	9288.098
Residual	94	9499.055	101.054
F-ratio	91.912		
P-value	<0.0001		
Coefficient of determination (R2)	0.830		
R2-adjusted	0.821		
Multiple correlation coefficient (R)	0.911		
Residual SE	10.053		

Zero order and simple correlation coefficients

Variable	Latency interval	PPROM	GA	Average MT	CL
PPROM	-0.369				
GA	-0.540	0.000			
Average MT	0.839	-0.203	-0.371		
CL	0.504	-0.324	-0.312	0.338	
AFI	0.418	-0.735	-0.148	0.293	0.435

The following equation could predict the latency interval:

Latency interval (days) = 45.546 - 9.978 * PPROM - 2.640 * Gestational age (weeks) + 9.799 * Average myometrial thickness (mm) + 5.171 * Cervical length (cm) - 0.143 * AFI

For example we had a case with PPROM 30 weeks gestation. Her average myometrial thickness was 5.2mm. Cervical length was 2.8cm. AFI was 7cm. Her actual latency interval was 3 weeks.

By this equation we can calculate the predicted latency interval in days as following: Latency interval (days) = 45.546 - 9.978 * 1 - 2.640 * 30 + 9.799 * 5.2 + 5.171 * 2.8- 0.143 * 7=20.8 days.

Table 5 shows significant decrease in fetal weight at birth between preterm cases and full term cases in PPROM group , significant thinning in myometrial thickness at LUS, anterior, fundal and posterior myometrium, significant shortening in cervical length and significant decrease in AFI between both groups. But, there is no significant difference in membrane thickness between preterm and full term cases.

Table 6 shows that receiver-operating characteristics (ROC) curve was used to define the best cut off value of LUS myometrial thickness which was ≤4.5mm with sensitivity 100% and specificity 61%, anterior myometrial thickness which was ≤ 5.9mm with sensitivity 100% and specificity 66%, fundal myometrial thickness which was ≤7.6 with sensitivity 78% and specificity 76%, posterior myometrial thickness which was ≤ 5.8mm with sensitivity 94% and specificity 65%, cervical length which was ≤2.69 with sensitivity 78% and specificity 77% and AFI which was ≤8.5 with sensitivity 89% and specificity 77% for prediction of latency interval<7 days in PPROM cases.

Table 5: Comparison between preterm cases and full term cases in PPROM group as regarding fetal weight at birth, maternal weight, myometrial thickness, cervical length, AFI and membrane thickness

		Pre term (n=32)	Full term (n=18)	t. test	*p*. value
Fetal weight(gm)	Range	1050 – 2700	2800 – 3300	64.428	0.001*
	Mean ± S.D	2214.06 ± 422.56	3040.56 ± 138.75		
Maternal weight(kg)	Range	55 – 86	55 – 90	2.683	0.108
	Mean ± S.D	68.97 ± 8.29	73.06 ± 8.78		
LUS(mm)	Range	1.8 – 7.1	3 – 9	54.100	0.001*
	Mean ± S.D	3.35 ± 1.12	6.26 ± 1.67		
Anterior(mm)	Range	2.8 – 7.8	4.5 – 9.9	71.432	0.001*
	Mean ± S.D	4.83 ± 1.00	7.69 ± 1.38		
Fundal(mm)	Range	4.8 – 10.2	7.8 – 14.8	35.205	0.001*
	Mean ± S.D	7.35 ± 1.33	9.92 ± 1.70		
Posterior(mm)	Range	2.9 – 7.7	6 – 9.8	79.603	0.001*
	Mean ± S.D	5.03 ± 1.02	7.78 ± 1.08		
Cervical length(cm)	Range	1.8 – 3.8	2 – 4	20.952	0.001*
	Mean ± S.D	2.54 ± 0.45	3.18 ± 0.50		
Amniotic Fluid index(cm)	Range	1 – 14	3 – 18	4.468	0.040*
	Mean ± S.D	6.27 ± 3.56	8.45 ± 3.37		
Membrane thickness(mm)	Range	1.7 – 3.7	1.4 – 4.3	0.830	0.367
	Mean ± S.D	2.73 ± 0.53	2.57 ± 0.66		

Table 6: Receiver-operating characteristic (ROC) curve analysis for prediction of latency interval <7 days using myometrial thickness, cervical length and AFI in PPROM group.

	ROC parameter								
Predictor	AUC	SE	95% CI	Z	P-value	Youden index J	Cut-off	Sensitivity	Specificity
MT at LUS	0.861	0.040	0.777 to 0.922	9.040	<0.0001	0.610	≤4.5 mm	100%	61%
MT at anterior wall	0.890	0.035	0.812 to 0.944	11.093	<0.0001	0.659	≤5.9 mm	100%	66%
MT at fundus	0.802	0.051	0.711 to 0.875	5.888	<0.0001	0.534	≤7.6 mm	78%	76%
MT at posterior wall	0.847	0.041	0.761 to 0.911	8.574	<0.0001	0.591	≤5.8 mm	94%	65%
Cervical length	0.838	0.044	0.751 to 0.904	7.655	<0.0001	0.546	≤2.69 cm	78%	77%
AFI	0.889	0.040	0.810 to 0.943	9.796	<0.0001	0.657	≤8.5	89%	77%

AUC = area under ROC curve, SE = standard error, 95% CI = 95% confidence interval, Z = Z-statistic.

DISCUSSION

Prediction of the timing of delivery in PROM is found to be directly correlated with the myometrial thickness, the cervical length and the AFI, which is helpful to the patient and obstetrician to allow possible interventions such as the administration of steroids, magnesium sulfate for fetal neuroprotection, or even transfer to a tertiary center[9]. Also, the prediction of the latency interval after PROM may be very important while counseling women who would refuse hospital admission[11].

In the current study, One hundred singleton pregnant women were recorded between 28th -34th weeks gestation, they were divided into two groups: The first group (PPROM group) included fifty cases of PPROM, and the second group (control group) included fifty cases with no PPROM. There was no significant difference in maternal age, maternal weight and parity between both groups (Table 1).

In the present study, LUS and anterior myometrial thickness were significantly thinner in PPROM cases than in controls . Also, cervical length showed significant shortening, AFI was significantly decreased and membrane thickness was significantly thicker in PPROM cases especially who delivered preterm than in controls (Table 2). The study by Gupta *et al.* 2016[4] showed that LUS myometrial thickness was thinner in PPROM cases than in controls supporting our results. While, Buhimschi *et al.* 2005[15] found that LUS myometrial thickness was thicker in PPROM cases than in controls.

We found that anterior myometrial thickness was significantly thinner in PPROM cases than in controls. This disagreed with Buhimschi *et al.* 2005[15] who reported that anterior myometrial thickness was thicker in PPROM cases and Hamdi *et al.* 2010[14] who found that there was no significant difference in anterior myometrial thickness between both groups.

As regards to fundal myometrial thickness, our results were in concordance with the studies made by Hamdi *et al.* 2010[14] and Atarjavdan *et al.* 2011[1]. However, Buhimschi *et al.* 2005[15] found that fundal myometrial thickness was thicker in PPROM cases compared with controls. This difference in myometrial thickness may be due to small sample size, or degree of

oligohydramnios because in our study, PPROM cases had mild oligohydramnios but in other study oligohydramnios was severe, also, technical problem as the women's weight [15].

Buhimschi *et al.* 2005[15] measured the myometrial thickness within 12hs of PPROM while we measured the myometrial thickness within 24 hrs so, their cases may be in a state of myometrial quiescence and our cases may have been entered into a state of functional myometrial activation.

In the present study, there was a significant inverse correlation between the gestational age and latency interval and there was a direct correlation between myometrial thickness, cervical length, AFI and latency interval which was statistically significant (Table 3). As regards to gestational age, this result was supported by many studies[15, 5, 18] that confirm the significant inverse correlation between the gestational age and latency interval. However, Hamdi *et al.* (2010)[14] did not find any significant relation between the gestational age and latency interval. This may be due to small sample size regarding the relation between myometrial thickness and latency interval. Our result was found a positive correlation between anterior, LUS myometrial thickness and latency interval and this was in agreement with Gupta *et al.* 2016[4], Atarjavdan *et al.* 2011[1], Buhimschi *et al.* 2005[15]. Although this disagreed with Hamdi *et al.* 2010[14] and Kalantari *et al.* 2010[13]. They found no significant correlation between MT and latency interval with (p value = 0.05) (p value = 0.2), respectively. This may be due to small sample size in both studies.

Our study showed a direct correlation between AFI and latency interval similar to many studies[5, 15, 19] which was in contrast with Hamdi *et al.* 2010[14] and Singhal *et al.* 2011[18].

The positive correlation between cervical length and latency interval in our study was in agreement with Mehra *et al.* 2015[10], who reported that shorter transvaginal cervical length independently predict delivery within 7 days in women presenting with PPROM.

In the current study, the results of multiple regression for prediction of latency interval was illustrated, where average myometrial thickness, gestational age, and cervical length were independent predictors of latency interval.

It was clear that there was a strong correlation between the predicted and actual latency interval.

The latency interval can be predicted by an equation as following: Latency interval (days) = 45.546 - 9.978 * PPROM - 2.640 * Gestational age (weeks) + 9.799 * Average myometrial thickness (mm) + 5.171 * Cervical length (cm) - 0.143 * AFI (Table 4).

(For example we had a case with PPROM 30 weeks gestation. Her average myometrial thickness was 5.2mm. Cervical length was 2.8cm. AFI was 7cm. Her actual latency interval was 3 weeks.

By this equation we can calculate the predicted latency interval in days as following: Latency interval (days) = 45.546 - 9.978 * 1 - 2.640 * 30 + 9.799 * 5.2 + 5.171 * 2.8- 0.143 * 7=20.8 days.)

This was in contrast with Zakaria *et al.* 2019[20] who stated that there was a direct correlation between latency interval and fundal myometrial thickness (p value=0.001). By using the regression model, the latency interval was modeled as a dependent variable and the fundal MT as a predictor, and an equation was made to calculate the latency interval. This equation was: latency interval=(fundal myometrial thickness×32.7)– 237.5. This different equation may be due to use of fundal myometrial thickness only as a predictor of latency interval in their study. But, in our study we used multiple predictors of latency interval including gestational age, average myometrial thickness, cervical length and amniotic fluid index.

Follow up till delivery was done for both groups, where 18/50 of PPROM group delivered full term and 32/50 delivered preterm.

The current study showed that there was significant decrease in fetal weight at birth in PPROM cases who delivered preterm than PPROM cases who delivered full term and there were significant thinning in myometrial thickness and shortening in cervical length in cases who delivered preterm than who continued till maturity. There are no studies taking this point into consideration (Table 5).

In the present study, the cut off value of LUS myometrium ≤4.5 mm, the cut off value of anterior myometrium was ≤5.9mm, the cut off value of the fundal myometrium was ≤7.6 mm and the cut off value of posterior myometrium ≤ 5.8 mm for the identification of women whose latency interval was 7 days. This study also showed that the measurements of cervical length and amniotic fluid index can be used for prediction of labor within 7 days in women with PPROM when the cut off value of cervical length ≤ 2.69 cm and AFI ≤ 8.5 cm (Table 6).

In contrast to Atarjavadan *et al.* 2011[1] who found that the cut off value of the fundal myometrium was 6.9mm which was 79% sensitive and 39% specific and the cut off value of the anterior myometrium was 5.5 mm which was 89% sensitive and 42% specific for identification of women whose latency interval was 8 days, this difference may be due to different gestational age.

While, Buhimschi *et al.* 2005[15] showed that the cut off value of the fundal myometrium was less than 12.1 mm which was 93.7 % sensitive and 63.6 % specific for identification of women whose latency interval was 5 days, this difference may be due to different population and different protocols of management.

Our results about the cut off value of cervical length were in disagreement with Mehra *et al.* 2015[10] who found a positive association between shorter cervical length , low AFI and higher delivery rates within 7 days with cutoff value of TVCL ≤ 2cm and AFI ≤ 5cm . This difference may be due to use of transabdominal ultrasound in our study while Mehra *et al.* 2015[10] used transvaginal ultrasound.

Rizzo *et al.* 1998[21] demonstrated that cervical length less than 2 cm and low AFI at admission was associated with shorter latency interval, their reported median time from admission to delivery was 4.5 days which was shorter than the median of 7 days observed in our population, perhaps their performance of transabdominal amniocentesis on all their patients was related to shorter latency.

Gire *et al.* 2002[6] found that cervical length ≤ 2 cm was associated with shorter latency. The median latency period was 2 days, a possible reason for their shorter latency included a much higher clinical chorioamnionitis in 65%.

In the present study it was found that the complimentary use of measurements of myometrial thickness, cervical length and amniotic fluid index were important in prediction of latency interval in PPROM which might improve maternal and fetal outcome.

CONCLUSION

Following PPROM, it could be concluded that there were a significant thinning in the anterior and LUS myometrial thickness in addition to shortening of cervical length, decrease in amniotic fluid index and increase in membrane thickness. Also, the myometrial thickness, the cervical length and the AFI were directly correlated with latency interval.

The following equation could predict the latency interval in PPROM group: Latency interval (days) = 45.546 - 9.978* PPROM - 2.640* Gestational age (weeks) + 9.799* Average myometrial thickness (mm) + 5.171* Cervical length (cm) - 0.143* AFI. For example, we had a case with PPROM 30 weeks gestation. Her average myometrial thickness was 5.2mm. Cervical length was 2.8cm. AFI was 7cm. Her actual latency interval was 3 weeks.

By this equation, we can calculate the predicted latency interval in days as following: Latency interval (days) = 45.546 - 9.978 * 1 - 2.640 * 30 + 9.799 * 5.2 + 5.171 * 2.8- 0.143 * 7=20.8 days.

In our study, Receiver-operating characteristics (ROC) curve was used to define the best cut off value of LUS myometrial thickness which was ≤4.5mm, anterior myometrial thickness which was ≤ 5.9mm, fundal myometrial thickness which was ≤7.6, posterior myometrial thickness which was ≤ 5.8mm, cervical length which was ≤2.69 and AFI which was ≤8.5 for identification of latency interval<7 days in PPROM

We assumed that the sample size could be a limitation in our study; therefore, we recommend studies with more cases to clarify this issue in the future.

RECOMMENDATION

Accurate prediction of the latency interval in pregnancy complicated with PPROM remains an obscure confine in the art of obstetrics. The complimentary use of measurement of myometrial thickness, cervical length and amniotic fluid index can help in prediction of latency interval in PPROM which may improve maternal and fetal outcome. Further studies are recommended

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