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Role of Ultrasonic Assessment of Cervical Length and Amniotic Fluid Index in Predicting Delivery Latency Period Following Preterm Premature Rupture of Membranes

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Abstract: ***Introduction: Premature rupture of the membranes (PROM) is defined as spontaneous membrane rupture that occurs before the onset of labour. When spontaneous membrane rupture occurs before 37 weeks of gestation, it is called as preterm premature rupture of membranes (PPROM). The term "latency" refers to the time from membrane rupture to delivery. Infants delivered after preterm premature rupture of membranes are at high risk for gestational age dependent and infection related morbidity and mortality. Thus knowing about factors affecting latency would allow timely intervention to reduce all these complications. Aims and Objectives: To assess the role of amniotic fluid index (AFI) and cervical length in prediction of delivery latency period among women with preterm premature rupture of membranes. Methodology: This was a prospective observational study performed during November 2015 to March 2017 in the Department of Obstetrics and Gynecology, Smt Sucheta Kriplani Hospital, Lady Hardinge Medical College, New Delhi on 106 singleton pregnant women between 28 weeks to 34 weeks gestation with cephalic presentation and preterm premature rupture of membranes. All the women were subjected to ultrasound for determining AFI and cervical length and were followed up until delivery. Results: Out of 106 women, 95 women underwent into spontaneous labour were included in study. Forty-six women delivered within 7 days of test and 49 delivered afterwards. Out of 46 women, 34 (73.91%) had amniotic fluid index of ≤5cm and 31 (67.39)% women had cervical length of ≤ 2 cm. The sensitivity, specificity, positive and negative predictive value of AFI alone in predicting delivery within 7 days were 73.91%, 65.31%, 66.67% and 72.73% respectively. The sensitivity, specificity, positive and negative predictive value of cervical length alone in predicting delivery within 7 days were 67.39%, 73.47%, 70.45% and 70.59% respectively. Out of 95 women, 33 had both the characteristics, (amniotic fluid index ≤ 5cm and cervical length ≤ 2 cm), out of them, 26 (74.29%) delivered with 7 days. The sensitivity, specificity, positive and negative predictive value of combination of both in predicting delivery within 7 days were 74.29%,56.25%,78.79% and 50% respectively. The PPV of cervical length ≤ 2cm and AFI ≤ 5cm alone in predicting delivery within 7 days were 70.45% and 66.67%, whereas combination of both is 78.79%. For AFI > 5 the total number of women who had not delivered within 7 days were 33 out of which 28 women (84.85%) had CL of > 2 cm. The NPV of AFI > 5 cm and TVCL > 2cm was 84.85%, means women with these two characteristics would remains undelivered within 7 days. Conclusion: This study concluded that cervical length and amniotic fluid index both independently predict the delivery latency period following preterm premature rupture of membranes and combination of both factors improves predictive ability.***

Keywords: preterm premature rupture of membranes, latency period, transvaginal cervical length, amniotic fluid index, prediction of preterm delivery

1. Introduction

Preterm premature rupture of membranes (PPROM) complicates approximately 3% of pregnancies and is responsible for a third of preterm births. Respiratory distress syndrome (RDS) is the most common complication after pre term PROM at any gestation [1]. Preterm PROM is an important cause of perinatal morbidity and mortality, particularly because it is associated with brief latency from membrane rupture to delivery, perinatal infection, and umbilical cord compression due to oligohydramnios.[1] Even with conservative management, 50–60% of women with preterm PROM remote from term will deliver within one week of membrane rupture.[1] Management schemes exist from one extreme to the other; some use minimal testing to monitor maternal health only, whereas others suggest intensive and invasive plans that include cerclage with amnioinfusion, antibiotics, frequent fetal testing, and aggressive use of tocolytics and corticosteroids.[2] Clearly, this diversity of approach suggests substantial controversy. Prediction of the latency period could help to lessen the controversy; for example, if latency was expected to be short, then the utility of tocolytics to gain time for corticosteroid administration might be greater. A few studies reported that a cervical length of <2 cm may be associated with a shorter latency to delivery.[3,4,5] Prior studies found that a low (≤5 cm) amniotic fluid index (AFI) in PPROM is associated with a shorter latency and a higher rate of delivery within 7 days compared to women with a normal AFI.[3,4,5,] However, it is unclear how these two clinical variables can be used, either independently or in combination with CL, to help predict spontaneous preterm delivery in PPROM. Hence, the aim of this study was to assess the role of transvaginal sonographic measurement of cervical length and amniotic fluid index in women with PPROM between 28 to 34 weeks in predicting the delivery latency period.

2. Methodology

This was a prospective observational study performed during November 2015 to March 2017 in the Department of Obstetrics and Gynecology, Smt Sucheta Kriplani Hospital, Lady Hardinge Medical College including 95 women with singleton pregnancy between 28 to 34 weeks gestation. Women with chorioamniotis, multifetal pregnancy, antepartum haemorrhage, and women in labour were excluded from the study.Women were admitted in the ward and they were explained regarding the management protocol and consent was taken for inclusion in study. All the women after admission were subjected to detailed history and examination. Maternal parameters like parity, maternal age at the time of admission, gestational age at the time of presentation were noted. Basic investigations were done which includes haemoglobin, total leukocyte count, differential leukocyte count, C-reactive protein, urine routine microscopy and culture sensitivity, high vaginal swab. A sterile per speculum examination was done under all aseptic condition and presence of amniotic fluid coming out through cervical os was confirmed. At the same sitting, high vaginal swab was taken for culture sensitivity. Gestational age was calculated by last menstrual period or early trimester scan. Each of these admitted women were subjected to transabdominal ultrasound to calculate amniotic fluid index. Philips HD 11× E model ultrasound machine was used which had transabdominal probe of frequency 3-5 MHz and transvaginal probe of frequency 6-9MHz. Abdomen is divided into four compartment and each of the deep cord free vertical pocket of liquor is taken and sum up. Then after emptying, the bladder transvaginal ultrasound was done to measure cervical length. External cervical os was identified as point at which anterior and posterior lips of cervix comes together. The point at which cervical mucosa ends is considered to be internal cervical os.

The cervix was occupying approximately 50 to 75% of image. At least three measurements were obtained and shortest length was taken. Cervical measurement is done by placing the callipers between external and internal cervical os. All the admitted women were given expectant management, which includes antibiotics and steroids. Latency for purpose of analysis was stratified into two groups ≤ 7 days and > 7 days. After delivery, perinatal outcome was assessed. A note was made of birth weight, Apgar score at 1 and 5 minutes, duration of NICU stay and perinatal mortality. Delivery latency period in this study was time interval between performing transvaginal scan to delivery of baby which is studied among women delivered spontaneously.

3. Results

Out of total 106 women, 95 delivered spontaneously, 2 underwent caesarean delivery because of fetal distress. Out of 11 women, 9 women were induced, indication being severe anhydroamnios, gestational age completed 34 weeks, clinical signs and symptoms of chorioamnionitis and two were lost to follow up as their liquor was adequate and they were discharged from hospital. We had calculated the results and their statistical significance in 95 women who underwent spontaneous vaginal delivery without any intervention.

Out of 95 women, 46 (48%) delivered within 7 days and 49(52%) delivered after 7 days of performing ultrasound. We had calculated the results and their statistical significance in 95 women who underwent spontaneous vaginal delivery without any intervention. The mean age of women who delivered within 7 days was 28.07± 5.01 years and 28± 5.25 years in women who delivered after 7 days which was not significantly different. Majority of the women (36.84%) in our study who delivered within 7 days were primigravida. The mean period of gestation in women who delivered within 7 days was 31.36± 1.89 weeks and it was 31.41± 1.78 weeks in women who delivered after 7 days. Thus age, parity and period of gestation were not found to factors which predict delivery latency period. There was history of preterm birth in 10 women out of which 6 (60%) of these women were delivered within 7 days. Sixteen women had history of PPROM in previous pregnancy out of which 9 (56.25%) had delivery within 7 days in this pregnancy (p-value- 0.246).

The total number of women who had amniotic fluid of less than 5 were 51, out of which 34 (66.67%) women delivered within 7 days and 17 (33.33%) women delivered after 7 days. The total number of women who had AFI of more than 5 were 44 out of which 32 (72.72%) had latency period of more than 7 days. The sensitivity, specificity, positive predictive value, negative predictive value of AFI<5 in predicting delivery latency period were 73.91%, 65.31% ,66.67%, 72.73% respectively. The total number of women who had cervical length of ≤ 2 cm were 44, out of which 31 (70.45%) women had delivery latency period of less than 7 days.51 women had cervical length of > 2 cm out of which, 15 delivered within 7 days and 36 delivered after 7 days. The mean cervical length was 2.08 cm in women who had delivered within 7 days and 2.89cm in women who had latency period of more than 7 days ($p<0.001$). The mean AFI of women who had latency period of ≤ 7 days was 4.63 as compared to 6.42 in women who had not delivered within 7 days ($p<0.001$).

4. Discussion

Prediction of the latency period can be important, particularly when delivery in a hospital with tertiary level facilities is planned. Preterm premature rupture of membranes contributes to one third of preterm births[1]. Therefore prediction of latency period in these women by measuring cervical length and amniotic fluid index is helpful to estimate the time of delivery, need for hospitalization, antenatal steroids, antibiotics and nursery care. In a prediction study conducted by Suwan Mehra et al[6] in women with PPROM with gestational age between 23weeks +5days to 33weeks +6 days, cervical length of ≤ 2 cm was found in 40% of women. The predictive value of delivery within 7 days for a cervical length of ≤ 2cm was 62%.Sensitivity, specificity and negative predictive value of the study was 51%, 71%,61% respectively, these findings were comparable to our present study. There is positive association between shorter cervical length and high rate of delivery within 7 days.

In another study conducted by G.Rizzo et al[7] in 1998 in predicting delivery latency period in women with PPROM between 24 and 32 weeks, short cervical length, presence of cervical funnelling and cervical index of >0.5 were significantly associated with shorter delivery latency period

In another study conducted by E. Tsoi et al [8]in women with PPROM between 24 to 36 weeks of gestation, logistic regression analysis demonstrated that significant independent contribution in the prediction of delivery within 7 days was provided by cervical length (odds ratio (OR)=0.91, 95% CI 0.86–0.96, P=0.001)

Juan Piazze et al[9]conducted a study in women with gestational age between 24 and 34 weeks' with PPROM. Patients were categorized into two groups on the basis of AFI value (AFI ≤5 cms or AFI >5cms) performed at the time of admission. Latency in days from preterm PROM episode to delivery was significantly lower in the group with AFI <5 cm, P<0.05 (median 3.8 days 25–75 centiles 2–18 vs. 8.6 days) Delivery occurred by 48 h, 1 and 2 weeks in 32.4%, 63.5% and 81.7% of pregnancies, respectively in women with AFI <5cm.

In another study conducted by William E. MacMillan[10] in which Amniotic fluid index at initial evaluation was stratified into three groups: Low (less than 5.0), reduced (4.0 to 7.9), and normal (8.0 or higher). Latency in days from preterm premature rupture of membranes to delivery was evaluated for these groups. A difference was noted in that latency was significantly longer in the group with normal versus low or reduced amniotic fluid index groups. significantly longer in the group with normal versus low or reduced amniotic fluid index groups with overall mean latency period of 8.3±8.7 days as compared to 4.8± 5 in women with AFI ≤5

Vermillion etal.[11] showed that an AFI <5 cm after PPROM between 24 and 32 weeks' gestation is associated with shorter latency preceding delivery; this finding has been supported by several authors[12,13,14,15], which indicates that the presence of oligohydramnios in PPROM is related to a shorter latency (interval between rupture of membranes and delivery) compared to PPROM without oligohydramnios, while Borna etal.[16] showed that AFI <5 cm did not have a shorter latency until delivery.

Our study showed that there was an increase in PPV when we combine AFI and CL in prediction time of labor, so women with AFI ≤5 cm and CL ≤2 cm had 78.79%risk of delivery within 7 days after PPROM.

5. Conclusion

Our study shows that there was an increase in PPV when we combine AFI and CL in prediction of time of labor, so women with AFI ≤5 and CL ≤2 had 78.79% risk of delivery within 7 days after PPROM. The NPV of AFI > 5 cm and TVCL > 2cm was 84.85%, means women with these two characteristics would remains undelivered within 7 days. Furthermore, we found that there was no significant association between age, gestational age in weeks and parity with latency period for delivery.

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Tables

Table 1: Validity of Cervical Length in Predicting Delivery Latency Period

Mean ± SD	Delivery latency period ≤7 days	Delivery latency period ≥7 days	P - value
Age/years (18-38)	28.07 ± 5.01	28 ± 5.25	0.367
Parity(0-5)	1.75±1.09	1.77±1.29	0.345
Gestational age/ weeks (28 to 34)	31.36±1.89	31.41±1.78	0.463
Cervical length/cm	2.08±1.08	2.89± 0.76	<0.001
AFI/cm	4.63±1.64	6.42±1.64	< 0.001

Table 2: Validity of Cervical Length in Predicting Delivery Latency Period

Cervical length (cm)	≤ 7days		> 7 days		p-value
	N	%	n	%	
≤ 2	31	67.39%	13	26.53%	<0.001
> 2	15	32.61%	36	73.47%	
TOTAL	46	100%	49	100%	

Table 3: Prediction of Latency Period by Cervical Length

Sensitivity	67.39%
Specificity	73.47%
PPV	70.45%
NPV	70.59%
Accuracy	70.53%

Table 4: Validity of Amniotic Fluid Index in Predicting Delivery Latency

USG-AFI (cms)	≤ 7days		> 7 days		p-value
	n	%	n	%	
≤ 5	34	73.91%	17	34.69%	<0.001
> 5	12	26.09%	32	65.31%	
TOTAL	46	100%	49	100%	

Table 5: Prediction of Delivery Latency by Amniotic Fluid Index

Sensitivity	73.91%
Specificity	65.31%
PPV	66.67%
NPV	72.73%
Accuracy	69.47%

Table 6: Validity of Combination of AFI≤ 5CM and Cervical Length in Predicting the Delivery Latency Period

Cervical length (cm)	≤ 7days		> 7 days		p-value
	n	%	n	%	
≤ 2	26	74.29%	7	43.75%	0.017
> 2	9	25.71%	9	56.25%	
TOTAL	35	100%	16	100%	

Table 7: Prediction of Delivery Latency Period by Combination of AFI≤5cm and Cervical Length < 2CM

Sensitivity	74.29%
Specificity	56.25%
PPV	78.79%
NPV	50.00%
Accuracy	68.63%

Table 8: Validity of Combination of AFI >5CM and Cervical Length

Cervical length (cm)	≤ 7days		> 7 days		p-value
	n	%	n	%	
≤ 2	6	54.55%	5	15.15%	0.004
> 2	5	45.45%	28	84.85%	
TOTAL	11	100%	33	100%	

Table 9: Prediction of Delivery Latency by AFI>5CM and Cervical Length > 2CM

Sensitivity	54.55%
Specificity	84.85%
PPV	54.55%
NPV	84.85%
Accuracy	77.27%