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Original Research Article

## Ultrasonographic evaluation of cervical length and amniotic fluid index as predictor of pregnancy outcome in case of preterm premature rupture of membrane

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### ABSTRACT

**Background:** Preterm premature rupture of membrane (PPROM) is among the most important cause of the perinatal morbidity and mortality. We sought to determine whether cervical length and amniotic fluid index individually or in combination can predict the pregnancy outcome in cases of PPRM.

**Methods:** The prospective observational study was done on 170 women complicated by PPRM with gestational age between 24-36<sup>+6</sup> weeks. They were categorized into three groups Group I.24-28 weeks, Group II.28+1 to 32 weeks and Group III. 32+1 to 36+6 weeks. Cervical length and amniotic fluid index were measured using trans abdominal ultrasound within 24 hr of admission. Maternal outcomes were recorded in terms of latency period, chorioamnionitis, and abruption, and neonatal outcomes were recorded in terms of birth weight, first minute APGAR score <7, NICU admission and early neonatal death. Qualitative variables were correlated using Chi-Square test /Fisher's exact test. Univariate logistic regression was used to assess cervical length and AFI as a predictor of complication. A p value of <0.05 was considered statistically significant.

**Results:** Out of 170, majority (95) belonged to 28+1 to 32 weeks group. Latency was inversely related to period of gestation (p<0.0001). A long cervical length correlated with increased latency, increased risk of chorioamnionitis and increased neonatal complications in all three groups. Also, women with PPRM having AFI >5 cm had a greater mean latency period (8.32±1.25 days) which increased their risk of developing chorioamnionitis as compared to women with PPRM having AFI ≤5 cm, who had a shorter mean latency period (7.63±1.07 days) and a lower risk of developing chorioamnionitis (p value <0.0001).

**Conclusions:** Latency is inversely related to period of gestation. A long cervical length and increased amount of AFI correlates with increased latency, increased risk of chorioamnionitis and increased neonatal complications.

**Keywords:** AFI, PROM, Pregnancy outcome, Cervical length

### INTRODUCTION

India is the biggest contributor to the world's prematurity burden with almost 3.6 million premature births accounting for 23.6% of around 15 million global preterm births reported each year (WHO).

Preterm premature rupture of membrane (PPROM) is a breach in the chorioamniotic membrane prior to the onset of labour at <37 weeks of gestation. PPRM complicates 3% of all deliveries and is associated with 30-40% of preterm deliveries. It is an important risk factor for perinatal mortality and morbidity.<sup>1</sup>

Clinical factors associated with PPROM include low socioeconomic status, tobacco use, history of preterm labour, urinary tract infection, vaginal bleeding at any time in pregnancy, uterine distension (e.g. polyhydramnios, multifetal pregnancy), cerclage and amniocentesis.<sup>2,4</sup> The major maternal risks are chorioamnionitis (35%), abruption (19%) and sepsis (<1%).<sup>3</sup> Placental abruption is more common if rupture of membranes occur prior to 28 wk of gestation.<sup>5</sup> The risk of abruption increases 24 hr after membrane ruptures, particularly in the presence of intrauterine infection or oligohydramnios.<sup>6,7</sup>

Chorioamnionitis is also associated with gestational age at which PPROM occurs. Major fetal morbidity is pulmonary hypoplasia, RDS, sepsis, intraventricular hemorrhage and contractures. Pulmonary hypoplasia is frequent if PPROM occurs before 26 wk and the latency is prolonged for more than 5 wk. Latency, defined as the time from rupture of membranes till delivery has been described to be longer if PPROM occurs at an earlier gestational age.<sup>5,8</sup>

Oligohydramnios as a result of PPROM has been found to be associated with shorter latency and increased neonatal morbidity, but not associated with increased maternal or neonatal infections.<sup>9</sup> Many studies have been conducted using CL and AFI individually to predict the perinatal outcome in PTPROM and they show poor outcome. A combination of both the parameters has not been studied yet. A quantitative analysis of the prediction of adverse pregnancy outcome using both these two parameters in this study may help in management decisions of women with PPROM.

## METHODS

This was a prospective observational study conducted in Department of Obstetrics and Gynecology of a tertiary care centre in North Delhi. The study was approved by institutional ethics committee. A total of 170 women with singleton pregnancy who presented to hospital with PPROM from period of gestation 24 to 36<sup>+6</sup> weeks were enrolled in this study. All women with PPROM were hospitalized and put on bed rest and diagnosis of PPROM was made by per speculum examination showing pooled vaginal fluid and was managed according to the hospital protocol.

Period of gestation was confirmed by accurate dating (calculated by 1<sup>st</sup> day of last menstrual period) and ultrasound in early pregnancy if available. Patients who were in active labor, showing signs of chorioamnionitis, abruption, sepsis, with cervical cerclage operation, fetal congenital anomalies and complicated pregnancies were excluded from this study.

All diagnosed cases of PPROM were given prophylactic antibiotics for 48 hrs (ampicillin 2 gm i.v. 6 hourly, gentamicin 2 mg/kg i.v. 8 hourly and metronidazole 500

mg i.v. 8 hourly.) Inj. Dexamethasone 6 mg 12 hourly 4 doses were given for lung maturity. Trans abdominal cervical length assessment and amniotic fluid assessment was done within 24 hours of admission. All hematological and pathological investigations were carried out and repeated weekly. No tocolytics were given. Patients were observed for sign and symptoms of chorioamnionitis i.e., maternal pyrexia, maternal tachycardia, leukocytosis, uterine tenderness, offensive vaginal discharge, and fetal tachycardia. Patients were monitored with bi-weekly TLC/DLC and HVS culture for early detection of impending infection.

Patients were monitored till they went into spontaneous labour or were induced at 34 completed weeks whichever was earlier and the outcome were recorded. Further follow up was done till the patient was discharged from the hospital for late maternal and neonatal complications. Latency was defined as the time from rupture of membranes till delivery. For the purpose of analysis, latency was stratified into three groups, 1)  $\leq 2$  days, 2) 2-7 days, and 3)  $> 7$  days, and POG was stratified into three groups, 1) 24-28 weeks, 2) 28<sup>+1</sup>-32 weeks, and 3) 32<sup>+1</sup>-36<sup>+6</sup> weeks. Maternal outcomes were recorded in terms of latency period, chorioamnionitis, and abruption and neonatal outcomes were recorded in terms of birth weight, first minute APGAR score  $< 7$ , NICU Admission and early neonatal death.

## RESULTS

Present study reveals that latency is inversely related to period of gestation. A long cervical length correlates with increased latency, increased risk of chorioamnionitis and increased neonatal complications. As shown in Table 1, women with POG of 24-28 weeks with CL  $\leq 2.5$ cm had mean latency period of  $8.65 \pm 1.56$  days, 7.31% had chorioamnionitis, 24.39% babies of such women were admitted to NICU and 17.07% babies died in their early neonatal period; and women with POG of 24-28 weeks with CL  $> 2.5$ cm had mean latency period of  $9.32 \pm 2.21$  days, 63.41% had chorioamnionitis, 75.61% babies of such women were admitted to NICU and 65.85% babies died in their early neonatal period. Similar trend of fetomaternal outcomes were also shown in the other two groups of women with POG 28<sup>+1</sup>-32 weeks and POG 32<sup>+1</sup>-36<sup>+6</sup> weeks.

As shown in Table 2, women with POG of 24-28 weeks with AFI  $\leq 5$  cm had mean latency period of  $7.63 \pm 1.56$  days, 19.51% had chorioamnionitis, 39.02% babies of such women were admitted to NICU and 21.95% babies died in their early neonatal period; and women with POG of 24-28 weeks with AFI  $> 5$  cm had mean latency period of  $8.32 \pm 2.21$  days, 51.22% had chorioamnionitis, 58.54% babies of such women were admitted to NICU and 39.02% babies died in their early neonatal period. Similar trend of fetomaternal outcomes were also shown in the other two groups of women with POG 28<sup>+1</sup>-32 weeks and POG 32<sup>+1</sup>-36<sup>+6</sup> weeks.

**Table 1: Maternal and neonatal outcome in Preterm PROM with respect to cervical length.**

Parameters	POG = 24 – 28 wks			POG = 28 <sup>+1</sup> – 32 wks			POG = 32 <sup>+1</sup> – 36 <sup>+6</sup> wks		
	Cervical length (cm)		P-value	Cervical length (cm)		P-value	Cervical length (cm)		P-value
	≤ 2.5	>2.5		≤ 2.5	>2.5		≤ 2.5	>2.5	
Mean latency (days)	8.65±1.56	9.32±2.21	<0.0001	5.42±1.26	6.14±1.46	<0.0001	1.36±0.32	1.54±0.42	<0.0001
Chorioamnionitis	3 (7.31%)	26 (63.41%)	0.006	2 (2.10%)	20 (21.05%)	0.006	1 (2.94%)	8 (23.53%)	0.006
Abruption	0 (0.00%)	1 (2.45%)	1.000	0 (0.00%)	1 (1.05%)	1.000	1 (2.94%)	2 (5.88%)	1.000
Mean BW (kg)	1.050.5	1.08±0.42	0.568	1.7±1.2	1.8±1.4	<0.0001	2.2±0.7	2.4±0.9	<0.0001
1 <sup>st</sup> min APGAR<7	10 (24.39%)	31 (75.61%)	<0.0001	23 (24.21%)	30 (31.57%)	<0.0001	2 (5.88%)	4 (11.76%)	<0.0001
NICU admn	10 (24.39%)	31 (75.61%)	<0.0001	23 (24.21%)	30 (31.57%)	<0.0001	2 (5.88%)	4 (11.76%)	<0.0001
Early NND	7 (17.07%)	27 (65.85%)	0.0002	5 (5.26%)	17 (17.89%)	0.0002	2 (5.88%)	4 (11.76%)	0.0002

**Table II: Maternal and neonatal outcome in Preterm PROM with respect to amniotic fluid index.**

Parameters	POG = 24 – 28 wks			POG = 28 <sup>+1</sup> – 32 wks			POG = 32 <sup>+1</sup> – 36 <sup>+6</sup> wks		
	AFI (cm)		P-value	AFI (cm)		P-value	AFI (cm)		P-value
	≤ 5	>5		≤ 5	> 5		≤ 5	>5	
Mean latency (days)	7.63±1.56	8.32±2.21	<0.0001	5.28±1.38	6.42±1.29	<0.0001	1.63±0.08	1.85±0.05	<0.0001
Chorioamnionitis	8 (19.51%)	21 (51.22%)	<0.0001	7 (7.36%)	15 (15.79%)	<0.0001	4 (11.76%)	5 (14.71%)	<0.0001
Abruption	0 (0.00%)	1 (2.44%)	1.000	1 (1.05%)	2 (2.12%)	1.000	0 (0.00%)	1 (2.94%)	1.000
Mean BW (kg)	1.04±0.35	1.05±0.42	0.568	1.73±0.60	1.82±0.76	<0.0001	2.1±0.3	2.5±0.8	<0.0001
1 <sup>st</sup> min APGAR<7	16 (39.02%)	24 (58.54%)	<0.0001	21 (22.10%)	28 (29.47%)	<0.0001	4 (11.76%)	7 (20.59%)	<0.0001
NICU admn	16 (39.02%)	24 (58.54%)	<0.0001	21 (22.10%)	28 (29.47%)	<0.0001	4 (11.76%)	7 (20.59%)	<0.0001
Early NND	9 (21.95%)	16 (39.02%)	0.0002	14 (14.73%)	16 (16.84%)	0.0002	3 (8.82%)	4 (11.76%)	0.0002

## DISCUSSION

The finding of the present study that longer the cervix, more is the latency period, is consistent with Rizzo et al who examined 92 women and reported that the median interval to delivery was 2 days when cervical length was <20mm, compared to 6 days with longer cervix.<sup>10</sup> Similarly, in a recent study by Mehra et al a shorter TVCL independently predicted delivery within 7 days in women presenting with PPRM and TVCL >2cm greatly improved the potential to remain undelivered at 7 days following cervical length assessment.<sup>11</sup> In contrast, Carlan et al found no significant difference in latency period based on cervical length.<sup>12</sup>

In this study, women with AFI > 5 cm in all the three groups had higher mean latency period as compared to women with AFI ≤5cm (p value <0.0001). This finding was consistent with study of Tavassoli F et al who demonstrated that patients with AFI <5 exhibited a significantly shorter latency period (p=0.049).<sup>13</sup> 43% of cases delivered during the first 48 hours and only 6.6% of

pregnancies were prolonged by more than 2 weeks. However, in group with (AFI≥5), 31.7% of patients delivered during the first 48 hours and 21.7% of pregnancies were prolonged by more than 2 weeks. Most studies have not reported this point, but in a study by Borna et al the latency period was observed to be equal in both groups.<sup>14</sup> Piazzè et al and Vermillion et al reported significant correlation between oligohydramnios and latency period.<sup>15,16</sup> Mehra S also found that an AFI <5cm independently predicted delivery within 7 days in women presenting with PPRM.<sup>11</sup>

Present study also shows that longer the cervix and larger the AFI, more was the incidence of maternal infection, however the literature is conflicting in the correlation of AFI with occurrence of chorioamnionitis in cases of PPRM. Mercer et al and Piazzè et al found no relationship between chorioamnionitis and oligohydramnios while Borna et al and Moberg et al found a significant correlation between AFI<5 and a higher rate of chorioamnionitis.<sup>9,14,15,17</sup> In the present study, the incidence of chorioamnionitis was higher in

women with CL >2.5 cm and AFI >5 cm. This increased incidence of chorioamnionitis can be probably due to the lower socioeconomic strata of patients coming to our hospital making this difference with an increased incidence of chorioamnionitis with longer latency.

Women presenting with preterm PROM are at increased risk of developing abruption, risk being higher in the presence of oligohydramnios especially within 24 hours of rupture of membrane. Present study however shows no significant correlation between abruption, AFI and CL consistent with study by CC Ananth et al. Compared women with intact membranes, the relative risk for abruption among preterm PROM and whose membranes were ruptured for 24-47 hours and 48 hours or more before delivery, respectively, were 2.37 (95%CI 0.99-9.09), and 9.87 (95% CI 3.57-27.82).<sup>7</sup> When preterm PROM was accompanied by intrauterine infections, the RR for abruption was 9.03 (95%CI 2.80-29.15) compared with women with intact membranes and no infections. Similarly, preterm PROM accompanied by oligohydramnios conferred over a 7.17-fold risk (95% CI 1.35-38.10) for abruption compared with women with neither of these 2 conditions.

Regarding neonatal outcome, we found that there was no significant relation between mean birth weight, CL and AFI which is consistent with the study of Tavasolli et al.<sup>13</sup> Present study also shows that longer the cervix and larger the AFI, more was the latency, more was the risk of maternal infection and this also had an impact on fetal outcome in the form of 1<sup>st</sup> minute APGAR <7, NICU admission and early NND. Tavasolli et al found that first minute and five minute Apgar score  $\leq 7$  was significantly higher in group with AFI <5, however the difference was not significant between the two groups.<sup>13</sup> In contrast Piazze et al found that there was a significant association between five minute Apgar score  $\leq 7$  and AFI <5 (p <0.001), but in this study, the association was not statistically significant.<sup>15</sup> Present study is contradictory to Tavasolli et al which found that the overall rate of early neonatal death was 8.8%.<sup>13</sup> 10 cases (13.2%) of neonatal deaths were observed in group with AFI <5 while only 2 cases (3.3%) were recorded for group with AFI  $\geq 5$ . Therefore, the rate of neonatal death was significantly higher in group with AFI <5 compared to group with AFI  $\geq 5$  with a p value of 0.045.

## CONCLUSION

Latency is inversely proportional to period of gestation which means lesser the period of gestation more will be the latency period. A long cervical length and increased amount of amniotic fluid index co-relates with increased incidence of chorioamnionitis and neonatal complications probably due to increased latency. Since the latency cannot be predicted in advance in pre-term pre-mature rupture of membranes, women with shorter cervix and lesser amniotic fluid index needs to be hospitalized and managed aggressively and should be monitored

vigorously for further complications. The women with longer cervix and higher amniotic fluid may require a longer duration of antibiotic coverage since the latency period is more.

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