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Relationship of Amniotic Fluid Index and Cervical Length with Delivery Latency in Patients with Preterm Premature Rupture of Membranes (PPROM): A Hospital Based Study

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Abstract: ***Objective:*** *We sought to find the relationship of Amniotic fluid index (AFI) and cervical length with delivery latency among patients with preterm premature rupture of membranes (PPROM) and to determine overall pregnancy outcome in pregnancies complicated with PPROM.* ***Study Design:*** *This study was a prospective observational study conducted in Lalla Ded hospital Srinagar, in women with PPROM who consented to undergo Sonographic measurement after admission. Total of 312 patients were studied. All women with PPROM were hospitalized and diagnosis of PPROM was established on the basis of a history suggesting amniotic fluid leakage and sterile speculum examination demonstrating either amniotic fluid passing through the cervix or fluid accumulation in the posterior vaginal fornix and were managed according to the hospital protocol. 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. Further follow up was done till the patient was discharged from the hospital for late maternal and neonatal complications. Latency was stratified into two groups: A) <7 days, and 2) ≥7 days, Period Of gestation was stratified into two groups. B) 28-33weeks, and 2) 34-36weeks. C) Amniotic fluid index was stratified into two groups 1) AFI <5cms and 2) AFI ≥ 5cms.* ***Results:*** *Out of 312 patients 169 patients had latency period of less than 7 days and 143 patients had latency period of more or equal to 7 days. Most of patients with AFI <5 and/or CL <2 delivered within 7 days and most of patients with AFI ≥5 and/or CL ≥2 were having delivery latency ≥7 days. So delivery latency was directly related to amount of AFI and cervical length. Most of patients with POG <34 weeks delivered with delivery latency ≥7 days and most of patients with POG ≥34 weeks delivered with delivery latency <7 days .Amongst the babies who developed complications most of them babies were extreme preterm. The complications seen in preterm infants in our setting were Respiratory distress syndrome, hypothermia, hypoglycaemia, intra cranial haemorrhage, Apnoea of prematurity, Necrotizing enterocolitis, sepsis and death. The survival and salvageability of these preterm babies were dependent on their gestational age, birth weight and Apgar score. Babies with late preterm gestation were having good birth weight and good Apgar score were found less prone to these complications and vice versa.* ***Conclusion:*** *A shorter TVCL (Transvaginal cervical length) and lesser AFI independently predict delivery within 7 days in women presenting with PPROM. The combination of an AFI ≥5 cm and TVCL ≥2 cm greatly improved the potential to remain undelivered after 7 days and vice versa. These findings may be helpful for counselling and optimizing maternal and neonatal care in women with PPROM. Latency is inversely proportional to period of gestation which means lesser the period of gestation more will be the latency period. Since the latency cannot be absolutely 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.*

Keywords: amniotic fluid index, cervical length, labour latency, preterm birth, preterm premature rupture of membranes, transvaginal cervical length.

1. Introduction

Premature rupture of the membranes (PROM) is defined as spontaneous membrane rupture that occurs before the onset of labour . Preterm premature rupture of membrane (PPROM) is a spontaneous[1 30] breach in the chorioamniotic membrane prior to the onset of labour at <37 weeks of gestation. The duration of a normal pregnancy is between 37 and 42 weeks' gestation. PPROM 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. The etiology of PPROM is multifactorial but infections play a significant role. Prior to rupture of the membranes, there is probably a disruption of

collagen synthesis at molecular level, a change in collagen structure or increased collagen degradation .[2 19]

Risk factors[3 29] for PPROM are very similar to those of preterm labour and are:

- Lower socioeconomic status
- Past history of PPROM
- Cervical incompetence
- Genital tract infection or colonization with Chlamydia trachomitis, Neisseria gonoohoea, Trichomonas vaginalis, Group B streptococcus, Gardnerella vaginalis
- Urinary tract infection
- Increased friability and decreased tensile strength of membranes
- Low maternal body mass index , BMI<19kg/m2
- Polyhydramnios
- Short cervix
- Multiple pregnancy
- Iatrogenic invasive procedures e.g., amniocentesis, fetal blood sampling.

The most common complication of preterm birth is respiratory distress; neonatal sepsis, umbilical cord prolapse, placental abruption, and fetal death. Sepsis, intraventricular haemorrhage and necrotizing enterocolitis are also associated with prematurity (but are less common near term).

In premature rupture of membranes pH of amniotic fluid helps to differentiate it from acidic pH of vaginal discharge via nitrazine paper test. Rate of turnover of amniotic fluid is 500ml/hr.[4] Volume of amniotic fluid is maximum at 32-34 weeks (1000ml) and as pregnancy advances volume of amniotic fluid decreases to 800ml at 40weeks and 200ml at 42weeks. Major contributor of amniotic fluid is maternal plasma in early weeks (first trimester), fetal skin from 12-20weeks and fetal urine from 20 weeks onwards.

Best investigation for measurement of amniotic fluid volume is ultrasonography, in which abdomen is divided arbitrarily into four quadrants (a, b, c, and d) and largest vertical pocket in each quadrant is measured in centimetres. Largest vertical pockets in all four quadrants are added to get Amniotic fluid index(AFI). Normal AFI is 5-24cms. [5]The most sensitive method of measurement is single largest vertical pocket method. Normal value for single largest vertical pocket is2-8cms. Polyhydramnios is defined as a state where liquor amnii exceeds 2000 mL or when amniotic fluid index (AFI) is more than 24 cm (>95th centile for gestational age) and a largest vertical pocket is >8 cm. Oligohydramnios is defined when the maximum vertical pocket of liquor is less than <2 cm or when amniotic fluid index (AFI) is less than 5 cm (<10th centile). With AFI <5 cm (below 5th percentile) or >24 cm (above 95th percentile) was considered abnormal at gestational age, from 28–40 weeks.

Latency is the duration between rupture of membranes (ROM) and Delivery (this time frame can be hours, days or weeks).[6]

Latency is inversely correlated with the gestational age at ROM. The earlier the gestational age, the less likely labour will start at short notice after ROM. At term, the majority of women (90to95%) have delivered within72 hours without an intervention to induce labor. Because of the risk of a short latency period, many neonates are born prematurely after PPROM. Therefore the risk of morbidity and disabilities later in life because of prematurity is high.

After delivery, perinatal outcome will be assessed. Birth weight, Apgarscore at 1 and 5 minutes, duration of NICU stay and perinatal mortality will be noted.

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.[20] Even with conservative management, 50–60% of women with preterm PROM remote from term will deliver within one week of membrane rupture. 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. 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.[7 16]

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.

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 sonographic measurement of cervical length and amniotic fluid index in women with PPROM between 28 to 34 weeks in predicting the delivery latency period.[8 19]

2. Materials and Methods

Our study was conducted for a period of one and a half year in LALLA DED Hospital, Govt Medical College Srinagar. This study was approved by the Institutional ethical committee Govt Medical College Srinagar. This study was a prospective observational study conducted in women with PPROM who consented to undergo Sonographic measurement after admission. Total of 312 patients were studied.

All women with PPROM were hospitalized and diagnosis of PPROM was established on the basis of a history suggesting amniotic fluid leakage and sterile speculum examination demonstrating either amniotic fluid passing through the cervix or fluid accumulation in the posterior vaginal fornix and were managed according to the hospital protocol. Two doses of 12 mg betamethasone were given intramuscularly, 24 h apart.

Sonographic assessment of cervical length and amniotic fluid was done within 24 hours of admission. All haematological and pathological investigations were carried out as per hospital protocols. Patients were observed for sign and symptoms of chorioamnionitis i.e., maternal pyrexia, maternal tachycardia, leucocytosis, uterine tenderness, offensive vaginal discharge, and fetal tachycardia. Patients were monitored with TLC/DLC, CRP and HVS culture for early detection of impending infection. Vaginal culture were taken at diagnosis of PPROM and treated accordingly during labour. When culture results were unavailable, patients were treated empirically with intravenous antibiotics during labour. Routine daily follow-up was conducted for evidence of active labour, infection or well being. Follow-up included examination of body temperature, pulse, blood pressure, uterine tenderness, white blood cell count, non-stress test (twice a day), biophysical profile (twice a week) and estimated fetal weight evaluation (every 10–14 days). Vaginal examinations were avoided as long as the patient was asymptomatic and free of contractions. When indicated, sterile visual inspection of the cervix with speculum was preferred over digital examination.

Patients were monitored till they went into spontaneous labour or were induced at 34 completed weeks whichever will be earlier and the outcome was recorded. Labour was induced at 34 weeks, either by vaginal prostaglandin E2 tablets or oxytocin. Caesarean section was performed based on obstetrical indications. Tocolytic treatment is avoided in cases of PPROM.

The time of delivery was determined by individual circumstances. When following conditions were observed, induction of labour was initiated or caesarean delivery was performed:

1) Signs of overt infection or chorioamnionitis, including fever or elevated CRP;
2) Active labour progression;
3) Non-reassuring of fetal well-being.

However we followed with expectant management if the obvious signs of infection or fetal distress were absent. 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.

Further follow up was done till the patient was discharged from the hospital for late maternal and neonatal complications.

For the purpose of analysis,

Latency was stratified into two groups:
1) <7 days, and 2) ≥7 days,
Period Of gestation was stratified into two groups.
1)28-33+6 weeks, and 2) 34-36+6 weeks.17, 26 and
Amniotic fluid index was stratified into two groups
1) AFI <5cms and 2) AFI ≥ 5cms

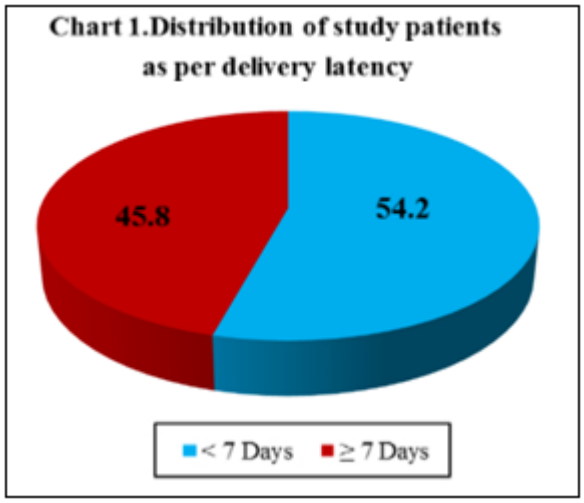
3. Results

Total number of patients included in our study was 312 aged from 20 years to 40 years.

Out of 312 patients 169 patients had latency period of less than 7 days and 143 patients had latency period of more or equal to 7 days (Table 1, Chart 1).

Table 1: Distribution of study patients as per delivery latency

Delivery Latency	Number	Percentage
<7 Days	169	54.2
>7 Days	143	45.8
Total	312	100

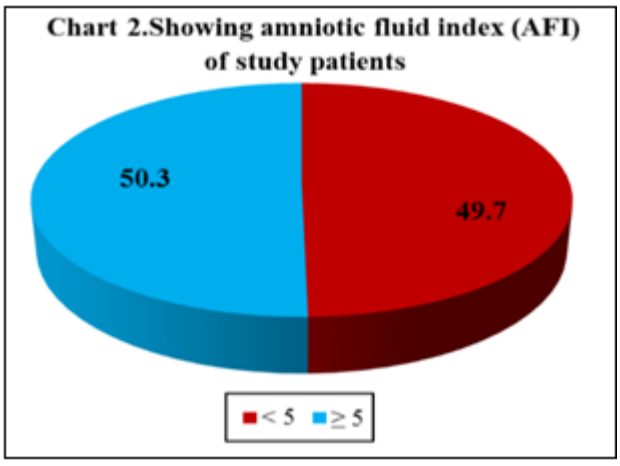


Out of 312 patients, 155 patients had AFI<5 and 157 patients had AFI≥5.

Out of 155 patients with AFI <5cms, delivery latency was <7 days in 102 patients and ≥7 days in 53 patients. (Table 2, Chart 2)

Table 2: Showing amniotic fluid index (AFI) of study patients

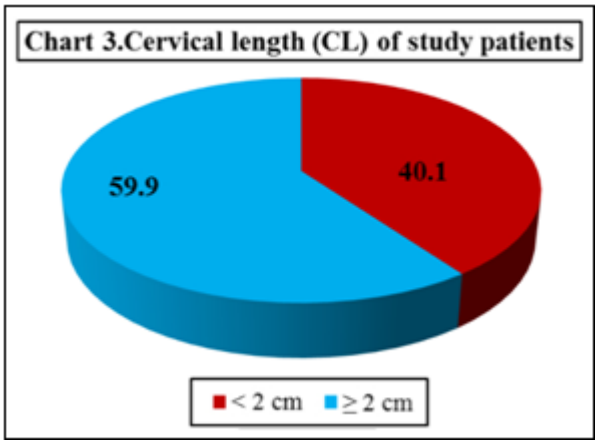
AFI	Number	Percentage
<5	155	49.7
>5	157	50.3
Total	312	100



Out of 312 patients, 125 patients had cervical length <2cms and 187 patients had cervical length ≥2cms. (Table 3, Chart.3)

Table 3: Cervical length (CL) of study patients

Cervical Length	Number	Percentage
<2	125	40.1
>2	187	59.9
Total	312	100

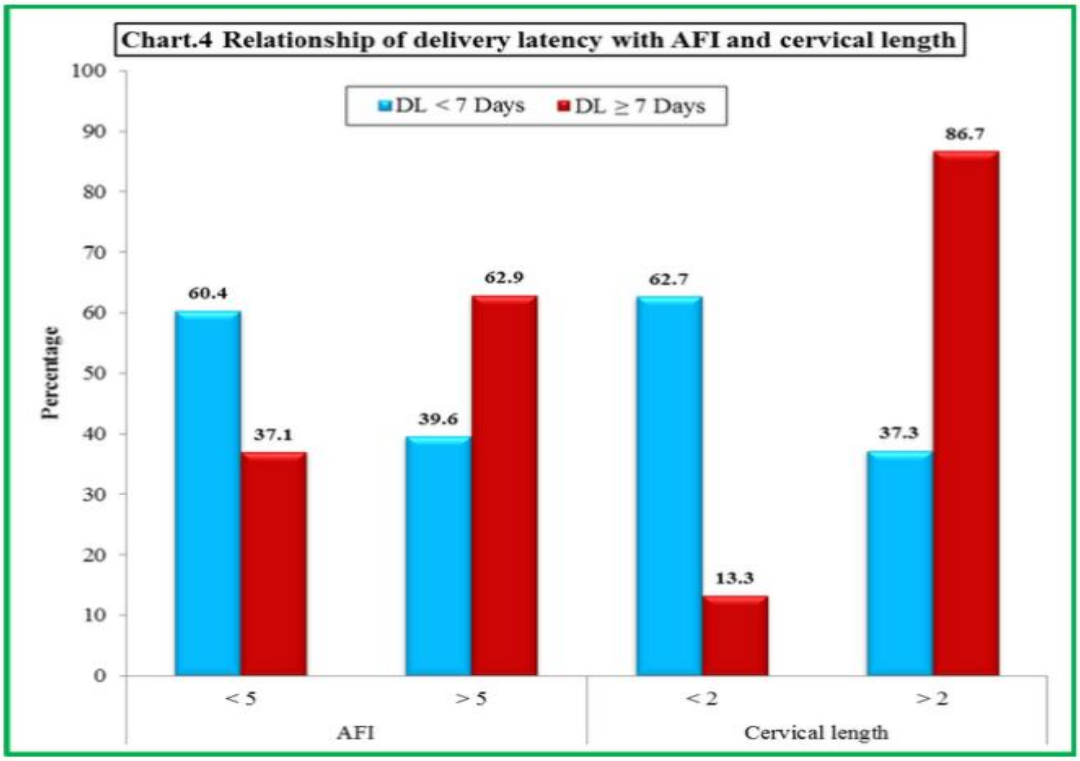


Total number of patients with AFI<5cms were 155. Out of 155 patients, delivery latency was <7 days in 102 patients and ≥7 days in 53 patients. Total number of patients with AFI≥5cms was 157. Out of 157 patients, delivery latency was <7 days in 67 patients and ≥7 days in 90 patients. Out of 312 patients, 169 patients delivered within 7 days and 143 patients had delivery latency ≥7 days. Out of 169 patients who delivered within 7 days, 102 patients were having AFI<5 and 67 patients were having AFI≥5. Out of 143 patients whose delivery latency was ≥7 days, 90 patients were having AFI≥5 and 53 patients were having AFI<5. So most of patients with AFI <5 delivered within 7 days and most of patients with AFI ≥5 were having delivery latency ≥7 days. Out of 169 patients who delivered within 7 days, 106 patients were having CL<2 and 63 patients were having CL≥2. Out of 143 patients whose delivery latency was ≥7 days, 90 patients were having CL≥2 and 53 patients were having CL<2. So most of patients with CL <2 delivered within 7 days and most of patients with CL ≥2 were having delivery latency ≥7 days.

Table 4: Relationship of delivery latency with AFI and Cervical length among study patients

Parameter		DL< 7 Days		DL ≥ 7 Days		P- value
		No.	%age	No.	%age	
AFI	<5	102	60.4	53	37.1	<0.001*
	>5	67	39.6	90	62.9	
Cervical Length	<2	106	62.7	19	13.3	<0.001*
	>2	63	37.3	124	86.7	

* Statistically significant (P- value < 0.05); P- value by Chi-Square test



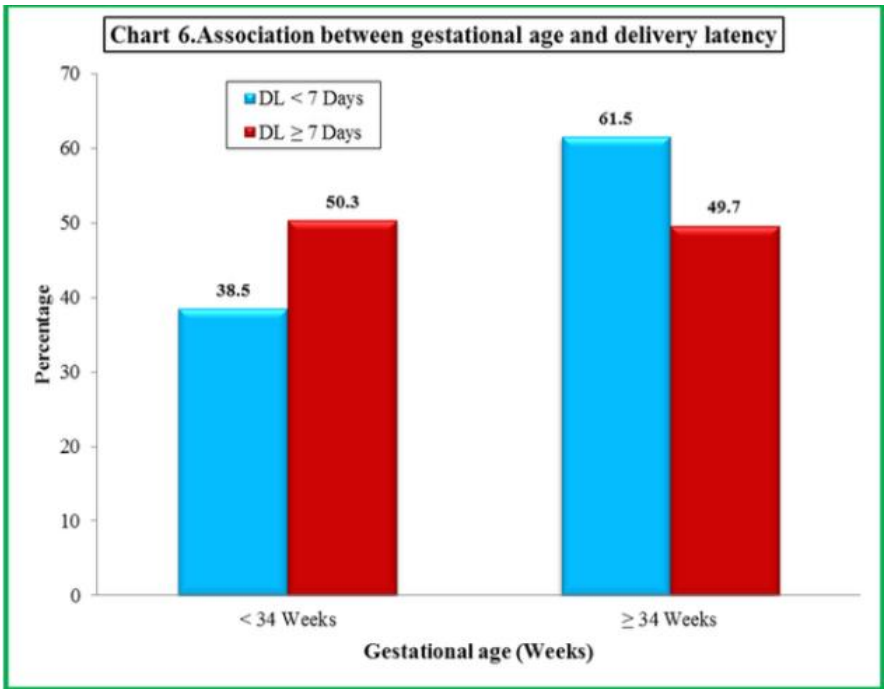
Among 312 patients, 137 patients were having period of gestation from 28-33+6 weeks and 175 patients were having period of gestation from 34- 36+6weeks.

Out of 137 patients with period of gestation from 28-33+6 weeks, 65 patients had delivery latency of <7 days and 72 patients had delivery latency ≥7 days

Out of 175 patients with period of gestation from 34-36+6 weeks, 104 patients had delivery latency <7 days and 71 patients had delivery latency of ≥7days.

Table 5: Association between gestational age and delivery latency among study patients

Gestational Age (weeks)	DL< 7 Days		DL ≥ 7 Days		P- value
	No.	%age	No.	%age	
< 34 Days	65	38.5	72	50.3	0.035*
≥ 34 Days	104	61.5	71	49.7	
Total	169	100	143	100	

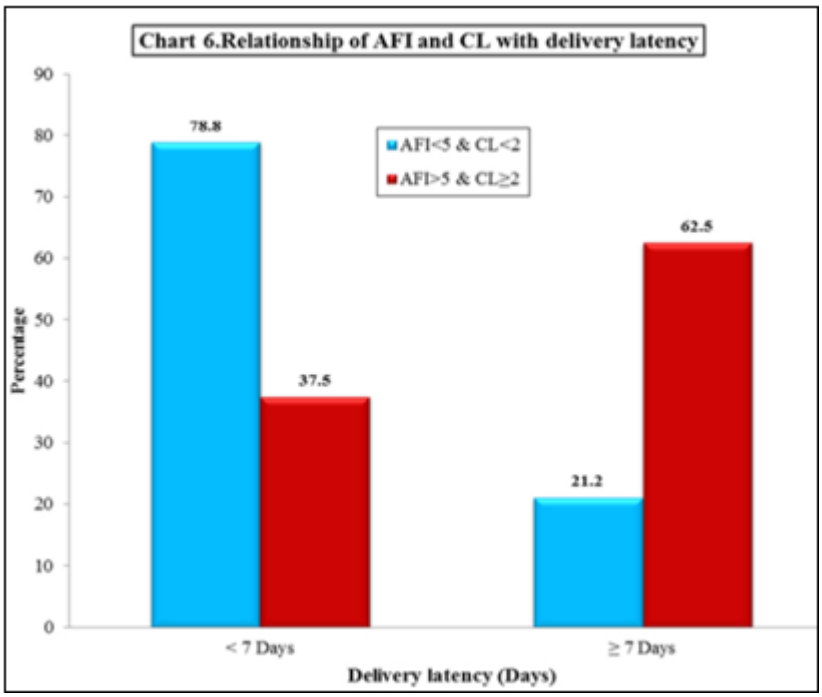


Among 312 patients admitted with PPROM 104 patients were having both AFI<5cms and CL<2cms, 136 patients were having both AFI≥5cms and CL≥2cms. Out of 104 patients with both AFI<5cms and CL<2cms, 82 delivered within 7 days and 22 patients were having delivery latency more than 7 days while out of 136 patients with both AFI≥5cms and CL≥2cms, 51 delivered within 7 days and 85 patients were having delivery latency more than 7 days.(Table 6. Chart 6)

Table 6: Relationship of AFI and Cervical length with delivery latency among study patients

Delivery Latency	AFI < 5 & CI < 2		AFI > 5 & CI ≥ 2		P- value
	No.	%age	No.	%age	
< 7Days	82	78.8	51	37.5	<0.001*
≥ 7Days	22	21.2	85	62.5	
Total	104	100	136	100	

* Statistically significant (P- value < 0.05); P- value by Chi-Square test



Among 312 patients who were admitted with PPROM, 240 patients delivered during hospital stay. Out of 240 delivered patients 98 patients were 28-33+6weeks of gestation and 142 patients were of 34-36+6 weeks of gestation. Out of 98 patients with period of gestation 28-33+6weeks, 92 patients delivered vaginally and 06 patients delivered via caesarean section. Out of 142 patients with period of gestation 34-36+6 weeks, 100 patients delivered vaginally and 42 patients delivered via caesarean section. Amongst 98 delivered patients of gestation 28-33+6weeks, 56 patients delivered within 7 days of latency(46 with A/S <6/10 and 10 with A/S≥6/10) and 42 patients delivered with delivery latency ≥ 7 days (20 with A/S <6/10 and 22 with A/S≥6/10).

Amongst 142 delivered patients of gestation 34-36+6 weeks, 80 patients delivered within 7 days of latency(42 with A/S <6/10 and 38 with A/S≥6/10) and 62 patients delivered with delivery latency ≥ 7 days (28 with A/S <6/10 and 34 with A/S≥6/10).

Out of 240 patients who delivered during hospital stay in presence of a neonatologist, their babies were sent to NICU immediately for close observation and necessary treatment. Out of them, 194 babies developed complications and were admitted for more than a week in NICU while 46 babies were discharged uneventfully from NICU after an observation of at least 48 hours. Among 194 babies who developed complications 98 babies were extreme preterm and 96 babies were late preterm. The complications seen in preterm infants in our setting were Respiratory distress syndrome, hypothermia, hypoglycaemia, intra cranial haemorrhage, Apnoea of prematurity, Necrotizing enterocolitis, sepsis and death. The survival and salvageability of these preterm babies were dependent on their gestational age, birth weight and Apgar score. Babies with late preterm gestation, good birth weight and good Apgar score were found less prone to these complications and vice versa.

Discussion and Conclusion

Our study was a prospective observational study including 312 patients with PPROM. All PPROM patients were admitted and diagnostic workup and management was started. Out of 312 patients 169 patients had latency period of less than 7 days and 143 patients had latency period of more or equal to 7 days. Most of patients with AFI <5 and/or CL <2 delivered within 7 days and most of patients with AFI ≥5 and/or CL ≥2 were having delivery latency ≥7 days. So delivery latency was directly related to amount of AFI and cervical length.[9 10 11]

Most of patients with POG <34 weeks delivered with delivery latency ≥7 days and most of patients with POG ≥34 weeks delivered with delivery latency <7 days

Amongst the babies who developed complications most of them babies were extreme preterm a. The complications seen in preterm infants in our setting were Respiratory distress syndrome, hypothermia, hypoglycaemia, intra cranial haemorrhage, Apnoea of prematurity, Necrotizing enterocolitis, sepsis and death.[12] The survival and salvageability of these preterm babies were dependent on their gestational age, birth weight and Apgar score. Babies with late preterm gestation were having good birth weight and good Apgar score were found less prone to these complications and vice versa.

A shorter TVCL and lesser AFI independently predict delivery within 7 days in women presenting with PPROM. The combination of an AFI ≥5 cm and TVCL ≥2 cm greatly improved the potential to remain undelivered after 7 days and vice versa.[13 14] These findings may be helpful for counselling and optimizing maternal and neonatal care in women with PPROM.[18 22]

Latency is inversely proportional to period of gestation which means lesser the period of gestation more will be the latency period. Since the latency cannot be absolutely 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.[28 24]

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