Study of labour admission test and amniotic fluid index in term high risk pregnancy and their association with labour and perinatal outcome

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Manuscript submitted – 21st November 2021
Peer review completed – 29th March 2022
Accepted for Epub – 11th April 2023

Abstract:

Objective: In this study we study the association of both labour admission test (LAT) and amniotic fluid index (AFI) in predicting and preventing adverse perinatal outcome in high risk pregnancies. **Methods**: This is a prospective observational study. A total of 100 high risk pregnant females admitted in labour room with period of gestation ≥37 weeks, in labour. On admission, history was taken and general physical examination, P/A and P/V examination were performed to determine the stage of labour, following which patients were subjected to ultrasonography for measurement of amniotic fluid index and labour admission test. Mode of delivery, maternal complication, indication of cesarean delivery, colour of liquor, were recorded and neonatal outcome was analysed by APGAR score, whether the baby required NICU admission and condition at discharge. **Results**: There is statistical significance of AFI with LAT with a p value <0.001. Reduced AFI is more associated with pathological and equivocal and normal AFI had more of normal CTG (P<0.001). Decreasing AFI is significantly associated with meconium staining of the liquor, increasing chance of operative delivery, increasing chance of NICU admission of the neonate (p value <0.001). The same association was seen with LAT and APGAR score, NICU admission, and mode of delivery. **Conclusion**: From the study we can conclude that LAT and AFI can be used as a simple non-invasive tests that can serve as a screening tool in high risk obstetric patients in labour with better accuracy.

Keywords: Labour admission test, amniotic fluid index, high risk pregnancy, intrapartum fetal surveillance, perinatal outcome.

Public health is a science and art of preventing disease, prolonging life through and promoting health organized efforts of society [1]. Surveillance of the fetus during labour is a preventive care. The goal of intrapartum fetal surveillance is to detect potential fetal decompensation and to allow timely and effective intervention to prevent perinatal morbidity or mortality such as perinatal asphyxia, neonatal hypoxic ischemic encephalopathy, stillbirth and neonatal death.[2] Fetal monitoring during labour identifies the fetuses at risk of hypoxia damage, so that appropriate intervention can be instituted to optimize perinatal outcome.[3]

The labour admission test (LAT) was introduced as a screening test in early labour to detect compromised fetuses on admission and to select and triage the women in need of continuous fetal electronic monitoring during labour.[4,5] It is one of the most widely used primary test for assessment of fetal well-being at term in labour at the time of admission

Rongpipi K, Mittal M, Goyal R, Chaudhary G, Saxena V. Study of labour admission test and amniotic fluid index in term high risk pregnancy and their association with labour and perinatal outcome. The New Indian Journal of OBGYN. 11th April 2023. Epub Ahead of Print.

as it is simple, inexpensive, noninvasive, easily performed and interpreted. A record of fetal heart rate and uterine activity using cardiotocograph for about 20 minutes on admission to the labour ward is called a labour admission test. A normal pattern includes base line variability of 5-25 beats per minute and at least 2 accelerations in a 20 minute period. The test results of LAT are categorized as normal, equivocal or pathological according to RCOG guidelines.[6]

Amniotic fluid serves number of important functions in development of embryo and fetus. At term it measures about 600-800ml. Ultrasound assessment of amniotic fluid has important implication in obstetric care and has become an integral component of assessment of fetal wellbeing. Amniotic fluid index (AFI) is a semi-quantitative sonographic assessment of amniotic fluid volume, which is measured as sum of the 4 quadrant deepest vertical amniotic fluid pockets in the gravid uterus. It is a non invasive test done by measuring the amniotic fluid pockets in a four quadrant or of a single largest vertical pocket. At term AFI decline gradually to a mean of 8.37cm. Excess volume is associated with fetal anomalies and aneuploidy and less volume is associated with IUGR, renal anomalies. In later part of pregnancy, it is an integral component for assessment of fetal condition, perinatal outcome, intrapartum fetal distress, meconium passage, operative delivery and fetal death**.**

Many studies have been done so far on AFI and LAT in perinatal and fetal outcome separately, but very few studies have been done on combining both parameters. In this study we study the combined association of both these parameters (LAT and AFI) in predicting and preventing adverse perinatal outcome in high risk pregnancies.

Materials and methods

This is a prospective observational study done in the Department of Obstetrics and Gynecology, Deen Dayal Upadhyaya Hospital (DDUH) over a period of 1 year from April 2014 to March 2015. The study protocol was approved by the ethical committee of hospital. In this study we included a total of 100 high risk pregnant females admitted in labour room via the emergency or outpatient department with period of gestation ≥37 weeks, in labour.

Inclusion criteria:

1. Booked cases, primigravida and multigravida.
2. Cephalic presentation.
3. All term high risk pregnancies (post dated pregnancies, gest HTN, IUGR, gestational DM, bad obstetric history, oligohydramnios, hydramnios, Rh negative, medical disorders - DM, HTN, renal disease etc).

Exclusion criteria:

1. Multiple pregnancies, PROM, congenital anomaly of fetus.
2. Non cephalic presentations.
3. Acute hypoxic states (abruptio placentae, cord prolapsed, placenta praevia).
4. Patient indentified for elective LSCS.

In this study patients admitted in labour room through OPD or emergency fulfilling the criteria were included. On admission, the women's details and history including age, parity, antenatal care, menstrual history, obstetric and medical history were documented. General physical examination was done. Per abdominal and per vaginal examination were performed to determine the stage of labour, following which patients were subjected to ultrasonography for measurement of amniotic fluid index and labour admission test. For LAT, a tracing was taken for 20 minutes with the patient in a semi lateral position in the labour room with the help of cardiotocography (CTG) machine. A recording of fetal heart rate and the activity of the uterine muscle was done with cardiotocography. Both were recorded in a continuous tracing on thermal paper. The FHR traces obtained were categorized as normal, equivocal or pathological according to RCOG guidelines**.**[6]

Categorization of the components of CTG as per RCOG guidelines (table 1) -

Table 1: Categorization of the components of CTG as per RCOG guidelines

Features	Reassuring	Non-reassuring	Abnormal
Baseline fetal heart rate	110-160	100-109 161-180	<100 >180
Variability bpm (beats per minute)	>5	<5 for >40 but <90 min	<5 for >90 min
Decelerations	None	Early deceleration Variable deceleration Single prolonged deceleration<3min	Persistent late decelerations Variable/ single prolonged deceleration>3min
Accelerations	Present >15bpm	Absence of acceleration in otherwise normal CTG is of uncertain significance	Absence of acceleration in otherwise normal CTG is of uncertain significance

Based on the categorization of the individual features, RCOG guidelines have classified fetal heart rate patterns into the following:

1. Normal (Reactive) - A CTG where all 4 features are in reassuring category.
2. Equivocal – A CTG where one feature is in non-reassuring category.
3. Pathological- A CTG where 2 or more features are in non-reassuring category or 1 or more feature is in abnormal category.

Following the LAT, patients with reactive and equivocal trace were monitored intermittently by auscultation for one minute every 30 minute in the first stage of labour and every five minutes in the second stage of labour post contraction or a repeat test was done after four hours if not delivered. In those with ominous tracings, appearance of late, significant variable or prolonged decelerations, delivery was hastened by operative or instrumental intervention depending upon the stage of labour.

AFI measurement was performed with a real time ultrasound instrument and was measured by dividing the uterus into four imaginary quadrants. The deepest, unobstructed, vertical pocket of fluid was measured in each quadrant in centimeters. The four pocket measurements were then added to calculate the AFI. According to the measurement of AFI, three groups were formed as: AFI <5 cm, AFI 5-8 cm and AFI >8cm. Subjects were followed throughout labour till delivery. Mode of delivery, maternal complication, indication of cesarean delivery, color of liquor, were recorded and neonatal outcome was analysed by whether the baby required NICU admission and condition at discharge.

Statistical analysis was performed by the SPSS program for Windows, version 17.0. Continuous variables are presented as mean ± SD, and categorical variables are presented as absolute numbers and percentage. Sensitivity, specificity, PPV and NPV was also calculated to evaluate the diagnostic evaluation of labour admission test, AFI to predict perinatal outcome. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference

Results

A total of 100 high risk pregnant females admitted in labour room were studied. Maximum number of patients belonged to 21–25 years constituting 50%. The mean age ± SD was 25.19 ± 3.44 years. 38 % of the women were multiparous and 62 % women were primigravida. 61 % pregnancies were between 37-40 weeks period of gestation (POG) and 39 % pregnancies were > 40 weeks POG.

Table 2 shows the distribution of high risk pregnancy in study population. 44% patients had postdatism (postdated and oligohydramnios) followed by PIH (also accompanied with oligohydramnios and IUGR) (28%), Rh negative (10%), diabetes (6%), oligohydramnios (7%) and bad obstetric history (BOH) (5%).

Table 2: Risk factors in the study population		
High risk factors	**Number of subjects (n=100)**	**Percentage %**
Postdatism	39	39%
Oligohydramnios	7	7%
PIH, IUGR	6	6%
PIH	17	17%
Rh Negative	10	10%
BOH	5	5%
Diabetes	6	6%
Postdated, Oligohydramnios	5	5%
PIH, Oligohydramnios	5	5%
PIH – Pregnancy induced hypertension, IUGR – Intrauterine growth restriction, BOH – Bad obstetrical history.		

Table 3: Labour admission test (LAT)		
Labour admission test	**Number of subjects**	**Percentage (%)**
Normal	74	74
Equivocal	19	19
Pathological	07	07
Total	100	100

Table 4: Amniotic fluid index (AFI)		
AFI	**Number of subjects**	**Percentage (%)**
<5	17	17
5–8	13	13
>8	70	70
Total	100	100

Table 5: Correlation of study variables according to AFI and LAT				
Variables	**Amniotic Fluid Index (AFI)**			**P value**
	<5.0 (n=17)	**5.0–8. (n=13)**	**>8.0 (n=70)**	
Labour admission test				
Normal	4(23.5%)	9(69.2%)	61(87.1%)	<0.001*
Equivocal	9(53%)	2(15.4%)	8(11.4%)	
Pathological	4(23.5%)	2(15.4%)	1(1.4%)	
Meconium liquor				
• Clear	4(23.5%)	9(69.2%)	61(87.1%)	<0.001*
•Meconium	13(76.5%)	4(30.8%)	9(12.9%)	
Mode of delivery				
•Normal	1(5.9%)	5(38.5%)	58(82.9%)	<0.001*
•Instrumental	3(17.6%)	1(7.7%)	4(5.7%)	
•LSCS	13(76.5%)	7(53.8%)	8(11.4%)	
Apgar score				
• <7 (n=18) • >7(n=82)	10(55.6%) 7(8.5%)	6(33.33%) 7(8.5%)	2 (11.11%) 68(82.2%)	<.001*
NICU stay				
•No	3(17.6%)	8(61.5%)	66(94.3%)	<0.001*
•Yes	14(82.4%)	5(38.5%)	4(5.7%)	
*P value < 0.05 significant				

Table 3 shows that in the study population 74% women had a normal, 19% had equivocal and 7% had pathological CTG on LAT. Table 4 shows that the amniotic fluid index was <5 cm in 17% women, 13 % women had AFI of 5 - 8 cm and 70% women had AFI more than 8 cm. Table 5 shows the correlation of study variables according to AFI and LAT. There is statistical significance of AFI with LAT with a p value <0.001. Reduced AFI is more associated with pathological and equivocal and normal AFI had more of normal CTG (P<0.001).

There is statistical significance of AFI with color of the liquor. Colour of liquor following artificial rupture / spontaneous rupture showed clear liquor in 74% women and 26% women had meconium stained liquor. Meconium staining of the liquor is significantly associated with decreasing AFI (P <0.001*).

There is statistical significance of AFI with mode of delivery. 64% patients had normal delivery, 8% had instrumental delivery and 28% had caesarean section. With decreasing AFI there is increasing chance of operative delivery (P <0.001*).

There is statistical significance between AFI and APGAR score and NICU stay of the neonate. The APGAR score was <7 in 18% and >7 in 82% of 100 new born. Out of 18 women with AFI<5, 10 (55.6%) had an APGAR score <7 at 1 minute. Out of 17 neonate in subgroup of AFI <5, 14 (82.4%) required NICU admission. With reduced AFI there was increasing chance of NICU admission of the neonate (P value <0.001).

The table 6 shows the correlation of labour admission test (LAT) in patients with APGAR score, NICU admission and mode of delivery. Out of 7 women with pathological labour admission test, 5 had <7 APGAR score following delivery. Out of 7 women with pathological labour admission test, 5 required NICU admission. Out of 26 pregnancies with equivocal and pathological finding on labour admission test 6 had normal delivery, 3 instrumental delivery and 17 required LSCS. It is evident from this table that abnormalities in LAT are significantly associated with operative delivery.

Table 6: Correlation of labour admission test in patients with APGAR score, NICU admission and mode of delivery

Labour admission test		**Normal**	**Equivocal**	**Pathological**	**Total**	**P Value**
APGAR score at 1 minute	Score >7	74(9.24%)	6(7.31%)	2(2.43%)	N=82	<0.001
	Score<7	4(22.22%)	9(50%)	5(27.8%)	N=18	
NICU admission	Yes	7(30.4%)	11(47.8%)	5(21.8%)	N=23	<0.001
	No	67(87%)	8(10.4%)	2(2.6%)	N=77	
Mode of delivery	Normal	58(90.6%)	6(9.4%)	0	N=64	<0.001
	Instrumental	5(62.5%)	2(25%)	1(12.5%)	N=8	
	LSCS	11(39.3%)	11(39.3%)	6(21.4%)	N=28	

The table 7 shows that AFI <5 cm (p=0.015) and pathological (p=<0.001) finding in LAT had significant association with perinatal outcome. With AFI <5, sensitivity of the study was 75%, and the specificity was 85.42%, PPV 17.65%, NPV 98.8%, accuracy 85% and P value = 0.015. With LAT as pathological, Sensitivity of the study was 66.7%, and the specificity 93.6%, PPV 28.6, NPV 98.6, accuracy 92.6 and P value <0.001.

Table 7: Diagnostic evaluation of admission test and AFI to predict perinatal outcome

Parameters	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**Accuracy**	**P value**
AFI<5	75%	85.42%	17.65%	98.8%	85%	0.015
Admission test suspicious	50%	80.2%	5.26%	98.6%	79.6%	0.369
Pathological	66.7%	93.6%	28.6%	98.6%	92.6%	<0.001

Discussion

In this study, the mean age ± SD was 25.19 ± 3.44 years. The mean age of the subjects is similar in the study conducted by Maiti et al [7] which is 26.71 ± 3.49 years. In our study, the high risk patient included were postdatism 39%, oligohydramnios 7%, PIH 17%, BOH 5%, diabetes 6%, Rh negative 10%, IUGR 6%. In this study, 74% of patients had normal LAT, 19% equivocal and 7% pathological. The AFI was <5 cm in 17%, 5-8 cm in 13% and >8 cm in 70%. Labour monitoring was done the outcome was observed. 64% of patients were delivered by normal

vaginal delivery, 8% by instrumental, and 28% by LSCS. In this study, it was observed that the incidence of normal delivery was more common with normal LAT of about 90.6%. About 39.3% of patients with equivocal test had LSCS and 21.4% from pathological test. 69.6% of patients with equivocal and pathological LATs had NICU admission and 50% of equivocal and 27.8% of pathological test had APGAR <7 (1 min). In this study, it was observed that 23.5% of normal test, 53% of equivocal test and 23.5% of pathological test had AFI <5 (P<0.001). In the study by Maiti et al [7] incidence of non reassuring heart rate among severe oligohydramnios (AFI≤ 5 cm) was 76.7% and Umber et al [8] it was 52.7%. There was an increased incidence of LSCS 76.5% with AFI<5, 17.6 instrumental delivery and 5.9% normal delivery, which is comparable to 79% in the study by Maiti et al [7] and (56%) in a study by Bhagat et al [9].

In this study, it was also seen that there was increased incidence of NICU admission 82.4%, meconium stained liquor 76.5%, in patients with AFI<5. There is statistical significance of low AFI with meconium stained liquor. In the study by Maiti et al [7] the incidence of meconium stained liquor with group with AFI < 5 was 74.4%, and NICU admissions was 88.4 % (8), which is comparable. In the present study the incidence of APGAR score <7 (1 min) in patients with AFI <5 was 55.6%. In the study by Maiti et al [7], incidence of APGAR score <7 at 1 minute was 79.1% in group with AFI <5, and Bhagat et al [9] it was 36%.

Statistical analysis for LAT in pathological reading shows a sensitivity of 66.7%, specificity 93.6%, PPV 28.6%, NPV 98.6% , a p value of <0.001 which is significant and that for AFI <5 the sensitivity is 75%, specificity 85.42%, PPV 17.65%, NPV 98.8%, accuracy 85%, and a p value of 0.015 which is significant. The sensitivity and specificity of oligohydramnios in predicting foetal outcome was 59.1% and 75%, while it's PPV and NPV was 62.8% and 85%. It has a significant association with perinatal outcome (P value - <0.001) in a study by Maiti et al [7]. In study conducted by Shivani Khandelwal et al [10], it was found that admission test has a high specificity (94.7%) and a high negative predictive value (NPV) (81.8%) in predicting fetal distress when a reactive trace was compared with a nonreactive trace. In a study conducted by Ingemersson et al [4], the sensitivity of labour admission test was 23.5% and specificity was found to be 98.7% [4]**.** Rahman H et al [11] concluded that LAT has high specificity 94.8% and low false positivity. The present study found that the sensitivity of LAT is low 66.7%, but the specificity of the test was high 93.6%. PPV was found to be 28.6% while the NPV was high 98.6%. Thus, the present study supports the role of LAT in high risk obstetric patients. The results are supported by those reported by Ingemarsson et al [4] and Rahman H et al [11] and Shivani Khandelwal et al [10].

Conclusion

From the study we can conclude that LAT and AFI can be used as simple non-invasive tests that can serve as a screening tool in high risk obstetric patients in labour. It can help the obstetrician to be more alert in monitoring the labour ward either by intermittent electronic fetal heart rate monitoring or continuous monitoring if required. LAT and AFI can detect fetal distress already present on admission or likely to develop and prevent unnecessary delay in intervention. The potential advantage of LAT and AFI is that, a decrease in decision to delivery time can be made for those patients with fetal distress so that a major improvement in the outcome among parturient can be achieved with abnormal results.

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Conflict of interest: None. **Disclaimer:** Nil.