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Research Article

ADMISSION TEST, AMNIOTIC FLUID INDEX, AND COLOR OF LIQUOR IN TERM PREGNANCIES IN ACTIVE LABOR AND THEIR ASSOCIATION WITH LABOR AND PERINATAL OUTCOME

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ABSTRACT

Objective: The aim of the study was to study the admission non-stress test, amniotic fluid index, and color of liquor at term gestation in active labor in all primi gravida and multi gravida irrespective of their medical condition.

Methods: An observational study was done from January 2015 to August 2016 on 200 pregnant women who were admitted for labor and delivery. A detailed examination was done and non-stress test, amniotic fluid index (AFI), and color of liquor were studied in active labor. Details of the mode of delivery and condition of the mother and the neonate were assessed at the end of each delivery.

Results: The sensitivity of studying all the three parameters is 100% and specificity is 91.91%. The positive predictive value is 85.33%, negative predictive value is 100%, and accuracy is 94.58% with significant p value of <0.001.

Conclusion: From this study, we can conclude that studying all the three parameters, that is, admission test, AFI, and color of liquor in term pregnancies is a reliable method to assess perinatal outcome.

Keywords: Perinatal outcome, Admission test, Amniotic fluid index, Non-stress test, Color of liquor.

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INTRODUCTION

The main purpose of the various ante partum surveillance techniques is to detect fetal distress so, as to prevent fetal death. Routine electronic monitoring of fetal heart rate (FHR) with estimation amniotic fluid index (AFI) in term gestations and early rupture of membranes in active labor has become an established obstetric practice in the Western world. The birth process or labor is like a rebirth for every woman. Hence, to smoothen this journey, an antenatal risk classification is used in hospitals with limited number of monitors for the purpose of determining the patients who would require continuous fetal monitoring. Unfortunately, the risk assessment profiles are often insufficient tools for patient selection.

Admission test is one of the most widely used primary tests for assessment of fetal well-being at term in labor at the time of admission. It is a graphical recording of fetal heart activity and uterine contractions simultaneously and continuously. It is simple, inexpensive, noninvasive, easily performed, and interpreted. A normal pattern includes base line variability of 5–25 beats per minute and at least two accelerations in a 20 min period. The acme of acceleration is 15 beats per minute or more above the base line heart rate and lasting for 15 s or more. Accelerations and normal baseline variability are hallmarks of fetal health. Accelerations without baseline variability should be considered suspicious. Abnormal patterns may represent the effects of drugs, fetal anomaly, fetal infection, and hypoxia. Fetal hypoxia may develop when there is decreased liquor, thick meconium, cord prolapse, scar rupture, intrauterine growth restriction, pre- or post-term labor which, in turn, leads to increase likelihood of respiratory distress syndrome [1,2].

Amniotic fluid serves number of important functions in development of embryo and fetus. At term, it measures about 600–800 ml. Ultrasound assessment of amniotic fluid has important implication in obstetric care and has become an integral component of assessment of fetal well-being. AFI is a semi-quantitative sonographic assessment of amniotic fluid volume, which is measured as sum of the four quadrant deepest vertical amniotic fluid pockets in the gravid uterus. It is a noninvasive test done by measuring the amniotic fluid pockets in a four quadrant or of a single largest vertical pocket or largest transverse pocket. At term AFI decline gradually to a mean of 8.37 cm at term. Serial AFI measurements would be an effective way of assessing fetal status. A change in amniotic fluid volume is associated with adverse outcome. Excess volume is associated with fetal anomalies and aneuploidy and less volume is associated with IUGR and renal anomalies. In later part of pregnancy, it is an integral component for assessment of fetal health, perinatal health, fetal distress, meconium passage, operative delivery, and fetal death. Color of amniotic fluid is an important indicator of fetal well-being [3]. It is pale straw colored due to presence of exfoliated lanugo and epidermal cells from fetal skin. Any deviation of the normal color has got clinical significance. The presence of meconium in amniotic fluid is relatively common. It indicates normal maturity of fetal gastrointestinal tract as well as fetal hypoxia.

METHODS

This was a prospective study over a period of 20 months from January 2015 to August 2016. 200 term gestation females in active labor visiting MNR Medical College and Hospital, Sangareddy.

Inclusion criteria

All term gestation pregnancies in active labor were included in the study.

Exclusion criteria

Multiple gestations, non-cephalic presentations, and previous LSCS were excluded from the study.

A detailed history from the term gestation patient will be taken who are in active labor. The procedure of the study will be explained and regarding consent for the study will be taken. Examination of the

patient will be done and all relevant data will be obtained. Details of the mode of delivery and condition of the mother and the neonate will be assessed at the end of each delivery.

RESULTS

The present study was conducted in the OBG Department of MNR Medical College and Hospital from January 2015 to August 2016, where patients at term pregnancy in active labor were studied, following at which we arrived at these conclusions.

Maximum number of patients (82) belonged to 21–25 years constituting 49.8%.The Mean±SD was 22.81±3.49. About 80% of the women in the study were booked and had regular antenatal checkups. About 57.5% of the women were multiparous and 42.5% women were primi gravida. One hundred and thirty-six (68%) neonates did not require special neonatal care and 64 (32%) neonates required neonatal care (Table 1). Out of 64 neonates who required neonatal care, 48 (24%) neonates required stay in the NICU for 1–5 days and 4 (2%) neonates required stay in NICU for more than 10 days. One hundred and ninety-seven (98.5%) neonates were normal at the time of discharge, 3 (1.5%) neonatal deaths of which two neonatal deaths were after 2 days of resuscitative measures in NICU. Of the three neonatal deaths, two deaths were due severe birth asphyxia and one neonatal death was due to RDS. The AFI was <5 cm in 26 (13%) women. Fourteen (7%) women had AFI of 5–8 cm and 160 (80%) women had AFI more than 8 cm. Artificial rupture of membranes done in the same women in labor showed clear liquor in 144 (72%) women and 56 (28%) women had meconium stained liquor. Ninety-four (47%) pregnancies were between 38 and 39 weeks POG and 106 (53%) pregnancies were between 39 and 40 weeks POG. It is evident that 139 (69.5%) patients had normal delivery, 16(8%) had instrumental delivery, and 45 (22.5%) had caesarean section.

There is a statistically significant difference in AFI in women who were booked compared to unbooked. Unbooked women had lower AFI than booked. ($p<0.001$). There is statistical significance of AFI with admission test. Reduced AFI is more associated with non-reactive admission test ($p<0.0001$). There is statistical significance of AFI with color of the liquor. Meconium staining of the liquor is significantly associated with decreasing AFI. There is statistical significance of AFI with mode of delivery. With decreasing AFI, there is increasing chance of operative delivery ($p<0.001$). There is statistical significance in AFI and NICU stay of the neonate. With reduced AFI, there was increasing chance of NICU admission of the neonate ($p<0.001$) (Table 2).

There were 27 pregnancies with AFI <5 cm of which 26 (40.1%) required NICU admission. AFI <5 cm is significantly associated with NICU admission (Table 3).

Out of 54 (27%) women with non-reassuring admission test, 51 (94%) required NICU admission. In 56 pregnancies, there was meconium stained liquor, of which 52 (92.8%) required NICU admission. It is evident from this table that meconium staining of the liquor was significantly associated with NICU admission.

Out of 26 pregnancies in whom AFI was <5 cm, majority, that is, 23 patients (88%) had cesarean section. Out of 54 (27%) pregnancies with non-reassuring admission test, 2 (3%) had normal delivery, 12 (22%) instrumental delivery, and 40 (74%) required LSCS. It is evident from this table that non-reassuring admission test is significantly associated with operative delivery. In 56 pregnancies with meconium stained liquor, majority that is, 35 (62.5%) patients had cesarean section (Table 4).

Fifteen (7.5%) patients had all the three variables abnormal. Twenty-seven (13.5%) pregnancies where non-stress test (NST) were non-reassuring with meconium stained liquor. Eighteen (9%) pregnancies there was reduced AFI with meconium stained liquor. Nine (4.5%) pregnancies had AFI reduced with non-reassuring NST (Table 5).

Each parameter had significant association with perinatal outcome ($p<0.001$) (Table 6).

Sensitivity of study with three parameters was 100% whereas specificity was 91.91% with $p<0.001$ which is significant (Table 7).

DISCUSSION

Many studies done before focused on only one parameter whereas in my study, I have studied all the three parameters which make my study unique. In the discussion, there is comparison with other studies both individually and combined. Over the years, it has been recognized that fetal morbidity and mortality occur as a consequence of labor even in patients categorized as low risk based on various risk classifications. Indeed many of them need admissions to NICU from low-risk pregnancies. Among the various antenatal surveillance modalities used, NST is one of the easiest tests to perform and cost-effective. There are considerable numbers of clinical literatures that support the use of NST in the management of labor. Oligohydramnios in the antepartum period has been associated with intrauterine growth restriction, postdated pregnancy, and abnormal antepartum FHR patterns. Amniotic fluid volume is known to reduce with advancing gestational age. Thus, it seems logical to evaluate amniotic fluid volume in the early intrapartum period as a predictor of fetal morbidity.

Meconium stained amniotic fluid has been implicated as a factor influencing fetal well-being during the intrapartum and postpartum periods. The presence of meconium in amniotic fluid in cephalic presentation was of great concern even to the midwives and obstetricians of old age. Even the modern obstetricians are fully aware of this fact and they cannot be indifferent at the light of meconium in AF during labor which calls for close vigilance of fetal well-being. Patients included in the present study were from low risk group admitted in labor.

In the present study, maximum age group studied was between 21 and 25 years (41%) in the age group 18–20 years, it was 25% and between 26 and 30 years; it was 28%. In the present study, 53% of mother in study group fall in the gestational age between 39 and 40 weeks. In his study, mean gestational age was 40.04 weeks. In the present study, the incidence of reassuring NST performed in patients at term pregnancy was 73% and non-reassuring tests was 27% which is comparable to other studies.

In a study conducted by Vinita Das *et al*. [4], the incidence of reactive NST was 73.7% and non-reactive was 26.3%. Aparna *et al*. [5] found the incidence of reactive test to be 84.5% and equivocal 9.5%, and ominous 6.0% in only low-risk patients. In other words, total non-reactive NSTs were 15.5%. Similar studies by Ingemarsson *et al*. [6], on both low-risk and high-risk patients, this incidence was 94.3% among reactive groups and 5.7% among non-reactive group. In the present study, the incidence of reassuring test is 73% and non-reassuring is 27%, thus correlating with Vinita das *et al*. studies.

In table, we can see that in the study by Aparna *et al.* [5], the incidence of vaginal delivery in reactive group was 90.5% and in non-reassuring group was 61%. In another study of Ingemarson [6], out of 1041 patients 81.2% had vaginal delivery in reactive group and 83% ominous group. In comparison to above studies, in the present study, out of 200 patients who underwent admission test, 93% of the reactive group had normal vaginal delivery 3% of patients with non-reassuring test had normal vaginal delivery. On analyzing the study made by Aparna *et al*. [5], 3% reactive group and 5.3% non-reassuring group had Instrumental delivery. In the study group of Ingemarson *et al*. [6], 11.1% in reactive group, 6.1% in non-reassuring group had instrumental delivery (Table 8).

In comparison to above studies, in the present study, 2.6% in reactive group and 22% in non-reactive group had instrumental deliveries. The most common cause being prolonged second stage of labor. The number of patients who underwent LSCS in the study made by Aparna *et al*., [5]

Table 1 : Demographic distribution of patients

Age in years	Number of subjects	%
18–20	50	25.0
21–25	82	41.0
26–30	56	28.0
31–35	12	6.0
Total	200	100.0
Booked/unbooked		
Booked	160	80.0
Unbooked	40	20.0
Obstetric score		
Primi	85	42.5
Multi	115	57.5
AFI		
<5	26	13.0
5–8	14	7.0
>8	160	80.0
Color of liquor		
Clear	144	72.0
Meconium	56	28.0
Period of gestation		
38–39	94	47.0
39–40	106	53.0
Mode of delivery		
Normal	139	69.5
Instrumental	16	8.0
LSCS	45	22.5
Baby with mother		
Yes	136	68.0
No	64	32.0
NICU		
1–5 days	48	24
6–10 days	12	6
>10 days	4	2
Neonatal death		
RDS	1	33.3
Birth asphyxia	2	66.7
Babies died	3	100.0

Table 2: Correlation of study variables according to AFI

Amniotic Fluid Index			
Variables	**<5.0 (%)**	**5.0–8.0 (%)**	**>8.0 (%)**
Age in years			
18–20	10 (38.5)	4 (28.6)	36 (22.5)
21–25	8 (57.1)	5 (35.7)	69 (43.1)
26–30	6 (42.9)	3 (21.4)	47 (29.4)
31–35	2 (7.7)	2 (7.7)	8 (5)
Booked/unbooked			
Booked	12 (46.2)	9 (64.3)	139 (86.9)
Unbooked	14 (53.8)	5 (35.7)	21 (13.1)
Parity			
Primi	14 (53.8)	7 (50)	64 (40)
Multi	12 (46.2)	7 (50)	96 (60)
Admission test			
Reactive	2 (7.7)	8 (57.1)	136 (85)
Non-reassuring	24 (92.3)	6 (42.9)	24 (15)
Meconium liquor			
Clear	10 (38.5)	7 (50)	127 (79.4)
Meconium	16 (61.5)	7 (50)	33 (20.6)
Mode of delivery			
Normal	2 (7.7)	7 (50)	130 (81.3)
Instrumental	1 (3.8)	4 (28.6)	11 (6.9)
LSCS	23 (88.5)	4 (28.6)	19 (11.9)
POG			
38–39	9 (64.3)	5 (35.7)	80 (50)
39–40	17 (65.4)	9 (64.3)	80 (50)
ICU Stay			
No	1 (3.8)	7 (50)	128 (80)
Yes	25 (96.2)	7 (50)	32 (20)
Condition at the time of discharge			
Satisfactory	26 (100)	12 (85.7)	159 (99.4)
Non satisfactory	0 (0)	2 (14.3)	1 (0.6)

was 6.5% in reactive 35.5% in non-reassuring group. While in the present study, 3.4% in the reactive group and 74% in non-reassuring group LSCS were done. The most common cause being fetal distress. In the present study, 79.7% of babies were admitted in NICU mostly due to fetal distress. Non-reassuring NST is significantly associated with NICU admissions.

While assessing the usefulness of NST in predicting fetal outcome in the present study, as statistical analysis showed, the present study found that the sensitivity of NST, that is, ability to detect correctly those fetuses who are actually in distress was low 79.69%. However, specificity of the test, that is, ability to identify correctly those who are not at risk for fetal distress was high 97.79%. Positive predictive value was found to be 94.44% while negative predictive value was high 91.10%. In a study conducted by Ingemarsson *et al*. [6], the sensitivity of NST was found to

Table 3: Correlation of AFI score in patients with NICU admission

AFI score	NICU admission (%)	
	NO	**YES**
<5.0	1 (0.7)	25 (40.1)
5.0–8.0	7 (5.1)	7 (10.9)
>8.0	128 (94.1)	32 (50)
Inference	AFI<5.0 is significantly more associated with NICU admission with p<0.001*	
Admission test in patients with NICU admission		
Reactive	133 (97.8)	13 (20.3)
Non-reassuring	3 (2.2)	51 (79.7)
Total	136 (100.0)	64 (100.0)
Inference	Non-reactive admission test is significantly associated with NICU admission with p<0.001**	
Meconium liquor		
Clear	132 (97.1)	Clear
Meconium	4 (2.9)	52 (81.3)
p-value	<0.001	

Table 4: Correlation of AFI score with mode of delivery

AFI score	Mode of delivery (%)		
	Normal	**Instrumental**	**LSCS**
<5.0	2 (1.4)	1 (6.3)	23 (51.1)
5.0–8.0	7 (5.0)	4 (25.0)	19 (42.2)
>8.0	130 (93.5)	11 (68.8)	19 (42.2)
Inference	Lower AFI is significantly associated with p<0.001**		
Admission test			
Reactive	137 (98.6)	4 (25)	5 (12.5)
Non-reassuring	2 (1.4)	12 (75)	40 (88.5)
P-Value	<0.001		
Meconium liquor			
Clear	133 (97.8)	1 (6.3)	10 (22.2)
Meconium	6 (4.3)	15 (93.8)	35 (77.8)
p-value	<0.001*		

Table 5: Distribution of meconium color of liquor, admission test, and reduced AFI

NST	AFI	Color of Liquor	Number of cases	%
Reactive	Normal	Clear	131	65.5
	Reduced	Meconium stained	18	9
Non-reactive	Normal	Meconium stained	27	13.5
	Reduced	Clear	9	4.5
	Reduced	Meconium stained	15	7.5

Table 6: Diagnostic evaluation of admission test, AFI, and Liquor to predict perinatal outcome

Parameters	Sensitivity	Specificity	PPV	NPV	Accuracy	p-value
AFI	50.00	94.12	80.00	80.00	80.00	<0.001**
Liquor	79.69	97.06	92.73	91.03	91.50	<0.001**
Admission test	79.69	97.79	94.44	91.10	92.00	<0.001**

Table 7: Diagnostic evaluation of admission test with AFI with color of liquor to predict perinatal outcome

Parameters	Sensitivity	Specificity	PPV	NPV	Accuracy	p-value
Meconium liquor+Non-reactive NST+reduced AFI	100	91.91	85.33	100	94.58	<0.001*
Meconium liquor+Non-reactive NST	98.4	96.3	92.6	99.2	97	<0.001*
Meconium liquor reduced AFI	96.8	91.9	84.9	98.4	93.5	<0.001*
Non-reactive NST+reduced AFI	85.9	93.3	85.9	93.38	91	<0.001*

Table 8: Comparison of various studies with the present study

Study	Patients	NVD		Instrumental Delivery		LSCS	
		No	%	No	%	No	%
a) Aparna Hegde *et al*. [5]	200						
Reactive	169	153	90.5	5	3	11	6.5
Non-reactive	31	19	61	1	3.1	11	35.5
b) Vinita Das *et al*. [4]	175						
Reactive	129	-	-	-	-	59	45.7
Non-reactive	96	-	-	-	-	28	60.9
c) Ingermarsson [6]	1041						
Reactive	982	797	81.2	109	11.1	76	7.8
Non-reactive	59	49	83	3	0.5	7	11.8
d) Present Study	200						
Reactive	146	137	93	4	2.6	5	3.4
Non-reactive	54	2	3	12	22	40	74

Table 9: Predictive ability of NST in prediction of fetal outcome in labour

Study	Sensitivity	Specificity	PPV	NPV
Aparna *et al*. [5]	66.7%	96%	90%	38%
Ingemarsson *et al*. [6]	23.5%	98.7%	99%	40%
Present study	79.69%	97.79%	94.44%	91.10%

be 23.5% and specificity was 99.4%. Although positive predictive value was 40%, negative predictive value was quite high, 98.7%.

In a study conducted by Aparna *et al*. [5], the sensitivity of NST was found to be 66.6% and specificity was 90%. Although positive predictive value was 38.7%, negative predictive value was quite high, 96%. Thus, in the present study, we found that though the sensitivity of NST in fetal surveillance was low, the specificity and negative predictive values were significantly high, thus correlating with Debra *et al*. studies (Table 9).

In the present study, the incidence of thick meconium stained liquor was high among oligohydramnios group accounting for 61% of women and is comparable with the study conducted by Rutherford *et al*., (1987) (54%). The studies by Sarno *et al*., (1990) showed 41.9% incidence, and Raj Sriya *et al*., (2001) 38.88% incidence of thick meconium stained amniotic fluid in the oligohydramnios group.

In the present study, incidence of cesarean delivery was 88.5% among oligohydramnios group. This is comparable with the study conducted by Raj Sriya *et al*. [10], (43.05%). The incidence in the studies conducted by Rutherford *et al*. [9] was (11%) and Sarno *et al*. was (11.9%). In the present study, the incidence of NICU admissions among oligohydramnios

Table 10: Comparison of variables with other studies

Non-reassuring NST and NICU admissions	Percentages in various studies
Khandelwal *et al*.[7]	33%
Shakira *et al*.[8]	66%
Present study	79.7%
Occurrence of Meconium stained Liquor	
Rutherford *et al*.[9]	54%
Raj Sriya *et al*.[10]	38.88%
Present study	61%
LSCS for oligohydramnios	
Rutherford *et al*.[9]	11%
Sarno *et al*. [11]	11.9%
Raj Sriya *et al*.,[10]	43.05%
Present study	88.5%
NICU	
Baron *et al*.[12]	88.2%
Raj Sriya *et al*.[10]	88.88%
Present study	39.1%
Meconium Stained Liquor	
Goud and Krishna[13]	9.8%
Arun[14]	14%
Hari Bhaskar[15]	11.2%
Present study	28%
NICU in Meconium Stained Liquor	
Pravin Goud[16]	54%
Present study	81%
Perinatal Morbidity	
Arun[14]	6.85%
Present Study	32%
Meconium stained liquor with perinatal mortality	
Debdas[17]	3%
Goud and Krishna[13]	7.7%
Arun[14]	3.7%
Present Study	2.5%

was 40.1%. However, in the studies conducted by Raj Sriya *et al*. [10], it was 88.88% and 8.2% in the study by Baron *et al*. [12].

From table, it is evident that the incidence varies from 9.8% to 14%. In present study the incidence was 28% (among the MSAF cases the highest incidence was thick MSAF). Incidence of thick meconium stained liquor was almost 2 times more than thin meconium liquor whereas in the study done by Debdas [17] and Arun [14], incidence of thin meconium stained liquor was high.

The present study shown that NICU care was needed more about 81% in MSAF group babies. It is due to associated meconium aspiration in the babies. Other study by Pravin [13] also observed 54% required NICU care. In our study, morbidity in meconium stained liquor is comparable to other study in our present study; perinatal death was 2.5% in study group. In the series of other authors, perinatal mortality

ranged from 3% to 7.7%. They had similar observation as compared to the present study. In the present study 100%, perinatal mortality was in thick meconium group. In the study, sensitivity with three parameters (Admission test, AFI, and color of liquor) was 100% whereas specificity was 91.91% with p<0.001 which is significant (Table 10).

CONCLUSION

The antenatal surveillance of pregnancies with admission test, AFI, and color of liquor can effectively screen for identification of high-risk fetuses and segregate the population that is at risk for perinatal mortality and morbidity. The potential advantage of admission test with AFI and color of liquor 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. The use of admission test, AFI and color of liquor in monitoring pregnancies may result in an increase in the incidence of operative delivery as seen in our study (22% LSCS) and hence, associated high LSCS rates has to be considered. The sensitivity of studying all the three parameters is 100% and specificity is 91.91%. The positive predictive value is 85.33%, negative predictive value is 100%, and accuracy is 94.58% with significant.

In conclusion, admission test AFI and color of liquor can be used as an important non-invasive method to diagnose fetal compromise present at the time of admission in low-risk patients in early labor. Obstetricians can be more vigilant by either doing intermittent electronic fetal heart monitoring or if required continuous monitoring. By doing these three tests in term pregnancies, there will be decrease in the load of continuous monitoring. The above parameters can detect fetal distress already present on admission and unnecessary delay in intervention can be avoided.

AUTHOR CONTRIBUTIONS

All authors are involved.

CONFLICTS OF INTERESTS

Nil.

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