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Research Article

Amniotic fluid index, non-stress test and color of liquor: as a predictor of perinatal outcome

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ABSTRACT

Background: The universal aim of maternity care provision is birth of a healthy baby to a healthy mother. All birth attendants strive to achieve a good standard of care during labor to prevent an outcome such as 'birth asphyxia'. The aim was to study the role of AFI, NST and color of liquor in predicting perinatal outcome in term pregnancy in active labor.
Methods: Prospective observational study of in women 18-35 years of age in active Labor admitted in department of Obstetrics and Gynecology BRD Medical College Gorakhpur, India.
Results: In patient with AFI <5 cm, 83% needed intervention during labor (77% LSCS, 6% instrumental vaginal delivery) and 89% newborn had APGAR <7, while in AFI >5 cm group only 29% needed intervention (24% LSCS, 5% instrumental vaginal delivery) and only 20% newborn had APGAR <7. Normal NST (Cat.-I) group had 89% normal vaginal delivery and only 11% (9.5% LSCS, 1.5% instrumental vaginal delivery) needed intervention with 6% newborn with APGAR<7 at 1 minute ('p'<0.00001), while pathological NST (Cat.-III) group had 16% normal vaginal delivery and 84% (8% instrumental vaginal delivery, 76% LSCS) needed intervention during labor with 92% newborn with APGAR <7 at 1 minute ('p'<0.00001). Clear liquor group had 85% had normal vaginal delivery and only 15% needed intervention (14% LSCS, 1% instrumental vaginal delivery) with 8.3% newborn with APGAR <7 at 1 minute, while meconium stained liquor group only 6.5% had normal vaginal delivery and 93.5% needed intervention (16% instrumental vaginal delivery, 77.5% LSCS) with 87% newborn with APGAR <7 at 1 minute.
Conclusions: AFI, NST and color of liquor can effectively detect fetal distress already present at admission, thereby avoiding unnecessary delay and decrease in decision to delivery time and improve fetal outcome.

Keywords: Aminiotic fluid index, Non-stress test, Color of liquor, Perinatal outcome

INTRODUCTION

Pregnancy is one of the life's most exciting and fulfilling adventures. The birth process or labor is like a rebirth for every woman. The universal aim of maternity care provision is birth of a healthy baby to a healthy mother. All birth attendants strive to achieve a good standard of care during labor to prevent an outcome such as 'birth asphyxia'(policy statement 1996) and avoid its short or long term consequences (Mac Lennan) for the child.[1,2] However, despite best efforts, occurrences of birth asphyxia continue to happen in obstetric practice.[1]

Worldwide, the WHO estimates that between 4-9 million newborns suffer birth asphyxia each year (Vikram et al).[3] Of these about 1 million infants die and a similar number survive with long-term disabilities related to birth injury (Eerden PV et al) asphyxia.[4] Various ante-partum surveillance techniques (Penna L.) have been developed

for prompt detection and management of obstetric complications.[5] But in developing countries like INDIA where workload is more and resource settings are low, we need techniques which are simple, cost-effective, easy to use and less time consuming.

Estimation of amniotic fluid index (Phelan JP et al, Tom C et al, Callen PW) during ultrasonography is a major step for prediction of pregnancy outcome while electronic fetal monitoring (RCOG Guideline 2001) is the most widely used technique for assessing fetal well-being in Labor.[6,9,10] So AFI estimation with non-stress test at admission and assessment of color of liquor (Schultz M et al) at rupture of membranes-these three parameters altogether can be used as a valuable screening test to detect fetal distress (ACOG Practice Bulletin No 106, 2009) as early as possible and prevent fetal morbidity as well as mortality.[11,12]

METHODS

This prospective observational study was done on 206 pregnant women with term pregnancy (37 weeks to 41.6 weeks) in active labor admitted in labor room of department of obstetrics and gynecology, Nehru Chikitsalya, BRD Medical College, Gorakhpur, Uttar Pradesh from September 2014- October 2015 for a period of 12 months.

Inclusion criteria

All pregnant women of gestational age 37- 41.6 weeks in active labor b/w 18-35 years of age.

Exclusion criteria

- Multiple pregnancies.
- Pregnancy with gestational age < 37 weeks.
- Premature rupture of membranes.
- Congenital anomalies.
- Non-cephalic presentations/malpresentations.
- Previous LSCS.
- Intrauterine death.
- LSCS done for maternal indication (cephalopelvic disproportion ante-partum hemorrhage, ante-partum eclampsia).

Method of collection of data

After taking written and informed consent and fulfilling the inclusion criteria, patients were included in the study.

Method of study

Detailed antental history including presence of high risk factors was elicited from the patient, then they were clinically examined and subjected to ultrasonograhy for AFI estimation in the following manner (Magann EF).[13]

- Patient laid in supine position.
- A linear, curvilinear, or sector transducer can be used.
- Uterus divided into four quadrants using the maternal sagittal midline vertically, and the upper edge of the uterine fundus.
- The transducer must be kept parallel to the maternal sagittal plane and perpendicular to the maternal coronal plane throughout.
- The deepest cord free and clear pocket of amniotic fluid is visualized, and the image frozen. The ultrasound calipers were manipulated to measure the pocket in a strictly vertical direction.
- The process was repeated in each quadrant and the pocket measurements summed=AFI.

If the AFI is <8 cm, 4 quadrant evaluation was performed 3 times and average was taken.

After AFI estimation, non-stress test was done and color of liquor was noted during spontaneous or artificial rupture of membranes. Progress of Labor was monitored with partogram and mode of delivery, perinatal outcome (APGAR score of at 1 min and NICU admission), condition of neonate and mother were noted at the end of each delivery.

RESULTS

Depicts the distribution of amniotic fluid index, NST and color of liquor among 206 patients studied. 82% (170) had AFI >5.00 cm but <24.00 cm, while 18% (36) had AFI <5.00 cm i.e. they fall in oligohydramnios group (Table 1).

Table 1: Distribution of amniotic fluid index, non-stress test at admission and color of liquor.

Amniotic fluid index (Total=206)	**<5.00 cm**	**>5.00 cm but <24 cm**	
	36 (17.84%)	170 (82.52%)	
Non-stress test at admission (Total=206)	Normal	Intermediate	Pathological
	126	30	50
Color of Liquor (Total=206)	Clear	Meconium thick	Meconium thin
	144 (69.90%)	36 (17.47%)	26 (12.62%)

Out of 206 patients enrolled 61% had normal (Cat-I), 14.5% had suspicious/ indeterminate (Cat-II), while 24% had pathological/abnormal (Cat-III) tracings.

Out of 206 patients enrolled 144 (70%) had clear liquor while 62 (32%) had meconium stained liquor. 36 (thick) and 26 (thin).

Table 2 shows correlation of AFI with other study variables which is as follows:

In the oligohydramnions group (<5 cm)

- 66% patients were in the age group 18-25 years, 66% patients were unbooked,61% were primigravida
- 73% had abnormal/pathological NST at admission, 62% had meconium stained liquor during Labor,16% delivered vaginally while 83% needed intervention
- 89% newborn had APGAR score <7 and hence NICU admission in comparison to 20% in normal liquor group
- Newborn mortality in oligohydramnios group was 6% while 2% in normal liquor group.

Table 2: Correlation of study variables according to amniotic fluid index.

	Amniotic fluid index		
	<5.0 cm (%)	>5.0cm (%)	
Age			χ^2 =1.92 df=2 p=0.382
– 18-25 years	24 (66.0)	130 (76.0)	
– 26-30 years	09 (25.0)	33 (19.0)	
– 31-35 years	03 (09.0)	07 (05.0)	
Booking status			χ^2 =12.2 df=1 p=0.000
– Booked	16 (44.0)	126 (74.0)	
– Unbooked	20 (66.0)	44 (26.0)	
Parity			χ^2 =6.73 df=1 p=0.010
– Primi-gravida	22 (61.0)	64 (38.0)	
– Multi-gravida	14 (39.0)	106 (62.0)	
Non-stress test			χ^2 =55.8 df=2 p=0.000
– Normal	06 (16.0)	120 (70.0)	
– Intermediate	04 (11.0)	26 (16.0)	
– Abnormal	26 (73.0)	24 (14.0)	
Color of liquor			χ^2 =19.9 df=1 p=0.000
– Clear	14 (38.0)	130 (76.0)	
– Meconium	22 (62.0)	40 (24.0)	
Mode of delivery			χ^2 =40.6 df=2 p=0.000
– Normal vaginal discharge	06 (16.0)	120 (70.0)	
– Instrumental	02 (05.5)	10 (05.8)	
– LSCS	28 (77.5)	40 (23.5)	
Apgar score			χ^2 =64.8 df=1 p=0.000
– <7	32 (89.0)	34 (20.0)	
– >7	04 (11.0)	136 (80.0)	
Condition of baby discharge			χ^2 =1.80 df=1 p=0.179
– Satisfactory	34 (94.0)	167 (98.2)	
– Unsatisfactory	02 (06.0)	03 (01.8)	

- Pathological NST was more associated with oligohydramnios group (<5 cm)- 72% versus only 14% in normal AFI group.
- Pathological NST group- 76% LSCS, 16% vaginal delivery, and 8% instrumental vaginal delivery, while normal NST group had 9.5% LSCS, 1.5% instrumental vaginally delivery, and 88% vaginal delivery.

Table 3: The correlation of NST (at admission) with other study variables.

	NST at admission			
	Normal (%)	**Intermediate (%)**	**Pathological (%)**	
Age				
18-25 years	92 (60.0)	18 (12.0)	44 (18.0)	χ^2 =8.82 df=4 p=0.066
26-30 years	28 (66.0)	10 (23.0)	04 (11.0)	
31-35 years	06 (60.0)	02 (20.0)	02 (20.0)	
Booking status				
Booked	98 (69.0)	20 (14.0)	24 (17.0)	χ^2 =14.9 df=2 p=0.001
Unbooked	28 (43.0)	10 (15.0)	26 (42.0)	
Parity				
Primi-gravida	30 (45.0)	16 (24.0)	20 (31.0)	χ^2 =11.6 df=2 p=0.003
Multi-gravida	96 (68.0)	14 (10.0)	30 (22.0)	
Amniotic fluid index				
<5 cm	06 (16.0)	04 (11.0)	26 (73.0)	χ^2 =55.8 df=2 p=0.000
>5 cm	120 (71.0)	26 (15.0)	24 (14.0)	
Color liquor				
Clear	116 (81.0)	18 (12.0)	10 (07.0)	χ^2 =90 df=2 p=0.000
Meconium	10 (16.0)	12 (19.0)	40 (65.0)	
Mode of delivery				
Normal vaginal delivery	112 (89.0)	06 (04.7)	08 (06.3)	χ^2 =111 df=4 p=0.000
Instrumental	02 (16.7)	06 (50.0)	04 (34.0)	
LSCS	12 (17.6)	18 (26.4)	38 (56.0)	
Apgar score				
<7	08 (12.0)	12 (18.0)	46 (70.0)	χ^2 =122 df=2 p=0.000
>7	118 (84.0)	18 (12.8)	04 (02.8)	
Condition of baby discharge				
Satisfactory	125 (62.0)	29 (14.4)	47 (23.6)	χ^2 =4.22 df=2 p=0.121
Unsatisfactory	01 (20.0)	01 (20.0)	03 (60.0)	

- Normal NST group had 6% APGAR <7 (at 1 minute), 94% APGAR >7. Pathological NST had 92% APGAR <7 and 8% >7. So there was significant difference in neonatal outcome in the two groups.

Table 4 shows the correlation of study variables (AFI, NST and color of liquor) with perinatal outcome (in terms of mode of delivery and newborn APGAR score at 1 minute).

Table 4: Correlation of mode of delivery and neonatal outcome (in terms of APGAR score at 1 min).

	Mode of delivery				APGAR score at 1 min.		
	Normal delivery (%)	Instrumental vaginal delivery (%)	LSCS (%)		<7(%)	>7(%)	
AFI				χ^2 =40.6			χ^2=64.8
<5cm	06 (17.0)	02 (05.5)	28 (77.0)	df=2	32 (89.0)	04 11.0)	df=1
>5 cm	120 (71.0)	10 (05.8)	40 (23.5)	p=0.000	34 (20.0)	136 (80.0)	p=0.000
NST							
Normal (category-I)	112 (89.0)	02 (1.58)	12 (09.5)	χ^2 =111	08 (06.4)	118 3.6)	χ^2 =122
Intermediate (category-II)	06 (20.0)	06 (20.0)	18 (60.0)	df=4	12 (40.0)	18 60.0)	df=2
Pathological (category-III)	08 (16.0)	04 (08.0)	38 (76.0)	p=0.000	46 (92.0)	04 (08.0)	p=0.000
Color of liquor				χ^2 =113			χ^2 =123
Clear	122 (85.0)	02 (01.0)	20 (14.0)	df=2	12 (08.4)	132 1.6)	df=1
Meconium stained	04 (06.5)	10 (16.0)	48 (77.4)	p=0.000	54 (87.0)	08 (13.0)	p=0.000

In patient with AFI <5 cm, 83% needed intervention during labor (77% LSCS, 6% instrumental vaginal delivery] and 89% newborn had APGAR <7, while in AFI >5 cm group only 29% needed intervention (24% LSCS, 5% instrumental vaginal delivery) and only 20% newborn had APGAR <7.

Normal NST (Cat.-I) group had 89% normal vaginal delivery and only 11% [9.5% LSCS, 1.5% instrumental vaginal delivery] needed intervention with 6% newborn with APGAR<7 at 1 minute ('p'<0.00001), while pathological NST (Cat.-III) group had 16% normal vaginal delivery and 84% (8% instrumental vaginal delivery, 76% LSCS) needed intervention during Labor with 92% newborn with APGAR <7 at 1 minute ('p'<0.00001).

Clear liquor group had 85% had normal vaginal delivery and only 15% needed intervention (14% LSCS, 1% instrumental vaginal delivery) with 8.3% newborn with APGAR <7 at 1 minute, while meconium stained liquor group only 6.5% had normal vaginal delivery and 93.5% needed intervention (16% instrumental vaginal delivery, 77.5% LSCS) with 87% newborn with APGAR <7 at 1 minute.

DISCUSSION

The findings of (Table 1) regarding AFI has been found to be similar to the study by Syeda Azra Tasneem et al, where 20% were in oligohydramnios (<5.0 cm AFI) group, 21% in border line oligo group (5.1-8.0 cm AFI) while 59% were in normal AFI group (>8 cm).[14] In the study by Bhagat M et al, 12.5% had AFI <5.00 cm, while 87.5% had AFI >5.00 cm, similarly in the study by Alchalabi HA et al, 37% patients had AFI <5.00 cm while 63% had AFI >5.00 cm.[15,16]

Our findings regarding NST has been found to be similar to the study by Lohana RU et al, where 85% had reactive and 15% had non-reactive NST at admission.[17] In the study by Shreshtha P et al Cat.-I is 77%, Cat.-II 9%) and Cat.-III 20% while in the study by Rahman H et al; Cat.-I is 77.0%, Cat.-II 14%) and Cat.-III 9%.[18,19]

Observation regarding color of liquor found to be comparable to studies by Becker S, where prevalence was 10%, Ziadeh SM et al also had prevalence of 11%, while Maymon E et al in the study had 17% prevalence and Nathan et al in their study had prevalence of 20%.[21-23]

In the oligohydramnios (<5 cm) group, there was significant association with pathological NST at admission, meconium stained liquor during Labor, caesarean delivery for fetal distress, newborn APGAR at 1 minute <7, NICU admission and newborn mortality ('p' value <0.00001) (Table 2).

The rate of intervention during Labor (instrumental vaginal delivery/ caesarean) increases as NST changes from Cat.-I to Cat.-III, hence NST can detect fetuses at risk early, which can be saved by proper intervention on time (Table3). In a similar study by Rahman H et al.[19] Cat.-I had 11% intervention, Cat.-II had 39% needed intervention, and Cat.-III had 86% needed intervention (LSCS). In the study Sandhu et al, 15% intervention in Cat.-I NST 55% intervention in Cat.-II and 73% intervention in Cat.-III NST.[24] Similarly in the study by Shrestha P et al fetal distress was more in Cat.-II and Cat.-III, hence needed more intervention.[18] Patients who

underwent LSCS (51), 85% had NST of Cat.-II and Cat.-III. In a similar study by Rahman H et al, incidence of Cat.-I NST 77%, Cat.-II 14.4% and Cat.-III NST 8.7%. Also in the study by Lohana RU et al there were more operative deliveries in non-reactive NST group alongwith poor outcome in terms of meconium stained liquor; APGAR score <7 at 5 minutes and NICU admission.[19,17]

All 3 study variable (NST, AFI and color of liquor) are good predictor of healthy fetus in pregnancies between 37-41.6 weeks and probability of adverse outcome such as operative delivery and poor APGAR score increases with oligohydramnios, pathological NST and meconium stained liquor (Table 4).

CONCLUSION

In present study results show that decreased AFI, pathological NST at admission, meconium stained liquor during labor are associated with more caesarean deliveries for fetal distress and poor perinatal outcome (APGAR <7 AT 1min,NICU admission).

SO NST, AFI and color of liquor can effectively detect fetal distress already present at admission, thereby avoiding unnecessary delay and decrease in decision to delivery time and improve fetal outcome.

Therefore AFI, NST and color of liquor-all three together can be used as an important non-invasive method to diagnose fetal compromise already present at the time of admission and obstetricians can be more vigilant by doing intermittent/continous EFM. By doing these three simple tests load of continuous monitoring can be decreased in low resource settings and improving fetal outcome.

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REFERENCES

1. Policy statement: task force on cerebral palsy and neonatal asphyxia of the society of obstetricians and gynecologists of Canada. J Soc Obstet Gynecol Can.1996;1267-1279
2. Lennan M. A template for defining a causal relationship between acute intrapartum events and cerebral palsy: international consensus statement. British Med J. 1999;319:1054-9.
3. Sinai VT, Arulkumaran S. Arias' practical guide to high-risk pregnancy and delivery, a South Asian Perspective. Available at http:// www.jogc.com /article/S0849-5831(16)30890-4/pdf 359. Accessed on 12 February 2012.
4. Eerden PV, Peter S. Bernstein, neonatal encephalopathy and cerebral palsy: defining the pathogenesis and pathophysiology. Am College Obst Gyne. 2003;8(2).
5. Penna L. Fetal surveillance in labor. In :Arulkumaran S, Regan L, Papageorghiou AT, Monga A, Farquharson, eds. Chapter 10.7 in Oxford desk Ref Obs & Gyne. Oxford University Press;2011.
6. Phelan JP, Smith CV, Broussard P. Amniotic fluid volume assessment with four quadrant technique at 36-42 weeks gestation. J Reprod Med. 1987;32:540.
7. Winter TC, Roger SC. Clinical sonography: A practical guide hagerstown, MD: Lippincott Williams and Wilkins. 2006:502.
8. Callen PW. Amniotic fluid volume; its role in fetal health and disease. In ultrasonography in Obstetrics and Gynecol, 5th ed. Philadelphia, Saunders Elsevier. 2008:764.
9. Modena AB, Fieni S. Amniotic fluid dynamics. Acta Bio Medica Ateneo Parmanese. 2004;75(1):11.
10. Royal College of Obstetricians and Gynecologists. Evidence based Clinical Guideline no.8,2001.The use and interpretation of CTG in intrapartum fetal surveillance. RCOG Press. London.
11. Schultz M. San Francisco, Calif: The significance of the passage of meconium during labor. Am J Obstet Gynecol. 1924;8:288.
12. ACOG Practice Bulletin No.106:Intrapartum fetal heart rate monitoring :nomenclature, interpretation and general management principles. American College of Obstetricians and Gynecologists. Obstet Gynecol. 2009;114:1191-3.
13. Magann EF, Sanderson M, Martin JN. The amniotic fluid index, single deepest pocket and two-diameter pocket in normal human pregnancy. Am J Obstet Gynecol. 2000;182:1581.
14. Tasneem SA, Ali MK, Qushnood F. A study of amniotic fluid index in term pregnancy. Int J Curr Res Aca Rev. 2014:2(1):147-52.
15. Bhagat M, Chawla J. Correlation of amniotic fluid index with perinatal outcome. Rev Bras Ginecol Obstet. 2013;35(8):342-8.
16. Alchalabi HA, Obeidat BR, Jallad MF, Khader YS. Induction of labor and perinatal outcome: the impact of the amniotic fluid index. Am J Obstet Gynecol. 2005;192(6):1803-9.
17. Lohana RU, Khatri M, Hariharan C. Correlation of non-stress test with fetal outcome in term pregnancy (37-42 weeks). Int J Reprod Contrac Obst Gynae. 2013:2(4):639-45.
18. Shrestha P, Misha M, Shrestha S. A prospective study on impact of non-stress test in prediction of pregnancy outcome. Am J Public Health Res. 2015;3(4):45-8.
19. Rahman H, Renjhen P, Dutta S. Reliability of admission cardiotocography for intrapartum monitoring in low resource setting. Cochrane Database Syst Rev. 2012;12:CD007863.pub3
20. Becker S, Solomayer E, Dogan C, Wallwiener D, Fehm T. Meconium stained amniotic fluid- perinatal outcome and obstetrical management in a low risk

suburban population. Am J Obstet Gynecol 2001;185 (4):863-8.
21. Ziadeh SM, Sunna E. Obstetric and perinatal outcome of pregnancies with term labor and meconium stained amniotic fluid. Eur J Obstet Gynecol Reprod Biol. 1998;80(2):169-73.
22. Maymon E, Chaim W, Furman B, Ghezzi F, Shoham Vardi I, Mazor M. Meconium stained amniotic fluid in very low risk pregnancies at term gestation. Gynecol Obstet Invest. 1998;45(1):19-23.
23. Nathan L, Leveno KJ, Carmody TJ, Kelly MA, Sherman ML. Meconium: a 1990 perspective on an old obstetric hazard. Gynecol Obstet Invest. 1994;37(2):91-5.
24. Sandhu GS, Raju R, Bhattacharyya TK, Shaktivardhan. Admission cardiotocography screening of high risk obstetric patients: Med J Armed Forced India. 2008;64(1);43-5.

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