

## Amniotic fluid index at admission in labour as predictor of intrapartum fetal status

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### Summary

To re-examine the value of amniotic fluid index at admission in labour (aAFI) as a predictor of intrapartum fetal status, in 326 term pregnancies at their admission in labour, labour admission test (LAT) and antepartum risk status were recorded. The different categories were correlated with fetal/neonatal outcome. There were 68.7% women at low risk on the Minnesota scale for antepartum status. The proportion of women with low aAFI ( $\leq 5$  cm) was higher in the high-risk group (8 of 12, 64%,  $p = 0.0001$ ) and occurrence of significantly higher non-reassuring fetal status (NRFS; 10 of 12 with low AFI, 83%,  $p = 0.0001$ ). Number recording LAT as non-reactive trace (41 cases) was similar irrespective of the pregnancy status (24 and 17 in low- and high-risk cases, respectively) and fetal status through labour (21 and 20 in fetuses with NRFS and otherwise, respectively). Negative predictive value was similar between the groups (88% for aAFI and 89% for LAT), and LAT was found to be more specific (91%) than 64% for aAFI. Sensitivity and positive predictive values were poor in both. It is concluded that aAFI is not a reliable screening test to predict intrapartum fetal compromise.

**Keywords:** Amniotic fluid index, antepartum risk score, intrapartum fetal compromise, labour admission test, non-reassuring status

### Introduction

Intrapartum fetal compromise as a major contributor to neonatal morbidity is of great concern for the obstetrician, attending neonatologist, the parturient and her family. Antenatal risk assessment profiles are often insufficient in picking up these cases. It is seen that intrapartum fetal morbidity and mortality are not uncommon even in the low-risk population and fetal acidosis might occur with the same frequency as in the high-risk group. Hence, the reliability of antenatal risk profiles for predicting fetal problems in labour are challenged.

The concept of an admission test in early labour, the labour admission test, using either an initial period of fetal heart rate monitoring or the fetal response to acoustic stimulation appeared attractive when proposed. But, these are found to have very low sensitivity and high false positive rates as screening tests for fetal compromise in labouring low-risk pregnancies (Blix and Oian 2001).

Amniotic fluid index determination at admission in labour (aAFI) is studied as a risk screening tool in identifying parturients who would eventually develop intrapartum fetal compromise (Rutherford et al. 1987; Sarno et al. 1990; Ghosh et al. 2002). Some authors however (Chauhan et al. 1992, 1997), have stressed repeatedly that low indices do not consistently predict poor peripartum events.

The purpose of this investigation was to re-examine the value of aAFI as a predictor of intrapartum fetal status.

### Material and methods

A total of 326 consenting consecutive parturients with well-dated singleton pregnancy at term having vertex presentation

and admitted in early labour were studied. The study protocol was approved by the Departmental Review Board.

On admission to the labour ward, they were categorised as at high or low risk, using the Minnesota system of scoring (Edwards et al. 1979). Fetal heart trace was taken for 30 min (Corometrics and Huntleigh; paper speed 1 cm/min) and amniotic fluid index (AFI) was recorded as described by Phelan et al. (1987) AFI estimation was done by the obstetric sonologist not involved in labour care. The obstetrician managing labour was not informed of the Minnesota score and aAFI.

The fetal heart trace was interpreted as reassuring and non-reassuring (ACOG 1995). Maternal and fetal wellbeing along with progress of labour were monitored. Recording of Apgar scores at 1 and 5 min and neonatal morbidity index (NMI) estimation were used for assessing asphyxia status of the newborn. The NMI was calculated using estimation of the gestational age by new Ballard scores, birth weight and the recognition of congenital anomalies and soft tissue injuries, if any.

For any neonate requiring stay in the intensive care unit, the duration of stay and its indication were noted. The neonate was considered to have had fetal compromise, hereafter termed as non-reassuring fetal status (NRFS), if any of the following were present: meconium staining of the amniotic fluid, fetal heart trace abnormality, Apgar scores  $\leq 7$  at 1 and 5 min, NMI of  $> 6$  or neonatal intensive unit (NICU) hospitalisation.

Outcome of labour, delivery and neonate was studied in relation to different AFI subgroups. To determine the significance of observed difference in proportions, the  $\chi^2$ -test

was used. Statistical significance was set at 95% level ( $p > 0.05$ ).

## Results

Of the 326 parturients studied, 224 (68.7%) were inferred to be with low risk pregnancy on the Minnesota scale. The mean gestational age was 38 weeks, age of parturients was 24 years and 180 women (55.2%) were primigravidas. The proportion of women with low aAFI ( $\leq 5$ ) was higher in high-risk group and occurrence of NRFS was also significantly higher in them. Of the four low-risk pregnancies that had  $\leq 5$  cm AFI, fetal status was not reassuring in three of them. Number recording LAT with cardiocogram as non-reactive trace was similar, irrespective of the pregnancy status and fetal status through labour, although a significantly higher proportion of non-reactive LAT was noted in the group who eventually had NRFS (Table I).

When inferences of LAT were compared with aAFI subgroups, in parturients with AFI  $> 5$  cm and the outcome of NRFS, LAT failed inconsistently. Non-reactive LAT did not correlate with NRFS in pregnancies with higher AFI (Table II). Of the 10 cases with AFI up to 5 cm that showed non-reactive LAT, 5 were clustered in the group of AFI between 3–3.9 cm ( $\chi^2 = 58.7$ ;  $p = 0.000001$ ).

Neither aAFI nor LAT seemed to have dependable sensitivity. Although LAT was found to be more specific, both of them possessed similar higher negative predictive value (Table III).

The incidence of caesarean delivery in the study was 14.1% (46 of 326 cases) and was inversely proportional to the aAFI status. Pregnancies with low aAFI of  $< 5$  cm were found to be associated with poorer perinatal outcome. It was observed that 14 fetuses had meconium aspiration syndrome, all requiring neonatal intensive care unit stay (Table IV).

## Discussion

Normal parturition is an asphyxiating event for the fetus. Incidence of acidosis at birth is not found to be different between the low and high-risk groups. But, it is difficult to predict with accuracy, which fetus would develop hypoxia in labour and the degree of hypoxia the baby would undergo.

To resolve this, reallocation of risk status was suggested using LAT. It has been shown that if the LAT is reactive, the probability of an adverse outcome is low (Ingemarsson et al. 1986). Recording lower sensitivity and positive predictive

Table II. Correlation of labour aAFI and LAT with fetal status.

aAFI (cm)	LAT	NRFS		RFS	
		n	(%)	n	(%)
Up to 5 (n = 12)	Reactive* (n = 2)	1	50.0	1	50.0
	Nonreactive† (n = 10)	8	80.0	2	20.0
5.1–8 (n = 116)	Reactive* (n = 96)	21	21.9	75	78.1
	Nonreactive† (n = 20)	11	55.0	9	45.0
> 8 (n = 198)	Reactive* (n = 187)	10	5.4	177	94.6
	Nonreactive† (n = 11)	2	18.2	9	81.8

\* $\chi^2 = 173.8$ ,  $p = 0.00001$ ; † $\chi^2 = 189.5$ ,  $p = 0.000001$ . aAFI, amniotic fluid index at admission in labour; LAT, labour admission test; NRFS, non-reassuring fetal status; RFS, reassuring fetal status.

Table III. Validation of aAFI and LAT.

Validation	AFI (%)	LAT (%)
Sensitivity	58	40
Specificity	64	92
Positive predictive value	24	51
Negative predictive value	88	89

aAFI, amniotic fluid index at admission in labour; LAT, labour admission test.

Table IV. aAFI and pregnancy outcome.

Outcome	aAFI (cm)					
	< 5 (n = 12)		5.1–8 (n = 116)		8.1–20 (n = 198)	
	n	(%)	n	(%)	n	(%)
<b>Mode of delivery</b>						
Normal	0		80	69.0	182	91.9
Instrumental vaginal	2	16.7	12	10.3	4	2.0
Caesarean section	10	83.3	24	20.7	12	6.1
<b>Neonatal outcome</b>						
Apgar score $< 7$	1	8.3	1	0.9	0	
Umbilical artery pH $< 7.1$	1	8.3	0		0	
NMI $> 6$	1	8.3	2	1.7	0	
MAS	8	66.7	3	2.6	3	1.5
Neonatal intensive care unit stay	9	75.0	23	19.8	14	7.0

aAFI, amniotic fluid index at admission in labour; NMI, neonatal morbidity index; MAS, meconium aspiration syndrome.

Table I. Predictors of intrapartum fetal status in relation to pregnancy risk and fetal status.

Predictors of fetal status	Pregnancy status				Fetal status			
	Low risk (n = 224)		High risk (n = 102)		NRFS (n = 53)		Reassuring (n = 273)	
	n	(%)	n	(%)	n	(%)	n	(%)
<b>aAFI (cm)</b>								
< 5 (n = 12)	4	33	8	67	10	83*	2	17
5.1–8 (n = 116)	74	64	42	36	21	18*	95	81
> 8 (n = 198)	146	74	52	26	22	11*	176	88
<b>Labour admission test (LAT)</b>								
Reactive (n = 285)	200	89	85	83	32	11†	253	89
Non-reactive (n = 41)	24	11	17	17	21	51†	20	49

\* $\chi^2 = 43.8$ ,  $p < 0.00001$ ; † $\chi^2 = 12.1$ ,  $p = 0.0000$ . aAFI, amniotic fluid index at admission in labour; NRFS, non-reassuring fetal status.

values (53% and 61%, respectively) in the earlier analysis of 500 LATs, we opined that reactive LAT tracing is of some predictive value at least for the first few hours after admission in labour in women with pre-existing risk factors (Kushtagi and Nagaroni 2002). In the present study, reactive LAT was found in almost equal proportions among antenatally determined high- and low-risk groups. With reactive LAT, 89% of the fetuses had a reassuring status. Ingemarsson et al. (1986) reported 17% intrapartum fetal compromise in the presence of reactive LATs. In the present study, the proportion of cases with non-reassuring status was 51% when the trace was non-reactive. Analysing 932 records retrospectively, Blix and Øian (2001) found sensitivity for LAT to be too low and with too many false positives in low risk women. Later, following the meta-analysis of controlled trials, they did not find any evidence supporting the LAT as beneficial in low risk women (Blix et al. 2005).

When attention was turned to AFI from the fetal heart trace,  $\leq 5$  cm of aAFI was found to be associated with an increasing incidence of intrapartum fetal compromise (Rutherford et al. 1987) and it was looked to as a screening tool of promise. On statistical analyses, aAFI is said to be associated with a higher specificity (86.4%) and higher negative predictive value (96.7%) by some (Sarno et al. 1990) and higher sensitivity by others (Baron et al. 1995). In the present study, we noted marginal specificity (64%) and good negative predictive value (88%).

Observations from this study indicate that AFI as a risk-screening tool at admission in labour was less specific than the fetal heart activity trace. The reason could be that gestation week-specific AFI (< 5th percentile for the gestational age) was not used, as suggested by Moore and Cayle (1990). But, it is reported that the equation proposed by them to derive the percentile values was not faultless. Moreover, semiquantitative methods of amniotic fluid volume assessment, such as the amniotic fluid index, are inherently subject to error (Williams 1993). Studying the impact of oligohydramnios by two different definitions on outcome of pregnancies, Chauhan et al. (1997) opined that oligohydramnios should not be an indication for aggressive intervention in a mixed population of 'high-risk' pregnant patients. The issue of whether intrapartum oligohydramnios is predictive of subsequent intervention for fetal distress and neonatal acidosis however, remains unanswered.

#### Acknowledgement

The authors are thankful to Dr Prashanth K Adiga, Associate Professor in Obstetrics-Gynecology at Kasturba Medical College, Manipal for help in recording the amniotic fluid index of parturients.

**Declaration of interest:** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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