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Research Article

## Abnormal fetal heart tracing patterns in patients with meconium staining of amniotic fluid and its association with perinatal outcomes

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### ABSTRACT

**Background:** CTG is the most commonly used test for antepartum and intrapartum fetal surveillance. Objective: Evaluation of labours complicated by MSAF or abnormal fetal heart rate tracings or both and its predictability of adverse perinatal outcomes.

**Methods:** Prospective observational study of laboring patients with evidence of suspected fetal distress carried out at department of Obstetrics and Gynecology, Institute of Maternal and Child Health, Kozhikode, Kerala during the time period July 2013 - December 2013. Analysis of clinical data of 600 labouring women with evidence of presumed fetal jeopardy (either in the form of abnormal FHR tracings or MSAF or both) were done. Pregnancy variables and perinatal outcomes were compared and correlated with FHR tracings. Statistical analysis was carried out by chi-square and ANOVA tests. Level of significance was set at P value <0.05.

**Results:** The presence of FHR tracing abnormalities was associated with an increased risk of perinatal mortality and neonatal morbidity. There was significantly higher Caesarean Delivery (CD), low APGAR scores, higher requirement of neonatal resuscitation and admission to NICU and higher perinatal deaths among abnormal FHR tracing group.

**Conclusions:** 1) The presence of abnormal FHR tracing pattern in MSAF patients is associated with an increased risk of adverse perinatal outcomes. 2) Adverse fetal outcomes were also noted in patients with clear liquor but abnormal FHR tracings. 3) Similar adverse outcomes were more common in the tracing showing decelerations.

**Keywords:** CTG, Meconium, FHR patterns, APGAR scores

### INTRODUCTION

The ultimate goal of intrapartum assessment of fetus is to identify accurately and safely fetuses who are affected negatively by the stresses of labour.

With the recognition of low PPV of continuous EFHRM for fetal acidemia and the increased CD associated with its use, the benefits of using EFHRM for reducing serious adverse neonatal outcomes has been questioned.

MSAF occurs in less than 5% of preterm labours but is more common in term (10-22%) and post term deliveries (25-52%).<sup>1-3</sup> The passage of meconium may be a normal physiologic event reflecting fetal maturity. It may on the other hand, reflect fetal hypoxia or increased vagal activity from cord compression.

Although MSAF is associated with an increased risk of perinatal morbidity and mortality, the association between specific fetal heart tracing abnormalities and neonatal outcomes remains to be defined in this context.<sup>1,2</sup>

In the context of MSAF, routine FHR monitoring has been recommended to screen for early signs of fetal hypoxia.<sup>4</sup>

Umstad<sup>5</sup> investigated the predictive value of abnormal FHR tracing pattern in early labour and found that the presence of meconium in the amniotic fluid improved the predictive properties of the test. In contrast, Steer et al.<sup>6</sup> investigated the interrelationships among abnormal CTG's in labour, MSAF, cord blood PH and Apgar scores among 1219 consecutive births. The presence of abnormal FHR tracings did not appear to modify the association between MSAF and adverse outcomes.

With the background of these conflicting results, further research is required to assess the relevance of FHR tracing abnormalities in the context of MSAF.

This study was designed to compare the pregnancy outcomes and the perinatal and early neonatal outcomes among patients with abnormal FHR tracings with or without MSAF.

## METHODS

This study was conducted in the department of Obstetrics and Gynaecology, Institute of Maternal and Child Health, Government Medical College, Kozhikode. A total of 600 labouring women with evidence of presumed fetal jeopardy (either in the form of abnormal FHR tracing or MSAF or both) were enlisted. Analysis of their data concerning sociodemographic and obstetric characteristics were taken from their case records.

- Data regarding maternal and neonatal outcomes were obtained from clinical charts
- Measures of pregnancy outcomes were mode of delivery, CD, indications for CD (% of CD for fetal distress), oligamnios, MSAF, cord around neck of fetus.
- Measures of neonatal outcomes were Apgar at 1' and 5' intervals, birth weight, requirement of resuscitation, NICU admissions for causes other than prematurity, duration of NICU stay, complications and perinatal mortality.

### *Inclusion criteria*

Nulliparous/multiparous women with singleton, term gestation, in labour, cephalic presentation and a non-reassuring FHR tracing and/or MSAF as diagnosed by resident or attending staff.

### *Exclusion criteria*

If there was a known or suspected fetal anomaly, chorioamnionitis, placenta previa, vaginal bleeding due to

other causes, breech presentation, multiple pregnancy, acute hypoxia (like rupture uterus, abruption, cord prolapse) or an indication for urgent delivery.

We take an admission test and subsequently repeat the CTG when she's in labour.

A total of 600 labouring women who showed evidence of presumed fetal jeopardy either in the form of abnormal FHR tracing or MSAF or both were enlisted and followed till after delivery.

### *Definition of abnormal tracings*

1. Baseline tachycardia - >160 bpm
2. Baseline bradycardia - <110 bpm
3. Any of above with decreased BT BV
4. Presence of decelerations
  - a. Late decelerations
  - b. Atypical variable decelerations
5. Absence of accelerations

## RESULTS

Of the total 600 labouring patients enrolled in the study with presumed fetal jeopardy were divided into 3 groups.

### I. With MSAF

- (A) With Normal FHR tracing - 232 (38.7%)
- (B) With abnormal FHR tracing - 143 (23.8%)

### II. Clear liquor

- (C) With abnormal FHR tracing - 225 (37.5%)

Table 1 shows the patient's sociodemographic and obstetrical characteristics according to FHR tracings.

The mean age of patients were  $25.6 \pm 4$  years ranging from 18-35. Patients in above 30yrs age group had more of abnormal FHR tracings which may be due to associated comorbidities and obstetric complications.

Among the associated obstetric complications, preeclampsia, IUGR and oligamnios showed maximum correlation (those with abnormal FHR tracings had 43.6% incidence of associated obstetric medical complications,  $P = 0.002$ ). Preeclampsia was seen in 32.9% of patients with presumed fetal jeopardy.

**Table 1: Correlation of maternal age and obstetric complications with abnormal tracing.**

		(A) MSAF normal tracing (n=232)	(B) MSAF abnormal tracing (n=143)	(C) Clear liquor abnormal tracing (n=225)	P value
Age	<30	220 (41.2%)	122 (22.8%)	192 (36%)	<0.001 highly significant
	>30	12 (18.2%)	21 (31.8%)	33 (50%)	
Obstetric complications	Preeclampsia	19 (8.2%)	19 (13.3%)	44 (19.6%)	0.002
	IUGR	6 (2.6%)	13 (9.1%)	25 (11.1%)	0.001
	Oligamnios	6 (2.6%)	11 (7.7%)	35 (15.6%)	0.0001

Table 2 shows major abnormal FHR tracing patterns in the study group. Of which, 38% of ladies had decelerations (including late and variable), 30% of them had only tachycardia. 22% of laboring women showed only absence of accelerations with other parameters being normal.

**Table 2: Major fetal heart rate abnormalities.**

	Total		Outcome	
	No.	%	Abnormal	Normal
Tachycardia	110	29.8%	15 (13.6%)	95 (86.3%)
Bradycardia	14	3.8%	7 (50%)	7 (50%)
Absent/reduced BTBV	14	3.8%	8 (57%)	6 (43%)
Decelerations	140	38%	117 (84%)	23 (16%)
Absence of accelerations	80	21.7%	20 (25%)	60 (75%)

Table 3 illustrates the pregnancy outcomes in terms of mode of delivery in three study groups. The frequency of CD for fetal indication was maximum in patients with FHR tracing abnormalities, found to be statistically significant. 86.3% in those with MSAF and abnormal FHR tracing and 55.6% in those with clear liquor and abnormal FHR tracing. In those with MSAF and normal tracing, we had a CD rate of 53.4% which may be due to the fact they had other associated obstetric factors and were remote from delivery.

**Table 3: Mode of delivery.**

	A	B	C	P value
Vaginal delivery	108 (46.5%)	20 (14%)	98 (43%)	0.022
Caesarean delivery	124 (53.4%)	123 (86%)	127 (56.4%)	0.302
Spontaneous labour	186 (80.2%)	94 (65.7%)	93 (41.3%)	0.00001
Induced labour	46 (19.8%)	49 (34.3%)	132 (58.7%)	0.00001

Of the total laboring patients with abnormal tracings, 185 patients out of total 368 (50.27%) had undergone preinduction cervical ripening for one or other reasons.

Of the total 375 patients with MSAF, 99 patients (26.4%) had undergone induction of labour. Of these patients with MSAF and abnormal FHR tracing, 53 out of 143 (37.1%) were following induced labour (P <0.05).

The proportion of women with normal amount of liquor in USG were more in those with normal tracing (77.58%) than in abnormal tracing group (29.8%) wherein more of oligamnios were seen (67.09%) in the abnormal tracing group. Difference was statistically significant.

**Table 4: Correlation of nature of cord, placenta & amount of liquor with tracing patterns.**

Amount of liquor	Abnormal tracing (368)	Normal tracing (232)
Reduced	250 (67.9%)	52 (22.4%)
Normal	110 (29.89%)	180 (77.58%)
Increased	8 (2.1%)	0
Normal cord	316	228 (98.2%)
Compressed cord (around neck)	52 (14.13%)	4
Placenta		
Normal	320 (86.9%)	230 (99.1%)
Small	40 (10.8%)	-
Big	8 (2.1%)	2

Similarly, the proportion of abnormally big and small placentae was more with abnormal tracing group (12.9%) compared to normal tracing group (1%).

Compressed umbilical cord was found to be high among women with abnormal FHR tracing (14.6%) but not statistically significant.

MSAF was seen more associated with small placentae and decreased liquor.

#### Perinatal outcomes

Table 5 shows the fetal outcomes. Birth weight was lower in abnormal FHR tracing group though not statistically significant and lower APGAR scores at 1' and 5' was significantly more in abnormal tracing groups with or

without MSAF (82.5% versus 17.4% than normal tracing group ( $P < 0.05$ ).

More importantly, 49.6% of low APGAR scores were seen in those with clear liquor and abnormal FHR tracing ( $P = 0.00001$ ).

The babies who needed immediate resuscitation and admission to NICU was higher in abnormal tracing group (76.74% versus 23.2%) which was statistically significant ( $P = 0.00001$ ). In those labours complicated by MSAF, more babies in the group of abnormal tracing required admission to NICU and in 15 babies meconium was suctioned below cords.

The perinatal deaths were more in abnormal FHR tracing group (6 FSB and 28 NNDs) irrespective of nature of liquor. Those who had MSAF but normal tracings had no perinatal deaths and had better outcomes. Of the NNDs in the abnormal tracing group, 6 of them had congenital heart disease.

**Table 5: Perinatal outcomes.**

	(A) MSAF normal tracing (n=232)	(B) MSAF abnormal tracing (n=143)	(C) Clear liquor abnormal tracing (n=225)
<b>Birth weight</b>			
<2.5	46 (19.8%)	37 (25.9%)	65 (29.1%)
2.5-3	161 (69.4%)	94 (65.7%)	147 (65.9%)
>3.5	25 (10.81)	12 (8.4%)	11 (4.9%)
<b>P = 0.05</b>			
Low APGAR	26 (17.2%)	49 (32.8%)	74 (49.6%)
NICU admission	40 (17.2%)	57 (39.9%)	75 (33.3%)
<b>P = 0.00001</b>			
Meconium----- -- below cords	-	4	2
Immediate resuscitation reqd.	2	20	14
<b>Perinatal deaths</b>			
FSB	0	4 (2.8%)	2 (0.9%)
NND	0	14 (19.8%)	14 (6.2%)

## DISCUSSION

In the context of MSAF (Grade II and III), we found that the presence of FHR abnormalities was associated with an increased risk of perinatal mortality and/or neonatal morbidity. The significance of FHR abnormalities on the risk of adverse outcomes in the presence of MSAF remains controversial.

Hairong et al. demonstrated that the risk of perinatal mortality and neonatal morbidity was significantly

increased in infants in the presence of a moderately abnormal tracing (According to them in the presence of thick MSAF, abnormal FHR tracings were associated with an increase in the risk of perinatal mortality and morbidity (OR of 1.67) compared to patients with normal tracings.<sup>7</sup>

There was no significant difference between the 3 groups of patients with MSAF and without MSAF and abnormal FHR tracing regarding the maternal age, parity and gestational age which was similar to studies such as Dellinger et al.<sup>8</sup>

CTG showing only tachycardia had only 13.6% abnormal outcomes. It's the early sign of fetal distress. So, once interventions are done early, outcomes were good. In our study, in CTG showing decelerations, 84% had abnormal outcomes which are similar to studies done by Kubli et al.,<sup>9</sup> Shifrin et al.,<sup>10</sup> Keogen et al.<sup>11</sup> (Decelerations included all types - late and moderate to severe variable decelerations).

Abnormal outcomes were more seen in those who had preeclampsia, IUGR and oligamnios.

Regarding the mode of delivery, CD were more in those with MSAF and abnormal tracing which was similar to study by Dellinger et al.<sup>8</sup> and Katun et al. and Chauhan et al.<sup>12</sup>

Perinatal outcomes, as seen, low APGAR scores were more in those with abnormal FHR tracing (with or without MSAF) and subsequent NICU admissions were also more in this group which was similar to many studies mainly Dellinger et al.<sup>8</sup> Convulsions, possibly due to HIE were seen in those with abnormal tracing when compared to those with normal FHR tracing. Of perinatal deaths, still births and NNDs were seen only in the abnormal FHR tracing group. Other authors have failed to demonstrate an association between FHR tracing abnormality & adverse neonatal outcomes in the presence of meconium staining.<sup>6,13</sup> 20 deaths were following vaginal delivery possibly due to delay in delivery.

## CONCLUSION

A reassuring FHR pattern strongly predicts a good outcome for the neonate and management options for labour can be presented to the patient.

EFM reduces hypoxia related deaths by 60% which translates into the prevention of 1 perinatal death per 1000 births at the expense of an increase in operative vaginal and CD for non-reassuring fetal status by a factor of 2-3.<sup>14</sup>

In summary, in the presence of MSAF, nonreassuring fetal heart rate patterns are associated with an increase in perinatal mortality and neonatal morbidity compared with patients with normal tracings. Non-reactive tracings in the background of normal liquor also carries a higher

perinatal risk. Hence a need for caution in situations where we come across a non-reassuring tracing and should be managed accordingly on the background of the clinical scenario.

#### Abbreviations

CD - Caesarean delivery  
CTG - Cardiotocogram  
MSAF - Meconium stained amniotic fluid  
EFHRM - Electronic fetal heart rate monitoring  
FHR - Fetal heart rate

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