NEONATAL OUTCOMES WITH CONTINUOUS INTRAPARTUM ELECTRONIC FETAL MONITORING VS. INTERMITTENT AUSCULTATION

*Harsh Vardhan Gupta¹, Narinder² and Ruku³
¹Department of Pediatrics, GGS Medical College, Faridkot
²Department of Pediatrics, Adesh Medical College, Bathinda
³Department of Pathology, GMC Patiala
Author for Correspondence

ABSTRACT
This study was undertaken to observe how the EFM alters the neonatal outcome as compared to IA. The present study was conducted in Maheshwari Children’s Hospital and associated obstetric centers, Bathinda, India. This study included 990 women, pregnant with single live fetus, who were monitored during the labour either by intermittent auscultation (IA) or electronic fetal monitoring (EFM) by cardiotocography (CTG). All the women were examined clinically for onset of labour and fetal well being on admission. Every third pregnant women admitted in labour was assigned to group monitored by EFM and remaining were monitored by IA. There were no differences between the groups in terms of maternal age, gravidity, parity, gestational age, and number of antepartum high-risk factors. Out of 990 pregnant women, who qualified for the study, 660 were in IA group and 330 were in EFM group. No. of intrapartum related deaths in IA group were 13.64 per 1000 as compared to 9.09 per 1000 in EFM group. The difference was statistically non significant (p value > 0.05). As compared to IA, EFM during labour results in decreased incidence of development of HIE Stage II. However it does not alter the incidence of development of total HIE cases, and HIE stage I & III.

Key Words: Electronic Fetal Monitoring, Intermittent Auscultation, HIE

INTRODUCTION
The human infant is particularly vulnerable to asphyxia in the perinatal period. During normal labour, transient hypoxemia occurs with uterine contractions, but the healthy fetus tolerates it well. There are five basic events that lead to asphyxia during labour and delivery:
1. Interruption of umbilical blood flow (e.g. cord compression).
2. Failures of gas exchange across the placenta (e.g. placental abruption).
3. Inadequate perfusion of the maternal side of the placenta (e.g. severe maternal hypotension).
4. An otherwise compromised fetus who cannot further tolerate the transient intermittent hypoxia of the normal labour (e.g. growth retarded fetus).
5. Failure to inflate the lungs and complete the changes in ventilation and lung perfusion that must occur at birth. Though it can occur because of airway obstruction, excessive fluid in the lungs, or weak respiratory effort, alternatively it may occur as a result of fetal asphyxia from one of the above four events, because fetal asphyxia often results in an infant who is acidotic and apneic at birth.
Asphyxia in the fetus or newborn infant is a progressive and reversible process. The speed and extent of progression are highly variable. In the early stages asphyxia usually reverses if its cause is removed. Once asphyxia is severe, spontaneous reversal is unlikely because of the circulatory and neurological changes that accompany it. Sudden, severe asphyxia can be lethal in less than 10 minutes (Rehan and Phibbs, 2005). Target organs of perinatal asphyxia are the brain, heart, lungs, kidneys, liver, bowel and bone marrow. In a study of asphyxiated newborn, 34% had no evidence of organ injury, 23% had an abnormality confined to one organ, 34% involved two organs and 9% had three affected organs. The most frequent abnormalities involved the kidney (50%), followed by CNS (28%), cardiovascular system 25%,
and pulmonary (23%) system. Hypoxic-ischemic brain injury is the most important consequence of perinatal asphyxia (Aurora and Snyder, 2004).

Perinatal asphyxia is the most common cause of neonatal renal failure. Blood levels of urea nitrogen and creatinine helps in the diagnosis and management of renal failure (Mohan and Pai, 2000).

The main objective of intrapartum fetal monitoring is the reduction or prevention of congenital neurological deficit by screening for intrapartum hypoxia/acidosis, thereby enabling obstetrician to undertake appropriate intervention. Although a majority of congenital neurological handicaps are not related to intrapartum events, intrapartum monitoring is undertaken to avoid deaths or morbidity due to intrapartum hypoxia. Monitoring is mainly performed by either intermittent auscultation (IA) or electronic fetal monitoring (EFM) by cardiotocography (CTG) (Jibodu and Arulkumaran, 2005).

Introduction of CTG in routine intrapartum fetal monitoring is expected to reduce perinatal mortality and morbidity due to fetal hypoxia/acidosis. The present study was undertaken to see the effects of continuous EFM on neonatal outcome in comparison to intermittent auscultation.

MATERIALS AND METHODS

The present study was conducted in Maheshwari Children’s Hospital and associated obstetric centers, Bathinda, India. This study included 990 women, pregnant with single live fetus, who were monitored during the labour either by intermittent auscultation (IA) or electronic fetal monitoring (EFM) by cardiotocography (CTG). All the women were examined clinically for onset of labour and fetal well being on admission. Every third pregnant women admitted in labour was assigned to group monitored by EFM and remaining were monitored by IA. EFM group was managed according to latest ACOG guidelines. IA was defined as auscultation of the fetal heart rate for at least 60 seconds every 15 minutes during the first stage of labor and every 5 minutes during the second stage of labor (Barstow et al., 2010). There were no differences between the groups in terms of maternal age, gravidity, parity, gestational age, and number of antepartum high-risk factors. Following parameters were observed for neonatal outcome:

1. **Intrapartum-related Neonatal Deaths-** It classifies babies who died from childbirth related hypoxic events (Lee et al., 2011). It included two subsets of neonates;
   - Fetal Deaths- include babies born dead, but who were alive at the onset of labour.
   - Neonatal Deaths- include babies who died in neonatal period due to hypoxia related events during labour.

2. Need for resuscitation at Birth- it was assessed and provided as per the guidelines mentioned in Manual of Neonatal care 5th edition Cloherty JP (Ringer, 2004); which very closely follow the Apgar score at 1 minute.

3. Apgar score of 5 or <5 at 5 minutes (Perlman and Risser, 1996) - Apgar score was calculated at 5 min as proposed by Virginia Apgar 1953 (Apgar, 1953).

4. Organ damage related to intrapartum hypoxia- it was assessed in terms of brain and renal injury only (Perlman et al., 1989). Pulmonary and cardiac damages were not evaluated due to lack of adequate infrastructure.
   - i) Brain injury- defined as hypoxic ischemic encephalopathy (HIE) and classified into stage I, II and III according to Sarnat and Sarnat stages of HIE (Sarnat and Sarnat, 1976). Neonates were assigned to the most severe stage of HIE achieved.
   - ii) Renal injury – defined as Acute Renal Failure (ARF) when Blood Urea Nitrogen (BUN) >20 mg/dl and Serum creatinine >1.5 mg/dl (Mehta, 2004).

Statistics

Fischer’s exact test was used to find statistically significant differences.

Out of 990 pregnant women who qualified for the study, 660 were in IA group and 330 were in EFM group. No. of intrapartum related deaths in IA group were 13.64 per 1000 as compared to 9.09 per 1000 in EFM group. The difference was statistically non significant (p value > 0.05). 12.12 % in IA and 11.51 % in EFM group required resuscitation at birth (p value > 0.05). 3.94 % neonates in IA and 3.03 % in
EFM group were having Apgar score less than or equal to 5 at 5 minutes. Difference observed was not significant statistically (p value > 0.05). A total of 3.33 % neonates in IA and 2.42 % in EFM group developed HIE (p value > 0.05).

### Observations

<table>
<thead>
<tr>
<th></th>
<th>IA</th>
<th>EFM</th>
<th>p-Value</th>
<th>Statistical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Intrapartum-related deaths</td>
<td>Total</td>
<td>9</td>
<td>3</td>
<td>0.7601</td>
</tr>
<tr>
<td></td>
<td>Fetal</td>
<td>5</td>
<td>1</td>
<td>0.6698</td>
</tr>
<tr>
<td></td>
<td>Neonatal</td>
<td>4</td>
<td>2</td>
<td>1.0000</td>
</tr>
<tr>
<td>No. of neonates who Needed resuscitation at birth</td>
<td>80</td>
<td>38</td>
<td>0.8355</td>
<td>NS</td>
</tr>
<tr>
<td>Number of neonates with Apgar score equal or &lt; 5</td>
<td>26</td>
<td>10</td>
<td>0.5897</td>
<td>NS</td>
</tr>
<tr>
<td>No. of neonates who developed HIE</td>
<td>Total</td>
<td>22</td>
<td>8</td>
<td>0.5560</td>
</tr>
<tr>
<td></td>
<td>Stage I</td>
<td>7</td>
<td>4</td>
<td>1.0000</td>
</tr>
<tr>
<td></td>
<td>Stage II</td>
<td>13</td>
<td>1</td>
<td>0.0434</td>
</tr>
<tr>
<td></td>
<td>Stage III</td>
<td>2</td>
<td>3</td>
<td>0.3404</td>
</tr>
<tr>
<td>No. of neonates who developed ARF</td>
<td>14</td>
<td>5</td>
<td>0.6278</td>
<td>NS</td>
</tr>
</tbody>
</table>

1.06 % and 1.21 % in IA and EFM groups respectively developed HIE stage I, whereas corresponding figures for HIE stage III are 0.30 % and 0.91 % respectively. None of these differences in frequencies observed were significant statistically. However 1.96 % in IA and 0.30% EFM neonates developed HIE stage II, which was a statistically significant difference (p value < 0.05).

In terms of renal damage, 2.12 % neonates in IA group and 1.52 % in EFM group developed acute renal failure. Difference was not statistically significant.

### DISCUSSION

There were no statistically proved differences between “Intrapartum-event related Neonatal Death” rates in fetuses either monitored by Intermittent Auscultation or Electronic Fetal monitoring, which corroborated with the studies of Graham et al., (2006), Barstow et al., (2010), Haverkamp et al., (1976), Bailey (2009) and Alfirevic (2006). But this finding was contradictory to the studies of Vintzileos et al., (1993) who found that EFM decreases perinatal mortality (Vintzileos, 1993), which could be because of few neonatal deaths in their study which could not have been prevented by intrapartum fetal monitoring. We found no difference in either Neonatal or Fetal Death rates separately, between two groups. Similar results were found in various studies (Graham et al., 2006; Haverkamp et al., 1976; Bailey, 2009; Alfirevic, 2006). However this in contradiction to the study of Barstow et al., (2010) who found decreased fetal mortality rates in EFM group, and they further stated that this advantage was offset by increase in rate of caesarian section deliveries (Barstow et al., 2010).

As compared to IA, EFM did not reduce significantly the ‘Need for Resuscitation at Birth’ as defined by 1 minute Apgar score. Similarly there was no statistical difference in the percentage of neonates with 5 minute Apgar score less than or equal to five. This is in accordance with the findings of MacDonald et al., (1985) and many other studies (Graham et al., 2006; Barstow et al., 2010; Haverkamp et al., 1976; Bailey, 2009; Alfirevic, 2006).
3.33% neonates in IA and 2.42% neonates in EFM group developed signs of HIE, though these differences were not statistically significant. But 1.96% neonates in IA and 0.3% neonate in EFM group developed HIE stage II. The difference was statistically significant. Seizures are one of the main criteria defining the stage II HIE. This is in accordance with the study of Barstow et al., (2010) who concluded that compared with intermittent auscultation, continuous electronic fetal monitoring reduces the risk of neonatal seizure by 50% (Barstow et al., 2010). The similar observations were made in other studies (Barstow et al., 2010; Haverkamp et al., 1976; Bailey, 2009; Alfirevic, 2006). However there were no statistically significant differences in the incidence of HIE stage I & III between the two groups. In terms of renal injury, defined by development of acute renal failure, there were no statistically significant differences between IA and EFM groups. There were no studies available to compare this parameter.

Limitations
The present study was undertaken at tertiary level care centers, where most patients are referred in with complications. So the sample studied may not be the true representative of the general population.

Conclusion
Fetus is particularly vulnerable to hypoxia during labour which leads to perinatal morbidity and mortality as well as long term sequels like cerebral palsy. Fetal monitoring during labour is done to prevent fetal hypoxia. Traditionally it is done by intermittent auscultation (IA) for detecting changes in fetal heart rates as an indicator for fetal hypoxia. New modalities of fetal monitoring are introduced with the expectation to detect fetal hypoxia with greater sensitivity and specificity. One of such modalities is Cardiotocography which is also called Electronic Fetal Monitoring (EFM). EFM records changes in the fetal heart rate and their temporal relationship to uterine contractions. The aim is to identify babies who may be hypoxic, so additional assessments of fetal well-being may be used, or the baby delivered by caesarean section or instrumental vaginal birth. This study was undertaken to observe how the EFM alters the neonatal outcome as compared to IA. We concluded that:

As compared to IA, EFM during labour results in decreased incidence of development of HIE Stage II. However it does not alter the incidence of development of total HIE cases, and HIE stage I & III.

EFM does not significantly prevent more “Intrapartum–related Deaths”, “Fetal Deaths” or “Neonatal Deaths” as compared to IA.

There are no statistically significant difference between IA and EFM groups in terms of “Need for Resuscitation at Birth”; and in the percentage of neonates with “5 minute Apgar score of less than or equal to 5”.

Incidence of development of “Acute Renal Failure” is not significantly different between the two groups.

REFERENCES


