International Journal of Basic and Applied Medical Sciences ISSN: 2277-2103 (Online)
An Online International Journal Available at http://www.cibtech.org/jms.htm
2013 Vol. 3 (2) May-August, pp.75-79/Gupta et al.
Research Article

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

***Harsh Vardhan Gupta[1], Narinder[2] and Ruku[3]**
[1]*Department of Pediatrics, GGS Medical College, Faridkot*
[2]*Department of Pediatrics, Adesh Medical College, Bathinda*
[3]*Department 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

		IA N= 660	**EFM N=330**	**p- Value**	**Statistical significance**
No. of Intrapartum -related deaths	Total	9	3	0.7601	NS
	Fetal	5	1	0.6698	NS
	Neonatal	4	2	1.0000	NS
No. of neonates who Needed resuscitation at birth		80	38	0.8355	NS
Number of neonates with Apgar score equal or < 5		26	10	0.5897	NS
No. of neonates who developed HIE	Total	22	8	0.5560	NS
	Stage I	7	4	1.0000	NS
	Stage II	13	1	0.0434	S
	Stage III	2	3	0.3404	NS
No. of neonates who developed ARF		14	5	0.6278	NS

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 Monitorting (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

Rehan VK and Phibbs RH (2005). Delivery Room Management. Avery's Neonatology-Pathophysiology & Management of the Newborn, MacDonald MG, Seshia MMK, Mullett MD editors **6**. Philadelphia: Lippincott Williams and Wilkins Publishers 305-326.

Jibodu OA (2005). Arulkumaran S. Intrapartum fetal monitoring. The Management of Labour. Arulkumaran S, Penna LK, Rao KB editors **2**, Chennai: Orient Printing Co. 70-85.

Lee ACC, Cousens S, Darmstadt GL and Blencowe H *et al.*, (2011). Care during labor and birth for the prevention of intrapartum-related neonatal deaths: a systematic review and Delphi estimation of mortality effect. *BMC Public Health* **11**(Suppl 3) S10.

Perlman JM and Risser R (1996). Can asphyxiated infants at risk for neonatal seizures be rapidly identified by current high-risk markers? *Journal of Pediatrics* **97**(4) 456-62.

Perlman JM, Tack ED, Martin T, Shackelford G and Amon E (1989). Acute systemic organ injury in term infants after asphyxia. *American Journal of Diseases of Children* **143**(5) 617-20.

Mehta KP (1991). Neonatal renal failure. *Indian Pediatrics* **28** 7-9.

Sarnat HB and Sarnat MS (1976). Neonatal encephalopathy following fetal distress: A clinical and electroencephalographic study. *Archives of Neurology* **33** 696–705.
Aurora S and Snyder EY (2004). Perinatal asphyxia. Manual of neonatal care. Cloherty JP, Eichenwald EC, Stark AR editors **5**. Philadelphia: Lippincott Williams and Wilkins Publishers 536-555.
Ringer SA (2004). Resuscitation in delivery room. Manual of neonatal care. Cloherty JP, Eichenwald EC, Stark AR editors **5**. Philadelphia: Lippincott Williams and Wilkins Publishers 57-69.
Mohan PV and Pai PM (2000). Renal insult in asphyxia neonatorum. Indian Pediatrics **37** 110-26.
Apgar V (1953). A proposal for a new method of evaluation of newborn infant. Current Researches in Anesthesia and Analgesia **4** 260-7.
Graham EM, Petersen SM, Christo DK and Fox HE (2006). Intrapartum electronic fetal heart rate monitoring and the prevention of perinatal brain injury. *Journal of Obstetrics & Gynecology* **108**(3 Pt 1) 656-66.
Barstow C, Gauer R and Jamieson B (2010). How does electronic fetal heart rate monitoring affect labor and delivery outcome? Evidence-based Answers from The Family Physicians Inquiries Network **59**(11) 653a-653b.
Haverkamp AD, Thompson HE, McFee JG and Cetrulo C (1976). The evaluation of continuous fetal heart rate monitoring in high-risk pregnancy. *American Journal of Obstetrics and Gynecology* **125**(3) 310-320.
Bailey RE (2009). Intrapartum Fetal Monitoring. *American Academy of Family Physicians* **80**(12) 1388-1396.
Alfirevic Z, Devane D and Gyte GM (2006). Continuous cardiotocography (CTG) as a form of electronic fetal monitoring (EFM) for fetal assessment during labour. *Cochrane Database of Systematic Reviews* **19**(3) CD006066.
Vintzileos AM, Antsaklis A, Varvarigos I, Papas C, Sofatzis I and Montgomery JT (1993). A randomized trial of intrapartum electronic fetal heart rate monitoring versus intermittent auscultation. *Journal of Obstetrics & Gynecology* **81**(6) 899-907.
MacDonald D, Grant A, Sheridan-Pereira M, Boylan P and Chalmers I (1985). The Dublin randomized controlled trial of intrapartum fetal heart rate monitoring. *American Journal of Obstetrics and Gynecology* **152**(5) 524-539.