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Lakshmikantha G

Associate professor, Department of obstetrics and gynecology, Mysore medical college and research institute, Mysuru, Karnataka, India

Sangeetha C

Medical officer, Department of obstetrics and gynecology, Mysore medical college and research institute, Mysuru, Karnataka, India

Correspondence

Lakshmikantha G

Associate professor, Department of obstetrics and gynecology, Mysore medical college and research institute, Mysuru, Karnataka, India

Electronic fetal monitoring at onset of labor to predict obstetric and neonatal outcome

Lakshmikantha G and Sangeetha C

Abstract

Objective: to determine that electronic fetal monitoring (EFM) can be used as a screening test to predict obstetric and neonatal outcome.

Methods: It's a prospective study conducted on 400 pregnant women at onset of labor by electronic fetal monitoring to assess obstetric and neonatal outcome.

Results: Incidence of normal traces was 69%, suspicious 24% and pathological traces was 7%. Out of 400 cases 318(80%) had vaginal delivery, 56(14%) had LSCS and 26(6%) had instrumental delivery. There was increased incidence of operative delivery and NICU admissions in suspicious and pathological tracings. This study has 76% sensitivity, 77% specificity, 96% positive predictive value and 33% negative predictive value for a normal test.

Conclusion: Electronic fetal monitoring (EFM) at the onset of labor is an effective predictive technique to predict fetal outcome and plan an early intervention to prevent adverse perinatal outcome.

Keywords: Electronic fetal monitoring (EFM), Labor, Apgar Score, cord blood pH

Introduction

Onset of labor induces stress to fetuses leading to fetal heart decelerations in already hypoxic fetus. Hence every fetus deserves intrapartum monitoring^[1]. Electronic monitoring of fetal heart rate as a routine is becoming an established clinical practice. It is widely used in all laboring women both high risk and low risk and is considered a reliable and valid technology to measure fetal heart rate^[2]. A short recording of fetal heart rate and uterine contraction pattern during intrapartum period for 20-40 minutes at onset of labor could be used as a screening test to detect preexisting fetal hypoxia and plan early intervention to prevent adverse perinatal outcome. This study evaluates the role of electronic fetal monitoring at onset of labor to predict fetuses at risk for adverse outcome in both high risk and low risk cases.

Methods

The study period was between September 2012 and June 2013. It was a prospective study on 400 pregnant women who admitted to labor room. Pregnancy with fetal anomalies and preterm labor were excluded from this study. Electronic fetal tracings were grouped as normal, suspicious and pathological. Normal test includes baseline FHR of 110-160beats per minute, variability of 5-25 beats per minute in the absence of decelerations, presence of two accelerations of 15 beats per minute over the baseline lasting for 15 seconds. Suspicious test includes baseline FHR of <110 and >160 beats per minute, transient variability of < 5 beats per minute, absence of acceleration for > 40 minutes with transient deceleration. Pathological test includes base line FHR of <90 beats per minute and > 180 beats per minute, persistent variability of < 5 beats per minute, absence of acceleration, presence of persistent decelerations. If the test was normal intermittent auscultation was advised, if it was suspicious continuous electronic monitoring was advised and if the test was pathological immediate delivery was advised. Mode of delivery, Apgar score, NICU admission and cord pH were evaluated.

Results

Four hundred pregnant women who fulfilled the inclusion criteria were analyzed. Table 1 shows the type of electronic fetal monitoring with respect to risk of pregnancy. If the electronic fetal monitoring test to delivery interval exceeded 5 hours there was two fold increase in operative delivery. Indication for forceps after normal test was fetal distress in 4 cases and it was applied prophylactically for maternal cardiac disease in two cases. Indication for LSCS after normal test,

Cervical dystocia in two cases, prolonged PROM in four cases and CPD in two cases. was fetal distress in 8 cases, prolonged labor in 4 cases In suspicious test out of 96 cases 22(23%) taken up for LSCS and 2 cases (2%) delivered by ventouse application. LSCS was done for 14 cases (15%) due to fetal distress, 4 cases for obstructed labor and 4 cases for prolonged PROM. There were 8 (8%) cases of forceps delivery of which two had fetal distress. In pathological test out of 28 cases (7%) 4 cases were delivered normally, 6 cases delivered by forceps application and 4 cases delivered by ventouse where there was fetal distress in 2 and outlet contraction in the other two. Out of 14 cases delivered by LSCS fetal distress was the indication in 10 cases, CPD in 2 cases and prolonged PROM in the other two cases. Umbilical cord pH was evaluated for all cases and acidotic babies were detected (table 3). In 278 (95%) cases APGAR score was found normal i.e > 7 at 1 and 5 minutes. All 22 neonates (5%) with low APGAR were admitted to NICU. Six neonates died due to meconium aspiration syndrome and 4 died due to septicemia secondary to chorioamnionitis.

Discussion

Electronic fetal monitoring has been a subject of controversy for the last three decades. Several authors have criticized the policy of electronic fetal monitoring stating that it will lead to an increase in intervention rates with no evidence of fetal benefits [2]. Electronic fetal monitoring can be used to detect fetal intrauterine asphyxia already present [3, 4]. This would help in identifying population of women who would require continuous electronic fetal monitoring or intermittent auscultation. Antepartum risk factors are not accurate as predictors of fetal outcome as heart changes and fetal acidosis might occur with some frequency in both low risk as well as high risk cases. Four hundred pregnant women included in the present study were from both low risk and high risk pregnant women in labor. 40% the cases were from high risk group and 60% were from low risk group. In kamal Buckshee study 32% were in high risk and 68% were in low risk [5]. Both high and low risk cases were included in the Rose Jophy *et al* study [6]. In Ingermarson study only low risk cases were selected [7]. In the present study high risk factors are PIH, PROM, eclampsia, severe anemia and bad obstetric history. Observation in the present study shows that only 8 cases(2.8%) underwent LSCS for fetal distress in the normal test group. In pathological test group 24 cases(19.4%) had LSCS for fetal distress during labor. In cases of normal test out of 276 cases 250(90.5%) had vaginal delivery, 20(7.3%) had LSCS and only 6(2.2%) had forceps delivery. Out of 6 cases that had forceps delivery two were cardiac cases where prophylactic forceps was used an in 4 cases (2.7%) for fetal distress. It is in comparison to Rose Jophy *et al* study where in out of 136 normal test patients 5(3.7%) had forceps delivery for fetal distress. Twenty women underwent LSCS but only 8(2.8%) were for fetal distress in comparison to Rose Jophy study in which 3(2.2%) underwent LSCS for fetal distress in the normal test group. APGAR score less than 7 was seen in 2 cases (0.7%) as compared to Kamal Buckshee study where 3 cases (3.5%) had APGAR less than 7. In Rose Jophy *et al* study APGAR score less than 7 was not seen in normal test group. Fetal heart rate abnormalities like bradycardia were seen in 12 cases (4.3%). In Rose Jophy study fetal distress was observed in 9 cases (6.6%) which was correlating with the present study. Normal cord pH was seen in 218 (79%) and acidosis was seen in 58(21%) neonates after a normal test and admitted to NICU. Normal

tracing early in labor does not give us total assurance that abnormalities will not occur late in labor. When the test was normal and the delivery interval has prolonged for more than 5 hours the incidence of fetal distress is doubled leading to more operative deliveries as compared to interval less than 5 hours. It shows that electronic fetal monitoring in labor is not significant in predicting outcome if delivery exceeds more than 5 hours.

Suspicious test was seen in 96(24%) cases, 64 cases had vaginal delivery (66%), 22 cases were taken up for LSCS (22.9%). Vacuum was applied in 2 cases (3.25%) for fetal distress. Out of 22 LSCS cases, 14 cases (29%) were indicated for fetal distress. Four LSCS cases were done for prolonged labor and 4 for prolonged PROM. These observations were compared to Rose Jophy study wherein 8 cases (14%) underwent LSCS for fetal distress, in Ingermarson study 5 cases (10%) were taken for LSCS and in Kamal Buckshee study 3 cases (8%) were taken for LSCS for fetal distress. Instrumental delivery for fetal distress was accountable for 8.4% in the suspicious group. Fetal heart abnormalities were seen in 22 cases (23%) of which fetal tachycardia was seen more often than bradycardia. Meconium stained liquor was seen in 26 cases (27.1%) in comparison to Kamal Buckshee study where one case had meconium stained liquor (9%). APGAR score less than 7 was seen in 4 cases (6.4%) and were admitted to NICU. In Kamal Buckshee study, no baby was seen with APGAR less than 7. Cord pH was seen in 44 cases (45.8%) where as acidosis was seen in 52 cases (54%) and were admitted to NICU.

A pathological test was seen in 28 cases (7%) in which 4 cases (14%) were delivered vaginally 10 cases (35%) by instrumental (6 forceps, 4 vacuum) and 14 cases (50%) were taken for LSCS. Out of 14 cases, LSCS was done for 10 cases (35%). In comparison to Kamal Buckshee study LSCS was done in 2 cases (50%) for fetal distress. In Rose Jophy study, LSCS was done for 2 cases in pathological group accounting for 33.33%. In Ingermarson study 2 cases (20%) were taken for LSCS for fetal distress. Fetal heart rate abnormalities such as bradycardia were seen in cases among which 18 were admitted to NICU for birth asphyxia, meconium aspiration syndrome and also low birth weight. This will account to 64.2% of all pathological cases. In Rose Jophy study, 4 cases had fetal abnormalities accounting to 66.6%. APGAR score less than 7 were seen in 16 cases (57%). This was to compare to Rose Jophy *et al* study in which 3 neonates had low APGAR score in pathological group accounting to 50%. In kamal Buckshee study, APGAR less than 7 was seen in 1 case (25%). In present study 2 mothers had jaundice and babies were deeply asphyxiated and could not be resuscitated. Two mothers with chorioamnionitis were delivered by LSCS but the babies had meconium aspiration syndrome and died due to septicemia. The other 2 patients had viral fever for 4 days before delivery and thick meconium stained liquor was noted. Babies died due to septicemia. Perinatal mortality was 28% in the pathological group in the present study. Thick meconium stained liquor was seen in 16 cases (57.1%). Meconium stained liquor was seen in 1 case (16.7%) in Rose Jophy study. In Kamal Buckshee study, there were no cases detected with meconium stained liquor. Thin meconium was seen in 6.8% of all cases in Ingermarson *et al* study whereas thick meconium was observed in 2.8% cases. In the present study, thin meconium stained liquor was seen in 10 cases comprising 35.7 %. Normal cord pH was seen in 10 cases (36%). Acidosis was either mild or severe form was observed in 18 cases (64%) and 8 infants died in the NICU.

Table 1: EFM at onset of labor v/s risk group

Type of CTG	Number	High risk	Low risk
Normal	276	90(53.1%)	190(79.8%)
Suspicious	96	58(35.8%)	38(15.9%)
Pathological	28	18(11.1%)	5(4.2%)
Total	400	162	238

P value < 0.01

Table 2: EFM at onset of labor v/s mode of delivery.

Type of EFM (out of 400 cases)	Mode of delivery			
	Vaginal	forceps	ventouse	LSCS
Normal (276)	250 (90.5%)	6 (2.2%)	0	20 (7.2%)
Suspicious (96)	64 (66.6%)	8 (8.3%)	1 (2.1%)	22 (22.9%)
Pathological (28)	4 (14.3%)	6 (21.4%)	4(14.3%)	14 (50%)
Total	318(79.5%)	20 (5%)	6 (1.5%)	56 (14%)

Table 3: EFM at onset of labor v/s cord pH.

Type of EFM	Number	Normal cord pH	Acidosis
normal	276	218 (78.9%)	58 (21%)
Suspicious	96	44 (45.8%)	52 (54.1%)
Pathological	28	10 (35.8%)	18 (64.2%)
Total	400	274 (68.5%)	126 (31.5%)

P value < 0.01

Table 4: Acute fetal distress following EFM

Type of EFM	Rose Jophy <i>et al</i>		Present study		Ingermarson <i>et al</i>	
Normal	136	68%	279	69%	982	94.3%
Fetal distress (FD) +ve	9	6.6%	12	4.3%	32	1.3%
	127	93.3%	264	95.7%	950	98.7%
Suspicious	58	29%	96	24%	49	4.7%
FD +ve	16	27.6%	22	22.9%	5	10.2%
	42	72.4%	74	77.1%	44	89.8%
Pathological	6	15.5%	28	7%	10	1%
FD +ve	4	66.6%	18	64.3%	4	40%
	2	33.3%	10	35.7%	6	60%

Table 5: Overall efficacy of EFM

Study	Sensitivity	Specificity	PPV	NPV
Kamal Buckshee <i>et al</i> (5)	87.5%	27.7%	84.7%	33.3%
Ingermarson <i>et al</i> (7)	95.48%	31.1%	96.8 %	23.7%
Rose Jophy <i>et al</i> (6)	30.9%	98.45%	93.4%	66.6%
Present study	75.8%	76.9%	95.6%	32.25%

Conclusion

Electronic fetal monitoring (EFM) at the onset of labor is a simple economic tool and easy to perform. EFM at admission has a good predictive value for fetal well-being for next few hours of labor. It is a valuable screening test to identify the fetuses at risk for non-reassuring fetal status. It is found that EFM at the onset of labor can be used as a screening procedure to detect preexisting fetal hypoxia and plan early intervention to prevent adverse perinatal outcomes.

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