

## COMPARISON OF PATHOLOGICAL VERSUS SUSPICIOUS CARDIOTOCOGRAPHY IN PREDICTING FETAL DISTRESS IN TERMS OF APGAR SCORE AND UMBILICAL CORD PH AT ONE MINUTE ON CAESAREAN SECTION.

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### ABSTRACT

**Background:** Cardiotocography (CTG) has been used widely in recent decade to reduce intra-partum fetal mortality. Pathological CTG is more accurate in predicting fetal distress in term of APGAR score and umbilical cord blood PH.

**Objective:** To determine difference in fetal out come in terms of APGAR score and cord pH at one minute in pathological compare to suspicious CTG.

**Methods:** This comparative analytical study was carried out at as Obstetrics and Gynecology Department, Lahore General Hospital, Lahore in duration of six months after approval of ethical committee. We included 454 antenatal patients in our research which were divided in two groups: group-A (Pathological trace) and group-B (Suspicious trace) i.e. 227 in each group. All infants were observed for neonatal outcome as were admitted in neonatal ICU and APGAR score < 7 and umbilical cord pH at one minute.

**Results:** The mean age of all participating pregnant females was  $28.86 \pm 6.56$  years while the mean age in group-A (Pathological trace) and group-B (Suspicious trace) was  $29.34 \pm 6.56$  years and  $28.38 \pm 6.54$  years, respectively, with insignificant *p*-value of 0.119 (i.e > 0.05). In groups A and B, the proportion of babies with an APGAR score of less than 7 was 80.6 % and 5.7 %, respectively, *p*-value <0.001. The NICU admission rate in group-A (77.1%) was higher than in group-B (9.3%), *p*-value < 0.001 and umbilical cord pH at one minute after delivery was 89.4% in group A, 15% in group B and *P* value < 0.001.

**Conclusion:** When compared to suspicious CTG, pathologically trace showed a higher rate of APGAR score less than 7, fetal distress, and admission to neonatal ICU. Moreover, pathological CTG trace has higher predictive accuracy for neonatal outcome such as fetal distress, APGAR score < 7 and admission to NICU and umbilical cord blood pH.

**Keywords:** Intrapartum CTG, Suboptimal CTG, Fetal acidosis, APGAR score, Pathological CTG, Suspicious CTG.

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### INTRODUCTION

Increasing caesarean section rate is a serious issue in the present era. One of the key factors to the high caesarean section rate is suboptimal CTG, which accounts for 10 to 25 percent of all cases. Even more concerning is the fact that over 63 percent of them are based on non-reassuring/suspicious CTG, with roughly 30 percent of them being unneeded.<sup>1</sup> According to recent WHO guidelines, the cesarean section rate shouldn't be greater than 15% at population level.<sup>5</sup>The most commonly

utilized intrapartum fetal assessment tools are auscultation of fetal heart rate (FHR) intermittently, electronic fetal monitoring such as CTG, fetal scalp blood sampling.<sup>2</sup> Despite its widespread use, CTG has not proven to be an ideal monitoring tool. The purpose of CTG recording is to identify when there is concern about fetal wellbeing to allow interventions to be carried out before the fetus is harmed. The focus is on identifying fetal heart rate pattern associations with inadequate oxygen supply to the fetus. A normal CTG indicates good fetal cardiac activity but a poor CTG does not always indicate fetal distress. Moreover, there is not enough data to show whether it is absolutely justified as sometime the fetus turns out to be normal without any signs of distress at delivery. There is a need to evaluate the diagnosis of fetal distress made solely on CTG to avoid such unnecessary interventions.<sup>3</sup> A reactive CTG predicts normal acid and base status in 98% infants but a non-reactive CTG has a low positive predictive value in term of fetal pH <7.25.(Dellinger et al., 2000)Even though the pathological CTG patterns had only 50-65% accuracy for low APGAR score and fetal acidosis at birth.<sup>4</sup> The variance in CTG pattern and fetal outcome can be attributed to intra-observer and inter-observer bias and lack of agreement on nomenclature and descriptions for explanation of fetal heart rate. Thus, fetal cord blood pH is a gold standard method for fetal distress assessment. The low umbilical cord pH has a better correlation with HIE and is considered as a better investigation for assessing fetal compromise.<sup>1</sup> The objective of this study is to determine difference in fetal out come in terms of APGAR score and cord pH at one minute in pathological compare to suspicious CTG.

**METHODS**

This is comparative analytical study. This study was carried out at the Obstetrics and Gynecology Unit-1, Lahore General Hospital, Lahore. The study was completed in 6 months (1-1—2020 t0 30-06-20) after approval from ethical committee. A total of 454 (227 cases) in each group was included in this research. The sample size is calculated using neonatal admission needed as 26.09% in  $ph \leq 7.20$  and no admission needed in NICU as 17.39% in  $ph \leq 7.20$ . We used 80% power of study, 95% confidence level and 5% margin of error. All pregnant women, aged 18-40, from 37 to 42 weeks gestation included in this study. All pregnant women with medical condition like diabetes, hypertension, IUGR excluded. Data were recorded in SPSS version22. Qualitative data like neonatal admissions in NICU and APGAR score < 7 were presented as frequency & percentage chi square test was applied in both study groups. Quantitative statistics

like; age, parity, gestational age was presented as mean ± standard deviation. Chi square was applied to compare APGAR score. P value <0.05 was significant.

**RESULTS**

The mean age of all participating pregnant females was  $28.86 \pm 6.56$  years while the mean age in group-A (Pathological trace) and group-B (Suspicious trace) was  $29.34 \pm 6.56$  years and  $28.38 \pm 6.54$  years, respectively, with insignificant *p*-value of 0.119 (i.e > 0.05). In group-A there were 183(80.6%) neonates who had APGAR score < 7 and 44(19.4%) neonates who had APGAR score ≥ 7 while in group-B there were 13(5.7%) neonates who had APGAR score < 7 and 214(94.3%) neonates who had ≥ 7 APGAR score. The percentage of APGAR score < 7 was higher in group-A (80.6%) as compared to group-B (5.7%), *p*-value < 0.001. The sensitivity, specificity, PPV, NPV and overall diagnostic accuracy of Pathological trace for APGAR score < 7 was 93.37%, 82.95%, 80.62%, 94.27% and 87.44% respectively. (Table I).

The percentage of fetal acidosis was statistically higher in group-A (89.4%) as compared to group-B (15.0%), *p*-value < 0.001. The sensitivity, specificity, PPV, NPV and overall diagnostic accuracy of Pathological trace for fetal acidosis was 85.65%, 88.94%, 89.43%, 85.02% and 87.22% respectively. (Table II). In group-A,175(77.1%) neonates needed NICU admission and in group-B there were 21(9.3%) neonates who needed NICU admission. The percentage of NICU admission was statistically higher in group-A (77.1%) as compared to group-B (9.3%), *p*-value < 0.001. The sensitivity, specificity, PPV, NPV and overall diagnostic accuracy of Pathological trace for NICU admission was 89.29%, 79.84%, 77.09%, 90.75% and 83.92% respectively. (Table III)

Table-1: Comparison of mean APGAR score in both groups.

		APGAR score		Total	P Value
		<7	≥ 7		
<b>Study Group-A</b>		183(80.6%)	44(19.4%)	227(100%)	0.001
<b>Group B</b>		13(5.7%)	214(94.3%)	227(100%)	
<b>Total</b>		196(43.2%)	258(56.8%)	454(100%)	

Group-A: Pathological trace, Group-B: suspicious trace  
 Chi-square = 259.46, *p*-value = <0.001(Highly Significant)  
 Sensitivity = 93.37% (88.98, 96.08)  
 Specificity = 82.95% (77.88, 87.04)  
 Positive Predictive Value = 80.62% (74.98, 85.23)  
 Negative Predictive Value = 94.27% (90.45, 96.62)  
 Diagnostic Accuracy = 87.44% (84.08, 90.18)

Table-2: Comparison of fetal outcome in both study groups

		Fetal acidosis		Total
		Yes	No	
<b>Groups</b>	<i>Group-A</i>	203(89.4%)	24(10.6%)	227 (100%)
	<i>Group-B</i>	34(15%)	193(85%)	227 (100%)
<b>Total</b>		237(52.2%)	217(47.8%)	454 (100%)

Group-A: Pathological trace, Group-B: suspicious trace  
 Chi-square = 252.1, p-value <0.0001 (highly significant)  
 Sensitivity 85.65% (80.62, 89.55)  
 Specificity 88.94% (84.07, 92.45)  
 Positive Predictive Value 89.43% (84.75, 92.79)  
 Negative Predictive Value 85.02% (79.8, 89.08)  
 Diagnostic Accuracy 87.22% (83.84, 89.99)

Table-3: Comparison of fetal outcome in both study groups

		NICU admission		Total
		Yes	No	
<b>Groups</b>	<i>Group-A</i>	175(77.1%)	52(22.9%)	227 (100%)
	<i>Group-B</i>	21(9.3%)	206(90.7%)	227 (100%)
<b>Total</b>		196(43.2%)	258(56.8%)	454 (100%)

Group-A: Pathological trace, Group-B: suspicious trace  
 Chi-square = 212.9, p-value <0.0001 (highly significant)  
 Sensitivity = 89.29% (84.18, 92.88)  
 Specificity = 79.84% (74.53, 84.29)  
 Positive Predictive Value = 77.09% (71.2, 82.08)  
 Negative Predictive Value = 90.75% (86.27, 93.87)  
 Diagnostic Accuracy = 83.92% (80.26, 87.01)

## DISCUSSION

In current study the percentage of APGAR score less than 7 was higher in group-A (80.6%) as compared to group-B (5.7%), p-value < 0.001. The percentage of fetal acidosis was statistically higher in group-A (89.4%) as compared to group-B (15.0%), p-value < 0.001. The percentage of NICU admission in group-A (77.1%) was statistically higher as compared to group-B (9.3%), p-value < 0.001. Similar to our study results, study was done at the Lady Reading Hospital in Peshawar, Pakistan from January to July 2019, to determine the relationship between immediate postpartum umbilical cord pH, fetal compromise, and outcome. There were 27 full-term pregnant women with abnormal CTG. The age distribution was 48.14 percent for those aged 20 to 25, 40.74 percent for those aged 26 to 30, and 11.11 percent for those aged 31 to 35. CTG abnormalities included severe bradycardia, late decelerations, and persistent varied 46 decelerations without baseline variability. In 77 percent and 22 percent of cases, the child's birth weight was less than 3.5 kg and more than 3.5 kg, respectively. At birth, 74.07 percent of the neonates had acidosis (pH 7.2), and one had severe hypoxemia (pH 6.85). The cord pH had a substantial association with the APGAR score

at 0 minutes (r=0.818, p=0.001) and five minutes (r= 773, p=0.001). NICU admissions were made for 18 neonates with a pH of less than 7.2 and two newborns with a pH of more than 7.2 (p-value= 0.005). Low umbilical cord pH values in caesarean newborns are associated with a low APGAR score and NICU admission<sup>7</sup>.

Another observational study on 'Predictive Accuracy of intrapartum CTG in Terms of Fetal Acid Base Status at Birth' was conducted in 2004 at MCH Center, Pakistan Institute of Medical Sciences, Islamabad. All CTG tracings were reviewed using FIGO guidelines and compared for fetal arterial blood gas indices. 57 patients who underwent cesarean section due to suboptimal CTG, 51 (89%) had suspicious trace while 6 (11%) had pathological trace. Positive predictive value of CTG was 18% for fetal hypoxia, 48 21% for fetal hypercarbia, 26% for fetal acidosis and 37% for base excess. Predictive value of suspicious trace for similar blood indices was 13%, 13%, 17% and 35% respectively. For pathological trace, predictive value was 50%, 83 %, 100% and 66% and respectively. Based on the results, it was concluded, that the suspicious CTG trace has low predictive value in terms of fetal acid base status at birth and needs to be complemented with other diagnostic modalities before undertaking any operative intervention. Pathological CTG on the other hand is highly predictive of fetal acidosis at birth warranting immediate intervention<sup>1</sup>.

Another study with similar results was carried out in Father Muller Medical Hospital in India. In study, among 255 women ,54.9% had suspicious CTG and 45.1% had pathological CTG. Subjects with pathological CTG had more babies with low APGAR score compared with suspicious CTG (62.6% VS 26.4%).55% of babies with pH <7.2 needed NICU admissions compared to 12% with normal pH.<sup>8</sup>

Another study with similar results was carried out at Mahatma Gandhi Institute of Medical Sciences Hospital in India in 2015.Of total 30 cases ,2 (6.6%) women had severe bradycardia 13 women (43.3%) decelerations both late and persistent and 5 cases (16%) had meconium-stained liquor Total of 30 women ,3 (10%) had normal vaginal delivery and 26 (86.6%) underwent cesarean section of all babies ,10 (33%) had acidosis pH<7.2 and rest 20 (66%) had pH ranges 7.20-7.40.<sup>9</sup>

Contrary to our results, another study was done on 165 pregnant women in Max Smart Super specialty Hospital in New Delhi, India, The number of acidotic cases (Ph<7.20) was 2 (5.6%) in normal traces of CTG whereas 34 cases (94.4%) cases of normal traces were non acidotic. In the suspicious CTG ,2 (3.2%) were acidotic and 59 cases (96%) were non acidotic. In pathological CTG ,13 cases(19%) were acidotic and 55 cases (80.9%)were non acidotic.There was no significant

association of CTG category with cord blood pH and fetal acidosis but the presence of meconium stained liquor was statistically significant association with umbilical cord pH and fetal acidosis.<sup>10</sup>

## CONCLUSION

It is concluded that APGAR score < 7 in pathological CTG was low 80.6% caese while in suspicious CTG it was 44%. The percentage fetal acidosis was 89.4% in group A and group B it was 15%. and admission to neonatal ICU was higher in pathological trace 77% when compared with suspicious CTG trace 9.13%. Moreover pathological CTG has higher predictive accuracy for neonatal outcome such as fetal distress, APGAR score < 7 and admission to NICU.

**Ethical Approval:** Submitted

**Conflict of Interest:** Authors declare no conflict of interest.

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