



## RELATIONSHIP BETWEEN FOETAL DISTRESS AND UMBILICAL CORD BLOOD GAS ANALYSIS

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**ABSTRACT**

**Introduction:** Birth asphyxia is one of the leading causes of perinatal mortality and morbidity in India leading to both developmental and neurological complications in term and preterm infants [1]. The umbilical cord blood gas analysis (UCBGA) in newborns has been considered as a definitive factor for fetal evaluation. Umbilical cord blood gas analysis is now carried out on all deliveries to obtain an objective indicator of neonatal status regardless of whether the fetus has been exposed to perinatal hypoxia or not [6]. **Objectives:** The aim of the study was to assess the association of foetal distress with umbilical cord blood gas parameters and if positive, validate its diagnosis retrospectively. Furthermore, to elicit the need of making UCBG analysis a routine practice at tertiary centres, in order to rule out foetal hypoxia as a cause of cerebral palsy and other related disorders, the child develops in later life. **Methods:** It was a cross sectional study done in 131 Antenatal term mothers who attended the Labour room of Obstetrics and Gynaecology department in Dr. SMCSI medical college. All patients presenting in emergency room/labour room with features of foetal distress confirmed clinically using NST/CTG/ARM were included in the study. Neonates born to the included mothers were assessed for the functional outcome with the Apgar score and UCBG analysis. **Result:** Out of 131 cases, 74 cases (56.5%) had an abnormal CTG, 38 cases (29%) had meconium stained liquor and 19 cases (14.5%) had a non-reactive NST. Of all delivered babies, 24 babies had metabolic acidosis (16.8%). Of these, 14 (58.3%) required NICU admission. Rest 10 (41.66%) born healthy, was brought to mother side. Only 3 babies had low APGAR score after 5 minutes and remained hypoxic, which was statistically insignificant. **Conclusion:** It is recognised from this study that there is no exclusive method among these three (abnormal CTG, non reactive NST and meconium stained amniotic fluid) with absolute sensitivity and specificity which can determine perinatal hypoxia. It was also found that majority of caesarean sections which were done for fetal distress, did not show neonatal acidosis.

**KEYWORDS :** Perinatal asphyxia; foetal distress; umbilical cord blood gases**INTRODUCTION**

Birth asphyxia refers to a condition during labour in which there is impaired fetal oxygenation leading to fetal hypoxemia and acidosis [3]. Fetal distress during intrapartum period is predicted by meconium in amniotic fluid and abnormal patterns of fetal heart monitoring in CTG. Decreasing fetal distress and its consequences, is a compelling goal in obstetrics.

The umbilical cord blood gas analysis in newborns has been considered as a definitive factor for fetal evaluation. Normal range of umbilical cord pH is  $7.40 \pm 0.20$ . Studies showed that low pH is significantly associated with the probability of seizures, intubations, NICU admissions and long-term adverse consequences [4]. Metabolic acidosis in umbilical cord arterial blood at birth is indicated by  $\text{pH} < 7.0$  and base deficit (BD)  $\geq 12.0$  mmol/L [1].

**METHODOLOGY****Study Design:** Cross Sectional Study**Study Setting:** Department of Obstetrics and Gynaecology, Dr. SMCSI medical college, Karakonam.**Study Population:**

A sample size of 131 Antenatal term mothers who attended the Labour room of OBG department in Dr. SMCSI medical college, satisfied any one of the inclusion criteria and gave written informed consent, and their newborns.

**Study Sample:**

Blood sample collected from the umbilical cord immediate postpartum.

**Inclusion Criteria:**

All term ( $\geq 37$  weeks' gestation), singleton, live born infants with no major anomalies, who showed any one of the below mentioned, in utero:

1. Suspicious/Pathological CTG
2. Indeterminate/abnormal NST
3. Meconium stained liquor

**Exclusion Criteria:**

1. Inadequate sample

2. Error during transportation of the sample
3. Error during collection of the sample

**Study Variables:****During Labour:** NST, CTG, Meconium stained amniotic fluid

**Post Labour:** Apgar score, Umbilical cord blood gas parameters, Newborn cried or not, if not: usage of tactile/ bag & mask/ Resuscitation, days of NICU admission. Newborn is assessed Immediately after birth, an approximate 10-cm segment of cord was isolated between a set of two clamps. 1 mL blood was sampled into a preheparinized syringe by needle aspiration; excluding all air bubbles and capping the syringe. Blood from both artery and vein were sampled and analysed, so that arterial blood results can be validated as truly arterial. In view of that, separate colour coded labels were assigned to the arterial (red) and venous (blue) syringes. The syringes were placed in an ice pack and taken to the laboratory within 30mins of collection. ABG calculated using Radiometer's ABL-80 FLEX.

**RESULTS**

Out of the 131 women who participated in the study, the mean age of the study sample was  $25.87 \pm 3.3$  years. The major findings of the study are as follows: 86 (65.6%) women were nulliparas followed by 40 primiparas (30.5%). Only 3.8% formed the multipara involved; possibly indicating the rate of foetal distress is more in nulli and primiparas.

Majority of the mothers had no maternal risk factors (73.3%), but 17 women out of the total, were suffering from gestational hypertension, among which one baby had metabolic acidosis. There wasn't any notable foetal risk factor other than reduced liquor complicating 10.7% of the pregnancies followed by 4 babies diagnosed IUGR prenatally (3.1%). 83 women had their labour induced using Foleys or Misoprostol or both, signifying that induction of labour increases the chances of clinical foetal distress. Only 12 cases of PROM were included in the study of which 4 cases showed metabolic acidosis.

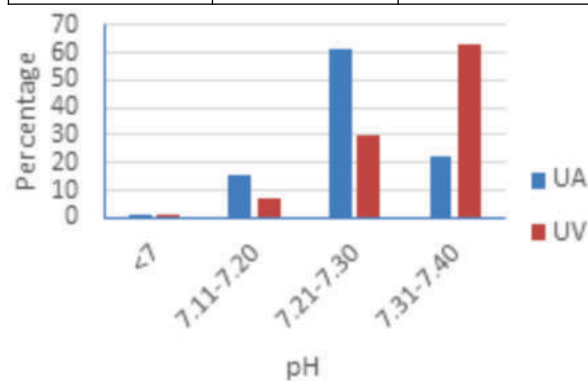
Nearly half of the cases (55.7%) with foetal distress underwent Emergency LSCS (48.9% had MSAF and 29.3% had foetal distress in labour), followed by 16% vacuum assisted delivery. There were 3 cases of face to pubis delivery with all 3 showing signs of birth

asphyxia upon delivery. Most of the babies were born in the range of 2.5 to 3.5 kg (75.6%) with 16 (12%) babies more than 3.5 kg undergoing distress; 2 of which showed metabolic acidosis and was admitted in NICU. 36 babies' required tactile stimulation while no babies required bag and mask ventilation or intubation. Out of the total 78 babies requiring NICU admission, 12 (15.3%) had metabolic acidosis. Only 3 babies had low APGAR score after 5 minutes and remained hypoxic. The difference in the proportion of Apgar score at 5 min across fetal distress was statistically significant (P value 0.031) but was not significant at 1 min. Majority (81.6%) of babies with MSAF cried at birth while 18.4% required tactile stimulation. In 71% (n=27) of them required NICU admission in which 10 babies had low APGAR score. The pH value of 7.28±0.05 was obtained from cases with MSAF (p value of 0.211). Out of the 19(14.5%) non-reactive NST cases, 7 required tactile stimulation. Out of 7 babies requiring NICU admission, 2 babies had low APGAR after 5<sup>th</sup> minute. The pH of 7.26 ±0.06 was obtained from cases of non -reactive NST (p value of 0.211).

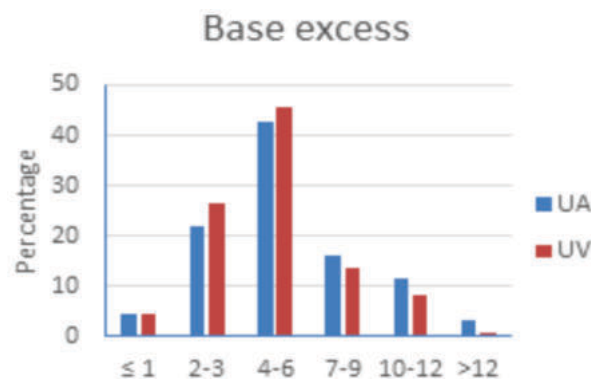
There were 74 cases of foetal distress from abnormal CTG. Among the 74 cases, 5 babies who had pathological CTG had pH <7.2 and 10 babies who had suspicious CTG had a pH<7.2 No babies had pH <7. Pvalue is not statistically significant (0.058). In the present study there was no statistically significant difference across Fetal distress in umbilical cord blood gas components parameters like (UA pH, UA pO<sub>2</sub>, UA pCO<sub>2</sub>, UA HCO<sub>3</sub>, UV pO<sub>2</sub>, UV pCO<sub>2</sub> and UV HCO<sub>3</sub>) P value (>0.05). Even though 109 babies had pH more than 7.2 ,65 babies among 109 still needed NICU admission because they showed signs of asphyxia upon delivery; inferring that the normal value or range of pH (7.2 cut off for this particular study) should be still kept for discussion. It was also found that majority of cesarean sections (55.72%) which were done for fetal distress, did not have an association with their corresponding blood gas values as majority of babies (83.56%) after delivery had cord blood pH within normal range (7.30±0.20).

**Table 1: Percentage Distribution Of Foetal Distress**

Fetal distress	Frequency	Percent
MSAF	38	29
NST	19	14.5
CTG	74	56.5
Total	131	100



**Fig: 1.** Percentage Distribution Of Ph Of Umbilical Artery And Vein



**Fig:2.** Percentage Distribution Of Base Excess Of Umbilical Artery And Vein

**DISCUSSION**

Mean Age of the study group was 25yrs, among most of women were nulliparas possibly indicating the rate of foetal distress is more in nulli and primiparas in conjunction with studies by Thorp JA et al 1989. A recent study by Genc, S et al(5) studied the association of parity and foetal distress. They found significant foetal distress in women aged over 40yrs and primiparous similar to the present study findings. Majority of the mothers had no maternal risk factors (73.3%), but 17 women out of the total, was suffering from gestational hypertension although anemia stood out as the prominent maternal risk factor. But since all cases of anemia was corrected, it is an incoherent determinant. There was one case of a mother with gestational hypertension and IUGR who delivered a live female baby with metabolic acidosis (pH 7.07). In comparison to the present study findings, Ahmadpour-Kacho et al(6), in 96 women found hypertension in 2%, and diabetes in one percent of the study population. There wasn't any notable foetal risk factor other than reduced liquor complicating 10.7% of the pregnancies followed by 4 babies diagnosed IUGR prenatally (3.1%). During the review it was seen that there were 8 cases of previous LSCS women who came in spontaneous labor whose NST was either abnormal or indeterminate posted for emergency LSCS. ARM was not done pre -operatively in such patients and the colour of the liquor was only examined during the operation; 2 cases of MSAF was noted. A study by Ahmadpour- Kacho et al(6) found abnormal fetal heart rate in 7 %, IUGR in 3%, circular cord in 2%, Chorioamnionitis in 1%, Abnormal AF(amnionic fluid) volume in 4%. In 83 women (63.4%) the labour was induced using Foleys (mechanical method) following 23% (n=18) or Misoprostol tablet kept vaginally (25 mcg) and in 10% (n=8) or both simultaneously 66.7% (n=52); signifying that Induction of labour increases the chances of clinical foetal distress. Gommers et al 2017 (7), suggested that using the Foleys catheter is a safe intervention with the risk of developing a non-reassuring fetal heart rate in 10.8% (793 of 7336 women), 10.1% (507 of 5008 women) showing fetal distress and 14.0% (460 of 3295 women) found meconium stained liquor. Only 12 cases out of 131, came in PROM of which 4 cases showed metabolic acidosis in UCBGA. Leslie J et al in 1984 observed 237 patients, significant for higher incidence of cesarean section due to fetal distress in patients with PROM and that the electronic fetal heart rate patterns in patients with fetal distress revealed 16 of 21 patients (76%) with PROM consistent with umbilical cord compression.

Nearly more than half of the cases (55.7%) with foetal distress underwent Emergency LSCS followed by 16% vacuum assisted delivery. On the other hand, 34 women (26%) underwent normal delivery in spite of clinical diagnosis of foetal distress. There were 3 cases with face to pubis delivery (direct occipito posterior position of foetal head) with prolonged labour and all 3 babies showed signs of birth asphyxia upon delivery. Johnson JWC observed that delivery by cesarean section without labor results in values more closely approximating adult blood gases (higher pH, PO, base excess, and bicarbonate, and lower PCO).

Studying the indication of operative/instrumental deliveries, 48.9% had MSAF as an indication for the procedure done while 29.3% had foetal distress in labour. There were ten cases each of recurrent variable deceleration and non -reassuring NST. In a similar study by Naina Kumar et al, C sections were done for 30 cases, 2 (6.67%) women had fetal bradycardia, 13 (43.34%) abnormal non-stress test, 5 (16.67%) meconium stained liquor and 10 (33.34%) fetal bradycardia/tachycardia with meconium stained liquor.

Most of the babies were born in the range of 2.5 to 3.5 kg (75.6%) with 16 (12%) babies more than 3.5 kg undergoing distress; 2 of which showed metabolic acidosis and was admitted in NICU for further management. 16 babies weighed <2.5kg out of which 10 were small for date/constitutional small babies and 6 were IUGR. IUGR is associated with distress and asphyxia and a 6- to 10-fold increased perinatal mortality as studied by Pollack Raphael in 1992. In 72.5% or 95 babies soon after birth while 36 required tactile stimulation of less than 30 seconds. No babies required bag and mask ventilation or intubation. There was one case of neonatal death for which the cord blood was not taken, and hence excluded from the study. Out of 131 babies born, 78 (59.5%) required NICU admission, rest of them were given to the mother upon good APGAR score. Out of the total, 12 babies admitted in NICU (15.3%) had metabolic acidosis. Low APGAR score was found in 42 babies at 1<sup>st</sup> minute but 39 babies were labelled good after the 5<sup>th</sup> minute. Only 3 babies still had low APGAR

score and remained hypoxic. The difference in NICU admission across the UV pH was found to be insignificant with a P-value of 0.199.

In present study, clinically foetal distress was diagnosed by 3 parameters. Colour of the liquor, NST and CTG finding; following which, if found abnormal, the pregnancy was terminated or labour was cut short by prompt interventions. 74 cases (56.5%) had an abnormal CTG, 38 cases (29%) had MSAF on ARM and 19 cases (14.5%) had a non-reactive NST.

In the present study the incidence of NICU admission was 59.5%. Ahmadpour-Kacho, M et al(6) study found NICU admission in 6.12% especially in high risk mother's group. Gommers, J et al, found NICU admission in 7.2% (650 of 9065 deliveries). The difference in the incidence of NICU admission across the studies may be due to the sample size and sample selection.

Study done at Mahatma Gandhi Institute of Medical Sciences, Maharashtra, India, by Naina kumar et al in 30 term women in 2015 showed that out of 13 women having abnormal NST, only 3 (23.07%) babies had acidosis and required NICU admission. A study performed on 400 pregnant women in Shahid Sadughi and Mojibian Labour Hospital of Yazd, Iran by Mojibian mahdieh et al, had two neonates with pH less than 7.14 (one between 7 to 7.2 and other was more than 7.2) stating that baseline disorders of mothers including hypothyroidism, PIH, Overt DM and GDM had no relation with fetal distress and pH, PCO<sub>2</sub> and Base Deficit of umbilical cord are not a precise predictive factor for fetal distress.

In UCBGA, pH value of 7.2 was taken as the cut off determinant for metabolic acidosis in our hospital. According to which, 22 babies were diagnosed to have metabolic acidosis in NICU (16.8%). In 109 babies had pH more than 7.2 out of which 65 babies still needed NICU admission because they showed signs of asphyxia upon delivery.

The difference in the proportion of Apgar score at 5 min across fetal distress was statistically significant (P value 0.031) but was not significant at 1 min. Ahmadpour-Kacho, M et al found high-risk group's Apgar score at the first and fifth minute lower than the low-risk group's. However, there was no significant difference in Apgar scores between the two groups at the 10th and 15th minute. This study stresses the importance of prenatal risk factors on the immediate general state of newborns upon delivery, as well as the effect of prompt intervention on neonatal condition improvement. Further, in the low risk group, there was no significant association between Apgar score at 1st and 5th minute and umbilical artery pH. Apgar score at first minute and umbilical cord pH act separately. If prompt care and resuscitation are initiated, there will be insufficient time to develop chronic hypoxemia and acidosis. In the high-risk category, however, both the Apgar score and the umbilical cord pH should be used to determine the neonate's true status. Socol and colleagues demonstrated that infants with an Apgar score of less than or equal to 3 at five minutes and a problematic clinical course had lower umbilical cord arterial pH readings and larger base deficit values than their straightforward clinical course counterparts.<sup>91</sup> In the present study there was no statistically significant difference across Fetal distress in umbilical cord blood gas components parameters like (UA pH, UA pO<sub>2</sub>, UA pCO<sub>2</sub>, UA HCO<sub>3</sub>, UV pO<sub>2</sub>, UV pCO<sub>2</sub> and UV HCO<sub>3</sub>) P value (>0.05). There was statistically significant difference across Fetal distress in umbilical cord blood gas components parameters like (UA BE, UV pH and UV BE) P value (<0.05). Victory, R et al(8), showed that the relationship to cord blood values was identical for each of these newborn outcomes, with minimal variation in the data analysis whether utilising pH or BE values, and whether from the umbilical artery or vein.

## CONCLUSION

In the present study, clinical diagnosis of foetal distress was made using three parameters i.e., abnormal CTG, non reactive NST and meconium stained amniotic fluid on ARM. Due to lack of advanced monitoring tools like fetal scalp blood sampling and fetal oximetry in our hospital, to interpret neonatal acid base status, we opted for cord blood gas analysis. The study revealed that none of the parameters have a significant association with fetal acidosis. Hence it is recognised from this study that Umbilical artery cord blood analysis should not be considered as an exclusive method to determine perinatal hypoxia status in our set up with absolute sensitivity and specificity.

It was also found that majority of cesarean sections (55.72%) which were done for fetal distress, did not have an association with their

corresponding blood gas values as majority of babies (83.56%) after delivery had cord blood pH within normal range.

## Ethical Consideration

The study is approved by the institutional human ethical committee

## Funding

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