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Comparative Fetal Cord Blood Analysis In Hypertensive Vs Normotensive Patients With Decreased Fetal Movement In Term Pregnancy

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Abstract

Aim- To evaluate whether there is a significant difference between the cord blood gas parameters of pregnancies complicated with Pregnancy induced hypertension(PIH) and uncomplicated pregnancies in cases of reduced fetal movements and to note perinatal outcome in these two groups.

Methods- This study was designed prospectively. Between April 2021 and September 2022, 40 hypertensive and 40 patients without high risk complaining of reduced fetal movements at term were recruited. Cord blood gas analysis was done in both the groups and its perinatal outcome was noted. Statistical analysis was done by SPSS software with p-value=0.05.

Results- Fetal acidosis, fetal hypercapnia, fetal polycythemia, low birth weight and NICU admission was statistically significant (p<0.5) among hypertensive mothers. But hypoxia, bicarbonate level, APGAR at 1 and 5 mins and neonatal death showed no association.

Conclusion- Reduced fetal movements in many cases is a subjective sign of fetal compromise. Especially in high risk groups like hypertension, it becomes even more necessary to take measures to predict neonatal outcome. Hence, cord blood analysis in high risk groups can act as an important tool to establish Fetal acidosis.

Keywords: cord blood analysis, fetal acidosis, hypertension, reduced fetal movements

Introduction

The uteroplacental unit is affected by capillary damage in hypertensive patients, leading to fetal acidosis and in severe cases as fetal demise. This may reflect as reduced fetal movements. Maternal perception of fetal movements thus plays an important role in antepartum and intrapartum monitoring so it's a common reason for self-referral for assessment by health care professionals. In 5% of patients who reported with reduced fetal activity had 60 times more risk of still birth.[1] Apart from still birth, it's also associated with preterm labour, fetal growth restriction, increased rate of caesarean sections, low APGAR scores and poor neonatal outcomes in terms of high rate of NICU admission, neonatal seizures and neonatal death.[2] The fetal movements can be assessed by daily fetal movement count (DFMC) and Cardiff count to 10 Chart. In DFMC counting is done three times a day, that is, in morning after breakfast, afternoon after lunch and evening after dinner for 1hr. More than 3 foetal movements per hour or more than 10 foetal movements in 12 hours is considered normal.[3] It was previously demonstrated that in some cases a pronounced decrease up to cessation of fetal movements occurred before fetal death in utero while

fetal heart beats were still audible for at least 12 h. Decreased fetal movement has been described in association with decreased amniotic fluid, maternal illicit drug use, maternal smoking, maternal overweight, sedatives, and fetal sleep state.[4]

Chronic fetal hypoxia and/or acidaemia are the most important parameters affecting neonatal outcomes in high-risk pregnancies, like pre- eclampsia.[5] Therefore, prevention and identification of fetal acidemia is the most important goal of antepartum fetal monitoring. Complications in the mother include eclampsia, abruptio-placenta oliguria, anuria, dimness of vision and HELLP syndrome.[6] Common complications in babies born to PIH mothers include intrauterine death (IUD), intrauterine growth retardation (IUGR), perinatal asphyxia, neonatal infections and bleeding complications. It has been reported that these neonates may have some haematological complications which add to the existing morbidity in them. Severe and long term PIH mothers deliver prematurely because of which neonates carry a risk for IUGR development due to decrease in nutrients nourishing the baby.[7]

It has been reported that nucleated red blood cells increase secondary to uteroplacental hypoperfusion in babies of pre- eclamptic mothers.[8] In addition, it was shown that the possibility of thrombocytopenia was higher in newborns of preeclamptic mothers who had hypertension and especially thrombocytopenia, compared to normotensive mothers.[9] Preeclampsia has been reported to be a risk factor for neonatal neutropenia and infections in premature newborns.[10] Therefore, early detection and prophylactic treatment are recommended in newborns at high risk. Newborns of hypertensive mothers have a risk for polycythemic, infectious, and bleeding complications.[11]

Umbilical artery cord blood pH is considered as the most important analysis showing fetal acidemia.[12] Therefore CBG analysis is recommended by the American College of Obstetricians and Gynecologists (ACOG) and the Royal College of Obstetricians and Gynecologists (RCOG) in all high- risk deliveries. [13,14]

Aims And Objectives

To evaluate whether there is a significant difference between the cord blood gas parameters of pregnancies complicated with Pregnancy induced hypertension(PIH) and uncomplicated pregnancies in cases of reduced fetal movements.

To note perinatal outcome in these two groups.

Materials And Methods

1. This was an observational prospective study.
2. Study duration- 18 months (April 2021- September 2022)
3. Place of study- Tertiary care hospital in eastern INDIA

Inclusion criteria (for cases)

➢Complain of reduced fetal movement (<10 movements in 12 hours)

➢Singleton Pregnancy

➢Term pregnancy (37 weeks- 40 weeks)

➢Cephalic Presentation

➢Non-Scarred Uterus

➢Blood pressure ≥140/90 mm of Hg

Inclusion criteria (for control)

➢Complains of reduced fetal movement (<10 movements in 12 hours)

➢Singleton Pregnancy

➢Term pregnancy (37 weeks- 40 weeks)

➢Cephalic Presentation

➢Non-Scarred Uterus

➢Blood pressure <140/90 mm of Hg

Exclusion criteria

➢Not willing to participate

➢Multiple pregnancy

➢Pregnancy with diagnosed fetal anomalies (even post delivery)

➢Preterm labour

➢Non cephalic presentation

➢Previous history of scarred uterus

➢Patient with history of antepartum hemorrhage

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➢Patient with history of premature rupture of membrane, oligohydramnios and meconium-stained liquor

Parameters and procedure

Step 1: Recruitment

An informed consent was taken from all women who participated in the Study. Women who presented with reduced fetal movement (<10 movements in 12 hour when patient is active) at term were explained to lie down in left lateral position and advised to count the fetal movement i.e at least 10 movements in 2 hours. Women who could not perceive adequate fetal movement were advised to visit the maternity unit of our hospital. Once admitted they were explained that an algorithmic approach will be followed for assessment of fetal well-being and pregnancy outcome will be recorded. Once an informed consent was taken, she was included in study. However, for hypertensive mothers they were immediately admitted for further work up.

Step 2: History taking and clinical examination

For each woman who are included in the study detailed history of current pregnancy, past obstetric history and medical history any risk factor in current pregnancy was recorded in case record form. This was followed by general examination, systemic examination and obstetric examination (symphysio-fundal height, liquor assessment). FHS was auscultated with hand held Doppler to exclude IUFD. In case of discrepancy in symphysio fundal height and period of gestation and scanty liquor in both cases and controls, they were subjected for cardiotocography and ultrasonography. Doppler was done if USG was suggestive of IUGR.. Further management was carried out as per RCOG Greentop guideline 57.[15] The normotensive patients with normal CTG and perceiving adequate fetal movement were excluded from the study.

Step 3: Cardiotocography

Cardiotocography was performed within 2 h for at least 20 min and result was interpreted according to NICE 2017/FIGO 2015 Guideline.Women showing pathological CTG, for them decision for delivery was taken accordingly. However, remaining women with suspicious CTG were subjected to next step of investigation.

Step 4: Ultrasonography

All hypertensive patients and clinically IUGR patients normal cardiotocography were subjected to ultrasonography for fetal biometry and fetal biophysical profile. Color Doppler was done if scan suggested IUGR. Ultrasonography was also done in patients with no risk factors but with recurrent reduced fetal movements.

Step 5: Perinatal outcome

Patients who complained of persistent reduced fetal movements in absence of high-risk factors and no evidence of chronic placental insuffiency (Controls) and patients with hypertension and foetus with features of chronic placental insufficiency (Cases) were terminated via caesarean section in order to standardise, mode of delivery. Cord blood was taken and sent for ABG. Perinatal outcome in terms of ABG parameters, birth weight, APGAR at 1 min and 5 min, NICU admission and outcome at discharge were noted.

Technique of collection of cord blood

1. Umbilical arterial blood is preferred than umbilical vein blood as arterial pH and base deficit provides the most accurate information on foetal acid base status.
2. To obtain the foetal blood, 10-20 cm segment of umbilical cord was clamped as soon as after delivery since delay in cord clamping can cause alteration in blood pH and gas.
3. Blood was drawn taken in heparinised 2 ml syringe from umbilical artery and immediately ABG was done.
4. In case, umbilical artery was not accessible then vessels from fetal side of placenta were used.

Statistical analysis was done by SPSS software with p-value being 0.05.

Result And Analysis

Study material consisted of 40 cases with age matched controls. Age of patients ranged from 16 years to 38 years with a mean of 26.5 years and 26.38 years for cases and controls respectively (table 1 and figure 1).

Out of 40 cases, 27 (68%) were multigravida. Similarly out of 40 controls, 11 (27.5%) were multigravida and rest were primigravida (figure 2).

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Normal range for pH was taken as 7.12-7.35. Table 2 and figure 3 shows mean cord blood pH was 7.16 and 7.24 for cases and controls respectively. Cases had 2.63 times (odd's ratio) more risk of fetal acidosis as compared to control. P-value showed significant association as its value was 0.01, which implies fetal acidosis was more pronounced in cases.

Normal range of cord blood pCo2 is 41.9-73.5 mmHg. Table 3 and figure 4 showed mean pCO2 for cases and controls as 67.83mmHg and 59.91 mmHg, respectively. Cases had 3.6 (odd's ratio) times more risk of fetal hypercapnia as compared to cases. Hence, hypercapnia is more in cases and it's statistically significant (p-value=0.04).

Normal range of cord blood pO2 is 6.2-27.6mmHg. Table 4 and figure 5 showed mean pO2 as 15.38 and 17.69mmHg for cases and controls, respectively. Risk of fetal hypoxia was 3.08 (odd's ratio) times more in cases compared to controls, but the difference was not significant. Although, incidence of hypoxia was more in cases than controls but it was not statistically significant.

Normal range of cord blood bicarbonate is 18.8-28.2 mEq/L. Table 5 and figure 6 showed mean cord blood bicarbonate in cases and controls as 21.72 mEq/l and 22.2 MEq/l, respectively. There was no risk of altered bicarbonate levels in cases and controls as odd's ratio was 1 and p-value (0.6) was also not significant.

Normal range of cord blood hemoglobin is 12.14-19.7 gm%. Table 6 and figure 7 showed mean hemoglobin for cases and controls as 18.71 gm% and 16.4 gm%, respectively. Fetal polycythemia was found to be 2 times more in cases than controls. Thus, polycythemia is strongly associated with hypertensive patients with reduced fetal movememts as compared to controls as p-value is 0.0001.

Table 7 and figure 8 showed low birth weight was found to be 3.66 times more in cases than in control and it was statistically significant (p-value= 0.0073). So, we can conclude that low birth is more seen in hypertensive mothers.

Table 8 and figure 9 showed APGAR at 1 min was 1.71 times poor in cases than in control and it was not statistically significant (p-value= 0.3)

Similarly, table 9 and figure 10 showed APGAR at 5 mins, which was only 0.75 times poor in cases than in control and it was not significant (p-value= 0.59).

NICU admission showed a staggering figure of 9.94 times more incidence in cases as compared to controls and it was statistically significant (p value= 0.0002) as per table 10 and figure 11. Hence, it's statistically proven that babies of hypertensive mothers were more compromised and thus required admission.

Neonatal death was found to be 2.05 times more in cases than in control but it was not statistically significant (p-value= 0.56). As per table 11 and chart 12, there were 2 neonatal deaths in cases and 1 in controls, cause of death was HIE (hypoxic ischemic encephalopathy) and neonatal sepsis for each neonatal death in cases and cause of death was HIE for one death reported.

Table 1: Relationship Based On Age

Age	Case	Control
<20yrs	3	1
20-30yrs	30	34
>30yrs	7	5
Total	40	40

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Table 2: Showing distribution based on cord blood pH in cases and controls

pH	Case	Control
<7.12	19	10
7.12-7.35	21	30
Total	40	40

Table 3: Distribution as per cord blood pCO2

pCO2	Case	Control
>73.5	19	13
41.9-73.5	11	27
Total	40	40

Table 4 : Distribution as per cord blood pO2

pO2	Case	Control
<6.2	8	3
6.2-27.6	32	37
Total	40	40

Table 5: Distribution as per cord blood bicarbonate

Bicarbonate	Case	Control
<18.8	9	9

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18.8-28.2	31	31
Total	40	40

Table 6 : Distribution as per cord blood hemoglobin

Hb	Case	Control
>19.7	8	4
12.4-19.7	32	36
Total	40	40

Table 7: Distribution as per birth weight

Baby weight	Cases	Controls
<2.5kg	22	10
≥2.5kg	18	30
Total	40	40

Table 8 : Distribution as per APGAR at 1 min

Apgar at 1 min	Cases	Controls
≤6	12	8
>6	28	32
Total	40	40

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Table 9: distribution as per APGAR at 5 mins

Apgar at 5min	Cases	Controls
≤6	8	10
>6	32	30
Total	40	40

Table 10: Distribution as per NICU admission

NICU admission	Cases	Controls
Yes	21	4
No	19	36
Total	40	40

Table 11 : Distribution as per condition of baby at discharge

Condition at discharge	Cases	Controls
Dead	2	1
Alive	38	39
Total	40	40

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Figure 1: Showing age distribution in cases and controls

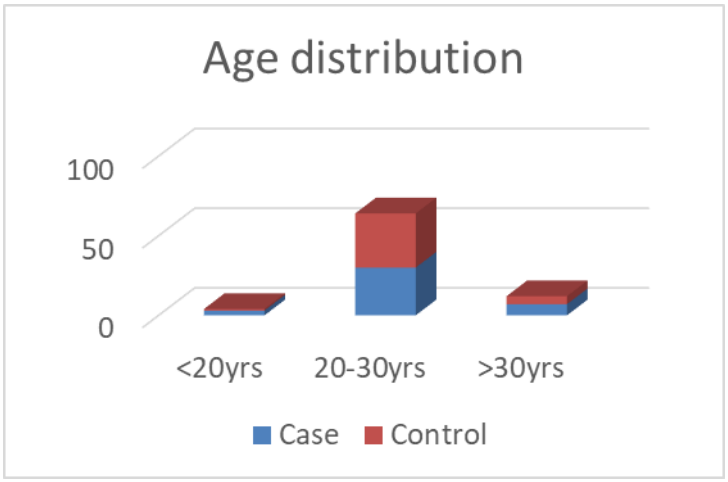

Figure 2: Showing distribution based on parity in cases and controls

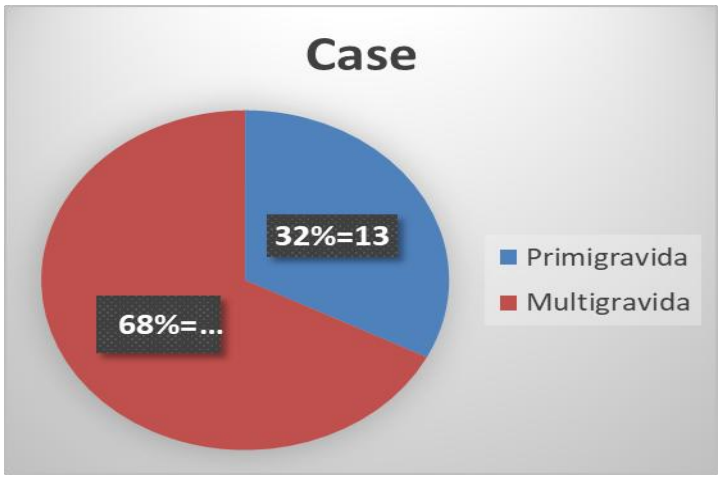

Figure 3: Distribution as per cord blood pH

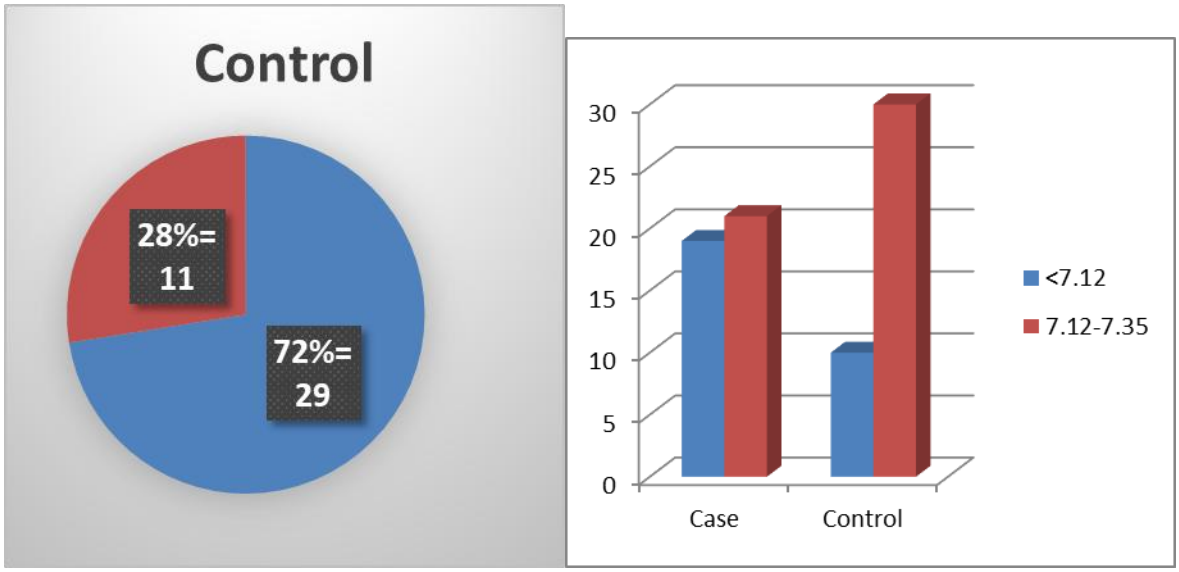

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Figure 4 : Distribution as per cord blood pCO2

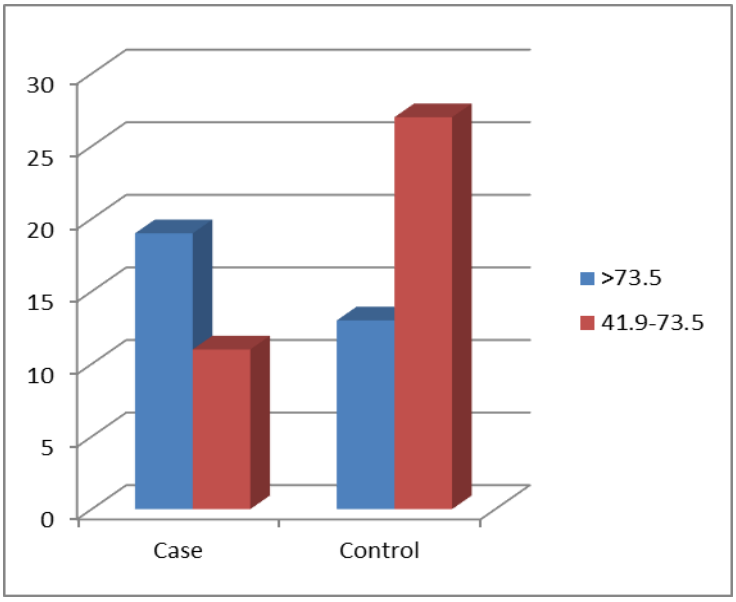

Figure 5: Distribution as per cord blood pO2

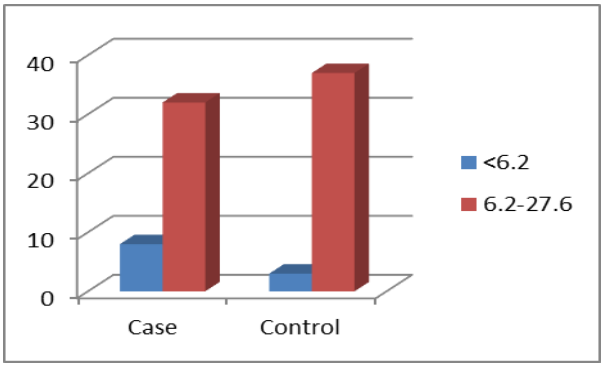

Figure 6 : Distribution as per cord blood bicarbonate

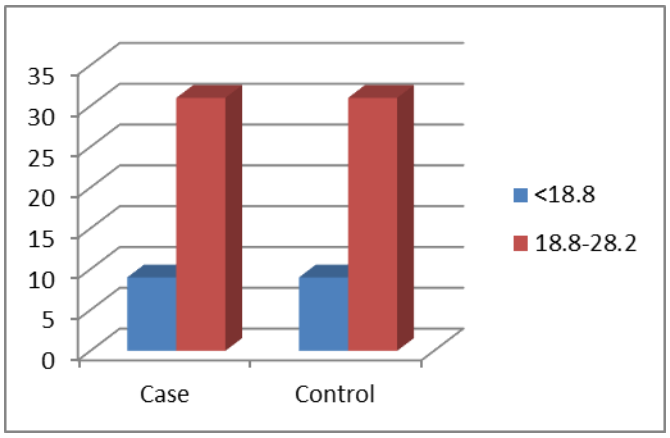

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Figure 7: Distribution as per cord blood hemoglobin

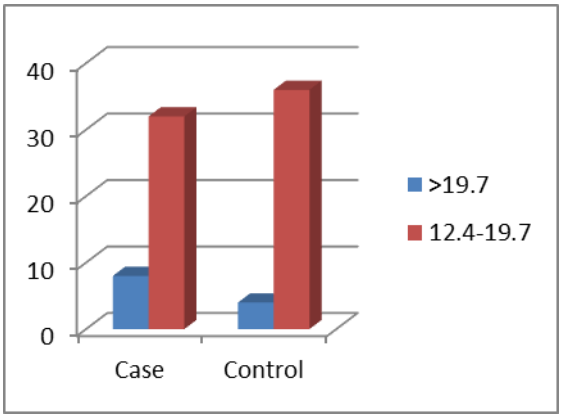

Figure 8: Distribution as per birth weight

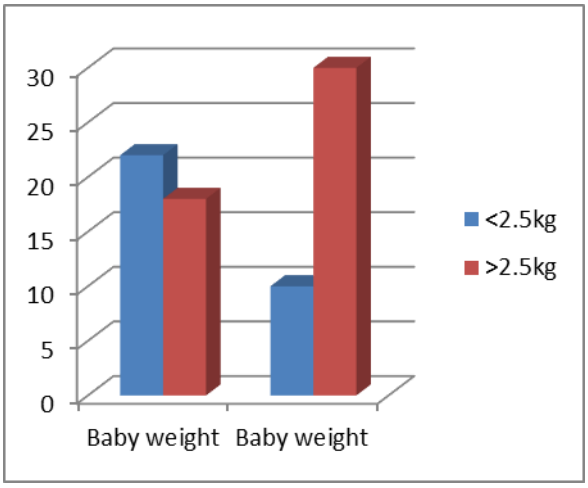

Figure 9: Distribution as per APGAR at 1 min

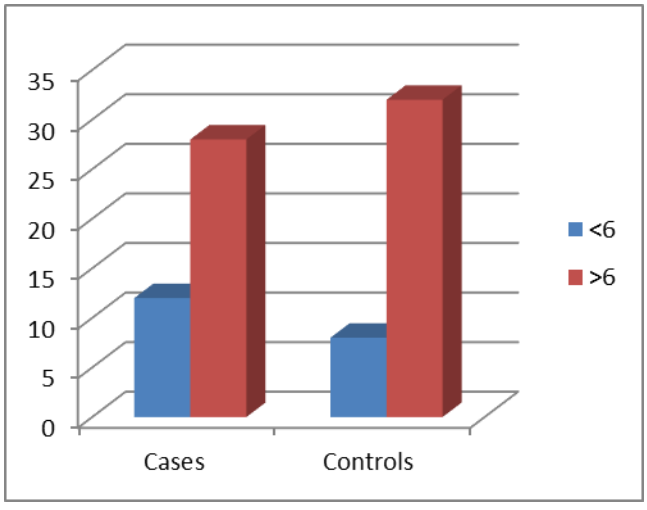

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Figure 10: Distribution as per APGAR at 5 mins

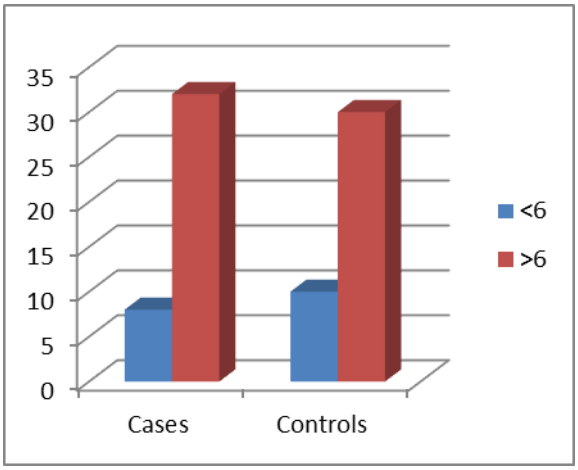


Figure 11 : Distribution as per NICU admission

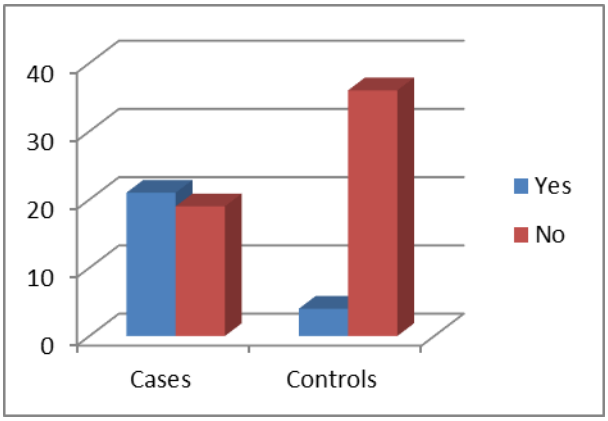
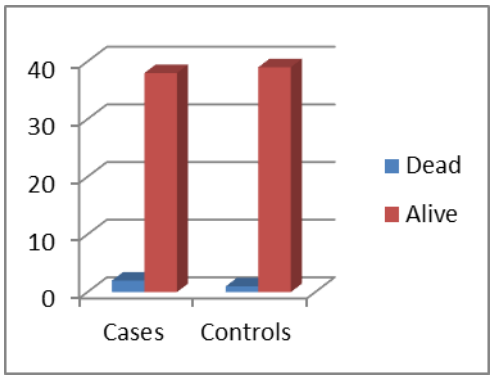


Figure 12: Distribution as per condition of baby at discharge



Discussion

A reduction or change in fetal movements can be a warning sign of an ongoing fetal compromise. This study was done to assess these patients so that a timely intervention could improve fetal prognosis. A well aware mother gives first-hand information about the change in pattern of normal fetal movements which in many cases is a reliable subjective finding to suspect any in- situ pathology. Thus, such mothers were recruited after following the protocol and after termination of pregnancy, cord blood gas analysis was done to further predict short term well being of these babies (long term effects were not seen as these patients and babies were not followed up after

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discharge. Fetal cord blood analysis is widely performed to determine objectively the metabolic condition of fetus and can make us take prompt measures in delivering babies in risk. This can further identify neonatal risk of developing diseases like neonatal encephalopathy and helps to initiate neuroprotective measures.[16] Some experts have defined pathological acidosis as the level at which adverse sequalae arises. It has been seen that pH as low as 7 is tolerated by fetus with an eventful outcome. Pre-eclapmsia is essentially a placental vascular disorder that comprises exchange of gases and nutrition which further reflects reduced fetal movements in the mother.[17] We saw fetal acidosis was significant in cases (p-value=0.01) and many studies show that fetal acidosis can occur as a result of decreased placental blood flow, like study by Matsuo et al.[18] In this study, polycythemia was significant (p-value=0.0001) in cases than in control. Study of Philip et al and Meher et al, showed results that indicated increased erythropoiesis as it showed increased nucleated erythrocyte.[19,20] Even study by Kurtal et al showed polycythemia in hypertensive patients.[21] Najib et al study showed no significance with respect pO2 and HCO^-_3 which was similar to our study but pCO2 was significant (p-value=0.04).[22] There were many studies which showed poor APGAR at 1 min and 5 min in hypertensive mothers with reduced fetal movement, but in this study no association could get established. Low birth weight was more in cases and was statistically significant (p-value=0.0073) which was comparable to study by Bolat et al.[23] Neonatal admission was highly significant (p-value=0.0002) in cases and it was supported by many studies like Jessica et al. Neonatal death although was more in cases than control but it was not statistically proven.[24]

Limitations

1. It was a small sample sized study
2. Selection biased, other causes of reduced fetal movements like placental pathology was not studied
3. None of the cases and controls in the study had still birth, this may be due to the fact these participants in the study had received standarised care and were all delivered by caesarean section.
4. Both of the groups were not well standardised, only criteria adopted was mode of delivery which was caesarean section in both groups and it was not sufficient.
5. In cases, there was no demarcation for chronic hypertension, PIH with severe features and PIH without severe features thus altering results.
6. Long term follow up of infants for both the groups were not done.

Conclusion

Newborns of hypertensive mothers carry risk for complications including sepsis, hypoxia, hypercapnia and polycythemia. Reduced fetal movement though benign in uncomplicated pregnancies should alarm the obstetrician in these high risk groups to take interventional measures such as drugs, intravenous fluids and in severe cases termination of pregnancy. Routine cord blood analysis should be adopted to predict prognosis of these newborns.

Acknowledgement

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Ethical Approval

The study was conducted after the approval of the institutional ethical committee.

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