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RESEARCH ARTICLE
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ESTIMATION OF THE ROLE OF MATERNAL ANAEMIA IN FETAL HEMOGLOBINOPATHIES VIA CORD BLOOD ANALYSIS.

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Abstract

Background: Anemia is the most prevalent medical condition during pregnancy. According to the World Health Organization, anemia in pregnancy is defined as having a hemoglobin concentration below 11 g/dl and a hematocrit below 33%. Iron deficiency is the primary cause of anemia in over 90% of cases, while deficiencies in folic acid and vitamin B12 account for 5% of total cases. Additionally, there is a direct correlation between maternal hemoglobin levels and the presence of anemia in newborns, with mothers who are anemic more likely to give birth to anemic infants.
In this study we have studied the effect of maternal anemia to the neonatal anemia by estimation of cord hemoglobin levels.

Material and Methods: We enrolled 71 anemic mothers coming to tertiary care center and investigated for CBC parameters were studied like hemoglobin, MCH, MCHC, MCV and Hematocrit. The data were analysed for the effect of maternal hemoglobin level on neonatal hemoglobin.

Result: In our study, we found that:
Cord blood hemoglobin (HB) was significantly lower in severe maternal anemia (7.00) compared to mild (8.73) and moderate (8.76) cases ($p<0.05$).
Newborn Mean Corpuscular Volume (MCV) was significantly lower in severe maternal anemia (100.00) compared to mild (100.22) and moderate (102.21) cases ($p<0.05$).
Newborn Mean Corpuscular Hemoglobin (MCH) was significantly lower in severe maternal anemia (33.90) compared to mild (34.08) and moderate (34.83) cases ($p<0.05$).
Newborn Mean Corpuscular Hemoglobin Concentration (MCHC) was significantly higher in severe maternal anemia (33.90) compared to mild (33.20) and moderate (33.53) cases ($p<0.05$).
Newborn hematocrit (%) was significantly higher in moderate maternal anemia (46.44) compared to mild (36.49) and severe (38.30) cases ($p<0.05$).

Conclusion: the maternal anemia having direct relation with the fetal hemoglobin level, MCH, MCHC ,MCV AND Hematocrit of the neonate and is having direct impact on the neonatal anemia.

INTRODUCTION

Anemia is the most frequent medical ailment encountered during pregnancy, with varying prevalence, causes, and levels of severity in different populations.[1]

The World Health Organization's definition of anemia in pregnancy is based on hemoglobin concentration, with levels below 11 g/dl and hematocrit values below 33%. Anemia is further categorized as mild when hemoglobin ranges from 10.0 to 10.9 g/dl, moderate when it falls between 7.0 to 9.9 g/dl, and severe when it is less than 7.0 g/dl.[2]

Approximately 30% to 50% of women experience anemia during pregnancy. Iron deficiency is the leading cause, accounting for over 90% of cases. This deficiency is mainly attributed to the heightened demand for iron required for the developing fetus and placenta. Other contributing factors include early childbirth, frequent pregnancies, short gaps between pregnancies, menstrual blood loss, and limited access to prenatal care and iron supplementation.[3] Folate deficiency occurs in approximately 5% of cases, although it is frequently underdiagnosed. It is almost invariably the underlying cause of megaloblastic anemia in pregnancy, while vitamin B12 deficiency is a rare occurrence in this context.[4]

In pregnancy, anemia often presents without noticeable symptoms and is typically identified through routine screening. Common clinical manifestations encompass sensations of fatigue, dizziness, episodes of fainting, and a general sense of lethargy. Sometimes, pallor of the skin may be observable.[5] In pregnancy, anemia is typically screened by assessing hemoglobin levels through a complete blood count at the onset of pregnancy. Subsequent assessments are often conducted later in pregnancy, commonly at the beginning of the third trimester, and once more at term. While this method may lack specificity, it offers the advantage of being a cost-effective and straightforward procedure.

The occurrence of anemia is more frequent during the third trimester of pregnancy compared to the first and second trimesters.[6] The elevated prevalence of anemia in developing nations is a multifaceted issue, influenced by various factors that vary with race, geographic location, socioeconomic status, dietary practices, healthcare access, and parasitic infections.[7]

Anemia during pregnancy has been demonstrated to have a link with unfavorable maternal outcomes, including preterm labor, low birth weight, antepartum hemorrhage, puerperal sepsis, postpartum hemorrhage, as well as both maternal and perinatal mortality.[8,] Maternal anemia can potentially lead to fetal anemia, as there is a direct correlation between maternal hemoglobin levels and the hemoglobin levels in cord blood. With this context in mind, our study aimed to investigate the influence of maternal anemia on the hemoglobin levels in cord blood.

RESULT

Table 1: Comparison of mean cord blood HB with respect to maternal anemiagrade

Grade of Anemia in mother	N	MeancordbloodHB	SD	F	p	Inference
Mild	33	8.73	0.48	18.73	0.0001 (<0.01)	Highly significant
Moderate	31	8.76	0.96			
Severe	7	7.00	0.00			
Total	71	8.57	0.88			

Mean cord blood HB in mild, moderate and severe maternal anemia was 8.73±0.48, 8.76±0.96 and 7.00±0.00 respectively. When we compared the mean cord blood HBwith respect to maternal anemia severity grades, the difference was found to bestatistically significant ($p<0.05$). It means cord blood HB was significantly less in severe anemia in our study.

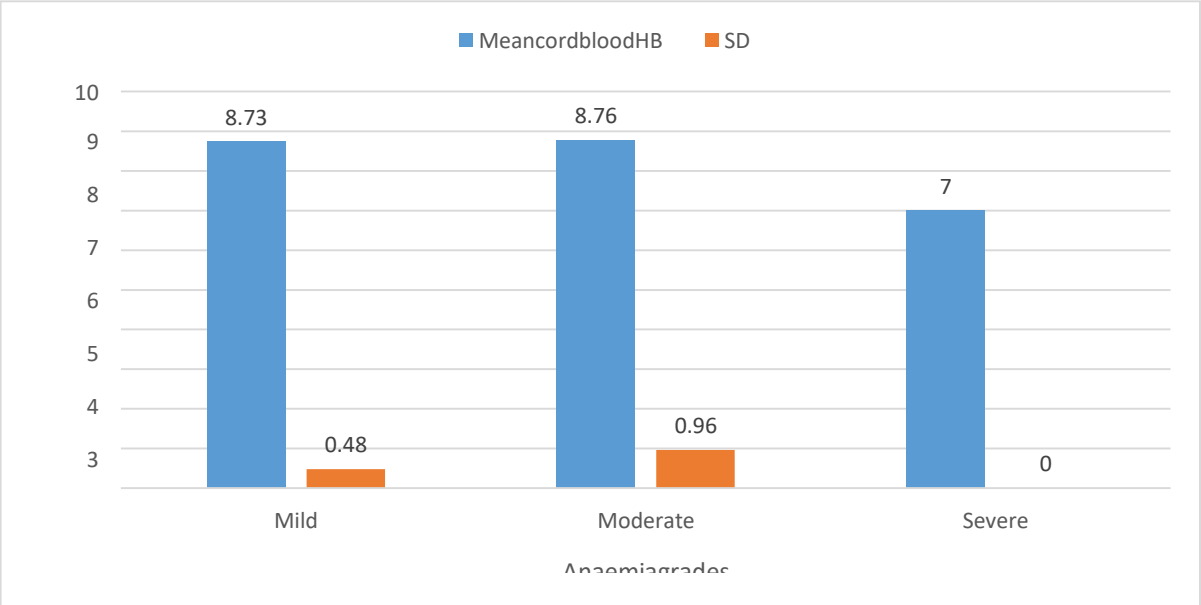

Fig.1: Comparison of mean cord blood HB with respect to maternal anemiagrade

Table 2: Comparison of mean newborn MCV with respect to maternal anemiagrade

	Grade of Anemia inmother	**N**	**Mean**	**SD**	**F**	**p**	**Inference**
New bornMCV(fl)	Mild	33	104.22	2.17	7.8	0.0001 (<0.01)	Highlysignificant
	Moderate	31	102.21	2.32			
	Severe	7	100.00	0.00			
	Total	71	101.07	2.34			

Mean new born MCV in mild, moderate and severe maternal anemia was100.22±2.17,102.21±2.32 and 100.00±0.00 respectively. When we compared the mean newborn MCV with respect to maternal anemia severity grades, the difference was found to bestati stically significant ($p<0.05$). It means newborn MCV was significantly less insevere maternal anemia in our study.

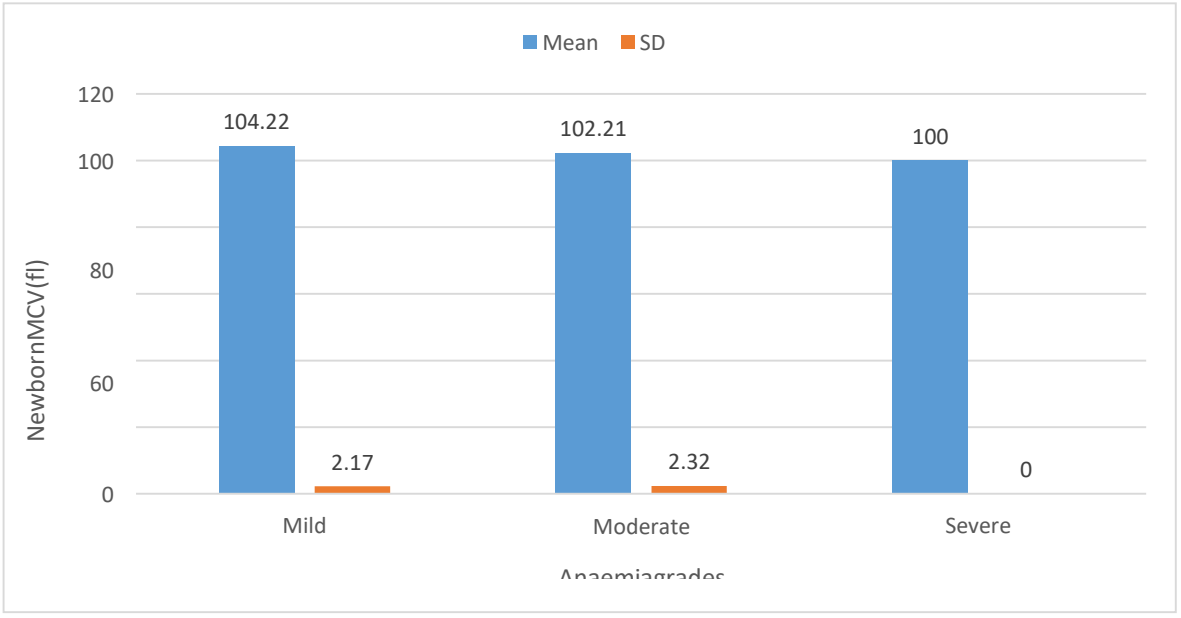

Fig.2: Comparison of mean newborn MCV with respect to maternal anemi a grade

Table 3: Comparison of mean newborn MCH with respect to maternal anemiagrade

	Grade ofAnemia inmother	N	Mean	SD	F	p	Inference
New born MCH (pg)	Mild	33	34.08	0.70	14.16	0.0001 (<0.01)	Highlysignificant
	Moderate	31	34.83	0.60			
	Severe	7	33.90	0.00			
	Total	71	34.39	0.73			

Mean newborn MCH in mild, moderate and severe maternal anemia was 34.08±0.70, 34.83±0.60 and 33.90±0.00 respectively. When we compared the mean newbornMCH with respect to maternal anemia severity grades, the difference was found to bestatistically significant ($p<0.05$). It means newborn MCH was significantly less in severe maternal anemia in our study.

Fig. 3 : Comparison of mean newborn MCH with respect to maternal anemia grade

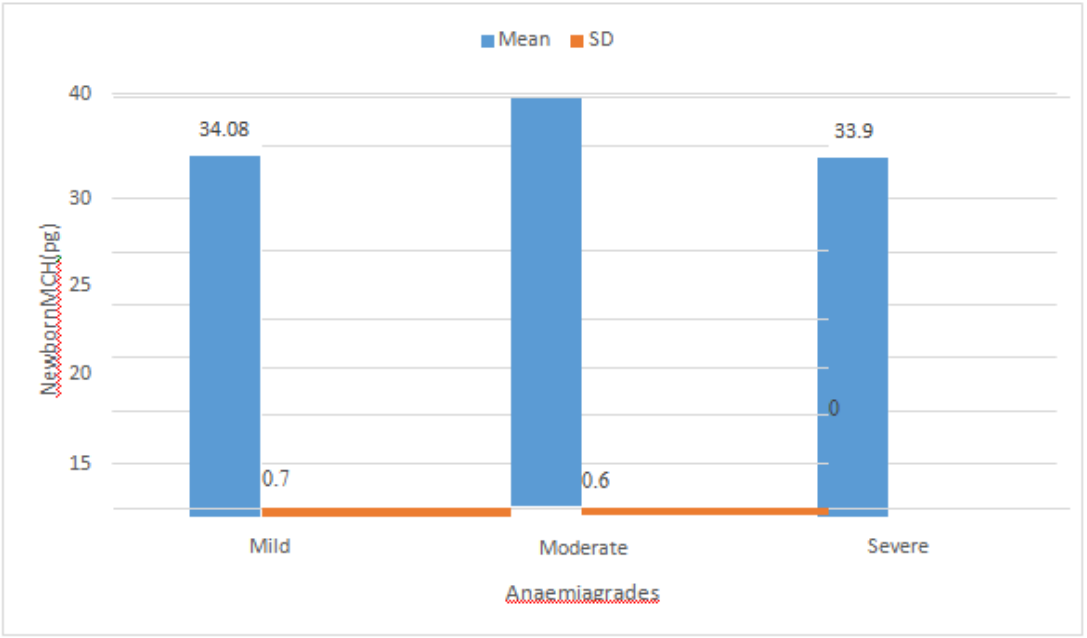

Table 4: Comparison of mean newborn MCV with respect to maternal anemiagrade

	Grade of Anemia in mother	N	Mean	SD	F	p	Inference
New born MCHC (g/dl)	Mild	33	33.20	0.92	2.56	0.084 (>0.01)	Notsignificant
	Moderate	31	33.53	0.81			
	Severe	7	33.90	0.00			
	Total	71	33.41	0.85			

Mean newborn MCHC in mild, moderate, and severe maternal anemia was 33.20 ± 0.92, 33.53 ± 0.81, and 33.90 ± 0.00, respectively. When we compared the mean newborn MCHC with respect to maternal anemia severity grades, the difference was found to be statistically significant ($p < 0.05$). It means newborn MCHC was significantly higher in severe maternal anemia in our study.

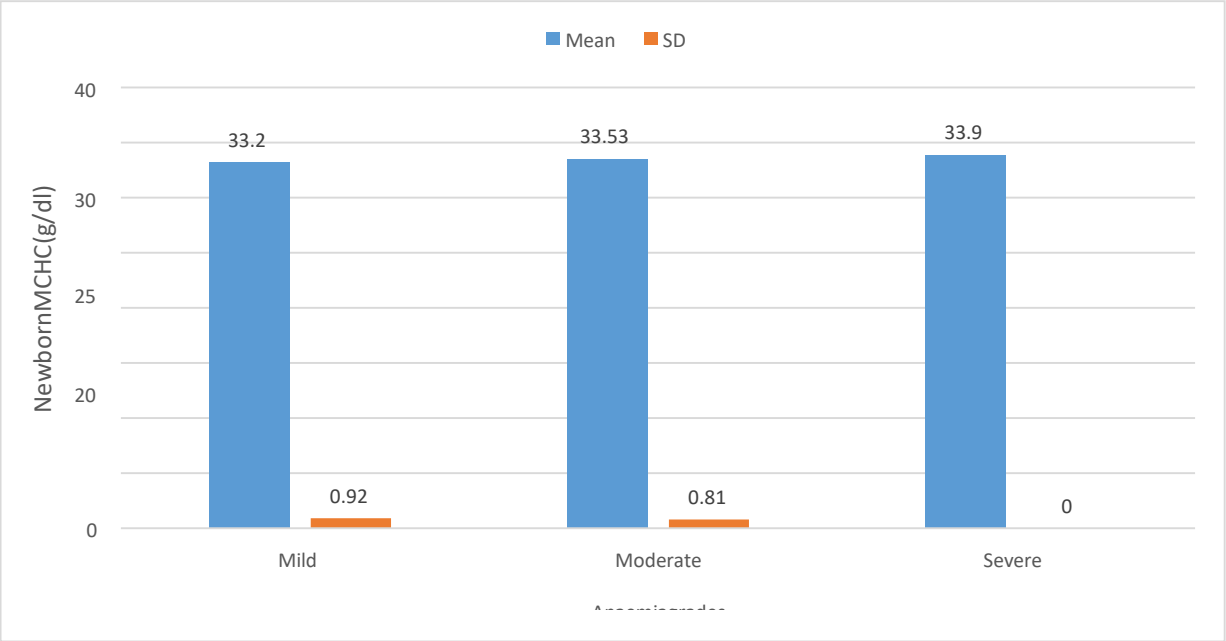

Fig.4: Comparison of mean newborn MCV with respect to maternal anemiagrade

Table 5: Comparison of mean newborn hematocrit with respect to maternalanemiagrade

	Grade ofAnemia inmother	**N**	**Mean**	**SD**	**F**	**p**	**Inference**
Newborn haematocrit(%)	Mild	33	36.49	8.87	18.0	0.0001 (<0.01)	Highly significant
	Moderate	31	46.44	4.37			
	Severe	7	38.30	0.00			
	Total	71	41.01	8.22			

Mean newborn hematocrit (%) in mild, moderate, and severe maternal anemia was 36.49 ± 8.87, 46.44 ± 4.37, and 38.30 ± 0.00, respectively. When we compared the mean newborn hematocrit (%) with respect to maternal anemia severity grades, the difference was found to be statistically significant ($p < 0.05$). It means newborn hematocrit was significantly higher in moderate maternal anemia in our study.

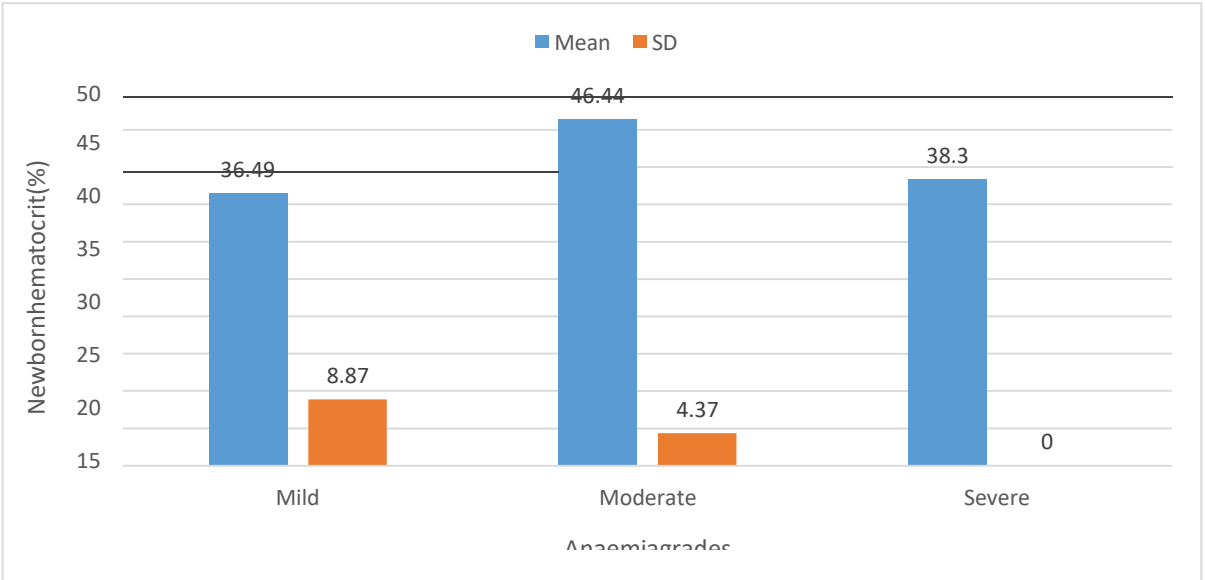

Fig.5: Comparison of mean newborn haematocrit with respect to maternalanemiagrade

DISCUSSION

The mean cord blood hemoglobin (Hb) in mild, moderate, and severe maternal anemia was 8.73 ± 0.48, 8.76 ± 0.96, and 7.00 ± 0.00, respectively. When we compared the mean cord blood Hb with respect to maternal anemia severity grades, the difference was found to be statistically significant ($p < 0.05$). This indicates that cord blood Hb was significantly lower in cases of severe anemia in our study.

In our study, we identified a statistically significant positive correlation between maternal hemoglobin (Hb) levels and cord blood hemoglobin (Hb) levels, with a p-value below 0.05.

Agrawal R et al.[9] reported that the mean cord blood Hb in mild, moderate, and severe maternal anemia was 15 ± 0.72, 14.6 ± 0.88, and 13.1 ± 0.79, respectively. The difference was found to be statistically significant ($p < 0.05$), consistent with our study findings.

Al-Hilli NM et al.[10] reported that the mean cord blood Hb in mild, moderate, and severe maternal anemia was 14.79 ± 1.36, 13.89 ± 0.9, and 12.1 ± 1.04, respectively. The difference was statistically significant ($p < 0.05$), aligning with our study findings.

Rumi Debbarma et al.[11] reported similar findings, with mean cord blood Hb in mild, moderate, and severe maternal anemia being 14.79 ± 1.36, 13.89 ± 0.9, and 12.1 ± 1.04, respectively, and a statistically significant difference ($p < 0.05$).

Dhanasekaran R et al.[12] (2019) assessed how maternal anemia influences cord blood hemoglobin levels in neonates. The mean cord blood hemoglobin levels for infants born to anemic mothers in mild, moderate, and severe anemia groups were 15.54 ± 0.77, 14.7 ± 0.93, and 14.08 ± 0.88, respectively. Compared to the non-anemic group, a statistically significant difference was observed with p-values < 0.05, 0.01, and 0.05 for mild, moderate, and severe groups, respectively. They also observed a direct linear relationship between maternal and cord blood hemoglobin levels. This suggests that as maternal hemoglobin decreases, cord hemoglobin levels decrease proportionally, indicating a notable impact of maternal anemia on cord hemoglobin. Furthermore, this decline appears to be proportional to the severity of anemia, likely due to impaired iron transport through the placenta at higher degrees of anemia.

Similar findings were noted by **Najeeba CM et al. [13]** at Babylon University, who also observed a linear relationship between maternal and cord hemoglobin levels in newborns.

Rumi Debbarma et al.[11] identified a linear association between cord hemoglobin and maternal hemoglobin levels, consistent with the findings of our study. In contrast, **Marmoury GH et al. [14]** reported no correlation between cord and maternal hemoglobin levels.

Nhonoli et al.[15] discovered that when mothers had both iron deficiency and anemia, newborns also exhibited reduced hemoglobin levels and lower iron levels in cord blood.

Singla et al.[16] established a substantial connection between maternal hemoglobin levels and iron levels in cord blood.

Fenton et al.[17] identified a direct correlation between maternal ferritin levels and cord blood ferritin levels.

CONCLUSION:

From the results of this study, it was concluded that there were statistically significant differences in newborn hematological parameters based on the severity of maternal anemia. Cord blood hemoglobin, MCV, and MCH were significantly lower in severe maternal anemia, while MCHC was significantly higher. Newborn hematocrit was notably higher in moderate maternal anemia. These findings emphasize the impact of maternal anemia on neonatal hematological outcomes.

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