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Adverse Perinatal Outcomes: Their Association with Maternal Anemia

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ABSTRACT

The incidence of anemia during the third trimester of pregnancy correlates with a heightened risk of negative postnatal outcomes. **Objective:** To access the relationship between hemoglobin levels in laboring women and perinatal outcome. **Methods:** A prospective cohort study was done at Department of Obstetrics and Gynecology, Nishtar Hospital, Multan from September 2020 to December 2021 using non-probability purposive sampling technique. A total of 135 anemic pregnant women (Group A) fulfilling inclusion and exclusion criteria was recruited for the study from labour room plus 135 non-anemic women were also recruited as control group (Group B). The data was recorded and explored. **Results:** 135 anemic laboring pregnant ladies were taken in this study having mean age 25.63 ± 4.53 years (range; 19-37 years) and 85.2% had ages less than 30 years. Cesarean section deliveries were noted to be in 50.4% in group A (anemic women) versus 48.1% in group B (non-anemic women). Preterm birth was noted to be 29.6% in group A versus 6.7% in group B. Small for gestational age was 53.3% in group A versus 12.6% in group B. Low birth weight was 54.8% in group A versus 16.3% in group B. Still birth was 7.4% only in anemic women while it was not observed in control group. **Conclusions:** The results of this study supported strong relationship of low haemoglobin in mothers with untoward perinatal outcome; growth retarded babies, preterm, Low birth weight and cesarean section rate. Strong media awareness campaigns should be launched for awareness for iron supplementation among targeted population.

INTRODUCTION

The World Health Organization (WHO) has estimated that around 2 billion world population or approximately one third of the people are affected with anemia and recent estimated have shown great variation in its burden among pregnant women. Maternal anemia is more prevalent in developing countries particularly Africa and Southeast Asia, where it can be encountered in as many as 35-75% of total pregnancies while it is less than 20% in developed nations [1, 2]. The sustainable development goals take very clear steps towards nutritional status that incudes the World Health Assembly targets for scaling down anemia in reproductive age groups (15-49 years) to half by 2025 [3, 4]. The threshold up to which anemia in pregnant women can affect perinatal outcomes still inconclusive due to certain issues such as; insufficient biological factors, social and economic conditions, different environmental conditions and changes in lifestyle modifications as well as prior to or during pregnancy may be implicated in high burdens of low birth weight [5]. Various dietary habits, such as taking low nutritional diets and lower weight gains in pregnancy, are contributing factors towards low intake of the nutrients required which are measured as necessary for the growth of the fetus for example vitamin B and iron. Ionic iron is the essential mineral which may promote the synthesis of new hemoglobin molecules as well as it is the major basis for energy and required in transporting the oxygen to various organs of the body [6, 7]. Lower concentrations of hemoglobin (Hb%) may promote various changes in angiogenesis of placenta which may restrict supply of oxygen thus limiting fetal growth. This may consequently

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lead to certain adverse events such as intrauterine growth restriction and may lead to low birth weight [8, 9]. Recent studies have demonstrated that anemia in pregnancy i.e. Hb levels less than 11g/dl is noticeably associated with birth weight less than gestational age in babies in comparison with those ladies having normal hemoglobin levels during pregnancy [10, 11].

Hence, this study has been done to explore the role of maternal hemoglobin levels with adverse perinatal outcomes in the anemic new moms of Southern Punjab, Pakistan to ascertain role of hemoglobin levels with such adverse outcomes.

METHODS

It was a prospective cohort study, carried out at Department of Obstetrics and Gynecology, Nishtar Hospital, Multan from September 2020 to December 2021 using non-probability purposive sampling technique. The study was approved by the Institutional Ethical Review Board of Nishtar Medical University; Multan vide Reference No. 14417-27/NMU. Iron deficiency anemia in third trimester was defined as Hemoglobin <11g/dl and serum ferritin < 30 microgram/liter according to WHO. Inclusion criteria were laboring mothers with maternal age 18-45 years, primigravida or multi gravida (up to 3) and singleton pregnancy accessed by ultrasound. All women selected were otherwise having uncomplicated pregnancies with body mass index of 18.5-24.9kg/m^2. Exclusion criteria were laboring mothers with multiple pregnancies, medical disorders like diabetes, hypothyroidism, hyperthyroidism, Hypertension, Ischemic heart disease, valvular heart disease, previous history of preterm births and malignancy were precluded from the study. Babies born with neonatal sepsis, birth asphyxia and meconium aspiration were excluded. Sample size was 270 pregnant women calculated by following formula. $n = z^2\ pq/d^2$, where, p = 75% (hypothesized frequency of need of NICU admission in newborn of anemic women), q = 100 - p, d = 5.2% margin of error), z = 1.96 (95% confidence) [12]. Sample was divided into two equal groups of anemic (Group A) and non-anemic women (Group B). Women were recruited for the study from labour room after informed consent and was assured of their confidentiality. Detail history was taken from laboring mothers regarding number of children before current pregnancy, inter birth interval, menstrual irregularities, pregnancy termination. Small for Gestational Age (SGA), Low Birth Weight (LBW), and stillbirths, were measured by comparing the frequency of these outcomes in the anemic group (Group A) with the non-anemic group (Group B). The reference values for SGA and LBW were based on the World Health Organization's criteria for gestational age-specific growth percentiles and weight thresholds, respectively. Stillbirths were recorded based on the absence of signs of life at birth, as per the hospital's standard clinical definitions. The data were recorded and explored by using SPSS version 27.0. Descriptive statistics was used to summarize data. Maternal outcomes such as mode of delivery and preterm labour was analyzed in both groups. Fetal outcomes like small for gestational age, low birth weight, still birth, and NICU admission were studied in the anemic and non-anemic group. The Hb% levels of women during labour and birth weights were extracted from the labour room record. Mean or median with respective measures of dispersion was calculated for quantitative variables like age, gestational age of patient. Frequencies and percentages were calculated for categorical variables like maternal anemia and birth weight of baby. Effect modifiers like age, gestational age and parity was controlled by stratification. Post stratification chi-square test was applied to see their effect on outcome. All tests were two sided and judged statistically significant at $p<0.05$.

RESULTS

A total of 135 anemic laboring pregnant ladies were taken in this study having mean age 25.63 ± 4.53 years (range; 19-37 years) and 115 (85.2%) had ages less than 30 years. Of these 135 laboring anemic women, 53 (39.3%) belonged to rural areas and 82 (60.7%) belonged to urban areas. Majority of these women were poor 90 (66.7%) and 45 (33.3%) were middle income. Similarly, 97 (71.9%) were illiterate while 117 (86.7%) were house-wives and 79 (58.5%) were living in joint family system. Only 26 (19.3%) were having regular antenatal monthly visits to the hospital. Overall Hb level was 10.04 ± 0.46 g/dl in anemic women and 11.57 ± 0.54 g/dl in non-anemic women. Maternal outcome like cesarean section deliveries were noted to be in 50.4% in group A versus 48.1% in group B (P = 0.715). Preterm labour resulting in preterm delivery was noted to be 29.6% in group A versus 6.7% in group B (P = 0.001). Small for gestational age was 53.3% in group A versus 12.6% in group B (P = 0.001). Low birth weight was 54.8% in group A versus 16.3% in group B (P = 0.001). Still birth was 7.4% only in anemic women while it was not observed in control group. NICU admission was 67% among anemic women. Early neonatal deaths were never reported in any group.

Table 1: Association of Maternal Hemoglobin Levels with Maternal Outcomes

Maternal Outcomes	Hemoglobin Levels (gm/dL)		p-Value
	Group A Mean ± SD	Group B Mean ± SD	
Mode of Delivery (Cesarean Deliveries)			
Yes	9.64 ± 0.36	11.23 ± 0.77	0.001
No	10.97 ± 0.88	11.84 ± 0.23	
Preterm Labour			
Yes	9.32 ± 0.42	11.51 ± 0.32	0.001
No	10.98 ± 0.97	11.91 ± 0.63	

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The association between maternal hemoglobin levels and neonatal outcomes is presented in Table 2. For neonates classified as Small for Gestational Age (SGA), the mean hemoglobin level was significantly lower in anemic mothers (Group A: 9.64 ± 0.41) compared to non-anemic mothers (Group B: 11.31 ± 0.42, p = 0.001). Among non-SGA neonates, the hemoglobin levels were higher in both groups, with Group A at 10.77 ± 0.88 and Group B at 11.88 ± 0.71. Similarly, Low Birth Weight (LBW) neonates were more prevalent in Group A, with a mean hemoglobin level of 9.74 ± 0.46 compared to 11.51 ± 0.49 in Group B (p = 0.001). For non-LBW neonates, hemoglobin levels in Group A and Group B were 10.90 ± 0.70 and 11.71 ± 0.67, respectively. Stillbirths were reported exclusively in Group A, with a mean hemoglobin level of 9.52 ± 0.37 (p = 0.001), while no cases were observed in Group B. These findings underscore the significant impact of maternal anemia on adverse neonatal outcomes, including SGA, LBW, and stillbirths.

Table 2: Association of Maternal Hemoglobin Levels with Neonatal Outcomes

Neonatal Outcome	Group A Mean ± SD	Group B Mean ± SD	p-Value
Small For Gestational Age			
Yes	9.64 ± 0.41	11.31 ± 0.42	0.001
No	10.77 ± 0.88	11.88 ± 0.71	
Low Birth Weight			
Yes	9.74 ± 0.46	11.51 ± 0.49	0.001
No	10.90 ± 0.70	11.71 ± 0.67	
Still Births			
Yes	9.52 ± 0.37	NA	0.001
No	10.85 ± 0.89	NA	

DISCUSSION

Maternal anemia still remains global health issue with most of the burden falls among developing countries such as Africa, Southeast Asia and in this country, Pakistan [13]. Recent estimates have demonstrated that these countries harbor maternal anemia as much as double high in comparison with developed countries. Data have shown maternal anemia may affect 35-75% of pregnancies developing countries while this figure drops to be 19% for developed countries. It was well narrated that maternal anemia was a powerful predictor for poor perinatal outcomes (both maternal and neonatal) such as low birth weight, preterm deliveries, NICU admissions, small for gestational age and still births [14]. Furthermore, recent reports from developing nations have also implicated maternal mortality was two times high among severely anemic pregnant women [15]. A total of 135 anemic laboring pregnant ladies were taken in this study having mean age 25.63 ± 4.53 years (range; 19-37 years) and 115 (85.2%) had ages less than 30 years. Debella A *et al.*, from Ethiopia has also reported 26.6 ± 6.15 years mean age of the anemic pregnant women, similar to this case series [16]. Mahmood T *et al.*, from Bahawalpur has also reported 29.4 ± 12.5 years mean age of the anemic pregnant ladies, similar to these results [17]. Bone JN *et al.*, from India has reported similar findings among anemic pregnant women [18]. Kabir MA *et al.*, from Bangladesh has also described 25.71 years mean age of the anemic pregnant women, similar to these results [19]. Baig JA *et al.*, has also reported 28.85 ± 5.12 years mean age of the anemic pregnant women, similar to this study results [20]. Of these 135 laboring anemic women, 53 (39.3%) belonged to rural areas and 82 (60.7%) belonged to urban areas. Debella A *et al.*, from Ethiopia has also reported 38.8% anemic pregnant women were from rural areas, like these findings [16]. Kabir MA *et al.*, from Bangladesh has also reported 32% of the anemic pregnant women from rural areas, same as these results [19]. Majority of these women were poor 90 (66.7%) and 45 (33.3%) were middle income. Debella A *et al.*, from Ethiopia has also reported findings like this study [16]. Kabir MA *et al.*, from Bangladesh has also reported majority of the anemic pregnant women were poor, just like these results [19]. Baig JA *et al.*, has also reported same end result [20]. Similarly, 97 (71.9%) were illiterate while 117 (86.7%) were house-wives and 79 (58.5%) were living in joint family system. Only 26 (19.3%) were having regular antenatal monthly visits to the hospital. Debella A *et al.*, from Ethiopia also reported 49.2% of the anemic pregnant women were housewives and 40% were illiterate, similar to these results [16]. Kabir MA *et al.*, from Bangladesh has also reported 89% of the anemic pregnant women were housewives, similar to these results [19]. Baig JA *et al.*, has also reported 64% of anemic pregnant women were living in joint family system, similar to the study results [20]. Cesarean section deliveries were noted to be in 50.4% in group A versus 48.1% in group B (P = 0.715). Mahmood T *et al.*, from Bahawalpur has also reported 45% cesarean section rate among anemic pregnant ladies, similar to our results [17]. Preterm birth was noted to be 29.6% in group A versus 6.7% in group B (P = 0.001). Debella A *et al.*, from Ethiopia has also reported 22.2% preterm births among anemic pregnant women, similar to our results [16]. Mahmood T *et al.*, from Bahawalpur has also reported 39% preterm birth among anemic pregnant ladies versus 15% among control group (P=0.001), similar to our results [17]. Kabir MA *et al.*, from Bangladesh has also reported 40.5% preterm births among anemic pregnant women, similar to our results [19]. Baig JA *et al.*, has also reported 36% preterm births among anemic pregnant women compared with 18% in non-anemic group (P=0.001), similar to these study results [20]. Low birth weight was 54.8% in group A versus 16.3% in group B (P = 0.001). Debella A *et al.*, from Ethiopia has also reported 18.8% low birth weight among anemic pregnant women, lower than our results [16]. Mahmood T *et al.*, from Bahawalpur has also reported 59% low birth weight among

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anemic pregnant ladies versus 23% in control group (P=0.001), similar to our results [17]. Kabir MA *et al.*, from Bangladesh has reported 18.3% low birth weight among anemic pregnant women [19]. Baig JA *et al.*, has also reported 63% low birth weight among anemic pregnant women versus 18% in non-anemic group, similar to our study results [20]. Small for gestational age was 53.3% in group A versus 12.6% in group B (P = 0.001). Mahmood T *et al.*, from Bahawalpur has also reported 73% small for gestational age among anemic pregnant ladies versus 23% among control group, similar to our results [17]. Still birth was 7.4% only in anemic women while it was not observed in control group. Debella A *et al.*, from Ethiopia has also reported 4.9% still births among anemic pregnant women, just like our results [16]. Mahmood T *et al.*, from Bahawalpur has also observed 8% still births among anemic pregnant ladies versus 3% among control group, same to our results [17]. Another study by Kabir MA *et al.*, in Bangladesh has also stated 8% still births rate among anemic pregnant women, close to our outcome [19]. Baig JA *et al.*, has also mentioned same findings [20].

CONCLUSIONS

These results supported that strong relationship of maternal anemia with deleterious perinatal sequel. Low birth weight, growth retarded babies, cesarean section rate and preterm births were the major adverse outcomes observed in our study. Mean hemoglobin level was significantly lower among anemic pregnant women with adverse events as compared with those having normal pregnancy outcomes. Strong media awareness campaigns should be launched at national level for awareness for iron supplementation among targeted population to overcome these adverse events.

Authors Contribution

Conceptualization: AA[1]
Methodology: BK, HS, AA[2], KR
Formal analysis: BK, HS
Writing, review and editing: AA[1], SP

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

The authors declare no conflict of interest.

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