Maternal Anemia Prevalence and Subsequent Neonatal Complications in Iraq

Shaymaa Kadhim Jasim[1], Hayder Al-Momen[2]*, Farah Al-Asadi[1]

[1]*Department of Obstetrics and Gynecology, College of Medicine, University of Baghdad, Baghdad, Iraq,* [2]*Department of Pediatrics, Al-Kindy College of Medicine, University of Baghdad, Baghdad, Iraq*

Abstract

BACKGROUND: Anemia during pregnancy is still a challenge throughout the world, and it may cause severe health consequences in the maternal and fetal sides.

AIM: This study aims to find out the prevalence of maternal anemia and potential adverse outcomes in Iraq.

METHODS: In Medical City Tertiary Center in Baghdad, singleton pregnant ladies came for delivery were involved over 6 months' period. Based on hemoglobin (Hb) readings; they were divided into no anemia group (Hb>11 g/l) and anemia group which were further subdivided into mild, moderate, and severe (Hb =10–10.9, =7.1–9.9, and <7 g/l, respectively). Full history and examination were performed by attending obstetrician and pediatrician for the upcoming babies.

RESULTS: Maternal anemia prevalence was 84.84% out of 4473 cases. No anemia group was 15.16%, mild 40.73%, and moderate 40.73%, while severe anemia group (24.93%). Maternal occupation, educational status, and Hb levels were significantly associated with anemia (p < 0.001), unlike parity, body mass index, and delivery mode. Neonatal preterm delivery, birth weight and length, small for gestational age (SGA), Apgar score, respiratory distress, and high death rate were strongly related to mothers' anemia (p < 0.001), on the contrary of septicemia, birth asphyxia, and hypoglycemia, in spite of their higher frequency rates in anemia groups. Birth weight, and length, and gestational age were lowered significantly in moderate and severe anemia, while Apgar score was low throughout all anemia categories. SGA was significant in severe anemia.

CONCLUSION: Maternal anemia is highly prevalent in Iraq with significant adverse neonatal events and elevated rates of mortality.

Introduction

Anemia during pregnancy is a distinct health issue throughout the world, with a special focus in the third world and low- and middle-income populations. People from Africa, Southeast Asia, and Mediterranean areas are at higher risk of anemia [1], [2].

Poor nutritional status such as iron and folic acid deficiency is one of the main causes of maternal anemia in addition to physiological etiologies [3], [4], [5].

Globally, anemia is present in 14–75% of pregnant mothers in developing countries, while the percentage is 16–29% in developed countries. More than half of pregnant ladies develop anemia without supplements [6], [7], [8].

Anemia within pregnancy may lead to adverse birth outcomes including (but not limited to) prematurity, low birth weight (LBW), and neonatal mortality [9], [10].

There are wide variations in maternal anemia burden between various geographical distributions, and even within the same region so that it is vital to study population factor in specific areas to study maternal anemia and pregnancy outcomes in different parts of the world, aiming to offer some data to the involved health authorities to put effective strategies trying to prevent anemia during pregnancy and improve its outcomes [11], [12].

We aimed at this study to find out the prevalence of anemia in pregnant mothers and the possible neonatal consequences in Iraq.

Materials and Methods

Patients' data

Throughout the 6 months' data collection period (from January 2, 2019, to July 1, 2019), all singleton pregnant ladies presented with labor to the Department of Obstetrics and Gynecology at Medical City Hospital in Baghdad, the capital of Iraq country, were involved. It is the biggest specialized tertiary obstetrical center in Iraq that receives cases from all over the country.

Mothers with systemic diseases or abnormalities such as hemoglobinopathies (such as thalassemia and sickle cell anemia), diabetes, hypertension, renal

problems, smoking, and oligo- or polyhydramnios were excluded from the study.

Detailed medical history was taken by the attending obstetrician, and recorded within hospital files, including the age of pregnant women, gestational age (using the date of last cycle, and/or as early as possible ultrasound examination), parity, occupation, educational status, and delivery mode. Weight was measured in kilograms (kg), and height in meters (m) to calculate the body mass index (BMI), which equals to kg/m^2. Blood was taken to measure hemoglobin (Hb) concentration performed by coulter counter approach. Cases with Hb levels >11 g/l (gram per liter) were considered normal and no anemia could be defined, while anemia is documented when Hb <11 g/l and divided into three categories, Hb = 10–10.9 g/l was the mild anemia group, Hb = 7.1–9.9 g/l was assumed to have moderate anemia, and Hb <7 g/l was related to the severe anemia group [13].

After delivery, the neonates were examined by the attending pediatrician and sent for blood sugar routinely according to the hospital policy. All findings were put down in the medical records. LBW was considered when birth weight <2500 g, while small for gestational age (SGA) was defined as birth weight <3rd percentile for gestation, and preterm delivery took place before completed 37 weeks of gestation [14].

Neonatal septicemia was confirmed by positive findings of blood culture, the definition of birth asphyxia was met when Apgar score <6 at 5 min [15], and neonatal blood sugar of <40 mg/dl was named as hypoglycemia [16]. Newly delivered babies with their mothers were followed up closely until hospital discharge or death (if any). Informed consent was obtained from all participants. Institutional Review Boards at Al-Kindy College of Medicine, and College of Medicine, at the University of Baghdad approved this research. Work was done in accordance with the Helsinki Declaration.

Statistical analysis

Statistical Package for the Social Sciences (SPSS) version 22 (IBM Corp., Armonk, NY, USA) was used to complete statistical analysis. Chi-square and Fisher's Exact tests were utilized for categorical data, while continuous data were analyzed using unpaired *t*-test. p ≤ 0.05 was considered as statistically significant. Mean± standard deviation (SD) was used for data expression.

Anemia consequences were separated from the effects of possible confounders using linear regression analysis to foresee continuous outcomes such as birth weight and length of gestation, while analysis of logistic regression was done to predict categorical results such as SGA and neonatal death.

The analysis of regression included the major influence of Hb as a continuous event. The binary analysis was performed between Hb (continuous variable) and all other possible foretellers in all analyses, and preceding selections were applied to localize covariates and interaction expressions to be included in regression patterns. Only occupation and age of mothers were regarded as covariates within all analyses of regression whatever the significant level was, because of their likely confounding effect.

Results

Total number (n) of involved cases was 4473 pregnant women; their mean age was 24±57 years ranging from 14 to 43 years. Normal Hb level (>11 g/l) was found in 678 women (15.16%), mild anemia group had 858 cases (19.18%), moderate anemia was observed in 1822 (40.73%), and severe anemia group involved 1115 ladies (24.93%). The prevalence of maternal anemia in all groups was 84.84%.

Parity, BMI, and delivery mode were not found to be significantly associated with maternal anemia, unlike occupation, educational status, and Hb levels, as shown in Table 1.

Regarding neonatal outcomes, preterm delivery, birth weight and length, SGA, and Apgar score (at 1 and 5 min) were significantly related to maternal anemia, as shown in Table 2. However, all the above parameters were worse with the severe anemia group, while the normal Hb group had the best results.

Respiratory distress and neonatal death were significantly associated with maternal anemia. Most

Table 1: General maternal characteristics

Maternal variable	Mild anemia (n, %)=858 (19.18%)	Moderate anemia (n, %)=1822 (40.73%)	Severe anemia (n, %)=1115 (24.93%)	Normal Hb (n, %)=678 (15.16%)	p-value
Maternal age in years (mean±SD)	24.33±2.6	23.92±4.1	25.20±3.4	24.85±1.6	0.732
Hemoglobin (g/dl), (mean±SD)	10.42.67±4.8	8.39±8.6	6.21±7.4	11.84±5.8	<0.001
Parity, primigravida: multigravida	276:582	624:11983	376: 739	221: 457	0.823
BMI, (mean±SD)	29.12±2.5	29.36±62	28.89±4.1	29.74±39	0.043
Occupation: n (%)					
a) Employed: n (%)=1298 (29.02%)	307 (23.65)	281 (21.65)	108 (8.32)	602 (46.38)	< 0.001
b) Housewife: n (%)=3175 (70.98%)	551 (17.35)	1541 (48.54)	1007 (31.72)	76 (2.39)	
Educational status:					
a) Primary school level or higher: n (%)=1562 (34.92%)	483 (30.92)	389 (24.90)	126 (8.07)	564 (36.11)	< 0.001
b) Below primary school level: n (%)=2911 (65.08%)	375 (12.88)	1433 (49.23)	989 (33.97)	114 (3.92)	
Delivery mode: n (%)					
Cesarean section (CS): n (%)=3126 (69.89%)	635 (20.31)	1176 (37.62)	596 (19.07)	719 (23.00)	0.172
Normal vaginal: n (%)=1347 (30.15%)	223 (16.55)	396 (29.40)	469 (34.82)	259 (19.23)	0.693

BMI: Body mass index.

of respiratory distress cases were preterm (n = 325, 90.03%, p < 0.001), and most of neonatal mortality was due to respiratory distress not responded to management (n = 221, 59.41%, p < 0.001).

Other complications such as septicemia, birth asphyxia, and hypoglycemia were not related significantly to anemia. Nevertheless, most of these complications were more frequent within the severe anemia group, and except birth asphyxia. These findings are evident in Table 3.

Table 4 is designed to look deeper into neonatal outcomes in relation to categories of maternal anemia. Birth weight (g) was decreased in both moderate and severe anemia groups (−83.11 g, p = 0.01; −507.72 g, p ≤ 0.001, respectively) when compared with normal Hb group.

Furthermore, birth length (cm) and gestational age (weeks) were significantly and progressively lower in moderate and severe anemia groups in comparison with normal Hb category (p values were decreased progressively with increasing anemia severity; as for birth length, p = 0.03 in moderate anemia and p ≤ 0.001 in severe anemia group, while it was p = 0.02 and p ≤ 0.001, respectively, in case of gestational age). However, Apgar score (at 1 min and 5 min) had statistically significant lower levels throughout all anemia groups compared with the normal Hb group. Finally, odds ratios of SGA were significantly higher in a severe group (p < 0.001). Some of these observations were associated with the influence of Hb on the age of gestation (weeks). After adjustment of this gestational age in regression analysis, we confirmed a negative association between Hb readings (continuous) and birth weight (kg), birth length (cm), Apgar score at 1 and 5 min, and SGA.

Discussion

The prevalence of maternal anemia at the time of delivery in our data was 84.84%, other local researchers found lower rates of 67% and 50.4% [17], [18]. This variance may be due to the wider range of drainage of patients to our hospital, as it receives cases from different cities inside the Iraqi borders, including rural and urban areas; this may give our results more reliability. In India and Pakistan, the prevalence rates were higher, reaching up to 89.6% and 90.5%, respectively [19], [20], but lower in Switzerland 18.5%, confirming the fact that suggests a distinct increase in maternal anemia in developing countries [21].

Herein this study, moderate anemia was higher than mild anemia. This finding was approved by some Indian scientists [19], but opposed by others whom stated higher rates of mild anemia followed by moderate and severe anemia according to the geographical and cultural backgrounds [20]. Iraqi people usually consume large amounts of black tea daily (which is considered as the second most popular drink after water in Iraq) that affect iron absorption, resulting in higher rates of more severe anemia [22], [23].

Employment and educational status was inversely related to anemia in our patients, in line with data collected from Thailand and Russia [24], [25].

Maternal anemia in our sample showed a significant negative effect on preterm delivery, birth weight and length, and Apgar scores at 1 and 5 min. Moreover, the higher the severity of maternal anemia, the lower the values of birth weight and length, independently from gestational age. These observations

Table 2: General neonatal features

Neonatal variable	Mild anemia (n, %)=858 (19.18%)	Moderate anemia (n, %)=1822 (40.73%)	Severe anemia (n, %)=1115 (24.93%)	Normal Hb (n, %)=678 (15.16%)	p-value
Preterm baby: n (%)=447 (9.99%)	35 (7.83)	116 (25.95)	267 (59.73)	29 (6.49)	<0.001
Birth weight (g), (mean±SD)	3171.4±402.6	2863.5±342.1	2719.2±361.7	3346.8±327.3	<0.001
Birth length (cm), (mean±SD)	48.54±3.6	47.89±2.2	47.32±3.9	49.56±2.7	<0.001
SGA: n (%)=359 (8.03%)	62 (17.27)	67 (18.66)	69 (19.22)	161 (44.85)	<0.001
Apgar score, (mean±SD) at:					
1 min	7.7±1.3	7.4±1.1	6.9±0.8	7.9±1.6	<0.001
5 min	8.7±1.2	8.4±0.6	8.0±1.4	8.8±0.9	<0.001

SD: Standard deviation, SGA: Small for gestational age.

Table 3: Neonatal complications related to study groups

Neonatal complication, n (%)	Mild anemia (n, %)=858 (19.18%)	Moderate anemia (n, %)=1822 (40.73%)	Severe anemia (n, %)=1115 (24.93%)	Normal Hb (n, %)=678 (15.16%)	p-value
Septicemia, 89 (1.99)	22 (24.72)	20 (22.47)	23 (25.84)	24 (26.97)	0.584
Respiratory distress, 361 (8.07)	68 (18.84)	101 (27.98)	159 (44.04)	33 (9.14)	<0.001
Asphyxia, 96 (2.15)	25 (26.04)	24 (25.00)	23 (23.96)	24 (25.00)	0.532
Hypoglycemia, 541 (12.09)	137 (25.32)	120 (22.18)	136 (25.14)	148 (27.36)	0.210
Mortality, 372 (8.32)	30 (8.06)	82 (22.04)	226 (60.75)	34 (9.14)	<0.001

Table 4: Neonatal complication for each category

Variable	Mild anemia				Moderate anemia				Severe anemia			
	Diff.	95% CI		p-value	Diff.	95% CI		p-value	Diff.	95% CI		p-value
Birth weight (g)	−178.32	−286.12	91.82	0.14	*−83.11*	-223.42	−202.73	0.01	*−507.72*	−701.11	−323.11	<0.001
Birth length (cm)	−0.21	−0.86	0.41	0.38	*−1.97*	-2.75	−0.52	0.03	*−2.12*	−2.84	−0.67	<0.001
Apgar score at 1 and 5 min	*−0.73*	−0.97	-0.38	0.03	*−0.79*	-0.82	−0.03	0.01	*−0.88*	−0.93	−0.51	<0.001
Gestational age (weeks)	−0.08	−0.42	0.53	0.34	*−0.52*	-0.49	−0.21	0.02	*−0.47*	−1.51	−0.06	<0.001
	OR	95% CI		p-value	OR	95% CI		p-value	OR	95% CI		p-value
SGA	1.34	0.53	3.98	0.86	1.09	1.21	1.92	0.63	*1.96*	1.29	2.54	<0.001

*Bold Italic values represent differences and odds ratios which are statistically significant from normal Hb. OR: Odds ratio, CI: Confidence interval, SGA: Small for gestational age.

were also found by other papers from Iran [26], Bangladesh [27], Scotland [28], and Brazil [29].

The occurrence of SGA in our data with severe anemia is agreed by other scientists, which may be caused by placental morphological changes that lead to hypoxia, oxidative stress, deficient nutritional transport, and increased the chance of fetal infection or inflammation [30], [31].

Regarding neonatal complications, we observed that neonatal respiratory distress was strongly associated with maternal anemia, which was in turn strongly linked to preterm delivery. This opinion was also adopted by many researchers [32], [33].

Other neonatal complications such as septicemia, hypoglycemia, and birth asphyxia were not related to maternal anemia in our neonates, as mentioned by papers came from different countries such as Egypt [34] and India [35].

The neonatal mortality rate in the involved cases was 8.32% which is nearer to the national figures 6–8.5% [36] and showed a significant relation with severe anemia in pregnancy, which was also found in Japan [37], and a recent systematic review and meta-analysis supported by the World Health Organization [38].

Our data have the power of prospective collection of a large sample of Iraqi pregnant women to evaluate the recent updated maternal anemia status in the Iraqi community, which suffer a lot from violence and wars in the previous years, this might affect the nutritional status and living conditions of pregnant mothers. Fortunately, our study environment and population have a great deal of similarity with most of the third world and limited income countries.

The weak point in this study that we measured Hb levels on delivery and did not evaluate time spent with anemia nor the cause of that anemia, whether nutritional or pathological. Furthermore, neonatal complications were followed up till patient discharge only, while some adverse events may occur remotely because of LBW or prematurity.

We hope these findings will trigger a more progressive work about maternal anemia to stand on the real situation regarding pregnant mothers and their babies in various parts of the globe, trying to put in effect preventive and management steps since it is a correctable disease.

Conclusion

The prevalence of maternal anemia was 84.84%. It is significantly associated with preterm delivery, LBW and length, decreased Apgar score, neonatal respiratory distress, and high neonatal death rates. Early neonatal complications such as sepsis, asphyxia, and hypoglycemia had no relation with maternal anemia.

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