ORIGINAL ARTICLE

Sideropaenic anaemia: Impact on perinatal outcome at tertiary care hospital

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Abstract

Objective: To determine association between sideropaenic anaemia among women and adverse perinatal outcome.

Methods: This prospective cohort study was conducted at Civil Hospital a tertiary care hospital in Karachi, from February to August 2011, and comprised pregnant women. The participants were divided into two equal groups: those who had sideropaenic anaemia were in Group A, and those without it were in Group B. Data was collected by random choice (lottery) method. SPSS 13 was used for data analysis.

Results: Of the 234 women, there were 117(50%) in each group. Besides, there were 130(55.5%) women aged 26-30 years, 62(26.5%) 21-25 years and 42(18%) 31-35 years. There were 78(66.7%) cases of preterm births in Group A compared to 23(19.7%) in Group B. Low birth weight was witnessed in 43(36.8%) cases in Group A and in 20(17.1%) cases in Group B. There were 8(6.8%) perinatal mortalities in Group A and 2(1.7%) in Group B. In Group A, 38(32.5%) cases showed Appearance, Pulse, Grimace, Activity, Respiration score <5 at 1 minute compared to 16(13.7%) cases in the other group. Similarly, the score <7 at 5 minutes was recorded in 25(21.4%) deliveries in Group A and 12(10.3%) in Group B.

Conclusion: Sideropaenic anaemia was found to be an important risk factor for adverse perinatal outcome.

Keywords: Sideropaenic anaemia, Preterm birth, Low birth weight, Perinatal mortality, Apgar score, Stillbirth. (JPMA 66: 952; 2016)

Introduction

Sideropaenic anaemia is frequent in pregnancy. According to the World Health Organisation (WHO), around 2 billion people, amounting to over 30% of the world's population, are anaemic. Sideropaenia (iron deficiency) is the most common cause of anaemia. Iron-deficiency anaemia is the most widespread nutritional disorder in the world. The most commonly affected population is children and women. It is estimated that 56 million pregnant women (41.8% of the total) are affected with anaemia, largely, because of iron deficiency.[1]

According to the WHO, pregnancy anaemia exists if haemoglobin (Hb) is lower than 11gm/dL.[1] Definite estimate of haematological pregnant women status for analysis of sideropaenic anaemia implies checking of Hb and serum ferrite level (bivariate criteria).[2] As the mean corpuscular volume (MCV) increases with normal gestation, the reduction in MCV usually seen in iron deficiency is not a reliable marker in pregnancy.[2]

Sideropaenic anaemia has great impact on the health of foetus. Hypoxia due to anaemia has a significant effect on the placenta. The placenta plays an active role of foetal programming during intrauterine life,[3] and placental maturity is required for spontaneous induction of labour.[4] The ability of the foetus in the uterus is presumed to be a function of the placental surface area available for the exchange of respiratory gases and nutrients. Hypoxia is a critical factor in placental development of blood vessels.[5] Many studies have found that low Hb concentration during pregnancy is associated with increased risk for preterm and low birth weight babies, and is also responsible for increased perinatal morbidity and mortality due to increase in preterm birth and in utero growth restriction.[6] Foetal wellbeing score, i.e. Appearance, Pulse, Grimace, Activity, Respiration(APGAR) score, value is also significantly decreased during the first and fifth minute after delivery.[7] However, some studies do not confirm these findings.[8]

The extent to which placental changes caused by maternal anaemia affect foetal development, growth and pregnancy outcome is not clearly understood.[9] The current study was planned to determine if the anaemic mothers have more adverse perinatal outcomes, like preterm birth, low birth weight, perinatal mortality, poor Apgar score values and still birth, than non-anaemic mothers.

The rationale behind this research was to identify areas to which intervention should be targeted. Neonatal intensive care requires the use of technologically

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advanced treatment method i.e. not feasible for poor population. Therefore, intervention could be focused on improving maternal care and preventing causes, and to add to our researches on maternal anaemia and its effect among pregnant women.

Patients and Methods

This prospective cohort research was conducted at Civil Hospital a tertiary care hospital in Karachi from February to August 2011, and comprised pregnant women in the 25-35 years age group. The participants were divided into two equal groups: those who had sideropaenic anaemia in Group A and those who did not were in Group B. Data was collected by random choice lottery method.

Those included were between 20 and 35 years of age, had gestational age 35-42 weeks, single baby pregnancy, spontaneous vaginal delivery, Hb< 11gm/dl and serum ferritin <12 µgm/L in labour and two occasions of current pregnancy during the 3rd trimester.

In contrast, cases showing mothers with multiple pregnancy, delivery by caesarean section (CS), previous history of adverse perinatal outcome and other medical disorders like malaria, chronic medical disorder that can influence outcome to minimise confounding effect were excluded.

Informed consent was obtained from all the participants. A structured questionnaire was administered to each woman in Urdu on the day after delivery. Sociodemographic information and data related to newborns was collected. Sideropaenic anaemia was confirmed when Hb<11/dl and serum ferritin < 12 µgm/L (bivariate criteria) as MCV was not reliable during pregnancy. The exact gestational age of the pregnant women was determined according to date, considering the last menstrual cycle that had been confirmed with ultrasound diagnostic procedures, preterm was delivered before 37 weeks completed, low birth weight considered if the baby weighed < 2,500gm at birth. Perinatal mortality was defined as death of foetus after 24 weeks of pregnancy until 1 week after delivery. 'Still birth' was birth of foetus with no signs of life, with APGAR score at 1 and5 minutes noted. Sample size was calculated as the minimum numbers of subjects in each group with sufficient statistical power (two-sided significance at 0.05 with power of 80%).

SPSS 13 was used for data analysis. Sociodemographic characteristics, medical and obstetrical events were independent variables. Frequency and percentages were calculated. Stratification was done with regards to age, parity, education, employment status and monthly income to see effects on outcome. Results are expressed in frequency, relative risk (RR) and 95% confidence interval (CI). Difference was considered significant at p<0.05.

Results

Of the 234 women, there were 117(50%) in each group. There were 130(55.5%) women aged 26-30 years, 62(26.5%) 21-25 and 42(18%) 31-35 years. Moreover, 135(57.7%) women were illiterate, 39(16.7%) had primary education, 25(10.7%) were educated up to matric, 33(14%) were educated up to high school, and 2(0.85%) had pursued higher than secondary education. Family income of 84(35.9%) participants was in the range of Rs10,000 to Rs15,000 (Table-1).

There were 78(66.7%) cases of preterm births in Group A compared to 23(19.7%) in Group B (RR 2.63; p=0.0001). Low birth weight was witnessed in 43(36.8%) cases in Group A and in 20(17.1%) in Group B (RR 1.58; p=0.001). There were 8(6.8%) perinatal mortalities in Group A and 2(1.7%) in Group B (RR 1.64; p=0.05). In Group A, 38(32.5%) cases showed APGAR score <5 at 1 minute compared to 16(13.7%) cases in Group B (RR 1.6; p=0.001). Similarly, APGAR score <7 at 5 minutes was recorded in

Table-1: Demographic and Socioeconomic Characteristics of Anaemic and Non-anaemic group.

Characteristics	Anaemic group		Non anaemic group	
	No	%	No	%
Age				
21-25	33	28	29	25
26-3o	62	53	68	58
>30	22	19	20	17
Parity				
Primi	42	36	40	34
3-Feb	55	47	59	50
5-Apr	20	17	18	15
Educational status				
Illiterate	62	53	73	62
Primary	21	18	18	15
Matric/SSc	15	13	10	9
Secondary/HSc	19	16	14	12
>sec	0	0	2	2
Employment status				
House wife	65	56	56	48
employed	52	44	61	52
Monthly income				
10,000	31	26	25	21
10,000-15,000	40	34	44	38
15,000-20,000	27	23	32	27
>20,000	19	16	16	14

SSC: Secondary school certificate
HSC: Higher secondary certificate.

Table-2: Association of Maternal Anaemia and Perinatal Outcome among Cases and Controls.

Variables		Anaemic group N=117	Non anaemic group N=117	RR	95% CI	P value
Preterm birth	Yes	78(66.7)	23(19.7)	2.63	1.98-3.5	0.0001
	No	39(33.3)	94(80.3)			
Low birth weight	Yes	43(36.8)	20(17.1)	1.58	1.24-2.006	0.001
	No	74(63.2)	97(82.9)			
Perinatal mortality	Yes	8(6.8)	2(1.7)	1.64	1.17-2.01	0.05
	No	109(93.2)	115(98.3)			
Low Apgar < 5 at 1 min	Yes	38(32.5)	16(13.7)	1.6	1.26-2.04	0.001
	No	79(67.5)	101(86.3)			
Low Apgar < 7 at 5 min	Yes	25(21,4)	12(10.3)	1.45	1.11-1.89	0.02
	No	92(78.6)	105(89.7)			
Still birth	Yes	6(5.1)	1(0.90)	1.75	1.26-2.44	0.055
	No	111(94.)	116(99.1)			

RR= Relative Risk, 95% CI = 95% confidence interval.
Apgar: Appearance, Pulse, Grimace, Activity, Respiration.

25(21.4%) deliveries in Group A and 12(10.3%) in Group B (RR 1.45; p=0.02) (Table-2).

Discussion

Anaemia is well recognised as a major health problem. Sideropaenic anaemia is a common pregnancy disorder. Its prevalence is very high in South Asia, such as India, Pakistan and Bangladesh.[1] Alarmingly high prevalence of this condition in pregnant women has been reported in local studies, including 69.9% in Pakistan,[10] 46% in India,[11] and 50-59% in Bangladesh.[12] Restricted dietary habits, ignorance, poverty and gender bias are possible reasons of this high prevalence.

A study found that demographic parameters are relatively insignificant risk factors of anaemia in pregnancy. Pregnancy in younger age, high parity and illiteracy are still contributing risk factors. A Nigerian study found that more than 81.5% of women with anaemia in pregnancy were teenagers (15-19 years).[13] A study in Bangladesh found high parity and illiteracy as contributing risk factors similar to this study.[14] It is poor, less educated who are affected the most.

Low Hb concentration during pregnancy is associated with increased risk of adverse perinatal outcome, observed in this and other studies. Studies have shown that iron supplementation alone or in combination with folic acid is associated with the well-being of the mother and foetus. It leads to a significant reduction in anaemia incidence during pregnancy and plays a vital role in reducing maternal and foetal morbidity and mortality.[15] Anaemic mother's placenta total volume is similar to placenta for high altitudes pregnancies that are considered as a preplacental hypoxic condition.[15] Hypoxia as a consequence of maternal sideropaenic anaemia causes significant increase of terminal villi blood vessels in 1cm of placental tissues and their total volume.[1] The placenta and foetus grow independently and perceived changes seem to be a compensatory mechanism that develops in order to fulfil foetal needs in the disturbed environment.[4] The anaemia can be a direct cause of deterioration of foetal growth due to lack of oxygen flow to placental tissue or can be an indirect cause of maternal nutrition deficit.[16] Another consequence is that a diminished supply of foetal and placental tissue with iron modulates placental expression of transferring due to foetal and placental needs.[17]

We found a high frequency of low birth weight, preterm birth, perinatal mortality, low Apgar score at 1 and 5 minutes of birth in anaemic mothers. Low birth weight is an important indicator of obstetric care and health status. It continues to remain a major health problem worldwide, especially in developing countries where it is an important determinant of childhood morbidity associated with death during infancy. It has been observed in many studies that anaemic mothers' newborns weighed less than non-anaemic mothers.[9,18] One study in Sudan found that risk of low birth weight babies was 9 times higher in anaemic mothers.[19] Risk of low birth weight in our study was 1.58. A study found risk of 2.2 times for low birth weight babies in anaemic mothers.[20] In India, around 58% of low birth weight newborns' mothers were anaemic.[11] The predicted incidence of low birth weight newborns in anaemic mothers of tribal areas of Pakistan is higher as compared

to non-anaemic mothers.[21] Trials that included a large number of iron-deficient women showed that iron supplementation during pregnancy has a significant effect on incidence of low birth weight.[22] One of the major goals of the United Nations resolution is to reduce the incidence of low birth weight neonates by at least one-third between 2000-2010. "A World Fit for Children" was an important contribution towards Millennium Development Goal (MDG) 4 of reducing child mortality by two-thirds by 2015.[23] It was observed that risk of preterm birth was higher among anaemic mothers. This study found 2.63 times higher risk of preterm birth while another study reported risk of 4 times.[20] Risk of preterm birth was highly significant adverse risk associated with sideropaenic anaemia, also observed in another study.[20] Consistent with our study, association of maternal iron deficiency anaemia and greater risk of preterm birth was observed in other studies as well.[19,20] Along with higher risk of preterm birth, an additional concern related to the effect of iron deficiency on infant health is that preterm infants are likely to have low stores of iron and other nutrients, In the Jamaican Perinatal Survey of 10,000 in 1986, there was a 50% greater chance of mortality in the first year of life for those infants whose mothers had not been given iron supplements during pregnancy.[24] At the same time, a few studies did not find significant effect of iron deficiency during pregnancy on preterm birth and small for gestational age newborns.[8] Major cause of perinatal mortality is still birth and intrauterine death. In India, 100% mothers of still born and intrauterine death were anaemic.[11] In this study, risk of perinatal mortality was 1.75 times compared to 2.5 times in a local study.[20] Our finding of a higher risk of in-utero death and overall perinatal mortality amongst anaemic mothers was also demonstrated in many studies.[10,29] Better Apgar score signifies the status of well-being of the foetus. Higher maternal Hb concentration were correlated with better Apgar score (>7) and with a lower risk of birth asphyxia. Risk of poor Apgar score < 5 at 1 minute and <7 at 5 minutes was observed in this study. Lower Apgar score risk at birth was 1.8 times among anaemic mothers in one local study.[20] When pregnant women were treated with iron or a placebo in Niger, Apgar score of newborn was significantly higher in those mothers who received iron.[25] An association between maternal sideropaenic anaemia and adverse perinatal outcome has been observed.

This study had its limitations, including small sample size and the fact that it was conducted at a single hospital which may not necessarily reflect community situation. Since most women in Pakistan deliver at home, the burden of anaemia can be expected to be much higher outside the hospital setting. Likewise, effort was made to limit confounders with a strict exclusion criterion, but conditions such as malaria, nutritional deficiencies of foliate and vitamin B12, as well as human immunodeficiency virus (HIV) can trigger anaemia.

To reduce the burden of this problem and related morbidity, measures need to be implemented at community level. Education of girls, delaying age of marriage and creating awareness of pregnant women regarding the risks of adverse pregnancy outcomes with anaemia can help reduce this burden. Effective antenatal care and education of balanced diet can help to decrease maternal and perinatal mortality. Routine iron and folic acid supplementation should be considered important for the prevention of iron deficiency anaemia in high-risk groups.

Conclusion

The burden of sideropaenic anaemia was alarmingly high. It was an important risk factor for adverse perinatal outcome. Maternal sideropaenic anaemia was found associated with increased risk of delivery of preterm birth, low birth weight, low APGAR score at 1 minute of birth and perinatal mortality. In developing countries like Pakistan, maternal anaemia remains a cause of considerable perinatal mortality and morbidity. Importance of consumption of iron with folic acid to prevent development of anaemia and adverse perinatal outcome were confirmed.

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Conflict of Interest: No.

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References

1. WHO. Haemoglobin concentration for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva: WHO, 2011.
2. Clark P, Andrew J, Thomson, Ian A, Greer. Hematological problems in pregnancy. In: Keith Edmonds eds. Dewhursts text book of obstetrics & gynaecology, 8thed.Hoboken: Wiley-Blackwell, 2012; pp 151-72.
3. Waterland RA, Michels KB. Epigenetic epidemiology of the developmental origins hypothesis. Annu Rev Nutro. 2007; 363-88.
4. Benirschke K, Burton GJ, Baergen RN. Pathology of the human placenta, 6th ed. Berlin Heidelberg: Springer, 2012.
5. Huang A, Zhang R, Yang Z. Quantitative Stereological Study of placental structures in women with pregnancy iron- deficiency anaemia. Eur J ObstetGynecolReprod Biol. 2001; 97:59-64.
6. Kumar KJ, Asha N, Murthy DS, Sujatha M, Manjunath V. Maternal anaemia in various trimesters and its effect on newborn weight and maturity: An observational study. Int J Prev Med. 2013; 4:193-9.
7. Leflamme EM. Maternal haemoglobin concentration and pregnancy outcome: a study of the effects of elevation in EL ALTO, Bolivia. Mcgill J Med. 2011; 13:47.
8. Imdad A, Bhutta ZA. Routine Iron/ Folate supplementation during

pregnancy: effect on maternal anaemia and birth outcomes. Paediatr Perinat Epidemiol. 2012;26 Suppl 1:168-77.
9. Lelic M, Bogdanovic G, Ramic S, Brkicevic E. Influence of maternal anaemia during pregnancy on placenta and newborns. Med Arch. 2014; 68:184-7.
10. Jaleel R, Khan A. Severe anaemia and adverse pregnancy outcome. J Surg Pak. 2008; 13:147-50.
11. Kumar P, Pore P, Patil U. Maternal anaemia and its impact on perinatal outcome in a tertiary care hospital of Pune, in Maharashtra. I JBAMR. 2012; 1:111-9.
12. HKI, Bangladesh. Anaemia is a severe public health problem in pre-school children and pregnant women in rural Bangladesh. Nutritional Surveillance Project Bull. 2002; 10:1-4.
13. Idowa OA, Maham CF, Satloye D. Anaemia in pregnancy : A survey of pregnant women in Abeokuta, Nigeria. Afr Health Sci. 2005; 5:295-9.
14. Mahamuda B, Tanira S, Feroza W, Perveen HA &Shamim A. Effects of maternal anaemia on neonatal outcome- a study done in the specialized urban hospital set up in Bangladesh. Bangladesh Journal of Medical Science. 2011; 10:177-80.
15. Mayhew TM. Changes in fetal capillaries during preplacental hypoxia: growth, shape remodeling& villous capillarization in placenta from high altitude pregnancies. Placenta. 2003; 234:191-8.
16. Yildiz Y, Ozgu E, Unlu SB, Salman B, Eyi EG. The relationship between third trimester maternal haemoglobin & birth weight/ length; results from the tertiary care centre in turkey. J MaternFetal Neonatal Med. 2014; 27:729-32.
17. Yang MF, Pressman E, Guillet ML, Orlando M, McIntyar AW, Lafond J, et el. Impact of maternal & neonatal iron status on placental transferring receptor expression in pregnant adolescents. Placenta. 2010; 31:110-4.
18. Ahmed MO, Kulsoom U, Sughra U, Hadi U, Imran M. Effect of maternal anaemia on birth weight. JAMC. 2011; 23:77-9.
19. Elhassan EM, Abbaker AO, Haggaz AD, Abubakar MS, Adam I. Anaemia & low birth weight in Medani, Hospital Sudan. BMC Research Note. 2010; 3:181.
20. Lone FW, Qureshi RN, Emanuel F. Maternal anaemia & its impact on perinatal outcome.Trop Med Int Health. 2004; 9:486-90.
21. Badshah S, Mason L, McKelvie K, Payne R, Lisboa PJ. Risk factors for low birth weight in the public - hospital at Peshawar, KPK-Pakistan. BMC Public Health. 2008;8:197.
22. Lin HC, Lin HC, Chen SF. Increased risk of low birth weight and small for gestational age infants among women with tuberculosis. BJOG. 2010; 117:585-90.
23. United Nations. Resolution adopted by the General Assembly. In S- 27/2. A world fit for children. New York: United Nations; 2002.
24. Greenwood R, Golding I, Mc Caw- Binns A, Keeling I, Ashley D. The epidemiology of perinatal death in Jamaica. Paediatr Perinat Epidemiol.1994; Suppl 1:143-57.
25. Prezosi P, Prual A, Galan P, Daouda H, Boureima H, Hercherg S. Effect of iron supplementation on the iron status of pregnant women: consequences for newborns. Am J ClinNutr. 1997; 66:1178-82.