Original Article

Injectable Iron and Blood Transfusion for Correction of Anemia in Pregnancy in a Peripheral Tertiary Hospital in Bangladesh: A Quasi-Experimental Study

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Abstract

Background: Anemia in pregnancy is one of the most commonly encountered medical disorders. ***Objective:*** To compare the effects of injectable iron and blood transfusion for correction of anemia in pregnancy. ***Methods:*** This quasi-experimental study was conducted in the Obstetrics & Gynaecology outpatient department (OPD) of Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh, between April and December of 2020on 100 expecting mothers through interviews, investigation of hemoglobin (Hb) level at 16 weeks, 24-28 weeks and 36 weeks. The injectable iron and blood transfusion were the experiments given to the pregnant women around 24-28 weeks.The effect of the experiment along with other factors were assessed over the change of Hb level from 24-28 weeks to 36 weeks. ***Results:*** Only iron injection singly significantly improved Hb level (1.4 mg/dl, $p<0.001$) though it improved a little in combination with blood transfusion (0.472 mg/dl, $p=0.15$) too, but blood alone was associated with decreased Hb level (-0.414 mg/dl, $p=0.07$). Other factors were not related to the change. ***Conclusion:*** Iron injection improves hemoglobin status and should be given to all anemic women irrespective of presence or absence or other risk factors.

Keywords: Anemia, pregnancy, injectable iron, blood transfusion, anemia correction

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Introduction

Anemia in pregnancy is one of the most commonly encountered medical disorders with an overall global prevalence of around 56%[1]. Females are usually found to be anemic[2], which becomes obvious during pregnancy, contributing to 20-40% of maternal deaths[3]. In this situation, the risk of death is double in developing countries[4]. Albeit the intervention options are limited to oral iron therapy, injectable iron and blood transfusion[5] or a combination of any or all of these, the prevalence of anemia during pregnancy in Bangladesh remains over 25%[6,7]. The treatment options include dietary sources, oral, intravenous or intramuscular iron therapy, blood transfusion of the combination of any of the above[8].

Study shows that anemia is more prevalent in second trimester hence focus the importance of intervention during this period of time[3,9]. With a high prevalence of anemia in pregnancy[6,7,10], the need to assess the effective intervention has become a necessity in a recourse-compromised country like Bangladesh. World Health Organization (WHO)[11] targeted a 50% reduction of anemia in women of reproductive age. Oral iron therapy has been a common treatment option during pregnancy, though non-adherence, infection, coexisting morbidity or incorrect diagnoses have led to treatment failure[8]. Besides oral iron, researchers have tried intravenous, intramuscular, blood transfusion or other intervention options[8,12-17] to correct anemia in pregnancy. We find information of post-partum anemia correction[18], but there is a knowledge gap comparing blood transfusion and intravenous iron therapy, or a combination of these two to the patients, the effectiveness of these two interventions for improvement of anemia needs to be examined. We aimed to compare the effect

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of injectable iron and blood transfusion to correct anemia in pregnancy in a peripheral tertiary health care facility, to refute the null hypothesis that the intervention is not effective.

Methods

This quasi-experimental study was conducted in the Obstetrics & Gynaecology outpatient department (OPD) of Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh, between April and December of 2020 on 100 willing pregnant women who completed a minimum of three antenatal visits. Expecting mothers who declined to participate, or who had severe co-morbidities were excluded. We recorded age (completed years), education level, address, religion, gravida, blood group, Rh typingand serum hemoglobin at 16, 24-28 and 36 weeks. History of iron intake, sun exposure, progesterone therapy, eggs and fruits consumed per week, thalassemia, iron injection, blood transfusion were among the suspected factors. The questionnaire was developed based on the important factors from different studies and reviewed afterwards by an expert panel of clinicians and epidemiologists.The experiments consisted of iron supplementation and/or blood transfusion, after first trimester as indicated by their Hb concentration, so we took 24-28 weeks as baseline and checked whether iron supplement and/or blood transfusion could improve their blood Hb at 36 weeks of pregnancy or not.

We recorded the data in excel after collection and cleaned to remove any stroke or data error. After data management in excel, the product was exported to SPSS where the final analysis was done, the figures were constructed in excel though. We operationalized Hb category taking ≥11 mg/dl as normal, 10.1-10.9 mg/dl as mild, 7.0 to 10.0 mg/dl as moderate, and <7 mg/dl as severe anemia respectively. We assessed numeric and categorical anemia variable with the demographic and other related variables using Mann Whitney U and Kruskal-Wallis test. We deducted Hb level of 24-28 weeks from 36 weeks to compute the change as outcome variable. Because the interventions were mixed up as some patients got only iron injection, some only blood transfusion and some both, we computed a new variable of intervention classifying those who took only iron injection, those who took only blood transfusion and those who took both the intervention. We applied non-parametric test to assess the variables as the sample size was small and also continuous variables showed skewed distribution. Finally, we conducted generalized linear model analysis taking the significant factors from the univariate and bivariate analysis. We also included some clinically important though non-significant variables like iron intake, thalassemia, assumed to be confounding with the Hb concentration. Because almost invariably we advise for oral iron to all patients, as happened here too, added with the clinical experience and practice, we did not assess the oral iron with injectable one in the model.

The quantitative variables are presented as mean±standard deviation (SD), minimum (Min) and maximum (Max), while the qualitative variables are presented as frequency and percentage. We considered a p value of ≤0.05 to be significant in our study.

Results

Table 1 shows the baseline information of the respondents. The respondents were 25.04±4.27 years of age, almost 50% of them had secondary education. There was a nearly homogeneous distribution of their address. A half of them were primigravida. Around 90% of them were Muslims; A+ve, B +ve and O +ve blood group were almost equally distributed around 30% each. Figure 1 depicts the anemia status before and after intervention that the intervention significantly ($p<0.001$) shifted the severe and moderate anemia to mild and normal anemia. There were only 2 severe anemia which turned to moderate anemia after intervention. While looking at the hemoglobin status, we observed that the hemoglobin level decreased from first to second trimester, which again increased in third trimester. The minimum and maximum Hb level in third trimester roamed around the level of first trimester, though the mean Hb was a little higher than that of first trimester. Looking at the category of anemia in Table 2, we detected that the Hb level improved from second to third trimester indicating the effectiveness of the intervention. We constructed a general linear model to assess the change of Hb status by the intervention and other significant factors keeping age as covariate (Table 4). The model showed that only iron injection was significantly associated with improvement of Hb level by 1.4 mg/dl adjusting for other variables. Only blood transfusion was associated with a reduction of Hb level by 0.414 mg/dl. Other variables could not show any significant relation with the change.

Table 1. Basic demographic information of the respondents

Variables	Mean ± SD / N	Min-Max / %
Age	25.01 ± 4.26	18-36
Education		
Illiterate	2	2.0
Primary	29	28.7
Secondary	48	47.5
Graduate and above	22	21.8
Address		
Rural	58	57.4
Urban	43	42.6
Gravida		
1	52	51.5
2	25	24.7
>2	24	24.8
Religion		
Muslim	88	87.1
Non-Muslim	13	12.9
Blood group		
O +ve	32	31.7
A -ve	3	3.0
A +ve	28	27.7
B -ve	1	1.0
B +ve	30	29.7
AB +ve	7	6.9

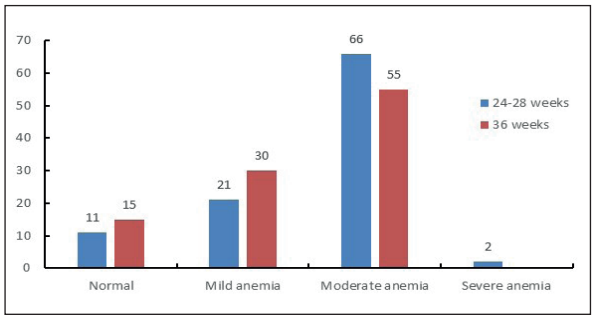

Fig. 1. Status of anemia before and after intervention

Table 2. Hemoglobin status at first, second and third trimester including change from second to third trimester after the intervention (N=100)

Weeks of pregnancy	Mean	SD	Min	Max
16 weeks	9.80	1.10	7	12.7
24-28 weeks	9.50	1.09	6.4	7.1
36 weeks	9.92	0.99	7.1	12.4
Weeks of pregnancy	Normal	Mild	Moderate	Severe
16 weeks	14	23	63	0
24-28 weeks	11	21	66	2
36 weeks	15	30	55	0

We evaluated several factors with Hb change, but none of those were associated with the Hb change except for the intervention variable ($p<0.001$) and Thalassemia ($p=0.03$). Table 3 showed that only iron injection significantly improved the Hb level by 1.5 mg/dl. Strikingly, only blood transfusion could not improve the Hb, rather the Hb decreased from 24-28 weeks to 36 weeks by 0.24 mg/dl even after blood transfusion. Similarly, oral iron intake couldn't improve the Hb level rather it was almost significantly higher in those who didn't take iron therapy. The significance was being contributed by iron injection only as appeared in post hoc test (data not shown).

Table 3. Second to third trimester change of hemoglobin with the factors

Variables	N	Mean	SD	p value
Religion				
Muslim	88	0.38	0.92	0.25
Non-Muslim	13	0.70	1.23	
Address				
Rural	58	0.51	1.01	0.26
Urban	43	0.29	0.88	
Education				
Illiterate	2	-0.35	0.49497	
Primary	29	0.52	1.11	0.64
Secondary	48	0.37	0.93	
Graduate and above	22	0.45	0.85	
Gravida				
1	52	0.39	0.93	
2	25	0.57	1.21	0.62
>2	24	0.31	0.71	
Blood group				
O +ve	32	0.365	0.91	
A -ve	3	0.97	0.45	
A +ve	28	0.45	1.20	0.86
B -ve	1	0.50	.	
B +ve	30	0.47	0.88	
AB +ve	7	0.11	0.67	
Sun exposure				
No	54	0.47	1.07	0.52
Yes	47	0.35	0.82	
Egg/week				
0	9	0.27	0.57	
3	7	0.00	0.79	
4	4	0.98	0.75	0.50
5	1	-0.20	.	
7	80	0.45	1.01	
Fruits/week				
0	10	0.39	0.67	
2	1	0.80	.	
3	8	-0.05	0.74	0.59
4	3	1.03	0.91	
5	1	-0.20	.	
7	78	0.45	1.01	
Oral iron intake				
No	17	0.81	0.92	0.06
Yes	84	0.34	0.95	
Progesterone therapy				
No	54	0.38	0.96	0.67
Yes	47	0.46	0.96	
Thalassemia				
No	95	0.45	0.98	0.03
Yes	6	-0.02	0.35	
Intervention				
No intervention	51	0.08	0.69	
Iron injection	27	1.47	0.89	
Blood transfusion	18	-0.24	0.43	<0.001
Both	5	0.54	0.52	

Table 4. General linear model to predict hemoglobin change

Parameter	Coefficient	p value
A (Intercept)	0.541	0.28
Blood + iron*	0.472	0.15
Only blood	-0.414	0.07
Only iron*	1.400	<0.001
Thalassemia	0.314	0.37
Age	-0.006	0.72

* Iron = injectable iron

Discussion

Our study excavated that fact that injectable iron can be a key management option to correct anemia in pregnancy. Other interventions like blood transfusion only and mixed intervention (blood transfusion and iron injection) cannot be regarded as treatment of choice to manage anemia in pregnancy, though we adopt these intervention preferences in our clinical setting. The present study is unique as we compared injectable iron and blood transfusion with and without combination, while other researchers compared oral iron with injectable iron, intravascular iron with intramuscular iron and other different combinations[12,13,17,19-21]. Though oral iron has been the first line of management choice in pregnancy[22], the clinical experts experienced that intravenous iron works better than oral iron. Even researchers found that oral therapy throughout the pregnancy failed to meet the purpose of iron therapy[12]. They advocated to assess the factors related to anemia so that proper treatment decision can be made[23]. Of the different interventions tried by different researchers, intravenous iron therapy proved to improve the Hb better than other intervention options[16]. Our study and other study findings bring about a question on rationality of the decision for blood transfusion. If the blood transfusion has got a small or no role as evidenced in our study, we should be more cautious about the cause of anemia before deciding for transfusion.

Out of different determinants of anemia, iron deficiency has been common in developing world so far research has been explored[1,9,23-25] with adverse pre, intra and post-natal outcomes[4,26]. As the pregnant women commonly suffer from this problem[3,7,12,23], researchers recommended for iron therapy to prevent the adverse outcome during and after pregnancy. Though age has been identified a risk factor related with anemia in pregnancy[1], we didn't find any relation with the improvement of Hb in our study.

Antenatal care (ANC) and gestation age at first ANC were related to anemia[24]. Researchers in Ghana showed that regular ANC visit can significantly improve the Hb level. This brings us an addressable limitation in our study which we learned after the collection of data and analysis. Researchers recommended different prevention strategies to prevent anemia in pregnancy. Of the options, women education especially nutrition education, deworming, diagnosing and treating chronic diseases in early pregnancy, government and non-government initiative through long term policy have been the key steps suggested by them[27].

Though our study significantly established the iron therapy to improve the Hb status of the pregnant women, we can't claim the strength of this study as it was not a randomized controlled trial (RCT). Being a quasi-experimental study, we should have adjusted other confounding factors such as ANC history, helminthic infestation and comorbidities.

Conclusion

Our study finding emphasized the fact to investigate the cause of anemia before initiating any treatment to correct anemia. As different study suggested that iron deficiency is the main cause of anemia in pregnancy in our population, we should keep in mind to prefer injectable iron over blood transfusion during pregnancy.

Conflict of Interest: The authors declare no conflict of interest.

Ethical approval: Ethical approval was obtained from Ethical Review Committee of Shaheed Ziaur Rahman Medical College, Bogura, Bangladesh.

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Authors'contribution:SMBB and FKN designed the study; FKN collected data and entered in excel; SMBB analyzed data in SPSS;SMBB and FKN wrote the manuscript, reviewed, and finalized the draft.

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