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Research Article

A Preliminary Study on Parenteral Intravenous Iron Sucrose (IVIS) Therapy in Managing Anaemia among Pregnant Women in Primary Care Setting of Rural Haryana

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I N F O

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A B S T R A C T

Background: Intravenous iron sucrose (IVIS) therapy is a newly introduced service component for combating moderate anaemia in pregnant women by the Haryana state as a public health measure from the year 2014.

Aim: The aim of this study was to ascertain the effect of IVIS therapy on pregnant females having anaemia who were receiving this therapy in a primary care setting.

Method: This prospective study was conducted at a randomly selected rural Primary Health Centre (PHC) in the Nuh district. 138 moderately anaemic females were given the standard form of IVIS therapy. The study subjects were requested to repeat haemoglobin levels after 2 weeks and 4 weeks of receipt of the last dose of therapy.

Results: Of the total 154 anaemic pregnant women, 138 (89.6%) were diagnosed to have moderate anaemia. The number of study subjects with moderate anaemia reduced from 138 to 54, (54.54% reduction) when haemoglobin level was measured at the end of 4 weeks (endline). The mean rise in haemoglobin level among moderately anaemic pregnant females was 1.62 g/dL. At the end of 4 weeks (endline), 73.75% of the study subjects achieved normal levels of haemoglobin (from a total of 80 moderately anaemic women measurement).

Conclusion: The mean rise in haemoglobin level in moderately anaemic pregnant females was 1.62 g/dL among participants who received IVIS therapy in a primary care setting in an underprivileged area in Haryana state. The women having severe anaemia achieved a better rise in Hb levels.

Keywords: Moderate Anaemia, Parenteral Iron Therapy, Haemoglobin Level, Pregnancy, Iron Sucrose Complex

Introduction

India still remains the home for 5.7% of pregnant women (aged 15-49 years) with anaemia of any grade during the course of their pregnancy.[1] Anaemia among pregnant women is a major problem with respect to a populous country like India, and it has remained stubbornly resistant to improvement despite multiple efforts. Its adverse impact is seen in the form of substantial maternal and infant deaths.[2] Anaemia among pregnant women may lead to poor maternal and child health outcomes as well. Iron deficiency is considered the main reason for anaemia in pregnant women in the Indian scenario.[3]

Parenteral iron preparations have shown certain advantages over oral iron in various scientific reports, especially issues related to poor adherence to oral iron.[4] The overall prevalence of anaemia among pregnant women in the Nuh district of Haryana state is high i.e., 78.6% than that in the rest of Haryana (55.0%).[5] Haryana state in Northern India adopted Intravenous iron sucrose (IVIS) therapy, as a public health measure, for combating moderate anaemia in pregnant women from 2014.[6]

IVIS therapy is a newly introduced service component because the use of an injectable form of iron was rolled out to combat anaemia as a national initiative first time in the history of India. Rolling out services at the level of primary health care remains a challenge. With this study, the researchers wanted to inform the ongoing IVIS programme about the improvement needed in the adherence to IVIS therapy, thus improving its effectiveness. The aim of this investigation was to ascertain the effect of IVIS therapy on pregnant females having anaemia receiving IVIS therapy in a primary care setting.

Materials and Method

The present prospective study was planned and rolled out under the aegis of the Department of Community Medicine at a tertiary care teaching medical college situated in the Nuh district of southern Haryana. The study was conducted for a period of four months from October 2020 to January 2021.

In this prospective study, multistage sampling was used for the purpose of data collection. In the 1st stage, one rural Primary Health Centre (PHC) was randomly selected from the list of rural PHCs of district Nuh. In the 2nd stage, from the randomly selected PHC, one day (1st day of data collection) was chosen randomly or by lottery method. In the 3rd stage, subsequent days of data collection were chosen by systematic random sampling. Pregnant females who were unable to tolerate oral iron, had moderate anaemia (Hb between 7 and 9.9 g/dL), and were in the 2nd or 3rd trimester of pregnancy were included in this study.

During the study period of four months, a total of 154 pregnant women were diagnosed having anaemia. Of these 154 anaemic pregnant women, 138 were diagnosed to have moderate anaemia (Hb between 7 and 9.9 g/dL). As per the government guidelines, a pregnant female becomes eligible for IVIS therapy if her haemoglobin level ranges from 7 to 9.9 g/dl in the 2nd or 3rd trimester of pregnancy. Thus 138 moderately anaemic females were eligible to receive IVIS therapy and therefore were counselled about the therapy. Study subjects found eligible were administered a total dose of 400 mg of iron sucrose in injectable form. The total dose was divided into four equal parts. Each dose contained 100 mg of injectable iron sucrose. Each dose was given as an infusion and after dilution in 100 ml normal saline on alternate days. Infusion was given slowly for an initial five to ten minutes so as to observe adverse reactions, if any. The remaining infusion was given over a period of thirty minutes. The remaining three doses of iron sucrose were given on alternate days. The participants were requested to repeat haemoglobin levels any time after 2 and 4 weeks of receipt of the last dose of IVIS therapy.

Ethical clearance was obtained vide letter number EC/OA-37/2020. Written informed consent was obtained from all the study subjects. Statistical analysis was performed with SPSS software version 22. Interpretation of results was done with appropriate statistical tools.

Results

Data of 154 participants were analysed and presented as preliminary findings in this study. 64.9% of the subjects (n = 100) were in the age group of 21-30 years, 83.1% of subjects (n = 128) were Muslim, and 49.4% were illiterate. The age of study participants at first childbirth was 21 years or less in 64.3% (n = 99) of subjects (Table 1).

Table 1. Distribution of Study Participants according to Selected Baseline Characteristics

Socio-demographic Variables	Frequency	Percentage
Age group (years)		
< 21	38	24.7
21-30	100	64.9
> 30	16	10.4
Religion		
Muslim	128	83.1
Hindu	25	16.2
Sikh	1	0.7
Literacy status		
Illiterate	76	49.4
Literate	78	50.6

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Age at first childbirth (years)		
≤ 21	99	64.3
> 21	55	35.7
Gravida status		
Primigravida	42	27.3
Multigravida	112	72.7

All these women were anaemic pregnant women in the second and third trimesters. Intravenous iron sucrose (IVIS) therapy was given to moderately anaemic pregnant women. Of the total 154 anaemic pregnant women, 138 (89.6%) were diagnosed to have moderate anaemia (Hb between 7 and 9.9 g/dL) (Table 2).

The number of study subjects with moderate anaemia reduced from 138 to 54, (54.54% reduction) when measured at the end of 4 weeks (endline). Similarly, the reduction in moderate anaemia was 37.65% at the end of 2 weeks (mid-term measurement) (Table 3).

The overall mean rise in haemoglobin levels was 2.15 g/dL. Haemoglobin levels were 7.78 g/dL at baseline and 9.93 g/dL at the end of 4 weeks (endline), whereas in moderately anaemic pregnant women, the mean rise in haemoglobin levels was 1.62 g/dL. Haemoglobin levels were 7.98 g/dL at baseline and 9.60 g/dL at the end of 4 weeks (endline). Changes in haemoglobin levels at baseline and endline were found to be statistically significant ($p < 0.001$) (Tables 4 and 5).

Overall, normal haemoglobin levels were noted among 38.31% of pregnant females at the end of 4 weeks among 154 anaemic study subjects. Normal haemoglobin levels were noted among 73.75% of pregnant females (from a total of 80 moderately anaemic women at mid-term measurement) at the end of 4 weeks (endline measurement). Normal haemoglobin levels were noted among 3.90% and 7.5% of pregnant females among 154 women and 80 moderately anaemic women respectively at the end of 2 weeks (mid-term measurement) (Table 6).

Table 2.Profile and Pattern of Anaemic Pregnant Women during the Course of IVIS Therapy

Grade of Anaemia	0 Weeks (Baseline)		At the End of 2 Weeks (Mid-term)		At the End of 4 Weeks (Endline)	
	Number of pregnant women	Percentage	Number of pregnant women	Percentage	Number of pregnant women	Percentage
Normal	-	-	6	3.89	59	38.31
Mild	-	-	61	39.61	38	24.68
Moderate	138	89.6	80	51.95	54	35.06
Severe	16	10.4	7	4.55	3	1.95
Total	154	100	154	100	154	100

Table 3.Proportional Change at Various Intervals among Moderately Anaemic Pregnant Women

Timeline	Moderately Anaemic Pregnant Women n (%)	Proportional Change (%)		
0 weeks (Baseline)	138 (89.6)	37.65		54.54
At the end of 2 weeks (Mid-term)	80 (51.95)		16.89	
At the end of 4 weeks (Endline)	54 (35.06)			

Table 4.Mean Values of Haemoglobin Levels of Anaemic Pregnant Women during the Course of IVIS Therapy

Mean Values of Hb	0 Weeks (Baseline)			At the End of 2 Weeks (Mid-term)			At the End of 4 Weeks (Endline)			P value*
	Mean	SD	95% CI	Mean	SD	95% CI	Mean	SD	95% CI	
Total (overall)	7.78	0.72	7.70, 7.84	8.66	0.95	8.59, 8.74	9.93	1.15	9.76, 10.02	< 0.001
Moderate anemia	7.98	0.88	7.74, 8.01	8.52	1.03	8.43, 8.59	9.60	1.22	9.51, 9.70	< 0.001
*t test application for baseline and endline values										

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Table 5.Mean Change in Haemoglobin Level among Pregnant Women (Overall & Moderate Anaemia)

	Mean Change in Haemoglobin Level		
Mean values of Hb	**Mean**	**SD**	**95% CI**
Total	2.15	1.68	2.04, 2.27
Among moderately anaemic pregnant women	1.62	1.33	1.52, 1.70

Table 6.Improvement to Normal Haemoglobin Levels from Total and Moderately Anaemic Pregnant Women during the Course of IVIS Therapy

Grade of Anaemia	0 Weeks (Baseline)	At the End of 2 Weeks (Mid-term)		At the End of 4 Weeks (Endline)	
	Number of pregnant women	Number of pregnant women	Change to normal (%)	Number of pregnant women	Change to normal (%)
Normal	-	6	3.90 (from total 154 women)	59	38.31 (from total 154 women)
Mild	-	61	-	38	-
Moderate	138	80	7.5 (from total 80 moderately anaemic women)	54	73.75 (from total 80 moderately anaemic women)
Severe	16	7	-	3	-
Total	154	154	-	154	-

Discussion

The present investigation assessed the effectiveness of IVIS in terms of the change in Hb level among anaemic pregnant women receiving IVIS therapy in a primary care setting in rural Haryana. In this study, we observed that the mean rise in Hb level among moderately anaemic pregnant women who received IVIS therapy in primary care setting was 1.62 g/dL (95% CI: 1.52, 1.70). Another study that assessed the mean rise in Hb level among moderately anaemic pregnant women in a primary care setting observed that it was 1.65 g/dL (95% CI: 1.56, 1.75).[7]

The mean rise in haemoglobin levels was noted as 1.62 g/dL among pregnant females having Hb levels between 7 and 9.9 g/dL in this study. Gupta A et al. conducted a study in Delhi among antenatal subjects having Hb levels from 7 to 9 gm%. The period of gestation ranged from 32 to 35 weeks among study subjects. The mean rise in Hb levels (in gm%) was noted as 0.56, 1.44, and 2.0 on days 14, 21, and 28 respectively.[8] Shrivastava D et al. conducted a cohort study in a rural set-up among 256 anaemic females. They were treated with IVIS therapy. The study reported a mean rise in Hb levels (in gm%) at the end of 1, 2, and 3 weeks as 1.1, 2.3, and 3.0 respectively.[9]

In this study, it was noted that the proportion of pregnant women who achieved normal Hb level was 73.75% (from a total of 80 moderately anaemic women) at the end of 4 weeks (endline measurement). At the same time, it is worthy to note that 54 women (of 138) remained moderately anaemic even after IVIS therapy. The excess iron pumped into the body causes oxidative damage to the body, hence the risks and benefits of IVIS therapy must be kept in mind as it is being used as a public health measure to tackle anaemia in pregnancy in the state. These oxidative damages have been found to produce some kind of neuropathies, cardiovascular diseases, and even cancers as well.[10-13] Study of such complications was beyond the scope of this study as such kinds of complications take a long time to develop and this study was conducted for a duration of four months.

When a public health programme is rolled out over a large and diverse geographical area and implemented with the help of a vast workforce, it is easy to recommend a simple and uniform guideline as thumb rules without many complexities. Probably that could be the reason, a uniform dose of 400 mg of IVIS irrespective of the Hb level of an individual pregnant woman, was considered in the guidelines of IVIS therapy. The doctor posted at a PHC can calculate the dose of iron sucrose needed for an individual lady with the help of formula. The author does not know the status of doctors who were available at PHCs in Haryana in 2014 when it was rolled out but as per the recent reports of the government of Haryana, 542 doctors were in position against the requirement of 379 doctors at PHCs in Haryana state.[14] In this scenario, an idea of advocating customised iron dose administration based on Hb level and pre-pregnancy weight of the pregnant women can be instituted. Calculation of the exact dose of

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iron sucrose depending on the haemoglobin status of an eligible candidate is possible when there is no shortage of doctors. It may be beneficial for anaemic women as a large number of them did not become non-anaemic despite IVIS therapy. Probably this is the reason that the government did not issue any guidelines to calculate Hb estimation at an individual level while releasing guidelines for IVIS therapy whereas such guidelines were released with the rollout of Anaemia Mukt Bharat later on.

Regarding fall and rise of haemoglobin levels in the course of normal pregnancy, haemoglobin level falls till 20 weeks of gestation and remains constant till 30 weeks of gestation and then rises slowly after that.[15,16] In the case of oral iron, results are expected after a period of 3 months of oral iron supplementation. On the other hand, a majority of published literature had measured Hb levels keeping the interval between the last dose of IVIS and Hb measurement at least 4 weeks.[4,7-9] Considering the inherent advantage of the parenteral iron route of IVIS therapy, it is believed that a change in Hb level after receipt of therapy is likely to become apparent much earlier as compared to the case of oral iron.

There are certain challenges that were encountered in the study which can lead to observation bias. Due to inadequate laboratory support in its underserved area, serum ferritin levels could not be captured, thus the researchers were not in a position to comment on body iron reserve. Poor nutritional status affects the haemoglobin levels but analysis of the nutritional status was not part of this study. That's an evident limitation of this investigation. It is important to note here that this study has been conducted in a rural set-up with a weak health system where only 12.8% of pregnant females received one antenatal check-up in the 1st trimester as per the District Level Health Survey 4 (DLHS4).[17] The possibility of a pregnant female in this area registering herself at a primary level health care set-up, at a stage where the gap between the last dose of iron sucrose and delivery would be more than sixteen weeks, is low. Thus it can be assumed that the set-up of this study reflects a representative set-up of rural India. The author felt difficulty in comparing results in this aspect as various studies with which the comparison was supposed to be done, were different in formulating inclusion criteria, grades of anaemia, and especially the time of endline comparison.

Conclusion

The mean rise in Hb level among moderately anaemic pregnant women was 1.62 g/dL among participants who received IVIS therapy in the primary care setting of an underprivileged area of Haryana state. Those having severe anaemia achieved a better rise in Hb levels. We recommend the idea of tailoring the dose of iron depending on the haemoglobin level and weight of the pregnant female before the pregnancy.

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Conflict of Interest: None

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