

# Efficacy of Intravenous Iron Therapy on Mean Rise in HB (Hemoglobin) Level in Children not responding to Oral Iron Therapy in Iron Deficiency Anemia

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## ABSTRACT

**Aim:** to determine the effect of intravenous iron therapy on mean rise in Hb (Hemoglobin) level in children not responding to oral iron therapy in iron deficiency anemia.

**Study design:** Quasi Experimental Study.

**Duration:** The study was conducted from Sept 2012 to March 2013.

**Settings:** Department of Pediatrics, Military Hospital, Multan.

**Methods:** A total of fifty (50) cases between 1-10 years of both sexes visiting outpatient department (OPD) at Military Hospital Multan having Iron deficiency anemia of less than 8 g/dl not responding to three months of oral iron therapy were included in the study.

**Results:** In this study, mean and sd for age was calculated as 6.75±2.69 years, 30(60%) were male and 20(40%) were females, mean Hb levels(g/dl) calculated at base line (before therapy) were 7.12±0.59 Hb g/dl while these findings after therapy were recorded as 9.33±0.50 g/dl,

**Conclusion:** We concluded that iron therapy when used intravenously for rise in mean Hb (Hemoglobin) level in children not responding to oral iron therapy in iron deficiency anemia are an effective treatment and may be recommended in our population.

**Keywords:** Children, Iron deficiency anemia, not responding to oral therapy, intravenous therapy,

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## INTRODUCTION

Anemia is defined as decreased concentration of hemoglobin and red blood cell mass compared with that in age matched controls. Prevalence of iron deficiency anemia in Pakistan is around 10% in healthy children<sup>1</sup>. A common cause of iron deficiency anemia (IDA) is poor dietary iron intake, especially in the children who are suffering from malnutrition, worm infestations, malabsorption and occult gastrointestinal blood loss. Other causes of IDA in children are chronic blood loss from the gastrointestinal tract<sup>2</sup>.

Multiple studies have clearly mentioned that iron deficiency anemia causes long term disease sequels as, impairment of psychomotor development, low IQ, lack of concentration, poor school performance, poor memory and cognitive functions<sup>3</sup>.

Oral iron supplementation is well established, effective and worldwide accepted mode of treatment in IDA. Various forms of oral iron preparations are available. However, patients do not always respond adequately to oral iron therapy because of non compliance due to side effects and prolonged duration of treatment. Gastrointestinal disturbances with oral iron have been a serious concern of oral iron supplements. The most widely recommended and used oral iron preparations are ferrous salts. But

patient's response to oral therapy is usually poor in term of haemoglobin and ferritin % rise .Its because of many factors. Compliance to long term oral therapy is main issue. Use of these salts is limited by low and variable absorption, chelation by food products and free radical mediated mucosal damage. In the latter situations, oral iron therapy is impractical so iron must be given by the parenteral route, whereas in toddlers or adolescents non-adherence to oral iron is common so these children may also benefit from parenteral iron therapy<sup>4</sup>.

The mean rise in hemoglobin after intravenous iron therapy is 3.1±1.7g/dl who failed to respond to oral iron therapy<sup>5</sup>.

There are very few indications for blood transfusion or parenteral iron therapy. One of the indication of intravenous iron therapy is the failure to responds to oral iron supplements<sup>6</sup>.

Intravenous Iron sucrose therapy is very safe and effective in children with IDA with resultant rise in hemoglobin levels irrespective of the underlying cause<sup>7,8</sup>. The benefits seen with IV iron therapy are independent of pretreatment levels of serum ferritin, iron, total iron binding capacity and percent transferrin saturation<sup>9</sup>. Other benefits of iron sucrose therapy is the low rate of serious side effects and the lack of needing a test dose prior to the administration of therapy<sup>10</sup>. A few patients reported

mild adverse effects including rash, fever, and irritability during or shortly after the infusion of iron sucrose<sup>10</sup>.

However, we planned this study to explore the hemoglobin rise after intravenous iron therapy in iron deficient children unresponsive to oral iron therapy and apply this in patients not responding to oral iron treatment.

## MATERIAL AND METHODS

A total of 50 cases between 1-10 years of both genders having Iron deficiency anemia of less than 8 g/dl not responding to three months of oral iron therapy from paediatric outpatient department (OPD) at Military Hospital Multan were included in the study and treated while patients of anemia suffering from gastrointestinal or pulmonary hemorrhage, severely anemic patients requiring Red Cell concentrate (Hb less than 4g/dl), patients having malabsorption syndromes like celiac disease, inflammatory bowel disease and tropical sprue and patients with transfusion dependent anemias like hemolytic anemias, aplastic anemias, fanconi anemia, diamond blackfan anemia etc were excluded from the study. An informed written consent and permission from Hospital Ethical Committee was obtained.

A relevant history about symptoms, systemic inquiry, birth, feeding, immunization past medical and surgical, family and duration and compliance of oral iron therapy was taken. Thorough physical examination of all the patients was recorded. Base line investigations of Hb%, and ferritin levels were taken. Patients meeting the inclusion criteria were offered intravenous iron sucrose preparation (venofer) according to dose calculated as formula mentioned above in operational definition, and were given in infusion. Maximum single dose was 7mg/kg dose requirement exceeding this given in divided doses every 3-7 days until total dose is administered. The infusion was given to patients as indoor case over a period of 2 hours with 1:1 dilution in 250 ml normal saline. Follow up response was seen after four weeks of administering intravenous iron sucrose by taking Hb (g/dl). If child develops dysentery, haematemesis, any ailment causing blood loss or if patient receives blood transfusion he was excluded from study.

Sample from the patients were taken and sent to AFIP (armed Forces Institute of Pathology, Multan) for Hb analysis and verified by Consultant Hematologist. All data was recorded on a Performa.

Data analysis was computer based with the use of SPSS version 12. The quantitative variables like age, baseline Hb, Hb at 4 weeks were calculated by taking mean and standard deviations. P value of <

0.05 was considered as significant. The confounding variables like age and gender were controlled by stratification.

## RESULTS

Age distribution of the patients was done which shows 13(26%) between 1-3 years, 17(34%) between 4-6 years and 20(40%) between 7-10 years of age while mean and sd was calculated as  $6.75 \pm 2.69$  years. (Table 1)

Gender distribution of the patients was done and presented in Table 2, where 27(60%) were male and 18(40%) were females. (Table 2)

Mean Hb levels (g/dl) were calculated at base line (before therapy), which shows 22(48.89%) had 5-6 Hb level (g/dl) while 23(51.11%) had 7-7.9 (g/dl), mean and sd was calculated as  $7.12 \pm 0.59$  hb g/dl (Table 3)

Mean Hb levels (g/dl) were calculated after therapy, which shows 41(91.11%) had 8-9 Hb level(g/dl) while 4(8.89%) had >9 g/dl, mean and sd was  $9.33 \pm 0.50$  g/dl (Table 4).

Table 1: Age distribution (n=50)

| Age (in years) | n  | %  |
|----------------|----|----|
| 1-3            | 13 | 26 |
| 4-6            | 17 | 34 |
| 7-10           | 20 | 40 |

Mean $\pm$ SD:  $6.75 \pm 2.69$

Table 2: Gender Distribution (n=50)

| Gender | n  | %  |
|--------|----|----|
| Male   | 30 | 60 |
| Female | 20 | 40 |

Table 3: Mean Hb Level of patients at base line (n=50)

| Hb level(g/dl) | n  | %  |
|----------------|----|----|
| 5-6            | 24 | 48 |
| 7-7.9          | 26 | 52 |

Mean and sd:  $7.12 \pm 0.59$

Table 4: Mean Hb Level of patients after therapy (n=50)

| Hb level(g/dl) | n  | %  |
|----------------|----|----|
| 8-9            | 46 | 92 |
| >9             | 4  | 8  |

Mean and sd:  $9.33 \pm 0.50$

## DISCUSSION

In current study, mean and sd for age was calculated as  $6.75 \pm 2.69$  years, 30(60%) were male and 20(40%) were females, mean Hb levels(g/dl) calculated at base line (before therapy) were  $7.12 \pm 0.59$  hb g/dl while these findings after therapy were recorded as  $9.33 \pm 0.50$  g/dl, mean rise was  $2.21 \pm 0.87$  hb g/dl.

The findings of the study are in agreement with a study showing mean rise in hemoglobin after intravenous iron therapy is  $3.1 \pm 1.7$  g/dl who failed to respond to oral iron therapy<sup>5</sup>.

Shelley E. Crary and co-workers<sup>11</sup> concluded that Parenteral iron is a safe and effective means to treat iron deficiency in children who cannot receive or do not respond to oral iron due to intolerance, poor adherence, or iron malabsorption.

To our knowledge, only a few such reports of iron sucrose exist in the literature. The best-described series includes 45 patients in Israel with iron deficiency due to nutritional iron deprivation and various other causes who had failed previous treatment with oral iron<sup>12</sup>. They received 5 mg/kg/day of elemental iron in the form of IV iron sucrose until the calculated iron deficit was replete. These children had an excellent response, with a significant increase in hemoglobin concentration at both 14 days and 6 months following treatment. Iron sucrose was well tolerated, with only one patient having transient hypotension and emesis and two patients experiencing drug extravasation.

IV iron preparations other than iron sucrose have recently been studied in adults and children. Sodium ferric gluconate complex has demonstrated a similar safety profile to iron sucrose in children receiving hemodialysis who were treated with erythropoietin.<sup>13</sup> Like iron sucrose, ferric gluconate must be given in divided doses, which is not convenient for most conditions encountered by hematologists including iron deficiency resulting from poor dietary intake.

However, the findings of the study in support with other studies are of the view that intravenous iron therapy for mean rise in Hb (Hemoglobin) level in children not responding to oral iron therapy in iron deficiency anemia is an effective method."

The limitation of the study are that we did not include any side effects of the drug, however during the study no such remarkable side effects were noted, it may be documented in further trials conducting the safety of the drug.

## CONCLUSION

We concluded that iron therapy when used intravenously for rise in mean Hb (Hemoglobin) level in children not responding to oral iron therapy in iron deficiency anemia are an effective treatment and may be recommended in our population.

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