EVALUATION OF INJECTABLE IRON SUCROSE THERAPY IN CHILDREN WITH IRON DEFICIENCY ANEMIA

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ABSTRACT

Objective: The study was designed to evaluate the response of intravenous iron therapy in children who were unable to tolerate oral iron.

Study Design: Quasi experimental study (pre and post treatment design).

Place and Duration of Study:The study period extended over a period of 2 years from Apr 2011 to Apr 2013 and was carried out in Combined Military Hospitals Okara and Panu Aqil cantt**.**

Material and Methods: One hundred and forty two children selected through non probability purposive sampling having iron deficiency anemia were included in the study. Iron deficiency anemia was diagnosed by measuring hemoglobin (Hb), red cell indices like mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and serum ferritin. Total iron deficit was calculated using the formula: Total iron deficit (in mg) = Body weight (kg) x (target hemoglobin-actual hemoglobin) {gm / dl} x 2.4 + depot iron (mg). Dose of iron sucrose to be given i / v (ml) = Total iron deficit / 2o mg. Pre treatment and three months post treatment mean Hb levels were compared in the sample and stratified according to gender.

Results: Out of 142 patients 87 (61%) were males and 55 (39%) were females. Mean Hb before treatment was 7.85 ± 0.78 gm / dl while three months post treatment mean Hb was 10.29 ± 0.89 gm / dl (p<0.001).

Conclusion: Parenteral iron therapy is a good alternative for children with iron deficiency anemia who cannot tolerate oral iron due to gastro intestinal side effects.

Keywords: Children, Iron deficiency anemia, Iron sucrose.

INTRODUCTION

Anemia is a global health problem and its global prevalence in young children is 43%[1]. The most common cause of anemia under five years of age is iron deficiency anemia. Different studies from Pakistan show different prevalence rates 34%, 73% and 41%[2-4]. Anemia is defined as hemoglobin less than 11 gm / dl in children below five years of age[5]. According to WHO global database on anemia, 50.9% of Pakistani children and 39.1% of pregnant women were found to be anemic[5].

Many studies have shown that micronutrients have vital role in brain development and their deficiencies can compromise full developmental potential and cognitive development in children[6-8]. Since ages iron has been used for treatment of anemia. Oral form of iron supplementation is simple, cheap and relatively effective way of treating iron deficiency anemia[9].

However in certain conditions like chronic diarrhea or oral intolerance to iron therapy and in non-compliant patients, oral iron cannot be used and iron has to be supplemented by parenteral route. Parenteral iron supplementation has advantages of faster replenishment of body iron stores and rapid increase in hemoglobin. Different parenteral iron preparations are available which are safe and effective.

This study was conducted to assess the efficacy of injectable iron therapy in children with iron deficiency anemia between 1-5 years of age. The purpose of this study was to know about the

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efficacy of intravenous iron sucrose therapy in children between 1 to 5 years of age with iron deficiency anemia who were unable to tolerate or respond to oral iron therapy

MATERIAL AND METHODS

A quasi experimental study (before and after comparison) was conducted from April 2011–April 2013 in Paediatric departments of Combined Military Hospitals Okara and Panu Aqil cantts. All outdoor patients with 1 to 5 years of age and having iron deficiency anemia and hemoglobin level between 7 to 10gm/dl were included in the study. Haemoglobin, serum ferritin and red cell indices mean corpuscular hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH) and mean corpuscular volume (MCV) were used for diagnosis of iron deficiency anemia. Reticulocyte count and RBC morphology were also requested. One hundred and forty two children calculated by G Power 3.1.9.2 software (alpha error probability=0.05, effect size=0.5, power=0.80), who were non responsive to oral iron therapy and were unable to tolerate iron therapy due to gastrointestinal side effects were included in the study group through non probability purposive sampling technique. While anemic patients whose anemia was not due to iron deficiency, patients with acute infections and with systemic disease like renal failure, cardiac problem, rheumatoid arthritis and liver disease, patients who were allergic to iron or with any other allergic condition and patients whose Hb level was less than 7 gm/dl were excluded from the study. Base line Hb was measured in all the patients and on follow up Hb was re-checked on monthly basis for three months after completion of iron therapy. Response was defined as rise in Hb of more than 1.5 gm/dl in three months.

For calculation of iron deficit, following formula was used:

Total iron deficit (in mg) = Body weight (kg) x (target Hemoglobin-actual Hemoglobin) {gm/dl} x 2.4 + depot iron (mg) [10].

Target Hb was 13 gm/dl. Depot iron was 15 mg/kg body weight. Dose of iron sucrose to be given i/v (ml) = Total iron deficit/20 mg. All the patients were subjected to sensitivity test by giving a test dose of 0.5- 1ml diluted in normal saline by slow i/v infusion. For any sign of adverse reaction patients' vital signs were monitored for 30 minutes. Facilities for cardiopulmonary resuscitation along with necessary medication were readily made available. In cases who were not sensitive, the total dose was diluted in 100ml normal saline and slowly infused over 4-6 hours. During the infusion patients were closely monitored for any adverse reaction.

Data were recorded on a structured pre designed proforma. Qualitative variables like gender were presented in percentages. Mean ± SD (standard deviation) was used to present quantitative variables like age, Hb (baseline) and Hb (post 1, 2 and 3 months follow up). Paired sample "t" test was applied (where applicable) to find out the significant difference between the pre and post treatment Hb levels. Independent samples "t" test was applied to find out significant difference in mean Hb levels between the groups. A *p*-value <0.05 was considered as significant. Data was entered and analysed in Statistical Package For Social Sciences (SPSS) 20.0

Table: Comparison of pre and post treatment Hb levels.

	Pre-treatment Hb (gm/dl) (mean+SD)	Post (3 months) treatment Hb (gm/dl) (mean +SD)	*p*-value
Total patients (n=142)	7.85 ± 0.78	10.29 ± 0.89	<0.001
Males (n=87)	7.95 ± 0.74	10.28 ± 0.89	<0.001
Females (n=55)	7.69 ± 0.84	10.30 ± 0.911	<0.001

RESULTS

Out of 142 patients, 87 (61.3%) were males while 55 (39%) were females. Mean age of the patients was 23.11 ± 12.38 months (22.19 ± 12.19 months in males; 24.67 ± 12.63 months in females). Pretreatment mean Hb was 7.85 ± 0.78 gm/dl. Pretreatment mean Hb in males and females was 7.95 ± 0.74 gm/dl and 7.69 ± 0.84 gm/dl respectively (p=0.062).

After one month of treatment mean Hb was 8.0 ± 0.77 gm/dl which was insignificant when compared with the pretreatment Hb (p=0.99). Two months post treatment Hb 9.43 ± 0.79 gm/dl vs 7.85 ± 0.78 gm/dl (pretreatment Hb) was found to be significant (p<0.001). Three months post treatment mean Hb (10.29 ± 0.89 gm/dl) when compared with the pretreatment mean Hb was found to be highly significant (p<0.001) (table).

Three months post treatment mean Hb was 10.28 ± 0.89 gm/dl in males which was found to be highly significant (p<0.001) when compared with pretreatment mean Hb in males. Post three months mean Hb was 10.30 ± 0.911 gm/dl in females and it was also found to be highly significant (p<0.001) when compared with pretreatment mean Hb of the females. However difference of three months post treatment mean Hb of males and females (10.28 ± 0.89 vs 10.30 ± 0.91 gm /dl) was found to be insignificant (p=0.954).

Only 3/142 (2.1%) patients had mild side effects like rash, shivering and fever. Serious side effects like hypotension or shock were not observed in any patient.

DISCUSSION

Iron is an essential trace element which plays a vital role in many body functions like synthesis of hemoglobin, energy metabolism, myoglobin formation, neurotransmitter production, collagen formation and normal functioning of the immune system[11, 12]. In general population one of the main causes of anemia is iron deficiency. Anemia due to iron deficiency is associated with increased mortality and morbidity in children[12, 13].

Patients of chronic renal failure on erythropoietin therapy who are dependent on hemodialysis and patients with iron deficiency anemia not responding to oral therapy have been treated successfully for years with intravenous iron[14]. Iron dextran, a high molecular weight iron compound, was used extensively in the past but its use was associated with life threatening anaphylaxis. Therefore, use of iron dextran and other iron preparations had been very limited in children with hematological disorders.

At present, there are many parenteral iron preparations available which include iron sucrose, ferric gluconate, low molecular weight iron dextran and the newest preparation ferumoxytol. These preparations have a much better safety profile than HMW iron dextran and have now replaced HMW dextran for treatment of anemia in both children and adults[13]. FDA has approved intravenous (IV) iron sucrose for non-dialysis dependent patients with anemia in 2000.

Intravenous iron therapy is superior to oral iron treatment and has several advantages such as faster and higher increase in hemoglobin levels and replenishment of body iron stores. For these reasons, modern parenteral formulations of iron have emerged as effective and safe alternatives for management of iron deficiency anemia.

This study revealed that 142 patients who completed the study showed good response and there was significant rise in the Hb (2.43gm/dl) 3 months after a single dose replacement therapy. Both males and females showed equal response and there was no significant statistical difference. Similar results were observed by Akin et al[15] who found a mean rise of 1.8 gm/dl, 6 weeks after the treatment. There is limited data from Pakistan regarding use of injectable iron in children in iron deficiency anemia however one small scale study revealed almost similar resuts[16]. Similar results were also found by Plummer et al[17] and Wall et al[18] who found a mean rise of 2 gm/dl in Hb levels.

In this study only few patients had mild side effects and the same was observed by Plummer et al,[17] Wall et al[18] and Siddiqui[19] et al.

CONCLUSION

Parenteral iron therapy is a good alternative in children who are suffering from iron deficiency anemia and cannot tolerate oral iron due to its gastro-intestinal side effects.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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