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Research Article

Comparative study on ferrous sulfate and iron polymaltose complex in management of childhood iron deficiency anemia

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ABSTRACT

Objective: To compare efficacy of ferrous sulfate(FS) with iron polymaltose complex(IPC) in treating childhood iron deficiency anemia.

Material and Methods: This randomized trial was conducted at Department of Pediatrics D. G Khan Teaching Hospital D. G Khan from February 2017 to August 2017. Total of 70 children aged 6months to 6years having IDA were enrolled. They were randomly allocated to 2 groups. In IPC Group, iron polymaltose complex was given while in FS group ferrous sulfate was given for 2 months. The dose of iron preparations given was 6mg/kg/day of elemental iron in 3 divided doses. Study participants were followed up after 2 months and noted for efficacy in terms of normalization of Hb and serum ferritin.

Results: Out of 70 children, 55.7% (n = 39) were male and 44.3% (n = 31) were female. Mean age of children was 2.46 years ± 1.36 SD. Majority of children(60%) were under 2 years. Mean weight of children was 10.7 Kg. Majority of children, 46 (65.7%) were <12 Kg, 24 (34.3%) were 12Kg or more. Mean Hb and ferritin before start of therapy in studied children were 7.85 g/dl ± 0.82 SD and 8.22 ng/ml ± 2.42 SD respectively. Mean post treatment Hb and ferritin in studied children were 10.9 g/dl ± 0.90 SD and 42.8 ng/ml ± 21 SD respectively. Compliance was good in 94.3% children in IPC group and 85.7% children in FS group. While comparing both groups efficacy was seen in 32 (91.4%) children in IPC group and 30 (85.8%) children in FS group which was insignificant statistically (P value = 0.45). The efficacy of IPC as compared to FS was statistically insignificant in all age groups i.e. age group of 6 month to <2 years(P value 0.71), age group of children 2-6 years(p value 0.45) as well as in both genders that is male(p value 0.13), female(p value 0.50). No statistically significant difference was seen in the efficacy between IPC and FS group in children weighing <12Kg(p value 0.48), children ≥12Kg(p value 0.8), children with good compliance(p value 0.42) and chidren with poor compliance(p value 0.61).

Conclusion: Results of this study revealed that there was statistically insignificant difference in the efficacy rate of iron polymaltose complex and ferrous sulphate when used as an oral iron replacement treatment in children with iron deficiency anemia. Ferrous sulfate and iron polymaltose can be used as alternative drugs as both have comparative efficacy.

Key words: Ferrous sulfate, iron deficiency anemia, polymaltose complex, WHO, neurotransmitter

INTRODUCTION:

Iron deficiency is the most widespread and common nutritional disorder in the world. It is estimated that 30% of global population suffer from iron deficiency anemia (IDA) and most of them live in developing countries.[1] WHO estimates that one out of every two preschool children in developing countries are iron deficient and prevalence of anemia is highest among preschool-age children (47%).[2] In 2004, iron deficiency anemia (IDA) resulted in 273,000 deaths among these 45% were in Southeast Asia.[3]

Iron deficiency anemia (IDA) can result in fatigue, may affect work capacity and exercise tolerance, reduce neurotransmitter function,

diminish immunological and inflammatory defenses. The most concerning effects of iron deficiency in infants and young children are impaired intellectual and motor functions.[4]

Iron deficiency may occur due to inadequate iron intake, decreased intestinal absorption of nutritional iron, increased iron requirement (e.g., during periods of rapid growth), or chronic blood loss. Long-term oral iron is frequently used as a first line therapy, but iron salts such as ferrous sulfate (FS) are frequently associated with high incidence of gastrointestinal side effects such as nausea, vomiting, diarrhea and constipation and may cause discontinuance of treatment.[5] Polynuclear preparations based on the ferric form of iron such as iron polymaltose complex(IPC) have been developed to improve tolerability.[6] Two randomized controlled trials done in pregnant ladies[7,8] have confirmed that IPC has similar efficacy but better tolerability. The data in children on IPC efficacy is scanty. The two international randomized studies one in 60 children aged 6 month to 18 month[9] with iron deficiency anemia and one in 103 children aged >6months[10] showed that IPC had similar efficacy with better tolerability to ferrous sulfate while two regional studies[11,12] gave controversial results. One conducted in india[11] in 2009 showed that efficacy of FS was 98.1% and IPC showed efficacy of 71.7% with statistically significant difference between both groups, other study[12] conducted in Mayo Hospital Lahore in 2013 showed that efficacy of FS was 97.3% and efficacy of IPC was 94.6% with no statistically significant difference.

The issue of efficacy between two therapies remains unsettled yet. This study is planned to clarify this issue and to confirm wether there is any significant difference between efficacy of FS and IPC or there is no significant difference between the two.

MATERIALS AND METHODS:

This randomized trial was conducted at Department of Pediatrics D. G Khan Teaching Hospital D. G Khan from February 2017 to August 2017.

Inclusion criteria:

1. Age from 6 months to 6 years, either sex.
2. Children with iron deficiency anemia, viz. children with baseline hemoglobin (Hb before starting therapy) <10.5 and serum ferritin ≤ 15ng/mL.

Exclusion criteria:

1. The main exclusion criteria are anemia due to other causes except IDA
2. Severe concurrent illness (cardiovascular, renal, and hepatic).
3. Known hypersensitivity to ferrous or ferric preparations.
4. Bleeding disorders suggested by history of bruises, bleeding from body orifices or visible bruises on examination.
5. Gastrointestinal bleeding suggested by history of hematemesis (bloody vomit), melena (black colored stools) or bloody stools.

OPERATIONAL DEFINITIONS:

Iron deficiency anemia:

Iron deficiency anemia is defined as: hemoglobin < 10.5g/dL and serum ferritin ≤ 15ng/mL.

Efficacy:

This is defined as normalization of Hemoglobin (Hb≥10.5gm/dl) and serum ferritin(>15ng/ml), assessed after regular use of prescribed drug in adequate dosage (6mg/kg of elemental iron in 3 divided doses) for two months.

Data collection procedure:

Total 70 children with iron deficiency anemia admitting in ward through outdoor or accident and emergency department fulfilling inclusion criteria were randomly allocated to two groups by lottery method. Informed consent obtained from the parents/guardian. One group (FS group) was given ferrous sulfate and the other one (IPC group) given iron polymaltose complex for 2 months. The dose of iron preparations given was 6mg/kg/day of elemental iron in 3 divided doses. Their demographic data as well as brief history was taken and brief physical examination was done.

They asked to return for follow up after 2 months and advised to bring with them the used bottles or wrappers of used tablets. Their hemoglobin and ferritin level obtained on week 0 and 8.Normalization of Hb concentration (Hb ≥10.5gm/dl) and serum ferritin(>15ng/ml) assessed after two months of start of treatment was considered as effective. All the data was entered on a pre-designed Performa for each patient.

SPSS-10.0 was used for statistical data analysis. Mean and standard deviation was calculated for weight, age, baseline hb, baseline ferritin, post treatment Hb and post treatment ferritin. Frequency and percentages were calculated for gender and efficacy. Efficacy between two groups was compared by chi square test. Effect modifiers/confounders (age, sex, weight) was controlled through stratification and post stratification Chi square test was applied to compare different strata. P value ≤0.05 was accepted as significant.

RESULTS:

Total 70 patients (35 in each group) were selected for this study. Mean age of children was 2.46 ±1.36 years. In IPC group, mean age was 2.47 ± 1.46 years and in FS group mean age of children was 2.46 ± 1.28 years. Efficacy of treatment was noted in 32 (91.4%) patients in IPC group and in 30 (85.8%) patients of FS group. Difference of efficacy rate between the both treatment groups was statistically insignificant with p value 0.45. (Table 1)

Out of 20 male patients of IPC group, efficacy was noted in 19 (95%) patients and out of 19 male patients of FS group, efficacy of treatment was noted in 15 (84.2%) patients. But the difference of efficacy rate between both groups was statistically insignificant with p value 0.13. Out of 15 female patients of IPC group, efficacy was noted in 13 (95%) patients. Among the 16 female patients of FS group, efficacy noted in 15 (84.2%) patients. Difference of efficacy rate in both groups was statistically insignificant with p value 0.50. (Table 2)

Patients of both group were divided into two age groups i.e. age group 6 months to <2 years and age group 2-6 years. In IPC group and FS group, 20 and 22 patients belonged to age group 6 months to <2 years and efficacy rate was 18 (90%) and 19 (86.36%) respectively. In age group 2-6 years, 15 patients belonged to IPC group and 13 patients belonged to FS group. Efficacy rate was 14 (93.33%) and 11 (84.62%) in IPC and FS group respectively. Difference of efficacy rate between IPC group and FS group for both age groups was statistically insignificant with p value 0.71 and 0.45. (Table 3)

Patients were divided into two weight categories i.e. ≤12 kg weight group and >12 kg weight group. In weight group ≤12 kg, efficacy rate was 19 (90.48%) and 20 (83.33%) in IPC and FS group respectively. The difference statistically insignificant (P = 0.48). In weight group >12 kg, efficacy rate was 13 (92.86%) and 10 (90.91%) respectively in IPC and FS group. But the difference was insignificant (P = 0.85). (Table 4)

Table 1: Comparison of efficacy between two groups

Group	Efficacy		Total	P Value
	Yes	No		
IPC Group	32 (91.4%)	3 (8.6%)	35	0.45
FS Group	30 (85.8%)	5 (14.2%)	35	

Table 2: Comparison of efficacy between both groups for male and female

Group	Efficacy		Total	P. Value
	Yes (%)	No (%)		
Male patients of both groups				
IPC Group	19 (95%)	1 (5%)	20	0.13
FS Group	15(84.2%)	4 (15.8%)	19	
Female patients of both groups				
IPC Group	13 (95%)	2 (5%)	15	0.50
FS Group	15 (84.2%)	1 (15.8%)	16	

Table 3: Comparison of Efficacy between two groups for different age groups

Group	Efficacy		Total	P. Value
	Yes (%)	No (%)		
Age group 6 months to <2 years				
IPC Group	18 (90)	2 (10)	20	0.71

FS Group	19 (86.36)	3 (13.64)	22	
Age group 2-6 years				
IPC Group	14 (93.33)	1 (6.67)	15	0.45
FS Group	11 (84.62)	2 (15.38)	13	

Table 4: Comparison of Efficacy between two groups for different weight categories

Group	Efficacy		Total	P. Value
	Yes (%)	No (%)		
≤12 kg weight group				
IPC Group	19 (90.48)	2 (9.52)	21	0.48
FS Group	20 (83.33)	4 (16.67)	24	
>12 kg weight group				
IPC Group	13 (92.86)	1 (7.14)	14	0.85
FS Group	10 (90.91)	1 (9.09)	11	

DISCUSSION:

IDA is known to be the most common nutritional deficiency worldwide. It has significant impact on national progress on account of its adverse health consequences and economic losses of billions of dollars annually in developing countries.[7]

In Pakistan most IDA effected population segments are females of reproductive age and children under 5 years.[8] Prevalence of iron deficiency anemia among children under 2 years in Pakistan was reported as 69%.[9] In our study, majority of children (60%) were under 2 years and 40% between 2-6 years. Similarly in another local study 74% children were under 3 years of age and 26% were between 3-5 years.[10]High prevalence of IDA in this age group is due to high iron requirement for rapid growth. Risk factors associated with a higher prevalence of ID anemia (IDA) include low birth weight, high cow's-milk intake, low intake of iron-rich complementary foods and low socioeconomic status.[11]

In our study efficacy was seen in 91.4% children in IPC group and 85.8% in FS group which was statistically insignificant(p value 0.45). Results are comparable to other studies[12-14]which has shown similar results. In another local study[10] efficacy was 97% in FS group and 94% in IPC group with no significant difference. In our study IPC group, mean post treatment Hb was 11.0 ± 0.77g/dl as compared to 10.9 ± 1.02g/dl in FS group. These results are comparable to another study[13] in which the mean post treatment Hb values were 12.1 ± 1.19 g/dl with IPC vs. 11.9 ± 1.84 g/dl with ferrous sulfate.

CONCLUSION:

It was concluded that there was no statistically significant difference in the efficacy of iron polymaltose complex and ferrous sulphate when used as an oral iron replacement therapy in pediatric patients with iron deficiency anemia. FS salt less expensive as compared to IPC, but in cases where FS is not tolerated, IPC can be used as an alternative.

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