IMPACT OF IRON PROFILE TO DIAGNOSE IRON DEFICIENCY ANEMIA IN PATIENTS WITH AND WITHOUT END STAGE RENAL DISEASE

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ABSTRACT

Background: The diagnosis of iron deficiency anemia (IDA) in end stage renal disease (ESRD) patients has a problem if only serum ferritin level is considered for diagnosis. Level of serum ferritin in IDA patients with ESRD usually in normaltohigh range. This is because that serum ferritin is an acute phase protein and elevated in inflammatory process/chronic diseases. The aim of the present study is to evaluate the problems in iron markers to diagnose the iron deficiency anemia in these patients.

Material and Methods: The present comparative cross sectional study conducted in the department of Nephrology, institute of kidney diseases, Hayatabad Medical Complex and Khyber Girls Medical College. Duration of the study was one year. A total of 200 end stage renal disease patients enrolled in the study.3 ml of blood were collected in an EDTA vacutainer tube for determination of complete blood count and 3 ml of blood in without anti-coagulant vacutainer tube for evaluation of serum iron profile. Descriptive data is represented as mean ± standard deviation and range values. ANOVA test applied to compare the mean values of all 3 groups. Student "t" test was used to study and compare the levels of all iron markers in IDA with and without ESRD patients.

Findings: The group A (IDA patients with ESRD) had high serum ferritin levels as compared to serum ferritin in group B patients (IDA without ESRD). The mean values of serum ferritin levels were compared when ANOVA test applied through SPSS. There was a significant differences seen among the means value of serum ferritin levels of all the three groups and p value was less than 0.001. However the mean value of TIBC and serum iron in group A & B T had not significant difference.

Conclusion: The present study reveal that normal to high serum ferritin level found in IDA with ESRD patients while in IDA without ESRD patients, serum ferritin level is lower than normal range. Complete iron profile are important for reaching to the ultimate diagnosis of IDA in end stage renal disease patients.

Key Words: End stage renal disease, Iron deficiency anemia, Serum Ferritin, Serum iron, TIBC.

INTRODUCTION

Chronic kidney disease (CKD) is a universal public health issue which is closely associated with early mortality, poor quality of life, and higher financial burden over health care centres[1]. In the developing countries like Pakistan, there is increasing incidence and more prevalence of end stage renal disease (ESRD) with poor outcomes. Based on Economic Survey of Pakistan in 2005-06, about 21 million people in Pakistan have CKD[2].

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There are enough evidences that morbidity and mortality of ESRD can be prevented or delayed by proper and in time management, through early investigations and treatment.[3,4]

In ESRD patients, anemia is a multifactorial manifestation but the iron deficiency contributes more amongst all nutritional deficiency anemias. Other causes of renal anemia are decreased synthesis of erythropoietin, reduced life span of circulating red blood cells due to uremia, vitamin B12 and folic acid deficiency, blood loss due to reduced platelets functions in uremia.[5] The erythropoietin secretion decreases progressively as the glomerular filtration rate (GFR) decreases[6]. Anemia related complications in ESRD patients may include increasing fatigue, depression, reduced exercise tolerance, dyspnea, and cardiovascular (CVS) manifestations, such as decreased functions of left ventricle and then failure in end stage and stroke. Untreated anemia may lead to increase the risk of prolong hospitalization and mortality in ESRD patients.[7]

The diagnosis and management of IDA in ESRD patients has a problem if only serum ferritin level is considered for diagnosis. Level of serum ferritin in IDA patients with ESRD usually remains in normal range

or higher, as compared to patients who have only IDA without ESRD.[8] This is because that serum ferritin is an acute phase protein and is also elevated in inflammatory conditions and chronic diseases like CKD. But in our setup, only serum ferritin is advised to diagnose IDA and the other 2 markers i.e. serum iron and TIBC are ignored. The estimation of serum iron and TIBC are simple test which can be done with low cost and in less time by photometry method. Serum ferritin alone is an inaccurate tool for the diagnosis and management of IDA in ESRD patients.[9]

The objective of the present study is to evaluate frequency of iron deficiency anemia in ESRD patients and the problems in iron markers to diagnose the iron deficiency anemia in these patients. This study will also give us information which will help in the proper diagnosis and treatment of IDA in ESRD patients. Ultimately this effort will reduce complications and morbidity among ESRD patients.

MATERIAL AND METHODS

The present descriptive, comparative cross sectional study conducted in the Department of Nephrology, Institute of Kidney Diseases, Hayatabad, Peshawar and samples were assessed in pathology laboratories of Institute of kidney disease, Hayatabad Medical Complex and Khyber Girls Medical College. Duration of the study was one year. A 86 end stage renal disease anemic patients (Group A), 86 iron deficient without end stage renal disease (Group B) and 86 normal individuals of control group (Group C) for comparison and their age range from 20-70 years participated in the study.

Before samples collection, informed consent has been taken from each patient who was selected for the study. 3 ml of blood were collected by aseptic measure in a purple top EDTA vacutainer tube (BD manufacturer) for determination of complete blood count and 3 ml of blood in a red top without anti-coagulant vacutainer plan tube for evaluation of serum iron, total iron binding capacity and serum ferritin levels. Complete blood count was determine by an automated hematology analyzer (Rubby cell dyne, Abbott, USA)and serum iron/ TIBC was determine by semi-automated spectrophotometer analyzer (Micro lab 300) while serum ferritin levels were evaluated by microplateimmunoenzymometric assay technique.

Descriptive data is represented as mean ± standard deviation and range values. ANOVA test applied to compare the mean values of all 3 groups of our study. Student "t" test was used to study and compare the levels of all iron markers in IDA with ESRD and IDA with no ESRD, p-value calculated statistically and their values recorded. P values of 0.05 or less were considered significant.

RESULTS

In present study out of 200 end stage renal disease patients 86 (43%) were diagnosed with iron deficiency anemia and rest of the patients 114 (57%) had anemia without iron deficiency. The group A (IDA patients with ESRD) had high serum ferritin levels with mean value of 121.17 ± 35.36 ng/ml as compared to serum ferritin in group B patients (IDA without ESRD) with mean value 8.71 ± 3.94 ng/ml. Serum ferritin in group C (Control group) was 151.24±41.7 ng/ml. The mean values of serum ferritin levels were compared when ANOVA test applied through SPSS. There was a significant differences seen among the means value of serum ferritin levels of all the three groups and p value was less than 0.001.

However the mean value of TIBC in group A was 412.77 ± 43.56 ug/dl and in group B was 484 ± 49.7 ug/dl. Mean values of serum iron in group A was 28.51±7.80 ug/dl and in group B it was 27.09±7.l8 ug/dl. These values of serum iron and TIBC in both groups of IDA patients with ESRD and without ESRD have not shown significant difference.

Table 1: Descriptive information with mean values and standard deviation of each variables in all groups of the study

	Study Population Groups		
	A (IDA with ESRD)	B (IDA without ESRD)	C (Control)
N	86	86	86
Age	49±18	46 ±15	48.±17
Hb (gm/dl)	8.81±2.8	9.34 ±1.5	13.73±1.2
Serum Ferritin (ng/ml)	121.17 ±35.36	8.71 ±3.94	151.24 ±41.7
Serum iron (ug/dl)	28.51±7.80	27.09 ±7.18	86.98 ±26.6
TIBC (ug/dl)	412.77 ±43.56	484 ±49.7	243 ±36.45

DISCUSSION

The objective of present study was to know the fero-kinetic alterations like serum iron, TIBC and serum ferritin levels in ESRD patients with IDA and to compare it with patients having only IDA and with a normal control group as well. In present study, there were total 258 cases included in 3 groups as A, B, and C. Each group comprising of 86 subjects. Group 'A' included IDA patients with ESRD, in group B IDA patients without ESRD, while in group C an equal number of normal subjects were randomly taken. The majority of study subjects were males (65.5%) and 34.5% were females. The increased number of males indicates that males are more prone to develop the CKD and other reason is that males seek medical attention more readily than females in developing countries[2,6].

The mean age of patients, included in all 3 groups of our study ranged from 48 to 50 years. Similarly Indonesian and in Nigerian studies the mean age of ESRD patients ranged from 47 to 50 years. Most of the ESRD patients in our study, were in the age of around 50 years of age on average, which indicates that increased age may also be a risk factor for CKD. As age increases GFR decreases therefore CKD is common in adults as compared to young age.[10,11]

Our study demonstrated that 86 out of 200 ESRD patients (43%) had IDA (Fig: 5). While a study in Tanzania, 52% of ESRD patients had IDA. A study by McClellan,which was based on a large scale cross sectional USA multicenter survey, found this prevalence 37.75%12, 13. In Indonesia it was 53.1%[10] and in Iran it was 45.0%[14]. Each study has explained that the severity of the anemia was depended upon the severity of the ESRD[15].

Our findings are similar to James et al[16], who while studying iron deficiency anemia and the role of intravenous iron among CKD patients, found out that 40.4% of 102 anemic ESRD patients had ID (who had serum ferritin <100 ng/ml) and 59.6% had serum ferritin > 100 ng/ml despite of IDA[14]. In our study, 21% of patients who had serum iron and serum ferritin levels in normal range but then TIBC was high with low Hb and MCV. So they had functional iron deficiency due to ESRD, where the iron stores are not utilized.

Ultimately, the diagnosis of IDA in ESRD is difficult and will remain unreliable due to the misleading high level of serum ferritin in these patients of ESRD with IDA. In ESRD patients, the increased level of serum ferritin is associated with ESA resistance and further increase of anaemia15. In one study by Kalantar Zadeh K found that 34% of ESRD patients had evidence of inflammation, who were on dialysis and had increased level of serum ferritin. Concomitant inflammation was found the cause of their increased level of serum ferritin.

In another study, in 82 patients of ESRD, who were on hemodialysis, observed that they had serum ferritin level > 800 ug/ml. C reactive proteins were also found high in these ESRD patients.[17]

CONCLUSION

The present study shows a comparatively high level of serum ferritin in IDA with ESRD patients. While in IDA without ESRD group, serum ferritin level is lower than normal range. All the three iron markers i.e serum iron, serum ferritin and serum TIBC are important for reaching to the ultimate diagnosis of IDA. In our setup, it has been observed that as a trend only serum ferritin is used to investigate iron status and to monitor the response to treatment IDA.

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