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Comparison of iron status markers in iron deficiency anemia and anemia of chronic kidney diseases

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Abstract

Introduction: There are few studies on comparison of iron status markers between anemia due to iron deficiency and anemia due to chronic kidney disease.

Objective: To study iron status markers in iron deficiency anemia and anemia of chronic kidney diseases and compare them.

Materials and Methods: A Hospital based cross sectional comparative study was carried out among 60 study subjects over a period of one year. 30 of them were having anemia due to iron deficiency and 30 of them were having anemia due to chronic kidney disease. 5 ml venous blood was collected with all universal precautions from all cases and controls. Total iron binding capacity (TIBC), serum iron, and serum ferritin were assessed among cases of IDA and healthy controls using standard methods only.

Results: Hemoglobin percentage in IDA and anemia of CKD is not significant, where as serum iron, TIBC, serum ferritin and transferrin saturation percentage are significant in IDA group when compared to anemia in CKD group. But the severity of anemia as measured by hemoglobin level was more in patients with CKD.

Conclusion: The severity of anemia was more in patients with chronic kidney disease compared to patients with anemia due to iron deficiency.

Keywords: Iron status markers, Anemia, Comparison, Diagnosis, Severity.

Introduction

Anemia constitutes a common problem in clinical practice and hematological laboratories. Anemia is neither a diagnosis in itself nor a specific entity but a manifestation of an underlying disease process which is often related to the severity of the disease process.[1]

If the CKD patient is kept on hemodialysis and develops anemia then IV iron is administered as per the guidelines. And a CKD patient with anemia not on hemodialysis should be given oral iron as per the guidelines. This iron administered intravenously may cause overload of the iron in the patients. Therefore it is necessary to monitor the iron status markers in all such patients so that in any abnormal case identified promptly and treated.[2]

Total iron binding capacity, serum ferritin and transferring saturation are the regular markers of the iron status. They are useful to decide whether treatment with iron is required or not and also what form of treatment should be given. Serum ferritin acts as a bone marrow iron store indicator. But in cases of functional iron deficiency the serum ferritin levels may be present in the absence of stores.[3]

Studies have shown that patients of chronic kidney disease from India can develop overload of iron and this finding was similar to studies from developed countries.[4]

There are two major forms of iron deficiency i.e. functional and absolute. They can occur in combination or can occur separately. As a result of this, there is erythorpoiesis taking place in the deficient states of iron.[5]

Decrease in the content of the iron in the body is called absolute iron deficiency. The important reason is decreased absorption of the iron from gut or improper intake of iron in the diet. This when becomes lesser than the actual body demand results in iron deficiency. In such cases the stores from the body in the form of ferritin stored in spleen and liver gets depleted.[6]

WHO estimates that half of all anemias are caused by ID & that the prevalence of ID in developing countries is ~2.5 times that of other anemia. According to UNICEF report, two billion people suffer from anemia worldwide & most of them have IDA, especially in underdeveloped, developing countries, where 40-50% of children under age 5 are iron deficient. Iron deficiency and anemia are linked to increased maternal morbidity and mortality & impaired functional capacity in women.[7]

There are few studies on comparison of iron status markers between anemia due to iron deficiency and anemia due to chronic kidney disease. Hence present study was undertaken to study iron status markers in iron deficiency anemia and anemia of chronic kidney diseases and compare them.

Materials and Methods

A Hospital based cross sectional comparative study was carried out at Department of Biochemistry, JJM Medical College, Davangere among 60 study subjects over a period of one year.

Institutional Ethics Committee permission was obtained before the study was initiated after presenting the study protocol to the Committee. Eligible participants as per the study criteria were explained the nature of the study and written informed consent was taken.

Table 1: Age distribution of study subjects

Age (years)	Anemia of iron deficiency		Anemia due to CKD		Total	
	Number	%	Number	%	Number	%
21-30	7	23.3	3	10	10	16.7
31-40	14	46.7	18	60	32	53.3
41-50	09	30	09	30	18	30
Total	**30**	**100**	**30**	**100**	**60**	**100**

Group I: Only those cases who were having pallor on clinical examination, with hemoglobin level less than or equal to seven gm% or if the peripheral smear proved that the picture was of microcytic hypochromic anemia were included in the present study for group I. Only those cases aged 20-50 years only were included. And finally only those who consented to be part of the present study were included. All others were excluded.

Group II: Only those cases who were having chronic kidney disease with pallor on clinical examination, with hemoglobin level less than or equal to seven gm% or if the peripheral smear proved that the picture was of microcytic hypochromic anemia were included in the present study for group I. Only those cases aged 20-50 years only were included. And finally only those who consented to be part of the present study were included. All others were excluded.

Anemia suspected to be due to any chronic disease other than CKD was excluded from the present study.

5ml venous blood was collected with all universal precautions from all cases and controls. Total iron binding capacity (TIBC), serum iron, and serum ferritin were assessed among cases of IDA and healthy controls using standard methods only.[8]

Statistical Analysis

Descriptive data are presented as mean ± SD and range values. Student "t" test was used to study and compare biochemical parameters among cases and control. For all the tests, a p-value of 0.05 or less was considered for statistical significance.

Results

Table 1 shows age distribution of study subjects. Overall majority of the cases were in the age group of 31-40 years (53.3%) followed by the age group of 41-50 years (30%). Similar trend was seen in group of anemia due to iron deficiency and anemia due to chronic kidney disease.

Table 2 shows sex wise distribution of study subjects. Overall it was found that the incidence of anemia was marginally more in females (51.7%) compared to males (48.3%). But when we see in anemia due to chronic kidney disease, then we found that it was much more in males (56.7%) compared to females (43.3%). This may be due to the fact that kidney disease is more among males compared to females. But in anemia due to iron deficiency it was found that it was still more in females (60%) compared to males (40%). This is due to more blood loss in females than males.

Table 2: Sex wise distribution of study subjects

Sex	Anemia of Iron Deficiency		Anemia due to CKD		Total	
	Number	%	Number	%	Number	%
Male	12	40	17	56.7	29	48.3
Female	18	60	13	43.3	31	51.7
Total	**30**	**100**	**30**	**100**	**60**	**100**

Table 2: Sex wise distribution of study subjects

Sex	Anemia of Iron Deficiency		Anemia due to CKD		Total	
	Number	%	Number	%	Number	%
Male	12	40	17	56.7	29	48.3
Female	18	60	13	43.3	31	51.7
Total	**30**	**100**	**30**	**100**	**60**	**100**

Table 3 shows comparison of IDA and anemia of CKD groups with regarding to Hb, serum iron, TIBC, serum ferritin and transferrin saturation. Hemoglobin percentage in IDA and anemia of CKD is not significant, where as serum iron, TIBC, serum ferritin and transferrin saturation percentage are significant in IDA group when compared to anemia in CKD group.

Table 4: Study of IDA and anemia of CKD at various ranges of hemoglobin percentage

Hb Percentage Levels	IDA No	IDA %	Anemia of CKD No	Anemia of CKD %
2.1-3.0	1	3.2	--	--
3.1-4.0	4	12.9	2	6.9
4.1-5.0	7	22.6	5	17.2
5.1-6.0	8	25.8	9	31.0
6.1-7.0	11	35.5	13	44.8
Total	**30**	**100.0**	**30**	**100.0**

Table 4 shows study of IDA and anemia of CKD at various ranges of hemoglobin percentage. The above table shows that maximum cases of IDA had Hb levels in the range of 6.1-7.0g% ; followed by 5.1-6.0g% , 4.1-5.0g% , 3.1-4.0g% and 2.1-3.0g% respectively. Similarly, maximum cases of CKD fall in the HB group of 6.1-7g% followed by 5.1-6.0g%, 4.1-5.0g%, 3.1-4.0g%, 2.1-3.0g% respectively.

Discussion

Hospital based cross sectional comparative study carried out among 60 study subjects. 30 were having anemia due to iron deficiency and 30 were having anemia due to chronic kidney disease. Both the groups were compared in terms of iron status markers.

Bahrainwala J et al[9] discussed about diagnosis in patients with chronic kidney disease of iron deficiency anemia. They stated that in patients with chronic kidney disease, not only anemia is common but rather important clinically. There is decreased production of erythropoietin by kidneys and it results in anemia. There is a need for proper diagnosis of anemia in patients with CKD as it will decide whether the patients can be given replacement with iron or he needs agents that stimulate erythropoietin. But it is not easy to diagnose accurately anemia in patients with chronic kidney disease. Iron status indicators have poor sensitivity in these cases. Bone marrow examination may not be possible in each and every case.

Agarwal R et al[10] discussed the uncertainties of anemia due to iron deficiency in patients with chronic kidney disease and expressed certain cautions for the same. They mentioned about one Meta analysis which has shown that use of IV iron did not increase the hemoglobin level significantly compared to oral iron therapy. Hence the author has cautioned about interpretation of studies showing importance of IV iron over oral iron as many of the studies were carried out for a short term. The author emphasized that side effects associated with oral iron therapy are minimal compared to IV iron therapy. Hence the physicians have to take a balanced call while choosing between oral and IV forms of iron therapy.

Ryu SR et al[11] observed in their study of 2198 patients of chronic kidney disease who were not on dialysis that the anemia prevalence was 45%. The authors found from their study that iron status markers, stage of kidney disease, count of leukocytes, concentration of the phosphorous, presence of diabetic nephropathy, body mass index were the risk factors for anemia. They also mentioned that 7.9% of the subjects were on IV iron therapy and erythorpoiesis stimulating agents were given in 42.7% of the cases.

Reddy GC et al[12] carried out a study to assess the iron status indicators among those CKD patients who were diagnosed with functions functional anemia. They found concluded that appropriate iron transport is affected by low levels of transferring. This leads to reduced supply of iron to hematopoietic sites. This leads to low levels of hemoglobin. This can also cause the hypo responsiveness to erythropoietin in patients undergoing dialysis.

Vincent Lau BC et al[13] carried out multi variate analysis in a study of 457 patients out of which 162 were anemic and 295 were non anemic. They found that patients with CKD with stage five were more likely to develop the anemia and they are 16.76 times more at risk of such anemia. CKD stage five patients were also 4.54 times more at risk of developing respiratory disorder. The authors concluded that as the stage of disease of chronic kidney disease increased, the risk anemia also increased.

The mean values of serum iron, TIBC, TSAT, serum ferritin in cases were in the range of 28.6 ±10.3 µg/dl, 496.0 ± 99.5µg/dl, 6.3±2.7% and 5.1 ± 2.3 ng/ml respectively. This is in accordance with the study of Robert Hawkins C.[14]

Conclusion

The severity of anemia was more in patients with chronic kidney disease compared to patients with anemia due to iron deficiency. But the iron status markers were significantly on the lower side patients with anemia due to iron deficiency compared to patients with chronic kidney disease.

Conflict of Interest: None.

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