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A STUDY OF SERUM FERRITIN AND TRANSFERRIN SATURATION IN PATIENTS WITH ANEMIA IN CHRONIC KIDNEY DISEASE

Rajashekar S¹

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ABSTRACT: BACKGROUND: Chronic Kidney disease is an important and non-communicable disease that affects people throughout the world. Anemia affects 60-80% of patients with renal impairment, and common in both pre-dialysis and in patients maintained on dialysis leading to decreased cognitive function, exercise tolerance, cardiac morbidity and mortality totally reduces quality of life and additional risk factor for early death. Present study of measurement of serum ferritin and transferrin saturation helps in diagnosis of iron deficiency in these chronic kidney disease patients.

METHODS: A prospective study was conducted between November-2009 and August 2011 in Krishna Rajendra Hospital attached to Mysore Medical College and Research Institute Mysore. In this study fifty cases of CKD with anemia were randomly selected. All patient data was collected through history, physical examination and laboratory investigation. **RESULTS:** In this study fifty cases of CKD were randomly selected for this prospective study. Among the fifty cases mean age was 56+9 years. Male patients 39(78%) and female patients 11(22%) by ratio 3.5:1. Most common symptoms were facial puffiness (92%), followed by pedal oedema (84%), easy fatigability (70%) and decreased urine output (22%). Most common associated diseases were diabetes mellitus (74%), hypertension (70%), IHD (30%) and dyslipidemia (14%). Mean haemoglobin percentage was 8.9 gm%, 40 (80%) patients were moderately anaemic. Most common type of anaemia was normocytic normochromic anemia with 30 (60%) patients, followed by microcytic hypochromic anemia, in 15(30%) patients and normocytic hypochromic anemia 5 (10%) patients. Among the fifty cases mean blood urea was 158.8mg% and mean serum creatinine was 9.5mg%. Among 50 patients 13(26%) patients has S. Ferritin concentration less than 100 ug% and 10 (20%) were between 100-200 ug% and 27 (54%) patients had >200ug%. Mean S. ferritin concentration was 185.5+28.58. Among 50 patients 22 (44%) patients has transferrin saturation level <20ug followed by 28 (56%) patients had >20 ug%. Mean +SD for transferrin saturation is 16.61 + 6.2. **CONCLUSION:** Measurement of serum ferritin and transferrin saturation is the primary investigation used in making diagnosis of iron deficiency anemia in chronic kidney disease patients. Most of the CKD patients showed iron deficiency anemia.

KEYWORDS: Chronic kidney disease; serum ferritin and transferrin saturation

INTRODUCTION: BACKGROUND: Chronic kidney disease is an important, chronic, non-communicable epidemic disease that affects world including India.^{1,2} It is characterized by irreversible deterioration of renal function, which results from diminished effective functioning of renal tissue. Ensuing impairment of excretory, metabolic and endocrine functions of the kidney leads to the development of clinical syndrome of uremia.³

Anemia is a common complication of chronic kidney disease. The prevalence of anemia varies with the degree of renal impairment in pre dialysis patients with CKD, but once end-stage kidney failure occurs, all patients are eventually affected.^{4,5,6} Anemia develops once renal function decreases

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to 50% because of a deficiency in endogenous erythropoietin production by the kidney, decreased red cell survival, blood losses, and increased red blood cell destruction once the patient begins dialysis treatment, particularly hemodialysis.⁷

Anemia reduces physical capacity, well-being, neurocognitive function, and energy level and worsens quality of life both in pre dialysis and dialysis patient. Absolute or functional iron deficiency is present in 25-38% of patients with anemia of CKD. Serum ferritin and transferrin saturation are most commonly done tests for diagnosing iron deficiency anemia.¹

METHODS:

STUDY DESIGN AND PERIOD: Institution based prospective study was conducted among CKD patients admitted in Krishna Rajendra Hospital attached to Mysore Medical College and Research Institute Mysore. From November 2009-August 2011.

STUDY POPULATION AND STUDY AREA: In this study, study population was patients with CKD admitted to Krishna Rajendra Hospital attached to Mysore Medical College and Research Institute Mysore.

SAMPLE SIZE AND SAMPLING TECHNIQUES: Fifty cases of CKD were selected on the basis of simple random sampling method, during the period from November 2009-August 2011.

DATA COLLECTION PROCEDURE: A Structured questionnaire was used to collect data about sociodemographic, clinical and laboratory parameters. All the patients underwent detailed, clinical examination and the following investigations were carried out.

Hb%, Complete hemogram, Fasting blood sugar, post prandial blood sugar, blood urea, serum creatinine, Serum electrolytes, Urine routine; albumin, Sugar, microscopy, Ultra sound abdomen, ECG, Fasting Lipid Profile, HIV 1&2< anti-HCV, HbsAg, Serum Iron, Serum Ferritin, Tranferrin Saturation, Total Iron Binding Capacity, Blood samples are drawn for Serum Ferritin concentration and measured by Chemilumiscence method. Transferrin saturation level calculated using formula Tranferrin Saturation = Serum Iron /TIBC.

VARIABLE: Age, sex, clinical features, Hb%, type of anemia, Blood Urea, Serum creatinine are study variables, serum ferritin and transferrin saturation are out come variables.

DIAGNOSIS OF CKD, ANEMIA IN CKD AND IRON DEFICIENCY: Diagnosis of CKD and Anemia in CKD as done According to standard guidelines. Absolute Iron deficiency is defined as serum ferritin <100ng/ml in non-dialysis dependent CKD and patients treated with peritoneal dialysis and <200ng/ml in hemodialysis patients. Functional iron deficiency is diagnosed when serum ferritin is 100-200% ng/ml. Transferrin saturation is <20% indicates iron deficiency in all patients.⁸

ETHICAL CONSIDERATION: Ethical approval was obtained from ethical committee of Mysore Medical College and Research Institute Mysore.

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RESULTS:

SOCIODEMOGRAPHIC AND CLINICAL CHARACTERISTICS:

Age (Years)	Number of Patients	Percentage
31-40	5	10
41-50	5	10
51-60	24	48
61-70	14	28
71-80	2	4
Total	50	100
AGE INCIDENCE		

In the study group of 50 Patients with CKD, maximum incidence of 24 (48%) patients seen in age group of 51-60years. Patients age ranged from 31-80 years. Mean age group of study patients is 56 + 9 years.

Gender	Number of Patients	Percentage
Male	39	78
Female	11	22
Total	50	100
Sex incidence		

In the study group of 50 patients of CKD, 39(78%) were males and 11(22%) were females. Male:female ratio was 3.54:1

Symptoms	Number of Patients	Percentage
Facial puffiness	46	92
Pedal oedema	42	84
Easy fatigability	35	70
Decreased urine output	16	32
Breathlessness	16	32
Altered sensorium	4	8
Incidence of symptoms in patients with CKD		

Among 50 patients with CKD, facial puffiness was the most common symptom found in 46(92%) patients followed by pedal oedema in 42(84%) patients, easy fatigability in 35(70%) patients, decreased urine output and breathlessness in 16(32%) patients each and altered sensorium in 4(8%) patients.

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ASSOCIATED DISEASES FOR CKD:

Diseases	Number of Patients	Percentage
DM	37	74
HTN	35	70
IHD	15	30
DM, HTN	26	52
DM, HTN, IHD	7	14
Dyslipidemia	7	14
Incidence of associated diseases		

Among 50 patients studied, 37(74%) patients had diabetes mellitus, followed by hypertension in 35(70%) patients. Combination of both diseases seen in 26(52%) patients followed by ischaemic heart disease in 15(30%) patients and dyslipidemia in 7(14%) patients, 7(14%) patients had all three diseases (hypertension, diabetes mellitus and ischaemic heart disease).

Percentage of Hb	Number of patients
6.1-7	1
7.1-8	6
8.1-9	23
9.1-10	17
10.1-11	3
Total	50
Type of anemia and Hb percentage, Stage of CKD	

Among 50 Patients of CKD studied, 23 Patients had haemoglobin percentage of 8.1-9gm%, followed by 17 Patients in the range of 9.1-10gm%. Haemoglobin percentage is ranged from 6.1-11gm%. mean haemoglobin is 8.9gm%.

Hb%	No. of Patients	Percentage	Stage of CKD
6.1-7	1	2	Stage of V
7.1-8	6	12	Stage of V
8.1-9	23	46	Stage of V
9.1-10	17	34	Stage of V
10.1-11	3	6	Stage of V
Total	50	100	Stage of V
Stage of kidney based on GFR correlation with Hb percentage			

Among 50 Patients of CKD studied Hb% ranged from 6.1-11 gm%. All of them belong to stage V CKD according to Cockcroft Gault formula.

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DISTRIBUTION OF BLOOD UREA SERUM CREATININE IN CKD:

B. Urea level	Number of patients	Percentage
51-100	1	2
101-150	25	50
151-200	20	40
201-250	3	6
251-300	0	0
301-350	1	2
Total	50	100
Distribution of Blood Urea in CKD		

Among 50 patients studied, 45(90%) patients had B. Urea level between 100 and 200. Mean B. urea level of total patients is 158.8.

Serum creatinine	Number of patients	Percentage
0-4.9	2	4
5-9.9	26	52
10-14.9	20	40
15-19.9	2	4
Total	50	100
Distribution of serum creatinine in CKD		

Among 50 patients studied, 46 (92%) patients had S. Creatinine level between 5-14.9 Mean S. creatinine level of total patients was 9.5 and range was 11mg%

SERUM FERRITIN AND TSAT IN CKD:

serum ferritin	Number of patients	Percentage
0-100	13	26
101-200	10	20
201-300	21	42
301-400	06	12
Total	50	100
Distribution of S. ferritin in CKD patients		

Among 50 Patients of CKD studied, 13(26%) patients had S. ferritin less than 100ug % followed by 10(20%) patients had between 101-200ug and 21(42%) patients above 200ug. Mean S ferritin of total patients is 185.5 and standard deviation is 28.58.

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TSAT%	Number of patients	Percentage
0.1-10	2	4
10.1-20	20	40
20.1-30	7	14
30.1-40	10	20
40.1-50	10	20
50.1-60	1	2
Total	50	100
Distribution of Transferrin saturation level		

Among 50 patients of CKD studied, 22(44%) patients had transferrin saturation level <20 ug% followed by 7(14%) patients >20ug% and 1(2%) patients is above 50ug%. Mean transferrin saturation is 16.6% and standard deviation is 6.2.

DISCUSSION: Majority of the study subject were males (78%) in line with several other studies like Avasthi et al., Alam SM et al., Altaf Basha et al., emulating this fact. As men suffer CKD more than females due to the fact that in developing countries men tend to seek medical attention than females.

The average age in the study is 56 + 9 was comparable to chug et al. study and the other hand remember that increasing age is a traditional risk factor of CKD as age increases, GFR decreases. Therefore CKD is common in elderly than young individuals.

This study showed DM, HTN, is the main underlying diseases for CKD individually. Half of the study subjects had both diseases (56%).

Among 50 patients 48% had moderate anemia which is comparable with Talwar et al. study. Most common type anemia is NNA, seen in the present study which is (60%). Mean S. ferritin is 185 + 28.58 and transferrin saturation is 16.6 + 6.2 respectively. Which is comparable with silverberg et al. and Bruce et al. studies?

LIMITATIONS:

1. It is a descriptive epidemiological study conducted only for 50 Patients of CKD for duration of one and half year only.
2. Serum ferritin is less sensitive indicator compared to recent methods like estimation of Hb% in reticulocytes.
3. Serum ferritin level can be affected (increases) in infection and inflammation.
4. S. ferritin is relatively low in women compared to men.
5. Transferrin saturation level can be low in hypoalbuminemia and other chronic diseases.
6. Selection of case done randomly.

CONCLUSION: Serum ferritin and transferrin saturation are the primary tools for assessing iron status and management in patients with anaemia of CKD both in pre-dialysis and post-dialysis patients.

Serum ferritin and transferrin saturation aids in making diagnosis of iron deficiency in CKD. and helps in guiding treatment with iron supplementation and erythropoiesis stimulating agents. Most of the CKD patients showed absolute and functional iron deficiency state.

ABBREVIATIONS:

CKD - Chronic kidney disease.
S. Ferritin - Serum ferritin.
TSAT - Transferrin saturation.
TIBC - Total iron binding capacity.
DM - Diabetes mellitus.
HTN – Hypertension.
IHD - Ischaemic heart disease.
Hb-Haemoglobin.
GFR - Glomerular filtration rate.
NNA - Normocytic normochromic anemia.

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REFERENCES:

1. Gupta S, Uppal B, Pawar B, Is soluble transferrin receptor a good marker of iron deficiency anemia in chronic kidney disease patients? *Ind J Nephrol* 2009 Jul; 19(3):96-99.
2. National Kidney Foundation: Kidney Disease outcomes quality initiative: clinical practice guidelines for anemia of chronic kidney disease. IV NKF-K/DOQI. Update 2000. *Am J Kidney Dis* 2001; 37: S182-238.
3. Strippoli GFH, Craig JC, Manno C, Schena FP. Hemoglobin targets for the anemia of chronic kidney disease: A meta-analysis of randomized, controlled trials. *J Am SocNephrol* 2004; 15: 3154-65.
4. Hsu CY, McCulloch CE, Curhan GC, Epidemiology of anemia associated with chronic renal insufficiency among adults in the United States: Results from the Third National Health and Nutrition Examination Survey. *J Am SocNephrol* 2002; 13: 504-10.
5. Obrador GT, Roberts T, St Peter WL, Frazier E, Pereira BJ, Collins AJ, Trends in anemia at initiation of dialysis in the United States. *Kidney Int* 2001; 60: 1875-84.
6. Hemodialysis. Australia and New Zealand Registry Annual Report. 2001.
7. Caro J, Brown S, Miller O, Murray T, Erslev AJ. Erythropoietin levels in uremic nephric and anephric patients. *J Lab Clin Med* 1979; 93: 449-58.
8. Mann JF. What are the short-term and long-term consequences of anemia in CRF patients? *Nephrol Dial Transplant* 1999; 14 (2): 29-36.

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AUTHORS:

1. Rajashekar S.

PARTICULARS OF CONTRIBUTORS:

1. Senior Resident, Department of General Medicine, Mandya Institute of Medical Science, Mandya.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Rajashekar S,
Senior Resident,
Department of General Medicine,
Mandya Institute of Medical Science,
Mandya-571401.
Email: prakashpsmandya@gmail.com

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