Screening Of Renal Diseases in The Subjects Belonging To The Urban Area With Serum Creatinine, Urea, Uric Acid, Calcium And Iron

Dr. Jyoti Dwivedi

Professor (Designate)
Dept. of Biochemistry
S. S. Medical College Rewa (M.P.) India.

Abstract- **Renal Function Tests are used to categorize renal dysfunction, severity of renal disease, and for the follow-up of renal diseases. Renal disease is any condition that causes renal inflammation or tissue damage and affects renal function. The aim of the study was the evaluation of serum iron and calcium parameters in patients with renal function test and analysis of the relationships between serum level of iron and calcium in women and men according to age in group's examined. Therefore, this study was carried out to investigate iron and calcium status in renal inflammation. The blood samples were analyzed for serum iron, urea, uric acid, creation and calcium level. Significantly decreased levels of serum iron, calcium and increased level of serum urea, uric acid and creatinine ($p<0.0001$).**

INTRODUCTION

Iron deficiency is common in patients with kidney disease.1Iron deficiency anemia can develop relatively early in the course of chronic renal failure (CRF).2 Anemia is a well-known consequence of chronic kidney disease (CKD), and its prevalence progressively increases when the estimated glomerular filtration rate decreases to less than 60 mL/min/1.73 m2. 3 Anemia is a common comorbidity of chronic kidney disease (CKD). As the diseased kidney loses its ability to produce the erythropoietin essential to the production of hemoglobin, anemia ensues.4 Serum creatinine is the most commonly used marker for estimation of glomerular filtration rate (GFR).5 Anemia is a universal problem among children with chronic kidney disease (CKD). Lower levels of glomerular filtration rate (GFR) are associated with lower levels of hemoglobin, and in adults the latter is most pronounced when the GFR falls below 60 mL/min per 1.73 m^2 .6 In children, the relationship between GFR and anemia is less clear. However, treatment of anemia in both adults and children has improved dramatically with the advent of regular erythropoietin (EPO) and iron therapy. As well, the many studies performed in adults and relatively fewer studies carried out in children have demonstrated that improved hemoglobin levels are associated with benefits in quality of life, cognitive function, exercise capacity and cardiovascular function .7,8,9,10 Patients with chronic kidney disease (CKD) need regular monitoring, usually by blood urea and creatinine measurements, needing venepuncture, frequent attendances and a healthcare professional, with significant inconvenience. 11 Anemia resulting from iron and erythropoietin deficiencies is a common complication of advanced chronic kidney disease (CKD). 12 Anemia remains an early and common complication of chronic kidney disease that causes troubling symptoms and reduced quality of life. 13 Anemia is one of the laboratory and clinical findings of chronic kidney diseases (CKD). The presence of anemia in patients with CKD has a wide range of clinically important consequences. According to current knowledge, anemia also contributes to the progression of CKD and is one of the factors that contribute to the high morbidity and mortality in patients with chronic renal failure and their reduced survival.14 Decreased availability of iron for erythropoiesis leads to the anemia of chronic kidney disease. 15 Potential renal toxicity from iron induced oxidant stress, especially in patients with underlying chronic kidney disease, merits further investigation.16

Renal anemia is caused by a lack of erythropoietin and iron, and is associated with increased morbidity and mortality in patients with chronic kidney disease.17 Whether calcium channel blockers (CCBs) are associated with lower hemoglobin levels in chronic kidney disease (CKD).18 Effect of calcium-based versus non-calcium-based phosphate binders on mortality in patients with chronic kidney disease.16 The non-linear relationships between the minerals and mortality to obtain accurate effect estimates.17

Various biochemical parameters that are presently determine in serum. Total iron, calcium, urea, uric acid and creatinine for the screening and diagnosis of renal disease as well as to alter mine the change that occurs in the metabolic process associated with the renal disease complication. The purpose of this research is to establish biochemical parameters for the screening and diagnosis of renal diseases and its complication with risk factors of iron, calcium. To determine the interrelationship of iron and other diagnosed parameter through them.

MATERIALS AND MATHODS

This study was conducted at the Department of Biochemistry S.S. Medical College Rewa (M.P.). Source of data- The study group compared of 111 subjects from 10-90 years of age.

Specimen collection and preparation/ collection of samples-Venous blood was collected from all subjects after 12 hours over night fasting. Fasting venous blood were drawn from all 3 ml of venous blood was collected and stored in a sterile vial. Blood was allowed to clot of room temperature. Clot was rimmed, centrifugation serum was separated by low speed centrifugation and the serum was stored in a sterile vial hemolyzed and lipemic samples were rejected.

Biochemical analysis-Serum total protein, bilirubin, calcium and iron were estimated by colorimetric method. Present work was approved by institutional research and ethical committee. Mean and standard deviation were determined for each variable in all groups. All results were expressed as mean +/-SD. Student "t" test was used to assess statistical significance of the results.

OBSERVATION

Table.1-The level of Serum calcium, iron, urea, uric acid and creatinine in the age group of 10-30 years.

Variables	Male (n=80)	Female(n=29)
Serum calcium (mg/dl)	9.10±0.78	8.81±2.72
Serum iron (mcg/dl)	74.30±60.46	70.44±53.33
Serum uric acid (mg/dl)	6.26±0.79	6.36±0.55
Serum Creatinine (mg/dl)	1.33±0.47	1.10± 2.35
Serum urea (mg/dl)	25.20±10·44	26.97±10·08

Table.2-The level of Serum calcium, iron, urea, uric acid and creatinine the age group of 31-60 years .

Variables	Male (n=42)	Female(n=60)
Serum calcium (mg/dl)	7.90±6.0	7.0±1.52
Serum iron (mcg/dl)	70.28±27.11	62.60±41.21
Serum uric acid (mg/dl)	9.46±7.48	9.60±1.13
Serum Creatinine (mg/dl)	1.77±0.43	1.50± 0.30
Serum urea (mg/dl)	41.92±28.51	40.25±18.24

Table.3-The level of Serum calcium, iron, urea, uric acid and creatinine in the age group of 61-90 yrs.

Variables	Male (n=38)	Female(n=34)
Serum calcium (mg/dl)	6.87±1.40	6.50±1.83
Serum iron (mcg/dl)	65·57±32·13	56·18±17·48
Serum uric acid (mg/dl)	10.8±13.7	10.0±1.55
Serum Creatinine (mg/dl)	2.25±0.32	2.0± 2.98
Serum urea (mg/dl)	65.9±14·62	63·5±20·12

Correlation coefficient and significance in the study group.

Parameter	Correlation coefficient	P value
Serum uric acid and Serum iron	-0.54	P<0.0001
Serum calcium and Creatinine	-0.81	P< 0.001
Serum uric acid and Serum calcium	-0.51	P<0.0001
Serum creatinine & Serum Iron	-0.62	P<0.0001
Serum Calcium & Serum Iron	+0.63	P<0.0001
Serum urea and Serum iron	-0.65	P < 0.0001
Serum urea and Serum calcium	-0.60	P < 0.0001

RESULT

The present study was done with an aim to screen the subjects10-90 years of age in urban region for renal diseases. The serum iron level obtained was then correlated with another parameter with determined. descriptive statics of diagnostic parameters presented in Table I. There was a statistically significant decreased level of the serum total protein, calcium, iron and increased serum bilirubin level in all groups. Table II- Description about correlation coefficient and significance with diagnosed parameters in the study groups.

DISCUSSION

Screening and early detection are important since significant renal damage may occur with few or no symptoms. Abnormal RFT, first indication of sub clinical renal disease and may thereby guide further diagnostic evaluation. Anemia frequently complicates the course of chronic kidney disease (CKD). Although erythropoietin deficiency is the major cause of anemia, iron deficiency occurs commonly and may evoke poor response to erythropoietin .21 The independent contribution of chronic kidney disease (CKD) and age to anemia in older nursing home residents.22 Prevalence of anemia (hemoglobin <13 g/dL for men and <12 g/dL for women) and CKD (estimated glomerular filtration rate <60 mL/min per 1.73 m(2), according to Modification of Diet in Renal Disease criteria) and the contribution of CKD and age to the prevalence of anemia.22 Overall, these results suggest that CKD contributes more strongly than older age to the high prevalence of anemia in older nursing home residents.22,23 Anemia is a common comorbidity of chronic kidney disease (CKD). The age-related rise in CKD makes anemia in CKD a problem of increasing prevalence among residents of long-term care facilities.23 Anemia is a frequent complication of chronic kidney disease (CKD). Inadequate production of erythropoietin by the failing kidneys leads to decreased stimulation of the bone marrow to produce red blood cells (RBCs). Anemia of CKD develops early and worsens with progressive renal insufficiency. 24,25 Iron deficiency is frequently seen in anemic CKD patients. Iron supplementation is essential for the treatment of patients with anemia of chronic kidney disease (CKD). 26 Anemia develops during the early stages of CKD and is common in patients with ESRD. 27 cardiovascular disease (CVD) remains the leading cause of morbidity and mortality in patients with end-stage renaldisease (ESRD).28,29,30,31 Intravenous (IV) iron is used in the treatment of anemia in patients with chronic kidney disease (CKD). 32 Hyperuricaemia has long been known to be associated with cardiovascular disease, and it is particularly common in patients with kidney disease, metabolic syndrome and diabetes mellitus.33

Iron deficiency is the most common cause of hypo responsiveness to erythropoiesis-stimulating agents (ESAs) in end-stage renal disease (ESRD) patients. Intravenous iron therapy into anemia management allowed attainment of target hemoglobin values in the majority of pediatric and adult CKD and ESRD patients.34,35,36 The prevalence of chronic kidney disease (CKD) is high and diabetic nephropathy is a leading cause of CKD. One of the most common complications of CKD is anemia, the frequency and severity of which increase as kidney failure progresses. Renal anemia is primarily caused by reduced renal erythropoietin production. It can also be associated with iron deficiency caused by reduced iron absorption, occult blood loss and impaired iron mobilization. 37. Partial, but not complete, correction of anemia is associated with improved outcomes in patients with CKD. Chronic renal disorders have a progressive course in most cases, and finally result in end-stage renal disease (ESRD).38 Association between serum concentrations of parathormone, calcium and phosphorus in hemodialysis patients.39 40,41 Hyperuricemia is associated with renal disease, but it is usually considered a marker of renal dysfunction rather than a risk factor for progression. 42 Although hyperuricemia has long been associated with renal disease, uric acid has not been considered as a true mediator of progression of renal disease. However, recent epidemiologic evidence suggests a significant and independent association between the level of serum uric acid and renal disease progression with beneficial effect of decreasing uric acid levels.43 Furthermore, our experimental data using hyperuricemic have provided robust evidence regarding the role of uric acid on progression of renal disease.

REFERENCES:

1. Bickford AK. Evaluation and treatment of iron deficiency in patients with kidney disease. Nutr Clin Care. 2002 Sep-Oct;5(5):225-30.
2. McClellan WM, Resnick B, Lei L, Bradbury BD, Sciarra A, Kewalramani R, Prevalence and severity of chronic kidney disease and anemia in the nursing home population. J Am Med Dir Assoc. 2010 Jan;11(1):33-41.
3. Rossert J, Froissart M. Role of anemia in progression of chronic kidney disease. Semin Nephrol. 2006 Jul;26(4):283-9.
4. Robinson BE. Epidemiology of chronic kidney disease and anemia. J Am Med Dir Assoc. 2006 Nov;7(9 Suppl):S3-6; quiz S17-21.
5. Thomas L, Huber AR. Renal function--estimation of glomerular filtration rate. Clin Chem Lab Med. 2006;44(11):1295-302.
6. Grabe DW. Update on clinical practice recommendations and new therapeutic modalities for treating anemia in patients with chronic kidney disease. Am J Health Syst Pharm. 2007 Jul 1;64(13 Suppl 8):S8-14; quiz S23-5.

7. K/DOQI; National Kidney Foundation (2006) III Clinical Practice Recommendations for Anemia in Chronic Kidney Disease in Children. Am J Kidney Dis 47(Suppl 3):S86–108.
8. Morris KP, Skinner JR, Hunter S, Coulthard MG (1994) Cardiovascular abnormalities in end stage renal failure: the effect of anaemia or uraemia? Arch Dis Child 71:119–122.
9. Morris KP, Sharp J, Watson S, Coulthard MG (1993) Non-cardiac benefits of human recombinant erythropoietin in end stage renal failure and anaemia. Arch Dis Child 69:580–586
10. Jabs K (1996) The effects of recombinant human erythropoietin on growth and nutritional status. Pediatr Nephrol 10:324–327
11 .Ebah LM, Read I, Sayce A, Morgan J, Chaloner C, Brenchley P, Mitra S. Reverse iontophoresis of urea in health and chronic kidney disease: a potential diagnostic and monitoring tool? Eur J Clin Invest. 2012 Aug;42(8):840-7.
12.Patel TV, Singh AK. Anemia in chronic kidney disease: new advances. Heart Fail Clin. 2010 Jul;6(3):347-57.
13.Fishbane S. Anemia in chronic kidney disease: status of new therapies. Curr Opin Nephrol Hypertens. 2009 Mar;18(2):112-5.
14. Besarab A[1], Coyne DW. Iron supplementation to treat anemia in patients with chronic kidney disease. Nat Rev Nephrol. 2010 Dec;6(12):699-710.
15.Zadrazil J1, Horak P.Pathophysiology of anemia in chronic kidney diseases. A review.Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2014 Jan 3.
16. Tolouian R[1], Rajabi B, Boman D, Bilbao J, Gupta A. Iron infusion and deposition in the kidney. Clin Nephrol. 2013 Mar;79(3):237-40.
17.Martines AM[1], Masereeuw R, Tjalsma H, Hoenderop JG, Wetzels JF, Swinkels DW. Iron metabolism in the pathogenesis of iron-induced kidney injury. Nat Rev Nephrol. 2013 Jul;9(7):385-98.
18. Cikrikcioglu MA[1], Karatoprak C, Cakirca M, Kiskac M, Zorlu M, Cetin G, Yildiz K, Erkoc R, Alay M, Erkal S, Erkal SN, Dogan S, Kazancioglu R Association of calcium channel blocker use with lower hemoglobin levels in chronic kidney disease. Eur Rev Med Pharmacol Sci. 2013 Sep;17(18):2530-7.
19. Jamal SA[1], Vandermeer B, Raggi P, Mendelssohn DC, Chatterley T, Dorgan M, Lok CE, Fitchett D, Tsuyuki RT.Effect of calcium-based versus non-calcium-based phosphate binders on mortality in patients with chronic kidneydisease: an updated systematic review and meta-analysis. Lancet. 2013 Oct 12;382(9900):1268-77.
20. Natoli JL[1], Boer R, Nathanson BH, Miller RM, Chiroli S, Goodman WG, Belozeroff V.Is there an association between elevated or low serum levels of phosphorus, parathyroid hormone, and calciumand mortality in patients with end stage renal disease? A meta-analysis. BMC Nephrol. 2013 Apr 17;14:88.
21Reardon G, Wasserman MR, McKenzie RS. The prevalence and recognition of chronic kidneydisease and anemia in long-term care residents. Consult Pharm. 2012 Sep;27(9):627-4
22.Schnelle J, Osterweil D, Globe D, Sciarra A, Audhya P. Chronic kidney disease, anemia, and the association between chronic kidney disease-related anemia and activities of daily living in older nursing home residents. J Am Med Dir Assoc. 2009 Feb;10(2):120-6.
23.McClellan WM, Resnick B, Lei L, Bradbury BD, Sciarra A, Kewalramani R. Prevalence and severity of chronic kidney disease and anemia in the nursing home population. J Am Med Dir Assoc. 2010 Jan;11(1):33-41.
24.Robinson BE. Epidemiology of chronic kidney disease and anemia. J Am Med Dir Assoc. 2006 Nov;7(9 Suppl):S3-6; quiz S17-21.
25.Agarwal AK. Practical approach to the diagnosis and treatment of anemia associated with CKD in elderly. J Am Med Dir Assoc. 2006 Nov;7(9 Suppl):S7-S12; quiz S17-21.
26.Rozen-Zvi B, Gafter-Gvili A, Paul M, Leibovici L, Shpilberg O. Intravenous versus oral iron supplementation for the treatment of anemia in CKD: systematic review and meta-analysis. Am J Kidney Dis. 2008 Nov;52(5):897-906.
27.Hudson JQ, Comstock TJ. Considerations for optimal iron use for anemia due to chronic kidney disease. Clin Ther. 2001 Oct;23(10):1637-71.
28. Cases A, Coll E, Collado S. Anemia in chronic kidney disease and its cardiovascular implications. Med Clin (176Barc). 2009 May;132 Suppl 1:38-42.
29.Levin A. Clinical epidemiology of cardiovascular disease in chronic kidney disease prior to dialysis. Semin Dial. 2003 Mar-Apr;16(2):101-5.
30.Jaradat MI, Molitoris BA. Cardiovascular disease in patients with chronic kidney disease. Semin Nephrol. 2002 Nov;22(6):459-73.
31. Hou FF, Ma ZG, Mei CL, Rong S, Huang SM, Liu XR, Yuan WJ, Cardiovascular disease in Chinese chronic renal insufficiency patients-epidemiology survey. Zhonghua Yi Xue Za Zhi. 2005 Feb 23;85(7):458-63.
32. Mansour W, Bissram M, Rosner MH. Intravenous iron therapy and risk for progressive loss of kidney function in patients with chronic kidney disease. Nephron Clin Pract. 2011;118(2):c189-94

33. Zapolski T, Waciński P, Kondracki B, Rychta E, Buraczyńska MJ Uric acid as a link between renal dysfunction and both pro-inflammatory and prothrombotic state in patients with metabolic syndrome and coronary artery disease. Kardiol Pol. 2011;69(4):319-26.
34. De Lima GA, Mazzali M, Gentil AF, Plotegher L, Grotto HZ. Anemia in chronic renal disease: evaluation of inflammatory activity on erythropoiesis and iron metabolism in patients not submitted to dialysis treatment. Clin Lab. 2012;58(7-8):695-704.
35. Agarwal AK. Practical approach to the diagnosis and treatment of anemia associated with CKD in elderly. J Am Med Dir Assoc. 2006 Nov;7(9 Suppl):S7-S12; quiz S17-21.
36. Adhikary L[1], Acharya S. Efficacy of IV iron compared to oral iron for increment of haemoglobin level in anemic chronic kidney diseasepatients on erythropoietin therapy. JNMA J Nepal Med Assoc. 2011 Jul-Sep;51(183):133-6.
37. Ruedin P[1], Dickenmann M, Martin PY, Wüthrich RP. Management of renal anemia in patients with chronic kidney disease: the role of the general practitioner. Rev Med Suisse. 2012 Jan 11;8(323):70-3.
38. Lankhorst CE[1], Wish JB. Anemia in renal disease: diagnosis and management. Blood Rev. 2010 Jan;24(1):39-47.
39. Tajbakhsh R[1], Joshaghani HR, Bayzayi F, Haddad M, Qorbani M. Association between pruritus and serum concentrations of parathormone, calcium and phosphorus in hemodialysis patients. Saudi J Kidney Dis Transpl. 2013 Jul;24(4):702-6.
40. Taniguchi M[1], Fukagawa M, Fujii N, Hamano T, Shoji T, Yokoyama K, Nakai S, Shigematsu T, Iseki K, Tsubakihara Y; Committee of Renal Data Registry of the Japanese Society for Dialysis Therapy. Serum phosphate and calcium should be primarily and consistently controlled in prevalent hemodialysis patients. Ther Apher Dial. 2013 Apr;17(2):221-8.
41. Micozkadioglu H[1], Ozelsancak R, Yildiz I, Erken E, Zumrutdal A, Torun D, Haberal M. Circadian rhythm of serum phosphate, calcium and parathyroid hormone levels in hemodialysis patients. Clin Lab. 2013;59(1-2):79-84.
42. Kang DH[1], Nakagawa T, Feng L, Watanabe S, Han L, Mazzali M, Truong L, Harris R, Johnson RJ. A role for uric acid in the progression of renal disease. J Am Soc Nephrol. 2002 Dec;13(12):2888-97.
43. Kang DH[1], Nakagawa T. Uric acid and chronic renal disease: possible implication of hyperuricemia on progression of renal disease. Semin Nephrol. 2005 Jan;25(1):43-9.