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ORIGINAL RESEARCH

Evaluation of biochemical parameters in chronic hemodialysis patients in a tertiary care teaching hospital

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ABSTRACT

Background: Protein energy malnutrition affects chronic Hemodialysis patients and is associated with significant morbidity and mortality. Malnutrition is related to inflammation, diminished dietary intake, adequacy of dialysis, socio economic factors. Various biochemical parameters like urea, creatinine, calcium, phosphorous, albumin, pre albumin, cholesterol, transferrin is measured. Anthropometric measurements like height, body weight, triceps skin fold thickness, mid arm circumference, mid arm muscle circumference is measured. Aim of this study is to assess malnutrition in chronic Hemodialysis patients through various Biochemical parameters and correlate them with anthropometric measurements. **Materials & methods:** All the participants or their attenders were informed about the study and informed consent was obtained from them. A brief history about their personal details such as life style, physical activity, food habits, their socioeconomic status, history of any illness was obtained. General examination and systemic examination were done. The study population N = 85 in the age group of > 25 years in both sexes under chronic Hemodialysis for more than three months. After getting the informed consent from the patient and patient attender, 4ml of blood was collected for biochemical investigations. **Results:** In this study, there was malnutrition among the Hemodialysis patients. P value was found to be significant for Cholesterol, Albumin, Prealbumin, Transferrin by One way ANOVA .Pearson Correlation between SGA score and Cholesterol, Albumin, Phosphorus, Calcium, Prealbumin, Transferrin showed statistically significant negative linear relationship .In our study Significant correlation is not seen for the Biochemical parameters and Anthropometric measurements like Body mass index, Mid arm muscle circumference. **Conclusion:** Malnutrition is one of the main causes of mortality and morbidity among Chronic Hemodialysis patients. So, Assessment of malnutrition should be done even before the initiation of Hemodialysis which will help in the favorable outcome of the Hemodialysis patients. Several parameters are available for the assessment of malnutrition, of which Biochemical parameters play a major role.

Key Words: Hemodialysis, Malnutrition, Anthropometric measurements, Biochemical Parameters.

INTRODUCTION

According to the updated review of World health organization 63% of the total mortality in India are due to non-Communicable diseases.(1) Global estimated prevalence of CKD is 13.4% and patients with end stage kidney disease needing renal replacement therapy is estimated between 4.902 and 7.083 million.(2). Chronic kidney disease refers to the group of clinical abnormalities that progressively declines as kidney function declines. A large number of systemic diseases that damage the Kidney lead to chronic kidney disease. Intrinsic disorders of the Kidney can also cause CKD. Clinically significant chronic kidney disease (CKD) is defined as the glomerular filtration rate being persistently < 60 mL/minute/1.73 m^2, which seems to be below the level of kidney function expected to occur with aging.

The Kidney Disease Outcomes Quality Initiative (KDOQI) from the national Kidney Foundation (NKF) defines chronic kidney disease as either damage in the kidney or Glomerular filtration rate (GFR), less than 60ml/min/1.73m^2 for a period of at least 3 months, where pathological abnormalities or markers of kidney damage includes abnormalities in either of the blood tests, urine tests or imaging studies that assess the kidney damage. (3)

Malnutrition refers to the presence of a low-nutrient intake or, an intake that is inadequate for the nutritional needs of the individual.(4) An increase in proinflammatory cytokines such as tumor necrosis

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factor-alpha and interleukin-6 can cause loss of protein stores and also can induce anorexia with reduced nutrient intake which ultimately leads to malnutrition. (5) The long-term complication of chronic kidney disease is Nutritional deficiencies and they are associated with reduced physical activity and poor survival (6)

In Chronic kidney Disease conditions that are not related to reduced nutrient intake like nonspecific inflammatory processes, transient, intercurrent catabolic illnesses, nutrient losses into dialysate, acidaemia, endocrine disorders such as resistance to insulin, growth hormone and insulin-like growth factor, hyperglucagonemia, hyperparathyroidism and loss of blood into the hemodialyzer, into faeces or by blood drawing results in loss of lean body mass. (4) Nutritional and metabolic derangements in patients with chronic kidney disease and dialysis is characterized by simultaneous loss of systematic body protein and energy stores, leading ultimately to loss of muscle and fat mass and cachexia.

Protein energy wasting is caused by hyper catabolic status, Uremic toxins, malnutrition, and inflammation, are exceptionally common and closely associated with mortality and morbidity in patients with CKD, particularly in those with CKD stage G3b, G4 and G5 eGFR<45ml/min/1.73m^2 BSA) and end-stage renal disease requiring maintenance dialysis and treatment(7)

Nutritional health is of grave significance in Hemodialysis patient's (8).Restricted eating in Hemodialysis patients may deteriorate their health (9) Nutritional status monitoring should include a Subjective Global Assessment administration once every 3-6 months. The modified Subjective Global Assessment is a reliable and valid tool for the Nutritional assessment of the Hemodialyzed Patients.(10). Anthropometric measurements like Mid arm circumference, mid arm muscle circumference, Triceps Skin fold thickness ,Body Mass Index adds a useful dimension to the interpretation of other standard assessment tools such as the clinical and dietary history, physical examination, and laboratory tests.(11) Malnutrition in Hemodialyzed Patients can cause morbidity and mortality. So, the nutritional status of the Patients should be predicted with the help of biochemical parameters and malnourishment should be corrected appropriately.

MATERIALS & METHODS

This study was done as a single center cross sectional study for a period of 6 months in 85 patients at Government Stanley Medical College at 24 Hours Biochemistry lab, Govt. Stanley Medical College &Hospital and Dept of Nephrology, Govt. Stanley Medical College & Hospital after obtaining ethical clearance from Ethical committee & prior permission from each department. Chronic Hemodialysis patients of both sex in the age group >25 years were included in the study. Patients with malignancy, acute infection, elevated body temperature and other chronic diseases were included. All the participants will be informed about the study and informed consent will be obtained from the participants. There is no risk for the participants in conducting this study.

After obtaining informed consent from the patient, under aseptic precaution, 4ml blood sample will be collected in red Plain tube before initiation of Hemodialysis. Blood in the plain red tube was allowed to clot and centrifuged at 2000-2500 rpm for 15 minutes. Serum samples were separated immediately from the cells and analyzed for Total protein, Albumin, Prealbumin, Transferrin, Total Cholesterol, Blood Sugar, Blood Urea, Creatinine, Triglycerides, HDL in our 24 hours central Biochemistry lab using auto analyzer - EM 360. Anthropometric measurements like weight, height, Body mass Index, Mid arm circumference, Triceps Skin fold thickness were measured thirty minutes after Dialysis session. Malnutrition was divided bases on standard global assessment score.

STATISTICAL ANALYSIS

The collected data were analyzed with IBM Statistical package for the social sciences (SPSS) software 23.0-version Normal distribution of the data was analyzed by the numerical test. The data was normally distributed. Thus, parametric tests were done to compare the means of anthropometric and biochemical parameters. p value <0.05 was considered to be significant.

RESULTS

In our study population, among total of 85 patients age range was from 18 to 65 years with mean age being 44.69 ± 13.91 years, Also 52 were male and rest 33 were female. In our study population, 28 had mild malnutrition, 29 had moderate malnutrition and 28 patients had severe malnutrition based on global assessment score.

Coming mean difference in anthropometric measurements, in comparison with severity of malnutrition there was significant difference in height, weight, body mass index and MAMC.

Table 1: Mean distribution of anthropometric measurements among study participants

Anthropometric measurements	Mean ± SD			p value*
	Mild	Moderate	Severe	
Height (cm)	157.9 ± 6.876	157.3 ± 9.132	150.1 ± 3.152	0.000
Weight (kg)	42.51 ± 7.918	47.81 ± 10.18	47.74 ± 7.751	0.037
BMI	17.02 ± 2.935	19.45 ± 4.242	21.39 ± 3.417	0.000

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TSF (mm)	12.84 ± 1.484	12.74 ± 1.521	12.46 ± 1.276	0.598
MAC (cm)	22.41 ± 2.618	23.19 ± 2.440	24.00 ± 2.130	0.052
MAMC	18.37 ± 2.760	19.19 ± 2.573	20.08 ± 2.064	0.041

In our study population, next, we did biochemical parameters and there was significant difference in hemoglobin levels and potassium levels in comparison to severity of malnutrition.

Table 2: Mean distribution of biochemical parameters among study participants

Anthropometric Measurements	Mean ± SD			p value*
	Mild	Moderate	Severe	
Hb	6.296 ± 0.762	7.234 ± 1.538	6.896 ± 1.041	0.011
Sugar	100.8 ± 31.31	102.8 ± 61.25	133.1 ± 60.59	0.063
Urea	79.76 ± 17.36	90.73 ± 39.88	76.86 ± 29.81	0.201
Creatinine	8.385 ± 1.531	8.726 ± 3.014	7.865 ± 1.094	0.292
PHOS	5.632 ± 1.802	5.118 ± 1.212	4.786 ± 0.779	0.062
Sodium	135.7 ± 2.394	134.9 ± 5.767	4.785 ± 0.765	0.400
Potassium	4.587 ± 0.608	4.428 ± 0.792	4.279 ± 1.088	0.035
Uric acid	7.561 ± 1.223	8.141 ± 1.944	8.332 ± 1.437	0.166
Calcium	6.589 ± 1.491	5.845 ± 1.605	5.882 ± 1.454	0.123

Further, in our study population there was significant difference in mean cholesterol level, albumin, pre albumin and transferrin level in comparison with severity of the malnutrition.

Table 3: Comparison of liver function test and lipid profile

Anthropometric measurements	Mean ± SD			p value*
	Mild	Moderate	Severe	
Total Cholesterol	136.7 ± 16.89	133.9 ± 37.97	97.64 ± 5.012	0.000
Triglycerides	113.7 ± 46.61	130.9 ± 65.51	140.4 ± 34.76	0.142
HDL	42.41 ± 8.145	38.57 ± 11.65	44.68 ± 15.19	0.158
Total protein	6.156 ± 0.666	6.042 ± 1.122	5.926 ± 0.682	0.604
Albumin	3.192 ± 0.229	3.167 ± 0.437	1.713 ± 0.659	0.000
Prealbumin	19.92 ± 5.708	28.10 ± 11.81	10.64 ± 3.871	0.003
Transferrin	182.3 ± 55.35	163.8 ± 42.48	90.00 ± 18.84	0.000

DISCUSSION

Patients undergoing maintenance Hemodialysis are at risk of Malnutrition and are at high risk of mortality and morbidity. Along with the comorbid conditions the most frequent complications in patients, undergoing Hemodialysis is Malnutrition.

The NKF-K/DOQI Clinical Practice Guidelines recommends assessment for nutrition in patients on maintenance dialysis and for assessment of protein–energy malnutrition and nutritional status with a combination of valid, and complementary, measures rather than any single measure alone as malnutrition can be identified with greater sensitivity and specificity using a combination of factors) The parameters used for assessment should be simple, effective, and readily available in any hospital (12).

Modified Subjective Global Assessment score is used to determine the nutritional status of the patients undergoing Hemodialysis. Using components of conventional SGA (which is determined by medical history on seven items and clinical findings on four items) ,a quantitative scoring was given ranging between 7 (normal) and 35 (severely malnourished).(12) In this study based on the Modified Subjective Global assessment it can be seen that Mild and severe Malnutrition are 32.9% and Moderate malnutrition is 34.1% among the participants. Anthropometric measurements like Body mass index, mid upper arm circumference, Mid Arm muscle circumference, Triceps skin fold thickness can be used to assess the nutritional status.

Comparison between Weights, Body mass index, Mid Arm muscle circumference between the 3 groups of Malnutrition found to be significant. However, there is no standard references for Anthropometric measurements and they are more prone to error due to interobserver variations. Development of edema in the chronic kidney disease patients also causes biases in the measurements.

There is no significant statistical difference between mean value of Anthropometric measurements among mild, moderate and severe malnutrition groups in this study. According to Carrero et al. Malnutrition in Hemodialysis patients is caused by (13) uremia-induced alterations resulting in increased energy expenditure, persistent inflammation, acidosis, and multiple endocrine disorders. The hyper catabolism of muscle and fat combined with decreased nutritional intake, inflammation, nutrient loss, poor physical

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activity, frailty, and the dialysis procedure itself can cause Protein energy wasting in patients undergoing Hemodialysis.

The mean distribution of Albumin (p value - 0.000), Prealbumin (p value – 0.003), Transferrin (p value 0.000) is found to be significant among the three groups. Serum albumin concentration, even when only slightly less than 4.0 g/dL, is one of the most important markers of protein energy malnutrition (PEM) in patients with CKD.(14). It is a very reliable indicator of visceral protein, although its concentration is also affected by its rate of synthesis and catabolism (half-life- 20 days), which is altered negatively in the presence of inflammation. Hypoalbuminemia is highly predictive of future mortality risk when present at the time of initiation of chronic dialysis as well as during the course of maintenance dialysis. The increase mortality with hypo-albuminemia, which is seen in 60–67% of the patients on maintenance HD, appears to occur even at a near-normal albumin level (3.5 g/dl). However, the risk is greater with more severe hypoalbuminemia, being greatest in patients with a plasma albumin concentration below 3.0 g/dl.(15)

Half-life of Prealbumin is 2 to 3 days and it is a favorable marker of acute changes of the nutritional state. Even in patients with protein-losing enteropathy Prealbumin was not influenced by intestinal protein losses. There is a statistically significant difference between the mean value of Albumin among Moderate and severe malnutrition groups (0.000) and Mild and severe malnutrition groups (0.000). There is a statistically significant difference between the mean value of Prealbumin among Mild and Moderate malnutrition groups (0.001), Moderate and severe malnutrition groups (0.000) and Mild and severe malnutrition groups (0.000).

Transferrin has a half-life of approximately 8 days and it can be used as a marker of early protein depletion. Several studies have suggested that serum transferrin may not be sensitive enough to detect a significant change in the nutritional status that occurs after several weeks of nutritional repletion, and coexistence of several clinical situations like anaemia, nephrotic syndrome, neoplastic disease, as well as use of several medications that may affect serum transferrin concentrations. According to Neyra et al, despite these potential limitations, serum transferrin was found to be a strong and early predictor of subsequent changes in serum albumin concentrations. Other recent studies have also reported serum (16). There is a statistically significant difference between the mean value of Transferrin among Moderate and severe malnutrition groups (0.000) and Mild and severe malnutrition groups (0.000) Serum cholesterol is an independent predictor of mortality in patients on maintenance HD.

The relationship between serum cholesterol and mortality was described as either “U-shaped” or “J-shaped,” with increasing risk for mortality as the serum cholesterol rises above the 200–300 mg/dL range or falls below approximately 200 mg/dL. (17) As the serum cholesterol decreases to, or below, the normal range for healthy adults (<200 mg/dL). Pre-dialysis serum cholesterol is generally reported to exhibit a high degree of co-linearity with other nutritional markers such as albumin, pre-albumin, and creatinine, as well as age. (18)

In this study p value is found to be significant for Cholesterol (0.000) in the lipid profile among the three groups. There is a statistical significant difference between the mean value of Cholesterol among Moderate and severe malnutrition groups (0.000) and Mild and severe malnutrition groups (0.000)

In addition, Patients undergoing Hemodialysis are also under Transplantation work up. Their Nutritional assessment should be done for better outcome after transplantation. Nutritional screening by Biochemical parameters among Hemodialysis patients thus becomes necessary to prevent further complications due to malnutrition to intervene when it is necessary and to improve the prognosis.

CONCLUSION

In our study, it is found that Malnutrition prevailed among the Hemodialysis patients and Biochemical parameters like Cholesterol, Albumin, Prealbumin, Transferrin found to be correlated with their malnutritional status based on their SGA scores. Early diagnosis of malnutrition should be done with Biochemical parameters in these patients to prevent future complications and to decrease mortality and morbidity among the End stage renal failure Patients. The limitations were that serial measurements of nutritional parameters should be done for better follow up and Prognosis.

REFERENCES

1. NONCOMMUNICABLE DISEASES COUNTRY PROFILES 2018.
2. Lv JC, Zhang LX. Prevalence and Disease Burden of Chronic Kidney Disease. In: Advances in Experimental Medicine and Biology. Springer New York LLC; 2019. p. 3– 15.
3. SECTION I PRINCIPLES OF LABORATORY MEDICINE SECTION VI APPENDIX 60 Reference Information for the Clinical Laboratory.
4. Fouque D, Kalantar-Zadeh K, Kopple J, Cano N, Chauveau P, Cuppari L, et al. A proposed nomenclature and diagnostic criteria for protein-energy wasting in acute and chronic kidney disease. In: Kidney International. Nature Publishing Group; 2008. p. 391– 8.
5. APPETITE INFLAMMATION NUTRITION ANAEMIA AND CLINICAL OUTCOME IN HEMODIALYSIS PATIENTS.
6. Koppe L, Fouque D, Kalantar-Zadeh K. Kidney cachexia or protein-energy wasting in chronic kidney disease: facts and numbers. Vol. 10, Journal of Cachexia, Sarcopenia and Muscle. Wiley Blackwell;

DOI: 10.69605/ijlbpr_14.2.2025.121

2019. p. 479–84.
7. Obi Y, Qader H, Kovesdy CP, Kalantar-Zadeh K. Latest consensus and update on protein- energy wasting in chronic kidney disease. Vol. 18, Current Opinion in Clinical Nutrition and Metabolic Care. Lippincott Williams and Wilkins; 2015. p. 254–62.
8. Ikizler TA. Optimal Nutrition in Hemodialysis Patients. Vol. 20, Advances in Chronic Kidney Disease. 2013. p. 181–9.
9. Kalantar-Zadeh K, Tortorici AR, Chen JLT, Kamgar M, Lau WL, Moradi H, et al. Dietary Restrictions in Dialysis Patients: Is There Anything Left to Eat? Seminars in Dialysis. 2015 Mar 1;28(2):159–68.
10. Janardhan V, Soundararajan P, Rani NV, Kannan G, Thennarasu P, Chacko RA, et al. Prediction of Malnutrition Using Modified Subjective Global Assessment-dialysis Malnutrition Score in Patients on Hemodialysis [Internet]. Available from: www.ijpsonline.com
11. Nelson EE, Hong CD, Pesce AL, Peterson DW, Singh S, Pollak VE. Anthropometric Norms for the Dialysis Population. American Journal of Kidney Diseases. 1990;16(1):32– 7.
12. Leavey SF, Strawderman RL, Jones CA, Port FK, Held PJ. Simple Nutritional Indicators as Independent Predictors of Mortality in Hemodialysis Patients
13. Carrero JJ, Stenvinkel P, Cuppari L, Ikizler TA, Kalantar-Zadeh K, Kaysen G, et al. Etiology of the Protein-Energy Wasting Syndrome in Chronic Kidney Disease: A Consensus Statement From the International Society of Renal Nutrition and Metabolism (ISRNM). Vol. 23, Journal of Renal Nutrition. 2013. p. 77–90.
14. Caraceni P, Tufoni M, Bonavita ME. Clinical use of albumin. Vol. 11, Blood Transfusion. 2013.
15. Stenvinkel P, Barany P, Chung SH, Lindholm B, Heimbü O. A comparative analysis of nutritional parameters as predictors of outcome in male and female ESRD patients.
16. Neyra NR, Hakim RM, Shyr Y, Ikizler TA. Serum transferrin and serum prealbumin are early predictors of serum albumin in chronic Hemodialysis patients. Journal of Renal Nutrition. 2000;10(4):184–90.
17. Goldwasser P, Mittman N, Antignani A, Burrell D, Michel M-A, Collier J, et al. Predictors of Mortality in Hemodialysis Patients1. 1993.
18. Piccoli GB, Quarello F, Salomone M, Iadarola GM, Funaro L, Marciello A, et al. Nephrology Dialysis Transplantation Are serum albumin and cholesterol reliable outcome markers in elderly dialysis patients? [Internet]. Nephrol Dial Transplant. 1995. Available from: http://ndt.oxfordjournals.org/