ORIGINAL ARTICLE

A Study on Association of Nutritional Status, Inflammatory Markers and Cardiac Function In Maintenance Hemodialysis Patients

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Abstract:

Poor nutritional status and associated inflammation may pose a risk of cardiovascular disease in CKD patients. This Study has been undertaken to investigate the association of nutritional status, inflammatory markers and cardiac function . A cross sectional study is performed on 120 hemodialysis patients and measured the Skin fold thickness, Midarm circumference, Serum albumin, SGA, Echo, CRP, Ferritin and lipid profile. There is significant negative correlation between CRP and LVEDV (r = -.298, p=.035) and there is significant negative correlation between CRP and MAC (r = -.362, p=.010) and positive co relation between CRP and ferritin, TDL and LDL, HDL and chol/hdl. This study shows the correlation between inflammatory markers measured by CRP and nutritional status and the negative effect both of these have on cardiac structural parameters.

Keyword – Hemodialysis, Inflammatory, Nutritional status, Cardiac function

1. Introduction:

Cardiovascular disease is the most important cause for morbidity and mortality in maintenance hemodialysis patients{5}. Poor nutritional status and associated inflammation may pose a risk of cardiovascular disease in CKD patients. Patients on MHD has higher risk for malnutrition and Inflammation than the general population. There are various available markers to detect malnutrition and inflammation in MHD patients{2,6}.

In hemodialysis patients, the activation of inflammatory response has been found as an important risk factor for the development of cardiovascular complications. We have investigated the inflammatory markers such as lipid profile, ferritin, CRP and the cardiac function markers such as left atrial diameter,interventricular septal thickness, left ventricular end-diastolic volume, left ventricular end diastolic volume and ejection function{5,7,10}

Patients on hemodialysis commonly develop inflammation and protein-energy deficiency. Additionally, the presence of volume overload and concurrent inflammation can make interpreting nutritional markers challenging.{1,4}.Therefore, it is necessary to combine the results of numerous measurements, such as anthropometry, biochemical assays, bioelectric impedance, subjective global evaluation, and others, in order to diagnose malnutrition in dialysis patients. Additionally, associations among several nutritional markers in HD patients have not been thoroughly researched.{2,11}. In the present study. we aimed to find out is there any association between the nutritional, inflammatory markers and cardiac function in patients on MHD.

2. Subjects And Methods:
Patients:

The Present Study Was performed in Hemodialysis unit of Saveetha medical college and hospital from 02/03/2022 to 20/05/2022. Around 120 patients are doing MHD in our hemodialyis unit. Patients on MHD who satisfies inclusion criteria are included in the present study. Consent of the person/relatives of the person participating in the study was taken after briefly explaining the study process intheir own language. The study was approved by IRB on 01/03/2022

Inclusion Criteria:

➢ Age more than 18 years

> Patients who are undergoing hemodialysis for atleast more than 3 months

Exclusion Criteria:

> All admitted patients with recurrent acute infection undergoing hemodialysis Patients with Acute kidney injury of any etiology requiring hemodialysis Patient with recent history of acute myocardial infraction within 3 months
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> Patient with history of recent admission within one month
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> Patient on statins and immunosuppressants

Baseline Characteristics:
Demographic data of the subjects including age, sex, diagnosis, dialysis vintage, Frequency of HD, Dry weight, Blood investigations such and haemoglobin ,urea, creatinine, Electrolytes, co- morbidity such as diabetic mellitus, hypertension, history of CVA, were collected.

Inflammatory Markers:
Inflammatory markers such as C-reactive protein, ferritin, lipid profile (low density lipoprotein,high density lipoprotein and very low density lipoprotein){3} is checked by collecting the blood sample from the patients.

Echocardiography:
With a Sequoia C256 and a 2.5 mHz multiphase array probe, patients were placed in the left decubitus position for the two-dimensional echocardiography.by a single skilled cardiologist who was not aware of the individuals' specific clinical conditions.Interventricular septal thickness, left ventricular end-diastolic volume, left atrial diameter, left ventricular end-diastolic volume, and EF are among the measurements taken.{7,9}.

Nutritional Status:
A questionnaire called the Subjective Global Assessment (SGA) that has six separate parts is used to evaluate the nutritional condition of the patients. Both subjective and objective evaluation are included in the components. Each patient would obtain a nutritional status score based on these evaluations, and they had been divided into four categories: 1) normal nutritional status, 2) mild malnutrition, 3) moderate malnutrition, and 4) severe malnutrition. Malnutrition was deemed to exist for the purposes of the current investigation if the SGA score was >1{11}. The bromcresol green technique was used to calculate serum albumin levels.

Statistical Analysis:

> Percentage analysis,descriptive analysis result is expressed as mean ± SD or by percentage. Correlation between the nutiritonal,inflammatory parameters and cardiac function markers was done using karl pearson co efficient of correlation. one way ANOVA is used to find
>
> Independent associations between variables. All the statistical analysis has been done using SPSSsoftware.
>
> Sample size calculation population 135; margin of error 1%; confidence level 99% and sample size 50
>
> This study was approved by the local ethics committee

Results:

A Sample of 50 Hemodialysis patient was included in this study. The mean age of the sudy population is 48.2±7.92(in years). It is noted that 18% of the patients belongs to less than 40 years, 38% of the patients belongs to 41-50 years, 36% of the patients fall in the age category of 51-60 years and 8% of the patients belongs to the age group of above 60 years. 52% of the patients are in the dialysis for up to 12 months, 22% of the patients are in dialysis for 13- 36 months and 26% of the patients are in the dialysis for above 36 months. Inflammatory markers, Nutritional status and Cardiac dysfunction readings were recorded. Baseline characteristics were given in table 1. Inflammatory, nutritional and cardiac markers for the included MHD patients are given in table 2. Number of MHD patients with abnormal parameters are given in table 3.Among the MHD patients, majority are moderately nourished based on the SGA score(Table 4).

Table 1: Baseline characteristics of the MHD patients

BASELINE CHARACTERISTICS	Mean±SD
Age(in years)	48.20 ± 7.92
HD Vintage (in months)	25.94 ± 27.22
HD frequency	2.24 ± 0.48
Sodium	137.50 ± 5.77

BASELINE CHARACTERISTICS		PERCENTAGE
SEX	MALE	70%
	FEMALE	30%
CAUSES OF CKD	DM	18%
	DM+HTN	22%
	HTN	40%
	NSAIDS	2%
	UNKNOWN	18%

Table 2: Inflammatory, cardiac and nutritional markers of MHD patients

CRP mg/dl	33.72 ± 44.88
TLC mg/dl	139.86 ± 29.13
LDL mg/dl	66.62 ± 26.07
HDL mg/dl	42.37 ± 12.47
VLDL mg/dl	27.14 ± 11.59
Chol/hdl ratio	3.22 ± 0.87
Ferritin mg/dl	516.39 ± 263.39
Albumin g/dl	3.49 ± 0.63
LA cm	4.59 ± 5.04
IVST cm	1.20 ± 0.26
LVEDD cm	6.08 ± 7.59
LVEDV ml	136.42 ± 38.76
LVPWT cm	1.21 ± 0.94
EF %	51.18 ± 13.21
MAC (INCHES)	12.86 ± 5.20
SFT(MM)	11.40 ± 5.87

Table 3: Percentage of patients with abnormalInflammatory,Nutritional and cardiac markers

		NORMAL		ABNORMAL	
		NO	%	NO	%
CRP		18	36%	32	64%
TOTAL CHOLESTROL		49	98%	1	2%
LDL		45	90%	5	10%
HDL		20	40%	30	60%
VLDL		34	68%	16	32%
CHOL/HDLRATIO		10	20%	40	80%
TRIGLYCERIDES		45	90%	5	10%
FERRITIN	FEMALE	3	6%	12	24%
	MALE	9	18%	26	52%
ALBUMIN		27	54%	23	46%
LA		26	58%	24	48%
IVST		30	60%	20	40%
LVEDD		18	36%	32	64%
LVEDV	FEMALE	1	2%	14	28%
	MALE	11	22%	24	48%
LVPWT		29	58%	21	42%
EF		25	50%	25	50%
MCA	FEMALE	1	2%	14	28%
	MALE	2	4%	33	66%
SFT	FEMALE	0	0	15	30%
	MALE	5	10%	30	60%

Table 4 : SGA SCORE in MHD patients

SGA –Nourishment Status	Number	Percentage
WELL NOURISHED	16	32%
MID/MODERATELY MALNOURISHED	22	44%
SEVERSELY MALNOURISHED	12	24%

Table 5: Correlation Between Inflammatory Markers And CardiacFunction:

		LA Cm	IVST Cm	LVEDD Cm	LVEDV Ml	LVPWT Cm	EF %
CRP mg/l	r	-.108	-.033	-.096	**-.298***	.023	-.022
	p	.455	.820	.509	**.035**	.874	.881
TLC mg/dl	r	.069	-.015	.050	-.207	-.102	.063
	p	.635	.918	.732	.150	.481	.665
LDL mg/dl	r	.081	.026	.099	-.070	.000	.123
	p	.575	.859	.492	.627	.998	.395
HDL mg/dl	r	-.031	-.015	-.049	.115	-.012	-.093
	p	.830	.920	.735	.425	.933	.521
VLDL mg/dl	r	-.019	-.205	-.043	-.110	-.258	.077
	p	.894	.154	.769	.447	.071	.596
Chol/hdl Ratio	r	.265	.002	.263	-.029	-.113	.090
	p	.063	.991	.065	.843	.434	.535
Ferritin mg/ml	r	-.057	.207	-.036	-.080	-.146	-.139
	p	.697	.150	.806	.580	.312	.336

*Significant at 5% level

There is significant negative correlation between CRP and LVEDV (r = -.298, p=.035) (Table 5).it indicates that increase in CRP correlates with decrease in LVEDV among our MHD patients.

There is no significant correlation between CRP, ferritin, lipid profile and LA, IVST, LVEDD, LVPWT, EF(Table 5)

Table 6: Correlation between Inflammatory markers and Nutritional status

		Albumin g/dl	MAC (INCHES)	SFT (MM)
CRP mg/l	R	-.220	**.362****	-.142
	P	.124	.010	.325
TLC mg/dl	R	.238	.038	-.036
	P	.095	.793	.805
LDL mg/dl	R	.212	-.142	-.011
	P	.139	.327	.940
HDL mg/dl	R	.198	-.091	.148
	P	.167	.528	.304
VLDL mg/dl	R	-.129	.027	.000
	P	.372	.850	1.000
Chol/hdl Ratio	R	-.120	-.214	-.086
	P	.406	.136	.552
Ferritin mg/ml	R	-.106	.031	.081
	P	.462	.831	.575

**Significant at 1% level

It is observed that there is significant negative correlation between CRP and MAC (r = -

.362, p=.010) (Table 6). It indicates that increase in CRP is associated with decrease in MAC among the MHD patients.

There is no significant correlation between CRP and SFT, Albumin and also no significant correlation between lipid profile, ferritin and MAC, SFT, albumin (table 6)

Nutrition Status And Cardiac Function

We intend to identify any correlation between nutritional status and cardiac function markers. One-way ANOVA is applied to identify any significant difference in the Nutrition statuswith regard to Cardiac dysfunction.

Table 7:Relation between Nutrition status and echocardiographic parameters in MHD patients

		Mean	SD	F-value
LA Cm	Well Nourished	3.67	0.79	**3.671*** **(p=.029)**
	Mildly/moderately malnourished	4.13	0.47	
	Severely Malnourished	5.50	0.56	
IVST Cm	Well Nourished	1.20	0.23	**0.148** **(p=.532)**
	Mildly/moderately malnourished	1.22	0.30	
	Severely Malnourished	1.17	0.24	
LVEDD Cm	Well Nourished	5.13	1.18	**3.394*** **(p=.037)**
	Mildly/moderately malnourished	5.38	1.45	
	Severely Malnourished	7.17	0.62	
LVEDV Ml	Well Nourished	131.73	34.61	**4.157*** **(p=.018)**
	Mildly/moderately malnourished	132.75	41.15	
	Severely Malnourished	145.63	40.57	
LVPWT Cm	Well Nourished	1.06	1.30	**0.246** **(p=.471)**
	Mildly/moderately malnourished	1.22	0.90	
	Severely Malnourished	1.31	0.24	
EF %	Well Nourished	57.06	10.64	**4.409*** **(p=.011)**
	Mildly/moderately malnourished	50.14	11.86	
	Severely Malnourished	45.25	16.25	

*Significant at 5% level

➢ There is significant difference in the mean LA diameter between the groups classified based on SGA. The mean LA diameter (**5.5**) is more among the Severely Malnourished patients than patients who are well nourished. (Table 7).

➢ Similarly**,** the mean LVEDD (**7.17**) and mean LVEDV (**145.63**) is high in the Severely Malnourished patients,compared to the other 2 groups which is statistically significant.

➢ The mean Ejection fraction is better in well nourished patients(mean EF 57.06%) than the patients who are severely malnourished (mean EF - 45.25%) which is statistically significant.(Table 7).

➢ There is no significant difference between the groups in the other parameters like IVST and LVPWT(Table 7).

Discussion:

The purpose of this study was to evaluate the association between nutritional status, Inflammatory markers and cardiac function among maintenance hemodialysis patients

In this study, totally 50 MHD patients were included based on Inclusion and exclusion criteria. The mean age of the study population was 48.20 ± 7.92 .Majority of the patients were doing twice weekly hemodialysis.

Inflammatory markers in MHD patients

Among the 50 patients on MHD, 32(64%) patients have raised CRP levels which shows increased inflammatory activity in these patients. 24%(N-12) patients have normal ferritin 98%((N-49) patients have normal total cholesterol,90% (N-45) patients have normal LDL,40%(N-20) patients have normal HDL,68%(N-34) patients have normal VLDL, 90%(N-45) patients have normal triglycerides and only 20%(N-10) patients have normal chol/hdl ratio. and we have been observed that there is a positive co relation between CRP and ferritin, TDL and LDL, HDL

and chol/hdl

Cardiac function markers by Echocardiography

In cardiac function out of 50 patients 58%(N-26) patients have normal LA,60%(N-30) patients have normal IVST,36%(N-18) patients have normal LVEDD,24%(N-12) patients have normal LVEDV,58%(N-29) patients have normal LVPWT,50%(N-25) patients have normal EF and it also shows that there is a significant co relation between LA andLVEDV it indicates that increase in LA has increased LVEDV among the patients.

Nutritional status markers

In nutritional status 54% (N-27) have normal albumin, 6%(N-3) patients have normal MCA,10%(N-5) patients have normal SFT. In SGA scores we observed that 32%(N-16) patients were well nourished,44%(N-22) patients were mid/moderatelymalnourished and 24%(N-12) patients were severely malnourished

Inflammatory markers and cardiac function:

In the study done by Byung-Soo Kim *et al.,*that persistent elevation of CRP may predict cardiac hypertrophy and dysfunction in patients on maintenance hemodialysis{5} Predialysis high-sensitivity CRP (hs-CRP) was measured twice at 3-week intervals in 52 stable hemodialysis patients, and echocardiographic tests were done.The high CRP group exhibited considerably greater left atrial diameters, IVST, LVEDV, and LVMI, but their EF was lower. In the high CRP group, the proportion of patients with low EF and LVH was considerably higher. LVEDD and LVPWT were not statistically different between the high and low CRP groups. In our present study, there is significant correlation between CRP and LVEDV ($r = -.298$, $p=.035$), it indicates that increase in CRP has decrease LVEDV among the patients. There is no cor relation between LA, IVST, LVEDD, LVPWT, EF and CRP, ferritin and lipid profile.

Bratisl lek listy *et al.,* done a study on serum CRP in association with various nutritional parameters in maintenance hemodialysis patients{8}. To investigate the association of serum CRP level with some nutritional variable in diabetic and non-diabetic end stage renal failure undergoing regular hemodialysis. They found there is a inverse co relation of serum CRP with serum cholesterol and triglycerides level. and a near significant positive correlation of CRP with serum ALP with serum intact parathyroid hormone (I PHT) were found. No significant correlation between serum CRP and serum albumin were seen. In our study we have found the differences in the nutritional status with regard to cardiac function and we also showed a significant negative effect of malnourishment on all structural cardiac measures such as LA, LVEDD, LVEDV and EF by ECHO; except IVST and LVPWT

Nutritional status and inflammatory markers

Franciele D *et al.,*done a study on associations between nutritional markers and inflammation in hemodialysis patients{11} . The purpose of this study is to examine the associations between clinical, laboratory, demographic, and nutritional markers and inflammatory state and malnutrition in hemodialysis (HD) patients. Fifty-two patients on regular HD were examined using clinical, demographic, laboratory, and nutritional data (food intake, anthropometric measures, bioelectric impedance, subjective global assessment—SGA, and appetite characteristics).These results suggested that an inflammatory condition causes muscle mass depletion, whereas a high BMI is related with diabetes and decreased diastolic BP, a known cardiovascular risk factor in uremic patients. SGA and phase angle were linked to established nutritional markers, proving their usefulness in HD patients. In our study we analyzed the association between inflammatory markers and nutritional status it showed significant inverse relationship between inflammatory markers CRP and MAC and there is no correlation between ferritin, lipid profile and SFT, albumin.

Conclusion:

The associations between inflammatory markers, nutrition status and cardiovascular morbidity have great reference to the outcomes of patients in hemodialysis. Hemodialysis can be complicated by infections or cardiac adverse events and malnourishment all of which worsen the inflammatory markers. This study shows the correlation between inflammatory markers measured by CRP and nutritional status and the negative effect both of these have on cardiac structural parameters.

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