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Research Article

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Prevalence and Predictors of Malnutrition among patients on Maintenance Haemodialysis in a Tertiary Care Centre, Sri Lanka

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Introduction

Chronic kidney disease (CKD) is a mammoth public health issue, the tide of which continues to rise continuously [1]. Approximately 2.5 million receive renal replacement therapy in the world and it is projected to double to 5.4 million by 2030 [1].

Maintenance haemodialysis (MHD) is the most widely utilised renal replacement therapy in patients with advanced kidney disease [1].

Although, Haemodialysis improves survival in end stage renal disease, the therapy and disease is associated with multiple acute and chronic complications. Malnutrition being one such complication shows a significant prevalence in haemodialysis population [1].

The aetiology of malnutrition is multifactorial. It includes poor food intake, hormonal and gastrointestinal disorders, and restricted diets, drugs that alter nutrient absorption, subtherapeutic dialysis, and associated comorbidities.

Malnutrition is considered an indicator of poor prognosis in CKD [1, 2]. The nutritional status of HD population is inversely associated with augmented risk of hospitalization and mortality; thus making it a crucial determinant of the outcome of these patients. Therefore, assessing the nutritional status is critical both to prevent malnutrition and for appropriate intervention in malnourished patients [1]. Therefore, a successful haemodialysis outcome is dependent on adequate nutrition.

Conventional nutritional assessment tools include anthropometry measurements, dietary energy and protein intakes and biochemical measurements, which are impractical in the routine use. Subjective Global Assessment (SGA) is a tool used by health care providers to assess nutritional status and help to predict nutrition related clinical outcomes. SGA was evaluated in different studies as an adequate tool for the assessment of nutritional status in dialysis patients (8, 9) [1, 2].

Kalantar-Zadeh et al developed alternative version of SGA, initially called the modified quantitative SGA and subsequently known as the Dialysis Malnutrition Score (DMS).

The DMS was reported to be more reliable than the conventional SGA in number of studies was described to correlate with age, dialysis duration, mid-arm muscle circumference (MAMC), BMI, serum albumin concentration, and total iron-binding capacity (TIBC) which were markers of malnutrition and inflammation [1, 2].

Though, malnutrition had been proven to be common and important predictor of adverse outcome throughout the world, there is no published literature assessing nutritional status among dialysis population in Sri Lanka. Therefore, this study was aimed to determine the prevalence, predisposing factors of malnutrition in MHD patients at a tertiary care haemodialysis centre in Sri Lanka utilising dialysis malnutrition score and conventional nutritional tools.

Method

This was a descriptive cross sectional survey carried out in the haemodialysis unit, District General Hospital, Trincomalee. All the patients underwent haemodialysis for end stage diseases from 1st June 2018 to 30th September 2018 were included.

Inclusion criteria were patients with end stage renal failure who were dialysed at district general hospital, Trincomalee, receiving haemodialysis for at least one month and aged more than 18 years at the date of survey.

We excluded patients who did not give consent, were unable to answer the questionnaire (difficulty in understanding questions, visual or hearing impairment), and had a previous kidney transplant or patients needing dialysis due to acute kidney injury.

Patients were interviewed during the dialysis session using an interviewer administered questionnaire to gather demographic, socioeconomic, and clinical data. Variables such as gender, age, ethnicity, family income and data on dialysis provision were gathered.

Nutritional status was evaluated by a trained dialysis nurse using a dialysis malnutrition score at the time of the interview. The patient also underwent anthropometric measurements and biochemical investigations.

Anthropometric Measurements

The body weight and skin-fold measurements were performed after termination of the dialysis session. Triceps skin-fold thickness (TSF) was measured in the midpoint between the acromion process and the olecranon process in the upper arm using a caliper. Mid-arm circumference (MAC) was measured using a tape measure at the same level. The measurements mentioned above were performed two times on the non-access arm of each dialysis patient and the average of two results was taken as the final value. Mid-arm muscle circumference (MAMC) was derived according to the following formula: MAMC = MAC – (0.31415 x TSF). Body mass index (BMI) was calculated as the ratio between post dialysis body weight in kilogram and the square of height in meter.

Modified Subjective Global Assessment-Dialysis Malnutrition Score (DMS)

The modified SGA has been indicated as a reliable and valid tool for the nutritional assessment for patients who are undergoing haemodialysis. The modified SGA includes two major categories: the history and physical examination. The history portion is comprised of five sections: weight/weight change; dietary intake; gastrointestinal symptoms; functional capacity; and disease state/co-morbidities as related to nutritional status. The second major category is the physical examination including an evaluation of the patient for fat and muscle wasting and presence of oedema. Each component has a score between one (normal) to five (very severe). Thus MS has a total score between 7 and 35. After completion DMS, patients were placed in one of three groups. Patients having DMS score between7-10 were considered as well-nourished patients. DMS score between11-22 were considered as having mild to moderate malnutrition. Likewise score between 23 and 35 were considered as severely malnourished [1].

Biochemical Investigations

The patients were also evaluated for biochemistry including serum albumin, and serum cholesterol after 12 hours fasting and prior to dialysis session.

Data Analysis

Data was analysed using the SPSS version 17. Data was presented as mean±SD (parametric data) and median±interquartile range (nonparametric data) and percentage patients (%). Pearson correlation coefficient 'r' (parametric data) and the Spearman rank correlation coefficient (non-parametric data) was used to assess the strength of associations between various nutritional variables.

Ethical considerations

Ethical approval for the study was obtained from Ethical review committee, National Hospital of Sri Lanka. Informed written consent was obtained from each participant.

Results

Characteristic	Value
Age (years) mean+-SD Median IQR	51.12+-13.4.2 54 43.0 – 61.0
Gender (n/%) Male Female	 41(63.1%) 24 (36.9%)
Ethnicity (n/%) Tamil Muslim Sinhala	 25 (38.46) 26 (40.0%) 14 (21.5%)
Monthly Family income (SLR) US$(mean+-SD)	17253.85+-16171.958 86.27+-80.25
Primary kidney disease (n/%) HTN DM APCKD CGN CKDU	 36 (55.38%) 19 (29.23%) 2 (3.07%) 3 (4.61%) 5 (7.69%)
Haemodialysis duration (months) mean+-SD	13.68+- 11.62
Number of haemodialysis per week (n/%) 1 2 3	 12(18.46%) 43(66.15%) 10(15.38%)
Vascular access (n/%) Temporary HD Catheter Permanent HD Catheter AVF	 15(23.07%) 12 (18.46%) 38 (58.46%)

Table 1: Sociodemographic and haemodialysis parameters

SD= Standard Deviation, IQR= Interquartile range, %= percentage, SLR= Sri Lankan Rupees, HTN= Hypertension, DM=Diabetes mellitus, APCKD=Adult Polycystic Kidney Disease, CGN= Chronic Glomerulonephritis, CKDU= Chronic Kidney Disease of Unknown Origin, HD= Haemodialysis, AVF= Arteriovenous Fistula

DMS Category	n/%
Well nourished	14 (21.5%)
Mild to Moderate Malnutrition	51 (78.5%)
Severe Nutrition	0

Table 2: Categorisation of Malnutrition by DMS

DMS= Dialysis Malnutrition Score, n= number, % = Percentage

Nutritional assessment tool	Mean+-SD
DMS	13.91+-4.193
BMI (kg/m^2)	22.39+-5.127
MAC(cm)	25.12+-4.06
TSF (cm)	2.06 +- 0.640
MAMC (cm)	23.81+-4.056
S.albumin	31.87+-5.788
S.Cholesterol	3.092+- 0.784
Dietary protein intake (g/kg/day)	0.68+-0.207
Dietary energy intake (kCal/kg/day) kcal/kg/day	27.99+-4.077

Table 2: Nutritional Assessment by different Tools

DMS= Dialysis Malnutrition Score, BMI= Body Mass Index, MAC= Mid Arm Circumference, TSF= Triceps Skin Fold Thickness, MAMC = Mid Arm Muscle Circumference

Variable	R value	P Value
Age in years	.251*	.043
Gender	.108	.391
Ethnicity	-.028	.824
Primary kidney disease	-.086	.498
Family income	.158	.210
Dialysis duration	.139	.269
Number of dialysis per week	.140	.277-
BMI (kg/m^2)	.076	.547
MAC(cm)	-.488**	.001
TSF (cm)	-.318**	.010
MAMC	-.386**	0.001
s.albumin	-.061	.628
s. cholesterol	-.022	.859
24h dietary protein	-.468**	0.001
24h dietary energy	-.132	.294

Table 3: Correlation of nutritional variables with DMS

*Denotes statistical significance, BMI= Body Mass Index, MAC= Mid Arm Circumference, TSF= Triceps Skin Fold Thickness, MAMC = Mid Arm Muscle Circumference

The study included 65 participants; with a mean age of 51.12+-13.4.2 years. Table 1 illustrates the sociodemographic and haemodialysis parameters of the population. Majority were males ((63.1%)). The most prevalent primary kidney diseases were hypertension (55.38%), diabetes mellitus (29.23%) and chronic kidney disease of unknown origin (7.69%). The average family income was SLR 17,253.85+-16171.95. The mean duration on haemodialysis was 13.68+- 11.62 months. Most patients (66.2%) were receiving haemodialysis only twice a week. Majority (58.46%) were dialyzed using AVF.

As indicated in Table 2, 78.5% of patients (n=51) were categorised to have mild to moderate malnutrition based on dialysis malnutrition score. No patients were diagnosed with severe malnutrition category. Fourteen (21.54%) patients were categorised as well nourished.

Table 2 shows the outcomes generated by different nutritional assessment tools. The average score of DMS in this study was 13.91+-4.193. Sixty-six percent of target population was found to have BMI of < 23kg/m2, while 83.3 % showed serum albumin <38g/dl according to criteria used to indicate protein energy wasting proposed by International Society of Renal Nutrition and Metabolism (ISRNM) expert panel [1].

The mean daily protein intake of study population was well below the recommended intake of 1.1g/kg body weight/day as proposed by renal association. A majority of 81.5% ate less than the recommended protein intake [1].

Table 3 shows the associations between the dialysis patients' quantitative dialysis malnutrition scores and nutritionally relevant parameters. The DMS correlated significantly with MAC (r=-.488**, p=.001), TSF (r=-.318**, p=.010), MAMC (r=-.386**, p=0.001), daily protein intake (r=--.468**, p=0.001) and age (r=.251*, p =0.043). All associations seem to be weak association as r values were between 0.2 to 0.5.

Discussion

Method

Evaluation of nutritional status in a haemodialysis patient is a challenge [1, 2]. There are numerous tools available including anthropometric and biochemical measurements, yet their sensitivity in recognising early malnutrition, practicability and applicability to haemodialysis patients have not been convincing [10].

Modified Subjective Global Assessment- Dialysis Malnutrition Score has come as a reliable, valid method with a good correlation to other nutritional markers in patients with chronic kidney disease. Further, it is quantitative and provides prognostic evidence to predict poor outcome[1]. It is inexpensive, non-invasive, can be performed rapidly and requires only brief training Therefore; this tool was used as the main method of diagnosing malnutrition among haemodialysis patients in our study.

Prevalence of Malnutrition

The study depicted a high prevalence of mild to moderate malnutrition (78.5%) among the study population based on DMS. A significant variation in prevalence of malnutrition was seen among countries. Some South Asian studies based on DMS showed malnutrition prevalence over 90% in haemodialysis patients [2, 3]. In contrast, a much lower prevalence (approximating 30%) was reported by several European studies based on Subjective Global Assessment [4, 5, 7].

Numerous factors play a role resulting in discrepancies in prevalence of malnutrition in different studies. These factors include utility of different evaluation methods, different health care systems, sample heterogeneity, diversity of dietary patterns, and variations in socioeconomic status between the countries[2]. Further, the dialysis mode, dose and frequency may affect the development of malnutrition[3]. In our study population, low frequency of haemodialysis (n=55{84.6%} received maximum two HD per week), low family income, low protein and energy diet may have contributed to the high prevalence. Further, Raguso, et al. showed that experience of the interviewer who administers SGA may influence the malnutrition classification [4].

Associations

Out study, depicted a strong correlation between ages, mid arm muscle circumference, daily protein intake with malnutrition. A significant association was not seen with other variables (gender, ethnicity, primary kidney disease, and family income, and dialysis duration, number of dialysis per week, BMI, S. albumin, S. cholesterol or 24h dietary energy intake).

Age

The prevalence of malnutrition depicted a significant positive correlation with age. Though advancing age was not a predictor of malnutrition in most studies, Kalantar-Zadeh, et al, reported a similar association [10, 20].

Advancing age is frequently associated with high occurrence of malnutrition due to multiple difficulties such as reduced appetite, poor dentition, and presence of comorbidities, reduced mobility and poor cognition.

MAC, TSF and MAMC

The study further indicated a very strong negative correlation between malnutrition and anthropometric measurements such as MAC, TSF and MAMC. Mid-arm muscle circumference (MAMC) is a bedside anthropometric measurement derived from MAC and TSF that estimates somatic protein reserve, an early indicator of nutritional depletion. Many studies show this consistent negative association between MAC, TSF, MAMC and malnutrition grading [5, 10, 14, 18, 19].

Daily protein intake was also found to be strongly negatively associated with malnutrition score in this study. Further, literature suggests low dietary protein intake may be associated with increased risk of death among hemodialysis patients and it to be an independent risk factor for outcome [5-7].

Further, dietary protein intake (mean+-SD = 0.68+-0.207 g/kg BW/day) was well below the recommend protein intake of 1.1-1.4 g/kg BW/day for patients on HD [14, 15]. In fact, 81.5% of population were taking proteins less than1.1g/kg/day. Patients were also relying on a low energy diet (mean+-SD=27.99+-4.077), below the recommended 30-40kCal/kgIBW/day although it didn't reveal a significant association with DMS. Similar findings were reported in some studies looking in to dietary intake in haemodialysis [14, 20]. Continuing on recommended low protein diet for CKD in to haemodialysis, non-availability of renal dietitians, low socioeconomic status might have potentially resulted in these findings.

Therefore, incorporation of a nutritional assessment methodology and dietary intervention has become mandatory in current HD practice in the country.

Serum albumin

Our study didn't reveal a significant correlation between S. albumin and malnutrition score. This finding was consistently evident in many other studies, [15-16]. S albumin may be confounded by non-nutritional factors such as chronic inflammation, coexistent liver disease, fluid overload and iron deficiency anaemia [14].

Further, Qureshi et al showed that serum albumin levels may be low even in apparently well-nourished haemodialysis patients[4]. This study also showed 85.71% (n=12/14) of well-nourished patients showed low serum albumin levels lesser than 38g/dl. Therefore, common utility of S. albumin as an isolated nutritional marker in a HD patient is questionable.

BMI

Moreover, no significant association between the malnutrition and the BMI was illustrated. This association is an inconsistent finding as several studies showed a significant correlation, while some didn't [10, 14, 15]. This discrepancy may be due to sub-adequate dialysis leading to fluid retention influencing weight measurement and erroneous BMI calculation. Therefore, nutritional assessment should not depend on the BMI alone. Further, according to KDOQI guidelines, the BMI threshold that indicates PEW in haemodialysis population is uncertain and varies among different ethnic groups [15].

It was a single centre observational study. The data were lacking in variables such as educational level, smoking, and co morbidity score to correlate with malnutrition. Inco-operation of C- reactive protein to assess the inflammation, dialysis dose to evaluate dialysis adequacy could have been important to correlate with malnutrition.

Conclusion

Prevalence of malnutrition is high in this Sri Lankan haemodialysis population. A Strong correlation was seen between Malnutrition score and advancing age, MAC, TSF, MAMC and daily protein intake. Regular Nutritional assessment and appropriate dietary and clinical management should be an integral part of maintenance haemodialysis provision [21-38].

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