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Importance of Variability Pattern Analysis for Malnutrition Information Score to Improve Treatment of Chronic Kidney Disease

Muhammed Zubair[1*], Shakeel khan[1], Usman Khalid[1] and Muhammed Kashif khan[1]

[1]Medicare International Hospital Gujranwala, Pakistan.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Morbidity and mortality envisaged by chronic kidney disease (CKD) remains a health menace throughout the world. Complications, incidence, prevalence, the impact of dietary recommendations, risk factors, outcome, and management strategies have not been rationalized due to several adversities resulting in escalated death rates. The objective of this study was to evaluate and establish a malnutrition information score (MIS) as a means of ease of CKD prevention and progression. MIS underlies the consistencies in findings through MIS show higher values can be corroborated to recommend the augmentation parameters in utilizing MICS techniques and other healthcare types of equipments.

Methods: A randomized, non-biased sampling of patients presenting to dialysis unit with their maintenance schedule program in the nephrology department of Medical Unit-3 of PIMS, Islamabad were introspected for inclusions. Personal history, BSF thickness and MAC values were measured, and MAMC was calculated by = MAC – (3.1416 x TSF). The study was conducted in the Department of Nephrology, PIMS, Islamabad for a duration of six months.

Results: The study conducted across 59 male patients and 33female patients indicate that males are more susceptible to CKD than females as evidenced by clinical stability of 67%. Appetite loss,

**Corresponding author: E-mail: drmz76@yahoo.com;*

degree of severity, Co-morbidity, BMI, MIS range, and clinical stability status of 100 study participants show variable indices indicating the stress on personal and family history of the patients. MIS pose as an indicator for determining the apt Malnutrition-Inflammation Complex Syndrome (MICS) and other types of equipments for treating CKD.

Conclusion: CKD patients undergoing maintenance hemodialysis analyzed for dietary balance affirm the utility of MIS in determining the MICS and other types of healthcare equipments indirectly in ensuring reduction in morbidity and mortality.

Keywords: Chronic kidney disease; malnutrition information score; maintenance haemodialysis; chronic renal failure; malnutrition-inflammation complex syndrome.

1. INTRODUCTION

Irreversible kidney damage, reducing kidney function progressively, is CKD replacing clinical terms CRF and CRI that described varying degrees of renal dysfunction. K/DOQI definition states CKD incited by kidney injury emancipated by either functional or structural anomalies irrespective of GFR levels. Various stages exist based on GFR levels in affected cases. Epidemiological retrospection of Global health concerns reveals that CKDs pose serious threats due to escalated incidence and prevalence in the US [1]. Prevalence of CKD according to NKF-K/DOQI workgroup supported CKD definition accepted internationally [2]: NHANES-3 observed serum creatinine levels ≥ 1.5, 1.7, and 2.0 mg/DL for individuals aged 12 years and above in 18,723 cases, between 1988 and 1994 [3], men: 5%, 1.9%, 0.6%, and women: 1.6%, 0.7%, and 0.3%, respectively. Classification of CKD according to NHANES-3 based on prevalence in the US from 1999 to 2004 [4,5] depicted that the US adult population (%) having persistent albuminuria were demarcated into five stages based on glomerular filtration rates.

Microalbuminuria It acts as a clinical indicator of diabetic nephropathy and an initial marker for non-diabetic CKD eventually that can leading to cardiovascular complications. Four thousand, one hundred and one (4101) cases analyzed by NHANES-3 (1999, 2000) assessed the prevalence of microalbuminuria as a lone marker for early kidney disease. In recent years microalbuminuria conditions are prevalent irrespective of gender, age, and race/ethnicity [5].

CKD patients' acquiring the possibilities of ESRD varies largely owing to genetic factors and highly modifiable risk factors. Differential accesses to healthcare can arrest/reduce/enhance ESRD progression posing the specificity of concern for African 4 Americans [6] precisely. Comparatively studies in Korea and Taiwan reported that microalbuminuria; proteinuria and GFR levels contribute to diabetes prevalence [7-9]. Age, co6morbidities, smoking, and lower GFR also attributes to CKD [10,11].

Early stages (1, 2) are asymptomatic, with the progression of renal functional deterioration than the symptomatic stages (3, 4). Moreover, the disease was not coerced to 9gender difference or age variations (NAPRTCS) [12]. Clinical evaluation through historical and physical aspects of a CKD patient analyzed through laboratory testing is critical in gauging the severity of renal impairment and associated complications. Physical examination includes measurement of growth parameters; life-stage based BP comparison basis NHANES-3 and population studies, assessment of pallor, hypervolemia, and deformities of extremities from renal osteodystrophy/oedema and 15 other signs, and cardiac auscultation cases with pericarditis.

Complications of CKD are often associated with kidney impairment that depicts lower 17 GFR (moderate/severe). Symptoms can be holistically addressed as dyslipidemia, fluid accumulation, electrolyte imbalance, endocrine abnormalities, growth impairment, and lowered clarity of renal excretions. Fluid-electrolyte abnormalities comprise sodium-water imbalance, hyperkalemia, renal osteodystrophy, and anaemia. Cardiovascular abnormalities that have been reviewed by several physicians and researchers from copious research show hypertension, LVH, dyslipidemia, and atherosclerosis. Endocrine dysfunction can incite from difficulties of growth hormone metabolism, thyroid function, and gonadal hormones. In children, uremia manifests as platelet dysfunction and pericardial disease. Neurodevelopment is indicated, affecting cognitive development

ranging from seizures, severe intellectual disability to subtle deficiencies resulting in poor schoolwork performance.

Arresting the progression of CKD usually is performed by the usage of nephrotoxic drugs/diagnostic agents that worsen renal function. Aminoglycoside antibiotics and NSAIDs in unadjusted doses and radiographic contrast material are culprits, especially in diabetics aggravating CKD. Cautionary use of drugs is advised to mitigate mortality rates and adverse complexities. Several disorders develop due to renal dysfunction that needs to be managed owing to profound implications in cardiovascular and diabetic perspectives.

Also hyperlipidemia and metabolic acidosis treatment stress the cessation of the smoking habit for effective treatment where smoking cessation was observed in the reduced rate of CKD progression [13]. Smoking seemed to correlate with enhanced risk of nephrosclerosis and progression rate in CKD patients [14].

Hence, Dietary Recommendation accounts for limiting the adversities caused by CKD. The impact of Dietary recommendations can be primarily segregated because of volume overload wherein GFR levels less than 10-15mL/min triggers volume overload. However, in mild to moderate CKD, though volume balance exists, response to sodium infusions is compromised hence overload don't aggravate the condition. Patients generally respond to a combination of dietary sodium restriction and daily diuretic therapy. Dietary recommendations have a positive impact on CKD patients with hyperkalemia [15,16], metabolic acidosis [17], hyperphosphatemia (dietary management restricts secondary hyperparathyroidism), renal osteodystrophy [18], hypertension [19], anaemia, and dyslipidemia [20]. Sexual dysfunction prevails as the major outcome as it's reported frequently in advanced-stage patients 50% of uremic males complained of symptoms of sexual dysfunction [21]. On a similar circumstance, female patients encountered amenorrhea with progression towards ESRD.

Complications of Hemodialysis in older patients contain intradialytic hypotension, malnutrition, dialysis withdrawal/depression, infection, and gastrointestinal bleeding. Hypotension occurs in 20-30% of dialysis patients and subsequently escalates in elderly patients undergoing procedure [22]. General mechanisms in combating negative effects include plasma osmolality reduction causing extracellular water movement into cells, and fluid removal to attain 'dry weight' [23]. Other factors contributing to exacerbations are autonomic neuropathy, poor cardiac reserve, acetate as a dialysate buffer, anti-hypertensive medications, lower sodium in dialysate, sudden adenosine release and severe hypocalcemia. Management in older patients strategically relies on nutritional consideration, social isolation, low income, inadequate knowledge, CKD and ESRD complications, ill-fitting dentures, depression, drug side-effects, impaired taste, anorexia, chronic constipation, hospitalization, dialytic, and hormonal-metabolic factors.

Prevalence of two concomitant indications referred to as MICS[37] or MIA syndrome [24]. MICS, the exposure-outcome paradox, leads to significant hospitalization and mortality. MIS involves seven components of SGA [25], a semi-quantitative scale comprising three severity levels, with BMI, serum albumin, and TIBC incrementally, a 10-component MIS has been created [26]. MIS has significant associations with prospective hospitalization and mortality, along with nutrition, inflammation, and anaemia. MIS is superior to conventional SGA and laboratory values, hence decisive in dialysis outcomes and an indicator of MICS, as this has strong degrees of sickness, morbidity, and mortality. High prevalence of PEM and inflammation in ESRD patients undergoing MHD [27] address a dire need for the prominent indicator of CKD. Hence the present study was chosen to evaluate and establish MIS as a means of ease of CKD prevention and progression.

2. MATERIALS AND METHODS

2.1 Study Design

The present study pertains to observational assessment at Nephrology Department, Medical unit–Pakistan Institute of Medical Sciences, Islamabad for 6 months.

2.1.1 Sample characteristics and Data collection

Samples size of 100 patients with the diagnosis of chronic renal failure and on maintenance hemodialysis and comply with the inclusion criteria are used in the study. A randomized, nonbiased sampling of patients presenting to

dialysis unit with their maintenance schedule program in the nephrology department of Medical Unit-3 of PIMS, Islamabad were introspected for inclusions.

2.1.2 Eligibility criteria

Patients' eligible for the study belong to 18 Years to 80 Years. Both male and female patients were chosen for the study focusing on healthy Volunteers.

2.1.3 Inclusion criteria

Clinically stable, CRF (any aetiology), MHD for 8weeks minimum comprise inclusions.

2.1.4 Exclusion criteria

ARF, Renal transplant (to be and done), HIV, Metastatic malignancy, active infection or malignancies, breastfeeding or pregnant.

2.2 Data Analysis and Statistical Considerations

Patients' history basis medical records/personal interview, standard details: weight, height, dietary intake, gastrointestinal symptoms, functional capacity, co-morbidity and anthropometric evaluation was done. BSF thickness and MAC measured, MAMC was calculated by = MAC – (3.1416 x TSF). Measurements used to calculate body fat. Laboratory values: serum albumin and TIBC considered. Data processing and analysis via SPSS version 13 were employed for assessing variability profiles and comparative assessments. Descriptive statistics and frequencies were calculated by background variables.

3. RESULTS

Total of 100 patients were included in our study after fulfilling the inclusion criteria. The minimum age of the study population was 32 years, the maximum age was 80 years and the mean age was 56.11years±14.01SD. The minimum height of the patients was 4 feet 5 inches, maximum height was 7 feet and the mean height was 5.64±0.474SD. Similarly the minimum weight of the patients was 40 kg, the maximum weight was 90 kg and the mean weight was 96.32kg±9.11SD). Out of total of 100 patients, 59 patients were male and 41 patients were female in our study population, 67(67%) of the patients were clinically stable and 33(33%) were unstable (Table 1).

Table 1. Descriptive Statistics of Patients, N is Sample

Patients' variables	N	Range	Minimum	Maximum	Mean	Std. deviation
Age	100	48	32	80	56.11	14.015
Height	100	2.5	4.5	7	5.645	0.4749
Weight	100	40	50	90	69.32	9.1551
MIS	100	26	4	30	12.16	6.73

Male: 59 and Female: 41 Stable: 67% and Unstable: 33%

Table 2. Appetite loss, degree of severity, Co-morbidity, BMI, MIS range, and clinical stability status of 3 study participants, Total = 100

Degree of Appetite Loss	Frequency (n)	Percent (%)	Degree of Severity	Frequency (n)	Percent (%)	Valid Percentage (%)
None	42	42.0	None	39	39.0	39.0
Mild	24	24.0	Mild	17	17.0	17.0
Moderate	23	23.0	Moderate	34	34.0	34.0
Severe	11	11.0	Severe	10	10.0	10.0

Co-morbidity status:	Patients' BMI:	Range of MIS:
> 1year: 22%	More than 20: 21%	0-5: 9%
Between 1-4 years: 44%	Between 18-19.99: 42%	6-10: 45%
< 4years: 30%	Between 16-17.99: 32%	11-15: 20%
Major co-morbid cases: 4%	Less than 16: 5%	16-20: 8%
		21-25:17%
		26-30:1%

Degree of Appetite Loss	Frequency (n)	Percent (%)	Degree of Severity	Frequency (n)	Percent (%)	Valid Percentage (%)
Clinical Stability Status:						
0-5: 9% were stable			16-20: 2% stable, 6% unstable			
6-10: 42% were stable, 2% unstable			21-25: 1% stable, 16% unstable			
11-15: 13% stable, 7% unstable			26-30:1% unstable			

Table 3. MIS versus outcome at the end of 6 months

MIS Score	Outcome after 6 months			Total
	Alive	Increased morbidity	Deceased	
0 – 5	9	0	0	9
6 – 10	34	11	0	45
11 – 15	6	5	9	20
16 – 20	0	1	7	8
21 - 25	0	7	10	17
26 - 30	0	0	1	1
Total	49	24	27	100

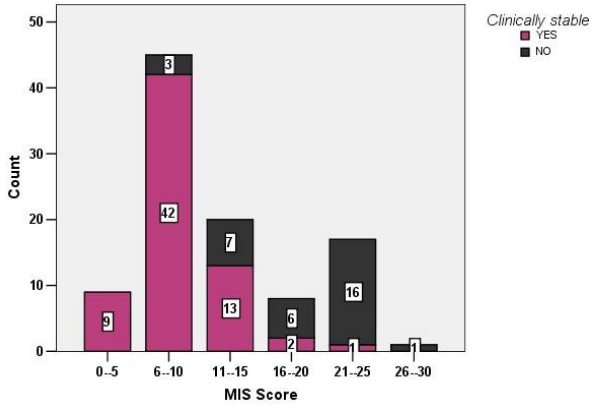

Fig. 1. Comparison between MIS score and clinically stability of the patients

Appetite loss, degree of severity, Co-morbidity, BMI, MIS range, and clinical stability status.

Appetite and weight loss was not apparently an indicator as only 11 patients showed severity in appetite and 10 patients' indicated severe weight loss. Gastrointestinal complications, comorbidity period, BMI, MIS range, and clinical stability status showed the desperate need for dietary supplementation in emancipating clinical stability (Table 2). These data are most significant in combating obesity based cardiovascular complications.

3.1 MIS Vs Outcome

Table (3) clearly demonstrates MIS score of 6-10 as an optimal outcome shows the importance of MIS scores in delineating CDK. Nevertheless increased morbidity also accompanies the MIS score. Hence further assessments like molecular marker basis for MIS score Vs CDK have to be pursued for accurate results (Fig. 1). The results summarily indicate the correlative intuitions for MIS in further determining criteria for treating CKD with parallel risk factors and appropriate healthcare equipments.

4. DISCUSSION

MICS (Malnutrition-Inflammation Complex Syndrome) refers to the duality in kidney disease characterized in MHD patients with an escalated symptomatic prevalence of PEM and inflammation [28]. We have included 100 patients in our study. Sample size and determination of male and female susceptibility ratio are usually undertaken universally [29].

In our study, the cohort population included contains 59% of the patients (male) and 41% (female) respectively. The tabulations and Fig.1 are indicative of the facts that CDK remains more prevalent among males as modifiable risk factors due to habitual parameters. The average Malnutrition inflammatory index score in our study was 12 with a minimum 4 and a maximum was 30. This average MIS score is somewhat increased as compared to other trials conducted internationally [30] where it was around 6.3. The significant consideration concerns with the severity of the disease. And more than 45% of the patients had MIS score of more than 10 and rest of the patients had MIS score of less than 10 whereas in a trial conducted by Kamyar Kalantar-Zadeh et al.[31], it was shown that only 25 % of the patients had MIS score of more than 8 and the rest of the patients had an MIS score of less than 8 [31].

The main reason for this gross difference in MIS score of their study with our study is the standard of care in their health system. Scoring pattern of MIS shows that the scores when reveals high values depict severity of the disease along with mortality patterns. In our study, 18% of the patients had MIS score of more than 20 indicating the terminally ill conditions of the CDK Patients. Further, a precise score doesn't associate between clinical stability of the patients with MIS score as patients with lower scores were more stable as compared to the patients with higher score. Mortality of the patients also reveals the similar status wherein higher MIS score had increased morbidity and mortality at 6 months of follow-up. Mortality in our study was 27% and was directly associated with increasing MIS score and this was also consistent with other studies [32].

Other variables like appetite loss, weight loss, low body mass index, were also analyzed in our study and were found to be associated with increased morbidity and mortality. As for comorbidity and its period are concerned, it was found that most of the patients had co-morbid conditions with variable duration. Future research upon linkage assessment of different comorbid conditions with morbidity and mortality are required to correlate these risk factors. Assessments of the nutritional and inflammatory status of hemodialysis patients, outcomes from MICS are poorly evaluated due to the lack of a rational method. Several indices of protein-energy malnutrition are available, ranging from well-known anthropometric measurements to more elaborate techniques, such as dual-energy X-ray absorptiometry [33]. Reliability and accountability of the detection methodologies for protein-energy malnutrition lacks reproducibility. Further inflammatory status analysis for a prompt status of quantifying pro-inflammatory cytokines are not well accepted globally.

Average MIS higher than international trials [26] can be attributed to disease severity and healthcare delivery systems. The inversely proportional association observed between stability and MIS. The direct association seen with morbidity and mortality (end of 6 months) were also documented earlier [27, 28]. Hence the present study also signifies six months as an effective period for data scrutiny and analysis. Coincidence with signs and symptoms associated with increased morbidity and mortality. An exacting analysis recommended for various co-morbid conditions with morbidity and mortality. Uniform assessment of the nutritional and inflammatory status of dialysis patients is necessary, despite the techniques used, reliability and practicality have not proved to be convincing. Poor clinical outcomes due to MICS necessitate suitable techniques and equipment required for gauging MICS. The male skewed study, having higher average MIS versus other studies show gender specificity and further analysis in the case of female cohorts will aid in more insights. Clinical stability, morbidity, and mortality were directly associated with rising MIS.

Hemodialysis patients are clinically assessed by and large using MICS with unpredictable outcomes. Hence, it is imperative to find the best tool that can reliably identify MICS and its degree of severity to risk-stratify the patients accurately. Nevertheless, this preliminary step needs to be followed by efforts to treat MICS. There is a paucity of information concerning the effect of nutritional therapy or anti-inflammatory modalities on morbidity and mortality in dialysis patients [29-33]. Randomized clinical trials are needed to compare the effect of nutritional support and anti-inflammatory agents, both independently and combined, in patients suffering from MICS, in order to improve poor outcomes in dialysis patients. To that end, a reliable tool to identify MICS and the degree of its severity is the most critical step.

5. LIMITATIONS

Family history and personal history of CKD patients involved in the study were not analyzed

for the modifiable risk factors and non-modifiable risk factors. Further, the cohorts' dietary inclusion variations when checked could yield deeper proven results for accessory diseases and outcomes. Further studies and clinical trials for characterizing MIS in CKD evaluation for advocating of healthcare equipments and MICS require intricate analysis.

6. CONCLUSION

Average MIS values in the reduction of CKD complications were assessed and the possibility of the intervention was predicted for the severity of the disease and delivery systems. Signs, symptoms, co-morbid conditions along dietary balance in maintenance hemodialysis prove further adequate methodologies for optimizing MIS in determining MICS and other healthcare equipments. Moreover, males are prone to be associated with CKD employing MIS values than females. Randomized clinical trials are required to authenticate for advocating the present analysis to efficiently curb morbidity, mortality and clinical stability of CDK patients to enhance the quality of life.

CONSENT

It is not applicable.

ETHICS APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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