Sensitivity and Specificity of Several Malnutrition Screening Tools for Chronic Kidney Disease Patient: A Narrative Review

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Abstract

Introduction: Malnutrition remains a critical risk factor for morbidity and mortality among CKD patients. However, malnutrition is preventable and treatable. Thus, early malnutrition screening of CKD patients is crucial. The present paper is a narrative review of the several studies related the use, sensitivity and specificity of developed malnutrition screening tools for CKD patients.

Material and Method: Articles were searched from five electronic databases i.e., PubMed, PMC, Semantic-scholar, Science-direct, and Google scholar. Several keywords used for literature searching including "malnutrition screening tools CKD"; "malnutrition CKD"; "malnutrition screening CKD". Inclusion criteria of this narrative review was the subject of intervention should be an aged 1 – 64 years old with experimental randomized control trial (RCT) or non-RCT study design. The exclusion criteria for this literature study were research published before 1990, literature studies, meta-analysis, comments, short communication, and editorial letters. Data then narratively described.

Result and Conclusion: Twelve publication were narratively described in final analysis. Development of malnutrition screening tools for CKD patient had been done since 1992 and still counting until 2020. At least thirteen screening tools had been tested for its use, sensitivity and specificity. Among 13 tools we analyzed, *Simple Nutrition Screening Tool* (SNST) and *The Renal Nutrition Screening Tool* (R-NST) revealed the highest sensitivity and specificity value which suitable to be used in adult population, while in children, only *Pediatric Digital Scaled MAlnutrition Risk Screening Tool* (PeDiSMART) showed a good sensitivity and specificity. Further study should be focusing to look for sensitivity and specificity in other specific population to ensure the right use of malnutrition screening tool.

Keywords: *malnutrition screening, chronic kidney disease, sensitivity, specificity*

Introduction

Hospital malnutrition conditions are prone to occur in hospital patients and can have an impact on increasing patient morbidity, affecting the healing process of disease, reducing quality of life, extending the duration of hospitalization and increasing the burden of financing[1]. Chronic Kidney Disease (CKD) is a type of degenerative disease which is a kidney function disorder, is irreversible, and results in insurmountable physiological changes that lead to significant mortality and morbidity[2]. Chronic Kidney Disease in the world is currently experiencing an increase and becoming a serious health problem, the results of the 2010 Global Burden of Disease study, Chronic Kidney Disease was the 27th leading cause of death in the world in 1990 and increased to 18th in 2010[3]. In Indonesia, the prevalence of CKD in 2013 was reported to be 2% with the lowest prevalence of 1% and the highest of 4%[4].

The severity of CKD can be reduced with proper nutritional care. However, a study in one hospital

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in Indonesia showed that 54.2% of CKD patients undergoing routine hemodialysis had malnutrition or already in malnutrition status[5]. This number is high and needs to be intervened as early as possible because malnutrition in patients with CKD can affect the response to therapy and quality of life. CKD patients undergoing hemodialysis therapy have a greater risk of malnutrition due to the hemodialysis process itself; where in the hemodialysis process, it not only removes metabolic waste and harmful substances in the blood, but also often causes the loss of important nutrients such as amino acids, glucose, and water-soluble vitamins[6].

Studies show a high prevalence rate of malnutrition in both children and adults with chronic kidney disease. A study among Southern Nigerian patients showed a prevalence of malnutrition increased significantly across CKD stages 2 to 5 (p=0.020), higher in male patients which also marked by higher level of serum albumin and creatinine[7]. Malnutrition among CKD patients caused by interrelated abnormal pathophysiological factors such as low ghrelin which leads to decreased appetite, lower energy and nutrient intake, metabolic imbalances, increased catabolism, hormonal derangements, inflammation, and dialysis related abnormalities[8].

Nutritional screening is a first-line process of identifying patients who may be at risk of becoming malnourished. If based on the nutritional screening tools, patients are at risk, then patients should be undergoing a comprehensive nutrition care process by a dietitian to prevent malnutrition risk. However, malnutrition is rarely diagnosed because of low sensitivity and specificity of screening tool. This narrative review aims to narratively described the use of several nutritional screening tools in CKD patients as well as comparing each sensitivity and specificity.

Material & Method

Articles were searched from five electronic databases i.e., PubMed, PMC, Semantic-scholar, Science-direct, and Google scholar. An online search was conducted in August 2020 for all articles related to development, use, or evaluation of malnutrition screening tools among CKD patient published in 1992 – 2020. Several keywords used for literature searching including "malnutrition screening tools CKD"; "malnutrition CKD"; "malnutrition screening CKD".

This narrative review aims to answer research questions "how is the use, sensitivity and specificity of several malnutrition screening tools in CKD patients?". The sample in this literature study was CKD patients aged 1 – 64 years who participated in experimental or non-experimental research that measured the provision of various malnutrition screening tools in CKD patients. Inclusion criteria of this narrative review was the subject of intervention should be an aged 1 – 64 years old with experimental randomized control trial (RCT) or non-RCT study design. The exclusion criteria for this literature study were research published before 1990, literature studies, meta-analysis, comments, short communication, and editorial letters. Two reviewers assessed articles for inclusion and study quality and extracted data. Only studies published in English were included. Data were summarized narratively.

The scope of this narrative review is in line with the aim that is to describe the use of several malnutrition screening tools in different population all over the world, describing its sensitivity and specificity in capturing malnourished patient.

Findings

We retrieved 40 papers at first literature search, eighteen publications were excluded because it met exclusion criteria i.e., literature studies. Twelve publication were narratively described in final analysis.

First published malnutrition screening tools was in 1992 called Subjective Global Assessment (SGA), the use of SGA was tested among 59 chronic uraemic patients treated by haemodialysis (n = 36) or CAPD/ Continuous Ambulatory Peritoneal Dialysis (n = 23). SGA is now also widely used in clinical setting for adult patient. The SGA instrument diagnoses malnutrition based on two criteria, namely medical history and physical examination. The medical history is based on five questions, while the physical examination is based on one examination. The results of the six questions were then classified into good / normal nutrition, mild/ moderate malnutrition, and severe malnutrition[9].

This SGA assessment aims to find out the etiology of malnutrition, whether due to decreased food intake, malabsorption, maldigestion or increased demand. Physical examination assesses the loss of muscle mass

and fat as well as the presence of ascites and is useful for identifying changes in body composition due to the effects of malnutrition or the influence of the disease process[10]. However, this first SGA for CKD patients did not establish its validity but showed a good reliability and claimed to be inexpensive method which can be recommended for a more frequent assessment of nutritional status in dialysis patients[9]. Furthermore, SGA was validated by Cooper (2002)[11] among 76 dialysis patients and Gurreebun, et al. (2007)[12] among 141 hemodialysis patients using biochemical characteristics such as serum albumin and Total Body Nitrogen (TBN) somehow still showing that SGA were less sensitive to detect malnutrition; means that while patients were malnourished based on biochemical data but not detected as malnourished by SGA. A review of SGA tool for CKD patients suggests that SGA is a useful tool for nutritional screening, but its validity and reliability should be established first in the selected population to ensure clinicians in targeting malnourished patients[13].

The SGA then developed to another tool called PG-SGA (Patient-Generated Subjective Global Assessment) by Desbrow, et al[14]. PG-SGA Includes medical history (weight, intake, symptoms, functional capacity, metabolic demand) and physical examination; then also categories patients into SGA categories (A, B or C) as well as providing a numerical score for triaging[15]. His study with total 60 hemodialysis patients proven that PG-SGA has good internal consistency, also high sensitivity and specificity (83% and 92%). Recently, Kosters, et al[16] also tested validity of PG-SGA among 123 CKD patients which also revealed a good sensitivity (78%) and specificity (94%). To differ, Kosters, et al simplify PG-SGA form to be Patient-Generated Subjective Global Assessment Short Form (PG-SGA-SF) using only 4 indicators, those are nutritional impact symptoms, food intake, daily functioning and weight.

The Renal DETERMINE Nutrition Screening Tools was also one of early tools developed to screen malnutrition[17]. The Renal DETERMINE Nutrition Screening Tools is a self-administered which aims to educate patient and increase awareness of their malnutrition risk; but also, can be administered by the healthcare provider as well. DETERMINE stands for ***D****isease,* ***E****ating poorly,* ***T****ooth loss, swallowing difficulty, or gastric distress,* ***E****conomic hardship,* ***R****educed social contact,* ***M****ultiple medications,* ***I****nvoluntary weight loss or weight gain,* ***N****eeds assistance with self-care, and* ***E****lderly over 65*. The Renal DETERMINE Nutrition Screening Tools consists of 13 Yes/No questions. No cut off points determined and also for its sensitivity nor specificity. To our understanding, this tool is no longer used considering lack of data on its accuracy to detect malnutrition at early stage; even though this tool is quite simple and easy to administer.

In 2016, Xia, et al.[18] study developed and tested new tool called *The Renal Nutrition Screening Tool* (R-NST) among 122 acute kidney injury, chronic kidney disease, and dialysis. The new R-NST was developed by using some of the content of the MST (e.g., weight and appetite) and incorporating best practice dietetic content (e.g., using specific biochemical measures). The R-NST consists of 9 questions, which must be completed in 3 steps—steps 1 and 2 provide 2 separate screening pathways, and step 3 calculates the final score. Step 1 consists of 5 compulsory questions (1-5) including recent involuntary weight loss and any eating behavior change, and renal specific nutrition indicators (e.g., serum phosphate and potassium and episodes of peritonitis). Step 2 includes 4 questions (6-9) assessing any episodes of persistent gastrointestinal symptoms that may be indicative of increased risk of undernutrition, as well as 3 renal specific biochemical markers, namely albumin, C- reactive protein, and serum urea. Final step 3 is total score from step 1 and 2, using the cutoff point >3, patient screened as at risk of undernutrition and should be referred to dietitian[18]. This tool has not been validated in other population.

Study done by Susetyowati[19] has also been developed new tools specifically used for Indonesian population called *Simple Nutrition Screening Tool* (SNST). Even though it was not developed for CKD patient since the first place, SNST proved to be a better tool than the NRS 2002 in malnutrition hemodialysis (MHD) patients against either SGA (Sensitivity 94.3% vs. 82.9%; Specificity 60% vs. 58.6%). The study which included MHD patients concludes SNST as a valid screening tool that is valid, accurate, simple and can be quickly filled, east to be administered by any health-care provider. SNST consist of six yes/no questions including does patient look skinny; experienced weight loss (clothes feels loose and feeling involuntary weight loss);

experienced a decrease in food intake in the last 1 week; experienced fatigue and suffering from any disease that cause decrease food intake. Patient will be put as in malnutrition risk if total score >3[20]. This study also validated Nutrition Risk Screening Score (NRS-2002) in CKD patient which also prove that NRS-2002 have a good validity in predicting malnutrition risk compared to objective measures (BMI, MUAC, HGS and energy intake). In line with this study, Müller, et al.[21] also validate NRS-2002 in more CKD patients (489). His study explained that NRS-2002 also found to have good sensitivity to predict malnutrition in CKD patient. The NRS combines both a measure of current potential undernutrition and a measure of disease severity and has been validated in various patient groups. The risk for malnutrition was defined as an NRS-2002 score of >3 points.

Malnutrition Inflammation Score (MIS) is another screening tool for CKD patient that showed 87.09% of sensitivity and 45.45% of specificity after tested in 73 hemodialysis patients[22]. Compared to previously describe tools, MIS has lower specificity which could generates many false-positive results and should be considered more to be used in clinical setting. Another three malnutrition screening tools was *Dialysis Malnutrition Score* (DMS), *Nutritional Risk Index* (NRI), and *Malnutrition Universal Screening Tool* (MUST)[23,16]. DMS and NRI were validated among 226 hemodialysis patients aged >18 years. Compaing all of those three, only DMS showed a good both sensitivity and specificity (81,3% and 71,4%), while NRI and MUST only showed good specificity but low sensitivity. Low sensitivity might result in higher false-negative results and not suitable to detect malnutrition among CKD patients.

Chronic Kidney Disease can also occur in pediatric patient in which malnutrition causes morbidity and mortality. A validated tool for malnutrition screening in children is limited. One study was found to validate *Pediatric Digital Scaled MAlnutrition Risk Screening Tool* (*PeDiSMART*) which showed a good sensitivity (87%) and a specificity (75%)[24]. This study could be duplicated in another population to be used for pediatric population.

This narrative review could be beneficial to be used as a as a reference to determine the differences in the various detection tools for malnutrition in patients with CKD.

In conclusion, out of twelve published paper narratively reviewed, among adult CKD patients, Simple Nutrition Screening Tool (SNST) proved to have highest sensitivity and specificity, followed by The Renal Nutrition Screening Tool (R-NST); while in children, only Pediatric Digital Scaled MAlnutrition Risk Screening Tool (PeDiSMART) showed a good sensitivity and specificity. We suggest every hospital or any other healthcare undergone a validity, sensitivity and specificity test for targeted population because the results presented in this study might be difference if used in other specific population.

Acknowledgements: We would like to thank Faculty of Public Health for supporting this manuscript writing.

Ethical Clearance: Ethical clearance is not applicable for narrative review.

Conflict of Interest Statement: The authors declare no conflict of interest.

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