ORIGINAL RESEARCH

# Comparing Tests Assessing Protein-Energy Wasting: Relation With Quality of Life

*Camiel L. M. de Roij van Zuijdewijn, MD, MSc,*[★,†] *Muriel P. C. Grooteman, MD, PhD,*[★,†] *Michiel L. Bots, MD, PhD,*[‡] *Peter J. Blankestijn, MD, PhD,*[§] *Marinus A. van den Dorpel, MD, PhD,*[¶] *Menso J. Nubé, MD, PhD,*[★,†] *and Piet M. ter Wee, MD, PhD*[★,†]

**Objective:** Protein-energy wasting (PEW), a state of decreased bodily protein and energy fuels, is highly prevalent among hemodialysis patients. The best method to determine PEW, however, remains debated. As an independent, negative association between PEW and quality of life (QOL) has been demonstrated, establishing which nutrition-related test correlates best with QOL may help to identify how PEW should preferably be assessed.

**Design and Methods:** Data were used from CONTRAST, a cohort of end-stage kidney disease patients. At baseline, Subjective Global Assessment (SGA), Malnutrition Inflammation Score (MIS), Geriatric Nutritional Risk Index, composite score on protein-energy nutritional status, normalized protein nitrogen appearance, body mass index, serum albumin, and serum creatinine were determined. QOL was assessed by the Kidney Disease Quality of Life Short Form 1.3. The present study reports on 2 general and 11 kidney disease–specific QOL scores. Spearman's rho (ρ) was calculated to determine correlations between nutrition-related tests and QOL domains. Twelve months after randomization, a sensitivity analysis was performed to test the robustness of the results.

**Results:** Of 714 patients, 489 representative subjects were available for analysis. All tests correlated with the Physical Component Score, except body mass index. Only SGA and MIS correlated significantly with the Mental Component Score. SGA correlated significantly with 10 of 11 kidney disease–specific QOL domains. The MIS not only correlated significantly with all (11) kidney disease–specific QOL domains but also with higher correlation coefficients.

**Conclusion:** Of the 8 investigated nutrition-related tests, only MIS correlates with all QOL domains (13 of 13) with the strongest associations.



## Introduction

MANY END-STAGE KIDNEY disease patients need lifelong dialysis treatment. Despite continuous developments in dialysis techniques and improving knowledge concerning the uremic syndrome over the last decades,[1] not only remains the life expectancy of these patients severely impaired but also is their quality of life (QOL) usually severely negatively affected in comparison to the general population.[2,3] Among others, QOL is influenced by appetite,[4] quality of sleep,[5] and nutritional status, i.e., protein-energy wasting (PEW).[6,7]

The International Society of Renal Nutrition and Metabolism (ISRNM) introduced the term PEW in 2008 to determine the state of decreased bodily protein and energy fuels in chronic kidney disease patients. PEW appears to be highly prevalent among hemodialysis (HD) patients.[8,9] The following diagnostic criteria were proposed for this syndrome: (1) low blood chemistry (albumin, prealbumin, or cholesterol), (2) low or decreasing body mass, (3) low or decreasing muscle mass, and (4) low dietary intake.[10] In the absence of a gold standard, however, the debate on how this syndrome should be assessed is ongoing.[11,12] Although randomized interventional trials are awaited, observational studies and experts suggest that patients suffering from PEW may benefit from supplementation of proteins and energy.[13–15] In addition, a recent randomized trial showed that in patients with a low serum albumin concentration, help with patient-specific barriers such as cooking or improvement of nutritional knowledge resulted in increased serum albumin levels.[16] Hence, it appears important to find a reliable way to identify PEW in these patients accurately and easily.

The quest for a gold standard has resulted in many clinical scoring lists, tools, and parameters to diagnose malnutrition

[★]*Department of Nephrology, VU University Medical Center, Amsterdam, The Netherlands.*

[†]*Institute for Cardiovascular Research VU University Medical Center (ICaR-VU), VU University Medical Center, Amsterdam, The Netherlands.*

[‡]*Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht, Utrecht, The Netherlands.*

[§]*Department of Nephrology, University Medical Center Utrecht, Utrecht, The Netherlands.*

[¶]*Department of Internal Medicine, Maasstad Hospital, Rotterdam, The Netherlands.*

*Financial Disclosure: See Acknowledgments on page XXX.*

*Support: See Acknowledgments on page XXX.*

*Address correspondence to Camiel L.M. de Roij van Zuijdewijn, MD, Department of Nephrology, VU University Medical Center, PO Box 7075, 1007 MB, Amsterdam, The Netherlands. E-mail: c.deroijvanzuijdewijn@vumc.nl*



*1051-2276/$36.00*

*http://dx.doi.org/10.1053/j.jrn.2015.09.003*

or PEW. The most widely investigated clinical nutrition-related scoring lists are the 3-point scaled SGA[17,18] as well as its modified successors, such as the 7-point scaled SGA (SGA-7)[19] and the Malnutrition Inflammation Score (MIS).[20] Other clinical nutrition-related scoring lists that have been proposed to assess PEW include the Geriatric Nutritional Risk Index (GNRI)[21] and the composite score on protein-energy nutritional status (cPENS).[22] Furthermore, a number of more or less individual parameters have been associated with PEW, such as serum albumin,[23] body mass index (BMI),[24] and the normalized protein nitrogen appearance (nPNA) rate.[25,26]

In short, presently, it is unknown how PEW can be determined best. With respect to mortality, we recently showed that serum albumin and MIS as markers for PEW predict mortality equally well.[27] Besides an impaired life expectancy, a consequence of PEW is a decrease in QOL, as has been stated by the ISRNM in 2008.[10] As such, it appears justified to assume that a preferred nutrition-related test should correlate with QOL. To contribute a piece of the puzzle in finding the preferred test to assess PEW, various nutrition-related tests are compared in their relation with various domains of QOL in the present study.

## Methods

Various cross-sectional analyses were performed using data from the CONvective TRAnsport STudy (CONTRAST, NCT00205556). Details concerning the design and methods of this study are described elsewhere.[28,29] In brief, CONTRAST was a randomized controlled trial primarily evaluating the effect of postdilution online hemodiafiltration compared with low-flux HD on all-cause mortality and cardiovascular events. Seven hundred fourteen patients were enrolled between 2004 and 2010 in 29 dialysis centers in 3 countries (the Netherlands [n = 26], Canada [n = 2], and Norway [n = 1]). Patients aged 18 years or older were eligible if treated with HD 2 or 3 times per week for over 2 months. Patients were considered ineligible in case of severe incompliance to dialysis prescription, treatment with HDF or high-flux HD in the 6 months preceding randomization or a life expectancy under 3 months due to nonrenal disease. Written informed consent was given by all patients before randomization. The study was performed in accordance with the Good Clinical Practice Guidelines and the Declaration of Helsinki. The study protocol was approved by a central medical ethics review board.

Participants were included in the present study if all investigated nutrition-related tests could be assessed at baseline. For this, the following information was necessary: SGA-7, gender, BMI, dry body weight, medical history, dialysis vintage, serum albumin, serum creatinine, nPNA, and total iron-binding capacity.

### Nutrition-Related Tests

#### *7-Point Scaled SGA*

Four items are scored on a scale from 1 (severely malnourished) to 7 (well nourished): (1) change in dry weight, (2) dietary intake change and gastrointestinal symptoms, (3) decrease of subcutaneous fat, and (4) muscle atrophy. An overall subjective score between 1 and 7 is then assigned by the professional conducting the test.[19]

#### *Malnutrition Inflammation Score*

The MIS is a modified and extended version of the SGA, in which the following 10 items are scored between 0 (normal) and 3 (severely abnormal), resulting in an overall score between 0 (well nourished) and 30 (severely malnourished): (1) change in post-dialysis weight, (2) dietary intake, (3) gastrointestinal symptoms, (4) functional capacity, (5) comorbidity including dialysis vintage, (6) decreased fat stores or loss of subcutaneous fat, (7) signs of muscle wasting, (8) BMI, (9) serum albumin, and (10) serum total iron-binding capacity. In the present analysis, the different MIS items were converted from various parts of the case-record form, as described previously.[27] Of note, this is the only score in which a higher score indicates worse nutritional status.

#### *Geriatric Nutritional Risk Index*

This continuous score was derived from the nutritional risk index[30] and originally designed for the elderly.[31] It is calculated by the formula:

$$\mathrm{GNRI} = (1.489 \times \text{albumin } [g/L]) + (41.7 \times [\text{body weight}/\text{ideal body weight}])$$

The ideal body weight was calculated using the Lorenz formula.[31] The part (body weight/ideal body weight) was set to 1 when the dry weight exceeded the ideal body weight.[30]

#### *Composite Score on Protein-Energy Nutritional Status*

The weighted nutrition-related score cPENS contains the following 4 items, based on the 4 diagnostic criteria for PEW as proposed by the ISRNM[10]: (1) creatinine, (2) albumin, (3) BMI, and (4) nPNA. If a patients' BMI was above 23 kg/m,[2] 1.0 point was assigned, 1.5 points were assigned if nPNA was above 0.80 g/kg/day, 2.0 points if serum creatinine was above 10 mg/dL, and 2.5 points if albumin was above 3.80 g/dL. In total, this resulted in a score between 0 (severely malnourished) and 7 (well nourished).[22]

#### *Creatinine*

Creatinine was determined in serum at each centers laboratory using standard techniques. Blood samples were drawn before dialysis.