ORIGINAL RESEARCH

# Frailty and the Quality of Life in Hemodialysis Patients: The Importance of Waist Circumference

*Nazanin Noori, MD, PhD,* Arti Sharma Parpia, MSc, RD,* Rajiv Lakhani, MD,† Sabrina Janes, MSc, RD,* and Marc B. Goldstein, MDCM, FRCP(C)**

**Objective:** Frailty among the end-stage renal disease (ESRD) population is highly prevalent and has been associated with mortality. Little is known about the relation of different aspects of body composition, a modifiable risk factor, with the risk of frailty in ESRD population.

**Design and methods:** One hundred and fifty-one patients including 85 men and 66 women, aged ≥18 years with ESRD who had been receiving conventional maintenance hemodialysis (HD) for at least 3 months were included. Body fat and muscle mass from both bioimpedance spectroscopy and skin-fold thickness and waist circumference as a surrogate of abdominal obesity were measured. Frailty was defined based on Fried's criteria. Health-related quality of life was collected using the RAND version of the Kidney Disease Quality of Life (KDQOL-36) Survey.

**Results:** We performed single and multiple predictor logistic regression analyses to determine factors associated with frailty. After adjustment for age, sex, and comorbidities, fat mass (both by bioimpedance spectroscopy and anthropometry) and waist circumference, but not muscle mass remained the main predictors of frailty. The odds ratio of frailty in the third tertile compared with the first was 4.97 (1.70-14.55) and 3.84 (1.39-10.61) for fat mass and waist circumference, respectively ($P$ for trends for both $<.05$). The scores of physical health and kidney disease effect component of quality of life were lower in frail compared with nonfrail patients (40.7 ± 9.2 vs. 33.7 ± 10.2, $P < .01$ and 66.8 ± 22.4 vs. 51.6 ± 25.7, $P < .05$ for physical health and effects of disease, respectively).

**Conclusions:** Frailty, which is associated with poor outcomes in chronic HD patients, is common and predicted by fat mass and waist circumference but not by body mass index and muscle mass. Interventions to modify abdominal obesity, reflected by waist circumference, could potentially lower the incidence of frailty and hence improve the quality of life in the HD population.


## Introduction

THE PROBLEMS FACED by patients with chronic kidney disease (CKD) are multifactorial and the patients' morbidity and mortality are linked to more than just simple kidney function, but also to the overall performance of their various biological systems.[1,2] Frailty is a common and important comorbidity and there is increasing interest in the factors which determine frailty in different populations, particularly in the CKD population. Frailty among the end-stage renal disease (ESRD) population is highly prevalent and has been associated with hospitalization and mortality independent of other comorbidities and disabilities.[3-5] Frailty is defined as "declined function across multiple physiological systems," which is distinct from normal aging.[3,6-9] Clinically, it can be described by Fried's classification in which 3 or more of the following criteria are present: unintentional weight loss, exhaustion, low strength, slow walking speed, and low physical activity.[9] Although the causes of frailty and protein-energy wasting are well reviewed especially in the elderly,[10] little is known about the relation of body composition, as a modifiable risk factor, with the risk of frailty in ESRD population.

The concept of health-related quality of life (HRQOL) is not new. In 1946, the World Health Organization defined health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."[11] The HRQOL concept addresses the effects of the individual's health on physical, cognitive, and social functioning in day-to-day life. Hemodialysis (HD) patients have a diminished HRQOL, both from the myriad of symptoms of ESRD and from the physical and mental burden of the dialysis treatment itself and the associated limitations of diet and travel.[12] HRQOL has also been demonstrated to be independently associated with cardiovascular events and death in patients with CKD.[13]

*Division of Nephrology, Department of Medicine, St. Michael's Hospital, Toronto, Ontario, Canada.

†School of Medicine, University College Dublin, Belfield, Dublin, Ireland.

Support: Funding was provided by donor contributions to the St Michaels Hospital Foundation.

Financial Disclosure: The authors declare that they have no relevant financial interests.

Address correspondence to Marc B. Goldstein, MDCM, FRCP(C), Division of Nephrology, St. Michael's Hospital, 30 Bond Street, #3061, Toronto, ON M5B 1W8, Canada. E-mail: goldsteinma@smh.ca



1051-2276/$36.00

http://dx.doi.org/10.1053/j.jrn.2017.07.007

Therefore, for these patients, the careful assessment of HRQOL may help guide provision of medical management to optimize their health experience. The separate influences of frailty and quality of life on CKD patients who are on dialysis treatment is relatively well documented, but few studies have examined both frailty and HRQOL and little is known about the influence of frailty on HRQOL in HD patients.

Hence, the objective of this study is to identify the body composition components that predict frailty in the chronic HD population and to investigate the contribution of frailty to the HRQOL of HD patients. Our hypothesis is that the patients' relative amounts of fat and muscle would predict frailty and in turn impact on quality of life. This information might be useful in determining appropriate interventions to reduce frailty and ultimately hospitalization and mortality in the dialysis population.

## Methods

### Study Design

This is a cross-sectional study of prevalent in-center HD patients at St. Michael's Hospital, a tertiary care, inner city teaching hospital in Toronto, Canada. Adults aged ≥8 years with ESRD who had been receiving conventional maintenance HD for at least 3 months were eligible for this study. Exclusion criteria for the study were pregnancy, blindness, cognitive impairment, or limb amputation. All patients were receiving conventional HD (4 hours per session, 3-4 times weekly) at the time of assessment. The dialysis machine was the Fresenius 5008 (Fresenius Medical Care, Bad Homburg, Germany) and the dialyzers were Fx 1000, Fx Cordiax 120 (Fresenius Medical Care), and the Toray BG-U series (Toray industries, Inc., Tokyo, Japan). We collected relevant demographic and clinical data, which included age, race, gender, cause of ESRD, dialysis vintage, history of coronary artery disease (defined as previous myocardial infarction or revascularization procedure), and diabetes status from the patient's clinical record. This study was approved by the Hospital Research Ethics Board. Since the bioimpedance spectroscopy (BIS) data and frailty assessment for this study was also used to guide routine patient care, a waiver of patient-level consent was authorized.

### Anthropometric Measurements

Participants were weighed wearing minimal clothing and no footwear. Body weight was measured to the nearest 0.1 kg on a TORNIX digital platform scale (TRONIX 5702 Bariatric Stand-On Scale, www.scale-tronix.com). Height was measured to the nearest 0.1 cm using a wall mounted stadiometer (TRONIX 5702) with participants standing erect and arms hanging freely at their sides. Waist circumference (WC) was measured in centimeter at the midpoint between the inferior margin of the last rib and the crest of the ilium[14] with the observer at eye level to the tape and at the end of a normal expiration. Mid-arm circumference was measured at the mid-point between the tip of the shoulder and the tip of the elbow (olecranon process and the acromion). The values were recorded to the nearest 0.1 cm. Skinfold thicknesses were measured predialysis at 4 sites (biceps, triceps, subscapular, and supra iliac) using a Harpenden skinfold caliper (Baty International RH15 9LR, England). If an arteriovenous fistula or graft was present, biceps and triceps thicknesses were measured on the contralateral arm. Skinfold thickness from each location was used to calculate body density (Appendix Table 1) which subsequently permitted the calculation of fat mass as described by Durnin and Womersley.[15] As surrogates of muscle mass, mid-arm muscle circumference (MAMC) was calculated as follows: MAMC = mid-arm circumference − 3.142 × triceps-skinfold thickness.[16] All measurements were performed by 1 observer (N.N.).

### BIS Measurement of Body Composition

We used the Body Composition Monitor (BCM; Fresenius Medical Care) to measure body compartments using BIS. Electrodes were attached to 1 hand and 1 foot (the limb contralateral to the arteriovenous access) after a 2 to 3 minute resting period in the supine position before the dialysis session. The recorded parameters were total body water (L), intra- and extra-cellular water (ICW and ECW), overhydration (L), fat mass and lean mass (kilogram). To determine muscle mass for our study purpose, we used Kaysen's formula to calculate skeletal muscle mass[17]:

Muscle mass = 9.52 + 0.331 × BIS measured ICW + 2.77 (male) + 0.180 × dry weight (kg) − 0.133 × age.

### Quality of Life Assessment

HRQOL was measured using the RAND version of the Kidney Disease Quality of Life (KDQOL-36) Survey, a 36-item short form survey with 5 subscales,[18] which included mental component summary, physical component summary, burden of kidney disease (burden), effects of kidney disease (effects), and symptoms and problems of kidney disease (symptoms; scales from the KDQOL-SF, v1.3). A paper KDQOL-36 form was self-completed by participants after verbal instructions from study personnel unless reading or comprehension problems precluded self-administration, in which cases, a research associate, or family member assisted participants in the questionnaire completion.

### Laboratory Measurements

Laboratory data from within the month previous to doing the BIS including serum hemoglobin, albumin, intact parathyroid hormone, total cholesterol, creatinine, calcium, and phosphorus were collected.

Dialysis session data for the session at which the BIS was measured (dialysis session duration, dialysate composition, ultrafiltration volume, relative blood volume changes), systolic and diastolic pressure (recorded pre-dialysis, after