The flowing contains abstracts of 26 scientific papers covering more than a decade of research. This research has been pioneered by Dr. Kamyar Kalantar-Zadeh*, who has performed research on patients with congestive heart failure and patients undergoing dialysis treatment. This research has been primarily funded by the U.S. National Institutes of Health. The following pages contain abstracts of the 26 papers in chronological order. Briefly summarizing these peer-reviewed technical papers:

BodyScript / Futrex Near-Infrared (NIR) technology provides body fat percentage accuracy equal to Hydrostatic Weighing and DEXA scan techniques.
-The papers compare the NIR approach to all three methods of bioelectrical impedance instruments, as well as with anthropometric measurements, including BMI, waist circumference, and other such parameters.
-Shows that NIR measurements are not affected by hydration variability in the body, but that body fat measurements from all versions of BIA instruments are degraded by changes in the normal body's hydration level that occur during the day.

This research also shows the importance of accurate and repeatable measurements for congestive heart failure and dialysis patients for the survival of those patients. The decade-long research has proven that NIR measurements are the only methods of body composition analysis that are usable on a long-term basis for critical body fat percent measurements. "We never forced data to be NIR (Futrex) favorable, data and all analyses are without any bias, indeed our statistician tried very hard to find flaws for NIR, but it turned out to be the best method." - Dr. Kamyar Kalantar-Zadeh

*Dr. Kamyar Kalantar-Zadeh, MD, MPH, PhD, Harold Simmons Center for Chronic Disease Research and Epidemiology, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, and UCLA David Geffen School of Medicine and UCLA School of Public Health, 1124 W Carson St, C1-Annex, Torrance, CA 90502. Phone: 310-222-3891, Fax: 310-782-1837; E-mail: kkalantar@rei.edu.

Nephrology Dialysis …, 1999 - ERA-EDTA

Near infra-red interactance for nutritional assessment of dialysis patients.

K Kalantar-Zadeh, E Dunne, K Nixon, K Kahn, G H Lee, M Kleiner and F C Luft
Author Affiliations: UCSF Renal Division, San Francisco General Hospital, CA, USA

Abstract

Background: Malnutrition is a common problem in dialysis patients and may affect up to one-third of patients. Near-infrared interactance (NIR) is a novel approach to estimate body composition and per cent total body fat. METHODS: We used near- infrared interactance (Futrex 5000) to estimate the body composition including body fat percentage, as well as subjective global assessment (SGA), anthropometric measurements including mid-arm circumference (MAC), triceps and biceps skinfold thickness, calculated mid-arm muscle circumference (MAMC), body mass index (BMI), and laboratory values. NIR score, SGA assessment and anthropometric parameters were measured shortly after the end of a dialysis session. NIR measurement was made by placing a Futrex sensor on the nonaccess upper arm for several seconds. Serum albumin, transferring (reflected by total iron binding capacity), and total cholesterol concentrations were performed as well.

Results: Thirty-four patients (20 men and 14 women) were selected from a pool of 120 hemodialysis patients. Their ages ranged from 26 to 86 years (58+/-14 years). Time on dialysis ranged from 8 months to 19 years (4.5+/-4.6 years). NIR scores were significantly different in three SGA groups: (A) well-nourished, 32.5+/-6.9%; (B) mildly to moderately malnourished, 29.2+/-5.3%; and (C) severely malnourished, 23.2+/-10.2% (P<0.001). Pearson correlation coefficients (r) between the NIR score and nutritionally relevant parameters were significant (P<0.001) for body mass index (r=+0.81), mid-arm circumference (r=+0.74), triceps skin fold (r=+0.54), biceps skin fold (r=+0.55), and mid- arm muscle circumference (r=+0.54). An inverse correlation was also found between NIR and years dialysed (r=-0.49, P=0.004), denoting a lesser body fat percentage according to NIR for patients dialysed longer. NIR was correlated with serum transferrin (r=+0.41, P=0.016) and cholesterol (r=+0.39, P=0.022) and marginally with serum albumin (r=+0.29, P=0.097).

CONCLUSIONS: We conclude that NIR, which can be performed within seconds, may serve as an objective indicator of nutritional status in haemodialysis patients. More comparative and longitudinal studies are needed to confirm the validity of NIR measurements in nutritional evaluation of dialysis patients.

Quote from article: "Methods. We used a commercially available NIR measuring device".

Near infra-red interactance for longitudinal assessment of nutrition in dialysis patients

Presented, in part, in the 9th annual meeting of the National Kidney Foundation, Atlanta, GA, April 2000.

Kamyar Kalantar-Zadeh MD, MPH, Gladys Block PhD, Mary Pat Kelly MS, RD, Concetta Schroepfer MS, RD, Rudolph A. Rodriguez MD, Michael H. Humphreys MD Author Affiliations: Division of Nephrology and Renal Center, University of California, San Francisco General Hospital, San Francisco, CA, USA.

Abstract

Objective: Serial nutritional assessment of dialysis patients is important because of the high incidence and prevalence of malnutrition in these patients. Near-infrared interactance (NIR) technology may provide a practical and reliable method to evaluate body fat and its changes over time in dialysis patients.

Design: Longitudinal study consisting of 2 cross-sectional measurements, 2 months apart.

Setting: Outpatient dialysis unit affiliated to a tertiary care community medical center.

Patients: Seventy-one dialysis patients (35 men, 36 women), 57 ± 15 years old, who have been on dialysis between 5 months and 11 years (43 ± 30 months). Twelve additional patients with similar features were studied during the second round.

Intervention: None.

Main outcome measures: NIR was used to estimate the body fat percentage. Other simultaneous measurements included subjective global assessment, anthropometric indices including midarm circumference, triceps and biceps skinfold thickness, and body mass index, and some laboratory values including albumin, transferrin, and cholesterol. NIR measurement was performed by placing a Futrex sensor on the nonaccess upper arm for several seconds, after logging the required individual data (sex, weight, height, and body frame), along with uniform physical activity levels for all patients, into a mini- computer.

Results: Seventy-one dialysis patients underwent nutritional and laboratory measurements. A second measurement round was performed 8 to 9 weeks after the first one and included 12 additional patients. Within each cross-sectional round, Pearson correlation coefficients (*r*) between the NIR score and nutritionally relevant variables were significant for anthropometric values (0.56 to 0.82) as well as low cholesterol and creatinine (0.22 to 0.30). The two serial NIR measurements on the same patients were highly consistent over the 2-month study interval (r = 0.96), whereas anthropometric values showed greater variability. The within-person coefficient of variation for NIR was low, indicating high consistency between 2 measurements. Moreover, the timing of the NIR measurement (predialysis *v* postdialysis) did not have any impact on consistency of the NIR results. The longitudinal changes of NIR had significant correlations with anthropometric and laboratory changes over time.

Conclusion: The NIR, which can be performed within seconds, may serve as a reliable and practical tool for objective measurements of nutritional status in hemodialysis patients. The NIR not only seems to have a high degree of reproducibility but may also be an optimal tool to detect longitudinal changes in body fat over time. The NIR measurement is independent of the fluid status in dialysis patients. More comparative and longitudinal studies are needed to confirm the validity of NIR measurements in longitudinal evaluation of dialysis patients.

Am Soc Nephrol 12:2797-2806, 2001

Association Among SF36 Quality of Life Measures and Nutrition, Hospitalization, and Mortality in Hemodialysis

Kamyar Kalantar-Zadeh, Joel D. Kopple, Gladys Block and Michael H. Humphreys

Author Affiliations: University of California, San Francisco and Division of Nephrology San Francisco General Hospital, San Francisco, California; University of California, Los Angeles, Division of Nephrology Harbor-UCLA Medical Center, Torrance, California; University of California, Berkeley, School of Public Health, Berkeley, California.

Abstract

Patients on maintenance hemodialysis (MHD) often show substantial reductions in quality of life (QoL). The SF36 (Short Form with 36 questions), a well-documented, self- administered QoL scoring system that includes eight independent scales and two main dimensions, has been widely used and validated. In 65 adult outpatients on MHD, the SF36 and its scales and dimensions, scored as a number between 0 and 100, and the nutritional and inflammatory state measured by subjective global assessment, near- infrared (NIR) body fat, body mass index (BMI), and pertinent laboratory values, including hemoglobin, albumin, and C-reactive protein were assessed. Twelve-month prospective hospitalization rates and mortality were used as the clinical outcomes. Multivariate (case-mix) adjusted correlation coefficients were statistically significant between SF36 scores and serum albumin and hemoglobin concentrations. There were significant inverse correlations between SF36 scores and the BMI and NIR body fat percentage. Hypoalbuminemic, anemic, and obese patients on MHD had a worse QoL. Prospective hospitalizations correlated significantly with the SF36 total score and its two main dimensions (r between -0.28 and -0.40). The Cox proportional regression relative risk of death for each 10 unit decrease in SF36 was 2.07 (95% CI, 1.08 to 3.98; P = 0.02). Of the eight components and two dimensions of the SF36, the Mental Health dimension and the SF36 total score had the strongest predictive value for mortality. Thus, in patients on MHD the SF36 appears to have significant associations with measures of nutritional status, anemia, and clinical outcomes, including prospective hospitalization and mortality. Even though obesity, unlike undernutrition, is not generally an indicator of poor outcome in MHD, the SF36 may detect obese patients on MHD at higher risk for morbidity and mortality.

Quote from article: "A commercial NIR interactance sensor was used".

American journal of nephrology, 2001

A Malnutrition-Inflammation Score Is Correlated With Morbidity and Mortality in Maintenance Hemodialysis Patients

Kamyar Kalantar-Zadeh, MD, Joel D. Kopple, MD, Gladys Block, PhD, and Michael H. Humphreys, MD

Author Affiliations: From the Division of Nephrology and Hypertension, Harbor-UCLA Medical Center and the University of California, Los Angeles, Torrance; Division of Public Health Nutrition, School of Public Health, University of California Berkeley; and the Division of Nephrology, San Francisco General Hospital and the University of California San Francisco, CA.

Abstract

Malnutrition inflammation complex syndrome (MICS) occurs commonly in maintenance hemodialysis (MHD) patients and may correlate with increased morbidity and mortality. An optimal, comprehensive, quantitative system that assesses MICS could be a useful measure of clinical status and may be a predictor of outcome in MHD patients. We therefore attempted to develop and validate such an instrument, comparing it with conventional measures of nutrition and inflammation, as well as prospective hospitalization and mortality. Using components of the conventional Subjective Global Assessment (SGA), a semiquantitative scale with three severity levels, the Dialysis Malnutrition Score (DMS), a fully quantitative scoring system consisting of 7 SGA components, with total score ranging between 7 (normal) and 35 (severely malnourished), was recently developed. To improve the DMS, we added three new elements to the 7 DMS components: body mass index, serum albumin level, and total iron-binding capacity to represent serum transferrin level. This new comprehensive Malnutrition-Inflammation Score (MIS) has 10 components, each with four levels of severity, from 0 (normal) to 3 (very severe). The sum of all 10 MIS components ranges from 0 to 30, denoting increasing degree of severity. These scores were compared with anthropometric measurements, near-infrared–measured body fat percentage, laboratory measures that included serum C-reactive protein (CRP), and 12-month prospective hospitalization and mortality rates.

Eighty-three outpatients (44 men, 39 women; age, 59 6 15 years) on MHD therapy for at least 3 months (43 6 33 months) were evaluated at the beginning of this study and followed up for 1 year. The SGA, DMS, and MIS were assessed simultaneously on all patients by a trained physician. Case-mix–adjusted correlation coefficients for the MIS were significant for hospitalization days (r 5 0.45; P < 0.001) and frequency of hospitalization (r 5 0.46; P < 0.001).

Compared with the SGA and DMS, most pertinent correlation coefficients were stronger with the MIS. The MIS, but not the SGA or DMS, correlated significantly with creatinine level, hematocrit, and CRP level. During the 12-month follow-up, 9 patients died and 6 patients left the cohort. The Cox proportional hazard–calculated relative risk for death for each 10-unit increase in the MIS was 10.43 (95% confidence interval, 2.28 to 47.64; P 50.002). The MIS was superior to its components or different subversions for predicting mortality. The MIS appears to be a comprehensive scoring system with significant associations with prospective hospitalization and mortality, as well as measures of nutrition, inflammation, and anemia in MHD patients. The MIS may be superior to the conventional SGA and the DMS, as well as to individual laboratory values, as a predictor of dialysis outcome and an indicator of MICS.

Quote from Article: "A commercial NIR sensor was used."

Nephrology Dialysis Transplantation Volume19, Issue 6: 1507-1519. doi: 10.1093/ndt/gfh143 First published online: April 6, 2004

Comparing Outcome Predictability of Markers of Malnutrition– Inflammation Complex Syndrome in Haemodialysis Patients

Kamyar Kalantar-Zadeh, Joel D. Kopple, Michael H. Humphreys and Gladys Block
Author Affiliations: Nephrology and Hypertension, Harbor-UCLA Medical Center, Torrance, CA; Division of Nephrology, San Francisco General Hospital, San Francisco, CA; and Public Health Nutrition and Epidemiology, UC Berkeley, Berkeley, CA, USA.

Abstract

Background: Markers of malnutrition–inflammation complex syndrome (MICS) are reported to predict mortality and hospitalization in maintenance haemodialysis (MHD) patients. However, it is not clear which one is a more sensitive and stronger predictor of outcome.

Methods: We examined the utility of 10 markers of MICS as predictors of prospective mortality and hospitalization, which included malnutrition–inflammation score (MIS), a fully quantitative score adopted from subjective global assessment, and serum levels of C-reactive protein (CRP), interleukin-6 (IL-6), tumour necrosis factor-α (TNF-α), albumin, pre-albumin, total iron binding capacity, creatinine, total cholesterol and normalized protein nitrogen appearance. A cohort of 378 MHD patients, who were randomly selected from eight DaVita dialysis facilities in the South Bay Los Angeles area, was studied.

Results: Patients, aged 54.5±14.7 years, included 53% men, 47% Hispanics, 30% African-Americans and 55% diabetics, who had undergone MHD for 37±34 months. Over a 12-month follow-up, 39 patients died and 208 were hospitalized at least once. Multivariate Cox and Poisson models that included 11 covariates [gender, age, race, ethnicity, diabetes, dialysis vintage, Charlson co-morbidity index (CCI), insurance status, Kt/V, body mass index and history of cardiovascular disease] were explored for the highest quartiles of inflammatory markers or the lowest quartiles of nutritional markers. The magnitude of relative risk of death and hospitalization was greatest for MIS, CRP and IL-6. In extended multivariate models that included all 10 MICS markers and 11 additional covariates simultaneously, CRP, MIS and CCI were the only consistent predictors of mortality and hospitalization, and their outcome predictabilities were superior to serum albumin.

Conclusions: The MIS appears to be a useful, short-term tool to risk-stratify MHD patients and may circumvent the need for measuring inflammatory markers such as CRP or IL-6.

Quote from the article: "To evaluate the percentage of body fat and lean body mass, the near infrared (NIR)
interactance was performed at the same time as the anthropometric measurements. A commercial NIR interactance sensor was used.

JASN, J Am Soc Nephrol 15:442-453, 2004, © 2004 American Society of Nephrology
CLINICAL SCIENCE

A Low, Rather than a High, Total Plasma Homocysteine is an Indicator of Poor Outcome in Hemodialysis Patients

Kamyar Kalantar-Zadeh, Gladys Block, Michael H. Humphreys, Charles J. McAllister and Joel D. Kopple

Author Affiliations: Division of Nephrology and Hypertension, Harbor-UCLA Medical Center, Torrance, California; and David Geffen School of Medicine at UCLA, Los Angeles, California; Division of Public Health Nutrition and Epidemiology, School of Public Health, University of California, Berkeley, California; University of California, San Francisco, San Francisco, California; and Division of Nephrology, San Francisco General Hospital, San Francisco, California; DaVita, Inc., Torrance, California; and UCLA School of Public Health, Los Angeles, California.

Abstract

An increased level of total plasma homocysteine (tHcy) is a risk factor for poor cardiovascular outcome in the general population. However, a decreased, rather than an increased, tHcy concentration may predict poor outcome in maintenance hemodialysis (MHD) patients, a phenomenon referred to as reverse epidemiology. Associations were examined between tHcy level and markers of malnutrition-inflammation complex syndrome and 12-mo prospective hospitalization and mortality in 367 MHD patients, aged 54.5 ± 14.7 (mean ± SD) years, who included 199 men and 55% individuals with diabetes. tHcy was 24.4 ± 11.8 μmol/L, and 94% of the patients had hyperhomocysteinemia (tHcy >13.5 μmol/L). tHcy had weak to moderate but statistically significant bivariate and multivariate correlations with some laboratory markers of nutrition (serum albumin, prealbumin, creatinine, and urea nitrogen) but no significant correlation with serum C-reactive protein or two proinflammatory cytokines (IL-6 and TNF-α). During 12 mo of follow-up, 191 MHD patients were hospitalized, 37 died, nine underwent renal transplantation, and 38 transferred out. Hospitalization rates were significantly higher in patients with lower tHcy levels. Mortality rate in the lowest tHcy quartile (17.4%) was significantly higher compared with other three quartiles (6.5 to 9.8%; Kaplan-Meier P = 0.04). Relative risk of death for the lowest tHcy quartile, even after adjustment for case-mix and serum albumin, was 2.27 (95% confidence interval, 1.14 to 4.53; P = 0.02). Hence, tHcy may be a more exclusive nutritional marker in MHD patients with no association with inflammatory measures. Despite a very high prevalence of hyperhomocysteinemia in MHD patients, lower values of tHcy are paradoxically associated with increased hospitalization and mortality. The lowest tHcy quartile confers a twofold increase in risk of death independent of hypoalbuminemia. The nutritional feature of tHcy in MHD patients may explain its reverse association with outcome.

Quoting this article: "A commercial NIR interactance sensor was used".

American Journal of Clinical Nutrition, Vol. 80, No. 2, 299-307, August 2004

Appetite and inflammation, nutrition, anemia, and clinical outcome in hemodialysis patients

Kamyar Kalantar-Zadeh, Gladys Block, Charles J McAllister, Michael H Humphreys and Joel D Kopple

Author Affiliations: From the Division of Nephrology and Hypertension, Harbor- University of California, Los Angeles Medical Center, Torrance, CA (KK-Z and JDK); the David Geffen School of Medicine, University of California, Los Angeles (KK-Z and JDK); the Division of Public Health Nutrition and Epidemiology, School of Public Health, University of California, Berkeley (KK-Z and GB); DaVita, Inc., Torrance, CA (CJM); the Division of Nephrology, University of California, San Francisco, San Francisco General Hospital (MHH); and the School of Public Health, University of California, Los Angeles (JDK).

Abstract

Background: Malnutrition-inflammation complex syndrome, an outcome predictor inmaintenance hemodialysis (MHD) patients, may be related to anorexia. Objectives: We examined whether subjectively reported appetite is associated with adverse conditions and increased morbidity and mortality in MHD patients.

Design: A cohort of 331 MHD outpatients was asked to rate their recent appetite status on a scale from 1 to 4 (very good, good, fair, and poor appetite, respectively). Anemia indexes and nutritional and inflammatory markers—including serum concentrations of C- reactive protein, tumor necrosis factor α, and interleukin 6—were measured. The malnutrition-inflammation score was used to evaluate the malnutrition-inflammation complex syndrome, and the SF36 questionnaire was used to assess quality of life (QoL). Mortality and hospitalization were followed prospectively for up to 12 mo. Results: Patients were aged 54.5 ± 14.4 y. Diminished appetite (fair to poor) was reported by 124 patients (38%). Hemoglobin, protein intake, and QoL scores were progressively lower, whereas markers of inflammation, malnutrition-inflammation scores, and the required erythropoietin dose were higher across the worsening categories of appetite. The adjusted odds ratios of diminished versus normal appetite for increased serum tumor necrosis factor α and C-reactive protein concentrations were significant. Significant associations between a poor appetite and an increased rate of hospitalization and mortality were observed. The hazard ratio of death for diminished appetite was 4.74 (95% CI: 1.85,12.16; P = 0.001).

Conclusion: Diminished appetite (anorexia) is associated with higher concentrations of proinflammatory cytokines and higher levels of erythropoietin hyporesponsiveness and poor clinical outcome, including a 4-fold increase in mortality, greater hospitalization rates, and a poor QoL in MHD patients. Appetite status may yield significant insight into the clinical status of dialysis patients.

"*Quotes from this article: "To evaluate the percentage of body fat and lean body mass, near infrared (NIR) interactance was performed at the same time as the anthropometric measurements. A commercial NIR interactance sensor (was used. NIR measurements were performed by placing a Futrex sensor on the nonaccess upper arm for several seconds, after the required data (date of birth, sex, weight, and height) from each patient were entered. NIR measurements of body fat have been shown to correlate significantly with SGA and other nutritional measures in MHD patients*

Journal of Renal Nutrition Volume 15, Issue 2, April 2005, Pages 231-243 - Original research

The Nutritional and Inflammatory Evaluation in Dialysis patients (NIED) study: Overview of the NIED study and the role of dietitians

Sara Colman RD, CSR, CDE, Rochelle Bross MS, RD, PhD, Debbie Benner MA, RD, CSR, Joanne Chow RD, Amy Braglia RD, Jenia Arzaghi RD, Jennifer Dennis MS, RD, Leslie Martinez RD, Delma Baylon Baldo RD, Vina Agarwal RD, Tina Trundnowski

RD, Jennifer Zitterkoph RD, Brenda Martinez, Osman S. Khawar MD, Kamyar Kalantar- Zadeh MD, PhD, MPH

Author Affiliations: DaVita, Norwalk, CA; Harbor-UCLA General Clinical Research Center, Torrance, CA; DaVita National Director Nutrition Services, Irvine, CA; Harbor- UCLA DaVita, Torrance, CA; DaVita Premier, Cudahy, CA; DaVita Kenneth Hahn Plaza, Los Angeles, CA; DaVita Lakewood, Lakewood, CA; DaVita Kidney Dialysis Center, Lynwood, CA, DaVita Sunrise Dialysis, Hawthorne, CA; NIED Study Center, Los Angeles Biomedical Research Institute at Harbor-UCLA, Torrance, CA.

Abstract

The absolute majority of maintenance hemodialysis (MHD) patients die within 5 years of commencing dialysis treatment, mostly because of cardiovascular (CV) disease. The strongest and most common correlates of death in MHD patients are not conventional CV risk factors, but markers of protein-energy malnutrition and inflammation, together also known as malnutrition-inflammation complex syndrome (MICS). Paradoxically, classic risk factors such as obesity and hypercholesterolemia are associated with better survival in MHD patients. It has been hypothesized that this so-called reverse epidemiology is caused by the overwhelming prevalence and dominating effect of MICS in MHD patients. Hence, the key to improving survival and quality of life in MHD patients may be a better understanding of MICS and its interactions with CV disease and outcome. The Nutritional and Inflammatory Evaluation in Dialysis Patients (NIED) study is a longitudinal multicenter cohort study that aims to examine these hypotheses. At any given semiannual round, approximately 360 MHD patients from 8 DaVita dialysis facilities in the Los Angeles area are examined; 900 MHD patients will be cumulatively studied by the end of this 5-year prospective study (October 2001 to September 2006). Repeated measures of markers of nutritional status and inflammation are performed by 10 to 12 dialysis unit dietitians while patients attend their routine HD treatment in their dialysis facilities. All-cause and CV mortality, hospitalization, and quality of life are studied as outcome measures. The collaborating dietitians are the main evaluators and play crucial roles in all aspects of the study. This article reviews the design and infrastructure of the NIED study and reports preliminary findings of the first 12 to 30 months of the study.

Serum Myeloperoxidase and Mortality in Maintenance Hemodialysis Patients

Presented in part at the 38th Annual Meeting of the American Society of Nephrology, November 8-11, 2005, Philadelphia, PA.

Kamyar Kalantar-Zadeh MD, PhD, MPH, Marie-Luise Brennan PhD, Stanley L. Hazen MD, PhD

Author Affiliations: Division of Nephrology and Hypertension, Los Angeles Biometical Research Institute at Harbor-UCLA Medical Center, Torrance, CA; David Geffen School of Medicine at UCLA, Torrance, CA; Departments of Cell Biology and Cardiovascular Medicine; Cleveland Clinic Foundation, Cleveland, OH.

Abstract

Background: During inflammation, myeloperoxidase (MPO) is released, for which its measurement in systemic circulation may be used as an index of leukocyte activation and oxidant stress. MPO levels correlate with angiographic evidence of coronary atherosclerosis and cardiovascular events in subjects with chest pain within the general population. We hypothesized that serum MPO levels are associated with adverse clinical outcomes in maintenance hemodialysis (MHD) patients.

Methods: MPO levels were determined in serum samples from 356 MHD patients at the start of a 3-year cohort. Results: Patients (46% women, 28% blacks, 54% with diabetes) were 54.6 ± 14.6 (SD) years old and had undergone MHD for a median period of 26 months. Measured serum MPO level was 2,005 ± 1,877 pmol/L (median, 1,444 pmol/L; interquartile range, 861 to 2,490 pmol/L). MHD patients with greater total body fat had greater MPO levels. MPO level had statistically significant ($P < 0.01$) and positive correlations with values for serum C-reactive protein (CRP; $r = +0.15$), interleukin 6 (IL-6; $r = +0.23$), tumor necrosis factor α (TNF-α; $r = +0.21$), and white blood cell count ($r = +0.21$). A death hazard ratio for each 1,000-pmol/L increase in serum MPO level was 1.14 (95% confidence interval [CI], 1.03 to 1.26; $P = 0.01$) after controlling for age, race (black), diabetes mellitus, dialysis vintage, Charlson comorbidity score, history of previous cardiovascular disease, blood hemoglobin level, and serum concentrations of albumin, CRP, IL-6, and TNF-α. After dividing MPO values into 3 equal groups (tertiles), the death hazard ratio of the highest tertile (versus the middle tertile) was 1.82 (95% CI, 1.07 to 3.10; $P = 0.03$).

Conclusion: Serum MPO levels correlate with levels of markers of inflammation and prospective mortality risk in MHD patients.

Quote from article: "A commercial near-infrared interactance sensor with a coefficient of variation of 0.5% for total body fat measurement was used. Near-infrared measurements were performed.

American Journal of Clinical Nutrition, Vol. 83, No. 2, 202-210, February 2006

Associations of body fat and its changes over time with quality of life and prospective mortality in hemodialysis patients

Kamyar Kalantar-Zadeh, Noriko Kuwae, Dennis Y Wu, Ronney S Shantouf, Denis Fouque, Stefan D Anker, Gladys Block and Joel D Kopple

Author Affiliations: From the Division of Nephrology and Hypertension, Los Angeles Biomedical Institute at Harbor-UCLA Medical Center, Torrance, CA (KK-Z, NK, DYW, RSS, and JDK); the Division of Nephrology, Hospices Civils de Lyon and University Claude Bernard, Lyon, France (DF); the Division of Applied Cachexia Research, Department of Cardiology, CharitÄ© Campus Virchowo-Klinikum, Berlin, Germany (SDA); and the Public Health Nutrition Program, School of Public Health, University of California, Berkeley, CA (GB).

Abstract

Background: In maintenance hemodialysis (MHD) patients, a larger body size is associated with better survival but a worse self-reported quality of life (QoL). It is not clear whether muscle mass or body fat confers the survival advantage.

Objective: We hypothesized that both a low baseline body fat percentage and a loss of fat over time were independently associated with higher mortality but with a better QoL score.

Design: In 535 adult MHD patients, body fat was measured directly with the use of near infrared interactance and QoL was measured with a Short Form 36 questionnaire. The patients were followed for ≤30 mo.

Results: Across four 12% increments of body fat at baseline, the reported QoL scores were progressively lower ($P < 0.01$). After a multivariate adjustment for demographics and surrogates of muscle mass and inflammation (ie, midarm muscle circumference, serum creatinine, and proinflammatory cytokines), 46 patients with body fat of <12% had a death hazard ratio (HR) 4 times that of 199 patients with body fat content between 24% and 36% (HR: 4.01; 95% CI: 1.61, 9.99; $P = 0.003$). In 411 MHD patients whose body fat was remeasured after 6 mo, a fat loss (≤–1%) was associated with a death risk 2 times that of patients who gained fat (≥1%) after a multivariate adjustment (HR: 2.06; 95% CI:1.05, 4.05; $P = 0.04$).

Conclusions: A low baseline body fat percentage and fat loss over time are independently associated with higher mortality in MHD patients even after adjustment for demographics and surrogates of muscle mass and inflammation, whereas a tendency toward a worse QoL is reported by MHD patients with a higher body fat percentage. Obesity management in dialysis patients may need reconsideration.

Quote from paper: "NIR interactance sensor with a CV of 0.5% for total body fat measurement was used"

Clinical Journal of the …, 2008 - Am Soc Nephrol

Combined High Serum Ferritin and Low Iron Saturation in Hemodialysis Patients: The Role of Inflammation

Mehdi Rambod, Mehdi Rambod, Csaba P. Kovesdy, Kamyar Kalantar-Zadeh

Author Affiliations: Harold Simmons Center for Kidney Disease Research and Epidemiology and †Division of Nephrology and Hypertension, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, California; and ‡Salem Veterans Affairs Medical Center, Salem, Virginia

Abstract

Background: Serum ferritin, frequently used as a marker of iron status in individuals with chronic kidney disease, is also an inflammatory marker. The concurrent combination of high serum ferritin and low iron saturation ratio (ISAT) usually poses a diagnostic dilemma. We hypothesized that serum ferritin ≥500 ng/ml, especially in the seemingly paradoxical presence of ISAT level <25%, is more strongly associated with inflammation than with iron in maintenance hemodialysis (MHD) patients.

Design, setting, and participants: In 789 MHD patients in the Los Angeles area, the association of serum ferritin ≥500 ng/ml with inflammatory markers, including IL-6 (IL-6) and C-reactive protein levels, and malnutrition-inflammation score (MIS) was examined.

Results: After multivariate adjustment for case-mix and other measures of malnutrition-inflammation complex, MHD patients with serum ferritin ≥500 ng/ml and ISAT <25% had higher odds ratio for serum C-reactive protein ≥10 mg/L. The area under the receiver operating characteristic curves for the continuum of ISAT and IL-6 in detecting a serum ferritin ≥500 ng/ml were identical (0.57 versus 0.56, P = 0.7). The combination of IL-6 with ISAT yielded a higher area under the receiver operating characteristic curve (0.61) than either ISAT or IL-6 alone (P = 0.03 and P = 0.02, respectively).

Conclusion: In MHD patients, ferritin values above 500 ng/ml, especially in paradoxical conjunction with low ISAT, are associated with inflammation. Strategies to dissociate inflammation from iron metabolism to mitigate the confounding impact of inflammation on iron and to improve iron treatment responsiveness may improve anemia management in chronic kidney disease.

Quote from article: "NIR measurements were performed by placing, for several seconds on the upper aspect of the arm without a vascular access, a Futrex sensor, and entering the required data (date of birth, gender, weight, and height) of each patient."

Original Investigation

Association of Malnutrition-Inflammation Score with Quality of Life and Mortality in Hemodialysis Patients: A 5-Year Prospective Cohort Study

Mehdi Rambod MD, Rachelle Bross RD, PhD, Jennifer Zitterkoph RD, Deborah Benner RD, Juhi Pithia RD, Sara Colman RD, Csaba P. Kovesdy MD, Joel D. Kopple MD, Kamyar Kalantar-Zadeh MD, MPH, PhD,

Author Affiliations: Harold Simmons Center for Kidney Disease Research and Epidemiology, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, CA; Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, CA; Division of Bionutrition, General Clinical Research Center, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, CA; DaVita Nutrition, DaVita Inc, El Segundo, CA; DaVita Wild West Division, Downey, CA; Salem Veterans Affairs Medical Center, Salem, VA; David Geffen School of Medicine at UCLA, Los Angeles, CA; UCLA School of Public Health, Los Angeles, CA. Received 31 March 2008; Accepted 2 September 2008. Available online 13 December 2008.

Abstract

Background: The Malnutrition-Inflammation Score (MIS), an inexpensive and easy-to-assess score of 0 to 30 to examine protein-energy wasting (PEW) and inflammation, includes 7 components of the Subjective Global Assessment, body mass index, and serum albumin and transferrin concentrations. We hypothesized that MIS risk stratification of hemodialysis (HD) patients in predicting outcomes is better than its components or laboratory markers of inflammation.

Study Design: 5-Year cohort study.

Setting & Participants: We examined 809 stable HD outpatients and followed them for up to 5 years (October 2001 to December 2006).

Predictors: MIS and other nutritional and inflammatory markers.

Outcomes & Measurements: Prospective all-cause mortality, health-related quality of life using the 36-Item Short Form Health Survey (SF-36), and tests of body composition. Results: The MIS correlated with logarithm of serum interleukin 6 level ($r = +0.26$; $P < 0.001$), logarithm of C-reactive protein level ($r = +0.16$; $P < 0.001$), and several measures of nutritional status. Patients with a higher MIS had lower SF-36 scores. After multivariate adjustment for case-mix and other measures of PEW, HD patients in the second (3 to 4), third (5 to 7), and fourth (≥8) quartiles of MIS had worse survival rates than those in the first (0 to 2) quartile ($P < 0.001$). Each 2-unit increase in MIS was associated with a 2-fold greater death risk, ie, adjusted death hazard ratio of 2.03 (95% confidence interval, 1.76 to 2.33; $P < 0.001$). Cubic spline survival models confirmed linear trends. Adding MIS to the constellation of age, sex, race/ethnicity, and vintage significantly improved the area under the receiver operating characteristic curve developed for predicting mortality (0.71 versus 0.67; $P < 0.001$).

Limitations: Selection bias and unknown confounders.

Conclusions: In HD patients, the MIS is associated with inflammation, nutritional status, quality of life, and 5-year prospective mortality. The mortality predictability of the MIS appears equal to serum interleukin 6 and somewhat greater than C-reactive protein levels. Controlled trials are warranted to examine whether interventions to improve the MIS can also improve clinical outcomes in HD patients.

Quote from article: "A commercial NIR interactance sensor with a coefficient of variation of 0.5% for total body fat measurement was used. NIR measurements were performed."

American Journal of Clinical Nutrition, doi:10.3945/ajcn.2008.25906

Vol. 88, No. 6, 1485-1494, December 2008

Nutritional status, dietary intake, and body composition

Association of serum prealbumin and its changes over time with clinical outcomes and survival in patients receiving hemodialysis

Mehdi Rambod, Csaba P Kovesdy, Rachelle Bross, Joel D Kopple and Kamyar Kalantar-Zadeh

Author Affiliations: From the Harold Simmons Center for Kidney Disease Research and Epidemiology (MR and K-Z), the Division of Nephrology and Hypertension (MR, JDK, and KK-Z), and the Bionutrition Services (RB), General Clinical Research Center, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, CA; the Salem Veterans Administration Medical Center, Salem, VA (CPK); and the School of Public Health, University of California, Los Angeles, CA (JDK and KK-Z).

Abstract

Background: In patients receiving maintenance hemodialysis (MHD), a low serum prealbumin is an indicator of protein-energy wasting.

Objective: We hypothesized that baseline serum prealbumin correlates independently with health-related quality of life (QoL) and death and that its change over time is a robust mortality predictor.

Design: Associations and survival predictability of serum prealbumin at baseline and its changes over 6 mo were examined in a 5-y (2001–2006) cohort of 798 patients receiving MHD.

Results: Patients with serum prealbumin ≥ 40 mg/dL had greater mid-arm muscle circumference but lower percentage of total body fat. Both serum interleukin-6 and dietary protein intake correlated independently with serum prealbumin. Measures of QoL indicated better physical health, physical function, and functionality with higher prealbumin concentrations. Although baseline prealbumin was not superior to albumin in predicting survival, in both all and normoalbuminemic (albumin ≥ 3.5 g/dL; n = 655) patients, prealbumin < 20 mg/dL was associated with higher death risk in adjusted models, but further adjustments for inflammatory cytokines mitigated the associations. In 412 patients with baseline prealbumin between 20 and 40 mg/dL whose serum prealbumin was remeasured after 6 mo, a ≥10-mg/dL fall resulted in a death hazard ratio of 1.37 (95% CI: 1.02, 1.85; P = 0.03) after adjustment for baseline measures, including inflammatory markers.

Conclusions: Even though baseline serum prealbumin may not be superior to albumin in predicting mortality in MHD patients, prealbumin concentrations <20 mg/dL are associated with death risk even in normoalbuminemic patients, and a fall in serum prealbumin over 6 mo is independently associated with increased death risk.

Quote from paper: "NIR interactance sensor with a CV of 0.5% for total body fat measurement was used"

Clinical Journal of the …, 2009 - Am Soc Nephrol

Association of Serum Alkaline Phosphatase with Coronary Artery Calcification in Maintenance Hemodialysis Patients

Ronney Shantouf, Ronney Shantouf, Csaba P. Kovesdy, Youngmee Kim, Naser Ahmadi, Amanda Luna, Claudia Luna, Mehdi Rambod, Allen R. Nissenson, Matthew J. Budoff, Kamyar Kalantar-Zadeh

Author Affiliations: Harold Simmons Center for Kidney Disease Research and

Epidemiology and Division of Cardiology, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, Department of Epidemiology, UCLA School of Public Health, Los Angeles, and DaVita, Inc., El Segundo, California; and Salem

Veterans Affairs Medical Center, Salem, Virginia.

Abstract

Background and Objectives: Recent in vitro studies have shown a link between alkaline phosphatase and vascular calcification in patients with chronic kidney disease (CKD). High serum levels of alkaline phosphatase are associated with increased death risk in epidemiologic studies of maintenance hemodialysis (MHD) patients. We hypothesized that coronary artery calcification is independently associated with increased serum alkaline phosphatase levels in MHD patients.

Design, setting, participants, & measurements: We examined the association of coronary artery calcification score (CACS) and alkaline phosphatase in 137 randomly selected MHD patients for whom markers of malnutrition, inflammation, and bone and mineral disorders were also measured.

Results: Serum alkaline phosphatase was the only measure with significant and robust association with CACS ($P < 0.003$), whereas either other biochemical markers had no association with CACS or their association was eliminated after controlling for case-mix variables. Serum alkaline phosphatase >120 IU/L was a robust predictor of higher CACS and was particularly associated with the likelihood of CACS >400 (multivariate odds ratio 5.0 95% confidence interval 1.6 to 16.3; $P = 0.007$). Serum alkaline phosphatase of approximately 85 IU/L seemed to be associated with the lowest likelihood of severe coronary artery calcification, but in the lowest tertile of alkaline phosphatase, the CACS predictability was not statistically significant.

Conclusions: An association between serum alkaline phosphatase level and CACS exists in MHD patients. Given the high burden of vascular calcification in patients with CKD, examining potential therapeutic interventions to modulate the alkaline phosphatase pathway may be warranted.

Quote from article: "A commercial NIR interactance sensor with a coefficient of variation of 0.5% for total body fat measurement was used. NIR measurements were performed."

Am J Nephrol 2009;29:571-581 (DOI: 10.1159/000191470)

Association of Serum Total Iron-Binding Capacity and Its Changes Over Time with Nutritional and Clinical Outcomes in Hemodialysis Patients

Rachelle Bross, Jennifer Zitterkoph, Juhi Pithiac, Deborah Benner, Mehdi Rambod,

Csaba P. Kovesdy, Joel D. Kopple, Kamyar Kalantar-Zadeh

Author Affiliations: Harold Simmons Center for Kidney Disease Research and Epidemiology, and Division of Bionutrition at General Clinical Research Center, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, California; DaVita Wild West, Downey, California; DaVita Nutrition Services, Irvine, California; and Salem VA Medical Center, Salem, VA., USA.

Abstract

Serum transferrin, estimated by total iron-binding capacity (TIBC), may be a marker of protein-energy wasting (PEW) in maintenance hemodialysis (MHD) patients. We hypothesized that low TIBC or its fall over time is associated with poor clinical outcomes. In 807 MHD patients in a prospective 5-year cohort, associations of TIBC and its changes over time with outcomes were examined after adjustment for case-mix and markers of iron stores and malnutrition-inflammation including serum interleukin-6, iron and ferritin. Patients with serum TIBC ≥250 mg/dl had higher body mass index, triceps and biceps skinfolds and mid-arm muscle circumference and higher serum levels of iron but lower ferritin and inflammatory markers. Some SF-36 quality of life (QoL) components were worse in the lowest and/or highest TIBC groups. Mortality was incrementally higher in lower TIBC levels (p-trend <0.001). Adjusted death hazard ratio was 1.75 (95% CI: 1.00–3.05, p = 0.05) for TIBC <150 compared to TIBC of 200–250 mg/dl. A fall in TIBC >20 mg/dl over 6 months was associated with a death hazard ratio of 1.57 (95% CI: 1.04–2.36, p = 0.03) compared to the stable TIBC group. Hence, low baseline serum TIBC is associated with iron deficiency, PEW, inflammation, poor QoL and mortality, and its decline over time is independently associated with increased death risk.

Quote from article: NIR measurements were performed by placing a Futrex® NIR sensor on the nonaccess upper arm for several seconds, and entering the required data."

American Journal of Kidney Diseases, Volume 54, Issue 6, December 2009, Pages 1062-1071

Original Investigation

Association of Soluble Endotoxin Receptor CD14 and Mortality among Patients undergoing Hemodialysis

Dominic S.C. Raj MD, Vallabh O. Shah PhD, Mehdi Rambod MD, Csaba P. Kovesdy, MD, Kamyar Kalantar-Zadeh MD, MPH, Phd

Author Affiliations: George Washington University School of Medicine, North Washington, DC, USA.

Abstract

Background: CD14 is a key molecule in innate immunity that mediates cell activation and signaling in response to endotoxin and other bacterial wall-derived components. CD14 protein exists in soluble (sCD14) and membrane-bound forms. The correlates of sCD14 in persons undergoing long-term hemodialysis (HD) therapy are not known. We hypothesized that increased sCD14 levels in HD patients are associated with proinflammatory cytokine activation and increased mortality.

Study Design: Cohort study.

Setting & Participants: 310 long-term HD patients who participated in the Nutritional and Inflammatory Evaluation in Dialysis (NIED) Study, a cohort derived from a pool of more than 3,000 HD outpatients during 5 years in 8 DaVita maintenance dialysis facilities in the South Bay Los Angeles, CA, area.

Predictors: sCD14 levels in serum.

Outcomes: 33-month mortality.

Results: Mean sCD14 level was 7.24 ± 2.45 μg/mL. Tumor necrosis factor α level was the strongest correlate of sCD14 level ($r = +0.24$; $P < 0.001$), followed by interleukin 6 level ($r = +0.18$; $P = 0.002$), serum ferritin level ($r = +0.21$; $P < 0.001$), total iron-binding capacity ($r = -0.19$; $P< 0.001$), body mass index ($r = -0.15$; $P = 0.008$), vintage ($r = +0.14$; $P = 0.01$), low-density lipoprotein cholesterol level ($r = +0.13$; $P = 0.03$), and body fat ($r= -0.11$; $P = 0.06$). During the 33-month follow-up, 71 (23%) patients died. Multivariable Cox proportional analysis adjusted for case-mix and other nutritional and imflammatory confounders, including serum tumor necrosis factor α, C-reactive protein, and interleukin 6 levels, showed that compared with the lowest sCD14 tertile, sCD14 levels in the third tertile (>7.8 μg/mL) were associated with greater death risk (hazard ratio, 1.94; 95% confidence interval, 1.01 to 3.75; $P = 0.04$).

Limitations: Survivor bias in combined incident/prevalent studies.

Conclusions: Increased sCD14 level is related positively to markers of inflammation and negatively to nutritional status and is an independent predictor of mortality in long- term HD patients. Additional studies are needed to examine the usefulness of sCD14 level in risk stratification and the clinical decision-making process in HD patients.

Quote from article: "A commercial NIR interactance sensor with a coefficient of variation of 0.5% for total body fat measurement was used. NIR measurements were performed."

Am J Kidney Dis. 2010 May;55(5):885-96. Epub 2010 Mar 25.

Comparing body composition assessment tests in long-term hemodialysis patients.

Bross R, Chandramohan G, Kovesdy CP, Oreopoulos A, Noori N, Golden S, Benner D,

Kopple JD, Kalantar-Zadeh K.

Author Affiliations: Harold Simmons Center for Kidney Disease Research and Epidemiology, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, CA, USA.

Abstract

Background: Protein-energy wasting is common in chronic kidney disease and is associated with decreases in body muscle and fat stores and poor outcomes. The accuracy and reliability of field methods to measure body composition is unknown in this population.

Study design: Cross-sectional observational study.

Participants: 118 maintenance hemodialysis patients were seen at the General Clinical

Research Center at Harbor-UCLA Medical Center, Torrance, CA.

Index tests: Triceps skinfold, near-infrared interactance, and bioelectrical impedance analysis using the Segal, Kushner, and Lukaski equations.

Reference test: Dual-energy x-ray absorptiometry (DEXA).

Results: Participants (42% women, 52% with diabetes, 40% African Americans, and

38% Hispanics) were aged 49.4 +/- 11.5 (mean +/- SD) years, and had undergone dialysis therapy for 41.1 +/- 32.9 months. Body mass index was 27.0 +/- 6.0 kg/m(2). Using DEXA as the reference test, the bioelectrical impedance analysis-Kushner equation, triceps skinfold, and near-infrared interactance were most accurate of the index tests in estimating total-body fat percentage, whereas bioelectrical impedance analysis-Segal equation and bioelectrical impedance analysis-Lukaski equation overestimated total body fat percentage. Bland-Altman analyses and difference plots showed that bioelectrical impedance analysis-Kushner and near-infrared interactance were most similar to the reference test. Bioelectrical impedance analysis-Kushner, triceps skinfold, and near- infrared interactance had the smallest mean differences from DEXA, especially in women (1.6%, 0.7%, and 1.2%, respectively). Similar results were observed in African American participants (n = 47).

Limitations: Measurements were performed 1 day after a hemodialysis treatment, leading to more fluid retention, which may have affected the reference and index tests differently.

Conclusions: Using DEXA as the reference test, both near-infrared interactance and bioelectrical impedance analysis-Kushner method yield more consistent estimates of total body fat percentage in maintenance hemodialysis patients compared with the other index tests. Near-infrared interactance is not affected by skin color. Field methods with portable devices may provide adequate precision.

Quote from article: "A commercial NIR interactance sensor with a coefficient of variation of 0.5% for total-body fat measurement was used. NIR interactance measurements were performed."

Journal of Renal Nutrition, Volume 20, Issue 4, July 2010, Pages 243-254

Original Research

Association of Relatively Low Serum Parathyroid Hormone with Malnutrition-Inflammation Complex and Survival in Maintenance Hemodialysis Patients

Ramanath Dukkipati MD, Csaba P. Kovesdy MD, Sara Colman RD, Matthew J. Budoff

MD, Allen R. Nissenson MD, Stuart M. Sprague DO, Joel D. Kopple MD, Kamyar Kalantar-Zadeh MD, MPH, PhD

Author Affiliations: Harold Simmons Center for Kidney Disease Research and Epidemiology and Division of Cardiology, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance; Department of Epidemiology, UCLA School of Public Health, Los Angeles; and DaVita, Inc., El Segundo, California; and Salem Veterans Affairs Medical Center, Salem, Virginia.

Abstract

Background: Low serum parathyroid hormone (PTH) has been implicated as a primary biochemical marker of adynamic bone disease in individuals with chronic kidney disease (CKD) who undergo maintenance hemodialysis (MHD) treatment. We hypothesized that the malnutrition-inflammation complex is associated with low PTH levels in these patients and confounds the PTH-survival association.

Methods: We examined 748 stable MHD outpatients in southern California and followed them for up to 5 years (October 2001–December 2006).

Results: In 748 MHD patients, serum PTH <150 pg/mL was more prevalent among non- blacks and diabetics. There was no association between serum PTH and coronary artery calcification score, bone mineral density, or dietary protein or calorie intake. Low serum PTH was associated with markers of protein-energy wasting and inflammation, and this association confounded the relationship between serum PTH and alkaline phosphatase.

Although 5-year crude mortality rates were similar across PTH increments, after adjustment for the case-mix and surrogates of malnutrition and inflammation, a moderately low serum PTH in 100–150 pg/mL range was associated with the greatest survival compared to other serum PTH levels, i.e., a death hazard ratio of 0.52 (95% confidence interval: 0.29–0.92, $p < 0.001$) compared to PTH of 300–600 pg/mL (reference).

Conclusions: Low serum PTH may be another facet of the malnutrition-inflammation complex in CKD, and after controlling for this confounder, a moderately low PTH in

100–150 pg/mL range appears associated with the greatest survival. Limitations of observational studies should be considered.

Quote from article: "of body fat and fat-free body mass, near infrared (NIR) interactance was measured at the same time as the anthropometric measurements, 38 using commercial NIR sensor with a coefficient of variation of 0.5% for total body fat measurement."

Am J Clin Nutr© 2010 American Society for Nutrition

Survival predictability of lean and fat mass in men and women undergoing maintenance hemodialysis

Nazanin Noori, Csaba P Kovesdy, Ramanath Dukkipati,

Youngmee Kim, Uyen Duong, Rachelle Bross, Antigone Oreopoulos, Amanda Luna, Debbie Benner, Joel D Kopple, and

Kamyar Kalantar-Zadeh

Author Affiliations: From the Harold Simmons Center for Kidney Disease Research and Epidemiology (NN, YK, UD, RB, AO, AL, JDK, and KK-Z), Division of Bionutrition (RB), General Clinical Research Center (RB), and Department of Pediatrics (KK-Z), Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, CA; the Salem Veterans Affairs Medical Center, Salem, VA (CPK); the University of Alberta, Edmonton, Canada (RD); the David Geffen School of Medicine at UCLA, Los Angeles, CA (JDK and KK-Z); the UCLA School of Public Health, Los Angeles, CA (JDK and KK-Z); and DaVita, El Segundo, CA (DB).

Author Notes: Supported by National Institutes of Health, National Institute of Diabetes, Digestive and Kidney Disease grants K23-DK61162 and R21-DK078012, research grants from DaVita Clinical Research, philanthropist Harold Simmons, and General Clinical Research Center grant M01-RR00425 from the National Centers for Research Resources, National Institutes of Health.

Abstract

Background: Larger body size is associated with greater survival in maintenance hemodialysis (MHD) patients. It is not clear how lean body mass (LBM) and fat mass (FM) compare in their associations with survival across sex in these patients.

Objective: We examined the hypothesis that higher FM and LBM are associated with greater survival in MHD patents irrespective of sex.

Design: In 742 MHD patients, including 31% African Americans with a mean (±SD) age of 54 ± 15 y, we categorized men (n = 391) and women (n = 351) separately into 4 quartiles of near-infrared interactance–measured LBM and FM. Cox proportional hazards models estimated death hazard ratios (HRs) (and 95% CIs), and cubic spline models were used to examine associations with mortality over 5 y (2001–2006).

Results: After adjustment for case-mix and inflammatory markers, the highest quartiles of FM and LBM were associated with greater survival in women: HRs of 0.38 (95% CI:0.20, 0.71) and 0.34 (95% CI: 0.17, 0.67), respectively (reference: first quartile). In men, the highest quartiles of FM and percentage FM (FM%) but not of LBM were associated with greater survival: HRs of 0.51 (95% CI: 0.27, 0.96), 0.45 (95% CI: 0.23, 0.88), and 1.17 (95% CI: 0.60, 2.27), respectively. Cubic spline analyses showed greater survival with higher FM% and higher "FM minus LBM percentiles" in both sexes, whereas a higher LBM was protective in women.

Conclusions: In MHD patients, higher FM in both sexes and higher LBM in women appear to be protective. The survival advantage of FM appears to be superior to that of LBM. Clinical trials to examine the outcomes of interventions that modify body composition in MHD patients are indicated.

Quote from article: "NIR interactance sensor with a CV of 0.5% for total body fat measurement was used".

Clinical Journal of the …, 2010 - Am Soc Nephrol

Mid-Arm Muscle Circumference and Quality of Life and Survival in Maintenance Hemodialysis Patients

Nazanin Noori, Joel D. Kopple, Csaba P. Kovesdy, Usama Feroze, John J. Sim, Sameer

B. Murali, Amanda Luna, Myra Gomez, Claudia Luna, Rachelle Bross, Allen R. Nissenson, Kamyar Kalantar-Zadeh

Author Affiliations: Harold Simmons Center for Chronic Disease Research and Epidemiology; and Division of Nephrology and Hypertension, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, California; David Geffen School of Medicine at UCLA, Los Angeles, California; UCLA School of Public Health, Los Angeles, California; Salem Veterans Affairs Medical Center, Salem, Virginia; and DaVita Inc., El Segundo, California.

Abstract

Background and objectives: Maintenance hemodialysis (MHD) patients with larger body or fat mass have greater survival than normal to low mass. We hypothesized that mid-arm muscle circumference (MAMC), a conveniently measured surrogate of lean body mass (LBM), has stronger association with clinical outcomes than triceps skinfold (TSF), a surrogate of fat mass.

Design, settings, participants, & measurements: The associations of TSF, MAMC, and serum creatinine, another LBM surrogate, with baseline short form 36 quality-of-life scores and 5-year survival were examined in 792 MHD patients. In a randomly selected subsample of 118 subjects, LBM was measured by dual-energy x-ray absorptiometry. Results: Dual-energy x-ray absorptiometry–assessed LBM correlated most strongly with MAMC and serum creatinine. Higher MAMC was associated with better short form 36 mental health scale and lower death hazard ratios (HRs) after adjustment for case-mix, malnutrition-inflammation-cachexia syndrome, and inflammatory markers. Adjusted death HRs were 1.00, 0.86, 0.69, and 0.63 for the first to fourth MAMC quartiles, respectively. Higher serum creatinine and TSF were also associated with lower death HRs, but these associations were mitigated after multivariate adjustments. Using median values of TSF and MAMC to dichotomize, combined high MAMC with either high or low TSF (compared with low MAMC/TSF) exhibited the greatest survival, i.e., death HRs of 0.52 and 0.59, respectively.

Conclusions: Higher MAMC is a surrogate of larger LBM and an independent predictor of better mental health and greater survival in MHD patients. Sarcopenia-correcting interventions to improve clinical outcomes in this patient population warrant controlled trials.

Quote from article: "A commercial NIR interactance sensor with a coefficient of variation of 0.5% for total body fat measurement was used."

Hemodialysis International, Volume 14, Issue 2, pages 182-192, April 2010

Association of serum alkaline phosphatase and bone mineral density in maintenance hemodialysis patients

Jong Chan Park, Csaba P. Kovesdy, Uyen Duong, Elani Streja, Mehdi Rambod,

Allen R. Nissenson, Stuart M. Sprague, Kamyar Kalantar-Zadeh

Author Affiliations: Harold Simmons Center for Chronic Disease Research and Epidemiology, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, California 90502, USA.

Abstract

Recent studies indicate that serum alkaline phosphatase (AlkPhos), a surrogate of high turnover bone disease, is associated with coronary artery calcification and death risk in maintenance hemodialysis (MHD) patients. The association between AlkPhos and bone mineral density (BMD) is not well studied. We studied the association between AlkPhos and dual-energy X-ray absorptiometry-assessed BMD in a group of MHD patients in Southern California. In 154 MHD patients, aged 55.3 ± 13.6 years, including 42% women, 38% Hispanics, 42% African Americans, and 55% diabetics, the mean serum AlkPhos was 121 ± 63 U/L (median: 101, Q25–75: 81–141); 36% had AlkPhos≥120 U/L and 50% had a total T-score≤−1. Whereas the total BMD did not correlate with age (r=0.01, P=0.99) or body mass index (r=0.10, P=0.22), it correlated negatively with AlkPhos (r=−0.25, P=0.002), including after multivariate adjustment (r=−0.24, P=0.003). The proportion of patients with a high coronary artery calcification score>400 was incrementally higher across worsening BMD tertiles (P trend=0.04). The BMD was significantly worse in MHD patients with serum AlkPhos≥120 U/L compared with

<120 U/L (1.01 ± 0.016 vs. 1.08 ± 0.013 g/cm2, respectively, P<0.001). The multivariate adjusted odds ratio of AlkPhos≥120 U/L for having a total T-score<−1.0 was 2.3 (1.1–4.8, P=0.037). Among routine clinical and biochemical markers, serum AlkPhos≥120 U/L was a better predictor of total T-score≤−1 in MHD patients. An association exists between higher serum AlkPhos and worse dual-energy X-ray absorptiometry-assessed BMD in MHD patients. Given these findings, studies are indicated to examine whether interventions that lower serum AlkPhos improve BMD in MHD patients.

Quote from article: "A commercial NIR interactance sensor with a coefficient of variation of 0.5% for total body fat measurement was used."

American Journal of Kidney Diseases Volume 56, Issue 2, August 2010, Pages 338-347

Original Investigation

Dietary Potassium Intake and Mortality in Long-term Hemodialysis Patients

Nazanin Noori MD, PhD, Kamyar Kalantar-Zadeh MD, MPH, PhD, Csaba P. Kovesdy MD, Sameer B. Murali MD, Rachelle Bross RD, PhD, Allen R. Nissenson MD, Joel D. Kopple MD

Author Affiliations: Harold Simmons Center for Chronic Disease Research and Epidemiology, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, CA 90502.

Abstract

Background: Hyperkalemia has been associated with higher mortality in long-term hemodialysis (HD) patients. There are few data concerning the relationship between dietary potassium intake and outcome.

Study Design: The mortality predictability of dietary potassium intake from reported food items estimated using the Block Food Frequency Questionnaire (FFQ) at the start of the cohort was examined in a 5-year (2001-2006) cohort of 224 HD patients in Southern California using Cox proportional hazards regression.

Setting & Participants: 224 long-term HD patients from 8 DaVita dialysis clinics.

Predictors: Dietary potassium intake ranking using the Block FFQ.

Outcomes: 5-year survival.

Results: HD patients with higher potassium intake had greater dietary energy, protein, and phosphorus intakes and higher predialysis serum potassium and phosphorus levels. Greater dietary potassium intake was associated with significantly increased death HRs in unadjusted models and after incremental adjustments for case-mix, nutritional factors (including 3-month averaged predialysis serum creatinine, potassium, and phosphorus levels; body mass index; normalized protein nitrogen appearance; and energy, protein, and phosphorus intake) and inflammatory marker levels. HRs for death across the 3 higher quartiles of dietary potassium intake in the fully adjusted model (compared with the lowest quartile) were 1.4 (95% CI, 0.6-3.0), 2.2 (95% CI, 0.9-5.4), and 2.4 (95% CI, 1.1-7.5), respectively (P for trend = 0.03). Restricted cubic spline analyses confirmed the incremental mortality predictability of higher potassium intake.

Limitations: FFQs may underestimate individual potassium intake and should be used to rank dietary intake across the population.

Conclusions: Higher dietary potassium intake is associated with increased death risk in long-term HD patients, even after adjustments for serum potassium level; dietary protein; energy, and phosphorus intake; and nutritional and inflammatory marker levels. The potential role of dietary potassium in the high mortality rate of HD patients warrants clinical trials.

Quote from article: “A commercial near-infrared interactance sensor with a coefficient of variation of 0.5% for total-body fat measurements was used as described elsewhere.”

CJASN May 2011 1100-1111

Quality-of-Life and Mortality in Hemodialysis Patients: Roles of Race and Nutritional Status

Usama Feroze, Nazanin Noori, Csaba P Kovesdy, Miklos Z. Molnar, David J. Martin, Astrid Reina-Patton§, Debbie Benner‖, Rachelle Bross*, Keith C. Norris, Joel D. Kopple, Kamyar Kalantar-Zadeh

Author Affiliations: Harold Simmons Center for Chronic Disease Research and Epidemiology; and Division of Nephrology and Hypertension, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, California; Salem Veterans Affairs Medical Center, Salem, Virginia; Institute of Pathophysiology, Semmelweis University, Budapest, Hungary; Department of Psychiatry, Division of Psychology, Harbor-UCLA Medical Center and Department of Psychiatry and Biobehavioral Sciences, David Geffen School of Medicine, UCLA, Torrance, California; DaVita, El Segundo, California; and David Geffen School of Medicine at UCLA and the

UCLA School of Public Health, Los Angeles, California.

Abstract

Background and objectives: Maintenance hemodialysis (MHD) patients often have protein-energy wasting, poor health-related quality of life (QoL), and high premature death rates, whereas African-American MHD patients have greater survival than non- African-American patients. We hypothesized that poor QoL scores and their nutritional correlates have a bearing on racial survival disparities of MHD patients.

Design, setting, participants, & measurements: We examined associations between baseline self-administered SF36 questionnaire–derived QoL scores with nutritional markers by multivariate linear regression and with survival by Cox models and cubic splines in the 6-year cohort of 705 MHD patients, including 223 African Americans. Results Worse SF36 mental and physical health scores were associated with lower serum albumin and creatinine levels but higher total body fat percentage. Spline analyses confirmed mortality predictability of worse QoL, with an almost strictly linear association for mental health score in African Americans, although the race–QoL interaction was not statistically significant. In fully adjusted analyses, the mental health score showed a more robust and linear association with mortality than the physical health score in all MHD patients and both races: death hazard ratios for (95% confidence interval) each 10 unit lower mental health score were 1.12 (1.05–1.19) and 1.10 (1.03–1.18) for all and African American patients, respectively.

Conclusions: MHD patients with higher percentage body fat or lower serum albumin or creatinine concentration perceive a poorer QoL. Poor mental health in all and poor physical health in non-African American patients correlate with mortality. Improving QoL by interventions that can improve the nutritional status without increasing body fat warrants clinical trials.

Quote from article: "NIR measurements were performed by placing, for several seconds on the upper aspect of the arm without a vascular access, a Futrex NIR sensor and entering the required data (date of birth, gender, weight, and height) of each patient."

American Journal of Kidney Diseases
Volume 57, Issue 1, January 2011, Pages 130-139
Original Investigation

Novel Equations to Estimate Lean Body Mass in Maintenance Hemodialysis Patients

Nazanin Noori MD, PhD, Csaba P. Kovesdy MD, Rachelle Bross RD, PhD, Martin Lee PhD, Antigone Oreopoulos MSc, PhD, Deborah Benner RD, Rajnish Mehrotra MD, Joel D. Kopple MD, Kamyar Kalantar-Zadeh MD, MPH, PhD
Author Affiliations: Los Angeles Biomedical Research Institute, Harbor-UCLA Medical Center, Torrance, CA, USA.

Abstract

Background: Lean body mass (LBM) is an important nutritional measure representing muscle mass and somatic protein in hemodialysis patients, for whom we developed and tested equations to estimate LBM.

Study Design: A study of diagnostic test accuracy.

Setting & Participants: The development cohort included 118 hemodialysis patients with LBM measured using dual-energy x-ray absorptiometry (DEXA) and near-infrared (NIR) interactance. The validation cohort included 612 additional hemodialysis patients with LBM measured using a portable NIR interactance technique during hemodialysis.

Index Tests: 3-month averaged serum concentrations of creatinine, albumin, and prealbumin; normalized protein nitrogen appearance; midarm muscle circumference (MAMC); handgrip strength; and subjective global assessment of nutrition. Reference Test: LBM measured using DEXA in the development cohort and NIR interactance in validation cohorts.

Results: In the development cohort, DEXA and NIR interactance correlated strongly ($r = 0.94$, $P < 0.001$). DEXA-measured LBM correlated with serum creatinine level, MAMC, and handgrip strength, but not with other nutritional markers. Three regression equations to estimate DEXA-measured LBM were developed based on each of these 3 surrogates and sex, height, weight, and age (and urea reduction ratio for the serum creatinine regression). In the validation cohort, the validity of the equations was tested against the NIR interactance–measured LBM. The equation estimates correlated well with NIR interactance–measured LBM ($R2 \geq 0.88$), although in higher LBM ranges, they tended to underestimate it. Median (95% confidence interval) differences and interquartile range for differences between equation estimates and NIR interactance–measured LBM were 3.4 (−3.2 to 12.0) and 3.0 (1.1-5.1) kg for serum creatinine and 4.0 (−2.6 to 13.6) and 3.7 (1.3-6.0) kg for MAMC, respectively.

Limitations: DEXA measurements were obtained on a non-dialysis day, whereas NIR interactance was performed during hemodialysis treatment, with the likelihood of confounding by volume status variations.

Conclusions: Compared with reference measures of LBM, equations using serum creatinine level, MAMC, or handgrip strength and demographic variables can estimate LBM accurately in long-term hemodialysis patients.

Quote from article: "A commercial NIR interactance sensor with a coefficient of variation of 0.5% for total body fat measurement was used."