PREVALENCE OF FRAILTY AND ITS ASSOCIATION WITH QUALITY OF LIFE, CLINICAL AND BIOCHEMICAL MARKERS IN END-STAGE RENAL DISEASE PATIENTS UNDER DIALYSIS

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Background and aims

Frailty is a clinical condition characterized by a significant decline in an older person's ability to carry out activities of daily living and comprises changes associated with ageing, chronic disease and lifestyle. Frailty is highly prevalent in people older than 65 years (prevalence rates range from 7% to 16.3%) and this prevalence tends to increase with age [1]. It is associated with an accumulation of age-related defects in different physiological systems, decreasing physiological reserves, increasing vulnerability to stressors and the risk of falls, hospitalization, institutionalization and death [2]. Moreover, frailty has been associated with adverse outcomes, such as physical limitations, impairment of cognitive function and low quality of life. Research has observed an increasing proportion of ESRD patients undergoing dialysis with increasing age [3-7], which is also associated with physiological decline. Frailty is a common complication in elderly patients with ESRD under dialysis, which is strong risk factor for low quality of life, morbidity and mortality [4, 8, 9]. As ESRD is a growing health public problem with an increasing prevalence worldwide and considering the lack of information on frailty in ESRD patients under online-hemodiafiltration (OL-HDF), this work aims to evaluate the prevalence of frailty and its association with socio-demographic, clinical and biochemical markers, as well as with quality of life and comorbidities in ESRD patients under dialysis.

Material and methods

Patients and study design

We performed a cross-sectional study to evaluate the prevalence of frailty in ESRD patients under OL-HDF and its relationship with sociodemographic, clinical and psychological factors and analytical data.

We evaluated 83 patients from two dialysis clinic in the northern region of Portugal (64.3 ± 14.6 years; 53% males) under dialysis three times a week, for 3–5 hours. The aetiology of ESRD was hypertension in 27 (32.5%), diabetes in 9 (10.8%) and both in 20 (24.1%) patients. Synthetic high-flux polysulfone dialyzers (Fresenius Medical Care, Bad Hamburg, Germany) were used. Patients were excluded if they: (1) had acute inflammatory or infectious diseases; (2) had been in the dialysis programme for less than three months; (3) were less than 18 years old; (4) did not agree to participate in the study. The ethics committees of the dialysis clinics involved approved this study. The patients were informed about the aim of this study and provided signed consent.

Initially, a physician assessed frailty using the FRAIL (fragility, resistance, ambulation, illnesses and loss of weight) questionnaire, cognitive function with the mini mental state examination (MMSE) and the global deterioration scale (GDS) and comorbidities with the Charlson comorbidity index (CCI). The patients themselves completed the abbreviated Lubben social network (LSNS-6), Beck depression inventory II (BDI-II) and kidney disease quality of life (KDQOL-SF) scales. Blind or disabled patients were helped by the physician to complete the self-administered questionnaires.

The classification of the ESRD patients as robust, pre-frail and frail was performed using the FRAIL scale score. This scale assesses physical frailty and includes five components: fatigue, resistance, ambulation, illness and loss of weight. The scores are as follows: 0 denotes robust patients; 1–2 represents pre-frail patients; 3–5 represents frail patients.

Statistical analysis

All variables are reported as mean ± standard deviation or as proportions. Data were analysed using the program SPSS 21.0 for Windows (SPSS, Inc., Chicago, IL). The normality of data was tested using the Kolmogorov–Smirnov test. Differences between groups were analysed using Student's t-test or the Mann–Whitney test, based on the results obtained in the Kolmogorov–Smirnov test. The association between categorical variables was analysed using the chi-squared test or Fisher's exact test. Pearson´s or Spearman rank correlation coefficients were used to evaluate the relationships between the sets of data. $P<0.05$ was accepted as indicating statistically significance.

Results

The results were analysed to evaluate the differences between robust, pre-frail and frail ESRD patients. Our results show a prevalence of pre-frailty of 54.2% (n=45) and of frailty of 28.9% (n=24) in our group of ESRD patients. Comparing the three groups of patients (robust, pre-frail and frail), we found that the frail patients group show a significantly higher age and a significantly increased proportion of female, diabetic and hypertensive patients. We also found a decrease in interdialytic weight gain, haemoglobin concentration, iron, transferrin and albumin serum levels and an increase in ferritin serum levels (Table 1).

A significant decrease in cognitive function (decreased MMSE scale score and increased GDS score) and the physical and mental components of quality of life, as well as a significant increase in depressive symptoms and in the number of comorbidities are also observed in the frail group of patients (Table 1).

Moreover, we also found a negative significant correlation between the frailty scale score and the MMSE scale score (r=-0.280; p=0.010), GDS score (r=0.277; p=0.011), albumin (r=-0.296; p=0.007) and iron (r=-0.255; p=0.02) levels, physical component summary of quality of life (r=-0.672; p<0.001), mental component summary of quality of life (r=-0.316; p=0.004) and interdialytic weight gain (r=-0.247; p=0.025); there is a positive significant correlation with depressive symptoms (r=0.488; p<0.001) and comorbidities (r=0.293; p=0.007) (Fig. 1).

Conclusions

In conclusion, our results show that frailty is a highly prevalent condition in ESRD patients under dialysis, particularly in older female patients, which is associated with a decrease in quality of life, cognitive function and nutritional status and with increased depressive symptoms and comorbidities. Given the greater mortality in frail ESRD patients, the identification of frail patients is of considerable importance in order to implement interventions to prevent frailty. Moreover, interdialytic weight gain and albumin serum levels must be considered as biomarkers of frailty in ESRD patients.

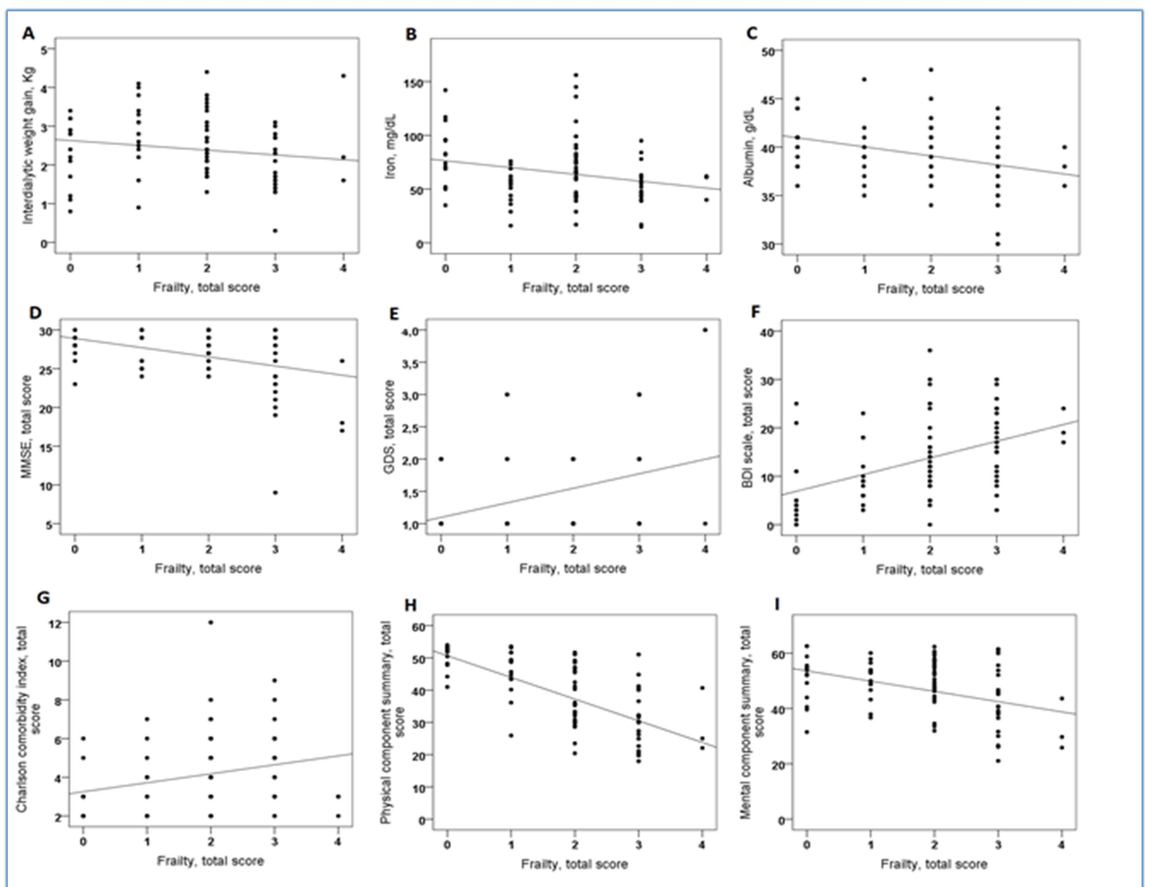

Fig. 1. Significant correlation between frailty score and interdialytic weight gain (A), iron (B), albumin (C), MMSE score (D), GDS score (E), BDI score (F), Charlson comorbidity index (G), physical (H) and mental (I) component summary scores of quality of life.

Table 1. Results for variables studied stratified by frailty status (robust, pre-frail, frail).

	Robust (n=14)	Pre-frail (n=45)	Frail (n=24)	p-value
Sociodemographic and clinical data				
Age, years	53.5 (46.3–72.3)	66.0 (53.5–76.5)	73.0 (65.0–77.8)[a]	0.021
Gender, n (%) male	10 (71.4)	29 (64.4)	5 (20.8)	0.010
Education, years	4.0 (4.0–6.0)	4.0 (4.0–5.5)	4.0 (0.0–4.0)	0.197
Diabetes, %	1 (7.1)	15 (33.3)	13 (54.2)	0.013
Hypertension, n (%)	4 (28.6)	25 (55.6)	18 (75.0)	0.020
Systolic pressure, mmHg	131.6 ± 10.9	132.6 ± 22.5	132.4 ± 23.6	0.989
Diastolic pressure, mmHg	67.4 ± 13.6	66.7 ± 12.6	61.7 ± 8.7	0.199
Number of drugs prescribed, n	6.5 (4.8–10.3)	8.0 (6.0–10.0)	7.0 (5.0–10.0)	0.846
Time under dialysis, months	61.0 (34.0–142.3)	42.0 (21.0–73.0)	40.5 (17.3–98.5)	0.565
CVC use, n (%)	1 (7.1)	5 (11.1)	4 (16.7)	0.658
Interdialytic weight gain, kg	2.3 ± 0.8	2.6 ± 0.8	2.0 ± 0.8 b)	0.015
Dialysis markers				
URR, %	76.8 ± 2.8	76.4 ± 3.6	76.9 ± 5.8	0.882
KTv	1.6 ± 0.2	1.5 ± 0.2	1.6 ± 0.3	0.268
Haematological data				
Haemoglobin, g/dL	11.5 ± 1.1	12.1 ± 1.7	11.1 ± 1.1 b)	0.038
Erythrocytes, $x10^{12}$/L	3.6 (3.5–4.0)	3.9 (3.6–4.3)	3.6 (3.4–4.0)	0.083
MCV, fl	94.9 ± 4.8	94.9 ± 5.4	95.0 ± 6.9	0.994
MCH, pg	31.2 (30.3–31.5)	31.0 (29.9–32.1)	31.2 (29.8–31.9)	0.726
MCHC, g/dL	32.7 (32.0–33.3)	32.6 (32.2–33.2)	32.3 (31.9–32.8)	0.070
Neutrophils, $x10^{9}$/L	3.0 ± 1.0	4.4 ± 2.0	4.2 ± 1.8	0.643
Lymphocytes, $x10^{9}$/L	1.9 ± 0.6	1.7 ± 0.5	1.6 ± 0.4	0.283
Neutrophil/Lymphocyte ratio	2.3 ± 1.1	2.7 ± 1.3	2.8 ± 1.5	0.556
Iron status				
Iron, mg/dL	78.0 (64.8–100.5)	62.0 (44.0–78.5)	50.0 (40.8–61.8)[a]	0.005
Transferrin, mg/dL	162.4 ± 22.8	177.4 ± 30.7	158.3 ± 24.0[b]	0.018
Ferritin, ng/mL	439.9 ± 287.1	294.7 ± 229.4	467.4 ± 273.1[b]	0.017
Nutritional markers				
Albumin, g/dL	40.6 ± 2.5	39.9 ± 2.9	37.2 ± 3.8[a,b]	0.001
BMI, Kg/m2	23.5 ± 3.0	26.1 ± 4.6	26.3 ± 4.5	0.126
LSNS-6				
LSNS-6, total score	14.0 (12.0–19.5)	15.0 (12.0–20.0)	13.5 (7.5–15.8)	0.095
MMSE				
MMSE scale, total score	28.0 (27.8–29.0)	28.0 (26.0–29.5)[a]	25.0 (21.3–29.0)[a,b]	<0.001
GDS				
GDS, total score	1.0 (1.0–2.0)	1.0 (1.0–2.0)[a]	2.0 (1.0–3.0)[a,b]	0.002
BDI-II				
BDI-II, total score	4.0 (1.8–11.0)	11.5 (6.5–17.5)[a]	17.5 (11.3–23.8)[a]	0.001
KDQOL-SF				
KDQOL-SF, physical composite	51.9 (48.1–52.9)	41.1 (31.5–48.7)[a]	30.1 (22.2–39.2)[a,b]	<0.001
KDQOL-SF, mental composite	53.2 (43.1–56.4)	52.2 (46.4–56.9)	39.9 (29.8–50.8)[a,b]	0.002
CCI				
CCI, total score	3.0 (2.0–3.0)	4.0 (2.5–5.5)	4.5 (3.0–6.0)[a]	0.037

Notes: a) $p<0.05$ vs robust group b) $p<0.05$ vs pre-fail group. CVC: central venous catheter; MCV: mean cell volume; MCH: mean cell haemoglobin; MCHC: mean cell haemoglobin concentration; BMI: body mass index; KDQOL: kidney disease patients' quality of life.

References

[1] Collard RM, Boter H, Schoevers RA, Oude Voshaar RC (2012). Prevalence of frailty in community-dwelling older persons: a systematic review. J Am Geriatr Soc. 60(8):1487-92., [2] Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. (2001). Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci. 56(3):M146-56., [3] Morley JE, Vellas B, van Kan GA, Anker SD, Bauer JM, Bernabei R, et al. (2013). Frailty consensus: a call to action. J Am Med Dir Assoc. 14(6):392-7., [4] McAdams-DeMarco MA, Law A, Salter ML, Boyarsky B, Gimenez L, Jaar BG, et al. (2013). Frailty as a novel predictor of mortality and hospitalization in individuals of all ages undergoing hemodialysis. J Am Geriatr Soc. 61(6): 896-901., [5] Musso CG, Jauregui JR, Núñez JFM. (2015). Frailty phenotype and chronic kidney disease: a review of the literature. International urology and nephrology. 47(11):1801-7.

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