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Prevalence of Malnutrition in Mexican CAPD Diabetic and Nondiabetic Patients

Malnutrition is often present on continuous ambulatory peritoneal dialysis (CAPD), and contributes to morbidity and mortality. Diabetics (DM) have an increased risk for developing malnutrition. Our purpose was to assess the nutritional status (NS) of our CAPD population, to define the differences between DM and nondiabetics (NoDM), and to identify NS-related factors. Patients were subjected to a nutritional assessment, which included a 24-hour dietary recall and a nutritional scoring system, including anthropometric, biochemical, and subjective evaluation, and first classifies patients as normal, and mildly, moderately, and severely malnourished. We studied 90 patients: 37 DM and 53 NoDM. In our whole population we observed a high frequency of malnutrition. NS was normal in 18%, and 20% had mild, 29% had moderate, and 33% had severe malnutrition. Ninety-one percent of DM and 76% of NoDM showed some degree of malnutrition. DM patients had significantly higher levels of malnutrition (p = 0.02), were significantly older, had more body fat, and spent less time on dialysis. There were 37 males and 53 females. Sex distribution was similar between DM and NoDM. Seventy-six percent of males and 86% of females had malnutrition. Moderate and severe malnourishment were more frequent in females. DM and female sex were the strongest predictors for moderate and severe malnutrition.

Key words
Nutritional assessment, malnutrition, diabetes

Introduction

Protein calorie malnutrition (PCM) is a common finding in continuous ambulatory peritoneal dialysis (CAPD) patients (1,2) and constitutes an important independent risk factor for morbidity and mortality (3-5). Three mechanisms have been identified to contribute to PCM in CAPD patients: decreased intake, increased losses, and altered metabolism (2,6). Coexisting conditions such as uremia, intercurrent illness, socioeconomic condition, and depression may also participate in the malnutrition observed in these patients. The imp... on. In essence, the di... tently for establishing a... adequate nutritional sta... tus (NS) diagnosis in ... patients. Nutritional assessment in CAPD patients may include anthropometric measurements, di... history, biochemical indexes, and subjective gl... global assessment (2,7). We believe that NS may be better estimated employing composite indexes (4,8,9) that include the already-mentioned variables. Diabetic (DM) CAPD patients may additionally develop PCM due to other chronic complications (anorexia, nausea, vomiting) present in this illness. DM patients often begin dialysis already malnourished (10) probably due to the fact that their energy intakes are often below the recommended daily allowance. This condition could be aggravated by greater protein peritoneal losses than in nondiabetic (NoDM) patients (11). Our study aims were to assess the nutritional status of our CAPD patients using composite indexes, to compare NS of DM and NoDM patients, as well as other clinical and demographic variables, and to identify NS-related factors.

Patients and methods

We selected 90 patients from a cohort of our CAPD clinic. Patients were excluded if they had less than two months of dialysis and a history of peritonitis within the last six weeks. Nutritional assessment was performed using conventional dietary, anthropometric, biochemical, and clinical parameters.

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TABLE I Patients' clinical and laboratory variables, according to the presence of diabetes mellitus (DM) and sex. Data are shown as mean ± SD

	Age (years)	*Time on dialysis (months)*	*SCr (mg/dL)*	*BUN (mg/dL)*	*Hb (mg/dL)*	*Cholesterol (mg/dL)*
DM	53±14	16±18	7.8±2.8	56±17	10.1±1.8	208±59
NoDM	39±16	34±32	11.1±4.6	61±22	8.8±2.2	200±50
p value	<0.001	0.004	<0.001	0.31	0.007	0.5
Male	47±15	31±31	11.6±5.0	64±19	9.7±2.3	186±40
Female	43±18	24±26	8.6±3.2	56±20	9.0±2.0	215±59
p value	0.31	0.29	<0.001	0.07	0.18	0.01

SCr = serum creatinine; BUN = blood urea nitrogen; Hb = hemoglobin; NoDM = nondiabetic.

Dietary intake

Dietary intake was estimated by a 24-hour dietary recall. To estimate consumed quantities and enhance accuracy, the interviewer used models of plates, glasses, spoons, and food letters of known quantities designed for this purpose (adapted from the National Dairy Council, Rosemont, IL). Precoded ques- [illegible]

energy intake (EI) and protein intake (PI) of the usual recommended daily allowance (30 – 35 kcal/kg of body weight, and 1.2 – 1.3 g of protein/kg of body weight, respectively). We did not consider dialysate glucose absorption.

Anthropometric measurements

[illegible]

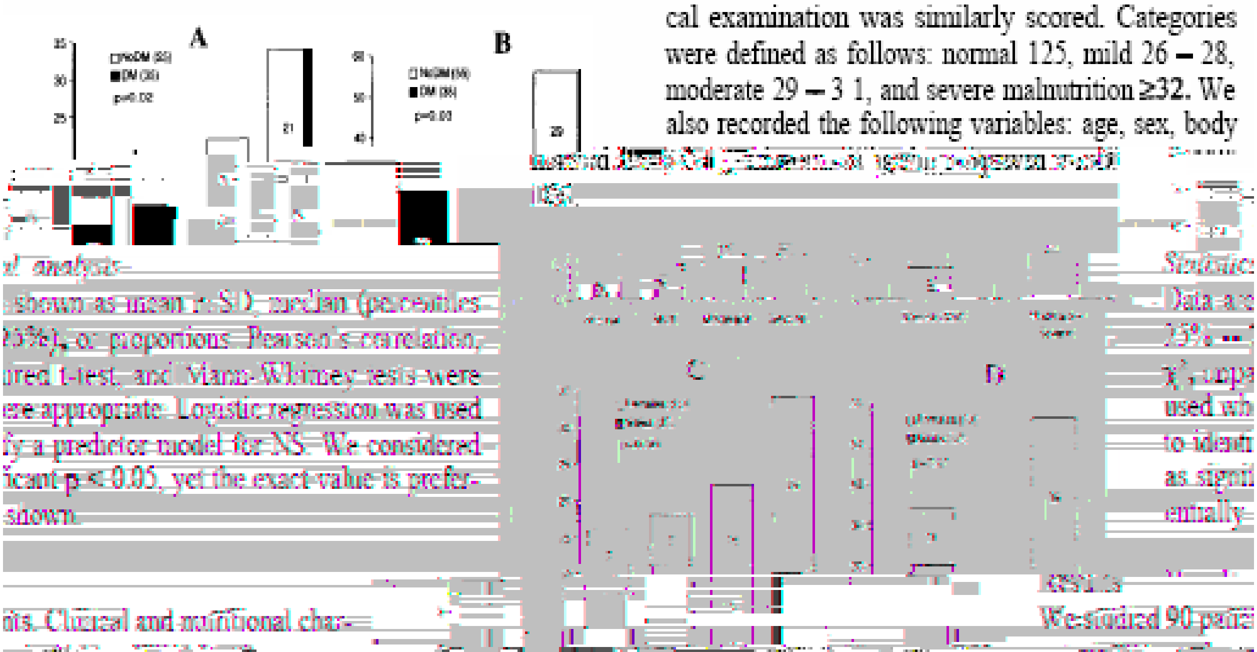
TABLE II Nutritional Parameters, according to the presence of diabetes mellitus (DM) and sex. Data are show[n] as mean ± SD or median (percentiles: 25% – 75%), as Student's t-test or Mann-Whitney U-test were respectively employed

	RBW (%)	*MAC (cm)*	*TSF (mm)*	*MAMA (cm²)*	*SA (mg/dL)*	*ST (mg/dL)*	*TLC (cells/mm³)*	*BMI*	*BF (%)*
DM	98±13	28±5	16±6	35±18	2.8±0.7	159±49	1592±627	25±3	33±6
NoDM	94±15	26±4	13±7	33±12	3.3±0.5	166±37	1618±594	23±4	27±8
p value	0.15	0.12	0.05	0.45	<0.0001	0.63	0.84	0.04	<0.001
Male	97±14	28 (26–30)	12±5	37 (31–45)	3.4±0.6	152±32	1640±633	25±4	26±7
Female	94±14	26 (23–28)	16±7	29 (21–34)	3.0±0.7	171±47	1585±587	23±4	31±8
p value	0.30	0.03	0.003	<0.001	0.005	0.17	0.67	0.04	0.006

	EI (%)	*PI (%)*
[DM]	[illegible]5±25	83±40
[NoDM]	[illegible]9±45	93±43
[p value]	[illegible].002	0.31
[Male]	[illegible]5±32	88±42
[Female]	[illegible]3±44	90±44
[p value]	[illegible]0.35	0.82

RBW = relative body weight; MAC = midarm circumference; TSF = triceps skinfold thickness; MAMA = mida[rm muscle area]; SA = serum albumin; ST = serum transferrin; TLC = total lymphocyte count; BMI = body mass index; BF = body [fat]; EI = % from recommended energy intake; PI = % from recommended protein intake.

5 if moderately, and 6 if severely decreased. Physical examination was similarly scored. Categories were defined as follows: normal ≤25, mild 26 – 28, moderate 29 – 31, and severe malnutrition ≥32. We also recorded the following variables: age, sex, body



...l analysis

...shown as mean ± SD, median (percentiles 25% – 75%), or proportions. Pearson's correlation, χ^2, unpaired t-test, and Mann-Whitney tests were used where appropriate. Logistic regression was used to identify a predictor model for NS. We considered as significant $p < 0.05$, yet the exact value is preferentially shown.

...nts. Clinical and nutritional char...

...p<0.0001]. Sex distribution was similar between DM and NoDM ... BMI, and BF were significantly higher in DM, whereas ... and ... were significantly lower. ... male patients had significantly higher levels of serum creatinine ... as well as higher ... serum cholesterol, ... There was a ... significant trend to higher BUN levels in males.

In our whole population, 29 were normal ... patients, with ... had mild, ... (24%) had moderate, and ... had severe malnutrition. ... of DM and ... of NoDM patients showed some degree of malnutrition. ... patients had significantly higher levels ...

...or – 10 for male) (13).

Biochemical parameters

Biochemical parameters included serum ..., total lymphocyte count (TLC), serum creatinine (SCr), cholesterol, and blood urea nitrogen (BUN).

Clinical examination

Clinical examination was performed ...

Figure 1 — ... nutritional status (NS) ... according to the presence of diabetes mellitus (DM) ... diabetic (NoDM) ... mild, moderate and severe malnutrition ... female ... or – 10 for male) (13).

Results

We studied 90 patients ...

Table 2 — ... logistic regression model ...

Variable	Coefficient	Odds ratio	p
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

tion than NoDM (p = 0.02): 3 DM patients (9%) were normal, and 5 (14%) were mildy, 14 (40%) were moderately, and 13 (37%) were severely malnourished; whereas 13 NoDM (24%) patients were normal, [illegible] (Figure 1A).

According to sex, [illegible] had more aggravated malnutrition. Moderate and severe malnutrition showed a trend (p = [illegible]) to be more frequent in females: [illegible] males were normal, and [illegible] mildly, [illegible] were moderately, and [illegible] were severely malnourished; whereas [illegible] females were normal, and [illegible] were mildly, [illegible] were moderately, and [illegible] were severely malnourished (Figure 1C).

In order to more adequately assess the role of female sex in the NS we categorized the patients into two groups: one included patients with normal and mild malnutrition, and a second one included patients who were moderately and severely malnourished, and we identified a higher proportion of females and DM in the higher levels of malnutrition. Such arrangement allowed us to establish more clearly the definite influence of DM and sex on NS (Figure 1B and 1D), and was further employed to analyze possible malnutrition predictors. In the logistic regression analysis we found that the best model to predict moderate and severe malnutrition included female sex and DM (Table II). We found collinearity between age and DM, yet we did not observe modifications in the significance and odds ratio of female sex and DM when age was added to the model; moreover, when we excluded DM from the model, age did not gain in significance.

Discussion

Multiple studies have shown a high prevalence of malnutrition and hypoalbuminemia in CAPD patients, and some of them have demonstrated the influence of these variables over morbidity and mortality (2, 5, 12). Otherwise, [redacted]

this could clearly explain this high frequency of malnutrition.

Our sample has a high proportion of DM patients, as this entity is the cause of end-stage renal disease [illegible] NoDM. [illegible] hyperglycemia, [illegible] higher peritoneal protein losses, and [illegible] could not be discarded. The presence of higher values of TSF, BMI, and increased % of BF [illegible] BF stores in DM patients. We could not evaluate the role of glucose dialysate absorption on the body composition of DM patients as we did not measure this variable. It is interesting to point out that DM patients had a shorter time on dialysis than NoDM, therefore they could have started CAPD with a more deteriorated NS.

We also observed higher levels of malnutrition in females than in males. As PI and PL were similar between sexes, and peritoneal protein losses do not appear to be different in relation to sex (18,19), a lower protein corporal reserve in females could be implicated as influencing the higher malnutrition levels [illegible]. Women showed more BF than men, as happens in the normal population. Female sex was not causative of the higher malnutrition level in DM, as it was uniformly distributed between DM and NoDM.

We observed a higher frequency of moderate and severe malnutrition in DM and a similar trend in females (Figure 1A and 1C). In order to clarify the analysis, we classified our patients into two major groups: one included patients with normal NS and mild malnutrition, and the other included patients who were moderately and severely malnourished (Figure 1B and 1D). Using this arrangement, we found a logistic regression model that predicts moderate and severe malnutrition, which includes female sex and DM, displaying similar predictive strength [redacted] ture, yet with a higher proportion of the moderately and severely malnourished. DM and female sex were the strongest predictive factors for moderate and severe malnutrition in this study.

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