Influence of educational level on myocardial hypertrophy of hemodialysis patients

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Abstract

Introduction: Chronic renal disease is associated with a high cardiovascular risk. Data from the general population associate cardiovascular diseases with low educational level, but no study has evaluated this association in patients on hemodialysis. **Objective:** This study aimed at evaluating the association between educational level, hypertension, and left ventricular hypertrophy in patients on chronic hemodialysis. **Methods:** A standard socioeconomic questionnaire was applied to 79 hemodialysis patients at the Hospital das Clínicas of Faculdade de Medicina de Botucatu, state of São Paulo. Clinical, laboratory and echocardiographic data were obtained from medical records. The patients were divided into two groups according to the median educational level, as follows: G1, patients with three or less years of schooling; G2, patients with more than three years of schooling. **Results:** Blood pressure, interdialytic weight gain, and variables statistically different in the two groups ($p < 0.2$) underwent multiple analysis. Independent associations were stated with $p < 0.05$ in multiple analysis. The mean age of patients was 57 ± 12.8 years, 46 were males (57%), and 53 white (67%). The variables selected for multiple analysis were: age ($p = 0.004$); educational level ($p < 0.0001$); body mass index ($p = 0.124$); left ventricular diameter ($p = 0.048$); and left ventricular mass index ($p = 0.006$). Antihypertensive drugs were similar in both groups. Systolic blood pressure ($p = 0.006$) and years of schooling ($p = 0.047$) had a significant and independent correlation with left ventricular mass index. **Conclusion:** In hemodialysis patients, left ventricular mass associated not only with blood pressure but also with educational level.

Keywords: educational level, left ventricular hypertrophy, uremia, dialysis, hypertension.

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Introduction

In the general population, low educational level associates with high cardiovascular morbidity and mortality.[1] Hypertension[2,3], diabetes[4], obesity[5], smoking[6], dyslipidemia[7], and renal failure[8], the latter being currently recognized as a cardiovascular risk factor[9], are more common among individuals with low educational level. Renal disease reduces life expectancy, and cardiovascular disease is the major cause of death among such patients.[10-12] Patients with chronic kidney disease and a low educational level have their life expectancy reduced even more as compared with those with a higher educational level.[13-15]

Left ventricular hypertrophy (LVH) is a good prognostic marker of cardiovascular disease in the general population[16], and, in renal failure, it identifies a subgroup of patients at very high cardiovascular risk.[11] Hypertension is the main etiopathogenic factor for the development of LVH in both the general population[17] and patients with renal failure.[11] In addition, hypertension is more frequent and more intense among unemployed individuals and even worse among unemployed individuals with a low educational level.[2,3,18] A large epidemiological study has associated LVH with low educational level in the general population.[19] No previous studies could be found in the literature assessing the association between LVH and low educational level in end-stage

chronic kidney disease patients. Thus, this study aimed at assessing the influence of low educational level on blood pressure and on LVH degree in patients on hemodialysis.

Methods

The present study was carried out at the Medical School of Botucatu, UNESP, from April to June 2005. The study comprised patients on hemodialysis, aged over 18 years. Patients with intellectual difficulties to answer the questionnaire, with valvulopathies, ventricular dyskinesia, or poor-quality echocardiogram were excluded from the study. The study abided by resolution 196/96 and was approved by the Committee on Ethics of the Medical School of Botucatu (protocol 1757/05).

The sample size (α error of 0.05 and β error of 0.20) was calculated and resulted in 35 patients in each group for detecting a difference of 15 g/m^2,[7] with standard deviation of 22 g/m^2,[7] in ventricular mass index, and 37 patients for detecting a difference of 10 mm Hg with standard deviation of 15 mm Hg in systolic pressure.

The study assessed 109 patients, 13 of whom were excluded. Of the remaining 96 patients, six died, six underwent transplantation, three moved to another city, one changed the dialysis method, and one recovered renal function before the first echocardiographic assessment. Therefore, 79 patients were analyzed. The median educational level was three years of schooling. The patients were divided into the following two groups according to the median educational level: G1 (40 patients with three or less years of schooling); and G2 (39 patients with more than three years of schooling). The educational level of the patients excluded did not differ statistically from that of the patients included: median, first and third quartiles of 3.5 (1.5-7) versus 3 (1-4) for patients excluded and included, respectively; p=0.26.

A standard questionnaire containing the following data was applied: age; sex; ethnic group; educational level in years of schooling; dialysis time; monthly family income; number of people in the household; and "employed" or "unemployed" status.

The following data were collected from the medical records: cause of renal disease; heart rate; blood pressure prior to hemodialysis (mean of 20 sessions prior to undergoing echocardiography) and interdialytic weight gain (mean of 20 hemodialysis sessions); body mass index (weight divided by the square of height); number of the classes of antihypertensive agents used; and echocardiographic data (diastolic left ventricular diameter, interventricular septum and posterior wall thicknesses). Echocardiography was performed according to the American Echocardiography Association Standards[20,21], and left ventricular mass (LVM) was calculated by using the Devereux formula. Left ventricular mass index (LVMI) was obtained by dividing LVM by height to the power of 2.7. 17

The following laboratory data were assessed: calcium; phosphorus; potassium; urea; creatinine; glucose; hemoglobin; hematocrit; parathyroid hormone; fractional urea clearance (Kt/V); cholesterol; triglycerides; bicarbonate; albumin; and ferritin. All laboratory data were obtained immediately before the midweek dialysis session.

Continuous variables were compared by use of the Student *t* test or Mann-Whitney test, when appropriate. Categorical variables were compared by use of the *Chi*-square test or Fisher exact test. Blood pressure, interdialytic weight gain, and variables differing between the groups at the significance level of 0.20 were included in the step-up multiple regression model using LVMI as dependent variable. When the p value was lower than 0.05, the association was considered statistically significant in multiple analysis. Parametric data were expressed as mean ± standard deviation and nonparametric data were expressed as median (first and third quartiles).

Results

The mean age of the case series was 57 ± 12.8 years, 46 were men (57%), and 53 were white (67%). The etiology of renal failure was hypertension in 27 patients, diabetes in 20, glomerulopathies in 16, and other causes in 16 patients. The groups did not differ in regard to the renal failure etiology. Table 1 shows the demographic data and Table 2 shows the clinical data. The number of classes of antihypertensive drugs used did not differ between the groups. The medications with specific potential for decreasing LVH, such as beta-blockers, calcium-channel blockers, angiotensin II receptor antagonists, and angiotensin converting enzyme inhibitors, did not differ either (Table 2). Blood pressure and other clinical variables did not differ between groups. The p value for body mass index (BMI) was 0.124.

The echocardiographic data in G1 and G2, respectively, were as follows: posterior wall thickness, 12.0 ± 2.05 mm and 12.2 ± 2.57 mm (p = 0.695); interventricular septum thickness, 12.3 ± 2.21 mm and 12.5 ± 2.52 mm (p = 0.835); LVM, 300 ± 96.7 g and

273 ± 100.1 g (p = 0.240). The groups differed regarding diastolic left ventricular diameter and LVMI (Figure 1).

Most laboratory data were similar in both groups (Table 3), except for urea and triglycerides. The p value for creatinine was 0.130.

Table 4 shows the step-up multiple regression analysis, and the following variables showed no statistically significant correlation with LVMI: age; BMI; interdialytic weight gain; creatinine; urea; and triglycerides. However, a significant and independent association of LVMI was observed with educational level in years of schooling and systolic blood pressure.

To better assess the relation between age, educational level, and LVMI, G1 was stratified in regard to age; patients aged 60 years or over were excluded. The mean age of that subgroup, consisting of the 18 youngest patients with lower educational level, was 51 ± 7.6 years, and was comparable to the mean age of G2 (52 ± 12.7 years) (p=0.711). That subgroup continued to differ in regard to LVMI, 97 ± 34.5 g/m^2,^{7} as compared with the LVMI of G2, 73 ± 24.2 g/m^2,^{7} (p=0.003).

Discussion

This study aimed at assessing the association between educational level and severity of LVH and AH of patients on hemodialysis. In G1, LVH was more intense as compared with that of G2. Associations of low educational level with ventricular hypertrophy and blood pressure were assessed by use of multiple regression analysis. Surprisingly, neither systolic nor diastolic blood pressure associated with low educational level. Our results suggest that ventricular hypertrophy is more intense among patients with low

Table 1 Demographic variables of patients on hemodialysis according to their educational level

	G1 (n = 40)	G2 (n = 39)	p
Age (years)	61 ± 11.6	52 ± 12.7	0.010
Female/Male	20/20	15/24	0.316
White/Non white	27/13	25/14	0.370
Years of schooling	1.0 (0.0-2.5)	4.0 (4.0-8.0)	< 0.001
Monthly income (R$)	730 (260 - 1525)	900 (633 - 1220)	0.522
People in the household (n)	3.5 (2.0 - 5.0)	3.0 (2.0 - 4.0)	0.533
Employed/unemployed	1/39	4/35	0.201

G1, educational level ≤ 3 years of schooling; G2, educational level > 3 years of schooling.

Table 2 Clinical variables of patients on hemodialysis according to educational level

	G1 (n = 40)	G2 (n = 39)	p
Dialysis time (months)	30.8 (9.80 - 64.1)	24.8 (6.3 - 58.7)	0.468
Anti-hypertensive drugs (median)	2 (1 - 2)	1 (0 - 2)	0.226
ACEI (number of patients)	19	15	0.559
Beta-blockers (number of patients)	14	11	0.684
CCB (number of patients)	10	12	0.748
Systolic blood pressure (mmHg)	146 ± 13.6	143 ± 16.2	0.315
Diastolic blood pressure (mmHg)	87 ± 7.1	87 ± 7.7	0.823
Heart rate (bpm)	76 ± 4.7	76 ± 4.1	0.931
BMI (g/m^2)	24.9 ± 6.27	23.1 ± 3.11	0.124
Interdialytic weight gain (kg)	2.27 ± 0.863	2.34 ± 0.840	0.711

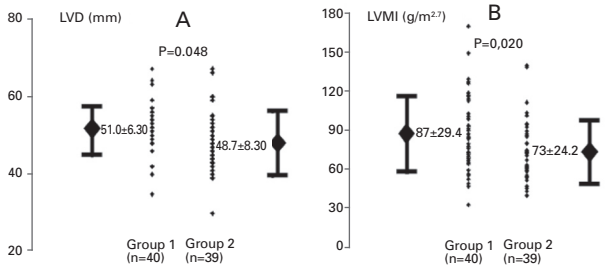
G1 = educational level ≤ 3 years of schooling; G2 = educational level > 3 years of schooling;
ACEI = angiotensin-converting enzyme inhibitor; CCB = calcium-channel blockers; bpm = beats per minute; BMI = body mass index.

Table 3 Laboratory variables of patients on hemodialysis according to the educational level.

	G1 (n = 40)	G2 (n = 39)	p
Calcium (mg/dL)	9.1 ± 0.64	9.3 ±1.08	0.227
Creatinine (mg/dL)	10.4 ± 3.38	11.5 ±3.07	0.130
Phosphorus (mg/dL)	5.5 ± 1.86	5.5 ± 1.92	0.942
Glucose (mg/dL)	100.5 (72.0 - 179.5)	97.0 (85.5 - 128.3)	0.829
Bicarbonate (mEq/L)	20.6 ± 4.41	20.2 ± 2.99	0.602
Hematocrit (%)	35.0 ± 6.31	33.3 ±4.98	0.194
Hemoglobin (g/dL)	11.3 ± 1.95	10.9 ±1.61	0.337
Potassium (mg/dL)	5.2 ± 0.92	5.0 ± 0.76	0.441
Urea (mg/dL)	120 ± 33.6	136 ± 33.1	0.039
Ferritin	474 (307 - 853)	542 (304 - 972)	0.526
Albumin (g/dL)	3.6 ±0.35	3.6 ± 0.48	0.971
Parathyroid hormone (pg/mL)	259 (121 - 479)	260 (126 - 482)	0648
Cholesterol (mg/dL)	148 ± 38.1	150 ± 32.6	0.858
Triglycerides (mg/dL)	160 (117 - 222)	130 (94 - 193)	0.035
Kt/V	1.45 ± 0.299	1.37 ± 0.255	0.229

G1 = educational level ≤ 3 years of schooling; G2 = educational level > 3 years of schooling; Kt/V = fractional urea clearance.

Figure 1. D A: left ventricular diameter (LVD) related to the educational level; B: left ventricular mass index (LVMI) related to the educational level. Group 1: educational level ≤ 3 years of schooling; Group 2: educational level > 3 years of schooling.



educational levels. It is worth noting that the median educational level of our patients on hemodialysis was half of that of the general Brazilian population, which is in accordance with data referring to patients with chronic kidney disease of another country.[9]

It is worth noting that the groups were divided according to their educational level as follows: G1 – educational level equal to or lower than three years of schooling [those who, before the 1971 National Educational Guidelines and Bases Law (Law 5692 of August 11, 1971, that was in effect until the promulgation of the most recent National Educational Guidelines and Bases Law), did not have the then

Table 4 Step-up logistic regression between demographic, clinical and laboratory variables and left ventricular mass index of patients on hemodialysis

	B	SE B	Confidence Interval	p
Years of schooling	-1.786	0.891	-3.56 to -0.012	0.048
Systolic blood pressure	0.560	0.201	0.157 to 0.963	0.007
Interdialytic weight gain	-	-	-	0.735
Age	-	-	-	0.713
Hematocrit	-	-	-	0.256
Triglycerides	-	-	-	0.266
BMI	-	-	-	0.980
Urea	-	-	-	0.959
Creatinine	-	-	-	0.959

B = slope of the regression line; SE B = standard error of the slope of the regression line; BMI = body mass index.

called complete elementary education]; G2 – educational level equal to or higher than three years of schooling, corresponding to the old complete elementary education. Considering the age of our case series, almost all patients attended elementary school before the promulgation of that 1971 law. Thus, the division was performed between those who did not have completed old elementary school and those who had at least completed elementary school. It is worth emphasizing that at that time there was a "rite of passage", which was an admission test to middle school. Therefore, it is worth noting that the median educational level coincides with a very important reference for people within the age group studied, that is, the passage from old elementary school to old middle school.

Considering that blood pressure did not associate with educational level, that is, patients of a lower or higher educational level did not differ in regard to blood pressure, the correlation coefficients of the regression model that considered blood pressure a dependent variable were not shown in the results. On the other hand, considering that blood pressure and LVMI had a close relation, blood pressure needed to be included as an independent variable in the multiple model, in which LVMI was a dependent variable. Even so, the low educational level had an additional effect to blood pressure elevation on the degree of cardiac hypertrophy.

It should be considered that the patients in G1 were older at the time of analysis. However, it is worth noting that multiple analysis was performed, and, still, educational level appeared as a factor associated with LVMI, independently of age. Thus, educational level had an additional effect to age, that is, when assessing patients of the same age and different educational level, LVMI statistically differed between both groups. To illustrate that statement, G1 was stratified and, when excluding the patients aged 60 years or above and constituting subgroups with similar ages, the educational level maintained an association with LVMI independently of age.

To explain the association between low educational level and blood pressure, a Brazilian study[22] has correlated the low socioeconomic level with salt ingestion, which could measure the association between low socioeconomic level and arterial hypertension. Hypervolemia is a common condition among patients with end-stage chronic kidney disease.[23] A previous study has demonstrated the existence of an independent correlation between hypervolemia and left ventricular mass in patients on hemodialysis.[24] In the present study, the higher ventricular diameter in patients with lower educational level corroborates the assumption that volume overload could explain the greater ventricular mass in those patients. However, the interdialytic weight gain was equal in both groups. Thus, volume overload cannot explain the results of the present study. An epidemiological study in the general population has shown the effect of low educational level on LVH. In Afro-Americans, the association between low educational level and LVH was independent of other cofactors, including hypertension[19], and this was attributed to psicossocial stress, which is more intense among those with lower educational levels.

There is evidence that low educational level has a strong negative impact on the prognosis of patients on hemodialysis.[13-15] In addition, cardiovascular diseases are the major causes of death among those patients, and LVH is a strong prognosis marker.[10-12]. Therefore, the correlation between educational level and ventricular hypertrophy could explain the higher mortality in patients with chronic kidney failure and lower educational level. However, no previous study has associated indicators of socioeconomic level with cardiovascular risk factors of patients on hemodialysis.

Conclusion

To our knowledge, this is the first study associating LVH and low educational level in end-stage chronic kidney disease patients.

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