Left Ventricular Hypertrophy in Chronic Kidney Disease. Is Pulse Pressure an Independent Risk Factor?

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Background: The study’s aim was to evaluate the relations between pulse pressure (PP), hypertension and anemia with left ventricular hypertrophy (LVH). Materials and methods: The risk factors and prevalence of LHV were evaluated in 111 patients with CRF. Results: LVH was diagnosed in 81.9% of all patients. The prevalence of hypertension was 72.6%. Anemia was present in all patients. Of the variables tested lower levels of hemoglobin, systolic blood pressure (SBP) and PP predicted the occurrence of LHV. Conclusions: This study has shown a strong association between chronic kidney disease (CKD) and LVH in pre dialysis patients. Pulse pressure, SBP and anemia play an important role in the development of left ventricular hypertrophy in CKD patients. Key words: Anemia; hypertension; left ventricular hypertrophy; pulse pressure.

1. INTRODUCTION
Cardiovascular complications are the leading cause of death in patients with end-stage renal disease (ESRD), accounting for 43-52% of deaths in these patients. Left Ventricular Hypertrophy (LVH) is a frequent occurrence in patients with CKD and is an important adverse prognostic indicator (1, 2).

Increased systolic blood pressure has been suggested as an independent predictor of left ventricular hypertrophy and its progression over time (2).

Anemia is an important determinant of cardiac hypertrophy and a frequent finding in uraemic patients (3). Anemia, in the long term, can be associated with progressive LV dilation, new-onset cardiac failure, and death (4).

Increased PP is associated with the increase of systolic blood pressure (SBP) and decrease in diastolic blood pressure (DBP). PP reflects stiffness of the large arteries and increases with age (5, 6). Increasingly, PP is recognized as an independent predictor of myocardial infarction, congestive heart failure, and cardiovascular death, even in hypertensive patients who undergo successful antihypertensive drug therapy, especially in older individuals (7). Patients with CKD show higher PP values than control subjects with normal renal function (8). Several studies have shown that PP is a reliable prognostic factor for mortality and cardiovascular disease in predialysis, replacement therapy and renal transplant patients (9).

The aim of our study was to evaluate the relations between pulse pressure, hypertension and anemia with left ventricular hypertrophy.

2. SUBJECTS AND METHODS
The study is trans-sectional. We studied 111 patients in the predialysis stages of CDK. The mean age was 42±16.3. The patients were devised in 4 groups according to the K/DOQI classification based on glomerular filtration (GFR). The first group of patients (26 patients) presented second stage of CKD (GFR 60-89,9ml/min). The second group (30 patients) presented third stage of CKD (GFR 30–59,9ml/min). The third group (32 patients) was at 4th stage of CKD (GFR 15-29,9ml/min) and the fourth group (23 patients) presented 5th stage of CKD (GFR <15ml/min). Creatinine clearance was calculated by using the Cockroft and Gault equation.

Hypertension was defined as systolic blood pressure (SBP) > 140mmHg and diastolic blood pressure (DBP) > 90mmHg. All patients were under antihypertensive therapy. Pulse pressure was calculated as a difference between SBP and DBP.

Anemia has been considered as a level of hemoglobin <13mg/dl in the men and <12mg/dl in women.

Echocardiography was performed using the Vingmed System Five echocardiographic system equipped with 2.5 MHz transducers. M-Mode and 2D measurements were done in accordance with methods recommended by the American Society of Echocardiography. Criteria for left ventricular hypertrophy (LVH) were considered LVMI >134 g/m² for males and >110 g/m² for...
females. Cardiac mass was calculated using Reichek and Devereux formula.

**Statistical analysis.**

Data are expressed as the mean ± SD. Spearman correlation was used to assess the relationship between LVMI and the variables (SBP, DBP, hemoglobin, pulse pressure). P value of < 0.05 was considered to be statistically significant. Statistical analysis were performed using the computer software SPSS 8.0

3. RESULTS

LVH was diagnosed in 81.9% of all patients. The prevalence of hypertension was 72.6%. Anemia was present in all patients. The specific data for the studied parameters are presented in Table 1. The correlations between left ventricular mass index and hemoglobin, systolic blood pressure, diastolic blood pressure and pulse pressure for each group and for all patients are presented in Table 2.

4. DISCUSSION

This study was undertaken to determine the prevalence of LVH and some factors associated with it. The prevalence of LVH is high (72.6%) in our patients. Most of the studies show prevalence 40-80% of this cardiac geometric anomaly in the pre-dialysis patients. The prevalence of hypertension was also high (81.9%) and anemia was present in all patients, independently from the stage of CKD. The prevalence of all parameters studied grows with the progression of CKD.

Of the variables tested, hemoglobin, SBP and PP predicted independently the occurrence of LVH. In the first and second group there is no significant correlation between LVMI and various parameters (Hb, SBP, and PP), although the prevalence of LVH was high in both groups. This data may be explained by the relatively small number of patients presented in relatively early stages of CKD. The third group shows correlation between LVMI and DBP, otherwise the 4th group shows a strong correlation with SBP and PP. When analyzed separately none of the groups demonstrates any correlation between lower levels of Hb and LVMI. In contrast, when all the patients were analyzed, it resulted a strong inverse correlation between levels of Hb and LVMI. By the other hand, it resulted also a strong positive correlation between SBP and PP with LVMI. We thought that this controversy data are result of the small number of patients for each group, and when we analyzed a significant number of patients the correlations emerged clearly.

Anemia contributes to volume overload. Our patients presented a high prevalence of hypertension; therefore peripheral resistance may have played a significant role in LVH observed in our patients. The analysis of dates shows that PP and SBP were predictors of LVH.

5. CONCLUSION

This study has shown a strong association between CKD and LVH in pre-dialysis patients. The patients were anemic and presented high prevalence of hypertension. In our study pulse pressure, SBP and anemia are important predictor factors for development of left ventricular hypertrophy. Different studies have shown that control of hypertension and anemia lead to a decrease of LVH prevalence. The effect of PP reduction on LVH in CKD remains to be determined. Therefore, more evidences are necessary to evaluate the role of PP reduction as a therapeutic target in the treatment of patients with CKD.

**REFERENCES**


**TABLE 1. Clinical, laboratory and echocardiography parameters by renal function. Hb- Hemoglobin, SBP – systolic blood pressure, DBP – diastolic blood pressure, PP- Pulse pressure**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>GFR 60-89,9 ml/min (n=26)</th>
<th>GFR 30-59,9 ml/min (n=30)</th>
<th>GFR 15-29,9 ml/min (n=32)</th>
<th>GFR &lt;15 ml/min (n=23)</th>
<th>Total (n=111)</th>
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<tr>
<td>Hb, mg/dL</td>
<td>8,6±1,2</td>
<td>8,2±1,8</td>
<td>7,8±1,2</td>
<td>7,3 ± 1,5</td>
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<td>SBP, mm Hg</td>
<td>160,3416</td>
<td>162,4418</td>
<td>148,0421</td>
<td>160,9412</td>
<td>157,9±17</td>
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<td>DBP, mm Hg</td>
<td>93,247</td>
<td>92,4410</td>
<td>91,8412</td>
<td>84,1496</td>
<td>90,4412,15</td>
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<td>Pulse pressure, mmHg</td>
<td>67,146</td>
<td>69,748</td>
<td>56,8412</td>
<td>76,940,8</td>
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<td>LVMI, g/m2</td>
<td>135,4055</td>
<td>145,418</td>
<td>160,32,75</td>
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**TABLE 2. Correlations values of left ventricular mass index and Hb, SBP, DBP and PP**

<table>
<thead>
<tr>
<th>Parameters</th>
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<th>Group III</th>
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<td>P</td>
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