THE INFLUENCE OF RISK FACTORS IN REMODELLING CAROTID ARTERIES IN PATIENTS UNDERGOING PERITONEAL DIALYSIS

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Abstract

Accelerated atherosclerosis and vascular calcification, with oxidative stress, endothelial dysfunction, and other factors causing the arterial stiffness, increases cardiovascular morbidity and mortality in patients on peritoneal dialysis. The aim of this paper is to assess changes in intima media thickness (IMT) at common carotid arteries (CCA) in patients with stable continuous ambulatory peritoneal dialysis (PD) and examine the relationship of these changes and other risk factors on the occurrence of atherosclerosis. The study was conducted on 35 stable PD patients (25 type 2 diabetic patients), aged 58,6 ± 10,6 years. CCA-IMT was assessed using ultrasound B-mode technique, bilaterally. Other risk factors for the occurrence of atherosclerosis were monitored through regular laboratory control. One atheromatous plaque was found in 19 patients (54,3%). Among 25 type 2 diabetic patients, vascular calcifications were found in 80% patients. In all PD patients, CCA-IMT is 0,77 ± 0,23, in PD patients with vascular calcifications CCA-IMT is 1,05 ± 0,2 mm, while in group without vascular calcifications the value of this parameter is 0,56 ± 0,09 ($p<0,01$). Significant differences were found between PD patients with and without vascular calcifications on CCA in patients age ($p<0,001$), as well as values of systolic blood pressure ($p=0,001$), serum phosphorus ($p=0,017$), product calcium and phosphorus ($p=0,021$), CRP ($p=0,039$), triglycerides ($p<0,05$) and lipoprotein (a) values ($p=0,044$). Our results suggest an important determination of common carotid arteries intima media thickness and its relation to other risk factors for the occurrence and progression of atherosclerosis in patients undergoing peritoneal dialysis.

KEY WORDS: BEN, Bosnia, endemic, non-endemic, family burden, GFR

Introduction

Arterial disease and left ventricular hypertrophy (LVH) are two main risk factors which cause an increased cardiovascular mortality rate in dialysis patients (1,2). Many peritoneal dialysis patients already have significant vascular lesions before initiating dialysis. Arterial diseases related to peritoneal dialysis (PD) are characterized by a high level of calcification in arterial wall, which is the same as in intima and media, in response to hemodynamic humoral abnormality (chronic uremia). The presence of calcification in patients on PD is linked to the increased stiffness of arteries of big capacity, especially elastic arteries like aorta and common carotid arteries (CCA) (3,4). Macrovascular diseases, including atherosclerosis and arteriosclerosis, develop abruptly in uremic patients. It is believed that they are responsible for a high incidence of ischemic cardiac disease, left ventricular hypertrophy (LVH), congestive heart disease, sudden death and stroke in these patients (5). Intima-media thickness (IMT) CCA is a strong, independent predictor of cardiovascular events in general population, just as in patients on PD. Therefore, monitoring IMT, together with other risk factors for the occurrence of atherosclerosis, will probably offer additional prognostic information for the risk of cardiovascular disease in patients on PD (6). IMT, the number of plaques and arterial remodelling are considered as predictors of accelerated atherosclerosis. An increased carotid IMT is considered as a critical lesion for the development of atherom, as well as an indicator of the weight of coronary arteries atherosclerosis (7,8). Carotid ultrasonography is one of the used imaging techniques for the assessment of atherosclerosis. The aim of this paper is to assess changes in CCA-IMT in patients with stable continuous ambulatory peritoneal dialysis (PD) using carotid doppler ultrasonography and examine the relationship of these changes and other risk factors on the occurrence of atherosclerosis.

Materials and Methods

We performed investigation at the Clinic for Nephrology of the University of Sarajevo Clinics Centre. In the study were included 35 PD patients mean aged 58,6 ± 10,6 years. All participants were clinically stable during at least 3 months prior to testing (without clinical vascular disorders, neoplasms, infectious and non-infectious inflammatory diseases or peritonitis associated with dialysis). CCA-IMT was measured using ultrasonography B-mode technique, bilaterally. IMT is the distance between echogenic outer edges of lumen-intima and media adventitia. It was measured in the end-diastolic phase, 0,5-1,0 cm proximally from the carotid bulbous on the posterior wall of the CCA. Diastole is determined according to ECG on the screen. IMT > 0,9 mm and the presence of discrete plaques are considered as markers of general atherosclerosis (2,9). The presence of arterial calcification is assessed by ultrasonography on CCA in the form of very echogenic plaques with a light white shade. Plaque is defined as localized echo structure which infiltrates in blood vessel lumen in which the distance between the connection of media – adventitia and the surface of lesion is turned to lumen 1 mm or more (9). The research included the distal part of CCA 2 cm in length. Blood pressure was measured in a sitting position three times, in intervals of 3 minutes, after at least 15 minutes of rest. Other risk factors for the occurrence of atherosclerosis are monitored through regular laboratory control. All statistical analysis were performed using SIGMA PLOT. Continuous variables were presented as a mean ± standard deviation values and compared using Student t-test. The p-value of <0,05 was consideres as significant.

Results

This study included 35 patients undergoing peritoneal dialysis, while 25 of them were type 2 diabetic patients (73,5%). Vascular calcification have been found in 74,3% of all PD patients (26/35) in compare with 22,8% participants without convincing ultrasonographic signs of atherosclerosis (p<0,001). The mean age of patients with vascular calcifications was 61,8 years, and those without them 42,5 years (p<0,001). Twenty diabetic patients (80%) were with estimated vascular calcifications of CCA (Table 1).

Patients	All	With vascular calcifications	Without vascular calcifications
Number	35 (100%)	26 (74,3%)	9 (25,7%)
Age (years)	58,6±15,6	61,8±11,8	42,5±11,0
Diabetes	25 (100%)	20 (80%)	5 (20%)

TABLE 1. Characteristics of PD patients with and without vascular calcifications in CCA

In PD patients with and without vascular calcifications on CCA, we found significant differences in next values: systolic blood pressure (p=0,001), serum phosphorus (p=0,017), product calcium and phosphorus (p=0,021), CRP (p=0,039), triglycerides (p<0,05) and lipoprotein a (Lp-a) values (p=0,044). Significant differences were not

	Total	With vascular calcifications	Without vascular calcifications	t	p
Systolic BP	150,9±21,1	157,2±17,2	131,2±21	3,523	0,,001
Diastolic BP	86,3±9,2	88,0±8,6	81,2±9,9	1,855	0,,0733
Albumin	32,88±2,7	32,65±2,82	33,7±2,1	0,1919	0,364
Ca	2,21±18,0	2,21±0,19	2,26±0,09	0,77	0,446
P	1,85±0,47	1,95±0,45	1,48±0,32	2,518	0,017
CaxP	4,15±1,2	4,38±1,24	3,2±0,53	2,427	0,021
PTH	309,12±246	287,31±230,95	390,11±301	0,980	0,33
CRP	10,61±11	12,65±11,47	3,08±3,68	2,153	0,039
Cholesterol	6,35±3,7	6,46±1,32	3,74±1,66	1,790	0,083
Triglyceride	2,48±0,83	2,60±0,84	1,81±0,30	2,03	0,05
LDL	4,11±1,41	4,14±1,46	4,02±1,32	0,178	0,859
Lp(a)	0,33±0,33	0,40±0,36	0,125±0,05	2,096	0,044
tHCY	20,9±6,99	21,17±28	20,01±6,17	0,384	0,703

TABLE 2. Relationship between cardiovascular risk factors and calcifications in CCA

	All patients	With vascular calcifications	Without vascular calcifications	t	p
Number (n)	35	26	8		
IMT mm	0,77±0,23	1,05±0,2	0,56±0,09	4,198	0,0001

TABLE 3. The mean IMT CCA value in the two investigated groups

confirmed in values of calcium (p=0,446), serum albumin (p=0,364), intact parathormons (p=0,33), cholesterol (p=0,083), lipoprotein of low density - LDL (p=0,859) and homocystein (p=0,703), in the group with and without vascular calcifications on carotid arteries (Table 2). In all PD patients CCA-IMT was 0,77 ± 0,23. In group with vascular calcifications CCA-IMT was 1,05 ± 0,2 mm, while in group without vascular calcifications the value of this parameter was 0,56 ± 0,09 (p<0,01). In 19 patients (54,3%) at least one atheromatous plaque had been found (Table 3).

Discussion

The results of number study published in the past several years confirmed accelerate atherosclerosis in the ESRD patients. During last several decades autopsy revealed close correlation between atherosclerosis of coronary arteries and the level of atherosclerotic lesions in CCA (7). IMT is considered as a surrogate of atherosclerosis in these patients. Most of the studies report significant association between prevalence of plaques detected by ultrasound and CCA-IMT (9,12). Benedetto et al. found that IMT in dialysis patients is associated with concentric left ventricular hypertrophy and that is an independent predictor of cardiovascular disease (7). It is also established that the increased arterial stiffness is an important predictor of mortality in patients with renal failure (10). According to Oh et al., patients with end-stage renal disease have a high prevalence of vascular calcifications related to microinflammation, high level of parathyroid hormone (PTH), product calcium x phosphorous (CaxP) and homocystein (tHCY) (2,11). Several studies have shown that the IMT progression predicted the risk of clinical coronary events more reliable than coronarography and lipid measurements (12,13). CCA-IMT measured in the dialysis patients ranged from 0,58 ± 0,04 mm to 1,06 ± 0,24 mm, which corresponds to our obtained results (10). Many papers and studies have confirmed the importance of age and diabetes in increase of CCA-IMT and the development of atherosclerosis in dialysis patients (11,13,14). We also found that the patients of older age (61,8±11,8 vs. 42,5±11,0) more prone to develop vascular calcification in the CCA (p<0,001). The results of this study identified higher levels of phosphorus and the product CaxP in PD group with ultrasonographic signs of atherosclerosis (CCA-IMT > 0,9 mm). Mean value of serum calcium and PTH were not significantly different between the two observed PD groups. Dialysis patients are not different from the general population by lipid abnormality and its consequences. Drueke and associates have found an independent association of LDL level and CCA-IMT in hemodialysis patients, as well as similar correlation with triglycerides (14). We had found significantly higher values of triglycerides and lipoprotein (a) in the PD group with vascular calcifications, which directly affect CCA IMT and the development of atherosclerosis. Higher levels of C-reactive protein were also detected in a group with vascular calcifications compared with the patients without vascular calcifications. Neither values of albumin, nor value of total homocysteine in participant significantly differ. The results of this study confirm high prevalence of carotid atherosclerosis in PD patients and reflect the high risk profile of these patients for development of cardiovascular events

Conclusion

- Carotid B mode ultrasonography is very important non-invasive method used to identify subclinical atherosclerosis.
- The our study revealed high prevalence of carotid calcification in PD patients and more prevalence in type 2 diabetic patients.
- The PD patients with carotid calcification and IMT more than 0,9 mm had higher levels of CRP, phosphorous, product CaxP, triglycerides and Lp(a).
- The results of this research indicate the significance of determination of IMT on CCA and its relation to other risk factors for occurrence and progression of atherosclerosis in patients undergoing peritoneal dialysis.

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