Original Article

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A Comparison of Abdominal Aortic Calcification Index (Aci) between Hemodialysis Patients and Control Group (Non-Diabetic, Non-Hypertensive Traumatic Patients)

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ABSTRACT

BACKGROUND AND OBJECTIVE: Calcification of media layer of peripheral arteries (Monkeburg sclerosis) often occurs with age and in diabetic patients with chronic renal failure. The appearance of this mark in hemodialysis patients can help predict cardiovascular events. Therefore, this study was conducted to compare the Abdominal Aortic Calcification Index (ACI) in hemodialysis and non-renal patients.

METHODS: In this cross sectional study, 84 hemodialysis patients who had the inclusion criteria were enrolled. 157 traumatic patients who had no chronic diseases like diabetes or hypertension were enrolled as the control group. The evaluation of CT scan sections, put the patients in three ACI groups (0-40), (41-80) and (81-120).

FINDINGS: A sum of 241 patients were enrolled in the study [84 (34.9%) in the case and 157 (65.1%) in the control group]. There was a significant difference in ACI between the two groups (P< 0.001). Comparing the chance of ACI in two groups, dialysis patients have a 22.67 times more chance to have severe ACI than mild ACI {CI 95% (4.987-103.062) (p=0.001)}, and also dialysis patients have a 7.32 times more chance to have severe ACI than moderate one {CI 95%(1.486-34.891) (p=0.001)}.

CONCLUSION: According to more severe ACI in dialysis patients in comparison to healthy people, renal disease and dialysis may have an essential role in vascular calcification and its complications.

KEY WORDS: *Hemodialysis, Trauma, Vascular Calcification, Abdominal Aortic Calcification*.

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Introduction

Calcification in the blood vessels is one of the most common forms of dystrophic calcification that may occur in two different sites within the vascular wall, intima, and media (1). Calcification of media layer of peripheral arteries (Monkeburg sclerosis) often occurs with age and in diabetic patients with chronic renal failure. The appearance of this mark in hemodialysis patients can be helpful in predicting cardiovascular events (1,2).

Media calcification reduces vascular compliance and the effect of hypertension and stress on myocardium and large vessels. Coronary artery disease is the end of a pathologic process characterized by calcification and stenosis, and no other treatment is definitive at this stage (3,4). The existence of a highly statistically significant association between ACI=Abdominal Aortic Calcification Index and the duration of hemodialysis on the one hand, and ACI and vascular events on the other hand in hemodialysis patients, according to the previous studies (1 and 2), now considered as undeniable principles. As far as the search is concerned, there is no direct comparison between ACI in hemodialysis patients and the healthy population of the community that does not have underlying disease such as diabetes and hypertension and chronic renal failure. Therefore, this study was performed to compare the calcification index of abdominal aorta in hemodialysis patients and those without kidney disease.

Methods

This cross-sectional study after approval by the Ethics Committee of Babol University of Medical Sciences with code MUBABOL.REC.1393.15 was performed on all hemodialysis patients of Shahid Beheshti Hospital in 2017. 84 hemodialysis patients underwent dialysis with lowflux polysulphone dialysers and dialysate calcium of 1.5 mmol/L in the last 3 months, 3 times a week for 4 hours have been enrolled in the group after receiving written consent. Among patients with trauma referring to Shahid Rajaee Hospital, Tonekabon, 157 patients age over 45 years, according to records (fasting blood glucose< 140, creatinine <1.4 and blood pressure< 140/90) without chronic underlying disease such as diabetes or hypertension and renal failure were entered as control group. In order to investigate the traumatic complications in the emergency department, they had an abdominal and hip CT scan without contrast that the abdominal aortic calcification index could be calculated as the control group. Patients undergoing dialysis for three months were included in the study.

People with acute infection, known malignancy, active collagen vascular disease such as rheumatoid arthritis, and taking phosphate binder, such as renagel or aluminum hydroxide, during the test (in cases used these drugs, drugs must be discontinued at least one month before entering the study), dialysis period less than 3 months, diabetes, being treated with anticoagulants and having a history of para thyroidectomy or parathyroid dysfunction were excluded. Hemodialysis patients underwent axial CT scan without contrast on abdominal aorta. TACI was measured according to 10 sections of the abdominal aorta from the origin of renal arteries from the aorta to the abdominal aortic bifurcation. Each section of the aorta was divided into 12 sections. (Fig 1).

Figure 1. Dividing the transverse section of the abdominal aorta into 12 sectors. In this image calcification is seen in 6 sectors

At each point, the number of parts in which calcification was observed was counted and the number for each section was summed up with a number corresponding to 9 other sections (calcifications with HU> 100), and then the total number in each patient was calculated from 120 and the ACI score was obtained for each patient (5). The ACI was calculated by a person who was unaware of the problem and was only trained

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to do the job. ACI levels were divided into 3 groups: 0-40, 41-80, and 120-81.

Similarly, ACI in traumatic patients in the control group was calculated and classified into the above three groups. To collect data, a checklist including age, sex and calcification index of abdominal aorta were collected. The Kolmogorov-Smirnov test was used to check the normal distribution of quantitative data. Chi-square test was used to analyze parametric data as well as odds ratio for comparing the chances of two groups to have ACI and p <0.05 was considered significant.

Results

A total of 243 patients (84 in the patient group and 159 in the control group) were studied. The mean age of the patients in the patient group was 50.15±16.93 years (range 18-83 years) and in the control group was 61.15±10.03 years old (range 87-45 years) (Table 1). There was a significant difference between the calcification level of abdominal aorta in both groups (p<0.0001). So that only two patients with trauma had an ACI score of between 81-120 (Fig 2). In different age groups, there was a significant difference between calcification of abdominal aorta in dialysis patients and traumatic patients (Table 2).

In ACI examination, there was a significant difference in both men and women. Male and female dialysis patients had the highest calcification of abdominal aorta (Table 3). In terms of ACI odds in the two groups, dialysis patients had 22.67 times more chance of severe ACI versus mild ACI than traumatic patients in control group. (p=0.001), CI 95% (4.987-103.062). In addition, dialysis patients, compared to traumatic subjects (control), were 32.7 times more likely than ACI to have moderate ACI (p=0.001). CI 95% (1,486-34,891)

Table 1. Basic information of patients in the two studied groups

Variables / Groups	Hemodialysis N(%)	Traumatic N(%)
Age group (year)		
≥50	41(48.8)	30(18.86)
51-70	32(38.1)	102(64.15)
71≤	11(13.1)	27(16.98)
Gender		
Man	46(54.8)	109(68.55)
Woman	38(45.2)	50(31.44)

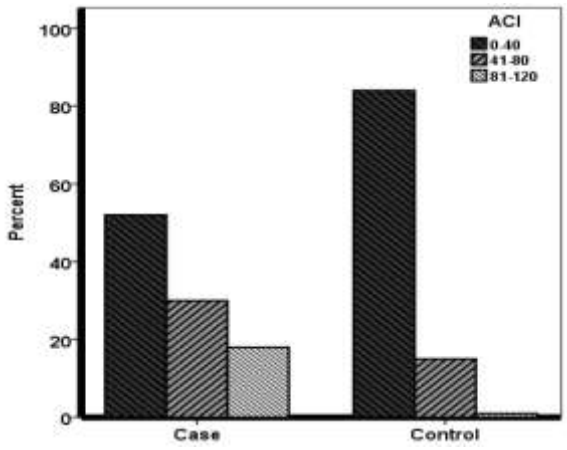

Figure 2. Distribution of abdominal aortic calcification in two groups

Table 2. ACI examination in terms of age in dialysis and control patients

ACI age group / Groups	Hemodialysis N(%)	Traumatic N(%)	P-value
≥50			
0-40	33(39.28)	30(18.86)	
41-80	7(8.33)	-	<0.0001
81-120	1(1.19)	-	
51-70			
0-40	9(10.71)	92(57.86)	
41-80	16(19.04)	8(5.03)	<0.0001
81-120	7(8.33)	2(1.25)	
70<			
0-40	2(2.38)	11(6.91)	
41-80	2(2.38)	16(10.06)	<0.0001
81-120	7(8.33)	-	

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Table 3. ACI examination according to gender in dialysis and control patients

Gender	ACI	Hemodialysis N(%)	Traumatic N(%)	P value
Male	0-40	25(29.76)	93(58.49)	<0.0001
	41-80	14(16.66)	14(8.8)	
	81-120	7(8.33)	2(1.25)	
Female	0-40	19(88.61)	40(25.15)	<0.0001
	41-80	11(13.09)	10(6.28)	
	81-120	8(9.52)	-	

Discussion

This study showed that the calcification index of abdominal aorta (ACI) in dialysis patients is higher than those without kidney disease, diabetes or hypertension, and it is well known that hemodialysis or chronic renal failure is a risk factor for aortic calcification. Cerebral and cardiovascular events are the main cause of disability and mortality in patients with End-Stage Renal Disease (ESRD) (6). Vascular calcification is more prevalent in dialysis patients than healthy people, and its diagnostic tool varies in different locations (aorta, coronary and carotid) (9-7).

Dialysis patients had more abdominal aortic calcification than traumatic patients. The ACI in traumatic patients was the most frequent in the range of 40-0, while in the range of 81-41 and 120-81, the incidence of dialysis patients was significantly higher. This simple, but highly significant statistical comparison shows well the hemodialysis role in increasing ACI in ESRD patients compared to control group, and, of course, its obvious association with vascular events in ESRD patients.

In a study done by Block and colleagues, all patients had dialysis, and two types of phosphate binder had been used, a partial conclusion was made that 65% of coronary calcifications in dialysis were presented. This study did not have a healthy control group (10).

There is also a positive and strong correlation between calcification of abdominal aorta and vascular events. In the study of Litwin et al., Intima Media Thickness (IMT) was compared in two healthy and CKD groups, and in the CKD group, more vascular damage was observed (11). In the study of Goodman et al., coronary calcification was compared in two groups of healthy and dialysis patients and the result was the same (12). Oh et al., in two groups of healthy and dialysis patients, using IMT measurements, Ct scan in carotid, reported a higher incidence of calcification in carotid of individuals with dialysis (13). The study of Huang et al. also suggested that calcification of abdominal aorta is associated with cardiovascular disease in peritoneal dialysis patients (14). OOn the other hand, the likelihood of patients with dialysis suffering from calcification of the heart valves is very high (15).

However, in all of these studies, the relationship between increased vascular calcification (carotid, coronary) and CKD progression or dialysis is observed (which is also present in our study), but in none of these cases, the calcification of abdominal aorta between dialysed individuals and healthy subjects in terms of kidney problems, diabetes and blood pressure have not occurred. In several investigations calcification has also been associated with factors such as age, diabetes, myocardial infarction, hyperlipidemia, increased fibrinogen or serum CRP, or decreased albumin, hypertension and dialysis duration (2).

Based on the results of this study, it was found that calcification index of abdominal aorta was significantly higher in patients undergoing chronic hemodialysis than in the control group (traumatic patients), which was representative of the population of normal people without the underlying disease, and this indicates the role of chronic hemodialysis (more than 3 months) in the increase in ACI in ESRD patients. The strengths and weaknesses of the study: The present study is the first study in relation to calcification of abdominal aorta,

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whose control arm is a population without underlying kidney disease or diabetes or blood pressure and this the strength of our study. As limitations of this study, because biochemical parameters such as Ca and P, Alk. P and iPTH were not available in the control group, we were not able to compare these parameters between this group and the case group (hemodialysis patients). Meanwhile, the selection bias may have occurred in the control group.

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