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Assessment of Vascular Calcification in Egyptian Patients with Chronic Kidney Disease

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Abstract: Vascular calcification is common in chronic kidney disease (CKD) and associated with increased morbidity and mortality. This calcification starts to develop in the early stages of chronic kidney disease and is present in over 50% of patients at the time of dialysis commencement. The aim of this study is to assess the degree of calcifications that may involve the main arteries (carotid, aorta) in Egyptian patients with chronic kidney disease and whether there is significant correlation between the age, Parathormone hormone (PTH), serum calcium, serum phosphorus, Ca x Ph product, cholesterol and triglycerides and these calcifications. The study was conducted on 81 individuals classified into three groups: 41 patients with stage 5 chronic kidney disease on regular hemodialysis for at least one year (group A), 30 CKD patients in predialysis period (group B) and 10 persons of normal individuals as control group (group C). All patients and control were subjected to full medical history, full clinical examination and laboratory investigations including serum calcium, Ph, (intact Parathormone hormone iPTH, Ca x Ph product, total cholesterol and triglycerides. Also CT abdomen (computed tomography of the abdomen) to assess the degree of calcification of abdominal aorta, Duplex study on the main common carotid arteries and echocardiography to assess the degree of aortic valve calcification if present were done. The results of abdominal aorta calcification (2.12± 1.44 vs 0.43± 0.63vs 0.10± 0.32) showed a highly statistical significant difference between group A and B& A and C ($P< 0.0001$) while being significant between B and C ($P<0.05$), common carotid artery calcification (0.73± 1.00 vs 0.57± 0.73vs 0.20± 0.42) showed a significant difference only between group A and C ($p<0.05$), while aortic valve calcification (0.46± 0.60vs 0.23± 0.43vs 0) showed a high significant difference between A and C& B and C ($P<0.01$). In dialysis patients abdominal aorta calcification &common carotid artery calcification and aortic valve calcification showed a significant correlation with iPTH, Cholesterol, Triglycerides ($p<0.01$). In pre-dialysis patients, common carotid artery calcification &abdominal aorta calcification and aortic valve calcification showed significant correlation with age ($p<0.01$). This study suggested increased incidence of vascular calcification in chronic kidney disease Egyptian patients on regular hemodialysis and pre-dialysis in comparison to the same age and gender of the healthy individuals. Vascular calcification in CKD patients is a very complicated multifactorial process which needs further studies.

Key words: Chronic kidney disease · Aortic valve calcification · Vascular calcification · Intact parathyroid hormone (iPTH) · Egyptian patients

INTRODUCTION

The majority of patients with chronic kidney disease have excessive vascular calcification. Cardiovascular disease and stroke is the leading cause of death in patients with end-stage renal disease that require dialysis at risk that is10-to 20- fold the age- and gender-matched general population [1]. Calcification of soft tissues and blood vessel walls occurs more frequently in dialyzed patients compared to the non-uremic population [2]. In end stage renal disease (ESRD), the presence of secondary and tertiary hyperparathyroidism, disordered

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calcium and phosphate homeostasis and the use of vitamin D-and calcium-based treatments in its therapy may all contribute to vascular calcification. Various factors decrease the rate of calcification or even reverse established calcifications, including parathyroid hormone-related peptide, bone morphogenic protein and osteoprotegerin [3].

This work aims to assess the degree of calcifications that may involve the main arteries (carotid, aorta) and aortic valve in Egyptian patients with end stage renal disease and weather there is significant correlations between the level of PTH, serum calcium, phosphorus, Ca x Ph product, cholesterol, triglycerides and the degree of vascular calcifications.

MATERIALS AND METHODS

Eighty one individuals were included in the study, (47 males and 34 females); all were selected from Al-Zahraa University Hospital, Al-Azhar University, Egypt. They were classified into three groups:

Group A: Which included 41 patients with CKD stage 5 (23 males and 18 females), aged from 26 years to 66 years, mean ± SD was (46.32±11.23 years) on regular hemodialysis for at least one year.

Group B: Included 30 patients in the pre-dialysis period (19 males and 11 females), aged from 28 years to 63 years,mean ± SD was (48.57±10.78 years) of them 17 patients are stage 4 chronic kidney disease (Cr. Cl. 15-29ml/min.), while 13 are stage 3 (Cr. Cl. 30-59ml/min.). Group C: consists of 10 healthy volunteers as control group who are age and sex matched to the patients (5 males and 5 females), aged from 25 years to 70 years mean ± SD was (44.60±14.84 years).

All groups were subjected to the following:

- Full medical history, including age and gender.
- Full clinical examination.
- Laboratory investigations including: kidney function tests, liver function tests, fasting blood glucose & 2 hour post prandial blood sugar, total serum calcium (albumin corrected), serum Phosphorus, total serum cholesterol and triglycerides. They were estimated using Hitachi 911 automated analyzer. Also, Intact parathyroid hormone (iPTH) using ELISA technique and Creatinine clearance calculated by the Cockroft-Gault equation [4]: (140-age) x body weight (kg) x F (F=1 if male, F=0.85 if female)/72 x serum creatinine

Radiological Investigations Include: CT scan of the Abdominal Aorta without IV contrast administration :

CT scans were performed with the CT scanner (high speed dual slice GE). The data acquisition parameters were:

120 kVp, 220 mAs, slice width 3 mm, gantry rotation time 0.75 s, table feed 16.5 mm/r [pitch 5.5 (x4 slices/rotation)].

The observer placed an electronic region of interest (ROI) around each area of calcification. The calcification score used is the Agatston scoring method, determines the density of the highest density pixel in each plaque and applies a weighting factor to each plaque, dependent upon the peak density in the plaque:

Density House Field unit (HU) of □130 = weight of 0;density of 130-199 = weight of 1; density of 200-299 = weight of 2; density of 300- 399 = weight of 3; density of = 400 = weight of 4.

The score for each plaque equals the plaque area (in Pixel) X Density cofactor = score in Agatston units (AU) [5] then the total score in the artery is calculated by the summation of the score in all segments.

Then the patient is given the final calcification score as follows:

Zero AU= 0 = No calcification.
0-10 AU = 1 = minimal calcification.
10-99 AU=2= mild calcification.
100-399AU=3= moderate to severe calcification.
= 400 AU=4= extensive calcification

Doppler For Assessment of The Common Carotid Arteries (cca) Calcification: The carotid arteries were evaluated at Al-Zahraa University Hospital at radiology department using Esaote ultrasonography unite equipped with MHZ linear-array transducer with facilities of real time B-mode, color coding and pulsed wave Doppler US to evaluate the presence and site of plaques. The protocol involved scanning the CCAs (Comman carotid arteries), the carotid bifurcations and the origins of the internal and external arteries. Patients were examined in a supine position, with the head in the axis of the body slightly tilted to the either side. Carotid intima media thickness (IMT) was measured as the distance between two parallel echogenic lines corresponding to the blood- intima and

media-adventitia interfaces. The normal thickness of the intima-media layer is of the order of 0.5 mm[6]. Gray scale imaging allows visualization of hypo echoic (non calcified) or hyper echoic (calcified) plaque in the vessel wall and texture either homogenous or heterogeneous and lumen surface either regular,irregular or ulcerated. The common and internal carotid arteries were scanned cross-sectionally and longitudinally

Echocardiography to assess the degree of aortic valve calcification if present. Every patient was examined by 2-D and M-mode echocardiography. The parasternal long axis, short axis (on the aortic valve) to assess the thickness and calcification of the aortic valve leaflets.

Statistical Analysis: Data was analyzed by Microsoft Office 2003 (excel) and Statistical Package for Social Science (SPSS) version 16. Parametric data was expressed as mean ± SD and non parametric data was expressed as number and percentage of the total. Comparing the mean ± SD of 2 groups was done using the student's t test. Measuring the mutual correspondence between two values was done using the Spearman correlation coefficient. P value > 0.05 is considered non-significant, value < 0.05 is considered significant and value < 0.01 is considered highly significant.

RESULTS

There was highly statistical significant increase in (mean ± SD) of iPTH in group A patients (880.08± 465.40 pg/ml) than group B (213.10±142.77 pg/ml) (P< 0.01) and there was highly statistical significant increase in (mean ± SD) of iPTH in group A (880.08± 465.40 pg/m) patients than group C (45.5 ± 19.87pg/ml) was found (P<0.01). Also there is highly statistical significant increase in mean ± SD of iPTH in group B than group C (213.10±142.77 vs 45.5 ± 19.87pg/ml) (P< 0.01) (Table 1, 2, 3). There was no statistical significant difference in the level of corrected calcium between group A (8.38± 0.90 mg/dl) and group B (8.73±0.79 mg/dl) (P > 0.05), while there was highly significant decrease in Mean ± SD of corrected calcium in group A (8.38± 0.90 mg/dl) compared to group C (9.2 ± 0.56mg/dl (P<0.01). Also there is no significant difference was obtained on comparison between groups B (8.73±0.79 mg/dl) and group C (9.2 ± 0.56mg/dl) (P> 0.05) (Table 1, 2, 3).

Mean ±SD of serum Phosphorus level in dialysis group A is higher than that in pre-dialysis group B with high statistical significant difference (5.78± 1.20 mg/dl & 4.79±0.91 mg/dl) (P<0.01). Also there was highly statistical significant increase of serum Phosphorus in patients of

Table 1: Comparative studies between group A and group B for all variables.

Variable	Group A Mean ±SD	Group B Mean ±SD	P-value
iPTH	880.08± 465.40	213.10±142 .77	0.01
Calcium	8.38 ± 0.90	8.73±0.79	0.081
Phosphorus	5.78 ± 1.20	4.79±0.91	0.001
CaxPh	48.32±10.66	41.4±5.68	0.001
Cholesterol	230.17±57.06	311.17±127.55	0.002
Triglycerides	193.05±89.42	202.70±94.67	0.666
AAC (CT)	2.12±1.44	0.43±0.63	0.0001
CAC (Doppler)	0.73±1.00	0.57±0.73	0.424
Aortic valve calcification (Echo.)	0.46±0.60	0.23±0.43	0.063

Table 2: Comparative statistics between group A and group C for all variables

Variable	Group A Mean ±SD	Group C Mean ±SD	P-value
iPTH	880.08± 465.40	45.50±19.87	0.01
Calcium	8.38 ± 0.90	9.20±0.56	0.01
Phosphorus	5.78 ± 1.20	3.83±0.30	0.01
CaxPh	48.32±10.66	35.28±3.96	0.01
Cholesterol	230.17±57.06	195.20±26.90	0.08
Triglycerides	193.05±89.42	111.90±11.62	0.01
AAC(CT)	2.12±1.44	0.10±0.32	0.01
CAC (Doppler)	0.73±1.00	0.20±0.42	0.014
Aortic valve calcification (Echo.)	0.46±0.60	0.00±0.00	0.01

AAC: Abdominal Aortic Calcification CAC: Common Carotid Calcification

Table 3: Comparative statistics between group B and group C for all variables

Variable	Group B Mean ±SD	Group C Mean ±SD	P-value
iPTH	213.10±142.77	45.50±19.87	0.01
Calcium	8.73±0.79	9.20±0.56	0.054
Phosphorus	4.79±0.91	3.83±0.30	0.01
Ca x Ph	41.4±5.68	35.28±3.96	0.01
Cholesterol	311.17±127.55	195.20±26.90	0.01
Triglycerides	202.70±94.67	111.90±11.62	0.01
AAC(CT)	0.43±0.63	0.10±0.32	0.036
CAC (Doppler)	0.57±0.73	0.20±0.42	0.062
Aortic valve calcification (Echo.)	0.23±0.43	0.00±0.00	0.006

AAC: Abdominal Aortic Calcification CAC: Common Carotid Calcification

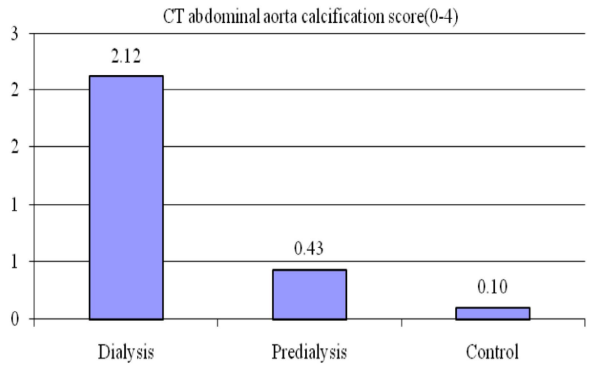


Fig. 1: Comparison between mean abdominal aorta vascular calcification score in group A (Dialysis), B (Pre-dialysis) and C (Control)

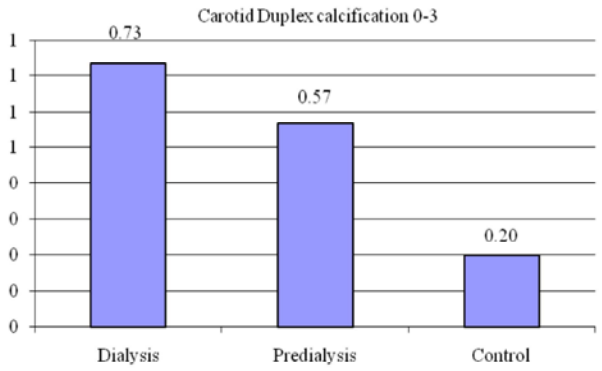


Fig. 2: Comparison between mean coronary artery calcification score in group A (Dialysis), B (Pre-dialysis) and C (Control)

group A (5.78± 1.20 mg/dl) and group B (4.79±0.91 mg/dl) than the control group (3.83 ± 0.30 mg/dl) (P<0.01) (Table 1, 2, 3). There was high statistical significant increase of Serum Ca x Ph product in patients of group A (48.32 ± 10.66 mg/dl) than group B (41.4 ± 5.68 mg^2/dl^2) and also than group C (35.28 ± 3.96mg/dl) (P< 0.01). While, there is highly statistical significant difference of Ca x Ph product in group B (41.4 ± 5.68 mg^2/dl^2 than group C (35.28 ± 3.96mg/dl) (P< 0.01) (Table 1, 2, 3). The (Mean ±SD) of abdominal aorta calcification in the patients of group A was highly significantly increase than group B (2.12 ± 1.44 vs 0.43 ± 0.63) (P< 0.01) and also than group C (0.10 ± 0.32) (P< 0.01). While, the abdominal aorta calcification in the pre-dialysis group B was significantly higher than group C (0.43 ± 0.63 vs 0.10 ± 0.32) (P <0.036) (Fig. 1& Table1, 2, 3).

As regards Mean ±SD of common carotid arteries calcification by doppler study, group A score was (0.73 ± 1.00), group B score was (0.57 ± 0.73), while group C score was (0.20 ± 0.42). There was no statistical significant difference was found between group A and B (P > 0.05), but the Mean ±SD of common carotid arteries calcification score in the patients of group A was significantly higher than group C (P <0.01). On the other hand, no statistical significant difference was found between group B and group C (P > 0.05) (Fig.2 &Tables 1, 2, 3). Regarding aortic valve calcification by Trans-thoracic Echocardiography, group A had a mean calcification score of (0.46 ± 0.60), while group B patients had a mean score of (0.23 ± 0.43) and group C no aortic valve calcification were detected. As regards Mean ±SD, no statistical significant difference was obtained between the patients in group A and B (P > 0.05), but the patients in group A had highly significant mean ±SD aortic valve calcification score higher than group C (P< 0.01). Also the patients in group B had highly significant mean ±SD aortic valve calcification score higher than group C (P< 0.006) (Fig. 3, Tables 1, 2, 3).

Correlation study of the different calcification scores in the dialysis group regarding iPTH, cholesterol and triglycerides showed high significant correlation with all parameters. While the phosphorus and Ca x Ph product showed high significant correlation with abdominal aorta calcification and aortic valve calcification, with non significant correlation with carotid artery calcification score. On the other hand the calcium showed non significant correlations with all parameters.

Table 4: Correlation between all variables obtained in relation to the different calcification scores in Group A

Variable	Abdominal Aorta calcification score		Carotid calcification score		Aortic valve calcification score	
iPTH	0.813	High sig.	0.624	High sig.	0.586	High sig
Calcium	0.178	Non sig.	-0.052	Non sig.	0.240	Non sig.
Phosphorus	0.556	High sig.	0.202	Non sig.	0.393	High sig
Ca x Ph product	0.603	High sig.	0.175	Non sig.	0.500	High sig
Cholesterol	0.731	High sig.	0.571	High sig.	0.537	High sig.
Triglycerides	0.75	High sig.	0.638	High sig.	0.648	High sig.
Age	0.280	Non sig.	0.648	High sig.	0.224	Non sig.
Duration of Dialysis	0.637	High sig.	0.07	Non sig.	0.603	High sig.

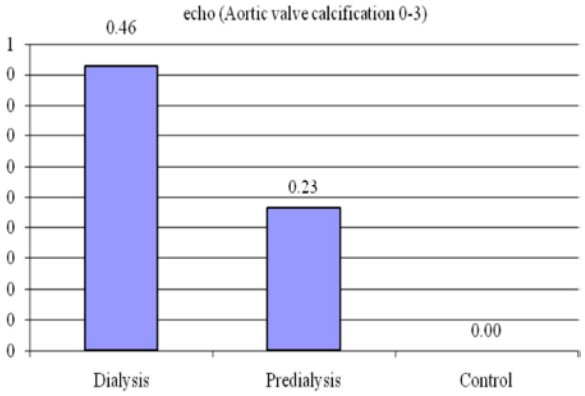


Fig. 3: Comparison between mean Aortic valve calcification score in group A (Dialysis), B (Pre-dialysis) and C (Control)

Age showed non significances with abdominal aorta and aortic valve calcification and high significance with carotid score. While the dialysis duration is highly significant with abdominal aorta and aortic valve calcifications while non significant with carotid calcification score (Table 4).

Correlation coefficient was done to evaluate the correlation between abdominal aorta calcification and other parameters in the pre-dialysis group. Abdominal aorta calcification had a non significant correlation with Ca x Ph product and the stage of chronic kidney disease, being negative non significant with Cholesterol and Triglycerides. On the other hand, it showed a high significant positive correlation with age, iPTH, Phosphorus, Carotid arteries calcification and aortic valve calcification. Also it showed a high significant negative correlation with corrected serum calcium (Table 5).

Our study showed a high prevalence (80%) of radiological vascular calcifications in hemodialysis patients, this percentage represents calcifications in the abdominal aorta, aortic valve and carotid arteries collectively (Fig. 4). But to specify, abdominal aorta calcifications was found in 78% of the hemodialysis patients with different scores, while 41% showed aortic valve calcifications and also 41% suffers from carotid artery calcifications with different scores (Fig. 5). While, in the pre-dialysis group, only 46.5% have radiological evidence of vascular calcifications. But to prescribe each item, 36.6% showed AAC, 23.3% showed aortic valve calcifications and 43% showed carotid calcifications (Fig.4 & 5).In group C, 20% only showed radiological evidence of vascular calcifications, 10% have abdominal aorta calcification, no evidence of aortic valve calcifications, while 20% showed evidence of carotid artery calcifications. But all calcifications in this group were of the score 1(Fig.4&5).

Table 5: Correlation between abdominal aorta calcification score and other parameters in the pre-dialysis group (B)

Predialysis	A.aorta calcificationr value	P value	Significance
Age(year)	0.673	< 0.01	High sig
iPTH	0.518	< 0.01	High sig
Calcium	-0.539	< 0.01	High sig
Phosphorus	0.484	< 0.01	High sig
Ca x P	0.274	> 0.05	Non sig
Cholesterol	-0.308	> 0.05	Non sig
Triglycerides	-0.257	> 0.05	Non sig
Carotid calcification	0.805	< 0.01	High sig
Aortic valve calcification	0.508	< 0.01	High sig
Stage of CKD	0.288	> 0.05	Non sig

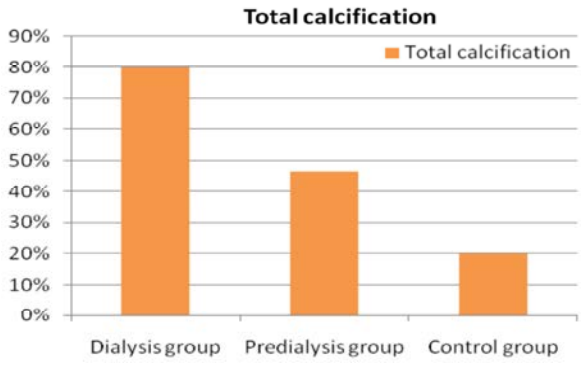


Fig. 4: Total calcification percentages in the study groups

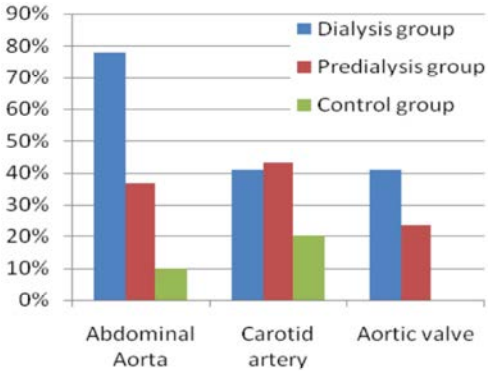


Fig. 5: Percentage distribution of diffeent calcifications in the studied groups

DISCUSSION

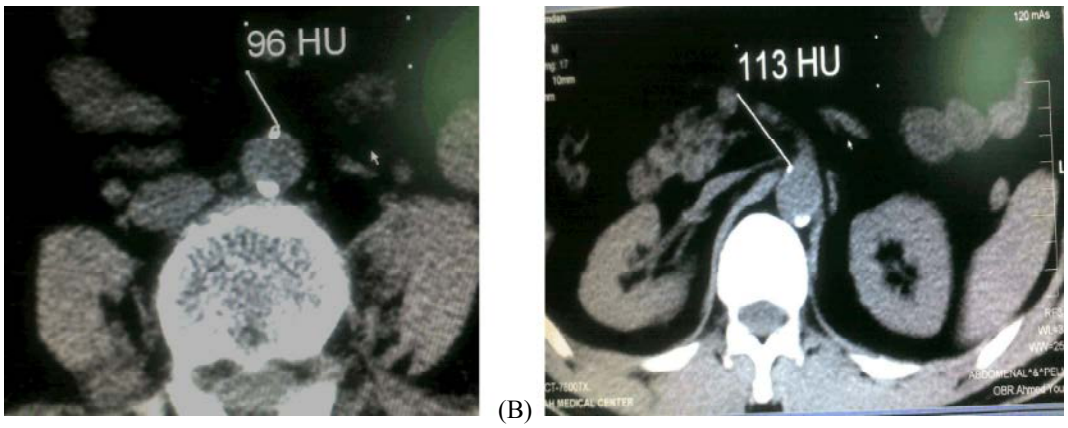
Patients with chronic kidney disease are at risk for vascular calcification because of multiple risk factors that induce vascular smooth muscle cells to change into a chondrocyte or osteoblast-like cell; high total body burden of calcium and phosphorus due to abnormal bone metabolism; low levels of circulating and locally produced inhibitors; impaired renal excretion; and current therapies [7]. Vascular calcification, which is associated with arterial stiffness, is now known to be an important predictor of cardiovascular and all-cause mortality in patients with renal disease. This calcification starts developing in the early stages of CKD and is present in over 50% of patients at the time of dialysis commencement [8]. Once calcification is present it continues to progress, though some medications have been shown to slow this progression. Vascular calcification and bone abnormalities are now both encompassed by the term of CKD-mineral bone disorder (CKD-MBD) and are thought to be part of the same disease process in CKD. Vascular calcification and arterial stiffness have been extensively researched in the renal population and many factors are known to be associated with their presence and progression. This calcification is an important factor to be considered in the management of the renal patient but there are different methods available for its measurement [8].

In our study, abdominal aorta calcifications, was found in 78% of the patients on hemodialysis with different scores, while 41% of patients showed aortic valve calcifications and also 41% suffers from carotid artery calcifications with different scores. While, in the pre-dialysis group, 36.6% showed abdominal aorta calcification, 23.3% showed aortic valve calcifications and 43% showed carotid arteries calcifications. In group C, 20% only showed radiological evidence of vascular calcifications, 10% have abdominal aorta calcification, no evidence of aortic valve calcifications, while 20% showed evidence of carotid artery calcifications. But all calcifications in this group were of the score 1.

In dialysis group, abdominal aorta calcification had a non significant correlation with age and calcium. On the other hand, it showed a highly significant positive correlation with iPTH, Phosphorus, Ca x Ph product, Cholesterol, Triglycerides, Carotid arteries calcification, aortic valve calcification and duration of dialysis.

In pre-dialysis group, abdominal aorta calcification had a non significant correlation with Ca x Ph product and the stage of chronic kidney disease and has a negative non significant correlation with cholesterol and triglycerides. On the other hand, it showed a highly significant positive correlation with age, iPTH, Phosphorus, carotid arteries calcification and aortic valve calcification. Also it showed a highly significant negative correlation with corrected serum calcium. As Regards abdominal aorta calcification, higher incidence was reported by Nigel *et al.* [9], where they recruited forty eight patients with end stage renal disease for non contrast dual slice CT scan of the abdominal aorta and discovered the radiological evidence of vascular calcifications in 90% of their patients. They also concluded that there is a high prevalence of vascular calcifications in pre-dialysis CKD patients, worse with increasing age, triglycerides and reducing renal function.

In the CORD (Calcification Outcome in Renal Disease) study done by Eero *et al.* [10], a total of 47 centers in six European countries participated in this cross-sectional study, a lateral lumbar radiograph was



(A) (B)

Fig. 6 A,B: Plain axial CT scan of the abdomen for two different patients revealing tiny calcified atheromatous plaque within the wall of lower abdominal aorta (96,113 HU) denoting minimal degree calcification.

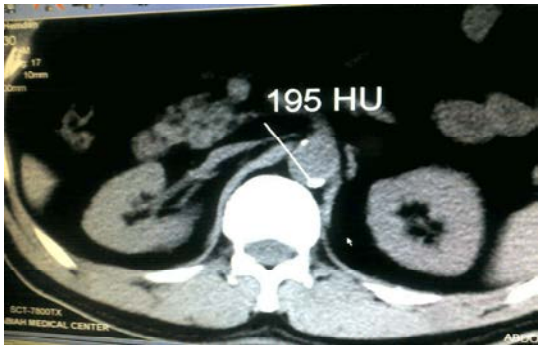


Fig. 7: Axial CT scan of the abdominal aorta reveling calcified atheroma (195HU) grade I keeping with mild degree calcification.

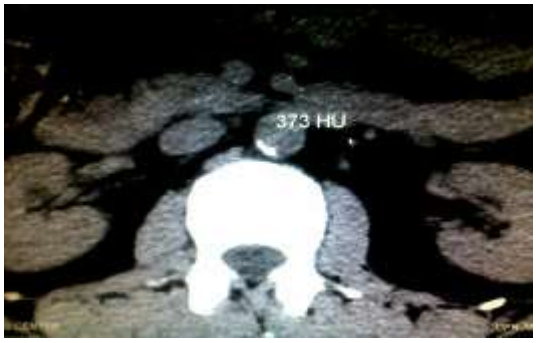


Fig 9: Axial CT scan of the abdominal aorta showing posterior wall calcified plaque (373HU) grade III denoting moderate to marked degree calcification.

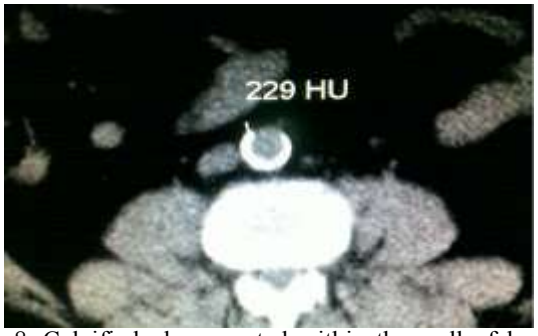


Fig. 8: Calcified plaque noted within the wall of lower abdominal aorta noted by axial CT cut of (229HU) grade II keeping with mild to moderate calcification.

obtained in 933 patients, their results were close to our results, as calcification (abdominal aorta calcification score =1) was present in 81% of the patients. The main findings were severe premature calcification of the abdominal aorta that was related to age, duration of dialysis and history of cardiovascular disease, on the other hand 19% of patients had no visible calcification in their abdominal aorta, even though some of them were >80 years of age. The present study also coincidence with the study of Shigeru *et al.* [11], who studied 101 adult Japanese patients and found that 82% had abdominal aortic calcification (50, 83 and 91% for CKD stages 3, 4 and 5, respectively). Our study is partially contrary to Stephanie *et al*. [12], as they have shown that age and dialysis duration are associated with presence of aortic calcification, being contrary to us only in the issue of age. Adragao *et al.* [13], has verified in a group of dialysis patients that simple vascular calcification is an independent predictor of either aortic or mitral valve calcification. Patients with vascular calcifications have an increased risk of having also valvular calcification. These results suggest that calcification is a systemic disorder in dialysis patients and it is possible that some of the factors involved in the pathogenesis of vascular calcification might also be involved in the pathogenesis of valvular calcification.

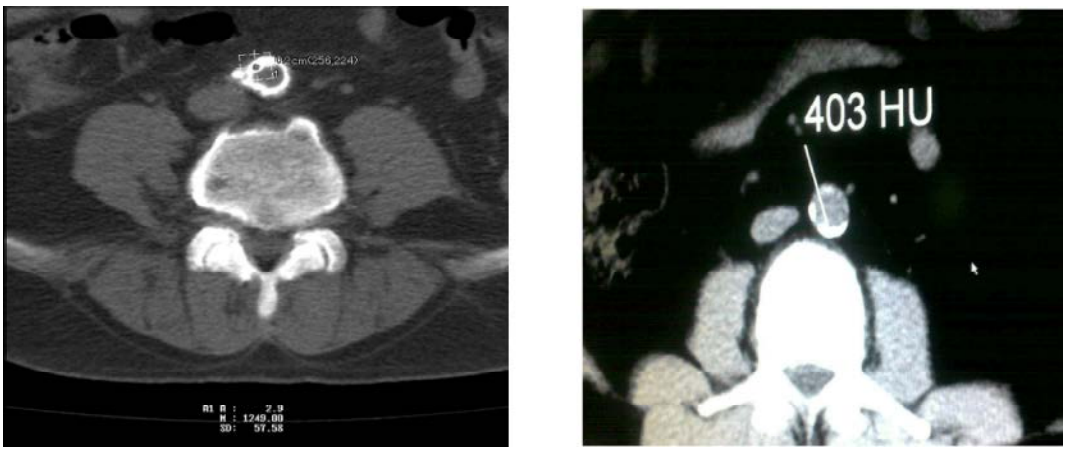


Fig. 10: Two different patients with calcified aortic wall plaque of (403,1200HU) denoting grade IV (extensive calcification).

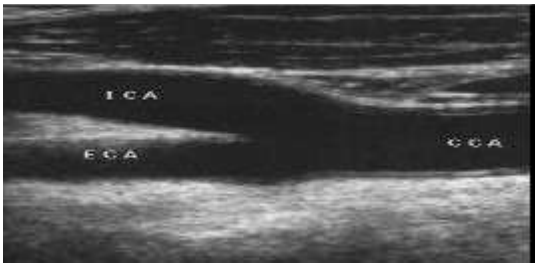


Fig. 11: Gray scale dupplex US study of the CCA and its bifurcation reveled diffuse mild intimal thickening 0.9 cm with surface irregularities.

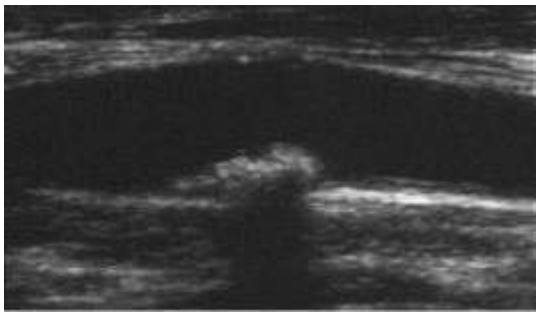


Fig 12: M-mode dupplex US scan of the carotid bulb showing echogenic (calcified) posterior wall atheroma with surface irregularities keeping with ulceration measuring 1.8 x1.3 cm with no significant haemodynamic changes.

In our study, in dialysis group, it showed a highly significant correlation between common carotid artery calcification and iPTH, cholesterol, triglycerides and age. On the other hand, it showed a non significant correlation with Calcium, Phosphorus, CaxPh product and duration of dialysis.

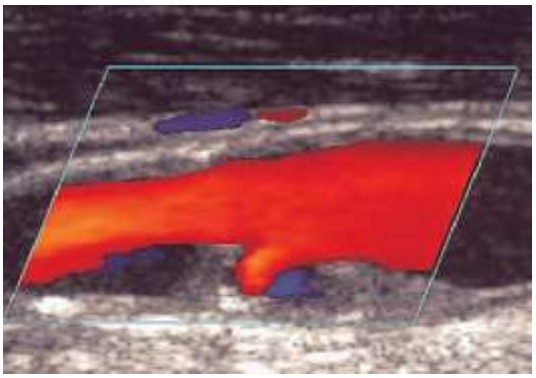


Fig. 13: Color dupplex US of CCA revealing significant, homogenous, slightly echogenic non calcified atheroma posterior wall atheroma with intimal ulceration measuring 2x1.6 cm with significant (more than 50% stenosis).

In pre-dialysis group, common carotid artery calcification showed a high significant correlation with serum iPTH and age. But it showed significant correlation with Phosphorus and negative significant correlation with Calcium. While, showed a non significant correlations with Ca x Ph product, cholesterol, triglycerides and the stage of CKD. In a study on Chinese population, LuXia *et al.* [14], have concluded that in population older than 40 years, carotid artery intimal medial thickness was significantly higher in subjects with early-stage CKD. The prevalence of common carotid artery calcification and carotid artery plaques was examined in a cross sectional study done by Sumida *et al.*[15], using multidetector computed tomography and high-resolution B-mode ultrasonography, respectively, in 135 patients with ESRD at the start of hemodialysis, common carotid artery

Fig. 14: Non significant calcified atheroma noted within the carotid bulb and extending to the origin of the internal carotid arteries, by gray scale dupplex US.

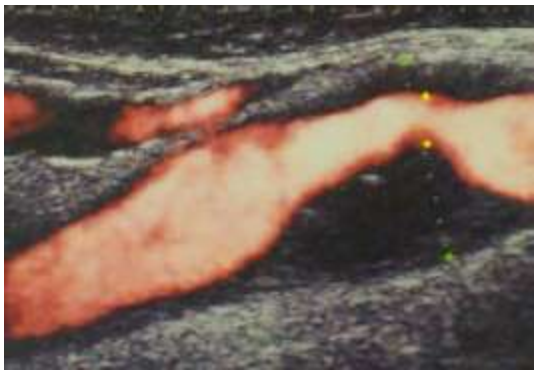


Fig. 15: Power dupplex study showing significant, homogenously hypo echoic, non calcified mainly within the posterior wall of CCA with significant (more than75%) stenosis.

calcification and carotid artery plaques were found in 71% and 65%, of the patients respectively, while in our study in the dialysis group it was 41%.

Our study coincides partially with Sumida *et al.* [15], which showed that common carotid artery calcification was significantly associated with age, dyslipidemia, calcium x ph product as we are, contrary to this study that our results showed that in the dialysis group common carotid artery calcification is not correlated to Ca x Ph product. In a study of 47 hemodialysis patients, without history of major cardiovascular complications, Common carotid artery intima media thickness and presence and thickness of atherosclerotic plaques were measured with ultrasound and coronary artery calcification with multidetector computed tomography. The study revealed close relationships between coronary artery calcification, Common carotid artery intima media thickness and the thickness of atherosclerotic plaques in dialysis patients. It may indicate that both vascular

Fig. 16: Power dupplex carotid US scan there is significant calcified atheroma noted within the carotid bulb extending to the origin of ECA measuring 0.9 x1.3 cm.

calcification and atherosclerotic lesions frequently coexist in patients with end stage renal disease and common carotid artery intima -media thickness that could serve as a surrogate marker of vascular calcification [16].

Regarding Aortic valve calcification, in our study in dialysis group, it showed a high significant correlation with serum iPTH, Phosphorus, Ca x Ph product, cholesterol, triglycerides, common carotid artery calcification, aortic valve calcification and dialysis duration, On the other hand, it showed a non significant correlation with Calcium and age.

In pre-dialysis group, aortic valve calcification had a high significant correlation with age, abdominal aorta calcification and negative high significance with Calcium. But it showed significant correlation with iPTH, common carotid artery calcification and Phosphorus. While, non significant correlations were obtained with Ca x Ph product, cholesterol, triglycerides and the stage of chronic kidney disease. Forty one of our hemodialysis patients showed aortic vascular calcification, while Yusuf *et al*. [17] have found that among forty-four patients on hemodialysis, valvular calcification was observed in 21 patients. Contrary to our study, Yusuf *et al*.[17], have found no significant differences with respect to phosphorus, parathyroid hormone and Ca ×Ph product. This study coincides with Leskinen *et al*. [18], who have found that the duration of dialysis is a risk factors for valvular calcification in chronic kidney disease and concluded that valvular calcification is common in these group, closely associated with findings of intimal arterial disease and the combined prevalence of mitral or aortic valve calcification were 31% in pre-dialysis patients, 50% in dialysis patients and 12% in controls.

CONCLUSIONS

The study has concluded that increased vascular calcifications in chronic kidney disease patients on regular hemodialysis and pre-dialysis patients in comparison to the same age and gender of the healthy individuals is a very complicated multifactorial process which needs further studies.

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