Original Article



# Correlation Between Calcium Phosphorus Product and Carotid Intimal-Medial Thickness in Patients of Chronic Kidney Disease Presenting to a Tertiary Care Hospital

**Haroon Ayub, Muhammad Farooq Mehr Ghulam and Muhammad Faisal Hashmi**

## ABSTRACT

**Objective:** To determine the correlation between Calcium Phosphorus product and carotid intimal-medial thickness in patients of chronic kidney disease presenting to a tertiary care hospital.
**Study Design:** Cross sectional study.
**Place and Duration of Study:** This study was conducted at the Department of Nephrology, Shaikh Zayed Hospital Lahore from 29-10-2016 to 28-04-2017.
**Materials and Methods:** One hundred and ten chronic kidney disease patients presenting to the Nephrology Unit of Shaikh Zayed Hospital Lahore. Patients were either gender, having age ≥30 years and ≤60 years with chronic kidney disease for at least 3 months. Patients fulfilling the inclusion and exclusion criteria were enrolled in the study. An informed consent was taken from the patients before including them in the study. Demographics of the patient which include name, age, gender, and carotid intimal-medial thickness was recorded. Blood samples for estimation of serum calcium and phosphorous were taken by using aseptic measures and standard procedure by the researcher himself and were sent immediately to the laboratory for serum analysis. Results were collected the next day by the researcher and Confidentiality of the data was ensured. Pearson correlation coefficient was calculated to measure the correlation between calcium phosphorus product and mean arterial pressure.
**Results:** The mean age of the patients was 52.6±8.33 years. Gender distribution shows that 56.4% (n=62) were males while 43.2% (n=48) were females. The mean duration of chronic kidney disease (CKD) was 8.81 years. The mean calcium phosphorus product and carotid intimal medial thickness (CIMT) was 57.2±7.19 and 0.45±0.09 respectively. There was a positive correlation between calcium phosphorus product and CIMT with a Karl Pearson correlation coefficient of 0.671 with pvalue <0.001. Data stratified with regards to age, gender and duration of CKD.
**Conclusion:** Calcium phosphorus product is positively correlated with carotid intimal medial thickness (CIMT) in patients with chronic kidney disease (CKD).
**Key Words:** Calcium phosphorus product, carotid intimal medial thickness, chronic kidney disease

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## INTRODUCTION

Disorders of calcium and phosphorus metabolism play an important role in the development of secondary hyperparathyroidism in patients with chronic kidney disease (CKD). These disturbances not only lead to mineral bone disease (renal osteodystrophy) but are predispose to cardiovascular disease. Calcium and phosphorus homeostasis is of utmost importance in maintaining a normal milieu in CKD patients. Disorders of calcium and phosphate can importance in maintaining of normal milieu in CKD patients. Disorders of calcium and phosphate can culminate in calcification of cardiac valves and acceleration of formation of vascular plaques.[1]

Abnormalities of calcium and phosphorus in CKD result in vascular calcification. This vascular calcification is associated with poor cardiovascular outcome.[2,3] Vascular calcification can manifest itself in the form of arterial stiffness or atherosclerosis. Arterial stiffness leads to increased afterload and precipitates left ventricular heart failure.[4,5]

Increased atherosclerosis on the other hand results in plaque formation. Atherosclerosis can be identified by various techniques like measurement of carotid intimal

Department of Department of Nephorology, Shaikh Zayed Hospital, Lahore.

Correspondence: Dr, Haroon Ayub, Consultant Nephrologist, Shaikh Zayed Hospital, Lahore.
Contact No: 0301-8430074
Email: haroonayub177@gmail.com

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medial thickness (CIMT) by ultrasonography, CT scan and latero-abdominal plain radiography.[6,7]

Calcium and phosphorus product is related to vascular calcification. Hyperphosphatemia, secondary hyperparathyroidism and metastatic calcification are all involved in the formation of atheromatous plaques in carotid vessels. These plaques can be analyzed by measuring CIMT.[6]

# MATERIALS AND METHODS

This study was carried out at Nephrology Department Shaikh Zayed Hospital Lahore from 29-10-2016 to 28-04-2017. Patients with either gender, having age ≥30 years and ≤60 years and with chronic kidney disease for at least 3 months were included. Patients with primary or tertiary hyperparathyroidism determined by serum PTH levels >70ng/L, known history of peripheral vascular disease, malignancy or diagnosed with calciphylaxis, diabetic patients (fasting BSR >126mg/dL) or taking antidiabetic drugs, history of previous carotid surgery, ischemic heart disease or stroke, current smokers or history of smoking during last year were excluded. Patients fulfilling the inclusion and exclusion criteria were enrolled in the study. An informed consent was taken from the patients before including them in the study. Demographics of the patient which include name, age, gender, medical registration number, address and contact number was recorded, Carotid intimal-medial thickness was determined as per operational definition by consultant radiologist and was noted in the proforma as well. Blood samples for estimation of serum calcium and phosphorous were taken by using aseptic measures and standard procedure by the researcher himself and were sent immediately to the laboratory for serum analysis. Results were collected the next day by the researcher and Confidentiality of the data was ensured.Pearson correlation coefficient was calculated to measure the correlation between calcium phosphorus product and mean arterial pressure. Data was stratified for age, gender and duration of CKD to deal with effect modifiers. Post stratification Karl Pearson correlation coefficient was applied.

# RESULTS

The mean age of the patients was 52.6±8.33 years. 99 (90%) patients had age 40-60 years, while 11 (10%) patients had age 18-39 years (Table 1). Gender distribution shows that 62 (56.4%) were males while 48 (43.2%) were females (Table 2). The mean duration of chronic kidney disease (CKD) was 8.81 years. The mean calcium phosphorus product and carotid intimal medial thickness (CIMT) was 57.2±7.19 and 0.45±0.09 respectively.There was a positive correlation between calcium phosphorus product and CIMT with a Karl Pearson correlation coefficient of 0.671 with pvalue <0.001 (Table 3).After stratifying the data for gender the correlation coefficient between calcium phosphorus product and CIMT was 0.390 in males and 0.873 in females (Table 4). When stratified with respect to duration of CKD the correlation coefficient between calcium phosphorus product and CIMT was 0.587 in patients having CKD for < 5 years, while the coefficient was 0.988 in patients having CKD for > 5 years (Table 5).

**Table No.1: Age distribution (n=110)**

| Age (years) | No. | % |
|---|---|---|
| 18-39 | 11 | 10 |
| 40-60 | 99 | 90 |
| **Total** | **110** | **100** |
| **Mean ± SD** | **52.0 ± 8.33** | |

**Table No.2: Gender distribution (n=110)**

| Gender | No. | % |
|---|---|---|
| Male | 62 | 56.4 |
| Female | 48 | 43.8 |

**Table No.3: Correlation between calcium phosphorus product and CIMT (n=110)**

| | CIMT | Ca×P |
|---|---|---|
| **CIMT** | | |
| Pearson correlation | 1 | .671* |
| Sig. (2-tailed) | | .000 |
| N | 110 | 100 |
| **Ca x P** | | |
| Pearson correlation | .671** | 1 |
| Sig. (2-tailed) | .000 | |
| N | 110 | 110 |

**Correlation is significant at the 0.05 level (2-tailed)

**Table No.4: Stratification of correlation between calcium phosphorus product and CIMT with regards to gender (n=110)**

| Gender | CIMT | Ca×P |
|---|---|---|
| **MALE** | | |
| **CIMT** | | |
| Pearson correlation | 1 | .300** |
| Sig. (2-tailed) | | .002 |
| N | 62 | 62 |
| **Ca x P** | | |
| Pearson correlation | .390** | 1 |
| Sig. (2-tailed) | .002 | |
| N | 62 | 62 |
| **FEMALE** | | |
| **CMIT** | | |
| Pearson correlation | 1 | .873** |
| Sig. (2-tailed) | | .000 |
| N | 48 | 48 |
| **Ca x P** | | |
| Pearson correlation | .873** | 1 |
| Sig. (2-tailed) | .000 | |
| N | 48 | 48 |

** Correlation is significant at the 0.05 level (2-tailed).

**Table No.5: Stratification of correlation between calcium phosphorus product and CIMT with regards to duration of CKD (n=110)**

| Duration of CKD | CIMT | Ca×P |
|---|---|---|
| **<5 years** | | |
| **CIMT** | | |
| Pearson correlation | 1 | .587** |
| Sig. (2-tailed) | | .000 |
| N | 80 | 80 |
| **Ca x P** | | |
| Pearson correlation | .587** | 1 |
| Sig. (2-tailed) | .002 | |
| N | 80 | 80 |
| >5 years | | |
| **CMIT** | | |
| Pearson correlation | 1 | .988** |
| Sig. (2-tailed) | | .000 |
| N | 30 | 30 |
| **Ca x P** | | |
| Pearson correlation | .988** | 1 |
| Sig. (2-tailed) | .000 | |
| N | 30 | 30 |

**. Correlation is significant at the 0.05 level (2-tailed)

# DISCUSSION

This cross sectional study was conducted to calculate the correlation between calcium phosphorus product and CIMT in patients with CKD in a tertiary care hospital. Mineral bone disease is a very common problem in patients with CKD. Cardiovascular disease is highly prevalent in patients with CKD.[3]

Vascular calcification leading to arterial stiffness and atherosclerosis is the main culprit for cardiovascular disease and mortality in patients with CKD. Carotid intimal medial thickness is non-invasive parameter to judge the amount of atherosclerosis in the vasculature. CIMT is also correlated to cardiovascular health in these patients.[8,9]

The mean age of the patients was 52.6±8.33 years. 90% (n=99) of the patients had age 40-60 years, while 10 % (n=11) of patients had age 18-39 years. This showed that most of the patients were above 40 years of age depicting the burden of disease in old age. In a study reported by Sharma,the mean age of patients was 46.2±15.3 which is comparable with our study.Gender distribution shows that 56.4% (n=62) were males while 43.2% (n=48) were females. In a similar study reported by Sharma,57 were male and 43 patients were female which is comparable with our study.[10]The patients were thus more or less equally distributed with respect to age.The mean duration of chronic kidney disease (CKD) was 8.81 years.

The mean calcium phosphorus product and carotid intimal medial thickness (CIMT) was 57.2±7.19 and 0.45±0.09 respectively. The recommended calcium phosphorus product in CKD is less than 55. Thus our patients had mean product above the recommended limit. This depicts the unsatisfactory and inadequate control of mineral bone disease in CKD in our part of the world and warrants tight scrutiny by nephrologists in this regard.The mean CIMT was also on the higher side highlighting the increased burden of cardiovascular disease in CKD in our patients.

There was a positive correlation between calcium phosphorus product and CIMT with a Karl Pearson correlation coefficient of 0.671 with pvalue 0.000. This positive correlation is in concert with previous studies in this regard.After stratifying the data for gender the correlation coefficient between calcium phosphorus product and CIMT was 0.390 in males and 0.873 in females. These figures are very interesting depicting increased correlation in females as compared to males. Although males are at a higher risk of cardiovascular disease than females, this scenario was reversed in our study. The reason could be the loss of cardio-protective factors in females with CKD leading to increased atherosclerosis.[9]

When stratified with respect to duration of CKD the correlation coefficient between calcium phosphorus product and CIMT was 0.587 in patients having CKD for <5 years, while the coefficient was 0.988 in patients having CKD for >5 years. This showed that as the duration of CKD increases, the amount of vascular calcification increases. This culminates into increased atherosclerosis.

# CONCLUSION

Calcium phosphorus product is positively correlated with carotid intimal medial thickness (CIMT) in patients with chronic kidney disease (CKD).

**Author's Contribution:**

| | |
|---|---|
| Concept & Design of Study: | Haroon Ayub |
| Drafting: | Muhammad Farooq<br>Mehr Ghulam |
| Data Analysis: | Muhammad Faisal<br>Hashmi |
| Revisiting Critically: | Haroon Ayub,<br>Muhammad Farooq<br>Mehr Ghulam |
| Final Approval of version: | Haroon Ayub |

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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