

**A study on the relationship between parameters of renal
osteodystrophy and the development of peripheral and
aortic vascular calcification in chronic renal failure
patients**

Thesis

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To my great Parents,
(Two true gems in my life)
To my great brother Fady
And
To my dear husband Akram

Abstract

✚ Background and aims:

Hemodialysis (HD) patients belong to the group of patients with a high prevalence of cardiovascular disease. Atherosclerosis is the most frequent cause of cardiovascular morbidity in patients with end-stage renal disease (ESRD). There is a high prevalence of vascular calcification among ESRD patients on hemodialysis and this is correlated to the presence of preexisting cardiovascular disease.

The aim of the present study was to test the correlation between various calcification scores and cardiovascular morbidity in patients with end stage renal disease on dialysis.

✚ Subjects and methods:

91 ESRD patients on regular hemodialysis at Kasr ElAini Hemodialysis Unit and Kasr ElAini Nephro-Urology Unit (King Fahd Unit) were recruited to participate in the study in observational period 18 months. The included patients were 44 males and 47 females . Patients below age 18 years and pregnant women were excluded.

All subjects incorporated in the study were evaluated thoroughly by history taking, clinical examination and routine laboratory investigations for hemodialysis patients. Vascular calcification was assessed by non-contrast CT abdomen ,lateral lumbar x ray and x rays of both hands and pelvis.

✚ Results:

We found a high prevalence of vascular calcification using six different radiological scores among ESRD patients on hemodialysis which increased progressively from proximal to distal along the abdominal aorta. This prevalence was higher in our study when measured by CT compared to plain X rays. Frequency distribution of vascular calcification by CT thorax score was 24.3% , CT suprarenal score was 33.7% , CT infrarenal score was 47.2% , CT bifurcation score was 42.3%, Kauppila score was 24.4% , and by Adraogo score was 34.1%.

We also found a positive correlation between calcification scores and diabetes mellitus , age and other factors correlating to the presence of vascular calcification including phosphate level, triglycerides, parathyroid hormone and dialysis adequacy as measured by kt/v urea.

We also found that cardiovascular disease in our study population was correlated in logistic regression analysis with age (P value = 0.001) and BMI (P value = 0.02) and negatively correlated with Kt/v urea (P value =0.006).

We also found that vascular calcification scores were also correlated positively with the presence of cardiovascular disease.

Conclusions:

There is a high prevalence of vascular calcification among hemodialysis patients and this is more readily predicted by CT based technique .This vascular calcification correlated positively with the presence of pre-existing cardiovascular disease.

Key words: Chronic kidney disease-Cardiovascular disease-Vascular calcification.

Table of contents

	Page
• Acknowledgment.....	4
• List of tables.....	6
• List of figures.....	8
• List of abbreviations.....	11
• Introduction and aim of the work.....	16
• Review of literature:	
○ Chapter 1: Cardiovascular diseases in chronic renal failure patients.	18
▪ Introduction:.....	18
▪ Epidemiology of cardiovascular disease in chronic kidney disease.....	19
▪ Risk factors for cardiovascular disease In chronic kidney disease patients.....	23
▪ Manifestations of CVD.....	52
○ Chapter 2: Vascular calcification in chronic renal failure patients.	90
▪ Definition of vascular calcification	90
▪ Prevalence of vascular calcification	90
▪ Pathogenesis and mechanism of vascular calcification	92
▪ Detection of vascular calcification	106
▪ Prevention and treatment of vascular calcification...	123
• Patients and methods.....	130
• Results.....	135
• Discussion.....	160
• Conclusion	165
• Recommendations.....	167
• References.....	168
• الملخص العربي.....	212



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List of tables

• Table 1.1	Risk factors for cardiovascular diseases in chronic kidney disease patients.	24
• Table 1.2	Direct or Indirect Consequences of Elevated Serum Phosphorus.	48
• Table 1.3	Cardiovascular Diseases in Chronic Kidney Disease	54
• Table 2.1	Inhibitors of vascular calcification.	103
• Tables 4.1/4.2	Master tables of all patients included in the study.	136-141
• Table 4.3	Descriptive statistics of demographic and laboratory data of patients included in the study.	142
• Table 4.4	Frequency distribution of clinical data of patients included in the study.	144
• Table 4.5	Frequency distribution of treatment of patients included in the study.	144
• Table 4.6	Descriptive statistics of CT thorax, CT suprarenal, CT infrarenal Kauppila Score, Adragao score and bifurcation score of patients included in the study.	145
• Table 4.7	Correlation between CT thorax, CT suprarenal, CT infrarenal, Kauppila Score, Adragao score and bifurcation score.	146
• Table 4.8	Correlation between demographic data with CT thorax, CT suprarenal, CT infrarenal, Kauppila score, Adragao score and bifurcation score.	149
• Table 4.9	Correlation between demographic and laboratory data with CT thorax, CT suprarenal, CT infrarenal, Kauppila Score, Adragao score and bifurcation score.	150

• Table 4.10	Comparison between demographic data of patients included in the study in relation to cardiovascular disease.	151
• Table 4.11	Comparison between CVD of patients included in the study in relation to intradialytic hypotension.	151
• Table 4.12	Comparison between laboratory data of patients included in the study in relation to cardiovascular disease.	151
• Table 4.13	Logestic regression for detection of risk factor of CVD of patients included in the study.	155
• Table 4.14	Logistic regression for detection of risk factor of CT thorax of patients included in the study.	156
• Table 4.15	Logistic regression for detection of risk factor of CT suprarenal of patients included in the study.	156
• Table 4.16	Logistic regression for detection of risk factor of CT infrarenal of patients included in the study.	157
• Table 4.17	Logistic regression for detection of risk factor of bifurcation of patients included in the study.	158
• Table 4.18	Logistic regression for detection of risk factor of kauppila score of patients included in the study.	158
• Table 4.19	Logestic regression for detection of risk factor of adragao score of patients included in the study.	159

List of figures

• Fig. 1.1	Distribution of the causes of death in patients with ESRD.	19
• Fig. 1.2	Increased incidence of mortality in CKD patients after myocardial infarction, PCI .	20
• Fig. 1.3	Cardiovascular mortality in general population and dialysis population.	21
• Fig. 1.4	Influence of GFR on cardiovascular outcomes.	22
• Fig. 1.5	Schematic presentation of traditional and novel (or uremia-specific cardiovascular risk factors in chronic kidney disease.	25
• Fig. 1.6	Risk Factors for SCD in dialysis patients.	83
• Fig. 2.1	In CKD media calcification is accelerated and superimposed to intimal calcification.	92
• Fig. 2.2	Calcified coronary atherosclerotic plaque of a patient with chronic renal failure.	92
• Fig. 2.3	The mechanism of vascular calcification.	94
• Fig. 2.4	Proposed mechanism of vascular calcification in CKD.	96
• Fig. 2.5	Fibroblast growth factor 23 (FGF23).	97
• Fig. 2.6	Cardiac valve calcification prevalence.	107
• Fig. 2.7	Valvular calcification is associated with lower survival.	108
• Fig. 2.8	Association between valvular calcification of either cardiac valve and coronary artery calcification.	109
• Fig. 2.9	Vascular calcification predicts valvular calcification in dialysis patients.	110
• Fig. 2.10	Arterial calcification increases mortality risk.	112
• Fig. 2.11	Relationship between severity of renal dysfunction and CAC assessed by EBCT.	114

• Fig. 2.12	Coronary artery calcification detected by EBCT and survival in ESRD.	115
• Fig. 2.13	CT abdomen detect aortic calcification in CRF patients.	116
• Fig. 2.14	CT scan of intense calcification in coronary arteries in dialysis patient.	116
• Fig. 2.15	Example of lateral lumbar X-ray showing calcification of the anterior and posterior wall of the abdominal aorta .	118
• Fig. 2.16	Simple vascular calcification score in plain x ray.	119
• Fig. 2.17	Vascular calcification was associated with arterial stiffness.	121
• Fig. 2.18	Higher pulse wave velocity ,pulse pressure associated with lower survival.	121
• Fig. 2.19	Effect of different phosphate binders on Coronary Artery calcification progression.	124
• Fig. 3.1	ACI measurement.	132
• Fig. 3.2	lateral lumbar X-ray showing calcification of the anterior and posterior wall of the abdominal aorta	133
• Fig. 3.3	Evaluation of vascular calcification score in plain radiographic films of pelvis and hands.	134
• Fig. 4.1	Frequency distribution of CT thorax , CT suprarenal , CT infrarenal , Kaupilla score , adragao score and bifurcaton.	145
• Fig. 4.2	Correlation between CT thorax and IHD of patients included in the study.	146
• Fig. 4.3	Correlation between CT suprarenal and IHD of patients included in the study.	147
• Fig. 4.4	Correlation between CT infrarenal and IHD of patients included in the study.	147
• Fig. 4.5	Correlation between CT bifurcation and IHD of patients	148

	included in the study.	
• Fig. 4.6	Correlation between CT Kauppila score and IHD of patients included in the study.	148
• Fig. 4.7	Correlation between CT Adragao score and IHD of patients included in the study.	149
• Fig. 4.7★	Comparison between CT thorax of patients included in the study in relation to cardiovascular disease.	152
• Fig. 4.8	Comparison between CT suprarenal of patients included in the study in relation to cardiovascular disease..	152
• Fig. 4.9	Comparison between CT infrarenal of patients included in the study in relation to cardiovascular disease.	153
• Fig. 4.10	Comparison between kauppila score of patients included in the study in relation to cardiovascular disease.	153
• Fig. 4.11	Comparison between Adragao score of patients included in the study in relation to cardiovascular disease.	154
• Fig. 4.12	Comparison between bifurcation score of patients included in the study in relation to cardiovascular disease.	154

List of abbreviations

AACS	Abdominal Aorta Calcification score
AB	Apoptotic bodies
ABI	Ankle-brachial index
ACC	American College of Cardiology
ACEi	Angiotensin converting enzyme inhibitor
ACI	Aortic calcification index
ADMA	Asymmetric dimethylarginine
AF	Atrial fibrillation
A.G.E	Advanced glycation end products
AHA	American Heart Association
ALP	Alkaline phosphatase
AMI	Acute myocardial infarction
AngII	Angiotensin II
ANP	Atrial natriuretic peptide
AoAC	Aortic arch calcification score
AOPPs	Advanced oxidation protein products
AVC	Aortic valve calcification
AVG	Arteriovenous grafts
BCP	Bony calcium phosphate
BNP	Brain natriuretic peptide
CAC	Coronary artery calcium scores
CAD	Coronary artery disease
CAPD	continuous ambulatory peritoneal dialysis
Cbfa1	Core-binding factor 1alpha
CETP	Cholesteryl ester transfer protein
CHD	Coronary heart disease

CKD	Chronic kidney disease
CO	Cardiac output
CRP	C-reactive protein
CVD	Cardiovascular disease
CVSSC	Cardiovascular Special Studies Center
DCOR	Dialysis Clinical Outcomes Revisited
DDAH	Dimethylarginine dimethylaminohydrolase.
EBCT	Electron beam computed tomography
ECSOD	Extracellular- superoxide dismutase
E.D	Endothelial dysfunction
eNOS	Endothelial NO synthase
ESRD	End-stage renal disease
FFA	Free fatty acid
FGF23	Fibroblast growth factor 23
Fig.	Figure
GFR	Glomerular filtration rate
Hb	Haemoglobin
HbA1c	Glycated hemoglobin
HD	Hemodialysis
HDL	High density lipoprotein
HF	Heart failure
HOMA	Homeostasis model assessment method
HSMC	Human Smooth muscle cell
HTN	Hypertension.
ICAM	Intercellular adhesion molecule.
ICD	Implantable cardioverter-defibrillator
IDDM	Insulin dependent diabetes mellitus
IE	Infective endocarditis

IHD	Ischemic heart disease
IL	Interleukin
IVUS	Intravascular ultrasound
KEEP	Kidney Early Evaluation Program
LAV	Left atrial volume
LDL	Low density lipoprotein
Lp(a)	Lipoprotein(a)
LVH	Left ventricular hypertrophy
LVMI	Left ventricular mass index
MAC	Mitral annular calcification
MDA	Malondialdehyde
MetS	Metabolic syndrome.
MGP	Matrix Gla protein
MI	Myocardial infarction
MPO	Myeloperoxidase
MRA	Magnetic resonance angiography
MSCT	Multislice computed tomography
MV	Microvesicles
MWFS	Midwall fractional shortening
NCBPs	Nitrogen-containing bisphosphonates
NO	Nitric oxide
NT-pro-BNP	N-terminal pro-brain natriuretic peptide
OPBs	Calcium-based oral phosphate binders
OPG	Osteoprotegerin
OPN	Osteopontin
O₂^{•-}	Superoxide anion radical
OxLDL	Oxidized LDL
PAD	Peripheral arterial disease