Assessment of peripheral vascular disease in patients on chronic hemodialysis using Toe/Brachial index

Thesis

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List of Abbreviations

ABI	Ankle Brachial Index
ACEI	Angiotensin Converting Enzyme Inhibitor
BMP	Bone Morphogenic Protein
Ca X P_{O4}	Calcium Phosphorous
CACS	Coronary Artery Calcification Score
CAD	Coronary Artery Disease
cAMP	Cyclic Adenosine Monophosphate
CCA-IMT	Common Carotid Artery Intimal Media Thickness
CKD	Chronic Kidney Disease
CRP	C Reactive Protein
CVD	Cardiovascular Disease
DM	Diabetes Mellitus
DNHD	Daily Nocturnal Hemodialysis
DOPPS	Dialysis Outcomes and Practice Patterns Study
DRG	Diagnosis Related Group

e GFR	Estimated Glomerular Filtration Rate
EBCT	Electron Beam Computed Tomography
EKG	Electrocardiogram
ESKD	End Stage Kidney Disease
ESRD	End Stage Renal Disease
GFR	Glomerular Filtration Rate
GN	Glomerulonephritis
Hcy	Homocysteine
HDL-C	High Density Lipoprotein Cholesterol
HTN	Hypertension
IC	Intermittent Claudication
IL-6	Interleukin 6
iPTH	Intact Parathyroid Hormone
LDL-C	Low Density Lipoprotein Cholesterol
Lp(a)	Lipoprotein A
LVH	Left Ventricular Hypertrophy
MI	Myocardial Infarction

MSCT	Multi-Slice Computed Tomography
MTHF	Methyl Tetrahydrofolate
NCEP	National Cholesterol Education Program
NPV	Negative Predictive Value
PAD	Peripheral Arterial Disease
PAOD	Peripheral Arterial Occlusive Disease
PPG	Photo Plethysmograph
PPV	Positive Predictive Value
PVD	Peripheral Vascular Disease
PVR	Pulse Volume Recording
RAS	Renin Angiotensin System
RRT	Renal Replacement Therapy
SHARP	Study Of Heart And Renal Protection
SPP	Skin Perfusion Pressure
SPSS	Statistical Program for Social Science
TBI	Toe Brachial Index
TCOM	Transcutaneous Oxygen Monitoring

TCPO2	Transcutaneous Partial Oxygen Pressure
TGF-ß1	Transforming growth factor beta-1
TNF	Tumor Necrosing Factor
VSMC	Vascular Smooth Muscle Cells

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Introduction

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Peripheral arterial disease (PAD) is a chronic arterial occlusive disease of the lower extremities caused by atherosclerosis. Widespread atherosclerosis is common in patients with end-stage renal disease, defined as the requirement for renal replacement therapy. Also, diabetes mellitus and high blood pressure have been linked to an increased risk of PAD in most patients with end stage renal disease. **[Rajagopalan S, *et al.,* 2006].**

Cardiovascular disease is common in chronic renal failure (CRF) patients and is responsible for more than 50% of their deaths. **[US Renal Data System, Annual Data Report 2003].**

At the same time, renal disease, even at the earliest stages, is a cardiovascular risk factor. **[Go A, *et al.,* 2004]**

Among the different localizations of cardiovascular diseases, peripheral arterial disease (PAD) affecting the lower limbs has a higher morbidity. Nevertheless, despite its importance, there are few reports of this pathology in CRF

patients, and most of them, with a few exceptions, have been performed in dialysis patients. **[García de Vinuesa S, *et al.*, 2005 and O'Hare A, *et al.*, 2004]**

The reasons for the high incidence of cardiovascular mortality are incompletely understood, but in the large part cannot be explained by the traditional risk factors. **[Leskinen Y, *et al.*, 2002]**

Inflammation, malnutrition, oxidative stress and abnormal mineral metabolism are risk factors for vascular disease specific to CKD. **[Kalantar-Zadeh K, *et al.*, 2003]**

The importance of early PAD diagnosis is supported by studies showing that a high percentage of PAD patients will suffer intermittent claudication which will evolve to pain at rest and risk of tissue necrosis, and even to amputation. Moreover, renal patients with PAD showed a higher mortality rate than those not affected by PAD [**Stenvinkel P, *et al.*, 2003].**

Consequently, it seems that the prevention of risk factors for the development of PAD may be beneficial and may prevent these adverse outcomes. Likewise, the early diagnosis of PAD makes it possible to act intensively on its risk factors **[Criqui M, *et al.,* 1992]**

PAD had been diagnosed from the clinical records, physical examination and the Toe-Brachial Index test (TBI), which is the ratio of the resting systolic pressure in the artery of the toe to that of the brachial artery, measured by Doppler ultrasound. **[Cimminiello C, *et al.,* 2002]**

TBI is a non-invasive test and has a higher sensitivity than the combination of a detailed clinical record and the careful physical examination of patients. Also it was found to be superior to the Ankle/Brachial Index (ABI) in the detection of peripheral vascular disease. The normal range for a TBI is considered to be an index > 0.65. If the TBI is below 0.65 there is reduced blood flow to the small vessels in the big toe. **[Shimazaki M, *et al.,* 2008]**