VASCULAR CALCIFICATIONS IN CHRONIC KIDNEY DISEASE, DIALYSIS AND KIDNEY TRANSPLANT PATIENTS: MULTIDISCIPLINARY EVALUATION

Lucisano Silvia[1], Villari Antonino[2], Benedetto Filippo[3], Pettinato Giuseppina[1], Cernaro Valeria[1], Lupica Rosaria[1], Trimboli Domenico[1], Costantino Giuseppe[1], Romeo Adolfo[1], Santoro Domenico[1], Buemi Michele[1]

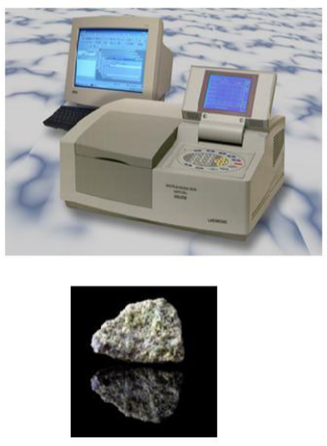
[1]Department of Internal Medicine, Unit of Nephrology, University of Messina, Messina, Italy
[2]Department of Inorganic and Analytical Physics, University of Messina.
[3]Unit of Vascular Surgery, Department of Thoracic and Vascular Surgery, University of Messina.

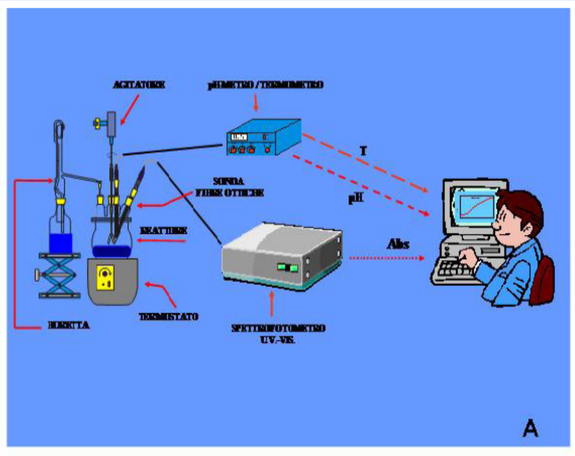
OBJECTIVES

Vascular calcification is a prevalent pathology in patients with chronic kidney disease (CKD). [1] These patients exhibit a hugely elevated risk of cardiovascular mortality compared with age-matched controls and develop accelerated medial as well as intimal calcification; this calcification rapidly progresses in patients on dialysis. The development of calcifications in CKD patients is strongly linked to dysregulated mineral metabolism, endothelial dysfunction and oxidative stress. We studied localization, chemical composition and structure of vascular calcifications in these patients.

METHODS

The study was conducted on 40 patients with IV-V stage of CKD, 10 dialysis patients (HD), 10 Kidney transplant patients (Tx) and a control group.
We first studied calcified plaques with computed tomography and ultrasonography. After we extracted the plaques, observed the structure under the electron microscope and studied the chemical composition of calcified part with the use of spectrophotometry (biological components were enzymatically degradated). (Fig. 1A)
We also measured with immunohistochemistry the expression of sirtuin 1 and 4 in each plaque. (Fig. 1B) Finally we correlated the results obtained with indices of renal function and inflammation.





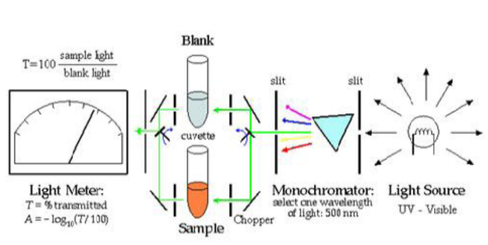


Fig.1

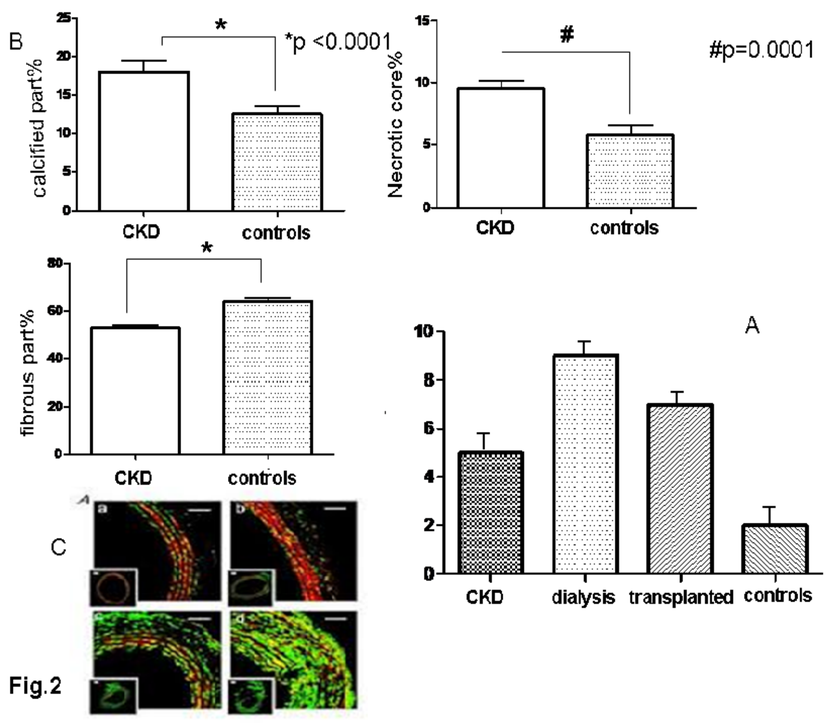


Fig.2

UNIVARIATE AND MULTIVARIATE CORRELATIONS

Variable	Partial R	β	P-value
ESR	**0.35 (P= 0.02)**	**0.32**	0.04
hs-CRP	**0.81 (P<0.005)**	**0.81**	**0.001**
Creatinine	**0.64 (P<0.001)**	**0.32**	**0.006**
Blood urea nitrogen	**0.40 (P<0.0001)**	**0.75**	**< 0.0001**
pH	**0.89 (P< 0.0001)**	**0.76**	**< 0.0001**
Calcium	**0.48 (P=0.001)**	**0.65**	**0.002**
Phosphorus	**0.53 (P=0.005)**	**0.54**	0.02
PTH	**0.43 (P=0.005)**	**0.24**	0.54
FGF23	**0.51 (P=0.0007)**	**0.23**	0.13

Table 1

RESULTS

CKD, HD and Tx patients have a greater number and spread of plaques compared with controls (Figure 2A) .
The plaques have higher volume and the percentage of necrotic core and calcium is greater than fibrous tissue ($p<0.0001$) (Figure 2B).
Chemical composition is also different: calcium phosphate and apatite are more represented in CKD, HD and Tx, while in controls whitlockite and calcium phosphate / apatite are represented in the same measure.
Sirtuin1 and 4 are mainly expressed in the plaques of CKD patients ($p <0.005$), indicating a greater hemodynamic stress (Figure 2C).
Calcium, pH, blood urea nitrogen, creatinine and high sensitivity C-reactive protein are positively correlated with number and volume of calcified plaques (Table 1).

CONCLUSIONS

Chronic kidney disease affects number and composition of arterial plaques. The plaques of these patients are more unstable and at rupture risk.
Important is the early control of hemodynamic and metabolic complications.

References

1. Gauthier-Bastien A, Ung RV, Larivière R, Mac-Way F, Lebel M, Agharazii M.: Vascular remodeling and media calcification increases arterial stiffness in chronic kidney disease. Clin Exp Hypertens. 2014;36(3):173-80.

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H) Clinical Nephrology, CKD. H1) Lab methods, progression & risk factors for CKD 1-5, nutrition in CKD, renal diseases (except GNs and cystic diseases).
Silvia Lucisano
DOI: 10.3252/pso.eu.51era.2014
Poster presented at: 51 ERA-EDTA CONGRESS AMSTERDAM 2014
PosterSessionOnline.com