

ASSOCIATION BETWEEN TRACE ELEMENTS AND CORONARY ARTERY CALCIFICATION IN CHRONIC HEMODIALYSIS PATIENTS

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OBJECTIVES

Cardiovascular disease (CVD) carries a major risk of mortality in hemodialysis patients¹. Trace element levels are under 0,01% of total body weight. Hemodialysis patients are at risk for deficiency of essential elements and excess of toxic heavy metals, both of which both can affect health². We conducted a study to measure the levels of trace elements of chronic hemodialysis patients, compare them with healthy controls and assess the influence of trace elements on calcification of coronary arteries.

METHODS

Thirty-nine hemodialysis patients dialyzed three times a week more than six months and 35 age-and sex-matched healthy individuals were included in the study. Exclusion criteria were; having active infection, active inflammatory disease, serum albumin <3,5 g/dl, coronary stent and/or by-pass operation, atrial fibrillation, cancer. None of the subjects received antibiotics, corticosteroids, anti-inflammatory-cytotoxic drugs, medications including trace elements during the study period. Demographic (age, gender), clinical (height, weight, previous mean 3-month pre-dialysis systolic and diastolic blood pressures) data were collected from patient files. Also previous 3-month laboratory data (calcium, phosphorus, parathormon, LDL cholesterol) were collected from patient files calculated mean values. Blood samples for trace elements were collected into tubes with EDTA and stored at -20°C until assay and quantified by inductively coupled plasma mass-spectrometry (ICP-MS). Coronary artery calcification (CAC) was assessed by multi-detector computed tomography and evaluated by the same person from radiology department.

RESULTS

The serum levels of selenium and uranium were significantly lower and levels of lithium, magnesium, aluminum, nickel, strontium, cadmium, tin, platinum, lead ve thallium were significantly higher in hemodialysis patients compared to controls (Table 1). The mean value of CAC score was 347,67 ± 822,35 (range 0-4224, median: 29,6). The level of cadmium was found statistically higher in the patients with high CAC scores (> median value) compared to the patients with low CAC scores (< median value). However we did not find any significance in correlations between CAC scores and trace element levels (for selenium r=-0,303, P=0,061).

Parameters	Hemodialysis Group (n=39)	Controls (n=35)	P
Age (year)	45,87 ± 10,06	44,94 ± 8,85	NS
Male (n, %)	64,10	65,71	NS
BMI (kg/m ²)	24,60 ± 4,52	26,19 ± 2,94	NS
SBP (mmHg)	131,67 ± 18,16	118,20 ± 13,63	0,001
DBP (mmHg)	77,67 ± 9,45	72,26 ± 9,77	0,019
Calcium (mg/dL)	8,70 ± 0,55	9,17 ± 0,34	0,000
Phosphorus (mg/dL)	5,07 ± 1,07	3,47 ± 0,38	0,000
ALP (U/L)	187,66 ± 242,05	65,54 ± 18,94	0,003
PTH (pg/mL)	693,05 ± 736,06	49,50 ± 20,03	0,000
25-OH VitD (ng/mL)	14,50 ± 10,10	25,54 ± 14,14	0,000
LDLCholesterol (mg/dL)	103,00 ± 39,23	129,91 ± 29,48	0,004
Lithium (ng/mL)	4,272 ± 2,263	1,163 ± 1,101	0,000
Magnesium (ng/mL)	17116, 41 ± 2293,45	15836,86 ± 1526,20	0,006
Aluminum (ng/mL)	53,632 ± 23,112	43,560 ± 9,767	0,016
Manganese (ng/mL)	14,601 ± 4,544	12,698 ± 15,218	NS
Cobalt (ng/mL)	0,901 ± 0,905	0,585 ± 0,352	NS
Nickel (ng/mL)	8,595 ± 3,581	3,121 ± 1,717	0,000
Copper (ng/mL)	748,735 ± 117,777	724,242 ± 89,855	NS
Zinc (ng/mL)	3625,435 ± 639,871	3753,714 ± 552,221	NS
Arsenic (ng/mL)	6,485 ± 3,944	6,044 ± 2,059	NS
Selenium (ng/mL)	116,604 ± 21,454	154,60 ± 22,990	0,000
Strontium (ng/mL)	30,630 ± 4,860	21,446 ± 5,956	0,000
Cadmium (ng/mL)	1,023 ± 0,588	0,711 ± 0,729	0,045
Tin (ng/mL)	1,605 ± 1,377	0,575 ± 0,344	0,000
Platinum (ng/mL)	0,005 ± 0,005	0,001 ± 0,001	0,000
Mercury (ng/mL)	0,151 ± 0,289	0,063 ± 0,088	NS
Thallium (ng/mL)	0,015 ± 0,012	0,011 ± 0,005	0,032
Lead (ng/mL)	71,286 ± 21,405	14,410 ± 7,428	0,000
Uranium (ng/mL)	0,016 ± 0,046	0,198 ± 0,356	0,005

Table 1. Comparison of demographic characteristics, clinical findings, trace element and heavy metal levels between chronic hemodialysis patients and controls

CONCLUSIONS

The levels of trace elements are altered by chronic hemodialysis. Especially cadmium was found higher in patients with high CAC scores. We believe that studies with more subjects will give information to us about this association.

REFERENCES:

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2. Gómez de Oña C, et al. Variation of trace element concentrations in patients undergoing hemodialysis in the north of Spain. *Scand J Clin Lab Invest*. 2016

