Relation between Serum Uric Acid and Vitamin D among Elderly Egyptians

Khalid El Sayed Abokhosheim [1], Magdy Elsayed Mohamed [2] and Reem Sabry El bedewy[3]

[1] Department of Clinical Pathology, Faculty of Medicine, Azhar University. Cairo, Egypt.
[2] Department of Internal Medicine, Faculty of Medicine, Azhar University, Cairo, Egypt.
[3] Department of Geriatrics, Faculty of Medicine, Ain Shams University, Cairo, Egypt.
drkhalid_abokhosheimQ@hotmail.com, Drreem_sabry2005@yahoo.com

Abstract: Objective: Association between low level of vitamin D (vit. D) and hyperuricemia has not been reported so far. We aimed to study the association of low level of vitamin D and serum uric acid among elderly Egyptians. **Methods**: We measured serum uric acid (SUA), lipid profile and vitamin D in 84 aged patients suffering from vit D deficiency regardless the cause of deficiency. The patients were selected from Internal Medicine and Geriatric outpatient clinics Azhar University Hospitals and Aldoaa Hospital -Ministry of Al Awkaf Cairo- as well as AinShams University Hospitals - at a period from 1st of May to the end of July 2011, In addition to twenty three normal volunteers of the same age and normal levels of vitamin D as control. After their consent. 4 ml venous blood was collected in plain tube, incubated 20 minutes at 37 °c then centrifuged at 3000 rpm for 10 min, the serum was separated and stored at – 20°C for assay of the studied parameters. **Results:** We found significant high level of cholesterol(p=0.0001); triglycerides(p=*0.0001)*; LDL (p=0.0001) and SUA (p= 0.0001) than control group, while There was a highly significant lower level of HDL in patient than control, p = 0.001 and in vit D than control,p = 0.0001. Also we founded negative correlation between SUA and vit D levels in patient group r = -0.924, p = 0.0001 but not in control group. Also our result revealed negative correlation between SUA level and HDL in patient group r = -0.734, p = 0.0001.There was a significant positive correlation between SUA and LDL in patient group, r = 0.965, p = 0.0001. SUA and triglyceride r = 0.754, p = 0.0001 as well as SUA and cholesterol = 0.834, p = 0.0001. **Conclusions**: Low level of vitamin D was significantly associated with high level of SUA among elderly Egyptians.This study suggested that a clinical trial should be conducted to clarify the causal relationship between vitamin D, SUA and lipid profile.

[Khalid El Sayed Abokhosheim, Magdy Elsayed Mohamed and Reem Sabry El bedewy. **Relation between Serum Uric Acid and Vitamin D among Elderly Egyptians.** *J Am Sci* 2013;9(12):984-988]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 126

Keywords: uric acid, vitamin D. lipid profile.

1. Introduction

Uric acid is a naturally-occurring waste product in the body. It is caused by the breakdown of the chemical purine. Uric acid is carried by the blood and filtered and secreted by the kidneys, then becomes waste product that exits through the urine (1). Most uric acid circulates as a urate anion. Normally, all urate measured in the body pool is believed to be soluble urate. When insoluble, urate crystal deposition occurs (2). Some clinical studies revealed that serum uric acid (SUA) can serves as a risk factor for cardiovascular diseases and as antioxidant defense(3).Clinical and epidemiological studies assumed that SUA has been related to the risk of hypertension (4,5), atherosclerosis (6) and cardiovascular diseases (CVDs) (7, 8).

Vitamin D(calciferol), and its metabolites have a significant clinical role due to their interrelationship with calcium homeostasis and bone metabolism. Subclinical vitamin D(vit D) deficiency, has been described among adolescents and the elderly,and may contribute to the development of osteoporosis and an increased risk of fractures and falls in the elderly(9,10). In addition to its role in calcium and bone homeostasis, vitamin D potentially regulates many other cellular functions (11,12).Hydroxylation of 25-hydroxyvitamin D to 1,25-dihydroxyvitamin D (1,25(OH)2 D) occurs in the mitochondria of the proximal tubules of the kidney. 1,25(OH)2 D is the physiologically active form of vitamin D, (13). Vitamin D deficiency or resistance is caused by one of four mechanisms: first,inadequate dietary vitamin D, fat malabsorptive disorders, second impaired hydroxylation by the liver to produce 25-hydroxyvitamin D, third, Impaired hydroxylation by the kidneys to produce 1,25(OH)2 D, and finally end organ insensitivity to vitamin D metabolites (hereditary vitamin D resistant rickets) (14).

The relation between vitamin D and uric acid level among elderly Egyptians has not been reported so far. So we focused to study the association of vitamin D with serum uric acid among elderly Egyptians.

2. Subject and method

The present study was carried out on eighty four patients with age ranged from 50 – 70 years suffering from vit D deficiency regardless the cause of deficiency. They were selected from Internal Medicine and Geriatric outpatient clinics, Azhar University Hospitals and Aldoaa Hospital -Ministry of Al Awkaf Cairo as well as Ain Shams University Hospitals - at a period started from 1st of May to the end of July 2011. In addition to twenty three normal volunteers of the same age and normal levels of vitamin D as control. Exclusion criteria includes those on serum uric acid lowering treatment, vit. D supplementation, patients with thyroid, parathyroid or chronic kidney diseases. After their consent, all cases were subjected to full history taking, clinical examination and all routine investigations as fasting, and post prandial blood sugar, liver function tests, kidney function tests, serum uric acid and vit D. 4 ml venous blood was collected in a red tube after overnight fasting, samples incubated 20 minutes at 37 ºc then centrifuged at 3000 rpm for 10 min, the serum was separated and stored at – 20°C for assay of the studied parameters.

Fasting blood glucose level was estimated according to glucose-oxidase method, using kits from Diamond Diagnostic. Serum triglycerides level was estimated according to (GPO-POD) method, using kits from Spinreact. Serum total cholesterol level according to (CHOD-POD) method using kits from Spinreact. Serum HDL-Cholesterol Level was estimated by "enzymatic colorimetric test' using kits from Spinreact. Serum LDL-Cholesterol Level (LDL) was calculated using Friedewald's formula if the triglycerides were less than 4.5 mmol/l, as following: LDL-cholesterol = total cholesterol – HDL-cholesterol – triglycerides/5.

Vitamin D was estimated using the automated ELECSYS 2010 corporation Roch - USA, base on the immunologically agglutination principle. Serum uric acid was measured using a commercial kit from spinreact diagnostics using photometric method.

Statistical analysis

Values were expressed as mean ±SD. The statistical analysis of the results was carried out according to the conventional standard statistical procedures using computed statistical analysis by SPSS, version 20.0 for Microsoft Windows. All variables were tested for normality of distribution. Paired-samples t test was used for comparison between parametric values, Pearson's correlation with correlation coefficient was used for parametric results. The significant difference was considered at $p<0.05$.

3.Results

Our results revealed high significant higher cholesterol level of patient group (197.42 ±10.32) than control group(147.86 ± 9.97), t= 18.871, p = 0.0001, triglycerides (178.04 ±10.79) than control (87.73 ± 5.89),t= 33.689, p = 0.0001, LDL-cholesterol (115.56 ±9.74) than control (79.37 ± 10.55), t= 12.365, p = 0.0001,and uric acid (6.87 ±0.58) than control (147.86 ± 9.97),t= 17.078, p = 0.0001. while there was a high significant lower level of HDL- cholesterol in patients (43.83 ±2.54) than control (50.82 ± 3.22),t= -7.504, p = 0.001. Moreover there was a high significant lower level of vitamin D (12.12 ±3.99) than control (60.56 ± 7.26), t= -25.923, p = 0.0001 (Table 1).

Table (1) show Comparison between levels of the studied parameters in the patient and control groups

P	T	±SE	±SD	Mean	Group
0.0001	18.871	1.12	10.32	197.42	Serum patient cholesterol
		2.08	9.97	147.86	Control group
0.0001	33.689	1.17	10.79	178.04	Serum patient triglycerides
		1.22	5.89	87.73	Control group
		0.27	2.54	43.83	Serum patient HDL-cholesterol
0.001	-7.504	0.67	3.22	50.82	Control group
0.0001	12.365	1.06	9.74	115.56	Serum patient LDL-cholesterol
		2.20	10.55	79.73	Control group
0.0001	17.078	0.06	0.58	6.87	Serum uric acid in patient group
		0.19	0.91	3.10	Control group
0.0001	-25.923	0.43	3.99	12.12	Vitamin D in patient group
		1.51	7.26	60.56	Control group

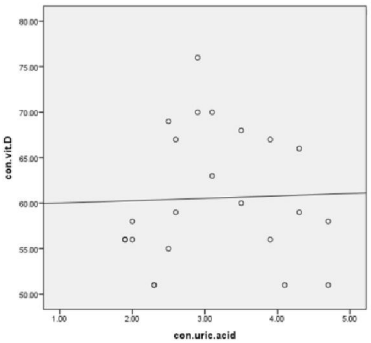
Table (2): Correlation between uric acid and vitamin D with lipid profile

Patient. LDL C		Patient. HDL C		Patient. triglycerides		Patient. Cholesterol		Control uric. Acid		Patient uric acid		
sig	r	sig	r	Sig	r	sig	r	sig	r	sig	r	
0.0001	0.965	0.0001	0.734-	0.0001	0.754	0.0001	834.	-----	--------	------	-----	Patient. SUA
0.0001	0.903-	0.0001	0.615	0.0001	638.-	0.0001	748.-	-----	------	0.0001	0.924-	Patient.vit D
--------	--------	----------	----------	-------	--------	---------	--------	880.	0.033	-------	-------	Control. Vit.D

P values < 0.05 were considered significant.

Table (2) showed significant negative correlation between SUA and vitamin D levels in patient group r = -0.924 *p* = 0.0001, also there is a negative correlation between SUA level and HDL-cholesterol level in patient group, r = -0.734, *p* = 0.0001. while no significant correlation between SUA and vitamin D levels in control group (scatrogram 1).

There was a significant positive correlation between SUA and LDL-cholesterol levels in patient group, r = 0.965, *p* = 0.0001, SUA and triglycerides r = 0.754, *p* = 0.0001 and SUA and cholesterol = 0.834, *p* = 0.0001.



(Scatrogram 1) showed no significant correlation between uric acid and vitamin D levels in control group

4. Discussion

Uric acid is a physiological free radical scavenger (15). In humans, uric acid is the main plasma antioxidant followed by vitamin C. Uric acid stabilizes vitamin C in plasma and protects it from oxidation (16).The significance of higher level of SUA in patient group than control obtained in the present study may be related to hypovitaminosis D. The increase in the level of uric acid in patients with decreased vitamin D may indicate the compensatory mechanism to counter the oxidative stress that occurs in these conditions (17). However one study show that Uric acid levels were negatively associated with HDL-cholesterol and positively with triglycerides and systolic blood pressure. This in agree with our results (18). Our study revealed a significant negative correlation between SUA and vit D levels, also there was a negative correlation between SUA level and HDL- cholesterol level While the correlation between SUA and vit D levels in control group was not significant. There was a significant positive correlation between SUA and LDL-cholesterol levels, SUA and triglyceride and SUA and cholesterol. Other study coincided with our results done on old age women revealed that Vit D insufficiency was significantly associated with elevated SUA among postmenopausal women (19). However in our study we not include gender as a discriminating factor.

Our result show significant higher level of cholesterol, triglycerides and LDL- cholesterol in patients with lower level of vitamin D than control group and a high significant lower level of HDL in hypovitaminosis D patients than control.Other study revealed no significant relation between vitamin D level and lipid profile (20).Another study concluded that no statistically significant effects for vitamin D supplementation observed for TC, HDL-C and TG (21). while John *et al,* 2005 showed a significant positive correlation between serum concentration of vitamin D and HDL as well as apolipoprotein A-I(22). In support of our finding, Jorde and Grimnes, 2011, Considered Low serum levels of 25(OH) D have also been associated with an unfavorable lipid profile, which could possible explain the relation with cardiovascular disease and mortality (23). In cross-sectional studies where serum levels of 25(OH)D and lipids were related and that included a minimum of 500 subjects, and 10 placebo-controlled double-blind intervention studies with vitamin D where more than 50 subjects were included. In all the cross-sectional studies serum 25(OH)D was positively associated with high-density lipoprotein cholesterol (HDL-C) resulting in a favorable low-density lipoprotein cholesterol (LDL-C) (or total cholesterol) to HDL-C ratio(24).Other study showed that 25(OH)D was inversely correlated with LDL and positively correlated with HDL-cholesterol (25).

Conclusion

Low level of vitamin D was significantly associated with high level of SUA among elderly Egyptians.This study suggested that a clinical trial should be conducted to clarify the causal relationship between vitamin D, SUA and lipid profile.

Recommendation

From our results, vitamin D supplementation may be used as a lowering agent for uric acid instead of hazards of allopurinol treatment in patients with hypovitaminosis D.Further researches is strongly recommended to study genetic polymorphism

distribution in large Egyptian population to achieve a compact overview that could explain the relationship between uric acid, vitamin D and lipid profile, and effect of vitamin D supplementation.

References

1. Choi JW, Ford ES, Gao X, Choi HK. Sugar-sweetened soft drinks, diet soft drinks, and serum uric acid level: the Third National Health and Nutrition Examination Survey. Arthritis Rheum 2008; 59:109.
2. Döring A, Gieger C, Mehta D, *et al.* SLC2A9 influences uric acid concentrations with pronounced sex-specific effects. Nat Genet 2008; 40:430.
3. Molino-Lova R, Prisco D, Pasquini G, Vannetti F, Paperini A, Zipoli R, Luisi ML, Cecchi F, Macchi C. ed J. 2013 Apr;22(2):325-30.
4. Forman JP, Choi H, Curhan GC: Uric acid and insulin sensitivity and risk of incident hypertension. Arch Intern Med 2009 169: 155–162.
5. Fei Teng, Ruihua Zhu, Caiyan Zou, Ying Xue, Manqing Yang, *et al.* Interaction between Serum Uric Acid and Triglycerides in relation to Blood Pressure. Journal of Human Hypertension, 2010 12: 31–37.
6. Ishizaka N, Ishizaka Y, Toda E, Hashimoto H, Nagai R, *et al.* Higher serum uric acid is associated with increased arterial stiffness in Japanese individuals. Atherosclerosis 2007 192: 131–137.
7. Chen JH, Chuang SY, Chen HJ, Yeh WT, PanWH Serum uric acid level as an independent risk factor for all-cause, cardiovascular, and ischemic stroke mortality: a Chinese cohort study. Arthritis Rheum,2009 61: 225–232.
8. Mankovsky B, Kurashvili R, Sadikot S: Is serum uric acid a risk factor for atherosclerotic cardiovascular disease? A review of the clinical evidence. Part 1.Diabetes and Metabolic Syndrome: Clinical Research and Reviews 2010 4:176–184.
9. Gordon CM, DePeter KC, Feldman HA, *et al.* Prevalence of vitamin D deficiency among healthy adolescents. Arch Pediatr Adolesc Med 2004; 158:531.
10. Das G, Crocombe S, McGrath M, *et al.* Hypovitaminosis D among healthy adolescent girls attending an inner city school. Arch Dis Child 2006; 91:569.
11. Lips P, Hosking D, Lippuner K, *et al.* The prevalence of vitamin D inadequacy amongst women with osteoporosis: an international epidemiological investigation. J Intern Med 2006; 260:245.
12. Holick MF. High prevalence of vitamin D inadequacy and implications for health. Mayo Clin Proc 2006; 81:353.
13. Cole CR, Grant FK, Tangpricha V, *et al.* 25-hydroxyvitamin D status of healthy, low-income, minority children in Atlanta, Georgia. Pediatrics 2010; 125:633.
14. Fraser D, Scriver CR. Hereditary disorders associated with vitamin D resistance or defective phosphate metabolism. In: Endocrinology, DeGroot LJ (Ed), Grune and Stratton, New York 1979. p.797.
15. Pasaoglu H, Sancak B, Bukan N. Lipid peroxidation and resistance to oxidation in patients with type 2 diabetes mellitus. Tohoku J Exp Med 2004;203:211-8.
16. . Maritim AC, Sanders RA, Watkins JB. Diabetes, oxidative stress, and antioxidants: a review. J Biochem Mol Toxicol 2003;17:24-38
17. Nieto FJ, Iribarren C, Gross MD, Comstock GW, Cutler RG. Uric acid and serum antioxidant capacity: A reaction to atherosclerosis. Atherosclerosis 2000; 148:131-9.
18. Qin Li, Zhen Yang, Bin Lu, Jie Wen, Zi Ye, Lili Chen, Min He, Xiaoming Tao, Weiwei Zhang, Ying Huang, Zhaoyun Zhang, Shen Qu and Renming Hu. Serum uric acid level and its association with metabolic syndrome and carotid atherosclerosis in patients with type 2 diabetes, European Journal of Endocrinology 2009 160 965–971.
19. Lu L, Yu Z, Pan A, Hu FB, Franco OH, *et al.* Plasma 25-hydroxyvitamin D concentration and metabolic syndrome among middle-aged and elderly Chinese individuals. Diabetes Care 2009 32:1278–83.
20. A. Strasak, E. Ruttmann, L. Brant *et al.* "Serum uric acid and risk of cardiovascular mortality: a prospective long-term study of 83 683 Austrian men," *Clinical Chemistry*, 2008 vol. 54, no. 2, pp. 273–284
21. Hao Wang, Ning Xia, Yang Yang, and Dao-Quan Peng. Influence of vitamin D supplementation on plasma lipid profiles: A meta-analysis of randomized controlled trials, Lipids in Health and Disease 2012, 11:42
22. John WG, Noonan K. Mannan N. Boucher BJ. Hypovitaminosis D is associated with reductions in serum apolipoprotein A-l but Not with fasting lipids in British Bangladeshis. *Am J Clin Nutr* 2005; 82: 517-522
23. Jorde R and Grimnes G. Vitamin D and metabolic health with special reference to the effect of vitamin D on serum lipids. Prog. Lipid Res. 2011 Oct;50(4):303-12

24. Sun Q, Shi L, Rimm EB, Giovannucci EL, Hu FB, *et al.* Vitamin D intake and risk of cardiovascular disease in US men and women. Am J Clin Nutr.2011,94:534–42
25. .Marie-He´le`ne Gannage´-Yared1, Rima Chedid2, Simon Khalife3, Emmanuel Azzi1, Fernand Zoghbi2and Georges Halaby. Vitamin D in relation to metabolic risk factors, insulin sensitivity and adiponectin in a young Middle-Eastern population, European Journal of Endocrinology 2009, 160 965–971

12/12/2013