Relation between Serum Uric Acid and Vitamin D among Elderly Egyptians

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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 of 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 found 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 $r = 0.834, p = 0.0001$.

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.

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, kidney function tests, serum uric acid and vitamin D. 4 ml venous blood was collected in a red tube after overnight fasting, samples 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.

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 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:

\[ \text{LDL-cholesterol} = \text{total cholesterol} - \text{HDL-cholesterol} - \text{triglycerides}/5. \]

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 \( p < 0.05 \).

#### 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>
<thead>
<tr>
<th>( P )</th>
<th>( T )</th>
<th>±SE</th>
<th>±SD</th>
<th>Mean</th>
<th>Group</th>
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<tbody>
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<td>0.0001</td>
<td>18.871</td>
<td>-1.12</td>
<td>9.32</td>
<td>197.42</td>
<td>Serum patient cholesterol</td>
</tr>
<tr>
<td>0.0001</td>
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<td>1.17</td>
<td>10.79</td>
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<tr>
<td>0.001</td>
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<td>2.54</td>
<td>43.83</td>
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<td>3.22</td>
<td>50.82</td>
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<td>0.91</td>
<td>6.87</td>
<td>Serum uric acid in patient group</td>
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<td>0.0001</td>
<td>-25.923</td>
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<td>3.99</td>
<td>12.12</td>
<td>Vitamin D in patient group</td>
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There was a significant positive correlation between SUA and vitamin D levels, as indicated by the Pearson correlation coefficient, r = 0.965, p = 0.0001. There was no significant correlation between SUA and HDL in control group, r = 0.754, p = 0.0001. However, one study showed that SUA negatively correlated with HDL in patients with lower levels of vitamin D compared to control group (20). Another study concluded that there was no statistically significant effect 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 findings, Jorde and Grimes, 2011, considered low serum levels of 25(OH)D have also been associated with an unfavorable lipid profile, which could possibly 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 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).

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 showed 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 HDL levels, also there was a negative correlation between SUA level and HDL-cholesterol level. While the correlation between SUA and HDL 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 Grimes, 2011, considered low serum levels of 25(OH)D have also been associated with an unfavorable lipid profile, which could possibly 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 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 suppletion.

References
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