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RESEARCH ARTICLE

Relationship between Hyperuricemia and Vitamin D Deficiency among Adult in Al Kharj, Saudi Arabia.

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Abstract

Background

Relationship between hyperuricemia and vitamin D deficiency in Saudi Arabia has not been reported so far, although hyperuricemia and vitamin D deficiency are common.

We aimed to study the relationship of elevated serum uric acid with vitamin D deficiency among adult in Al Kharj.

Subjects and Methods

We collected data from 181 participants attending Salman Bin Abdul Aziz University Hospital, Al Kharj from September to December 2014. Serum uric acid, 25-hydroxy vitamin D and other traditional biomarkers including fasting plasma glucose, blood lipids, were assessed in 131 patients aged above 18 years. In addition to 50 patients (volunteer) with normal uric acid level as control.Relationship between serum uric acid and vitamin D level was analyzed.

Results

The mean age of the studied patients was 37.42± 12.853. Obesity and vitamin D deficiency were prevalent in patients with elevated SUA (Hyperuricemic) as they were reported in 71.8% , 63.4% respectively. More than half of the hyperuricemic patients had increase level of glucose (60%) and abnormal cholesterol level mainly for LDLcholesterol as 77.9% had higher level. Hyperuricemic patients with vitamin D deficiency had higher levels of TG, TC and LDL cholesterol and lower level of HDLcholesterol than those with normal SUA level, but this difference was significant only for LDL cholesterol. SUA was inversely correlated with vitamin level and significantly correlated with LDLcholesterol .

Conclusions

Obesity , vitamin D deficiency and high LDL cholesterol level were prevalent in hyperuricemic patients and elevated uric acid was correlated with LDL cholesterol and vitamin D deficiency..

Recommendation

Further clinical trial are needed to confirm the relation of hyperuricemia with vitamin D deficiency and to clarify the impact of vitamin D supplementation on hyperuricemia and consequently the influence of SUA lowering treatment on CVD prevention.

INTRODUCTION

Hyperuricemia(HU) **is a**bnormally elevated blood level of uric acid, defined as a serum uric acid ((SHU)) level greater than 6.8 mg/dL dL (200-430µmol/L) at physiological temperature (37°C) and neutral pH (Johnson and Rideout , 2004 ; Choi et al,2005 ; Richette and Bardin , 2010). Hyperuricemia is a very common condition, being usually caused by an unhealthy lifestyle mainly a poor diet exceeding in purine nucleotides, protein, alcohol, and carbohydrates intake (Johnson and Rideout , 2004 ; Choi et al, 2005 ; Eggebeen, 2007 ; Richette and Bardin , 2010). Also some drugs as low-dose aspirin (Choi et al, 2005 ; Eggebeen, 2007) and diuretics frequently cause hyperuricemia (Eggebeen, 2007). Vitamin D deficiency, defined mostly as serum 25-hydroxyvitamin D (25(OH) D) levels of <20 ng/ml, is a common problem worldwide (Holick , 2006 ; Adams and Hewison, 2010). Parathyroid hormone has significant biologic influence on SUA (Dalbeth et al., 2009 ; Hui et al., 2012). As previous clinical study showed that parathyroid hormone increased the incidence of hyperuricemia (Miller et al., 2007). Meantime, vitamin D deficiency can activate parathyroid to induce the release of parathyroid hormone (Emilion E and Emilion R, 2011).

Several studies have demonstrated the relationship between metabolic syndrome and serum uric acid (SUA) levels (Ford et al., 2007) as well as low serum 25(OH)D levels (Ford et al., 2005; Hypponen et al., 2008 ; Lu L et al. 2009 ; Cheng et al., 2010). An elevated serum uric acid level (SUA) may be the most highly correlated laboratory value with the metabolic syndrome (Choi and Ford, 2007). Moreover, maintaining vitamin D levels might provide protective effects against metabolic syndrome and its sequelae (Chowdhury et al. 2009).

Metabolic syndrome is a clinical disorder characterized by the co-occurrence of heterogeneous traits, including abdominal obesity, hypertension, dyslipidemia (high triglycerides (TG) and low high-density lipoprotein cholesterol (HDL-C) levels), and impaired glucose tolerance (Alessi and Juhan, 2008). All these evidences suggested an association between elevated serum uric acid (SUA) and low serum 25-hydroxy vitamin D (25(OH) D).

In Saudi Arabia, studies reported high prevalence of vitamin D deficiency (72.4-78.1%) (**Alfawaz** et al. 2014) as well as hyperuricemia (41%) (Al-Arfaj , 2001). The relationship between vitamin D deficiency and hyperuricemia has not been reported so far.

Subject and Methods

We conducted a cross-sectional study in Al Kharj from the1st September to the end of December, 2014. The subjects were selected randomly from the patients attending Salman Bin Abdul Aziz University Hospital, Al Kharj aged more than 18 years of both gender, male and female. Written informed consent was obtained from all study participants. Exclusion criteria includes those on serum uric acid lowering treatment, vitamin .D supplementation, patients with thyroid, parathyroid or chronic kidney diseases.
The study included 131 patients with elevated serum uric acid level, in addition to 50 patients (volunteer) with normal uric acid level as a control
Body weight and height were reported and body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared.
Serum uric acid (SUA), 25-hydroxy vitamin D (25(OH) D), fasting blood sugar (FPG), triglycerides (TG) ,total cholesterol (TC) as well as high density (HDL)cholesterol were assessed for all subjects. Low density (LDL) cholesterol was calculated using Friedewald's f ormula : LDL-cholesterol = total cholesterol – HDL- cholesterol–triglycerides/5.
Hyperuricemia (HU) was defined as a serum uric acid ((SHU)) level greater than 6.8 mg/dL dL (200-430µmol/L). While for vitamin D status, deficiency was defined as a serum 25(OH)D less than <20 ug/L. Obesity was defined as BMI of 30 kg/m^2or more.

Statistical analysis

Statistical analysis was conducted by SPSS. In current study analysis, baseline characteristics of participants with and without elevated uric acid level were compared. Comparisons in means were performed by using Student's t-test. Comparisons in rates for categorical variables were performed by using the Chi-square test. Pearson correlation analysis was used to estimate correlation between SUA and 25(OH)D as well as BMI, FBG, triglycerides (TG),total cholesterol (TC), (HDL)cholesterol, low density (LDL) cholesterol.

Results

Among 181 patients included in current analysis, 131 were considered to have elevated SUA (greater or equal to 314 umol/L). The mean age of the studied patients was 37.42± 12.853. Patients with elevated SUA had higher levels of TG, TC and LDL cholesterol and lower level of HDL cholesterol than those with normal SUA level, but there was significant difference level only for LDL cholesterol as shown in Table 1. 71.8% of patients with elevated SUA were obese and 63.4% had vitamin D deficiency. More than half of the patients with elevated SUA had increase level of glucose(60%) and abnormal cholesterol level mainly for LDL cholesterol, where 77.9% had higher level(Table 2).SUA was significantly correlated with LDL cholesterol (p= 0.037), while SUA was inversely correlated with vitamin level, but did not reach significant level (P= 0.077)as shown in Table3.

Hyperuricemic patients with vitamin D deficiency are more likely to have higher level of glucose, TG, LDL cholesterol and lower level of HDL cholesterol. However, there was no significant difference in these parameters between patients with and without vitamin D deficiency except for glucose and HDL cholesterol (p =0.042, 0.013 respectively) (Table 4).

Table(1) Level of the studies parameters in patients with hyperuricemia and those with normal uric acid level (Control)

Characterstic	Mean 147.86	±SD Co	T	P
BMI Case Control	32.09 33.32	7.274 5.426	-1.234	0.270
Vit.D Case Control	17.63 17.62	8.527 9.963	0.011	0.995
Glucose Case Control	6.14 6.29	2.853 1.219	-0.156	0.644
Triglycerides Case Control	1.90 1.58	1.398 0.807	0.315	0.110
Cholesrterol Case Control	5.14 4.87	1.107 0.718	0.268	0.109
HDL Case Control	1.08 1.14	0.265 0.351	-.061	0.452
LDL Case Control	3.55 2.95\	0.999 0.844	0.598	0.008

Table(2) Prevalence of vitamin D deficiency, obesity , elevated glucose and lipid profile among patients with hyperuricemia

Characterstic	Patients N. 131
BMI (>30)	71.8%
Vitamin D (< 20 ng/ml)	63.4%
Glucose (>5.89)mmol/l	60.3%
Triglycerides (> 2. 26 mmol/l)	26.7%
Cholesrterol (> 5.20 mmol/l)	43.5%
HDL (< 1.68 mmol/l)	56.5%
LDL (> 3.34 mmol/l)	77.9%

Table(3)Correlationbetweenuric acidandvitaminD withlipidprofile

		BMI	Vitamin D	Glucose	Triglycerides	Cholesterol	HDL	LDL
PatientSUA	R	0.180	-0.155	0.043	0.009	-0.091	-0.144	-0.240
	P	0.108	0.077	0.644	0.921	0.336	0.203	0.037

Pvalues< 0.05 wereconsideredsignificant.

Table (4) Comparison of hyperuricemic patients with and without vitamin D deficiency

Characterstic	Vitamin D deficiency (< 20 ng/ml)	Vitamin D deficiency (> 20 ng/ml)	P value
BMI	32.70±6.82	31.10±7.97	0.338
Glucose	6.50±3.59	5.59±0.72	0.042
Triglycerides	1.91±1.60	1.87±0.89	0.896
Cholesrterol	5.09±1.18	5.23±0.96	0.527
HDL	1.12±0.33	1.00±0.00	0.013
LDL	3.40±1.10	3.79±0.77	0.075

Discussion

In the present study, patients with elevated SUA had higher levels of TG, TC and LDL cholesterol and lower level of HDL cholesterol than those with normal SUA level, but there was significant difference level only for LDL cholesterol. 71.8% of patients with elevated SUA were obese and 63.4% had vitamin D deficiency. More than half of the patients with elevated SUA had increase level of glucose (60%) and abnormal cholesterol level mainly for LDL cholesterol where 77.9% had higher level. Moreover, SUA LDL was significantly correlated with cholesterol LDL, and inversely correlated with vitamin D level, but did not reach significant level.

Hyperuricemic patients with vitamin D deficiency more likely to have higher level of glucose, TG, LDL cholesterol and lower level of HDL cholesterol. However, there was no significant difference in these parameters between patients with and without vitamin D deficiency except for glucose and HDL cholesterol.

Other studies coincided with our results. The authors of two studies found a significant association between elevated SUA and vitamin D insufficiency in middle aged and elderly Chiinese postmenopausal women (Hao et al., 2013 ; LU et. al 2009). Also the study done among elderly Egyptians revealed a significant negative correlation between SUA and vitamin D levels (Khalid et al., 2013). Uric acid level was reported that it was negatively associated with HDL-cholesterol and positively with triglycerides and systolic blood pressure (Qin et al., 2009 ; Wang et al., 2010). Moreover, it was reported that vitamin D supplementation may be used as an alternative therapy for hyperuricemia as it has little adverse effects (Hao et al., 2013). In contrast, other study found that the women ≥65 years who received both calcium and vitamin D had significantly elevated SUA level compared with those who received placebo (Brazier et al., 2005). On the other hand, it was found that elevated SUA was a risk factor of cardiovascular diseases (CVD) (Keenan and Pillinger 2009 ; Wen et al., 2010) and independently related to cardiovascular mortality, suggesting the clinical importance of monitoring and intervention based on the presence of an increased SUA concentration (Strasak et al., 2008). Interestingly, in another studies, higher intake of vitamin D was found associated with a lower risk of CVD in US men (Sun et al., 2011) and moderate to high of doses vitamin D supplementation may reduce CVD risk (Wang et al., 2010). Uric acid levels were reported that negatively associated with HDL-cholesterol and positively with triglycerides and systolic blood pressure (Wang et al., 2010).

Conclusion

Obesity and vitamin D deficiency and high LDL cholesterol level were prevalent in hyperuricemic patients and elevated uric acid was correlated with LDL cholesterol and vitamin D deficiency. .

Recommendation

Further clinical trial should be conducted to confirm the relation of hyperuricemia with vitamin D deficiency.

The impact of vitamin D supplementation on hyperuricemia and consequently the influence of SUA lowering treatment on CVD prevention are needed to be investigated

Acknowledgment

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References

- Adams JS, Hewison M. (2010) : Update in vitamin D. J Clin Endocrinol Metab. 95 : 471–476.

- Al-Arfaj A S (2001) : Hyperuricemia in Saudi Arabia. Rheumatol Int. , 20 (2) : 61-4
- Brazier M, Grados F, Kamel S, Mathieu M, Morel A, et al. (2005) : Clinical and laboratory safety of one year's use of a combination calcium+vitamin D tablet in ambulatory elderly women with vitamin D insufficiency: results of a multicenter, randomized, double-blind, placebo-controlled study. Clin Ther 27: 1885–93.
- Cheng S, Massaro JM, Fox CS, Larson MG, Keyes MJ, et al. (2010) : Adiposity, cardiometabolic risk, and vitamin D status: the Framingham Heart Study. Diabetes 59: 242–248.
- Choi HK, Mount DB, Reginato AM. (2005) : Pathogenesis of gout. Ann Intern Med. 143:499–516
- Choi HK, Ford E. (2007) : Prevalence of the metabolic syndrome in individuals with hyperuricemia. *Am J Med* . 120: 442–7.
- Chowdhury TA, Boucher BJ, Hitman GA (2009) : Vitamin D and type 2 diabetes: Is there a link? Prim Care Diabetes 3: 115–116
- Dalbeth N, Horne A, Gamble GD, Ames R, Mason B, et al. (2009) : The effect of calcium supplementation on serum urate: analysis of a randomized controlled trial. Rheumatology (Oxford) 48: 195–7.
- Eggebeen AT. (2007) : Gout: an update. Am Fam Physician. 76(6):801–8.
- Emilion E, Emilion R (2011) : Estimation of the 25(OH) vitamin D threshold below which secondary hyperparathyroidism may occur among African migrant women in Paris. Int J Vitam Nutr Res 81: 218–24.
- Ford E. S., Li C., Cook S., and Choi H. K., (2007) : "Serum concentrations of uric acid and the metabolic syndrome among US children and adolescents," Circulation, vol. 115, no. 19, pp. 2526–2532 .
- Ford ES, Ajani UA, McGuire LC, Liu S (2005) : Concentrations of serum vitamin D and the metabolic syndrome among U.S. adults. Diabetes Care 28: 1228–1230.
- **Alfawaz Hanan**, **Tamim Hani**, **Alharbi Shmeylan**, **Aljaser Saleh** and **Tamimi Waleed. (**2014) : Vitamin D status among patients visiting a tertiary care center in Riyadh, Saudi Arabia: a retrospective review of 3475 cases. *BMC Public Health* , **14**:159.
- **Hao Peng , Hongmei Li , Chao Li, Xiangqin Chao, Qiu Zhang and Yonghong Zhang. (2013) : Association between Vitamin D Insufficiency and Elevated Serum Uric Acid among Middle-Aged and Elderly Chinese Han Women .pone.0061159**
- Holick MF. (2006) : High prevalence of vitamin D inadequacy and implications for health. Mayo Clin Proc. 81:353–37.
- Hui JY, Choi JW, Mount DB, Zhu Y, Zhang Y, et al. (2012) :The independent association between parathyroid hormone levels and hyperuricemia: a national population study. Arthritis Res Ther. 14: R56.
- Hypponen E, Boucher BJ, Berry DJ, Power C (2008) : 25-hydroxyvitamin D, IGF-1, and metabolic syndrome at 45 years of age: a cross-sectional study in the 1958 British Birth Cohort. Diabetes 57: 298–305.
- Johnson RJ, Rideout BA. (2004) : Uric acid and diet - insights into the epidemic of cardiovascular disease. N Engl J Med. 350:1071–4.
- Keenan RT, Pillinger MH (2009) : Hyperuricemia, gout, and cardiovascular disease–an important "muddle". Bull NYU Hosp Jt Dis 67: 285–90.

- Khalid El Sayed Abokhosheim [1], Magdy Elsayed Mohamed [2] and Reem Sabry El bedewy (2013) : Relation between Serum Uric Acid and Vitamin D among Elderly Egyptians. Journal of American Science 9(12)
- Lu L, Yu Z, Pan A, Hu FB, Franco OH, et al. (2009) : Plasma 25-hydroxyvitamin D concentration and metabolic syndrome among middle-aged and elderly Chinese individuals. Diabetes Care 32: 1278–1283.
- Miller PD, Schwartz EN, Chen P, Misurski DA, Krege JH (2007) : Teriparatide in postmenopausal women with osteoporosis and mild or moderate renal impairment. Osteoporos Int 18: 59–68.
- Qin Li, Zhen Yang, Bin Lu, Jie, Zi Ye,Lilli Chen, Min Zhaoyun Zhang, Shen Qu and Renming Hu. (2009) : Serum uric acid level and its association with metabolic syndrome and carotid atherosclerosis in patients with type 2 diabetes. European Journal of Endocrinology 160 965-971.
- *Richette P, Bardin T. (2010) : Gout. Lancet. 375(9711):318–28.*
- Strasak A, Ruttmann E, Brant L, Kelleher C, Klenk J, et al. (2008) : Serum uric acid and risk of cardiovascular mortality: a prospective long-term study of 83,683 Austrian men. Clin Chem 54: 273–84.
- Sun Q, Shi L, Rimm EB, Giovannucci EL, Hu FB, et al. (2011) : Vitamin D intake and risk of cardiovascular disease in US men and women. Am J Clin Nutr 94: 534–42.
- Wen CP, David Cheng TY, Chan HT, Tsai MK, Chung WS, et al. (2010) : Is high serum uric acid a risk marker or a target for treatment? Examination of its independent effect in a large cohort with low cardiovascular risk. Am J Kidney Dis 56: 273–88.
- Wang L, Manson JE, Song Y, Sesso HD (2010) : Systematic review: Vitamin D and calcium supplementation in prevention of cardiovascular events. Ann Intern Med 152: 315–23.