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Research Article

Correlation between vitamin D and lipid profile in patients with ischemic stroke

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ABSTRACT

Background: This study aimed to investigate the relationship between serum vitamin D level and lipid profile in ischemic stroke patients.
Methods: 217 patients with ischemic stroke were selected for analysis between ages 45 and 80 years admitted at our hospital from January 2014 to December 2015. Measurement of serum vitamin-D concentration was made by electrochemiluminescence immunoassay. Confounding variables like diabetes, hypertension, smoking, alcohol, tobacco, BMI, CRP, S. uric acid, duration of sunlight exposure, prior history of drug intake or fracture and S. calcium were considered. 200 age and sex matched controls were taken. The source of data was questionnaires and multiple linear regression analysis and correlation analysis were used.
Results: A positive correlation was seen between vitamin D and serum cholesterol, VLDL, LDL, triglycerides, cholesterol/HDL ratio and LDL/HDL ratio but inverse correlation between vitamin D and HDL.
Conclusions: In ischemic stroke patients increase in vitamin D is associated with increase in atherogenic lipids.

Keywords: Vitamin D, Cerebral infarction, Lipid profile

INTRODUCTION

Exposure to sunlight and taking food rich in vitamin D can meet our daily requirements.[1,2] Low serum levels of 25-hydroxyvitamin D (25(OH)D) is also shown to be associated with insulin resistance.[3,4] Vitamin D insufficiency has been linked to cardiovascular diseases, infections and even cancer in recent large epidemiological studies.[5] Rise in serum cholesterol is associated with increase in cardiovascular diseases.[6,7]

Studies have also demonstrated that 25-hydroxyvitamin D deficiency is a novel CV risk factor, predicting both CV events and mortality.[8] Vitamin-D deficiency is associated with changes in PTH, calcium, phosphorus, and 1,25-dihydroxyvitamin D levels (1,25[OH]2D).[9]

METHODS

A case control study where all cases of ischemic stroke admitted from neurology clinic , OPD and medicine wards of LLR and associated hospitals, Kanpur, India from January 2014 to December 2015 and age and sex matched controls not having ischemic stroke were taken after informed consent.

Age group >30 years irrespective of sex with diagnosis of ischemic stroke by CT scan or MRI brain were included in the study and patients with valvular heart disease, cardiomyopathy, congenital heart disease and connective tissue disorders were excluded.

Detailed history and clinical examination focussing on carotid bruit, BMI and BP were taken. Serum vitamin D (25-hydroxy vitamin D) level was measured by chemiluminescence method by Architect i1000SR Machine (Abbott laboratories, Abbott park, IL 60064 USA) from morning fasting sample. Serum 25-hydroxy vitamin D <20 ng/ml was considered as deficient and >30 ng/ml as adequate.[10] Serum uric acid, serum calcium, CRP, complete blood count, serum creatinine, BUN, liver function tests, serum electrolytes, blood sugar (fasting, post prandial) and lipid profile were measured by automated analysers. CT scan of head (plain) and MRI brain (wherever feasible and indicated) were done.

RESULTS

12.9% cases had adequate vitamin D levels whereas 70.04% cases had vitamin D deficiency. 22% controls had adequate vitamin D levels whereas 43% controls had vitamin D deficiency. Among cases there were positive associations between vitamin D levels and BMI (r=0.3256, P ≤0.0001), vitamin D levels and HBA1c (r=0.1289, P=0.0580), serum cholesterol and vitamin D levels (r=0.3405, P ≤0.0001) (Figure 1), LDL and vitamin D (r=0.2779, P ≤0.0001) (Figure 2), VLDL and vitamin D (r=0.2846, P ≤0.0001).

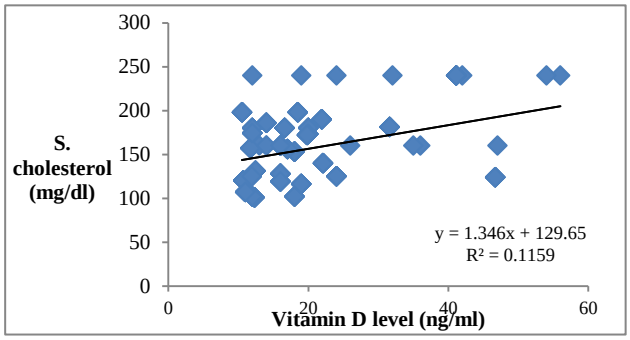

Figure 1: Vitamin D and serum cholesterol in cases.

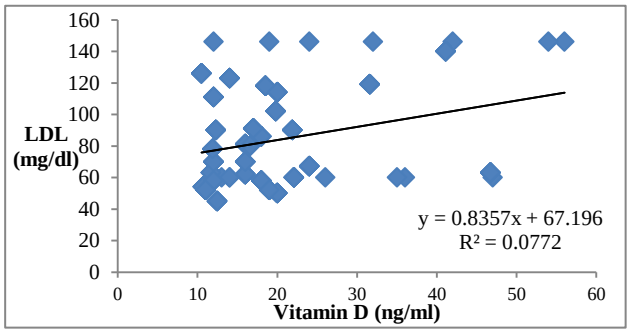

Figure 2: LDL and vitamin D in cases.

Significant positive associations between Cholesterol/HDL ratio and vitamin D levels (r=0.6847, P≤0.0001) (Figure 3) and LDL/HDL ratio and vitamin D levels (r= 0.2748, P≤0.0001) (Figure 4) were seen.

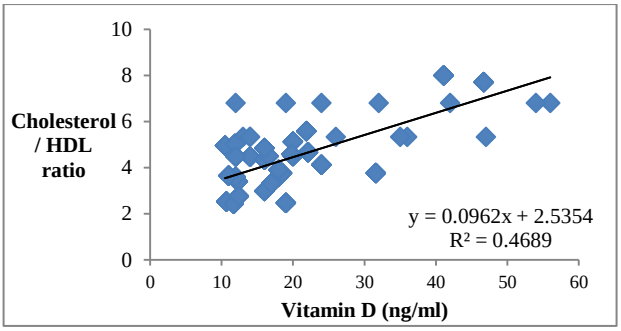

Figure 3: Vitamin D and cholesterol/HDL ratio in cases.

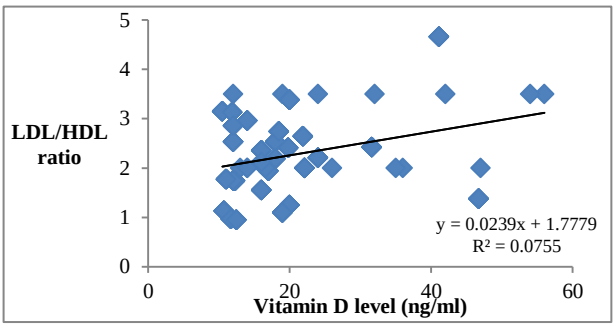

Figure 4: Vitamin D and LDL/HDL ratio in cases.

Among cases not significant associations were seen between vitamin D and triglycerides (r=0.1053, p=0.12) and HDL and vitamin D levels (r=-0.06051, P=0.3750).

Vitamin D deficiency was higher in cases (87%) as compared to controls (78%) and this association was found to be statistically significant (Chi-square=5.409, df=1, P=0.02 and odds ratio=0.5253(95% CI:0.3125 to 0.8828)) (Table 1).

Table 1: Comparison of deficiency of vitamin D in cases and controls.

Vitamin D (ng/ml)	Cases	Controls	Total
<30	189 (87%)	156 (78%)	345
>30	28 (12.9%)	44 (22%)	72
Total	217	200	417

Mean vitamin D level in cases was 19.142±9.453 SD ng/ml whereas in controls it was 23.974±13.125 SD ng/ml. This association was found to be statistically significant (t=4.338; df=415; P≤0.0001) (Table 2).

Table 2: Vitamin D levels in cases and controls.

Parameter	Vitamin D (ng/ml) in cases	Vitamin D (ng/ml) in controls
Mean	19.142	23.974
N	217	200
Standard deviation	9.453	13.125

DISCUSSION

Our study showed no correlation between 25-hydroxy vitamin and triglycerides or HDL but Jorde R et al found direct relationship between HDL and 25-hydroxy vitamin D and inverse relationship between triglycerides and 25-hydroxy vitamin D.[11]

Similarly studies from Cigolini et al. from Italy, Martins et al. from USA, and Hyppönen et al. from UK have shown significant relationship between deficiency of 25-hydroxyvitamin D and high triglycerides.[12-14] Auwerx et al showed significant positive association between 25-hydroxy vitamin D and HDL cholesterol in Belgian population group.[15]

It is known that vitamin D increases serum calcium by enhancing intestinal calcium absorption.[16] This calcium could then reduce serum triglycerides by reducing hepatic triglyceride formation and secretion.[17] Also calcium has been shown to bind to lipids in the gut and promote their excretion.[18] Vitamin D regulates triglyceride metabolism by causing the expression of VLDL cholesterol receptors in some types of cells.[19]

Our study showed positive association between 25-hydroxy vitamin D and LDL cholesterol in ischemic stroke patients similar to a study on diabetics in Iran by Saedisomeolia A et al.[20]

Grimes D et al suggested that in the presence of sunlight squalene is converted to 7-dehydrocholesterol and vitamin D and in the absence of sunlight it is diverted to the synthesis of cholesterol.[21]

Positive association was found between 25-hydroxy vitamin D and the ratio of low-density lipoprotein to high-density lipoprotein in our study whereas in a prospective study by Carbone LD et al. significant negative correlation was found between 25-hydroxy vitamin D and the ratio of low-density lipoprotein to high-density lipoprotein.[22]

When vitamin D deficiency is present, the risk of insulin resistance increases and this is associated with an elevation of levels of VLDL cholesterol and triglycerides.[17,23]

Majority of the subjects were deficient in vitamin D in our study similar to that stated by Lips P et al where serum (OH)D was lower with higher latitudes and with darker skin types.[24,25] India and China had more prevalence of vitamin D deficiency (serum 25(OH)D <25 nmol/l) as compared to Japan and South-East Asia.

In our study a positive correlation was seen between Vitamin D and serum cholesterol, VLDL, LDL, triglycerides, cholesterol/HDL ratio and LDL/HDL ratio but inverse correlation between vitamin D and HDL concluding that in ischemic stroke patients increase in vitamin D is associated with increase in atherogenic lipids.

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REFERENCES

1. Holick MF. Evolution, biologic functions and recommended dietary allowances for vitamin D. In: Holick MF, ed. Vitamin D: Physiology, molecular biology, and clinical applications. Totowa, NJ: Humana Press Inc;1998:1-16.
2. The vitamin D questions: how much do you need and how should you get it? Wolpowitz D, Gilchrest BA J Am Acad Dermatol. 2006;54(2):301-17.
3. Kamycheva E, Jorde R, Figenschau Y, Haug E. Insulin sensitivity in subjects with secondary hyperparathyroidism and the effect of a low serum 25-hydroxyvitamin D level on insulin sensitivity. Journal of Endocrinological Investigation. 2007;30(2):126-132.
4. Chiu KC, Chu A, Go VLW, Saad MF. Hypovitaminosis D is associated with insulin resistance and β cell dysfunction. Am J Clin Nutr. 2004;79:820-5.
5. Zitterman A. Vitamin D in preventive medicine: are we ingoring the evidence? British Journal of Nutrition. 2003;89:552-72.
6. Martin MJ, Hulley SB, Browner WS, Kuller LH, Wentworth D. Serum cholesterol, blood pressure, and mortality: implications from a cohort of 361 662 men. Lancet. 1986;ii:933-6.
7. Rose G, Shipley M. Plasma cholesterol concentration and death from coronary heart disease: 10 year results of the Whitehall study. Br Med J. 1986;293:306-7.
8. Wang TJ, Pencina MJ, Booth SL, Jacques PF, Ingelsson E, Lanier K, Benjamin EJ, D'Agostino RB, Wolf M, Vasan RS. Vitamin D deficiency and risk of cardiovascular disease. Circulation. 2008;117:503-11.
9. Kennel KA, Drake MT, Hurley DL. Vitamin D deficiency in adults: when to test and how to treat. Mayo Clinic Proc. 2010;85(8):752-8.
10. Food and Nutrition Board, Institute of Medicine. Dietary reference intakes for calcium and vitamin D. Washington DC, National Academy Press, 2010.
11. Jorde R, Grimnes G. Vitamin D and metabolic health with special reference to the effect of vitamin D on serum lipids. Prog Lipid Res. 2011;50(4):303-12.

12. Cigolini M, Iagulli MP, Miconi V, Galiotto M, Lombardi S, Targher G. Serum 25-hydroxyvitamin D3 concentrations and prevalence of cardiovascular disease among type 2 diabetic patients. Diabetes Care. 2006;29(3):722-4.
13. Martins D, Wolf M, Pan D, et al. Prevalence of cardiovascular risk factors and the serum levels of 25-hydroxyvitamin D in the United States: data from the third national health and nutrition examination survey. Archives of Internal Medicine. 2007;167(11):1159-65.
14. Hyppönen E, Boucher BJ, Berry DJ, Power C. 25-hydroxyvitamin D, IGF-1, and metabolic syndrome at 45 years of age. A cross-sectional study in the 1958 british birth cohort. Diabetes. 2008;57(2):298-305.
15. Auwerx, Johan, Roger B, Hugo K. Relation between 25-hydroxyvitamin D3, apolipoprotein AI, and high density lipoprotein cholesterol. Arteriosclerosis, Thrombosis, and Vascular Biology. 1992:12(6);671-4.
16. Wasserman RH. Vitamin D and intestinal absorption of calcium: a view and overview. In: P JW, Feldman D, Glorieux F, editors. Vitamin D. Acedemin press; San Diego, CA:2005;411-428.
17. Choi HS, Kim KA, Lim CY, et al. Low serum vitamin D is associated with high risk of diabetes in Korean adults. Journal of Nutrition. 2011;141(8):1524-8.
18. Christensen R, Lorenzen JK, Svith CR, Bartels EM, Melanson EL, Saris WH, Tremblay A. Effect of calcium from dairy and dietary supplements on faecal fat excretion: a meta-analysis of randomized controlled trials., Astrup A Obes Rev. 2009;10(4):475-86.
19. Kohno M, Takahashi S, Oida K, et al. 1α25-dihydroxyvitamin D3 induces very low density lipoprotein receptor mRNA expression in HL-60 cells in association with monocytic differentiation. Atherosclerosis.1997;133(1):45-9.
20. Saedisomeolia A, Taheri E, Djalali M, Moghadam AM, Qorbani M. Association between serum level of vitamin D and lipid profiles in type 2 diabetic patients in Iran. Journal of Diabetes and Metabolic Disorders. 2014;13:7.
21. Grimes DS, Hindle E, Dyer T. Sunlight, cholesterol and coronary heart disease. Quarterly Journal of Medicine. 1996;89(8):579-90.
22. Carbone, Laura D, et al. 25-Hydroxyvitamin D, cholesterol, and ultraviolet irradiation. Metabolism. 2008;57(6):741-8.
23. Ginsberg HN, Zhang YL, Hernandez AO. Regulation of plasma triglycerides in insulin resistance and diabetes. Archives of Medical Research. 2005;36(3):232-40.
24. Lips P. Worldwide status of vitamin D nutrition. J Steroid Biochem Mol Biol. 2010;121(1-2):297-300.

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