Effects of Vitamin D on Blood Pressure: Vitamin D act as Anti Hypertensive agent

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ABSTRACT

Aim
The purpose of this study to rule out the role of vitamin D in hypertensive patients.

Methodology
Total 100 hypertensive patients were selected with same age and same disease criteria, they were divided in to two groups; group A & B, 50 patients in each group. Group A patients were given antihypertensive drugs and group B patients were given antihypertensive drugs along with vitamin D orally in tablet form.

Results
Blood pressure readings were recorded on 1st day of visit then after 15 days & on 45 days interval of therapy. It was observed that there was significantly decline (p< 0.05) in B.P in those patients who were given antihypertensive drugs along with regularly vitamin D therapy.

Conclusion
From this study we concluded that vitamin D not only the vitamin or hormone but also act like antihypertensive agent.

Keywords: Hypertension, Vitamin D, Blood Pressure
INTRODUCTION
Hypertension is counted as the major cause and most important factor in the development of cardiovascular diseases worldwide. (1)
The National Health Survey of Pakistan estimated that hypertension affects 18% of adults and 33% of adults above 45 years old. In another report, it was shown that 18% of people in Pakistan suffer from hypertension with every third person over the age of 40 becoming increasingly vulnerable to a wide range of diseases. It was also mentioned that only 50% of the people with hypertension were diagnosed and that only half of those diagnosed were ever treated. Thus, only 12.5% of hypertension cases were adequately controlled. (2)
Vitamin D is named a »vitamin« like vitamin A or C because of its exogenous source, but without a doubt it is hormone. Vitamin D is a secosteroid that is made in the skin by action of sunlight, or much less frequently, ingested through diet. During ultraviolet B radiation, 7-dehydrocholesterol (provitamin D) is converted to previtamin D, which is converted into vitamin D. Vitamin D is very rarely found in food. It can be found in fish like salmon or in fish oils. In some countries foods like milk or bread products are fortified with vitamin D, but it is not an important source of vitamin D. In the liver vitamin D is converted by the enzyme cytochrome 450 into calcidol.
This conversion is under low metabolic control. Calcidol is biologically inert but it is used to determine vitamin D status because it has a long half-life, is easily measured, and there is good correlation between the level of calcidol and some diseases. There are many reasons for vitamin D deficiency or insufficiency: skin pigmentation, aging, obesity, lack of sun exposure, chronic disease, particularly chronic kidney disease, latitude of residence etc. (2, 3, 4).
In the kidney, calcidol is metabolized by the enzyme 1α-hydroxylase (CYP27B1) to calcitriol, an active metabolite of vitamin D. The production of calcitriol is very tightly controlled by calcium and phosphorus levels, by parathyroid hormone and fibroblast growth factor 23. Another enzyme in the kidney, 24-hydroxylase (CYP24), catabolizes calcidol and calcitriol into biologically inactive calcitriolic acid (2, 3). Calcitriol acts by activating the vitamin D receptor (VDR), which binds together with transcription factor RXR in specific regions of DNA (VDREs, vitamin D response elements) (5). Vitamin D receptors are widely distributed. In addition to tissue and organs involved in mineral and bone metabolism, VDRs are found in vascular smooth muscle, endothelium, the heart, brain, skin, pancreas, macrophages etc. Moreover, some cells like macrophages or vascular cells express 1α-hydroxylase, i.e. the possibility of converting calcidol into calcitriol. This extra renal calcitriol is not tightly controlled and the calcitriol produced in these cells have local, autocrine or paracrine effect. The distribution of VDRs and the local production of calcitriol demonstrate that vitamin D is a pluripotent hormone involved not only in calcium homeostasis and bone metabolism. Today, there is much data that vitamin D deficiency or insufficiency can cause bone disease, malignancies, metabolic and immunological diseases, and cardiovascular disease and hypertension (2, 3, and 4).

Biological links between vitamin D and blood pressure
The renin-angiotensin-aldosterone system (RAAS) is a main regulator of blood pressure and plays a critical role in the regulation of volume and electrolyte homeostasis. Increased activation of RAAS is associated with hypertension. It is well known that renin is produced in juxtaglomerular cells of the kidney and that it stimulates angiotensin II and aldosterone production. Their increased production elevates blood pressure by vasoconstriction and water retention. Secondary hyperparathyroidism, commonly seen in vitamin D deficiency, could be the reason for hypertension. The mechanism is not completely clear, but it is a well-known association that high PTH levels affect vascular smooth muscle cells and increase vascular stiffness and promotes atherosclerosis. This is very often seen in patients with chronic kidney disease. (6)

MATERIAL & METHODS
The present study was conducted at the medical OPD & Medical Research Centre Liaquat University of Medical & health Sciences Jamshoro Sindh Pakistan. Total 100 diagnosed hypertensive patients were
selected. All patients with age range from 40 to 50 years of age having hypertension from at least last two years. They were divided into two groups; group A & group B, 50 patients in each group. We give beta blockers or calcium channel blockers as antihypertensive in group A patients according to their need and suitable criteria. The same antihypertensive drugs were given to group B patients with same dose along with vitamin D orally in tablet form for 45 days. Vitamin D level was measured by ELISA technique. For statistical analysis SPSS version 16 was used.

RESULTS
At the time of first visit the mean systolic B.P of group A was 155mmHg and of Group B was 150 mmHg and diastolic B.P was 110 mmHg of group A while 115 mmHg of group B. After 15 days mean B.P group A, after taking antihypertensive drugs like Calcium channel blockers and beta blockers the it was 135/ 100 mmHg , and after 45 days trial it was 130/90 mmHg. On the other hand after 15 days of antihypertensive therapy along with taken vitamin D orally in tablet form the mean B.P was 130/100 mmHg and after 45 days therapy it was 120/75 mmHg.

Above results show that there was significantly decline (p < 0.05) in systolic as well as diastolic B.P in those patient who taken antihypertensive drugs along with vitamin D therapy.

Table No: 01 shows the Mean B.P levels in both groups at the time of 1st visit, after 15 and 45 days of therapy along with their significance.

Graph No: 01 shows the mean systolic B.P in both groups at the time of all three consecutive visits and graph B represents the mean diastolic B.P in both groups.

Graphically it shows that vitamin D has effects on both systolic as well diastolic but diastolic B.P affected more than systolic with vitamin D therapy.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Mean B.P (mmHg) at the 1st Visit</th>
<th>Mean B.P (mmHg) after 15 days of therapy</th>
<th>Mean B.P(mmHg) after 45 days of therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (n=50) Patients only taking antihypertensive drugs</td>
<td>155/110</td>
<td>135/100</td>
<td>130/90</td>
</tr>
<tr>
<td>B (n=50) Patients taking antihypertensive along with vitamin D</td>
<td>150/115</td>
<td>130/100</td>
<td>120/75 *</td>
</tr>
</tbody>
</table>

(* = P value < 0.05)

Graph A: Systolic B.P. of patients of both groups on their three different recordings.
DISCUSSION

Vitamin D has important role to maintain blood pressure especially arterial pressure. Most of population of Pakistan suffering from deficient values of vitamin D or near to normal but not the normal values due to different hereditary and environmental factors. Experimental evidence shows that calcitriol inhibits renin synthesis in the kidney. In a very good study Li et al. demonstrated that vitamin D, i.e. calcitriol, is a potent inhibitor of renin synthesis (7). They showed that renin expression and plasma angiotensin II production is increased in VDR receptor-null mice, leading to hypertension, cardiac hypertrophy and increased water intake. In wild mice, i.e. Mice with intact VDR receptors, the inhibition of calcitriol synthesis also led to increase in renin expression, whereas calcitriol injection led to renin suppression. Kong et al. have demonstrated that this action of calcitriol on juxtaglomerular cells, i.e. inhibition of renin expression, is independent of calcium and PTH (8). Moreover, Zhou et al. in a few experimental studies have demonstrated that defect in the 1a-hydroxylase gene, i.e. local production of calcitriol in some cells led to hypertension, left ventricular hypertrophy and systolic dysfunction (9). Tomaschitz A et al. evaluated the concentration of plasma renin, angiotensin 2 and calcidol and calcitriol in a large cohort of patients (LURIC study) (10). In 3,296 subjects a steady increase of plasma renin concentration across a declining concentration of calcidol or calcitriol was observed. They concluded that in humans a lower level of calcidol or calcitriol is related to the up regulation of RAAS. Obviously, there are enough results showing negative relationship between calcidol or calcitriol levels and RAAS activity. There are also autonomic mechanisms involved in the relationship between blood pressure and vitamin D. the present study also show the positive effects of vitamin D therapy along with antihypertensive drugs. These results strongly support that vitamin D act also as antihypertensive drug.

REFERENCES


