Introduction

CKD is an emerging public health problem and one of the most powerful predictors of premature cardiovascular disease. Progression of CKD and many of the cardiovascular complications may be linked to hypovitaminosis D. Patients with CKD have an exceptionally high rate of severe vitamin D deficiency that is further exacerbated by the reduced ability to convert 25(OH) vitamin D into the active form, 1,25 dihydroxyvitamin D.

The major complications related to CKD include cardiovascular disease, anaemia, infectious complications, neuropathy and abnormalities related to mineral and bone metabolism. Disturbance in mineral and bone metabolism accompanied by soft tissue and vascular calcification is one of the most common and important consequences of CKD development and progression. As well described in the literature, CKD is characterized by low 25(OH) vitamin D (calcidiol), low 1,25(OH)2 vitamin D (calcitriol) as well as vitamin D resistance.

According to the guidelines, serum levels of 25(OH)-D between 20 and 30 ng/ml indicate vitamin D insufficiency and levels less than 20 ng/ml indicate vitamin D deficiency. Severe deficiency is defined as a 25(OH)-D level less than 10 ng/ml. KDIGO (Kidney disease improving global outcomes) guidelines recommend that the serum level of 25(OH)D should be maintained over 30 ng/ml in patients of all stages of CKD.

It is well established in various studies that Patients with CKD have an higher rate of severe vitamin D deficiency. Limited studies have evaluated vitamin D status in Indian population groups and found the deficiency to be highly prevalent. No data, however, are available on the prevalence or severity of 25(OH)-D deficiency in Indian CKD patients.

Materials and Methods

It is an observational hospital based cross-sectional study on 100 cases of Chronic Kidney Disease patients and matched control subjects to study the Vitamin D status in CKD population and correlation between their serum 25-OH-vitamin D level and eGFR. Study was conducted in Vivekananda Institute of Medical sciences (VIMS), Ramakrishna Mission Seva Pratishthan (RKMSP), Kolkata for a period of 18 months (January 2017-June 2018).

100 CKD Patients were selected after proper initial screening from outdoor clinics, dialysis unit and different wards under department of General Medicine and Nephrology, RKMSP. Age and sex matched controls were selected from same study population. Ethical clearance was taken from the Institutional Ethical Committee prior to the commencement of the study.

Inclusion criteria were age of eighteen years or older and eGFR value <60 ml/min/1.73 m2. Patients were excluded who were on medications known to affect vitamin D absorption and metabolism such as anticonvulsants, isoniazid, rifampicin, theophylline, glucocorticoids, bisphosphonates
Among 100 cases, 44(44.0%) patients were female and 56(56.0%) patients were male. Among 100 control, 53(53.0%) patients were female and 47(47.0%) patients were male. Among cases, the mean age (mean ± s.d.) of patients was 60.69 ± 10.62 years. Among control, the mean age (mean ± s.d.) of patients was 60.81 ± 9.17 years. Among cases, 47(47.0%) patients were male. Among 53(53.0%) patients were female and among 100 control, 56(56.0%) patients were male. Among cases, the mean eGFR (mean ± s.d.) of patients was 25.66 ± 11.89. Among control, the mean eGFR (mean ± s.d.) of patients was 87.22 ± 17.82. Among 100 cases, 23 were CKD5 (eGFR<15), 44 were CKD4 (eGFR 15-30), 27 were CKD3b (eGFR 31-45), 6 were CKD3a (eGFR 46-60). Among 100 CKD cases, 21 were dialysis dependent.

Following laboratory investigations were done- Serum urea, creatinine, 25-OH-vitamin D, electrolytes (sodium, potassium, calcium, phosphate). Ultrasonography of lower abdomen was done to assess kidney sizes.

Estimation of GFR was done using MDRD-EPI study equation: GFR (mL/min/1.73 m2) = 175 × (Scr)-1.154 × (Age)-0.203 × (0.742 if female). Vitamin D levels are not a reliable measure of vitamin D status. The positive correlation was found between eGFR and vitamin-D level and that was statistically significant.

**Discussion**

This is a cross sectional, observational study of 100 cases of Chronic Kidney Disease patients in Department of Medicine and Nephrology, Vivekananda Institute of Medical sciences (VIMS), Ramakrishna Mission Seva Pratishthan (RKMS), Kolkata, during the period of January 2017-June 2018. This study on 100 cases of Chronic Kidney Disease patients and matched control subjects is undertaken to study the prevalence of Vitamin D deficiency in CKD population and correlation between their serum 25(OH)-vitamin D level and eGFR.

Zulfikar Jabbar et al found that mean age was 39.55 ± 19.88 years in control and 40.61 ± 12.04 years in cases. We found that among cases, the mean age (mean± s.d.) of patients was 60.69 ± 10.62 years and among control, the mean age (mean± s.d.) of patients was 60.81 ± 9.17 years. Among cases, the mean eGFR (mean ± s.d.) was 25.15 ± 11.89. Among control, the mean eGFR (mean ± s.d.) of patients was 87.22 ± 17.82. Among 100 cases, 23 were CKD5 (eGFR<15), 44 were CKD4 (eGFR 15-30), 27 were CKD3b (eGFR 31-45), 6 were CKD3a (eGFR 46-60). Among 100 CKD cases, 21 were dialysis dependent.

Among cases, 38(38.0%) patients had Vit D deficiency, 44(44.0%) patients had Vit D insufficiency and 18(18.0%) patients had normal Vit D. Among control, 5(5.0%) patients had Vit D deficiency, 33(33.0%) patients had Vit D insufficiency and 66(66.0%) had normal Vit D. Among cases, the mean Vit D (mean ± s.d.) of patients was 22.57 ± 9.76. Among control, Vit D of patients was 35.24 ± 10.18.

In CKD cases, among 79 non-dialysis patients Vit D of patients was 25.66 ± 8.54. Among 21 dialysis patients Vit D of patients was 10.94 ± 2.65. Difference of mean Vit D in Dialysis vs Non-Dialysis was statistically significant (p<0.0001).

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The positive correlation was found between eGFR and vitamin-D level and that was statistically significant.

**Results**

Among 100 cases, 44(44.0%) patients were female and 56(56.0%) patients were male. Among 100 control, 53(53.0%) patients were female and 47(47.0%) patients were male. Among cases, the mean age (mean ± s.d.) of patients was 60.69 ± 10.62 years. Among control, the mean age (mean ± s.d.) of patients was 60.81 ± 9.17 years. Among cases, the mean eGFR (mean ± s.d.) was 25.15 ± 11.89. Among control, the mean eGFR (mean ± s.d.) of patients was 87.22 ± 17.82. Among 100 cases, 23 were CKD5 (eGFR<15), 44 were CKD4 (eGFR 15-30), 27 were CKD3b (eGFR 31-45), 6 were CKD3a (eGFR 46-60). Among 100 CKD cases, 21 were dialysis dependent.

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**Table 1: Distribution of Age and sex in groups**

<table>
<thead>
<tr>
<th>Group</th>
<th>Case</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>44</td>
<td>53</td>
</tr>
<tr>
<td>Male</td>
<td>56</td>
<td>47</td>
</tr>
<tr>
<td>Mean age</td>
<td>60.69</td>
<td>60.81</td>
</tr>
</tbody>
</table>

**Table 2: Distribution of vitamin D in groups**

<table>
<thead>
<tr>
<th>Vitamin D</th>
<th>Case</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficiency</td>
<td>38</td>
<td>5</td>
</tr>
<tr>
<td>Insufficiency</td>
<td>44</td>
<td>33</td>
</tr>
<tr>
<td>Normal</td>
<td>18</td>
<td>62</td>
</tr>
</tbody>
</table>

**Table 3: Distribution of mean vit D in dialysis vs non-dialysis patients**

<table>
<thead>
<tr>
<th>CKD Sub group</th>
<th>eGFR Number</th>
<th>Vitamin D</th>
<th>p.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CKD 3a</td>
<td>45-60</td>
<td>6</td>
<td>36.31 ± 4.98</td>
</tr>
<tr>
<td>CKD 3b</td>
<td>31-45</td>
<td>27</td>
<td>25.15 ± 8.54</td>
</tr>
<tr>
<td>CKD 4</td>
<td>15-30</td>
<td>27</td>
<td>21.54 ± 10.18</td>
</tr>
<tr>
<td>CKD 5</td>
<td>&lt;15</td>
<td>23</td>
<td>14.58 ± 9.76</td>
</tr>
</tbody>
</table>

**Table 4: Distribution of mean vit D vs. eGFR**

<table>
<thead>
<tr>
<th>Number</th>
<th>Vitamin D</th>
<th>p.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialysis No</td>
<td>79</td>
<td>25.66 ± 8.54</td>
</tr>
<tr>
<td>Yes</td>
<td>21</td>
<td>10.94 ± 2.65</td>
</tr>
</tbody>
</table>

**Fig. 1: Distribution of mean Vit D vs. eGFR**

![Image of Fig. 1 showing the distribution of mean Vit D vs. eGFR](image-url)
control, 53(53.0%) patients had female and 47(47.0%) patients had male.

Rozita M et al\textsuperscript{10} found mean levels of 25(OH) D were comparable in the control and CKD groups (15.3 ± 4.2 ng/mL and 16.1 ± 6.2 ng/mL (p = 0.453) respectively. The proportion of subjects with 25(OH)D insufficiency and 25(OH) D deficiency were also comparable in both groups. However in 25(OH)D deficiency group, the mean levels of 25(OH)D was significantly lower in the CKD groups (11.2 (6.5) ng/mL vs 12.6 [3.7], p = 0.039). The serum 25(OH)D levels were also not different across the different CKD stages (p = 0.87).

We found that in cases, the mean Vit D (mean± s.d.) of patients was 22.57 ± 9.76. In control, the mean Vit D (mean± s.d.) of patients was 35.24 ± 10.18. Difference of mean Vit D in two groups was statistically significant (p<0.0001). We found that among cases, 38(38.0%) patients had Vit D deficiency, 44(44.0%) patients had Vit D insufficiency and 18(18.0%) patients had normal Vit D. Among control, 5(5.0%) patients had Vit D deficiency, 33(33.0%) patients had Vit D insufficiency and 66(66.0%) patients had Vit D normal. Association of Vit D vs. group was statistically significant (p<0.0001) (Table 3).

Arulanantham R et al\textsuperscript{12} found that the prevalence of vitamin D deficiency was much higher in stage IV and stage V CRF when compared to stage II and stage III CRF. So, as the severity of CRF increases the prevalence of vitamin D deficiency increases.

We found that in CKD stage V/ (eGFR<15) Vit D of patients was 11.11 ± 2.95. In CKD stage IV/(eGFR15-30) Vit D of patients was 26.82 ± 7.36. In CKD stage 3a/(eGFR>30) Vit D of patients was 36.31 ± 4.98. Difference of mean Vit D vs eGFR was statistically significant (p<0.0001) (Table 4 and Figure 1). The positive correlation was found between eGFR and Vitamin D level and that was statistically significant (Table 5).

**Summary and Conclusion**

Both deficiency and insufficiency of Vitamin D were higher in CKD patients compared to control and that is statistically significant. Vitamin D deficiency was more pronounced in advanced stages of CKD and more marked in hemodialysis patients compared to non-dialysis CKD patients. eGFR was strongly associated with serum Vitamin D level, that is also statistically significant. The positive correlation was found between Vitamin D and eGFR.

**References**