Observational Study

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The association between Vitamin D metabolites and low-energy distal radius fractures in non-elderly adults

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Background: This study aimed to evaluate Vitamin D metabolism in non-elderly adults with low-energy distal radius fractures (DRFs). Serum 25-hydroxyvitamin D [25-(OH)D] and 1,25-dihydroxyvitamin D [1,25-(OH)D] levels were compared with those of age- and sex-comparable healthy controls. In addition, the relationship between Vitamin D metabolites, other biochemical parameters, and articular involvement patterns was investigated in patients with low-energy DRFs.

Methods: This observational case-control study included 102 patients aged 18-60 years with low-energy DRFs and 138 age- and sex-comparable healthy controls in the

same age range. Serum 25-(OH)D and 1,25-(OH)D levels were compared between the fracture and control groups. In the fracture group, Frykman fracture type was used to assess articular involvement, and its relationship with alkaline phosphatase (ALP), calcium (Ca), phosphate (P), parathyroid hormone, and Vitamin D metabolite levels was analyzed.

Results: A total of 240 participants were included in the final analysis. Age and sex distribution were similar between the fracture and control groups ($p=0.285$ and $p=0.855$, respectively). Serum 25-(OH)D levels did not differ significantly between groups ($p=0.557$), whereas serum 1,25-(OH)D levels were significantly lower in the low-energy DRF group than in controls ($p<0.001$). Among Frykman fracture subgroups, significant differences were found in 25-(OH)D, ALP, and Ca levels ($p=0.009$, $p=0.001$, and $p=0.002$, respectively). Extra-articular fractures were associated with lower 25-(OH)D and higher ALP levels compared with other fracture subgroups, while Ca levels were lower than in selected intra-articular fracture subgroups.

Conclusion: Non-elderly adults with low-energy DRFs had lower serum 1,25-(OH)D levels despite having serum 25-(OH)D levels comparable to those of healthy controls. These findings suggest that alterations in active Vitamin D metabolism may be associated with low-energy DRFs in this population. Assessment of active Vitamin D metabolites together with conventional biochemical parame-ters may provide a more comprehensive understanding of the metabolic profile of non-elderly adults presenting with low-energy DRFs.