Letter to the Editor

Regarding "A Diagnosis of Vitamin D Deficiency Is Associated With Increased Rates of Anterior Cruciate Ligament Tears and Reconstruction Failure"

It was with great interest I read the article entitled "A Diagnosis of Vitamin D Deficiency Is Associated With Increased Rates of Anterior Cruciate Ligament Tears and Reconstruction Failure" by Albright and colleagues.[1] From a large, well-designed, retrospective study, Albright and colleagues[1] identify an increase in index anterior cruciate ligament (ACL) tears and revision ACL surgery rates with hypovitaminosis D. The inherent limitations of a retrospective protocol are discussed therein.[1] It is noteworthy, however, to highlight a significant strength of the study that has been lacking in this overarching field of research. Specifically, Albright and colleagues[1] assessed vitamin D status before trauma and related vitamin D status to ACL injury and revision surgery rates. This is significant because Albright and colleagues[1] controlled for the potentially deleterious and confounding influence of trauma-induced inflammation on serum 25(OH)D concentrations[2-4] by assessing vitamin D status before an ACL injury.

The systemic inflammatory response to an ACL injury (and surgery) is characterized by transient perturbations in diverse cytokines.[5-7] In addition to regulating host defenses and cell signaling, cytokines moderate the enzymatic machinery of vitamin D metabolism in peripheral blood immune cells.[2,8,9] Thus it is plausible that cytokine alterations in the circulation after an ACL injury contribute to the conversation of 25(OH)D to other vitamin D metabolites (e.g., 1,25-dihydroxyvitamin D).[6] This, in turn, temporally compromises serum 25(OH)D concentrations and potentially confounds both the interpretation of vitamin D status[4,10,11] and its subsequently inferred association with desired outcomes or variables.

The unique findings by Albright and colleagues[1] also establish the basis for future vitamin D research in those at risk for an ACL injury and outcomes after an ACL injury and surgery. For example, taking into consideration the recent association of index ACL tears with low vitamin D[1] and concomitant knee structure damage with an ACL injury,[12] it is reasonable to presume that low serum 25(OH)D exacerbates knee structure damage (e.g., meniscus, cartilage, or both) with an ACL injury. Second, low vitamin D and ACL injuries are related to the progression in knee osteoarthritis and post-traumatic knee osteoarthritis (PTOA), respectively.[13,14] However, it is unknown whether low vitamin D contributes to the development and progression in PTOA after an ACL injury. Third, low vitamin D associates with muscular weakness after an ACL injury[15] and with muscular atrophy and weakness in other conditions.[16-18] Quadriceps atrophy and weakness are predominant impairments that continue to challenge the rehabilitative efforts after an ACL injury and surgery, and it is unknown if correcting hypovitaminosis D diminishes muscular impairments and improves outcomes after an ACL injury.

Albright and colleagues[1] are commended for performing an outstanding study that extends our current knowledge. Future research assessing the impact of trauma induced alterations on serum 25(OH)D and determining whether correcting hypovitaminosis D improves outcomes after an ACL injury are warranted.

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References

1. Albright JA, Chang K, Byrne RA, et al. A diagnosis of vitamin D deficiency is associated with increased rates of

anterior cruciate ligament tears and reconstruction failure. *Arthroscopy* 2023;39:2477-2486.
2. Smolders J, van den Ouweland J, Geven C, Pickkers P, Kox M. Letter to the editor: Vitamin D deficiency in COVID-19: Mixing up cause and consequence. *Metabolism* 2021;115:154434.
3. Henriksen VT, Rogers VE, Rasmussen GL, et al. Pro-inflammatory cytokines mediate the decrease in serum 25(OH)D concentrations after total knee arthroplasty? *Med Hypotheses* 2014;82:134-137.
4. Reid D, Toole BJ, Knox S, et al. The relation between acute changes in the systemic inflammatory response and plasma 25-hydroxyvitamin D concentrations after elective knee arthroplasty. *Am J Clin Nutr* 2011;93:1006-1011.
5. Barker T, Henriksen VT, Rogers VE, Trawick RH. Improvement in muscle strength after an anterior cruciate ligament injury corresponds with a decrease in serum cytokines. *Cytokine* 2015;73:199-202.
6. Barker T, Martins TB, Kjeldsberg CR, Trawick RH, Hill HR. Circulating interferon-gamma correlates with 1,25(OH)D and the 1,25(OH)D-to-25(OH)D ratio. *Cytokine* 2012;60:23-26.
7. Bigoni M, Sacerdote P, Turati M, et al. Acute and late changes in intraarticular cytokine levels following anterior cruciate ligament injury. *J Orthop Res* 2013;31:315-321.
8. Edfeldt K, Liu PT, Chun R, et al. T-cell cytokines differentially control human monocyte antimicrobial responses by regulating vitamin D metabolism. *Proc Natl Acad Sci USA* 2010;107:22593-22598.
9. Hummel DM, Fetahu IS, Groschel C, Manhardt T, Kallay E. Role of proinflammatory cytokines on expression of vitamin D metabolism and target genes in colon cancer cells. *J Steroid Biochem Mol Biol* 2014;144 Pt A:91-95.
10. Waldron JL, Ashby HL, Cornes MP, et al. Vitamin D: A negative acute phase reactant. *J Clin Pathol* 2013;66:620-622.
11. Duncan A, Talwar D, McMillan DC, Stefanowicz F, O'Reilly DS. Quantitative data on the magnitude of the systemic inflammatory response and its effect on micronutrient status based on plasma measurements. *Am J Clin Nutr* 2012;95:64-71.
12. Lohmander LS, Englund PM, Dahl LL, Roos EM. The long-term consequence of anterior cruciate ligament and meniscus injuries: osteoarthritis. *Am J Sports Med* 2007;35:1756-1769.
13. Felson DT, Niu J, Clancy M, et al. Low levels of vitamin D and worsening of knee osteoarthritis: Results of two longitudinal studies. *Arthritis Rheum* 2007;56:129-136.
14. Snoeker B, Turkiewicz A, Magnusson K, et al. Risk of knee osteoarthritis after different types of knee injuries in young adults: A population-based cohort study. *Br J Sports Med* 2020;54:725-730.
15. Barker T, Martins TB, Hill HR, et al. Low vitamin D impairs strength recovery after anterior cruciate ligament surgery. *J Evid Based Complement Alternat Med* 2011;16:201-209.
16. Barker T, Henriksen VT, Rogers VE, et al. Vitamin D deficiency associates with g-tocopherol and quadriceps weakness but not inflammatory cytokines in subjects with knee osteoarthritis. *Redox Biol* 2014;2:466-474.
17. Houston DK, Tooze JA, Neiberg RH, et al. 25-hydroxyvitamin D status and change in physical performance and strength in older adults: The Health, Aging, and Body Composition Study. *Am J Epidemiol* 2012;176:1025-1034.
18. Janssen HC, Emmelot-Vonk MH, Verhaar HJ, van der Schouw YT. Vitamin D and muscle function: Is there a threshold in the relation? *J Am Med Dir Assoc* 2013;14:627-628.