Postoperative Vitamin D Surveillance and Supplementation May Prevent or Treat Deficiency after Total Knee Arthroplasty: A Retrospective Cohort Analysis

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INTRODUCTION:
Vitamin D deficiency is common among patients undergoing total joint arthroplasty, with rates as high as 63% of patients. Additionally, vitamin D deficiency is associated with poorer functional outcomes and increased complication rates after total knee arthroplasty (TKA). Yet, much of the current literature focuses on measuring and correcting preoperative vitamin D levels. To our knowledge, there is no longer term study evaluating postoperative vitamin D levels and supplementation following TKA. Thus, the purposes of our study were to: 1) compare quantitative vitamin D levels and supplementation regimens following TKA stratified by patient gender and race, and 2) evaluate the factors associated with vitamin D repletion in patients with vitamin D deficiency. We hypothesized that postoperative supplementation would be associated with increased vitamin D levels compared to no supplementation.
METHODS:
A retrospective cohort study was conducted of patients who underwent primary, unilateral TKA procedures from January 1, 2015 to December 31, 2022 in a single hospital. Exclusion criteria were patients who underwent revision TKA, did not have postoperative vitamin D labs, or died within two years of the date of surgery. We analyzed 25-OH vitamin D levels preoperatively and postoperatively at one month, three months, six months, one year, and/or two years. Vitamin D deficiency was defined as a 25-OH vitamin D level less than 30 ng/mL, and vitamin D sufficiency was defined as a level of 30 ng/mL and above. Supplementation categories were defined as none, low dose (1000 IU and below), medium dose (1001-5000 IU), and high dose (>5000 IU). Repletion was defined as achieving vitamin D sufficiency after being vitamin D deficient. Demographic data were collected for each patient. Statistical analyses were performed.
RESULTS:
A total of 671 patients who underwent 749 primary TKA procedures met inclusion criteria for this study. Some 69.7% of the patients were female, with an average age of 71.7±9.1 years, and 61.2% received supplementation. Patients who were vitamin D sufficient preoperatively who received low to medium dose vitamin D demonstrated higher vitamin D levels and ability to maintain sufficient levels postoperatively compared to no supplementation ($p<0.001$). Those who were vitamin D deficient preoperatively demonstrated higher vitamin D levels postoperatively using medium to high dose supplementation compared to no supplementation ($p=0.02$).
In total, 280 patients were vitamin D deficient either pre- or postoperatively, and 26.8% of them achieved repletion. For patients who were vitamin D sufficient preoperatively and became vitamin D deficient postoperatively (25.7%), supplementation was associated with achieving a vitamin D replete status at an average of 11.3 months ($p<0.001$), and repletion was higher using vitamin D3 (cholecalciferol) compared to vitamin D2 (ergocalciferol) ($p<0.001$).
Male patients were more likely to be vitamin D deficient preoperatively ($p<0.001$), but females were prescribed supplementation more often than males ($p=0.02$). Black patients demonstrated 2.8 times higher odds of having a vitamin D level below 30 ng/mL at any timepoint when compared to all other races ($p=0.03$).
DISCUSSION AND CONCLUSION:
Our study demonstrated that low to medium dose vitamin D supplementation (5000 IU and below) was beneficial for vitamin D sufficient TKA patients to achieve higher vitamin D levels and maintain vitamin D sufficiency. For vitamin D deficient TKA patients, medium to high dose supplementation (1001-5000+ IU) was beneficial for increasing vitamin D levels, though not all patients taking these doses achieved repletion. This work highlights the need to continue vitamin D surveillance in the long-term postoperative period, and the need to continue vitamin D repletion in patients following TKA, regardless of baseline vitamin D levels. Further work should be done to characterize potential sex and race differences in vitamin D deficiency and postoperative supplementation.