LETTER

A retrospective study on the correlation between low-density lipoprotein cholesterol and bone density

Dear Editor,

Osteoporosis, characterized by low bone mass and degeneration, is prevalent in the elderly and postmenopausal women, increasing the risk of fractures. As the global population ages, it poses a noteworthy public health concern. The bone mineral density (BMD) is crucial for assessing bone strength. The multifaceted etiology of osteoporosis encompasses genetic predispositions and environmental influences, underscoring the necessity for identifying pertinent risk factors to mitigate fragility fracture occurrences. Despite extensive research, the association between low-density lipoprotein cholesterol (LDL-C) levels and osteoporosis remains ambiguous. This study aims to explore the relationship between LDL-C levels and bone mineral density based on the existing National Health and Nutrition Examination Survey (NHANES) dataset, providing statistical information for early intervention by clinical practitioners for patients at a high risk of osteoporosis.

This study utilized NHANES data from 2013 to 2020 because the COVID-19 pandemic impacted NHANES 2019-2020 cycle data. The study enrolled 1984 individuals possessing comprehensive and valid assessments of lumbar spine, femoral neck, or total hip BMD. Inclusion criteria stipulated the availability of data on BMD and LDL-C. Exclusion criteria encompassed individuals undergoing lipid-lowering therapies, medications impacting bone metabolism, those afflicted with secondary osteoporosis-related ailments, or individuals with incomplete datasets. For detailed information on LDL-C and BMD levels measurements, one can visit the NHANES website[1]. We utilized single and multivariate linear regression models to estimate the linear relationship between LDL-C levels and BMD. Univariate analysis revealed a higher femoral BMD among males compared to females ($p < 0.001$), with advancing age correlating with diminished lumbar spine bone density ($p < 0.001$). Elevated body mass index emerged as a protective factor against BMD reduction ($p < 0.001$). Notably, univariate analysis unveiled a significant correlation between LDL-C and femoral neck BMD ($p = 0.003$), a trend corroborated in multivariate analysis even after adjusting for relevant covariates ($p < 0.001$). As LDL-C concentrations escalated, BMD exhibited a commensurate decline. These results are consistent with those reported by other studies and systematic reviews. Animal experiments explaining the mechanism of LDL-C involvement in bone metabolism support this finding. In mouse models, a high-cholesterol diet reduces BMD, likely due to increased osteoclast generation[2]. Statin drugs target the mevalonate pathway, also targeted by nitrogen-containing bisphosphonates, which are frontline drugs for treating osteoporosis. Topical administration of simvastatin promotes cellular events and bone formation in surgically generated bone defects in rats[3]. This may explain why lowering LDL-C with statins may have additional beneficial effects. Our study results are highly applicable due to the comprehensive sample selection across the US nation. However, recognizing the limitations of this study is crucial. NHANES surveys are cross-sectional, limiting inferences about the causal relationship between adult LDL-C and BMD. Therefore, we need prospective clinical and mechanistic basic studies to comprehend the specific mechanisms between LDL-C and BMD. Furthermore, we excluded oncologic patients from this study, as malignancy may significantly impact lumbar spine BMD. Thirdly, while bone health is considered to be affected by sex hormones, data on hormone levels was unavailable or lacking in the 2011-2018 NHANES database, preventing explaining these conditions in the current patient population.

In conclusion, our study reveals a negative correlation between LDL-C and lumbar spine BMD. Limitations such as causative relations exist; thus, further studies are needed to prove this relationship so that LDL-C measurement could serve as a responsive biomarker for early detection and treatment of osteoporosis.

Keywords: Low-density lipoprotein cholesterol, bone mineral density, osteoporosis, NHANES

Conflict of interest

None.

References:

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