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ORIGINAL ARTICLE

Significant association between osteoporosis and hearing loss: a systematic review and meta-analysis[☆]

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KEYWORDS

Osteoporosis;
Hearing loss;
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Abstract

Introduction: There is inconclusive evidence whether osteoporosis increases risk of hearing loss in current literature.

Objective: We conducted this meta-analysis to determine whether there is an association between hearing loss and osteoporosis.

Methods: This systematic review and meta-analysis was conducted from the studies in MEDLINE, EMBASE, and LILACS. Osteoporosis was defined as having a bone mineral density (BMD) with a T-score of less than -2.5 standard deviation. The outcome was hearing loss as assessed by audiometry or self-reported assessment. Random-effects model and pooled hazard ratio, risk ratio, or odds ratio (OR) of hearing loss with 95% confidence intervals (CI) were compared between normal BMD and low BMD or osteoporosis.

Results: A total of 16 articles underwent full-length review. Overall, there was a statistically significant increased odds of hearing loss in the low BMD or osteoporosis group with OR of 1.20 (95% CI 1.01–1.42, $p=0.04$, $I^2=82\%$, $P_{\text{heterogeneity}}=0.01$). However, the study from Helzner et al. reported significantly increase odds of hearing loss in the low BMD in particular area and population included femoral neck of black men 1.37 (95% CI 1.07–1.76, $p=0.01$) and total hip of black men 1.36 (95% CI 1.05–1.76, $p=0.02$).

Conclusion: Our study proposed the first meta-analysis that demonstrated a probable association between hearing loss and BMD. Osteoporosis could be a risk factor in hearing loss and might play an important role in age-related hearing loss.

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PALAVRAS CHAVE

Osteoporose;
Perda auditiva;
Metanálise

Associação significativa entre osteoporose e perda auditiva: uma revisão sistemática e metanálise**Resumo**

Introdução: Há evidências inconclusivas sobre se a osteoporose aumenta o risco de perda auditiva na literatura atual.

Objetivo: Realizamos esta metanálise para determinar se existe uma associação entre perda auditiva e osteoporose.

Método: revisão sistemática e metanálise foram realizadas a partir dos estudos em MEDLINE, EMBASE e Lilacs. A osteoporose foi definida como tendo uma densidade mineral óssea (DMO) com um escore T de menos que -2,5 DP. O desfecho foi a perda auditiva, avaliada por audiometria ou avaliação autorrelatada. O modelo de efeitos aleatórios e agrupados HR, RR ou OR de perda auditiva com Intervalos de Confiança (IC) de 95% foram comparados entre DMO normal e DMO baixa ou osteoporose.

Resultados: Um total de 16 artigos foram submetidos a revisão completa. Em geral, houve aumento estatisticamente significativo da probabilidade de perda auditiva no grupo de baixa DMO ou no grupo de osteoporose com OR de 1,20 (IC 95% 1,01-1,42, $p=0,04$, $p=82\%$, $P_{\text{heterogeneidade}}=0,01$). No entanto, o estudo de Helzner et al. relatou aumento significativo da probabilidade de perda auditiva na DMO baixa, em determinada área e população que incluiu colo femoral de homens negros 1,37 (IC 95% 1,07-1,76, $p=0,01$) e quadril total de homens negros 1,36 (IC 95% 1,05-1,76, $p=0,02$).

Conclusão: Nosso estudo propôs a primeira metanálise que demonstrou uma provável associação entre perda auditiva e DMO. A osteoporose pode ser um fator de risco para perda auditiva e pode desempenhar um papel importante na perda de audição relacionada com a idade.

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Introduction

Hearing loss is a common chronic condition of a disability estimated at 24.9 million people worldwide. It was reported by The World Health Organization as one of the leading causes of years lived with disability.¹ The estimated prevalence of hearing loss was 30% in the population over 65 years old and 50% in the population over 75 years old.^{2,3} Moreover, hearing loss is also associated with decreasing quality of life and functional outcomes including social isolation, depression, safety issues, mobility limitations, reduced income and employment opportunities.⁴⁻⁷ Risk factors influence to the degree and rate of deterioration of hearing loss include aging, genetic susceptibility, ototoxic medication exposure, otological disorders, smoking, and occupational and leisure noise exposure.^{6,8-10}

Osteoporosis has also been identified in some studies as a risk factor of hearing loss. The underlying mechanism of hearing loss in osteoporosis is complex and undetermined. Some studies purposed that a possible underlying mechanism is systemic demineralization of the skeletal system in osteoporosis includes temporal bone, which contains the cochlea capsule and the conductive system.¹¹⁻¹³ However, there were controversies and inconsistent results from other studies that showed non-significant association between osteoporosis and hearing loss. The accuracy of the results was limited due to the sample sizes of the study populations.² Therefore, we conducted this meta-analysis to determine whether there is an association between hearing loss and low bone mass or osteoporosis.

Materials and methods

This systematic review and meta-analysis was conducted and reported according to the Meta-analysis Of Observational Studies in Epidemiology statement¹⁴ and was registered in PROSPERO (registration number: CRD42015024987).

Search strategy

Two authors (AS, SU) independently searched published studies indexed in the MEDLINE, EMBASE, and LILACS (Literatura Latino Americana em Ciências da Saúde) from their date of inception to November 2015. References of all selected studies were also examined. The following main search terms were used: osteoporosis, osteopenia, bone density, bone mass, bone loss, hearing loss, audiometry, otoacoustic. The full search strategy was detailed in [Appendix 1](#).

Inclusion and exclusion criteria

Articles were considered eligible for inclusion if the following criteria were met: (1) published observational studies including cross-sectional, cohort, and case-control studies; (2) study in adults age 18 years or older; (3) clear methods of assessment of bone mineral density and hearing status were described; (4) clear diagnostic criteria for osteoporosis and hearing loss were reported; and (5) association of low BMD or osteoporosis and hearing loss was reported as

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