The Progression of vertebral osteoporosis: the correlations between vertebral pathologies and sociodemographic risk factors

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INTRODUCTION

The identification of vertebral pathologies in human skeletonized remains is difficult. Most of the methods for identifying pathological conditions involve macroscopic assessment and ordinal scoring, or through the use of expensive and potentially destructive processes such as radiographs or genetic testing. However, little is understood regarding the etiology of osteoporosis (OP), osteoarthrosis (OA), osteophytosis (VO), Schmorl’s nodes (SN), spondylolysis (SL), and lamenal spur (LS), and resultant differences between African and European American individuals due to the higher level of bone density in African American individuals, and resultant differences in calcium (Alcock 2008; Sinis 1990).

MATERIALS AND METHODS

The seven pathological vertebral conditions and their scoring systems used to explore their relationship to each other and to sociodemographic risk factors are provided in Figures 1–6. The Genant et al. (1985), Ubelaker (1999), Stewart (1985), and Merbs (2001; 2002) pathological scoring systems were applied to the vertebral series and compared to the documented sociodemographic records of 238 African (n = 48), T = 113) and European American individuals from the William M. Bass Donated Skeletal Collection at the University of Tennessee, Knoxville. The individuals were placed into five-year age groups (20–29 years) and separated by sex for each ancestral group. Occupation was divided into four groups: unknown, labor-intensive (e.g., construction, non-labor-intensive (e.g., office clerk and secretarial work), and unemployed. Each of these occupation and age categories, pathological conditions, and other sociodemographic risk factors (i.e., sex and ancestry) were analyzed with multiple Chi-square analyses to determine significant correlations.

RESULTS

Overall, the results of this study support the three proposed hypotheses that there are correlations between OP and other vertebral pathologies; that occupation influences their expression; and that there are ancestral differences in the expression of vertebral pathologies. Specifically, the results of this study indicate that most of the vertebral pathologies are correlated with sex, age, ancestry, and occupation (Table 1: Figures 7 and 8). Generally, the conditions are more severe with advancing age, with laborious occupations, and in European males. However, SL and SLT are not correlated with increasing age, which is expected since these conditions are generally observed in younger, more active individuals (Merbs 2002; Weiss 2009). Interestingly, only females show an increased prevalence for OA, particularly in L4; however, VO, SNs, SLT, and SLT show higher levels in males. Surprisingly, OP did not show a higher expression in females, which is observed in previous research involving postmenopausal women (Genant et al. 1996). However, the lack of OP in females in this study may be due to the low number of females in the sample. Additionally, OP, OA, VO, SNs, and SLT show higher levels of development among European Americans compared to African Americans. This may be due to increased bone density in African American individuals and population differences in calcium intake (Alcock 2008; Sinis 1990). All conditions except for SL and SLT are correlated with laborious occupations such as construction, mechanic, or laborer. However, individuals classified with non-labor intensive occupations still exhibited some level of development of these vertebral pathologies, particularly with advancing age. Moreover, the majority of the vertebral pathologies are correlated with each other (Table 2). Overall, these correlations indicate that many of the vertebral pathological conditions have a higher likelihood of development in individuals who have another vertebral pathology. These correlations additionally suggest that their expressions are influenced by many of the same processes (i.e., advancing age, physical activity and occupation, sex, and ancestry).

Despite the inclusion of 54 individuals of African American ancestry, the available sample was overwhelmingly European American, which is reflective of commonly studied skeletal collections. While the Bass Collection provides detailed records of sociodemographic data, the information is voluntarily provided by the donors and thus is not always complete or accurate. The authors hope to further this research with larger and more diverse collections, including a more equal representation of age, sex, and ancestries, along with sufficient antemortem data to indicate work history and habitual activity. This will provide more robust data that can inform correlations between vertebral pathological development and sociodemographic risk factors.

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REFERENCES


