OSTEOARTHRITIS AS AN INDICATOR OF DEMOGRAPHIC STRUCTURE OF PAST POPULATIONS: THE EXAMPLE OF A PORTUGUESE MEDIEVAL SAMPLE

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Summary

A paleodemographic and paleopathological study of the skeletal sample of S. João de Almedina, coming from the church with the same name, in Coimbra, Portugal and dated from the 12th to the 14th century had been carried out. In the present paper the results concerning osteoarthritis, its frequency and meaning, are presented. In a sample of nearly 40 adults, both vertebral column and appendicular skeleton were analyzed. In what osteoarthritis of the spine is concerned, the results obtained, with the highest incidence in lumbar spine followed by cervical and thoracic region, are in agreement with the observations on nowadays populations. The disease affects both men and women being the prevalence, as expected, higher in older individuals. The articulations on appendicular skeleton affected by this kind of disease vary with age, being the upper limbs more affected than the lower ones. The great incidence of osteoarthritis, both in the vertebral column and in the limb articulations, is in agreement with the demographic structure of the present population where a significant number of individuals older than 55 years were found. Therefore, in this paper, we try to demonstrate the usefulness of osteoarthritis to a good knowledge and interpretation of the demographic profiles of past populations.

Introduction

The available techniques for age estimation are far from being precise. «Age determination is ultimately an art, not a precise science» (Maples, 1989, p. 323). Improvements in age-estimation techniques seem deceptive. A recent test of some of the standard procedures, prove that the aging techniques depend a lot, among others, on the research sample. Their use, in other samples, is very limited (Santos, 1995). Consequently, we have to rely in the results of all the techniques employed as well as on the experience of the observer whenever we want to find the demographic structure of past populations.

The close relationship between demographic and paleopathological data is known. When the paleopathological results can corroborate the demographic ones, the demographic structure becomes more reliable. In the present paper we try to demonstrate the usefulness of osteoarthritis (OA) as an indicator of the demographic structure.
About osteoarthritis

Osteoarthritis (OA) has been recognised as the most common of the various articular disorders affecting humans and occurring in ancient skeletal material (Rogers and Dieppe, 1985). If it is only very probable that the Greek medicine of Hipocrates already knew it (Gremk, 1983), we are more sure about medieval times where OA was a well-known pathology afflicting the populations very often.

As a paleopathology, OA may provide important information on changing patterns and give clues to aetiology and prevention. OA is characterized by focal cartilage loss with subchondral bone reaction and mild synovitis, as responses to a variety of causative agents, including hormones, heredity, obesity and age (Resnick and Niwayama, 1988; Lovell, 1994). Among the factors implicated in the aetiology of osteoarthritis, age and physical activities (or trauma) are the most common.

In present study, the presence of osteoarthritis was recorded using the criteria of Crubézy, Morlock and Zammit (1985) (scored on a scale of 1-3).

All synovial facet joints from C1 to L5 were scored for presence and degree of expression of marginal bone proliferation, pitting of the subchondral bone and eburnation, while the intervertebral fibrocartilaginous joints were scored for marginal lipping, focal destruction of the vertebral body surfaces. Osteophytosis was scored only when arising horizontally from the margins of the vertebral body, as opposed to the vertical ossification of an enthesis (Lovell, 1994). The articulations analysed can be seen in Fig. 4.

The sample

The skeletons reported here came from the cemetery of the old church of S. João de Almedina in the City of Coimbra, Portugal and date from the later half of the twelfth to the end of the fifteenth century.

The sample of the present article consists of 36 adult skeleton choosen from a total of 100 individuals who had been subject of an extensive paleobiological analysis (Cunha, 1994). The choice was based on the completeness and preservation of the skeletal material.

As age methods we have employed the metamorphosis of the auricular surface of the ilium (Lovejoy et al., 1985) as well as endo and ectocranial suture closure (Masset, 1982), depending upon which skeletal elements were adequately preserved. Results are shown in Fig. 1 where ages are given in 10-years groups, starting by the age of 25. In some cases, no age could be assigned at all except to say that the skeleton was from an adult.

![Figure 1. Demographic profile of the medieval sample of S. João de Almedina (adults). These results were obtained on the basis of metamorphosis of the auricular surface.](image-url)
Results

OA is common in this sample and the age-specific prevalence rates are shown in Fig. 2.

Kendal’s coefficient corroborates the existence of a positive (and significative) correlation between age and OA for the majority of joints analysed.

The anatomical sites affected by OA are shown in Fig. 4. The most commonly affected sites were the spine and the shoulder.

The rate showed a progressive increase with age and was 100% in those who were aged 55 years or more at death. The lesion’s severity also increases in the same way (Fig. 3).

Osteophyte spur formation on the vertebral bodies is prominent and is most frequently seen at the anterior aspect of the vertebrae. The fifth and sixth cervical segments are the most frequently involved, particularly during the later decades of life (Fig. 5). This may had lead to a less mobile lower cervical spine and a hypermobile upper cervical spine (Emery and Bohlman, 1992).

In the present medieval sample, the thoracic region is less affected by this kind of degenerative changes than the cervical or lumbar spine probably because of the relative stability provided by the rib cage and the configuration of the thoracic vertebrae (Hardy, 1992). In most individuals the
Figure 5a. OA of cervical vertebra. Diarthroidal joint eburnation and porosity.

Figure 5b. OA on the lumbar articular processes. Posterior view. Articular surfaces are very polished, with formation of new bone, i.e., hypertrophy of the articular apophyses with osteosclerosis.

Intervertebral disk begins to deteriorate by the third decade of life.

The most severe lesions on the spine occurred on the lumbar region, being the L5 the more affected vertebra (Fig. 6).

Upper limbs are more affected than lower ones, with highest prevalence in the shoulder joint (Fig. 5 and Fig. 6). The specific joints affected by OA vary with age group studied. The involvement of the knee and hip (Fig. 7) occurred later in life.

Concerning multiple OA, at least 5 cases were found. A same individual had several articulations affected. All of them are senile (older than 60), the majority are females with a mean of four diseased joints.
Discussion

In all epidemiological studies, the relationship of OA to aging is the most striking feature (Peyron and Altman, 1992), nevertheless the mechanisms by which the process of aging relates to the onset of OA are poorly understood. There is strong evidence that degenerative joint disease occurs with increasing frequency in older individuals, perhaps related to a diminished capacity of aging cartilage to resist to mechanical stress due to changing physical and biochemical cartilaginous properties. Nevertheless, in contemporary populations, the correlation of joint degeneration and advancing ages is not linear in configuration. Rather, an age-related predisposition to degenerative joint...
disease appears to increase exponentially after the age of 50 or 60 years (Resnick and Niwayama, 1988).

The frequency of this disease in this past population is similar to the contemporary society, besides, its manifestations are similar not only in pattern but also in its correlation with age. When our results are compared with those of Waldron (1992) for the Black Death cemetery in London, we find out that the prevalence rates for OA present a similar pattern.

On the basis of the metamorphosis of the auricular surface and ectocranial suture closure, it was detected a high prevalence of old individuals. This is not a common finding in medieval populations. Considering the poor reliability of the age estimators employed, the high percentage of individuals with OA can be seen as a good indicator of the demographic structure. Moreover, the intensity of the disease increases with increasing ages. Indeed, the S.João de Almedina series is a good example of an agreement between paleopathological and paleodemographical data. Therefore, it proofs positive contribution of OA to the knowledge of past populations demographic structure.

Because OA is a disease of great antiquity, extremely common in human remains, because is amongst the easiest of diseases to recognise in the skeleton, because its manifestations are similar in nowadays populations and in past ones and, finally, because age is indeed a striking etiological factor, when estimating the demographic structure of past population, we consider that OA should be taken into account whenever possible.

Bibliography


