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Skeletal palaeopathology and the rheumatic diseases: Where are we now?

Many rheumatologists have an interest in the history of the rheumatic diseases. Sources of historical data include medical manuscripts, non-medical literature, art, and archaeological specimens such as mummies and skeletons. Skeletal material is more commonly available than mummies and should provide valuable data on rheumatic diseases which leave imprints on bones. Over the last decade there have been an increasing number of publications on arthritis in skeletons; this article briefly reviews these reports and their contribution to rheumatology.

Historical perspective on skeletal palaeopathology

From the earliest days of organised archaeology in the 19th century the remains of the people have been recovered alongside their artefacts and buildings. The most spectacular series of human remains are the mummies, and during the exploration of Egyptian sites many thousands of both mummies and skeletons were recovered. One of the first recorded scientific examinations of a mummy was that of Granville in the early 1820s,¹ but it was Marc Armand Ruffer, working in the early part of this century, who opened up this field of study and introduced the term 'palaeopathology'.²

Most human remains recovered are skeletons with no remaining soft tissue, and this is the material on which most of the work on palaeopathology has been done. Interest in the evidence of disease in bones arose in the 18th century during the examination of Pleistocene (ice age) cave mammal deposits, and was soon expanded by anthropologists to include fossil man. Ruffer,³ Moodie,⁴ and Hrdlicka,⁵ among others, wrote the first substantial papers on human skeletal palaeopathology. The discipline expanded after the second world war with the work in this country of Wells,⁶ Brothwell and Sandison.⁷ More recently, archaeology has expanded, and more material has become available. In addition, an increasing number of medically qualified people have taken an interest in skeletal palaeopathology. It is still a minority interest, however, and very few specialists such as rheumatologists or radiologists have helped the archaeologists and anthropologists in their attempts to diagnose and classify human disease from skeletal remains.

Can rheumatic diseases be diagnosed from skeletons?

Joint disorders are the commonest recorded abnormality in all published series of skeletal material. It is often difficult to make a 'diagnosis', however.

Most of the major rheumatic diseases affect subchondral and periarticular bone, leaving an imprint that is often characteristic when viewed by radiologists. Modern diagnosis is dependent on the pattern of changes both within and between joints, however, and on a constellation of other clinical, serological, and radiological features unavailable to the skeletal palaeopathologist. Ideally, the whole skeleton is required to help to establish the distribution of the disorder, but archaeological remains are often fragmented or not fully recovered during excavation. There have been several recent contributions to the problem of disease recognition from skeletons. Rogers and Waldron have outlined a system of classification of most of the common rheumatic diseases for use by anthropologists and others,⁸ and a recent symposium addressed the specific question of the erosive arthropathies.⁹ Another recent publication emphasised the lack of sensitivity of radiographs compared with the visual assessment of bony changes.¹⁰ Twenty four knees were examined by a palaeopathologist, and the bone radiographs were independently assessed by a radiologist; the palaeopathologist recorded obvious abnormalities in 16 cases, whereas the radiologist only saw changes in two. This emphasises that it is inappropriate to relate studies of prevalence of disease recorded from skeletons to modern epidemiological surveys that rely on other data such as radiology.

The published reports include many cases that show clear evidence of osteoarthritis, gout, ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis (DISH), and septic arthritis.^{11–15} In addition, cases mimicking other seronegative erosive arthropathies—for example, psoriatic or reactive arthritis, have been described. Diagnosis of rheumatoid arthritis (RA) from ancient skeletons remains controversial, however.¹⁶ A few possible cases have been described,¹⁷ including recent reports of an erosive arthropathy in an early native population in the United States.¹⁸ Skeletons often have evidence of cortical defects on or around the joint surface, especially in the wrists and shoulders, but it is not clear what these represent. They vary in size, may be invisible on radiographs, and do not usually tally well with our current experience of the distribution and pattern of changes in RA. Some people have interpreted skeletons with many of these lesions as having RA,¹⁹ others dispute this conclusion.²⁰ In addition to these lesions, other skeletons have unequivocal evidence of joint erosion; however, diagnosis remains difficult, the changes are usually asymmetrical, and bony growth around the lesions is often extensive, suggesting the possibility of a

seronegative spondarthritis.²¹ We remain to be convinced by any of the published cases.

Two dimensional epidemiology

The cause of many rheumatic diseases remains unknown and, as outlined in a recent leader in this journal, epidemiology is a powerful weapon to aid our understanding of their cause.²² It has been suggested that the addition of a time dimension to the current geographical and risk factor approaches to current epidemiological studies may be helpful²³; the antiquity of RA has been of special interest.²⁴ If RA is triggered by an infection or other environmental agent then its prevalence in different countries and in different historical periods might provide vital clues as to the nature of this aetiological agent. The descriptions of possible RA quoted above have led to speculations that it is either a recent disease, a 'New World' disease akin to syphilis, or even of viral origin from outer space!²⁵

There are many problems with this approach, other than the absurdity of data-free speculation.²⁶ First, the material obtained is sporadic and selected. Secondly, the lack of information on the age and circumstances of any given skeleton is a severe limitation to the interpretation of disease prevalence. Thirdly, it is difficult to prove the negative, in other words, not finding RA may be due to a lack of appropriate specimens rather than absence of the disease; it has been estimated that at least 1000 whole adult skeletons would have to be examined before one would expect to find one definite case of RA.²⁷ Finally, there is the persisting problem of diagnosis and the lack of correlation between visual and x ray findings mentioned above.

Nevertheless, interesting trends and findings have emerged on the patterns of rheumatic diseases seen in ancient skeletons. DISH, for example, is easily recognised, and seems to have a prevalence that is similar to that found today.²⁸ Similarly, evidence on the prevalence and patterns of osteoarthritis is emerging which suggests that there may be changes in the expression of the condition with time, if not of its overall prevalence.^{14 29} As classification criteria improve and more whole skeletons are carefully studied it may be possible to make more definitive statements about the history of certain forms of arthritis.

Understanding disease processes

The most exciting area of recent development in skeletal palaeopathology is the use of bones to ask specific questions about disease pathogenesis. Skeletons provide a unique, if limited, source of information. It is possible to examine the whole three dimensional bony structure of a joint, as well as the whole skeleton. In addition, bony changes can be examined by a variety of special techniques, such as scanning electron microscopy³⁰ and slab radiography, and the bone crystals can be extracted and examined. Recent reports indicate that human and bacterial proteins, including DNA, can also be extracted from ancient bones and probed for the presence of a specific epitope.³¹

These studies might help us to understand the different mechanisms of bone formation and resorption in rheumatic disease, and allow us to correlate them with visual and radiographic findings. In addition, susceptibility epitopes on DNA could be sought and related to the skeletal evidence of a given disease in antiquity. This work is in its infancy, and it will be interesting to see what emerges.

Conclusions

Until recently, the examination of ancient skeletons was only used to attempt a rough 'diagnosis' or infer some aspect of the lifestyle of its owner. Although skeletal palaeopathology remains a minority interest, of limited value in the advancement of rheumatology, it is now clear that serious questions can be considered by this discipline, and that the application of scientific rigour to the field may pay dividends in the future.³²

JULIET ROGERS
PAUL DIEPPE
Rheumatology Unit
Bristol Royal Infirmary
Bristol BS2 8HW

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