MODERN CASES OLD DISEASES : anthropological study of three male skeletons from Mozambique

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ABSTRACT

The aim of the present work is the study of three human skeletons from Mozambique, currently housed at the "Instituto de Investigação Científica Tropical", in Lisbon. Recovered during the Anthropological Mission to Mozambique ("Missão Antropológica a Moçambique") these individuals are documented by mortuary records dated from 1940's. The written information such as sex, age at death and cause of death recorded were confronted with macroscopic evidence observable on bones and teeth. Besides, other pathological lesions were detected. Among the most striking findings are osteomyelitis of the mandible, multiple traumatic lesions and symmetrical and well developed cribra orbitalia, a possible evidence of neoplasic diseases and a probable case of tuberculosis.

The importance of the study of pathology in archaeological and historical human remains to the understanding of the origin and evolution of diseases process as well as its importance to the current and future prevention is also discussed.

Introduction

The current study describes and discusses the results of the sex, age and pathological observation in three well preserved human skeletons documented by the mortuary records dated from 1940's, and recovered during the "Missão Antropológica a Moçambique", currently housed at the "Instituto de Investigação Científica Tropical", in Lisbon. The potential of the pathological studies in more ancient remains is also presented.

Paleopathology is today considered as a subdiscipline of Biological Anthropology (Buikstra and Ubelaker, 1994; Roberts and Manchester, 1995), and focuses on the study of the evolution and progress of diseases in humans and other animals through time (Roberts and Manchester, 1995). Paleopathologists examine both primary evidence (bones, calcified tissues, preserved bodies such mummies, and coprolites) and secondary sources such as contemporary documents (medical and historic records) and iconographic representations such as artifacts and works of art (Ortner and Putschar, 1981; Roberts and Manchester, 1995; Armelagos, 1997). This modern study of the history of diseases follows the biocultural approach, i.e. biological data are interpreted within appropriate cultural contexts which include relevant details of the historical development, local geography, and material culture of the people whose remains are under examination (Roberts and Manchester, 1995) representing the recent transdisciplinary vocation of paleopathology.

Sample and Methods

In the present study, the three human skeletons were firstly observed without previous knowledge of the records. The skeletal lesions recorded were identified by examination of the bones and teeth with the naked eye. Thus, for each one, sex diagnosis was performed on the basis of visual criteria for pelvis (Recommendations for Age and Sex Diagnoses of Skeletons, 1980) and age at death was estimated also using the Recommendations and by the methodologies that analyse the metamorphosis on the auricular surface of the ilium (Bedford et al., 1991) and in the pubic symphysis (France Casting, 1986; Brooks and Suchey, 1990) following the suggestions proposed by Santos (1996). Moreover, the pathological lesions were recorded macroscopically and a registration with a digital camera was done. Subsequently, these results were compared with the documental information and the more relevant data is presented in this article.

Results

Individual number 1. The sex diagnosis revealed a male individual. The epiphyseal union line was slightly visible in several long bones and all permanent teeth were erupted, including the third molar, which give an estimated age at death of less than 25 years old and more than 21. In the pathological domain, the macroscopic study revealed occlusal caries in the first right and second left molars in the mandible (Fig. 1). A severe abscess in the mandible was probably a consequence of the crown destruction of the right second molar, extending beyond the root and destroying the cortical bone area. This situation led to an osteomyelitis with pus formation and drainage by the cloaca that was surrounded by new bone.

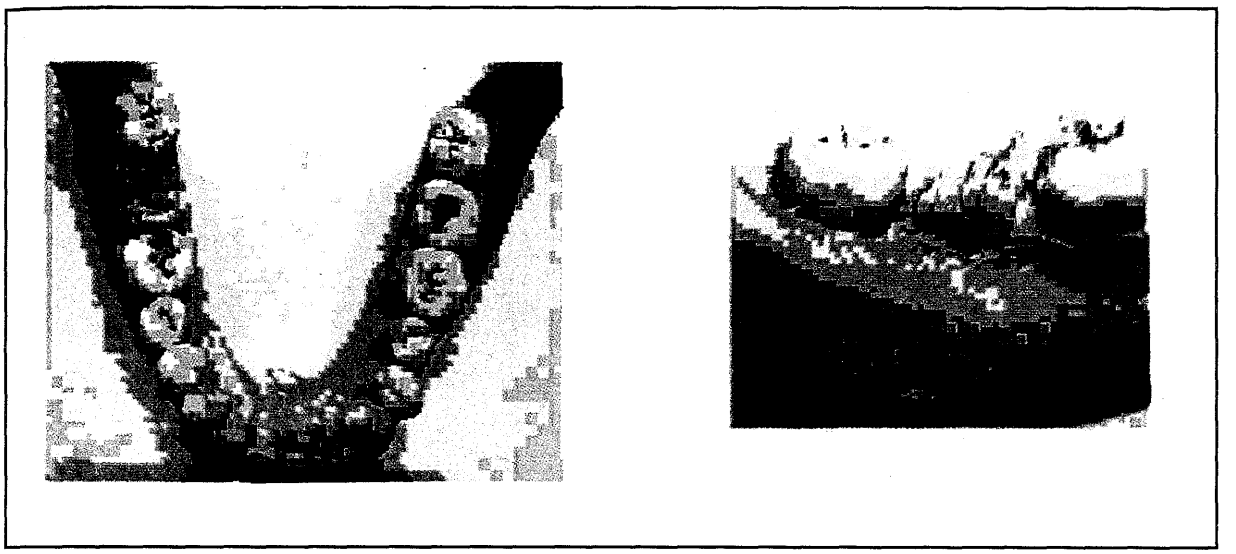

Figure 1. Osteomyelitis of the mandible - a dental related abscess have destroyed the cortical area and formed an opening for pus drainage.

Individual number 2. This individual was diagnosed as a male, with an age at death between 15 and 19 years old. Moreover, the third molars already erupted and several epiphysis fused with the diaphysis in long bones, places this skeleton probably more close to the upper limit of the age range obtained.

The skeleton shows several pathologies. In the skull, cribra orbitalia a porotic hyperostosis on roof of orbits, symmetrical and active at the moment of the death (fig. 2) and in the post cranial skeleton the atlas is unfused in the region of both anterior and posterior tubercles, which seems to be a congenital anomalies or a development problem since according to Scheuer and Black (2000) the time of fusion of these areas occurred around 4 to 6 years of age. Periostitis occurred as a thin layer in the visceral surface of the ribs (fig. 3A) in both sides of the thoracic cage, despite asymmetrically. New bone formation is visible in the left side mainly in the vertebral end of ribs (in rib number 5, and from rib 7 to 9). In the right ones these lesions are more extensive, taking place at the sternal end from the 2nd to the 9th ribs and at vertebral end from rib number 2 to 10, being more severe in the 8th and 9th.

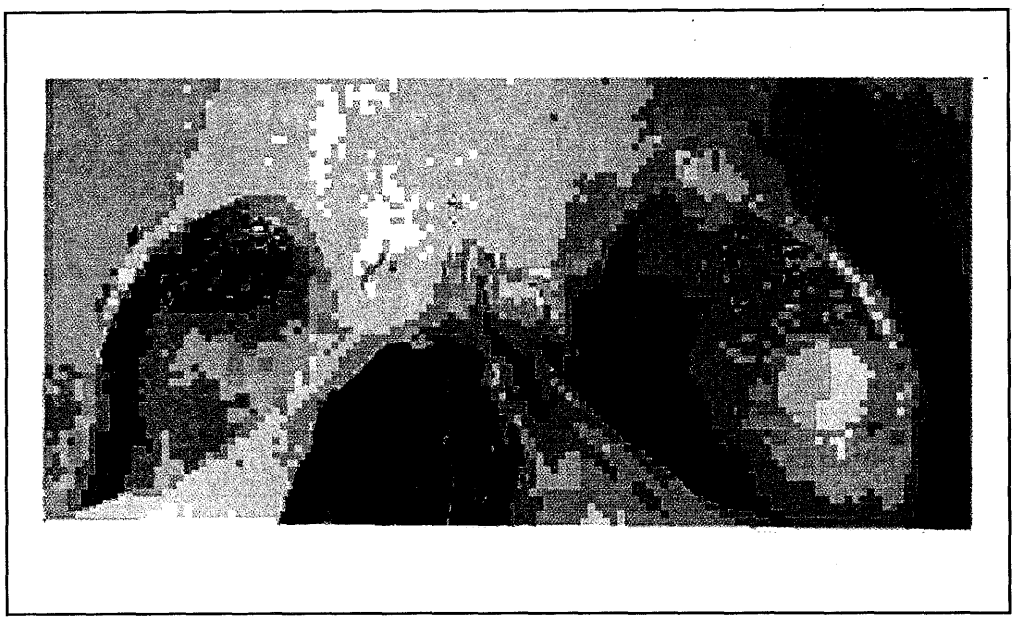

Figure 2. Cribra orbitalia in an adolescent individual. Range from porosity to porosity with coalescence of foramina, active at time of death.

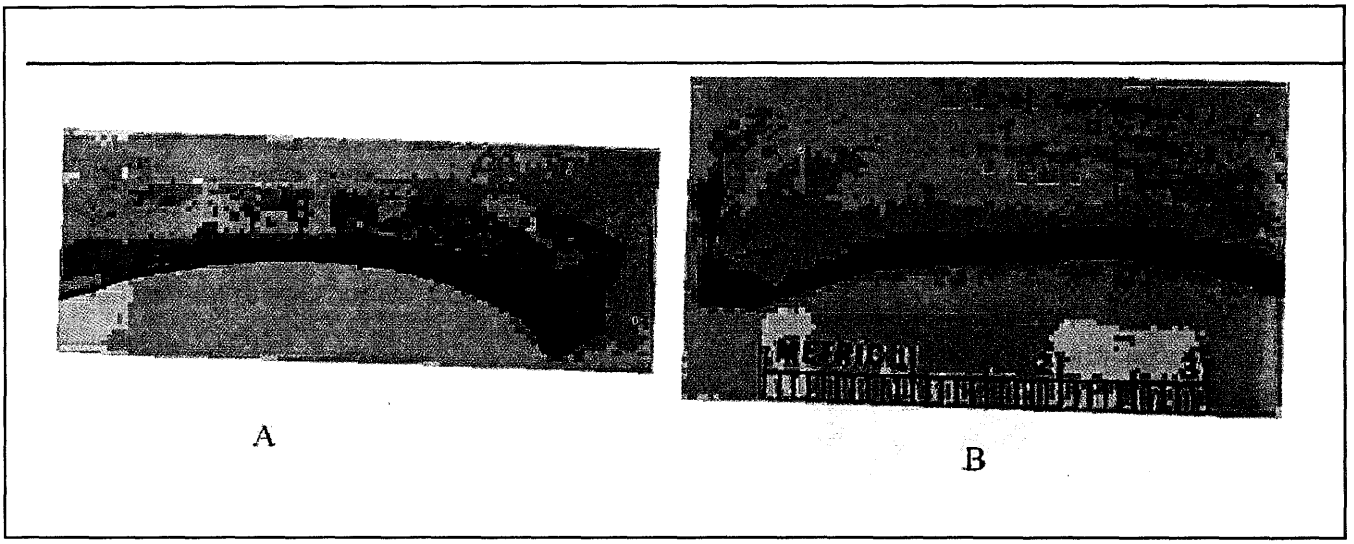

Figure 3A Ribs of individual number 2 with new bone on sternal ends and B proliferation of new bone on the visceral surface of a rib from individual number 3.

The hip region presents some changes: the head and neck of the right femur were partially destroyed by a non-active process at the moment of the death. The formation of a new articular surface on the top of the acetabulum of the correspondent innominate bone led to an increase in high of the acetabulum.

Individual number 3. The third skeleton belonged to an adult male to whom was recorded a layer of new bone formation at the vertebral end of rib number 2 to 10, at the left side of the thoracic cage and from the 2nd to 11th on the right ribs (fig. 3B).

In what concern oral pathology, this individual has a good general conditions in all the present teeth. However, the upper incisors and the central lower incisors were absent.

Lastly, he shows multiple traumatic lesions in the limbs. The left femur suffered two fractures as can be seen in the figure 4A: an oblique fracture in the upper part and a second one in the inferior end of the diaphysis. As a consequence of the infectious process a cloaca was formed. Both fractures were malaligned in the healing process which resulted in a shortening in the length of 2,5 cm of the left femur in comparison to the right one. The left foot of this individual also presented several injuries: 3 of the 5 metatarsals were fractured, being this condition particularly severe in the first metatarsal bone (fig. 4B).

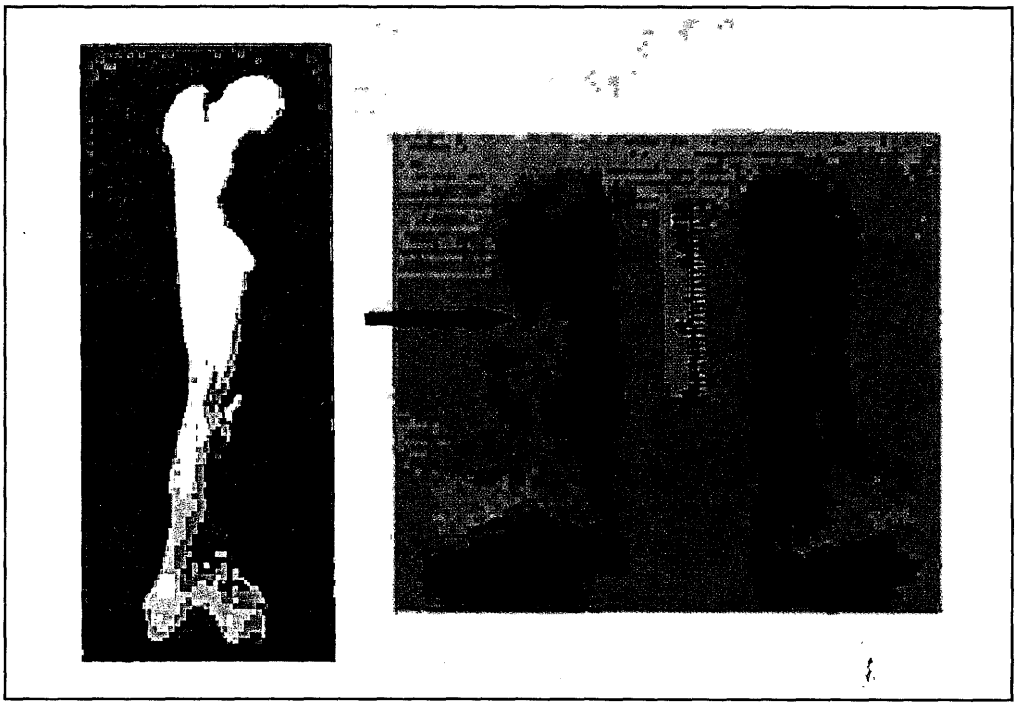

Figure 4. A. Femur with an infectious process due to a fracture and B a first metatarsal with a malaligned fracture.

Discussion

Important parameters to achieve in the study of past human populations are the sex and age at death as well as the pathological conditions namely in relation to these parameters. Thus, paleodemography and paleopathology are two important complementary disciplines to palaeanthropology. In the current work, the results of skeleton observations are compared with the documentary data and discussed according to bibliographic references.

The accuracy of sex and age at death estimation depends on characteristics that ranges from individual's intrinsic conditions to taphonomic factors that influence the completeness and state of preservation of the human remains. Moreover, as for living people, sex diagnosis is more reliable in adults while age determination is much easier in non-adults skeletons.

Male was the sex diagnosed for all three individuals which are in agreement with the records. In what concerns age at death, individual number 1 was biologically younger than chronologically, less than 22 years old by skeleton observation and 26 by documentary data. This, difference is perfectly understandable among the confidence range of the methods used. In fact, the theoretical problems inherent to the methodologies applied to the adult age at death estimation led to consider as most reliable the creation of wide age categories (Santos, 1996), such as young adults, middle adult and old adults as proposed by Buikstra and Ubelaker (1994). Considering this approach, individual number 3 was classified as a middle adult which is in agreement with the chronological age of 36. Finally, for individual number 2 the age recorded was 17 years old which is among the interval determined, between 12 to 19 years.

In the pathological field, the most striking lesions are discussed. Dental observation revealed a good condition in general. However, individual number 1 shows a severe abscess that destroyed the cortical bone covering the roots of second molar, this perforation drain the pus to the oral cavity and is surrounded by extensive bone apposition. According to Langsjoen (1998:409) "osteomyelitis of the jaws is a serious and potentially lethal lesion because of its frequently-associated bacteremia and surely must have been responsible for many deaths in antiquity". However, the cause of death recorded for this individual was dysentery. Unfortunately, this infectious of the intestinal tract doesn't leave a direct signature on the skeleton but documental data reveals at least a severe infection for this individual.

The ante mortem teeth loss in individual number 3 could have occurred as consequence of an accidental or a disease process or even as an intentional remotion. Despite not very common in Mozambique, dental mutilations was described by Paúl and Fragoso (1938) and by Norberto dos Santos (1962) thus, this situation could not be completely discarded.

Among the traces of non-specific pathological disorders is cribra orbitalia, a lesion shown by the adolescent (individual number 2). Its occurrence is bilateral in 90% of the cases (Aufderheide and Rodríguez-Martín, 1998) and more common in juveniles individuals (Roberts and Manchester, 1995). The aetiology of this pathological conditions is controversial however, the most plausible hypothesis related it with severe anaemia.

Trauma is one of the most common pathologies in human remains and its presence give important clues about occupation, life style and living conditions but indirectly also inform

e.g. about availability to treatment (Roberts and Manchester, 1995). In the present sample the individual number 3 suffered several fractures: on the right clavicle, left femur, and metatarsals that are impossible to determine if they occurred simultaneously or not. In the femur and on the first metatarsal there are signs of infections which reveal problems during the healing process as well as malaligned fractures responsible for shortening of both bones.

Until the moment, the transportation of the bones to radiological analyses was impossible, which precluded further details such as the type of fractures. However, it can be advanced that the distribution observed is not the most common in archaeological derived material, where according to Jurmain (2001) the forearm is the most affected.

In this individual the skeletal lesions, namely the complications of the fractures, with signs of infection, seem to agree with the diagnosis recorded to this individual: hemiplegia in the left side.

The destruction of the head of the femur and acetabulum change in the hip of individual number 2 still have an unknown origin. It is expect that the future radiological analysis will give a piece of information useful in this search. Moreover, the cause of death recorded, liver tumour with abdominal metastasis, do not provide complementary information for this lesion. However, it can be an explanation to the pattern of the rib lesions since the new bone formation is more severe in the right and lower ribs. In fact, the liver is the largest gland in the body, covered with the peritoneum except in the posterior part where it is in contact with the diaphragm (Moore and Agur, 1995:117), being located anteriorly from the 4th to lower ribs.

Currently, the aetiology of the new bone formation on the visceral surface of the ribs is a subject under debate. While some authors advocates that it can be the result of any thoracic disease, such as chronic pulmonary, a heart or neoplasic condition, recent studies give some clues about a differential diagnosis based on the texture and location of the new bone formation on the rib as well as the rib number and position of the affected areas.

In the skeleton number 3 these lesions seem more similar to the ones present in tuberculous individuals to whom the new bone formation is more common at the vertebral end of the ribs and more severe in middle thoracic cage area (Santos, 2000; Santos and Roberts, 2001). This hypothesis could not be confirmed or denied by the documental data. In fact, the origin and evolution history of tuberculosis in Africa is not well known. Despite the strong evidence in the Middle East and North of Africa since ancient times tuberculosis is almost unknown in inner sub-Saharan Africa before 1908 (Bates and Stead, 1993). However, medical records dated from 1897 from the Mengo Hospital at Kampala reported cases of tuberculosis among Ugandan, thirty-five years after contact with Europeans (Daniel,1998).

Tuberculosis is an infectious contagious disease that affects human, cattle and a variety of wild and domestic animals. However, it appears likely that the main source of human TB came from the close contact of humans with animals, either through the development of domestication or hunting. A significant part of transmission occurs through the air when people cough or talk and by ingestion of milk and meat from infected animals (Roberts and Manchester, 1995; Aufderheide and Rodríguez-Martín, 1998). Actually, this disease is the leading cause of mortality due to a single infectious agent, with

about 3 million death a year (WHO, 2000). However, this is not a new situation. Paleopathological evidence of TB in human skeletons, has been found worldwide.

The more consistent vertebral lesions has been found as far back as ca. 4,000 BC at the beginning of agricultural times in the Neolithic in Italy (Formicola et al., 1987; Canci et al., 1996) since than Europe have a continuous record of cases of tuberculosis until present days (for a summary see Santos, 2000). Americas have also an interrupted record of tuberculosis evidence since ancient times until post-Columbian ages as was summarised by Buikstra (1999). However, no other country could compete with Egypt in the number of ancient cases of TB. Several cases from the Pre-Dynastic period (ca. 4,800 to 3,100 BC) have been described by Elliot Smith (in Cule, 1999), Derry (1938), Ortner and Theobald (1993), Strouhal (1991; 1999) and Crubézy and colleagues (1998). These cases are not unexpected, as several figurines and other iconographic material seems to illustrate tuberculous vertebral columns (e.g. Ruffer, 1921 in Aufderheide and Rodríguez-Martín, 1998; Daniel et al., 1994). This disease was also reported in Egypt in more recent times, in around 1,000 BC, by Smith (1927 in Aufderheide and Rodríguez-Martín, 1998), Smith and Ruffer (1910 in Aufderheide and Rodríguez-Martín, 1998) and Latour (1998).

Elsewhere in the Middle East, Ortner (1979) described a possible tuberculous skeleton from the Early Bronze Age, Jordan. In Israel, Zias (1998) reported another case dated from about 3,500 BC. Zias (1991) published a description of a tuberculous individual from the Judean Desert dated from the 7th century AD. In Jerusalem a possible case of TB from the Crusader Period was described by Mitchell (1994 in Mitchell, 1999).

This apparently surprising absence of tuberculosis in sub-Saharian Africa could have an explanation is the scarcity of analytical work that has been undertaken. Thus, it seems important the paleopathological research in this region with the goal to understand the influence and the history of this infection disease in particularly and in paleopathology in general.

Final comments

In this study there was a quite good concordance of the skeletons observations with the documentary data. It has to be kept in mind that miss diagnosis in diseases as well as in age at death in the records could have occurred since these individuals died in 1940's. In addition, in this article the potential of biological anthropology and paleopathological researches was shown.

In the last 20 years, paleopathology has had an important impact in other sciences (Armelagos, 1997). The study of mortality and morbidity patterns of populations in the past is essential to our evaluation of the susceptibility of specific populations to certain diseases and disorders (Pfeiffer, 1991), and also contributes to modern medical knowledge and diagnosis (Rogers et al., 1990), including in the forensic sciences. This integration of demographic and morbidity data with other aspects of culture and medical knowledge make modern paleopathology a truly holistic science.

Ideally, the bioanthropological analyses should start during excavations of the remains because taphonomic and pathological conditions fragile the bone tissue limiting the accuracy of future studies. Another relevant aspect is the registration of the cultural context of the inhumation, only possible in the field by detailed

writing descriptions and photographic register in a way to allow also comparison with other materials. From these reasons it is of major importance the collaboration of archaeologists, historians, biological anthropologist /paleopathologists, among other professionals, along different works such as excavation, study of skeletons housed in museums or other institutions and divulgation of results namely as exhibitions. Only a research in a multidisciplinary perspective could provide new insights about the puzzling history of humankind.

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