Disease in Ancient Nubia

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Disease in Ancient Nubia

Changes in disease patterns from 350 B.C. to A.D. 1400 demonstrate the interaction of biology and culture.

George J. Armelagos

The study of disease in ancient man has had a rebirth (see *1*, *2*). The literature in this field during the first three decades of this century was voluminous, but there appears to have been a waning of interest in the 1930's. The individualistic approach of the early paleopathologists, in which the primary focus was the diagnosis of skeletal lesions, inhibited further development. It was not until epidemiological techniques were applied to the study of ancient disease that paleopathology regained prominence (*3*).

An obvious objective of paleopathology is to add to existing knowledge of the geographical and chronological distribution of diseases and injuries in ancient populations. In addition, an analysis of the disease patterns of ancient populations can sometimes provide an index of biological response to stress, hence information on cultural factors. As Ackerknecht (*4*) has stated, "The pathology of a society reflects its general conditions and growth and offers, therefore, valuable clues to an understanding of the total society." In other words, the patterns of pathology may reveal cultural patterns which are not apparent from the archeological record.

Problem and Approach

The study summarized here is an attempt to analyze the skeletal lesions found in populations from three archeological horizons in the Wadi Halfa area of Lower Nubia in the Republic of the Sudan (Fig. 1). Specifically, the analysis focused on populations from the Meroitic, X-Group (*5*), and Christian populations (Table 1), which Greene has shown, on the basis of genetically determined dental characteristics, to be biologically similar (*6*). In view of Greene's study, the possibility of elucidating, in prehistoric populations, differences in disease processes which result from cultural differences became another objective.

In this study I have attempted to overcome some of the shortcomings of the individualistic approach of the early studies through use of the paleoepidemiological method, which entails study of the host, the disease, and the environment (*7*). One of the most important aspects of paleopathology is study of the culture of the populations concerned. For knowledge of the culture we are dependent primarily on archeological investigations, which place the population in the proper position chronologically and provide information necessary for reconstructing the life pattern of the people. In some cases the reconstruction of cultural patterns may reveal stresses which affected biological processes; in other instances, an examination of the pathological conditions may provide insights into the cultural practices.

Lower Nubia is hot and extremely dry, and the dry heat helps to preserve the burials. Many of the skeletons examined in the study still had tissue adhering to them, although there was no evidence of embalming. The major causes of infrequent damage were the high water table and gnawing by insects; portions of some of the specimens showed evidence of such damage.

The nearly 800 skeletons analyzed in this study span the Mesolithic, Meroitic, X-Group, and Christian cultural periods—some 8000 years (Table 1). They included 39 fossilized human skeletons discovered in a Mesolithic site, which provided information on preagricultural adaptation in Nubia (*8*). Reconstruction of the Meroitic, X-Group, and Christian cultural horizons is hampered by the fact that the published reports on many of the sites excavated in recent years are only now beginning to appear (*9*). The people belonging to these cultural groups were basically agriculturists who practiced irrigation farming. There is variation in cultural development among the three groups, which can be explained in part in terms of the fluctuation of the Nile and of pressures applied by foreign groups.

The picture which has emerged indicates that the Meroitic phase (350 B.C.–A.D. 350) was a period in which a native Nubian culture attained one of its highest peaks. The center of the culture was far to the south, in Meroë; it is thought that the Wadi Halfa area of Lower Nubia enjoyed a degree of cultural development similar to that of the groups in the center of Meroitic development.

The X-Group period (A.D. 350–550) is thought to have been a time in which Nubian culture declined from the development characteristic of the Meroitic period. During the X-Group period the populations broke up into local groups, which were ruled independently.

The Christian period (A.D. 550–1300) saw the religious reunification of Nubia and was a period of cultural growth. The archeological evidence reveals long periods of stability, like the stability of the Meroitic development. The growth of villages and the development of writing and of art which were independent of Egyptian influence are all evidence of this cultural growth. Even after the Muslim conquest of Egypt, in A.D. 640–42, the Christians in Nubia maintained their independence. During the classic period of Christianity there was an elaboration of church architecture and the first evidence of urbanization, with concentration of population in large centers and in monastic communities. Nubia was an important center of Christianity at this time.

Pathological Conditions

An investigation of pathologies in prehistoric populations is usually restricted to examination of the skeletal system. The excellent state of preservation of the Nubian material made it possible to study many other condi-

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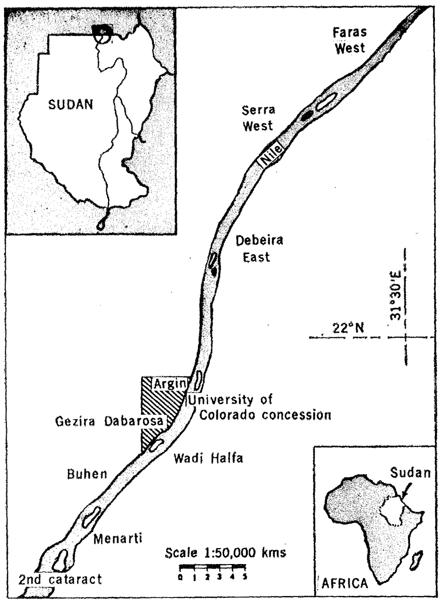


Fig. 1. The Wadi Halfa area of Lower Nubia. Note the relationship of the University of Colorado concession area (where all the sites discussed, except for NAX and 24I3, are located) to other sites in the Sudan. In the insert at upper left, the small circle indicates the Wadi Halfa area.

tions. For example, the hair was examined for evidence of parasitic infestation, since there had been reports of lice in ancient material (*10*). Forty percent of the scalp and hair samples from the X-Group series were infested with head lice, *Pediculus humanus capitis* (Fig. 2). Lice are known to be vectors for diseases such as relapsing fever, but any suggestion concerning the role of lice in the disease pattern of the prehistoric population of Nubia would be pure speculation.

In many instances the interpretation of skeletal lesions is difficult, whereas in other cases the cause is obvious. For example, the occurrence of hydrocephaly (Fig. 3), osteochondroma, and endochondromas in the Nubian series presented no problem of interpretation. Other lesions, such as those of Legg-Calvé-Perthes disease (aseptic necrosis of the head of the femur) (Fig. 4), were much more difficult to interpret. Other conditions rarely seen in skeletal populations, such as carcinoma, sarcoma, and hyperostosis frontalis, were found. The lesions were unusual; apart from this study, only four instances of hydrocephaly, 12 of malignant neoplasm (*11*), one of hyperostosis frontalis (*12*), and possibly three of Legg-Calvé-Perthes disease (*13*) have been reported in the archeological literature. There were also evidences of intentional mutilation—decorative scarification, tattooing (Fig. 5), and pierced earlobes—such as are rarely found in archeological material. Discovery and identification of these pathological conditions in a series from a limited area and in such a small sample is unusual.

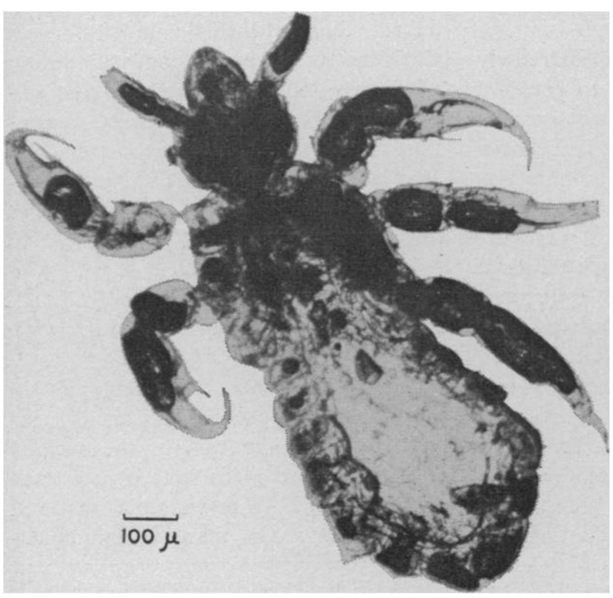
Study of the more frequently occurring pathological lesions provides insights for interpreting cultural behavior. It is from the frequency of occurrence of these lesions that inferences concerning cultural stresses are drawn. For example, the frequency of trauma resulting from aggressive action gives insights into the cultural behavior of a population which may not be attainable from examination of the artifactual remains.

Table 1. Chronological sequence of archeological horizons in Sudanese Nubia.

Group and sites (in parenthesis)	Sample size (No. of individuals)	Dates
Christian (6B13, 6G8, Meinarti)	403	A.D. 550–1300
X-Group (24I3, NAX)	218	A.D. 350–550
Meroitic (6B16)	129	350 B.C.–A.D. 350
Mesolithic (6B36)	39	7000 B.C.

In order to facilitate comparisons, I used broad categories in studying the Nubian material—categories such as congenital abnormalities; trauma; infectious, inflammatory, and degenerative lesions; neoplastic and metabolic diseases; and lesions resulting from artificial interference such as mutilation.

The incidence of traumatic lesions in a population provides a broad index of another form of stress in the culture. Since traumatic injuries are not necessarily due to aggressive behavior, they must be analyzed with care. For example, some fractures of the ulna or radius may be due to falls in which one or both bones in the forearm are fractured as the individual attempts to "break" the fall. On the other hand, a "parry fracture" (Fig. 6) most commonly occurs when an individual raises



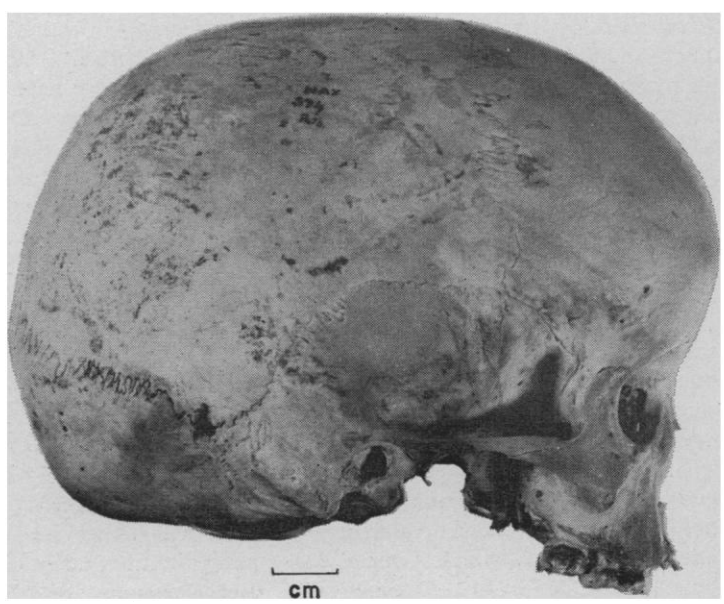


Fig. 2 (left). Head louse (*Pediculus humanus capitis*) from an X-Group female (A.D. 350 to 550). Fig. 3 (right). The skull of a hydrocephalic child from the X-Group site.

his arm to protect himself from a blow.

It is difficult to distinguish intentional cranial injuries from accidental ones; however, many of the cranial lesions were in locations such that they could hardly have resulted from an accidental fall, and it is assumed that most of them were probably the result of intentional blows. In the samples from the sites, the percentages of craniums with traumatic lesions were as follows: Meroitic, 14.2; X-Group, 13.2; Christian, 13.4. Seventeen individuals (56.1 percent) in the combined sample with cranial injuries are male, 13 (42.9 percent) are female.

Analysis of postcranial lesions, on the other hand, is more difficult, since intentional injury is suggested only in certain instances of multiple injuries and in lesions such as the "parry fracture." The percentages of individuals with postcranial lesions show a variation with culture group which was not apparent in the case of cranial lesions. The percentages are as follows: Meroitic, 5.6; X-Group, 3.1; and Christian, 11.3.

In the combined Nubian series, there seems to be a correlation between frequency of occurrence of postcranial lesions and sex. Of 12 individuals with postcranial injuries, ten (83 percent) are males, two (17 percent) are females. The two females with postcranial injuries were from a Christian cemetery. Although generalization from such a small sample would be unwarranted, the pattern of traumatic lesions does show an increase during the Christian period both in injuries from aggression and in those resulting from accidents.

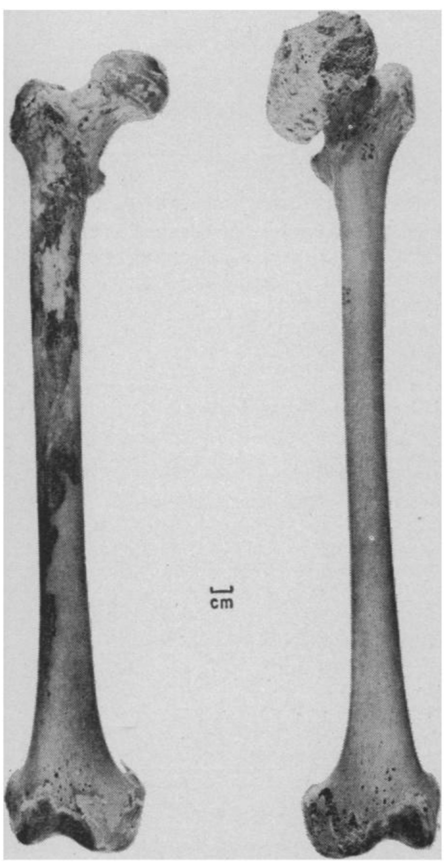


Fig. 4. Legg-Calvé-Perthes disease of the left femur (X-Group).

For revealing stress, some of the most informative pathological conditions are the degenerative lesions such as those of arthritis. In some of the Nubian populations, arthritis involved 10 percent of the vertebrae, while osteophytosis (lipping of the vertebral body) was found in 50 percent of the population. The frequency of occurrence of arthritic lesions is fairly constant throughout the Nubian series. For example, in the Meroitic sample there were arthritic lesions on 2.1 percent of the articular surfaces of the long bones; for the X-Group samples the average was about 3.0 percent; and for the two Christian samples the average was 3.1 percent. There was variation among the three groups in the extent of involvement of the mandibular condyle and the occipital condyle.

Arthritic lesions of the articular facets of the vertebrae were found in 0.6 percent of the specimens from site 6B16 (Meroitic); in 4.1 percent of those from site 24I3 (X-Group); in 7 percent of those from site 6B13 (Christian); and in 3.8 percent of those from site 6G8 (Christian). Part of the variation may be due to differences in the average age at death for the different populations. For the site 6G8 (Christian) population, for example, the average age at death for adults (15 years or older) is 35.6 years; for the site 24I3 (X-Group) population the figure is 29.7 years, and for the site 6B16 (Meroitic) population, 26.3 years.

The frequency of occurrence of osteophytosis also reflects, in part, the differences in life-span. The percentages of osteophytosis for the three cultural groups are as follows (values in parentheses are average age at death for adults): 6B16 (Meroitic), 5.8 (26.3); 24I3 (X-Group), 10.3 (29.7); 6B13 (Christian), 10.1; 6G8 (Christian), 24.9 (35.6). I feel that a major factor in the increase in osteophytosis was probably an increase in longevity. In other words, when people live longer the vertebrae are subjected to stress for a longer period. There is an apparent inconsistency here, since the increase in longevity is evidence of a reduction in selective pressure yet there is an increase in the frequency of occurrence of this minor pathological condition.

The rate of occurrence of osteoporosis as a function of age was determined in prehistoric samples for the first time in a study undertaken by John Dewey (*14*). Dewey obtained quantitative measurements of bone involution through direct measurement of the thickness of femoral cortical bone. The results of this study indicated a sex difference with respect to the rate of involution. The females in the Nubian

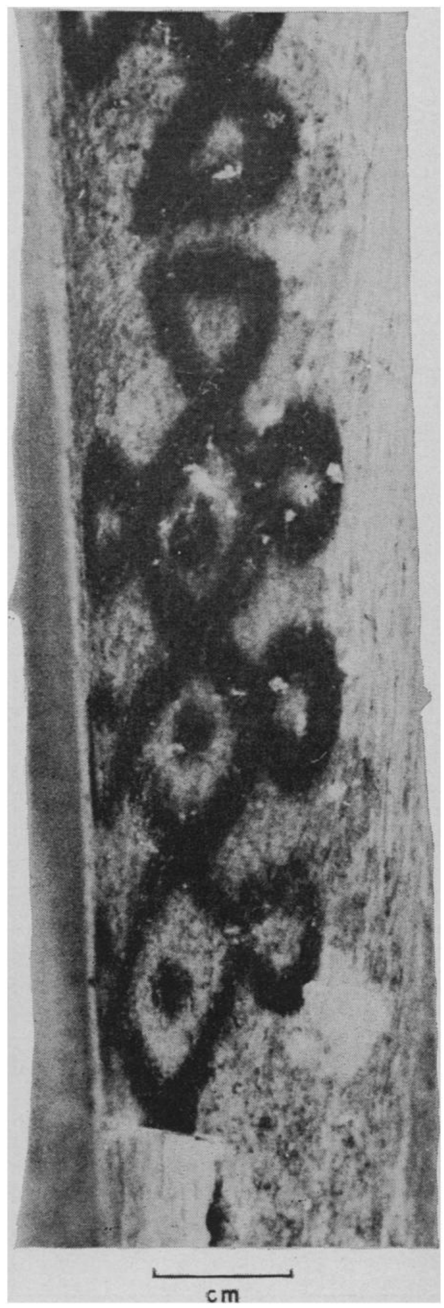


Fig. 5. Tattooing on the femur of an X-Group male (infrared photograph).

series show a rapid and statistically significant loss of bone (Fig. 7) compared to the loss in males. There appears to be no significant cultural difference with respect to bone loss. The females in the 22- to 31-year age group show a 6.3-percent decrease in thickness of femoral cortical bone, whereas males in this age group show an increase in bone thickness. The bone loss in females increases to 18 percent in the 32- to 41-year group and to 23.4 percent in the last age group (42 to 50+). The total loss in males from age 32 to 50+ is 13.8 percent.

Since differences in stature may obscure differences in bone loss among populations of different cultures, a method of normalization had to be developed; the ratio

(thickness of femoral cortical bone)/
(length of femur)

was used to correct for such differences in stature. In addition to showing a statistically significant loss of bone in the Nubian females, the normalization of data indicated that this ratio does differ for the Meroitic, X-Group, and Christian populations. Normalized data had not been used in earlier studies of bone involution; Dewey's analysis of the prehistoric material indicates that normalization of bone loss in modern series may be methodologically necessary.

Rates of bone involution in the prehistoric Nubian series and in modern series indicate that the ancient populations started losing bone at an earlier age and lost it more rapidly than modern populations. The bone loss in 51-year-old females in the Nubian series is as great as that in 60-year-old females in modern series (*15*).

Dental Pathology

The analysis of dental pathologies was limited to analysis of macroscopic lesions such as caries, missing teeth, apical abscessing, crowding, dental attrition, and alveolar recession. Analysis of carious lesions in archeological populations is always a problem. Since sampling biases may be introduced by tooth loss (*16*) and since missing teeth may be the result of any of several causes unrelated to the carious process, a comparison of the frequencies of occurrence of caries for the total sample of teeth from different populations may not reveal important differences that do in fact exist. On the other hand, comparison by tooth classes will reveal these differences.

The analysis of carious lesions in the Nubian series shows an increase in frequency of occurrence from 1 percent in Mesolithic times to 18 percent in Christian times. The cause cannot be specified, but it is suggested that the higher proportion of agricultural products in the Nubian diet was a contributing factor.

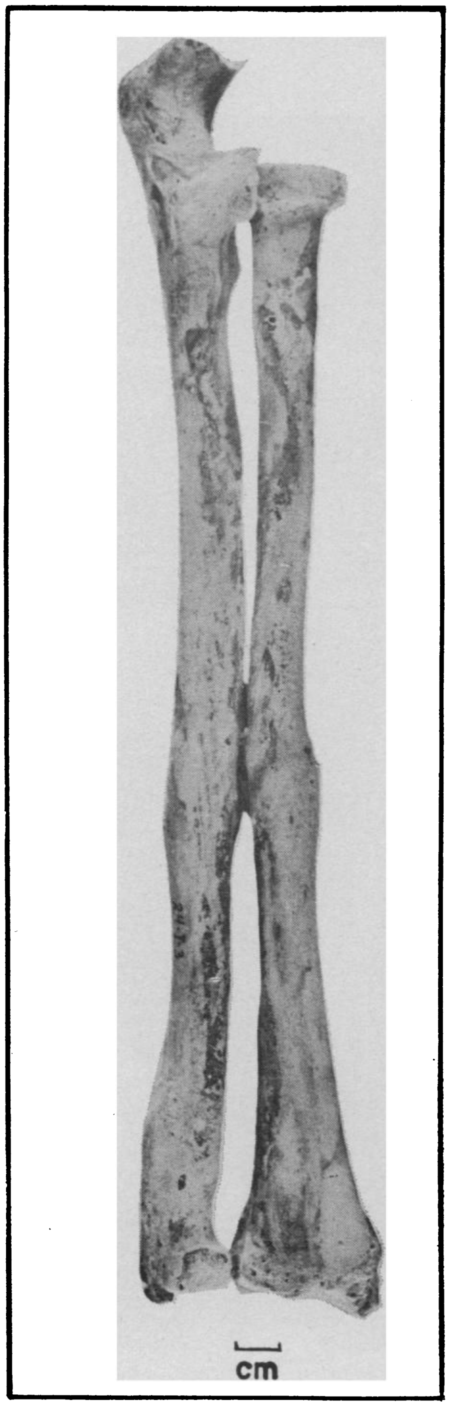


Fig. 6. Parry fracture of the ulna and radius.

There are other factors which have been frequently overlooked in the study of dental carious lesions in ancient populations. For example, the study of the Nubian series showed that the in-

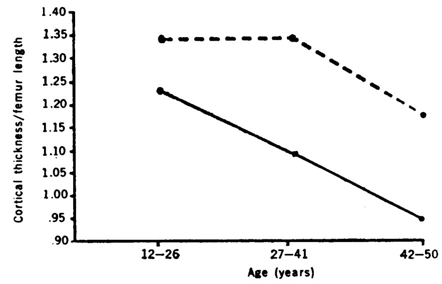


Fig. 7. Bone involution of the femur (ratio of thickness of femoral cortical bone to length of femur) in the combined Meroitic, X-Group, and Christian populations. Number of males in sample, 71; number of females, 107. Bone loss in males (dashed line) is not significant; bone loss in females (solid line) is significant ($P > .001$).

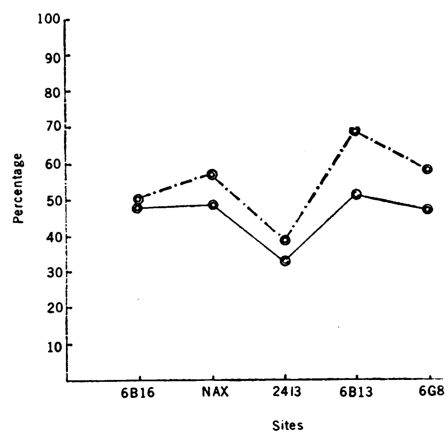


Fig. 8. Percentages of (dashed line) maxillary occlusal caries and (solid line) maxillae with stage-3 and stage-4 dental attrition (cusps abraded to expose dentine) for various populations.

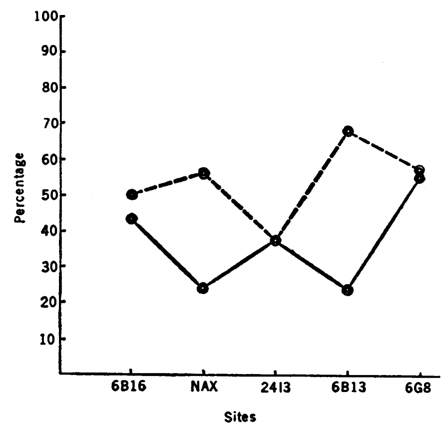


Fig. 9. Percentages of (dashed line) mandibles with stage-3 and stage-4 dental attrition and (solid line) maxillae displaying alveolar recession.

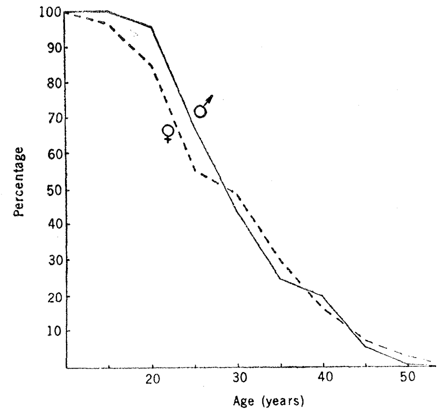


Fig. 10. Survival curve for the adult population from the Christian site of Meinarti (A.D. 1050 to 1100) ($N = 160$).

crease in dental attrition was followed by an increase in occlusal carious lesions (Fig. 8). Abrasion of the enamel gives cariogenic agents easy access to the vital tissues. Attempts to find evidence of similar factors in the frequency of occurrence of interproximal and gingival carious lesions have been unsuccessful.

A final point which should be made concerning dental pathology is the relationship of dental attrition to alveolar recession; the Nubian series shows an inverse relationship. Mastication inhibits alveolar recession. Although not unexpected, demonstration of this relationship in an ancient population is important (Fig. 9).

Mortality Data

The Nubian series reveals both general and specific survival patterns comparable to those of other populations. For example, the Meroitic, X-Group, and Christian samples all demonstrated the classic survival curve characteristic of an agricultural society. Mortality was high among infants, leveled off slightly among young adults, and increased sharply among older adults.

Comparison of survival rates for males and females indicates an increase in mortality for females during the childbearing years with a shift near, or shortly after, the 30th year, at which time there is a relative increase in the mortality rate for males (Fig. 10).

Summary

A study of the paleopathology of the Meroitic, X-Group, and Christian populations of Lower Nubia has provided information that is important in delimiting chronologically and geographically the distribution of a number of diseases. The finding of such conditions as carcinoma, endochondromas, sarcoma, hyperostosis frontalis, Legg-Calvé-Perthes disease, hydrocephaly, tattooing, and intentional scarification —all rare in skeletal material—is in itself an important contribution to our knowledge. In addition, evidence of infestation with head lice was found in some of the skeletal material.

The increased frequency of occurrence of traumatic postcranial lesions is due in part to intentional injury. The highest percentages of such lesions occur in the Christian series—populations which, on the basis of the mortality data, appear to have been under less stress than the cultural groups that preceded them. A similar pattern is manifested by degenerative lesions such as those of arthritis. The higher percentages of arthritic lesions may be in part due to increased longevity; the Christians were living longer than earlier populations, and degenerative lesions would be an expected consequence.

Another pathological condition which increases with age is osteoporosis. Although this is a well-known clinical entity in modern medicine, it had not previously been studied in a prehistoric population. The Nubian series provided an opportunity to study small homogeneous groups. In females, osteoporosis was shown to be correlated with age; in males, the bone loss was not statistically significant. It was also shown that normalization of the data [through use of the ratio (thickness of femoral cortical bone)/(length of femur)] is an important method of controlling for differences in stature. The rate of bone involution was higher than the rate in modern populations and demonstrated that prehistoric populations were losing as much bone by age 51 as modern populations lose by age 60.

The frequency of occurrence of carious lesions in the Nubian series has increased since Mesolithic times. Inclusion of more soft foods in the diet is undoubtedly a factor; dental attrition, cusp number, and fissure patterns may also have played a role. The analysis also demonstrated the need to analyze dental lesions by specific classes of teeth, since sampling bias may otherwise obscure some relationships.

The treatment of mortality data provided one of the most useful tools in the study of cultural growth.

The results of pathological analysis and mortality patterns suggest that the X-Group may not have experienced the cultural decline suggested by the archeological record, and that the X-Group period may have been one of cultural growth relative to the earlier, Meroitic period in Lower Nubia.

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