Osteoarthritis in Prehistoric Turkey and Medieval Byzantium

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In 1978 I studied skeletons from ancient populations of Byzantium and Turkey in order to assess the extent of the osteoarthritic process and to test the following two hypotheses. 1. Although the incidence of this disease was high in prehistoric times, it has steadily decreased through classic to modern periods. 2. Osteoarthritis was consistently more common in men than in women. These hypotheses were derived in part from my earlier observations about osteoarthritis found in samples from prehistoric to classic times and from later Greece.

Materials

For the 1978 study, the skeletons in the samples came from two areas. In one group, there were 54 adults as well as 19 children, including infants, representing the Chalcolithic to Early Bronze Age (dated 4th-3rd millennium B.C.). These specimens came from Kalinkaya in the Hittite territory of Central Anatolia. Secondly, the Byzantine specimens, which consisted of 132 adults and 31 children of the 7th to 12th centuries A.D., came from Kalenderhane Camii in Istanbul. These prehistoric and medieval skeletons were compared with 179 skeletons of modern Caucasian Americans obtained from various sources.* The data on osteoarthritis as well as possibly related skeletal stress and fractures for these three population groups are presented (Tables I-III).

The following lesions were considered. 1. Osteophytosis with varying degrees of lipping on vertebral bodies and on intervertebral facet joints. These were divided into four categories ranging from slight (0) to most pronounced (+++); the last represents virtual ankylosis or fusion. 2. Limb (diarthrodial) joints with the four degrees of lipping as classified above. Eburnation* was also identified as a consequence of cartilage damage and loss.

Results

The Early Bronze Age village people of Anatolia lived mainly by farming and trade (obsidian, copper, grain and meat) and to a lesser extent by hunting. At Kalinkaya (Figures 1, 2, 4), nutritional stress during the growing years of childhood is indicated by the following features: flattened pelvic inlets (index: 77, N=3),* clearly to strongly bowed tibiae in 70%, and flattened long bone shafts (humeral shaft index: 78.6, platymeric or upper femur index: 73.2, cnemic or tibial shaft index: 65.2, with N=35-29).** The short stature (164.2 cm in ten men and 153.1 cm in nine women) may also be derived in part from dietary deficiencies. Twenty percent of the women have healed ankle fractures or foot strains (Figure 1) affecting bone, which probably resulted from falls in their rocky country located at the junction of the plateau with the northern mountains. Both sexes have huge deltoid crests (75% of 29 people) and muscle stress signs throughout, thereby indicating equally hard work for both sexes in farming and hunting as well as in childbearing for women.

In the sample specimens from Byzantine Kalenderhane (Figures 3, 5, 6), there are more adult males (75% or a sex ratio of 300:100), no doubt due to the monastic character of the Kyriotissa foundation. Nutrition seems adequate, or at about the same level as that found in Byzantine Greece. Thus, the true pelvis is adequately deep, with the index being 87.6 (19) in comparison with 91.6 (103) in our modern American sample and contrasted to 75-85 in the 19th century.*** Except perhaps for the femur, long bone shafts are not notably flattened (humeral shaft: 81.1, platymeric: 84.3, and cnemic: 72.8, with N=51-71); tibiae are not bowed;
### TABLE I

**OSTEOARTHRITIS: VERTEBRAE PERCENTAGE FREQUENCIES**

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<td>USA Modern</td>
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#### Degree of Severity of Lesions

- **0 trace**
  - MALES: 67%, 31%, 50%, 46%
  - FEMALES: 62%, 61%
- **+**
  - MALES: 17%, 31%, 24%, 23%
  - FEMALES: 25%, 24%
- **++**
  - MALES: 16%, 25%, 18%, 23%
  - FEMALES: 13%, 15%
- **+++ pronounced**
  - MALES: 0%, 13%, 8%, 8%
  - FEMALES: 0%, 0%

#### No. of Specimens

- MALES: 21, 95, 108, 26
- FEMALES: 32, 71

#### % with osteoarthritis

- MALES: 33%, 69%, 50%
- FEMALES: 54%, 38%

### TABLE II

**OSTEOARTHRITIS: EXTREMITIES PERCENTAGE FREQUENCIES**

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#### Degree of Severity of Lesions

- **0 trace**
  - MALES: 88%, 67%, 71%, 93%
  - FEMALES: 87%, 86%
- **+**
  - MALES: 12%, 28%, 16%, 7%
  - FEMALES: 85%, 10%
- **++**
  - MALES: 0%, 5%, 11%, 0%
  - FEMALES: 3%, 1%
- **+++ pronounced**
  - MALES: 0%, 0%, 2%, 0%
  - FEMALES: 0%, 3%

#### No. of Specimens

- MALES: 21, 95, 108, 26
- FEMALES: 32, 71

#### % with osteoarthritis

- MALES: 12%, 33%, 29%
- FEMALES: 7%, 13%

### TABLE III

**OTHER FINDINGS: PERCENTAGE FREQUENCIES**

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#### Vertebral Fractures

- MALES: 8%, 3%, 12%, 8%
- FEMALES: 12%, 13%

#### Schmorl herniations

- MALES: 8%, 33%, 31%
- FEMALES: 0%, 12%

#### Special stress

- MALES: 17%, 5%, 7%
- FEMALES: 33%, 0%

#### Extremity Fractures

- MALES: 6%, 17%, 47%
- FEMALES: 33%, 13%

#### Extremity Special stress

- MALES: 55%, 28%
- FEMALES: 34%, 26%
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and the stature is 169.8 cm for 68 men and 154.9 cm for 16 women, or only 1-2 cm below that of contemporary Greece. The general health characteristics appear to have been better; for example, "age at death" is several years above that in Byzantine Greece. At Kalenderhane, however, there may be a selective factor favoring aged males (Figures 3, 6), since monks retired after an active life that often may have included military service.

Fractures occur in 18-19%, which is less than half the modern U.S. value, but high for ancient peoples. Out of about 70 skeletons, these fractures include 4 ribs, 2 Colles', 2 legs, 2 vertebrae, and 1 each of calcaneus, talus, clavicle, humerus neck, and femur intertrochanteric. There are two unreduced shoulder dislocations and numerous wounds of the legs, foot, hip, and head, suggesting war injuries in some cases. Surviving males at Kalenderhane may thus have been extra vigorous, but injuries may have increased the incidence of osteoarthritis. Deltoid crest size is even larger than at Kalinkaya, befitting work-related arthritis. Mongoloid traits (shovel incisors, extra-big flatfish face, pinched forehead, etc) occur in 15-25%, which suggests mercenaries and merchants either from beyond the Caucasus or from the Russian steppes.

Discussion

From the data presented (Tables I-III), it is evident that the overall incidence of osteoarthritis found in those samples from ancient Turkey is less (27% vs 38%) in prehistoric than in Byzantine times (influenced partly by a nine-year age increase) and in modern U.S. (27% vs 33% with no age increase). As expected, osteoarthritis affects vertebral joints more than limb joints, although fractures influence limbs about twice as much as vertebrae.

At prehistoric Kalinkaya, more women than men exhibited evidence of osteoarthritis, if one allows for the four-year age difference. In the modern American group, the frequency is higher in men than in women, even allowing for the six-year difference in age of death between females (37) and male accident victims (43). Consequently, for these two groups, the difference in the incidence of osteoarthritis is related to age and occupation rather than to sex per se. However, in the Byzantine sample, there is an excessively high number of males and a nine-year age difference between men (46) and women (37). Here, there is a sharp sex contrast that is probably occupational. Cultural differences are most relevant.

Fig. 1. Kalinkaya Female (ca. 33)
Exostosis from ankle strains, especially of bifurcating ligament.
"Arthritis": neck, thoracic vertebrae, shoulders, biceps insertion.

Chronic old shoulder dislocation.
Conclusion

The sample specimens we studied from the populations of ancient Turkey and Byzantine Istanbul give little support to the two hypotheses presented above. Contrary to the first hypothesis, we found no clearcut decline in the incidence of osteoarthritis from ancient to modern times, since the incidence in the Early Bronze Age culture at Kalinkaya was lower than in medieval Kalenderhane or in the modern U.S. control. With respect to my second hypothesis, no consistent sexual pattern of difference was evident. While men had more osteoarthritis than women in the two later periods, this difference did not hold true for the sample from ancient Turkey.
Acknowledgments

We would like to thank the following individuals: Sara Bisel and Peggy Angel, my wife, for their field assistance; Dr. Raci Temizer, Director of the Museum of Anatolian Prehistory in Ankara, for inviting us to study the Kalinkaya skeletons; Dr. Cecil L. Striker of the University of Pennsylvania and Dr. Dogan Kuban of Istanbul Technical University for inviting us to study skeletons from the cemetery next to the former Kyriotissa Church. Dumbarton Oaks also supported the excavation with travel funds.

References