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Bioarchaeological Assessment of Skeletal Remains from A Salvage Excavation in Antalya Province

Ahmet İhsan Aytek[1], Alper Yener Yavuz[2]

[1]Burdur Mehmet Akif Ersoy University, Faculty of Arts and Sciences, Department of Anthropology, Burdur, Türkiye
[2]Burdur Mehmet Akif Ersoy University, Faculty of Arts and Sciences, Department of Anthropology, Burdur, Türkiye

ORCID: A.İ.A. 0000-0002-7620-2333;
A.Y.Y. 0000-0002-4959-5581

Corresponding author/Sorumlu yazar:
Ahmet İhsan Aytek,
Burdur Mehmet Akif Ersoy University, Faculty of Arts and Sciences, Department of Anthropology, Burdur, Türkiye
E-mail: aytek@mehmetakif.edu.tr

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ABSTRACT

The Antalya province, with its many important archaeological sites, reveals cricital archaeological data for the human history of Anatolia. These data are not limited to archaeological results, but the skeletons found during excavations also reveal direct data about human life and death. However, the archaeological data of Antalya are not limited to known archaeological sites, but are also updated with the increasing number of rescue excavations in many parts of the city. In this study, the human skeletal remains of 96 individuals were examined. The skeletal remains were unearthed from 48 graves, which were used in both the Roman and Byzantine periods, during the rescue excavations carried out by the Antalya Museum Directorate in the Başköy neighbourhood of the Kepez district in 2022. The anthropological examination of the skeletons revealed 70 adults and 26 sub-adult individuals, and the most common age range at death was 35-50 years. The estimated sex, age at death and stature, and oral and dental health, pathological lesions, and skeletal variations were assessed. Among our findings, we show cases of avascular necrosis, ossification of the chondrosternal cartilage, cortical desmoid and double-rooted mandibular canine, conditions that are not well documented in ancient Anatolian records.

Keywords: Başköy, avascular necrosis, chondrosternal ossification, spina bifida, cortical desmoid

Introduction

Antalya has an important geography that hosts many ancient cities of Anatolia. It was the homeland of many ancient cities from both the Lycia and Pamphylia regions in ancient times. This region, which has been home to human groups since the Palaeolithic period, has hosted different civilisations in ancient times. In many archaeological excavations that have been carried out and are still being carried out in the city, important cultural findings belonging to these people have been brought to light. In addition to these cultural records, the skeletal elements of these people reveal direct information about human life and death. However, considering the potential of the Antalya province, anthropological studies on archaeological sites are proportionally very few. Anthropological studies on historical periods are limited to Alanya Castle, Patara and Perge (Erdal et al., 2006; Erdal, 2008; Erdal and Erdal, 2017; Keleş et al., 2013; Sevim Erol and Yavuz, 2015; Sevim Erol et al., 2016; Sevim Erol et al., 2018; Üstündağ and Demirel, 2008; Üstündağ and Demirel, 2009).

There are also studies on a few sites unearthed during museum excavations or rescue excavations (Angel, 1973; Erdal, 1997; Erdal, 2009a; Erdal, 2009b; Kansu and Çiner, 1968; Özdemir et al., 2011; Yılmaz Usta et al., 2020).

A total of 19 archaeological excavations are being carried out in the Antalya province, 17 of which have the status of presidential excavations and 2 of which are under the direction of museum directorates. The strong ancient background of the Antalya province has made it commonplace to find ancient remains everywhere in the city. Such ancient remains are also found during construction or agricultural activities. In 2022, the museum directorates carried out 6 rescue excavations in Antalya province (https://kvmgm.ktb.gov.tr/). The subject of this study is the human skeletons unearthed in a rescue excavation carried out by the Antalya Museum Directorate in the Kepez district.

Materials and Methods

In this study, the human skeletons of 96 individuals found in 48 graves unearthed during the rescue excavations carried out by the Antalya Museum Directorate in the Başköy of Kepez district in 2022 were examined (Fig. 1). The graves were carved into the bedrock (Fig. 2). Some graves were sealed with terracotta bricks and some with cap stones. Almost all of the graves were oriented in the northeast-southwest direction, and in a few cases the direction was exactly east-west. They were buried supine with the head in the west direction when observing the skeletons recovered in good and relatively intact condition. In most of the burials, it was observed that the hands were joined on the abdomen.

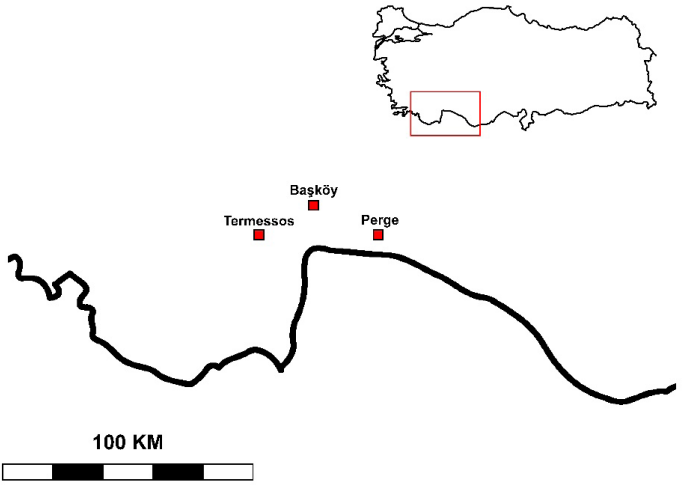

Figure 1: Location of the excavation site.

Figure 2: Grave number 5 (Excavation archive).

In a few graves, the arms of the individual lying on their back are extended straight on both sides. A coin dated to the Late Roman Period, fragments of vessels, glass and bronze bracelets, bronze cruciform pendants, bronze earrings, an object that may be an iron knife, a string of glass beads, a stone axe tip, iron grave nails and a bronze arrowhead were recovered from the graves. The associated findings reveal that the cemetery was used both during the Roman and Byzantine Periods, but no clear date was determined. Mosaics and cisterns were also found in the area.

Although the excavation was carried out in accordance with proper excavation techniques and being careful, the taphonomic processes they were exposed to during burial caused significant damage to the bones. However, the relatively better condition of the parts required for sex determination and age estimation provided important information. The anthropological study was carried out on the skeletons received from the Antalya Museum Directorate and brought to the Laboratory of the Department of Anthropology of Burdur Mehmet Akif Ersoy University to estimate the number of individuals, age and sex (among adults), and record observable pathological conditions and variations.

The age and sex of the individuals were estimated using standard methods. Sex estimation was based on pelvic morphology, according to the preauricular sulcus, incisura ischiadica major, angulus pubis, arc compose, foramen obturatum, corpus ossis ischii, crista iliaca, fossa iliaca, pelvis major and pelvis minor, subpubic angle and concavity, ventral arch, ischiopubic ramus, ischiopubic proportions, acetabulum and sacrum (Workshop of European Anthropologist, 1980; Buikstra and Ubelaker, 1994; Bruzek, 2002). Where the pelvis or os coxae were not observable, sex estimation was based on the characteristics of the skull; glabella, processus mastoideus, frontal and parietal eminence, nuchal crest, processus zygomaticus, orbital shape, external occipital protuberance, mental eminence, gonial angle, mandibular ramus angle and palate shape (Workshop of European Anthropologist, 1980; Buikstra and Ubelaker, 1994).

The age at death was estimated using the pubic symphysis, changes in the auricular surface of the os coxae, skull sutures, ageing of the medial epiphysis of the clavicle and cortical section, proximal part of the femur and complex ageing methods (Albert et al., 2007; Buckberry and Chamberlain, 2002; Ubelaker, 1989; Walker and Lovejoy, 1985). Statures of individuals were calculated from femoral and tibial lengths (Trotter and Gleser, 1952).

Results

Age and Sex Distribution

Sex could be estimated for 62 adult individuals; 35 males and 27 females were identified, while the sex of 8 adults could not be estimated (Table 1).

Table 1. Sex distribution of adult individuals.

Sex	Number of Individuals
Male	35
Female	27
Undetermined	8

Adults were classified as young adults (20-35 years), middle-aged adults (35-50 years), and older adults (over 50). Age estimation was possible for 23 of 35 male and 16 of 27 female individuals (Table 2). No significant differences in the representation of males and females, according to age, were observed.

Table 2. Age distribution of adult individuals.

Group	Age Range (Years)	Male	Female
YA	20-35	3	3
MA	35-50	16	10
OA	50+	4	3

Individuals estimated as non-adults or juveniles were classified as foetus (prenatal), infant (0-3 years), child (3-12 years), and older child (12-20 years). Non-adult individuals are depicted in Table 3.

Table 3. Age distribution of sub-adults.

Group	Number of Individuals
Foetus	3
Infant (0-3 years)	10
Child (3-12 years)	8
Older child (12-20 years)	5

Stature

The average stature of the 15 males was 168,15 cm. In females, the mean height of 8 individuals was 153,45 cm.

Variations

One individual had a metopic suture (Fig.3) and one individual had a double-rooted canine (Fig. 4).

Pathological Lesions

Pathological examination revealed vertebral fusion in one individual (Fig. 5), spina bifida in one individual (Fig. 6), enthesopathy in one individual (Fig. 7), arthritis in 3 individuals (Fig. 8-10), possible cortical desmoids in two individuals (Fig. 11-12), trauma in six individuals (Fig. 13-18), and ossification of chondrosternal cartilage in one individual (Fig. 19).

Figure 3: Metopic suture.

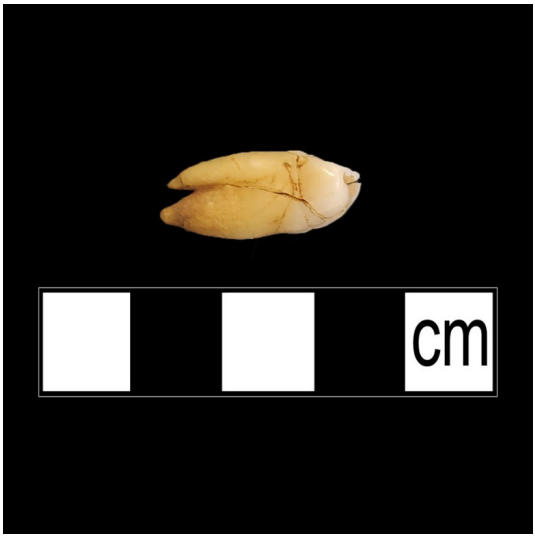

Figure 4: Double-rooted canine.

Pathological conditions on the vertebrae were not examined because the individuals came from graves with more than one burial and in many graves the vertebrae were mixed and poorly preserved. The same is valid for oral and dental health.

Figure 5: Vertebral fusion.

Figure 6: Spina bifida.

Figure 7: Entesopathy.

Figure 8: Osteoarthritis in the femoroacetabular region.

Figure 9: Osteoarthritis.

Figure 10: Osteophytic formations on the proximal part of the ulna and radius due to osteoarthritis.

Figure 11: Bone projection at the distal end of the humerus.

Figure 12: Bone projection in the shaft of the humerus.

Figure 13: Trauma to the humeral head causes avascular necrosis.

Figure 14: Trauma to the sacral bone at the level of the last two vertebrae.

Figure 15: Trauma on MC2.

Figure 16: Trauma in the proximal tibia-fibula articular area.

Figure 17: Trauma in the proximal articular area of the fibula.

Figure 18: Trauma in the shaft of the fibula.

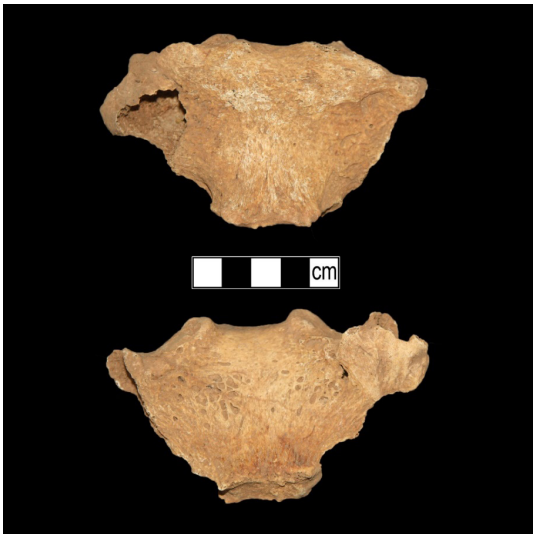

Figure 19: Ossification of the chondrosternal cartilage.

Discussion and Conclusion

In a study on the length of life of human communities living in Anatolia during the Roman and Byzantine Periods, it was found that the most common age at death was 35-50 for both periods (Aytek, 2020a). According to the total number of individuals examined, this rate is approximately 45% (Aytek, 2020a). In this study, the most common mortality range for both sexes was estimated to be 35-50 years. In this study, the most common age at death is also 35-50 and corresponds to 66% of the total individuals whose age of death could be determined. This indicates that the average life expectancy is similar for the Roman-Byzantine period sites in Anatolia (Aytek, 2020a). However, it should be noted that a small sample size does not always provide accurate results.

Although Antalya province has a rich history in terms of archaeological excavations, the anthropological publication density of the city lags behind this richness. Among the studies contemporary with the skeletal group evaluated in this study, the only periodically comparable data comes from the ancient city of Patara. In this study, the average age of males and females was 34.38 and 34.6 years, respectively (Sevim Erol and Yavuz, 2015). Although these data are not directly comparable with the Başköy skeletal group, it is observed that the average age at death for both sexes was below the middle-adult age range. This shows that the people of Başköy had a similar life expectancy as the people of Patara.

The mean height of 15 male individuals was 168,15 cm and the mean height of 8 female individuals was 153,45 cm. When these averages are compared with the Anatolian Roman and Byzantine Periods, it is seen that both sexes give results appropriate to the period (Aytek,

2020b). In the people of Patara, the average height of males was 169,02 cm and the average height of females was 160,64 cm (Sevim Erol and Yavuz, 2015).

This reveals that the average stature is almost the same in males and the Patara people were taller in females. Since the number of female individuals is very limited for both sites, it is impossible to make a comparison within the site.

A double-rooted mandibular canine was identified in one individual (Fig. 4). Because the tooth came from a mixed skeletal group, age and sex estimation could not be made. The frequency of this variation is usually between 5 % and 8%, but it is mostly observed in females (87.5%) (Lee and Scott, 2011; Alenezi and Al-Hawwas, 2016; Plascencia et al., 2017). Studies on this variation show that it did not evolve through an ancestral origin, but emerged in modern human populations and spread throughout Western Eurasia (Lee and Scott, 2011). It has also been shown that this variation is much more common in Europe than in Asia and that it originated in Europe and spread to Asia through migrations, but not very frequently (Lee and Scott, 2011).

Among the individuals, a female individual over the age of 50 years was found to have many pathological conditions in her body. While advanced osteophytic formation was observed in 4 vertebrae of the individual, age-related deformation was observed in other vertebrae. These kinds of osteophytes (bone formations) are typical characteristics of degenerative joint diseases, especially in the anterior and lateral parts of the vertebrae.

They can be in different shapes and sizes. They develop due to physical stress, age, and trauma (Ortner, 2003). A trauma lesion was detected in the sacral bone of the individual at the level of the last two vertebrae (Fig. 14), and osteoarthritis was observed in the femoroacetabular region (Fig. 8). Osteoarthritis is the damage and destruction of the articular cartilage, resulting in changes in the bone tissue beneath the cartilage. As individuals age, the articular cartilage begins to change. This change usually starts with the cartilage losing its mobile structure. Over time, the intra-articular fluid (synovium) becomes inflamed due to the destruction of the cartilage. With inflammation, the cartilage begins to suffer further damage and as the natural structure of the joint deteriorates, it begins to lose its former shape and mobility. In the final stages, bone spurs called osteophytes begin to form and the joint loses all its functionality (Ortner, 2003). Osteoarthritis is a disease that affects joint surfaces and most commonly affects the hands, knees, hips, and cervical and lumbar vertebrae (Tutuncu and Kavanaugh, 2005). It is also called degenerative joint disease because it occurs with joint movements. Direct biomechanical wear, functional wear, and tears are shown as the cause of this disease. In addition, many factors such as age and sex, hereditary characteristics, overweight, and trauma play an important role. Osteoarthritis is a very common joint disease in individuals who are engaged in jobs that put more strain on the joints. When both osteophytes and sacral trauma are considered together, the individual has a painful life. The advanced age of the individual can be interpreted as the main cause of these conditions.

Osteophytic formations due to osteoarthritis were observed in the proximal part of the ulna and radius of an adult individual, and eburnation was detected in the articular fovea of the individual (Fig. 10). Eburnation is considered the most advanced stage of osteoarthritis. The cartilages in the joint capsules completely dissolve and disappear.

The bones rub against each other, both abrading the bone and creating a shiny surface on the bone (Ortner, 2003). Because the humerus of the individual was not available, it could not be determined how the related pathology affected the humerus.

Spina bifida was detected in an individual of undetermined sex (Fig. 6). Spina bifida is a congenital pathology that occurs when one or more vertebrae fail to close at the midline. The most common site is the sacrum, and it is more common in males. Although its aetiology is generally attributed to genetic causes, it is thought that it may also be caused by environmental factors, such as erroneous drug use during pregnancy, diabetes, and febrile diseases in the first trimester of pregnancy (Özaras, 2015). It is thought to occur when folic acid and vitamin B12 are not taken in sufficient amounts during the development of the foetus in the womb (Kumar and Tubbs, 2011), and it has been shown that when folic acid is given to individuals with genetic predisposition, it can eliminate the negative effects (Osterheus et al., 2013). There are two main types: spina bifida cystica and spina bifida occulta. Spina bifida cystica is a dangerous type and can cause neurological damage and even death, while spina bifida occulta is a non-hazardous type and does not cause any problems that interfere with the life of the individual. The vertebral opening in the sacrum at S3, S4, and S5 can also be seen as a variation of the sacral hiatus, and it is recommended to look at other vertebrae and other anomalies in the body when diagnosing spina bifida (Kumar and Tubbs, 2011). In the individual identified in this study, S1 and S5 were absent, the vertebral aperture was detected at the S2, S3, and S4 levels and the angle of the aperture continued at the S5 level. Therefore, the specimens in this study were classified as spina bifida occulta. Because the related bone came from a mixed skeletal group, age and sex could not be determined, but the closure of the sacral vertebrae indicated that the individual was an adult.

Fusion of the three cervical vertebrae was observed in a middle-aged male (Fig. 5). Osteophyte outgrowths at the margins of the vertebrae can sometimes develop to an extreme degree. In some cases, this development can be so severe that the vertebrae fuse with each other. The causative factors are usually mechanical stress, pressure on the spine, or trauma. In addition to these factors, advanced age is also an important cause of osteophytes (Ortner and Putschar, 1985). The fact that the individual was not very old shows that this pathology may have been caused by daily activities.

Enthesopathy was observed in two calcaneus bones of a man (Fig. 7). Entosopathy is the name of the bony formations seen on the contact surfaces of tendons and ligaments with bones, resembling more like pointed spiny protrusions without a specific pattern. It is frequently seen on the calcaneus, femur (line aspera), and medial facet corner of the patella.

They are more common in men than in women. In addition, the ridges may thicken and become more prominent with advancing age (Mann and Hunt, 2012).

Two different humerus have bony projections on their shafts (Fig. 11-12). Although such projections can be interpreted as a result of a trauma, another diagnosis would be a cortical desmoid (tug lesion). Cortical desmoids are irregularities of a bone cortex because of repetitive stress at the attachment of a muscle.

They are generally known as femoral lesions but have been documented in humerus as well (Kay et al., 2017). The prevalence rate is higher in males (Johson et al., 1968; Simon, 1968), consistent with our examples. It is seen in physically active people, which shows arm strength. It is not always symptotic and thus does not require a treatment. The major problem for a cortical Desmond diagnosis in our cases is that this lesion is seen in the proximal part of the humerus because of the insertion of the pectoralis major muscle (Fulton et al., 1979). In our cases, one is located around the midpoint of the shaft and the other is near the distal end.

When the individuals were examined in terms of trauma, 6 trauma lesions were detected. One of these traumas occurred in the humerus (Fig. 13), one in the sacrum (Fig. 14), one in the metacarpal (Fig. 15), two in the tibia-fibula proximal joint region (Fig. 16-17) and one in the fibula (Fig. 18). Five of the traumata were observed in males and two in females. One of the humerus traumas caused small bony protrusions in the middle of the body and one near the distal end, which did not change the main form of the bone. Both humerus traumas are considered traumas that will not affect the life of the individuals due to their size and distance from the articulation points.

Ossification of the right-sided chondrosternal cartilage of the sternum was detected in the individual with has the trauma lesion on her humerus near the distal end (Fig. 19). The manubrium of the sternum articulates with the first rib with a cartilaginousa tissue. Ossification of this cartilaginous tissue forms a bone bridge between the sternum and the first rib. This condition, which is generally seen in older ages, is more common in women than in men (Saladin, 2011; Kumaraswamy and Kannadath, 2014). The incidence is 0.3% on average and does not show any symptoms except in some cases (Ashwini, 2015). The sample in this study is of a female individual over 50 years of age and presents age-sex data that fits the general profile. The first rib of the individual is absent.

Another important pathology was detected in the right humeral head of a young individual who had not yet reached adulthood (Fig. 13). In the proximal part of the humeral head of the individual, deep grooves were observed as a result of avascular necrosis. An agent has affected the blood flow in the area and caused avascular necrosis of the bone tissue (Lancigu and Rony, 2021). This prevented the normal shape of the humerus. When left untreated, this condition leads to osteoarthritis. However, the early death of the individual did not provide enough time for this to occur. The fact that no arthritis was observed and only depressions were observed indicates that avascular necrosis was in the third stage (Lee et al., 2022).

Because arthritis formation and deformity that would affect the movement of the humeral head in the glenoid fossa were not observed, it is thought to have significantly affected the life of the individual. However, the fact that the humeral head did not take the normal shape should have limited the movements of the individual to some extent. Studies have shown that another important cause of avascular necrosis is long-term steroid use (Lee et al., 2022). However, the fact that steroids are a product of the modern era eliminates this possibility. In addition, there are several causes, many of which are associated with modern times. Considering the shape and location of the lesions, the cause of necrosis is thought to be impact-related trauma. Approximately 40% of humeral fractures occur in the proximal region (Lefèvre et al., 2014). Because the scapula of the individual was not present, the effect of the trauma on the scapula and the individual's life could not be fully determined.

One of the fibula traumas occurred in the middle of the body (Fig. 18), while the other two occurred at the proximal articulation point with the tibia (Fig. 16-17). The trauma sites were degenerated in both individuals. This shows that the individuals had problems performing knee movements. The high rate of indigence of traumatic lesions can be interpreted as a result of the rural lifestyle.

Although the number of individuals evaluated in the study is not very high, it is thought to contribute to the literature with pathologic lesions, some of which are not seen very frequently. The double-rooted mandibular canine is also rare. In addition, this study reveals new information about the human history of the Antalya province, which is represented by publications below its potential in terms of anthropological studies, with direct information about the human history of this important geography.

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