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AUDITORY EXOSTOSES FROM ANCIENT LAODIKEIA (2ND–3RD CENTURY A.D.): THE RESULT OF BATH HABIT

ABSTRACT: Our auditory exostoses case is coming from South-west Anatolia, known as Ancient Laodikeia the part of Lydia, near Denizli, Turkey. The city is marked by the river Lykos, and thus was called Laodikeia and Lycum. The necropolis of the Ancient Laodikeia is dated between ca. 2nd and 3rd century A.D. The four male individuals who were found three graves in this necropolis indicating auditory exostoses on their temporal bones, three left and one right temporals. The causative reason for this anomaly is probably the habit of baths and also the river nearby the city Lykos. Also, the North of the city is neighbourhood to Hierapolis, known as Pamukkale, 'Cotton Fortress' formed by the travertine deposits of the calcium oxide-bearing waters of a stream is remarkable place for swimming and bath habit.

KEY WORDS: Auditory exostoses – Laodikeia – Lydia – Lycum – paleopathology

INTRODUCTION

Auditory exostoses are bone anomalies located in the external auditory canal, which have been studied by anatomists, clinicians and anthropologists more than 190 years ago (Hrdlička 1935, Kennedy 1986, Manzi *et al.* 1991). Auditory exostoses have been recorded in skeletal remains worldwide (Okumura *et al.* 2007, Capasso *et al.* 1999). For example Neolithic bones from about 5000 B.C. in Japan, early marine populations of northern Chile from about 7000 B.C. (Aufderheide *et al.* 1993).

Auditory exostoses have also been observed in Mesolithic Yugoslavians, pre-Hispanic individuals from the Canary Islands (1,700–540 years BP), Chileans (7000 B.C. to 1450 A.D.), pre-Columbian South American mummies, Lithuanians (from the Neolithic to the 17th–18th century A.D.), and individuals from Imperial Rome (1st–3rd century A.D.) (Frayer 1988, Manzi *et al.* 1991, Sakalinskas, Jankauskas 1993, Standen *et al.* 1997, Gerszten *et al.* 1998, Velasco-Vazquez *et al.* 2000).

Our auditory exostoses case is coming from South-west Anatolia, known as Ancient Laodikeia the part of Lydia, near Denizli, Turkey. The city is marked by the river Lykos, and thus was called Laodikeia and Lycum. The necropolis of the Ancient Laodikeia is dated between ca. 2nd and 3rd century A.D. (*Figure 1*).

MATERIALS AND METHODS

A total of 20 crania which belonging to adult individuals from Laodikeia, were studied for evidence auditory exostoses. These skeletal remains were found in the necropolis of the Ancient Laodikeia. The four adult male individuals who were found three graves in this necropolis are indicating auditory exostoses on their temporal bones, three left and one right temporal. The external auditory canal was examined with the naked eye. The individuals' age and sex assessments were made by using standard osteological techniques recommended by Buikstra and Ubelaker (1994).

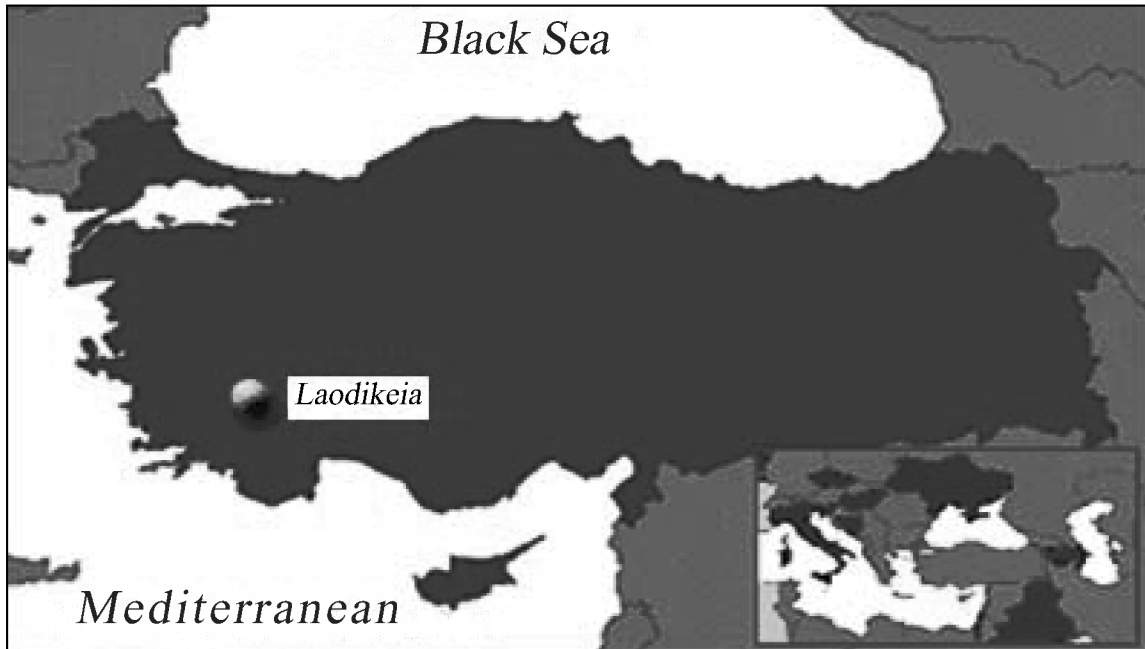


FIGURE 1. Location of Laodikeia.

RESULTS AND DISCUSSION

Auditory exostoses are visible as a rounded lump ranging in size from small to large, sometimes filling the opening (Mann, Hunt 2005). They may appear as irregular bony masses, sessile or pedunculate. Auditory exostoses have an extensive base and can be bilateral and multiple (Capasso *et al.* 1999). Many anthropologists and researchers prefer to use the term “auditory exostoses” to describe all discrete auditory lesions growing in the auditory canal (Velasco-Vazquez *et al.* 2000). After the work of Berry and Berry (1967) auditory exostoses have also figured in lists of cranial nonmetric traits despite the fact that their epigenetic nature has been questioned (Kennedy 1986, Manzi *et al.* 1991).

Hrdlička (1935) identifies exostoses to be seen in much higher frequencies in males than females and usually affects individuals over 25 years of age. Gregg and Gregg (1987) found male/female ratio 6/1 and Roche (1964) found it as 14/1. However the analyses of necropolis’ skeletons have not been finished we found auditory exostoses in 4 of the 20 individuals (20%). All of our lesions are belonging to adult male.

Although about 70 % of the lesions are found on the posterior wall, near the tympanomastoid sture it is possible to distinguish three major types of auditory exostoses on the basis of their position: 1 – Only on the anterior wall; 2 – Only on the posterior wall; 3 – Both on the anterior and posterior walls. Sometimes auditory exostoses almost



FIGURE 2 a. Auditory exostoses only on the anterior wall.



FIGURE 2 b. Auditory exostoses both on the anterior and posterior wall.



FIGURE 2 c. Auditory exostoses only on the posterior wall.



FIGURE 2 d. Auditory exostoses only on the anterior wall.

TABLE 1*: Suggested etiology for auditory exostoses.

Suggested etiology	References
alcoholism	Toynbee, 1849
ear piercing	von Luschan, 1896
canal form	Stewart, 1933
mastication stress	Burton, 1923
cranial deformation	Jackson, 1909; Oettekin, 1930; Ostman, 1894
chronic infection	Roosa, 1866; Cassells, 1877; Field, 1878
chronic irritation	Hrdlička, 1935; Sheehy, 1958; DiBartolomeo, 1979
gout and/or rheumatism	Toynbee, 1849; Field, 1878; Virchow, 1893
bathing	Tod, 1909; Manzi <i>et al.</i> , 1991; this study; 2009
cold water	van Gilse, 1938; Fowler&Osmun, 1942; Adams, 1951;
	Ascenzi&Balistreri, 1975; Kennedy, 1986; Standen <i>et al.</i> , 1997
swimming (marina,aquatic)	Wyman, 1874; Field, 1878; Kelson, 1900; Moore, 1900;
	Jackson, 1909; McKenzie, 1920; Belgraver, 1938;
	Harrison, 1951; Roche, 1964; Starachowicz&Koterba, 1977
	Velasco-Vazquez <i>et al.</i> , 2000; Okumara <i>et al.</i> , 2007
genetic	Seligman, 1864; Turner, 1978; Blake, 1880;
	Dalby, 1885; Hartmann, 1893; Hrdlička, 1935;
	Adis-Castro&Neumann, 1947; Berry&Berry, 1967

* This table was recreated after Aufderheide and Rodriguez-Martin (1998).

completely occlude the bony meatus (Aufderheide, Rodriguez-Martin 1998, Capasso *et al.* 1999). Our cases include all of three types (Figure 2 a, b, c, d).

Older anthropological investigators postulated that a lot of possible etiologies of auditory exostoses. DiBartolomeo (1979),

Kennedy (1986) and Aufderheide and Rodriguez-Martin (1998) have collected these and we have constructed from their studies and other articles some etiologies on Table 1. These old ideas were diminished considerably by the publication of Hrdlicka’s monographic work in 1935 (Kennedy 1986).

Briefly two primary models have been proposed to explain the etiology of auditory exostoses: genetic factors and environmental influences. From the 19th century until recently, the cause of auditory exostoses was thought to be genetic. Currently, most researchers agree that auditory exostoses are probably caused by environmental factors, and genetic predisposition has only a minor role in the development of this trait (Velasco-Vazquez *et al.* 2000, Mann, Hunt 2005).

Auditory exostoses are mostly associated with aquatic activities. They are seen in higher frequencies in swimmers and divers, especially cold water (Capasso *et al.* 1999, Mann, Hunt 2005). Kennedy (1986) found that the highest frequencies of auditory exostoses in the middle latitudes (30–45° N and S) among populations who exploit either marine or fresh water resources.

Auditory exostoses are also seen in pre-Columbian Peruvians of coastal villages who regularly engaged in cold-water baths and *thermae* (Ascenzi, Balistreri 1975, Capasso 1987). Manzi (1991) found auditory exostoses only middle-class males in Roman imperial age (1st–3rd century A.D.). Wealthy men used of cold water baths in the *frigidarium*. Presumably women and lower-class men did not participate in the entire this ritual (Capasso *et al.* 1999, Mann, Hunt 2005, Manzi *et al.* 1991).

Our auditory exostoses case is coming from Ancient Laodikeia. The necropolis of the Ancient Laodikeia is dated between ca. 2nd and 3rd century A.D. (Roman imperial age). The archaeological excavations showed that Ancient Laodikeia has four public bath-houses. We associate our cases with baths habit. Introduced to the Romans by their conquest of Greek southern Italy and Sicily in the ca. 3rd millennium B.C, social bathing in specifically designed bath-houses emerged the single most significant feature of Roman Culture.

Of all the leisure activities, bathing was surely the most important for the greatest number of Romans, since it was part of the daily regimen for men of all classes, and many women as well. Apart from their normal hygienic functions, they provided facilities for sports and recreation. Their public nature created the proper environment-much like a city club or community centre-for social intercourse varying from neighbourhood gossip to business discussions (Fagan 2002, Yegül 1992).

Small bathhouses, called *balneae*, might be privately owned, but they were public in the sense that they were open to the populace for a fee, which was usually quite reasonable. The large baths, called *thermae*, were owned by the state and often covered several city blocks. About 2:00-3:00 pm, men would go to the baths and plan to stay for several hours of sport, bathing, and conversation, after which they would be ready for a relaxing dinner (Fagan 2002, Yegül 1992).

Republican bathhouses often had separate bathing facilities for women and men, but by the empire the custom was to open the bathhouses to women during the early part of the day and reserve it for men from 2:00 pm until closing time, usually sundown, though we occasionally hear of a

bath being used at night. The women got the less desirable hours, their fee was twice as high as the men's, 1 *as* (a copper coin) for a woman and ½ *as* for a man (Fagan 2002, Yegül 1992). This shows that the Roman men spent lots of time than women. This is the reason the higher frequency of exostoses of men.

They might start in the warm room (*tepidarium*) which had heated walls and floors and then proceed to the hot bath *caldarium*. This room had a large tub or small pool with very hot water and a waist-high fountain *labrum* with cool water to splash on the face and neck. After this the bather might spend some time in the *tepidarium* again before finishing in the cold room *frigidarium* with a refreshing dip in the cold pool. Other rooms provided moist steam, dry heat like a sauna *laconicum* (Fagan 2002, Yegül 1992). These are the rooms of various temperature so this is another fact that we face exostoses of the individuals.

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