The human skeleton from the late iron age burial of Shirakavan (Armenia): a case study

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Bull Int Assoc Paleodont. 2017;11(2):51-61.

Abstract

This paper presents an bioarchaeological case study from Shirakavan. The skeletal remains belong to a male aged 40-45 years of age at death, with a stature above the average (177 cm). The presence of a horse skeleton in the discussed burial suggests that the human skeleton may have belonged to a horse rider. At the proximal end of the femur, there are some enthesopathies previously noted as common in horse riders. Analyses revealed a variety of pathologies, allowing inferences about the lifestyle and well-being of individual from Late Iron Age. The male suffered two cranial fractures, in nasal bones and frontal bone. Accidental falls involving facial injury may have contributed to antemortem tooth loss. Fractures ribs in the individual may be the result of direct blows to the chest or/from falling off of a horse. The clavicle injury observed in the individual discussed here can also be caused by a fall. There is degenerative pitting of the body of the neck vertebras indicating disc damage. Several vertebrae were asymmetrical (scoliosis). Perhaps mastoiditis was the leading cause of death at the individual from Shirakavan.

Keywords: Armenia; dental pathology; mastoiditis; injuries; osteoarthritis; porotic hyperostosis

Introduction

The study of human biological materials from archaeological contexts is in a key position to facilitate transdisciplinary research, to understand past and present populations through mortuary remains, and to make substantial theoretical contributions to the broadly conceived social sciences (1, 2). The focus of bioarchaeological research is wide ranging and may include analysis of mortuary sites (3), gender differences in dietary patterns (4), variation in health status across social groups (5) or subsistence transitions (6). A person's skeleton is remarkably informative about their health and wellbeing, dietary history, lifestyle (activity), ancestry, and key biological attributes (i.e., age and sex). This paper discusses how these areas are documented and interpreted via the study of human remains recovered from Shirakavan site on the Shirak plateau (Figure 1). At the end of 2015 archaeological season it was noted by unique opening - perfectly kept human skeleton, dated to 9th – 6th BCE. The individual in question was buried in a stone box (size 2.5x1.4m), oriented on an east-west axis. A horse skeleton and artifacts were all found near the human skeleton, at a depth of 2m. Shirak is the northwestern province of the Armenian Highland, bordering Turkey and Georgia. The earliest known historical sources mention Shirak as Eriakhi, a province under the influence of Urartu (7), an Iron Age kingdom in the Armenian Highland (8). In the period of the Urartian kingdom, horses were occasionally buried in human graves (9). The burial of nobles, heroes and Olympic victors with (their) horses was first documented in Homer's Iliad. That Mycenaean practice was to last for a long period of time as reported by later writers such as Herodotus and many others. In Armenia, horse burials (including chariots) have been identified from as early as the Middle Bronze Age (9). According to Devedjyan (9), numerous horse bones and skulls were deposited in graves at Lori Berd, usually in male burials. A similar case is known from the site of Azatan (unpublished material excavated in 2008 by Hamazasp Khachatryan and Larisa Eganyan) dating to the Late Bronze and Early Iron Ages from Shirak plain.

Anthropological study of the skeleton provides an understanding of the individual as a functioning, living human being. The record of traumatic incidents, paleopathological disorders imprinted upon a skeleton may contain a wealth of information about a lifetime of encounters with the environment and fellow humans. Here we report the injuries, diseases in a skeleton from Shirakavan, a cemetery dated to the Late Iron Age (i.e. the period when the Urartian kingdom flourished), buried together with a horse.

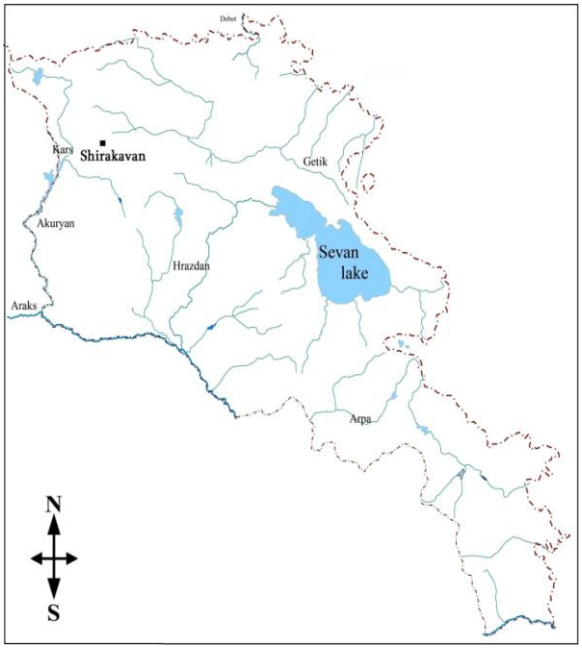

Figure 1. Map of Armenia showing the location of Shirakavan

Materials and methods

In 2008 - 2011, the Shirak regional museum began excavations at the Shirakavan site of under the direction of Khachatryan, Eganyan and Petrosyan. Subsequently, one additional burial was discovered, excavated in the late 2015. The individual was buried in a stone box (size 2.5×1.4m), oriented on an east-west axis. Was buried of a horse with a bronze belt around his neck. The burial detected black-

polished-handed pitcher, a small kitchen bowl, bronze buds chainmail, arrowheads and fragments of two iron knives.

Bioarchaeological analyses of human remains from Shirakavan were initiated by Khudaverdyan (10). The study found that indicators of iron deficiency (cribra orbitalia, porotic hyperostosis) and nonspecific systemic infection (periostitis) were present from the Shirakavan skeletal series.

The skeleton was analysed in detail, assessing for preservation and completeness (Fig. 1), as well as determining age-at-death and sex of the individual. Sex and age at death of the individual were determined according to standard osteological methods (11, 12; 13, 14, 15, 16). The stature was estimated from the femur length using regression equation of Trotter and Gleser (17). Measurements were taken as outlined in Alexseev (18, 19). Non-metric traits have been recorded for this skull (20) and dentition (21) in order to allow future comparisons with findings from other sites of Armenia. All bones were examined macroscopically and by taking x-rays.

Results

The skeleton was fairly complete and well preserved (Figures 2-3). The anthropological examination suggests that the skeletal remains belong to a male aged 40-45 years of age at death, with a stature above the average (177 cm). The form of the neurocranium, in norma verticalis, is ovoid. The cephalic index is probably mesocranic. The cranial vault is high. The nose is leptorhin. The orbits are mesoconch. Cranial non-metric traits: spina trochlearis, foramina zygomaticofacialia, spina processus frontalis ossis zugomatici (outgrowth), os wormii suturae squamosum, os postsquamosum, os wormii suturae coronalis, os wormii suturae lambdoidea, os asterion, foramina mastoidea, sutura palatina transversa (concave), sutura mendoza, sutura incisive, canalis craniopharyngeus, foramina mentalia. Dental non-metric traits: double shoveling. Postcranial non-metric traits: septal aperture (a hole in the distal humerus).

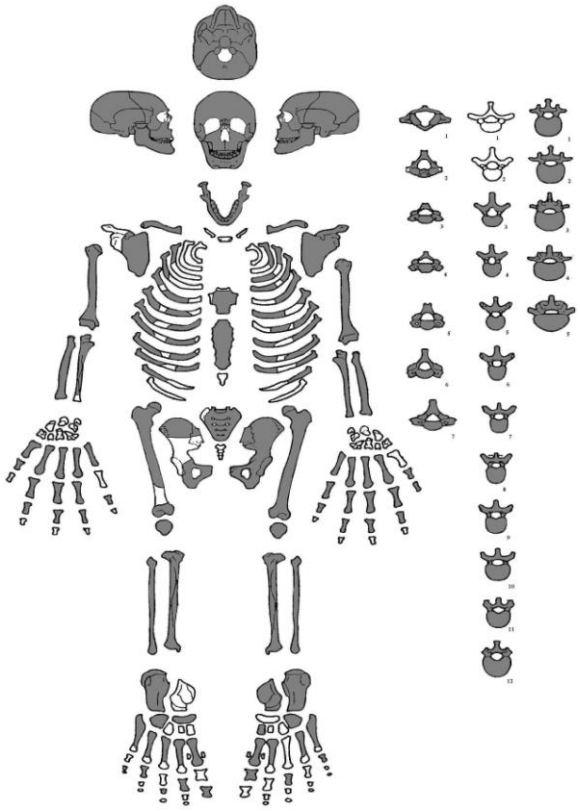

Figure 2. Completeness of the human skeleton from Shirakavan.

Dental pathologies. The left central incisor crown suffered a fracture and ante-mortem loss in life. Some degree of proliferative alveolar bone growth is evident. Enamel hypoplasia appears linearly on the enamel surface (I1, I2, C, M3). Chipping was observed in individual with of the affected teeth on the right side (Figure 4). One possible explanation for the chipping in the individual from Shirakavan is the result of biting down on a hard substance during production activities. Calculus was recorded on the upper molars on the buccal surface and lower incisors on the lingual surface.

Cranial pathologies and anomalies. Individual had suffered from chronic nutritional stress, as evidenced by the presence of porotic hyperostosis, due to lack of vitamin C or D (22), megaloblastic anemia (Walker et al., 2009) as well as infection during infancy. Response of a

human body to an exercise stress, a chronic (repeated) microtrauma is formation in the field of fastening of a trapezoid muscle (musculus trapezius) of the occipital roller (torus occipitalis: TOT = 3/left/, TOT = 2/right/). Formations of similar structure are possible at excessive loads of muscles since the early childhood.

individual has blunt force trauma to the near the nasal bones is on the frontal bone. The maximum width of this injury is 2 mm and is 3 mm in length (Figure 5). The lesion had puckered bevelled edges indicating that some healing had occurred. This individual also demonstrates traumatic injury of the nasal bones. Fractures here are the result of direct blows to the face (24) and/or falling from the horse.

Figure 3. Anterior view of cranium, right lateral view of cranium.

Figure 4. Dental pathologies: chipping, calculus, enamel hypoplasia

The injuries of this male were in various locations and all of the lesions occurred well before the individual's death (23). This

The manifestations of auditory exostoses a bilateral expression, was identified in a individual. The infection has produced a smooth walled cloaca with the appearance of an accessory foramen that passes through the masto-occipital suture. This case can be identified as simple mastoiditis. The lesion shows no signs of healing.

Postcranial pathologies and anomalies. Two well-healed rib fractures were observed. On the left side rib fracture was seen involving 8 and 9 rib. Rib fractures occur near the angle. Fractures here are the result of direct blows to the chest.

Figure 5. Traumas nasal bone and frontal bone.

Figure 6. Clavicles: fracture of the right clavicle and normal of the left.

Oblique fracture is present of the right clavicle. The affected clavicle was shorter than the contralateral (left=149mm/, right=146mm) and the bone exhibited angular alignment (Figure 6). The clavicle injury can be caused by a fall,

Figure 7. Tibiofibular synostosis and X-ray.

Figure 8. Morphology of proximal femur. Note the Poirier's facet and porosity

the severity of this case is consistent with a fall from a standing height (25). He is probably fell directly onto right shoulder. We also found an opening in the posterior part of the clavicle,

possibly representing a cloaca penetrating into the marrow space. A bony fragment healed in a malaligned position. All these signs suggest that the individual might have had osteomyelitis as a complication after clavicle fracture.

Figure 9. Evidence of a brain abscess.

An specimen of tibia and fibula with proximal tibiofibular synostosis is described (Figure 7). The bones belong to right side. The original joint surface is not recognizable as a result of the newly built bony bridge between the two articular surfaces. The bone in this area shows multiple vascular foramina and trabeculae. The rest of the shafts of the tibia and fibula do not show any abnormality. X-ray shows osseous continuity between the bones with cancellous bone within the synostosis.

The injuries on the clavicle, tibia and fibula accompanied infection set in and were followed by severe degenerative alterations.

At the proximal end of the femur, there are combinations of features that are labeled as enthesopathies (26). The femora at individual from Shirakavan have a strongly developed linea aspera indicative of strong adductor muscles, also have pronounced areas of insertion of all three gluteal muscles, but especially of g. minimus and g. medius on the greater trochanter and also has a distinct spicule in the trochanteric fossa (Figure 8). The orientation of the lesser trochanter or Poirier's facet together with the unilateral expression of enthesopathies in the calcaneus, would be consistent with Individual being a habitual horse-back rider. It was found the lesser trochanter or Poirier facet: bulging of the articular surface of the femoral head toward the anterior portion of the femoral neck.

In the individual both tibial tuberosities are rugged and irregular at their distal poles (Figure 9). There are some lateral deviation of the tuberosities. These changes have similarities to Osgood-Schlatter's disease (27) and this is a possible diagnosis here.

The next feature is the formation of osteophytes on the surface of the joint. The formation of new bone can be observed around the margins of the acetabulum, which is referred to as (slight) lipping. Various amounts of bony spicules or exostosis can be observed in the trochanteric fossa. On the calcaneal tuberosity there are cone-shaped osseous exostoses. The tubercles with cusps-like features of a molar tooth. Ossification exostoses are usually due to abrupt macrotrauma such as muscle rupture.

Osteophyte distributions on the calcaneus and along the vertebral column have been well documented (Figure 10). There is degenerative pitting of the body of the neck vertebras indicating disc damage. Several vertebrae were asymmetrical (scoliosis), with the vertebral body not being kidneyshaped, but more tear drop shaped. This had occurred in the 2 to 9 cervical vertebrae and 3 to 5 lumbar. The pedicles of several vertebrae were larger on one side than the other.

Discussion and conclusion

Paleopathological research can be exceedingly informative in many areas of physical anthropology particularly in the field of bioarchaeology. The presence of a horse skeleton in the discussed burial suggests that the human skeleton may have belonged to a horse rider and therefore it allows discussion regarding whether the observed pattern of trauma and degenerative joint disease may be

consistent with skeletal alterations resulting from habitual activity, namely horse ridding. Molleson et al. distinguished a suite of skeletal markers associated with the habitual and strenuous activity of equid riding, from a distinct pattern of markers that result from routine cart or chariot riding. This permitted the identification of a cart driver from the Royal Cemetery in the Predynastic period at Ur /c. 2500- 2350 BC/ (28), and four femora of probable bare-back equestrians at Kish (29). In a discussion of horseback riding in northeast Nebraska Native Americans, Reinhard et al. (30) described features associated with the muscle insertions and articulations of the lower limbs that could be attributed to habitual horse back riding. They specifically describe an elongation of the acetabulum among horseback-riding members of the Omaha and Ponca populations, compared with non-riding members of the same populations.

At the proximal end of the femur belonging to the individual from Shirakavan, there are some enthesopathies previously noted as common in horse riders (31, 26). The femora of the Shirakavan skeleton has a strongly developed linea aspera in conjunction with pronounced areas of insertion of all three gluteal muscles, but especially of the gluteus minimus and gluteus medius on the greater trochanter. There is also a distinct spicule in the trochanteric fossa. The orientation of the lesser trochanter or Poirier's facet together with the unilateral expression of enthesopathies in the calcaneus, would be consistent with the pattern expected in habitual horse riding. Exostosis of the trochanteric fossa has been linked to prolonged sitting posture with the lower limbs extended.

Although osteoarthritis is generally accepted as a pathological condition of multifactorial etiology (32), most regard it specifically as an age-related phenomenon which is the result of continuous mechanical loading of the joints throughout the lifetime an individual (33, 2, 32). Many researchers have used the prevalence and distribution of osteoarthritis to interpret levels of biomechanical stress in individuals incurred through the hardships of work and life within their culture. A generally accepted

Figure 10. Degenerative joint disease in the 5th lumbar vertebrae.

principle about osteoarthritis is that changes observed in and/or around the joints may be representative of modifications due to biomechanical factors such as trauma or activity, and those patterns have certain implications in the interpretation of lifestyle patterns from earlier populations (34, 35). Some researchers use osteoarthritis data as a basis for behavioral reconstructive methodology which in some cases have been successful (36, 37). In horse riders, for example, higher incidence of cervical and lumbar degenerative spondyloarthropathy has been suggested (38). Patterns of hip osteoarthritic have been found in association with horseback riders from the American Great Plains (39). These patterns have been explained as the result of specific loading which occurs during horse-back riding (30). The rider's posture causes the muscles in the back to contract to balance the spine and to prevent injury, which leads to large compressive forces being produced resulting in greater pressure placed on the intravertebral discs and facet joints (40).

Several features of the traumatic lesions observed in the individual from Shirakavan have the potential to provide information regarding the experience of accidents and/or violent activities. Falling from a horse was the most common mechanism of injury in horse riders (41, 42, 43). The head and extremities are the most commonly involved body areas in horse riding related injuries. The male from Shirakavan suffered two cranial fractures, in nasal bones and frontal bone. Although such cranial and facial lesions are often used as indicators of interpersonal violence (44, 45, 25, 46, 47, 48), they may also be the result of direct blows to the face resulting from falling off of a horse (23, 24).

Loss of teeth from the jaws is a complex and multicausal process (trauma, variations in dietary consistency, nutritional deficiency diseases, cultural or ritual ablation, et.) (49, 50, 51, 52). Display evidence of dental trauma in the individual from Shirakavan such as broken alveolar walls or septa in association with remodelling. Accidental falls involving facial injury may have contributed to antemortem tooth loss.

Fractures of the ribs can have varied causes, ranging from direct injury to falls against hard objects (24). Even in minor chest trauma there is a high rate of associated rib fractures (53). From a review of literature, it is clear that rib fractures could have contributed to the development of a number of complications (54). Even with potentially serious conditions, such as pneumothorax and hemothorax, the affected individual may have lived for some days prior to the onset of complications. In such circumstances ribs would have time to undergo a certain amount of healing prior to death, and with careful study such changes should be detectable. Ribs (especially the 8th and 9th) are usually fractured near the angle if the force is applied from the front (55). Single fractures are usually caused by direct blows, whereas multiple fractures often appear because of violent trauma produced by a large object or by compression on the rib cage (56). Fractures in the individual from Shirakavan may be the result of direct blows to the chest or/from falling off of a horse.

The clavicle injury observed in the individual discussed here can also be caused by a fall. The severity of the injury in the present case is consistent with a fall from a standing height (25). The individual from Shirakavan exhibits a type I fracture, i.e. a fracture occurring at the midshaft of the clavicle (57), and he probably fell directly onto his right shoulder. Clavicular shortening has been associated with some shoulder discomfort and disfunction and can alter the dynamics upper limb mechanics (58).

Since several lines hypoplasia can be seen in the individual, it can be speculated that this individual experienced multiple bouts of starvation or malnutrition due to serious disease. The formation of calculus is generally classed as a dental disease, which is heavily influenced by oral hygiene and dietary makeup. The causes for dental chipping, such as the extreme toughness and abrasiveness of some food types which sometimes include parts of fruit stones and bones (59), the adherence of

sand and grit to certain foods (60, 61). It seems more likely that dental chipping is the result of any or all of the above mentioned causes.

Mastoiditis must have posed a serious threat to man lives. Perhaps mastoiditis was the leading cause of death at the individual from Shirakavan.

This study of the individual from Shirakavan reveals a complex picture of lifestyle through the pattern of extensive paleopathology observed. Having been interred with a horse it is possible that the suite of pathological alterations identified on the skeleton of this individual, including trauma, degenerative joint disease and alteration of the morphology of the hip area, may be the result of habitual horse riding over a lifetime. We can note that the individual had the high social status and his body was interred with the appropriate honors and keeping of rules of funeral ceremonialism.

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