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Skeletal evidence of trauma in a Late Antiquity woman from Beniamin, Shirak Province, Armenia

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Abstract: *This study presents a detailed analysis of the skeletal remains of a single adult female (30–39 years) from Burial 2 at the Beniamin cemetery, Armenia, dating to the Late Antiquity period (1st century BC – 3rd century AD). The individual was interred in a secondary context within a stone cist, displaying pronounced flexion of the knees and hips, with the thoracic cage, pelvis, and limbs preserved in anatomical position, suggesting that the body may have been transported in a sack. Accompanying the remains were ceramic vessels and animal bones, marking this as a previously unrecorded burial type in ancient Armenia. The individual exhibited multiple injuries, including a maxillofacial fracture extending to the inferior margin of the right orbit, a healed depression fracture of the temporal and parietal bones, and a well-healed midshaft clavicular fracture. These findings provide insight into the lived experience of trauma in Late Antiquity Armenia and represent the first recorded instance of such maxillofacial trauma in the region. The study highlights the importance of integrating macroscopic, radiographic, and biomechanical analyses to reconstruct injury patterns and contributes to a broader understanding of regional palaeopathology in the South Caucasus.*

Key words: trauma; bulla ethmoidalis; fractures; violence

Introduction

In the Late Antiquity, Armenia was a buffer state between two powers: the Roman Empire in the west and Parthian/Sasanian Empire in the east. It was not a Roman province in the full sense of the term, except for a few short periods. Roman authorities established direct control over parts of its territory only intermittently, usually following military campaigns. The Arsakuni dynasty ruled Greater Armenia from AD 52 to 428 (with interruptions). The Arsakuni represented the Armenian branch of the Iranian Arsacid dynasty and came to power with the active support of Parthia. In AD 66, the Roman emperor Nero officially recognized Tiridates I as king of Armenia. During the first to the third centuries AD, the country became a battleground for the

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power struggle between Rome and Parthia. The political situation remained unstable and was marked by frequent military conflicts. During this period, Eastern (Iranian) cultural influence gradually intensified. These processes affected both the morphology of the local population (Khudaverdyan 2000) and the prevalence of violent trauma (Khudaverdyan 2015), among other aspects.

Figure 1. Map of Armenia showing the location of Beniamin (drawing by A.Yu. Khudaverdyan).

The Beniamin cemetery is located in the Akhuryan district near the village of Beniamin (**Figure 1**), in the Shirak region, approximately 12km from the regional center of Gyumri. Excavations conducted between 1989 and 2005 by Felix Ter-Martirosov (Institute of Archaeology and Ethnography, National Academy of Sciences of the Republic of Armenia), Hamazasp Khachatryan and Larisa Eganyan (Shirak Regional Museum, Gyumri, Republic of Armenia) (Yeganyan 2010), as well as Anahit Khudaverdyan (Institute of Archaeology and Ethnography, National Academy of Sciences of the Republic of Armenia), uncovered a total of 235 burials. From these excavations, 112 adult (65 female, 46 male, 1 undetermined) and 67 subadult skeletons were recovered. Most individuals were interred in stone-slab cists, although jug burials, shallow earth graves, and deep oval pit graves were also present. The burials exhibit a consistent orientation: most individuals were placed with the head facing northeast. The skeletons were laid either on their backs or on the right or left sides. Here we report on the pattern of injuries observed in a human skeleton from Burial 2 of the

Figure 2. Burial 2 in Beniamin cemetery, Armenia (photographs by Armen Shakparonyan). Most of the postcranial skeleton, except for a few cervical vertebrae, is preserved in anatomical position. The knees and hips show pronounced flexion, while the thoracic cage, pelvis, and limbs remain in anatomical position.

Beniamin cemetery, dated to the Late Antiquity period in Armenia (1st century BC – 3rd century AD).

Material and methods

The remains of the individual from Burial 2 were excavated by a team led by Hamazasp Khachatryan and Levon Agikyan. The individual was found in a secondary context within a stone cist measuring 1.10×1.30m, oriented along an east-west axis (**Figure 2**). The position of the bones suggests that the body may have been transported to the place of deposition in a sack. **Figure 2** shows pronounced flexion of the knee and hip joints, with the thoracic cage, pelvis, and limbs preserved in anatomical position, and clear articulation of the limb joints, spine, and thoracic cage. This is the first time that such a burial type has been recorded in ancient Armenia, and particularly within the Beniamin cemetery. In addition to human and animal bones, the grave also contained ceramic vessels.

The skeleton of the individual was examined in detail to assess its state of preservation and completeness, as well as to estimate skeletal age at death and sex. Morphological features of the pelvis and cranium were analyzed for sex estimation (Phenice 1969; Buikstra & Ubelaker 1994). Adult age at death was estimated using a combination of methods, including assessment of the pubic symphysis (Gilbert & McKern 1973; Katz & Suchey 1986; Meindl et al. 1985), auricular surface changes (Lovejoy et al. 1985), and cranial suture closure (Meindl et al. 1985).

All skeletal elements were examined macroscopically for evidence of traumatic lesions. The locations and characteristics of fractures were described and measured following the descriptive terminology proposed by Lovell (1997). Antemortem trauma was distinguished from perimortem trauma based on the presence of bone remodeling features such as callus formation or beveled fracture edges (Aufderheide & Rodríguez-Martín 1998). Criteria for differentiating perimortem and postmortem trauma were also applied.

The "hat brim line" (HBL) rule was used to differentiate injuries resulting from falls versus those caused by blows (Spitz 2006; Galloway 1999; Guyomarc'h et al. 2010; Henriques et al. 2023). The HBL corresponds to the area above the Frankfort horizontal plane, which passes through glabella and the superior margin of the external auditory meatus (Kremer et al. 2008). According to this criterion, injuries located below the HBL are more likely to have resulted from falls, whereas those above it are more likely to have been caused by blows.

Detailed examination of lesions under 4× and 10× magnification was performed to assess the degree of healing. Clavicle fractures were classified according to the Robinson classification system (Robinson 1998). The nature and extent of the frac-

tures were further assessed using X-ray imaging (Portable Digital X-ray Radiography System) at the Institute of Archaeology and Ethnography, National Academy of Sciences of the Republic of Armenia.

Results

The human remains from Burial 2 were sufficiently preserved to allow for a reliable morphological assessment of skeletal sex and age at death (**Figure 3**). Based on the morphological characteristics of the skull and pelvis, the degree of cranial suture closure, dental wear, and changes in the auricular surface, the individual was identified

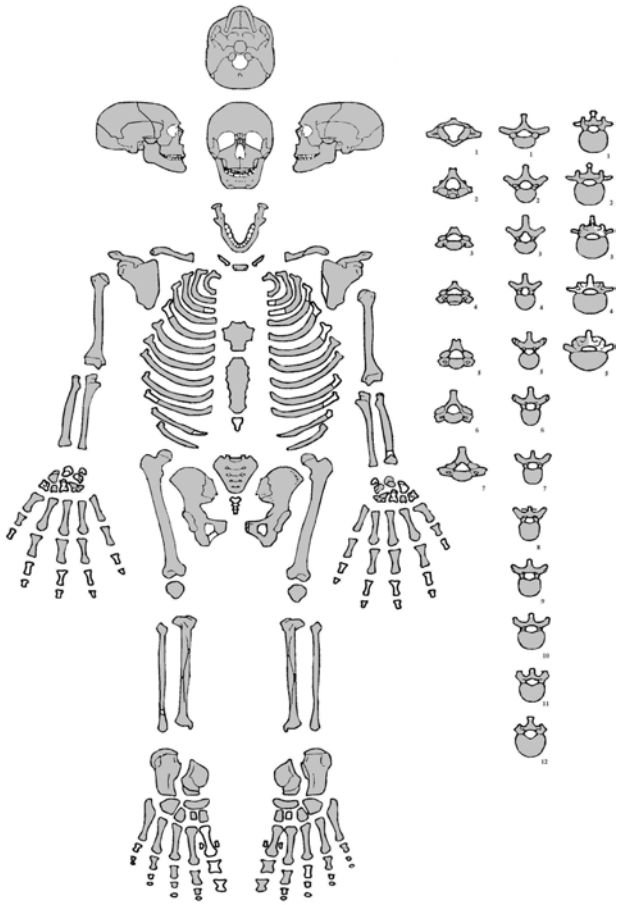

Figure 3. Skeletal completeness of the individual from Beniamin cemetery (grey colour: skeletal elements present, white: absent) (drawing by A.Yu. Khudaverdyan).

Figure 4. Fracture of the midfacial bones in Burial 2 from Beniamin cemetery (photographs by A.Yu. Khudaverdyan).

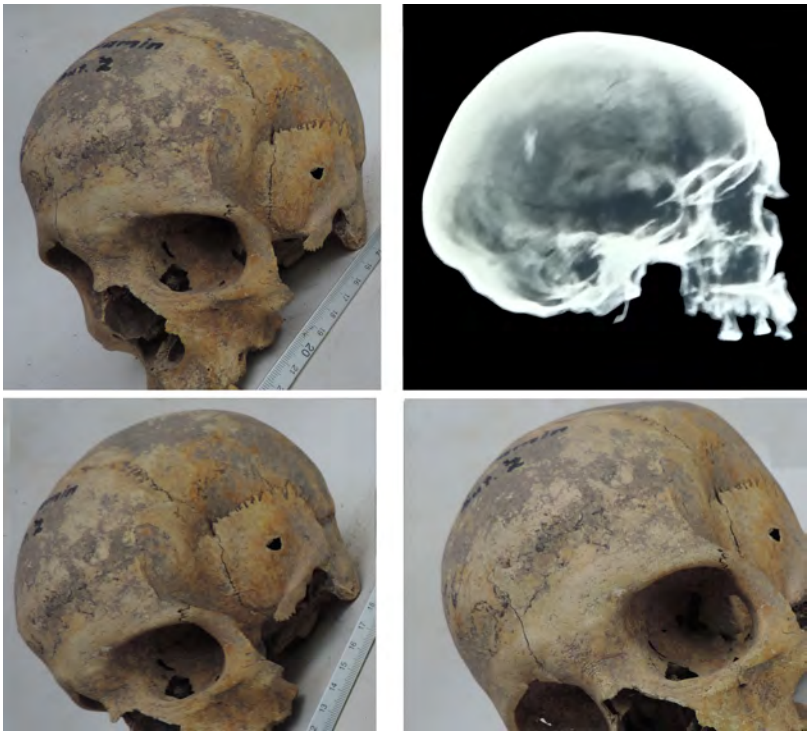

Figure 5. Fracture of the frontal, temporal, and parietal bones in Burial 2 from Beniamin cemetery (photographs by A.Yu. Khudaverdyan).

as a probable female estimated to have died between 30 and 39 years of age. An antemortem fracture of the right maxilla was observed, extending to the inferior margin of the right orbit (fracture length: 23.2mm) (**Figure 4**). The fracture line runs from the nasofrontal suture through the frontomaxillary suture, crossing the lacrimal bone and the floor of the orbit. From there, it extends through the infraorbital margin and along the facial wall of the maxillary sinus to the zygomatico-alveolar crest. The individual also exhibited a healed depressed fracture involving the frontal, temporal,

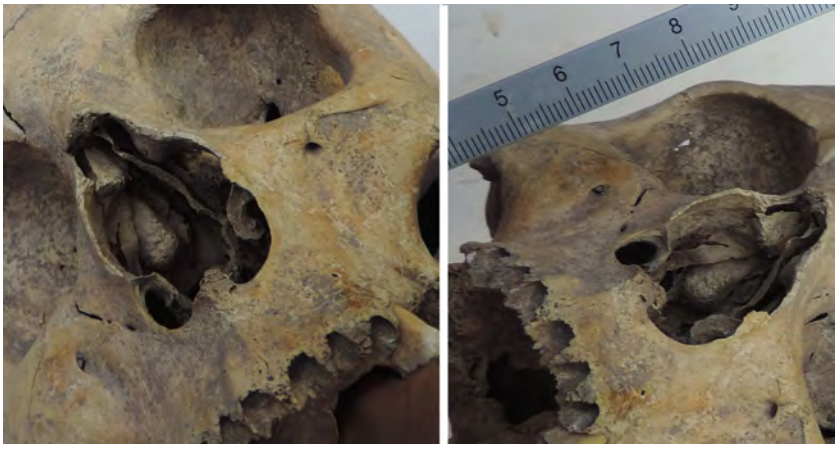

Figure 6. Bulla ethmoidalis and nasal septum deviation in Burial 2 from Beniamin cemetery (photographs by A.Yu. Khudaverdyan).

Figure 7. The clavicles from Burial 2 (photographs by A.Yu. Khudaverdyan).

and parietal bones (dimensions: 50×43.7mm), indicative of a severe cranial injury (**Figure 5**).

Changes were also observed within the nasal cavity, including an enlarged bulla ethmoidalis and pneumatization of the middle turbinate, which likely interfered with the ventilation and drainage of the paranasal sinuses. The pneumatized middle turbinate was associated with a marked deviation of the nasal septum (**Figure 6**).

In addition, several cranial damage was recorded that appear to be postmortem in origin. Fracture lines were observed in the maxillary (length: 34.5mm), frontal (length: 64.5mm), and occipital (length: 104mm) bones (**Figure 5**).

The left clavicle exhibited a simple, well-healed oblique fracture at its medial third (**Figure 7**). The bone was noticeably shorter (120mm) and broader than the unaffected right clavicle (132mm). The fracture occurred near the middle of the shaft (type 2B1, according to Robinson 1998) and displayed medial-lateral overlap. No signs of infection or osteomyelitis were detected.

Discussion

The distinction between accidental falls and interpersonal violence is a key topic in bioarchaeology. One of the earliest attempts at differentiating falls from blows based on cranial lesions was made by Richter (1905). Later, Kratter (1921) demonstrated that falls can result in injuries to the vertex and cranial vault, particularly when falling from a significant height or if the head strikes an obstacle during descent (Kratter 1921; Kremer et al. 2008; Kremer & Sauvageau 2009; Geserick et al. 2014). In 1931, Walcher introduced the HBL (hat brim line) rule, which states that fall-related injuries do not occur above the HBL under specific conditions: the person falls from a standing position onto a flat surface without inclines or stairs, falls from their own height, encounters no intermediate obstacles, and is an adult (Walcher 1931; Geserick et al. 2014).

Recent studies have aimed to differentiate between falls and blows in cases of blunt force trauma to the head (Ehrlich & Maxeiner 2002; Maxeiner & Ehrlich 2000; Kremer & Sauvageau 2009; Kremer et al. 2008; Guyomarc'h et al. 2010). These studies indicate that injuries caused by blows to the head are frequently located above the occipital bone, whereas lacerations within the occipital bone are more likely to result from a fall. Skull fractures within the occipital bone, however, occur with similar frequency in both aetiologies. Henriques et al. (2023) further observed a higher number of fall-related fractures than blow-related fractures above the HBL.

The skeleton of the woman from Burial 2 at Beniamin cemetery exhibited multiple traumatic injuries, several of which were below the HBL—a pattern typical of accidental falls. Kremer et al. (2008, 2009) note that skull fractures caused by blows

most often occur on the left side, whereas fractures from falls predominantly affect the right side. Considering the location and characteristics of the injuries in this individual, an accidental origin, such as a fall, appears most likely.

The woman also exhibited trauma to the maxillofacial region, which is particularly significant due to the anatomical and functional importance of this area, encompassing vital organs and the origins of the digestive and respiratory systems. Such trauma could also impact the central nervous system, potentially causing serious dysfunction.

In addition to fractures, the woman presented an enlarged nasal turbinate (concha bullosa) (Stallman et al. 2004). Although this condition is usually asymptomatic, it can cause complications if hypertrophied (Cohen & Matthews 2008). Previous studies have shown that enlarged turbinates are associated with a deviated septum but not necessarily with sinus disease (Stallman et al. 2004; Smith et al. 2010). In this case, the enlarged bulla ethmoidalis coexisted with a fracture, suggesting that inflammation may have spread through the orbit and/or periodontal lesions, leading to abnormal airflow and impaired patency of the sinus openings into the middle nasal passage. This obstruction, caused by hypertrophy of the middle turbinate, may have contributed to recurrent sinusitis during the individual's life.

Side lateralization of cranial fractures is another useful criterion for distinguishing the cause of injury. The woman from Burial 2 exhibited a healed fracture of the temporal and parietal bones, resulting in a massive depressed cranial defect, located on the left side of the skull. Typically, when a person falls on their side, the shoulders hit the ground first, followed by the parietal eminence. Nonetheless, it is often difficult to establish whether an injury resulted from a fall or from an assault. Most cranial injuries due to interpersonal violence occur on the left side, consistent with attacks by right-handed assailants, as approximately 90% of humans are right-handed (Calvin 1982; Larsen 1997).

Considering the violent context of the Late Antiquity period in the Shirak region, the presence of skeletal evidence of intentional violence at Beniamin cemetery (Khudaverdyan 2000) is not surprising. The Beniamin sample (1989–2005) shows a relatively high frequency of craniofacial trauma (32.7%), with males exhibiting more injuries than females. Several authors (Walker 1989; Alvrus 1999; Standen & Arriaza 2000) note that high frequencies of head and facial trauma are strong indicators of intentional violence, though these areas are also susceptible to injuries from falls and accidents. Clavicle fractures represent 2.6–4.0% of all adult fractures in clinical contexts, with a marked male predominance of approximately 70% (Nordqvist & Petersson 1994; Postacchini et al. 2002; Robinson 1998). These fractures typically result from a direct fall onto the shoulder or a direct blow (Hamblen & Simpson 2007; Nowak et al. 2000; Nordqvist & Petersson 1994; Robinson 1998). Most fractures (69–82%) occur in the midshaft, followed by 12–26% in the lateral portion and 2–

6% in the medial part (Nordqvist & Petersson 1994; Robinson 1998; Postacchini et al. 2002; Nowak et al. 2003). This pattern reflects anatomical support: the medial and lateral ends are reinforced by strong ligaments and muscles, whereas the midshaft lacks such support and is therefore more vulnerable. In the individual from Beniamin, the muscle attachments appear to have contributed to the displacement of the fracture fragments, leading to shortening of the clavicle, a pattern typically observed in midshaft fractures (**Figure** 7). Such injuries would have caused localized pain, bruising, and swelling (Khan et al. 2009). Though complications are rare, clavicular fractures can occasionally involve injury to the brachial plexus, subclavian vessels, lung, or pleura (Khan et al. 2009; Mouzopoulos et al. 2009; Postacchini et al. 2002). Healing typically requires six to ten weeks, with immobilization of the affected arm, followed by an additional six to eight weeks for restoration of strength, with full functional recovery occurring within 12–24 weeks (Hill et al. 1997; Kihlström et al. 2017; Lazarides et al. 2006; Robinson 1998).

Clavicle fractures commonly occur following falls from standing height. The Beniamin case is consistent with this typical injury pattern, as supported by previous studies (Robinson 1998; Nowak et al. 2003; Khudaverdyan et al. 2016; Kihlström et al. 2017). If so, it should be noted that left-sided clavicle fractures occur slightly more frequently than right-sided ones (Nowak et al. 2003; Nordqvist & Petersson 1994; Smekal et al. 2009; Lazarides et al. 2006), whereas bilateral and open fractures are comparatively rare (Postacchini et al. 2002; Nowak et al. 2003; Zlowodzki et al. 2005).

Conclusion

Injury recurrence is a key focus in palaeopathology and bioarchaeology, as analyzing trauma patterns—including antemortem and perimortem lesions—provides valuable insight into the lived experiences of individuals who suffered multiple traumatic events (Mant 2019; Redfern et al. 2017). The cause of maxillofacial injuries varies regionally due to a combination of social, cultural, geographical, and environmental factors, including patterns of interpersonal violence, occupational hazards, lifestyle practices, and local trauma risks associated with specific environments or activities (Tadj & Kimble 2003). In the case of the woman from Beniamin dated to the Late Antiquity, the pattern and localization of injuries—particularly the maxillofacial trauma extending to the inferior margin of the right orbit, the healed depression fracture of the temporal and parietal bones, and the clavicular fracture—suggest that both accidental falls and potential interpersonal violence may have contributed to her trauma history. These injuries reflect the complex interplay between individual vulnerability, environmental conditions, and the socio-cultural context of Late Antiquity in the

South Caucasus, providing insight into the lived experience of a female individual in a period characterized by both routine hazards and regional conflict.

Future research will include a comprehensive survey of skeletal injuries from the South Caucasus region to elucidate regional and temporal trends in trauma and better understand patterns of injury in past populations.

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