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Antemortem Cranial Injuries in the Altai Mountains Pastoralists of the Scythian and Xiongnu-Sarmatian Periods (5th Century BC to 5th Century AD)

This article describes healed cranial injuries in the Altai Mountains pastoralists of the Early Iron Age, the increased prevalence of which may testify to interpersonal violence aimed rather at injuring than killing the opponent. Skulls of more than 500 adults from burials of the Pazyryk (5th to 3rd century BC) and Bulan-Koba (2nd century BC to 5th century AD) cultures have been analyzed. On the world scale, the level of nonlethal violence among the Altai Mountains pastoralists was moderate (25.5 % in males and 9.1 % in females). The frequencies, however, differ between the southern and northern Pazyryk populations (males, 35.7 % vs. 15.3 %, respectively; females, 16.7 % vs. 5.6 %) and between the early and late periods of Bulan-Koba (males, 32.7 % vs. 22.1 %; females, 10.0 % vs. 6.3 %, respectively). The high prevalence of injuries among the Pazyryk people from the high-altitude valleys of the Southeastern and Southern Altai might indicate scramble for limited resources under a harsh climate, whereas the high frequency among the early Bulan-Koba pastoralists could have resulted from an inflow of migrants. In the Xiongnu-Sarmatian period, as compared to the Scythian period, repeated injuries became more frequent among males. Interpersonal violence among the Altai Mountains pastoralists involved mainly blows to the face, but in the Bulan-Koba males blows on the head were more random. Healed face injuries in women were likely associated with domestic violence.

Keywords: *Antemortem cranial injuries, violence, pastoralists, Early Iron Age, Pazyryk culture, Bulan-Koba culture, Altai Mountains.*

Introduction

The traumas of the cranial vault localized below the so-called "hat brim line", i.e. at the squamas of the frontal, parietal, and the upper part of the occipital bones, as well as traumatic lesions of the facial skeleton, are typically caused intentionally (Sheperd et al., 1990; Hussain et al., 1994; Walker, 1997; Maxeiner, Ehrlich, 2000; Harrod, Liénard, Martin, 2012). Thus, these types of injuries are one of the main sources of information for the study of domestic or warfare violence in ancient societies. Antemortem, or healed cranial injuries are in many cases related to acts of interpersonal violence aimed not to kill but rather to injury the opponent (Walker, 1989, 1997; Harrod, Liénard, Martin, 2012; Martin, Harrod, 2015). Cross-cultural studies show that different forms of violence, lethal and nonlethal, are weakly but positively correlated (Ember C.R., Ember M., 1994). On the other hand, a high rate of antemortem cranial trauma can serve as an independent indicator of social tension (Walker, 1989; Baustian et al., 2012).

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The aim of this study is to perform a comparative analysis of healed cranial injuries prevalence in the pastoralists of the Altai Mountains during the Scythian (5th century BC to 3rd century BC) and Xiongnu-Sarmatian (2nd century BC to 5th century AD) periods. Previous works have shown that the emergence and succession of ruling empires in Central Asia, including Xiongnu (2nd century BC to 1st century AD), Xianbei (2nd to 3rd century AD) and Zhouzhan (late 4th to 5th century AD) were substantially affecting the rate of warfare activity in the Altai Mountains (Tur, Matrenin, Soenov, 2018: 132). But to what extent the pastoralist lifestyle in this region was related to interpersonal violence remains an open question.

Material and methods

Healed cranial injuries in adult individuals were analyzed in the present study. The cranial sample of the Pazyryk culture (the Scythian period) was divided into two subsamples: one from Southeastern and Southern Altai, another from Central, Northern, and Northwestern Altai. The sample of the Bulan-Koba culture (the Xiongnu-Sarmatian period) comprised the skulls from the sites mostly located in Central Altai. In order to analyze the temporal change in the prevalence of trauma, the Bulan-Koba sample was, when possible, divided into two subsamples: Xiongnu-Early Xianbei (2nd century BC to early 3rd century AD) and Late Xianbei-Zhouzhan (second half of the 3rd to 5th century AD).

The individuals were aged and sexed using standard osteological criteria (Standards…, 1994: 15–38). The following age cohorts were used: young – 17–35 years, mature – 35–50 years, old – more than 50 years.

The main methodological difficulty for an epidemiological study of cranial injuries in paleopopulations is that the analysis of fragmentary skulls underestimates the prevalence of the lesions, while the preservation of skeletal remains may vary substantially between various samples. As experience has shown, gracile nasal bones are most often damaged or lost during excavations. Walker (1997: 150) reports the absence of nasal bones in 50–70 % of studied individuals, while less than a half of the cranial vault is preserved in only 10–30 % of the individuals. The issue of unequal preservation of skull structures is as relevant for the Pazyryk and Bulan-Koba samples. In order to minimize the influence of this factor, the frequency of nasal, facial, and vault injuries was calculated with respect to the number of observations for each of these regions. The absence of trauma was diagnosed only in individuals with at least 75 % of respective part of the skull preserved. The same criterion was employed for calculating an integrative value—the rate of injured skulls. Also, if only left or right side of the cranium is present, that specimen contributed 0.5 to the total count of individuals examined (Ibid.: 149). In the end, the total Pazyryk sample included 253 effective individuals (128 male and 125 female), and the total Bulak-Koba sample comprised 277 individuals (182 male and 95 female).

The descriptions of the healed traumas included their size, localization in the anterior or posterior half of the skull (with respect to *bregma*), left or right side of the skull. The significance of differences in frequency of trauma was evaluated using two-sided Fisher's exact test, and the significance level was set to 0.05. The prevalence of antemortem cranial injuries in various groups of the Altaian pastoralists was also assigned to one of three categories: low, medium (between the 1st and 3rd quartiles), and high. The boundaries between the categories were set on the basis of the variation of the prevalence of healed cranial injuries at the intergroup level in 42 geographically and chronologically diverse cranial samples. These reference data were compiled from the literature, and include samples from various parts of the world and dated from the Neolithic to the 17th century AD. As lethal and nonlethal forms of violence are not mutually independent, the rate of perimortem cranial traumas was tabulated as well.

Healed cranial injuries in the samples of the Pazyryk and Bulan-Koba cultures

Pazyryk culture (Tables 1, 2). The rate of antemortem cranial injuries in the Scythian period was much higher in males as compared to females (24.2 % vs. 10.4 %, $p = 0.005$). Local variations are observed for both sexes: the rate is substantially higher in the southern part of the Pazyryk area than in its northern part (35.7 % vs. 15.3 % in males, $p = 0.012$; 16.7 % vs. 5.6 % in females, $p = 0.072$).

The facial skeleton was injured more often than the cranial vault: 23.0 % vs. 8.6 % in males ($p = 0.004$), and 12.8 % vs. 2.4 % in females ($p = 0.005$). The most prevalent in all samples are fractures of nasal bones (Fig. 1). In two cases, these were accompanied by fractures of the adjacent part of the maxilla (Ulandryk-2, kurgan 6, burial 4; Yustyd-12, kurgan 3). Fractures of the mandible (Verkh-Elanda-2, kurgan 2, burial 2/3; Chultukov Log-1, burial 117), zygomatic arch (Tytkesken-6, burial 88), and supra-orbital ridge (Khankarinsky Dol, burial 17) were observed as well. An antemortem tooth loss in a young male (Ulandryk-3, kurgan 1) could also have been a result of an intentional injury. Differences between the two areas of the Pazyryk culture in the prevalence of nasal bone fractures in males ($p = 0.002$) and females ($p = 0.016$) are statistically significant, as well as in the rate of facial skeleton trauma in males ($p = 0.010$).

Table 1. **Cranial injures in male samples of the Pazyryk culture**

Sample	Antemortem injures				Lethal	Total
	nose	face	vault	skull		
Southeastern and Southern Altai						
Ak-Alakha-1, -3–5	0/1*	0/4	2/5	2/5	0/5	2/5
Alagail-1, -2	2/2	2/2	0/2	2/2	0/2	2/2
Baratal-1, -2	1/5	1/5	2/5	2/5	4/5	4/5
Barburgazy-1–3	0/2	0/3	0/4	0/4	0/4	0/4
Bertek-1, -10, -12, -27	1/3	1/3	0/4	1/4	0/4	1/4
Buraty-4	…	…	0/1	0/1	1/1	1/1
Dzholin-1	0/1	0/1	0/1	0/1	0/1	0/1
Kurai Steppe	0/2	0/2	0/2	0/2	1/2	1/2
Kyzyl-Dzhar-1–5, -8	2/10	2/11	1/10	2/10	1/10	3/10
Maltalu	1/2	1/3	0/3	1/3	0/3	1/3
Ulandryk-1–4	4/10	5/11	0/13	5/13	2/13	7/13
Yustyd-1, -12, -22	5/6	5/6	1/6	5/6	0/6	5/6
Total	*16/44 (36.4 %)*	*17/51 (33.3 %)*	*6/56 (10.7 %)*	*20/56 (35.7 %)*	*9/56 (16.1 %)*	*27/56 (48.2 %)*
Central, Northern, and Northwestern Altai						
Balyk-Sook	…	0/2	0/2	0/2	0/2	0/2
Bersyukta-2	…	…	0/1	0/1	0/1	0/1
Bike-1, -3	0/1	0/2	0/2	0/2	0/2	0/3
Verkh-Elanda-2	0/1	0/3	0/6	0/6	2/6	2/6
Kaindu	0/1	0/1	0/3	0/3	0/3	0/3
Maima-4	0/1	0/2	0/4	0/4	0/4	0/4
Tavdushka	0/3	0/4	0/4	0/4	0/4	0/4
Tytkesken-6	2/18	3/19	3/23	6/23	2/23	6/23
Khankarinsky Dol	1/6	2/3	0/5	2/5	0/5	2/5
Choburak-1, -2	0/2	0/2	0/3	0/3	0/3	0/3
Chultukov Log-1, -2	1/10	1/11	2/14	3/14	0/14	3/14
Yabogan-2, -3	0/4	0/3	0/5	0/5	1/5	1/5
Total	*4/47 (8.5 %)*	*6/52 (11.5 %)*	*5/72 (6.9 %)*	*11/72 (15.3 %)*	*5/72 (6.9 %)*	*14/72 (19.4 %)*

Notes. Number of skulls with trauma / total number of observations. Statistically significant local and territorial differences are italicized.

Healed injuries, mostly subtle depressed fractures, of the vault were detected in 10 males, 3 females, and 2 sub-adults (Fig. 2, *4*, *5*). Such injuries are typically caused by a blunt object with a small surface area. Almost all the lesions were found in the frontal bones. The mean area of the fractures is 74 mm^2 in males and 235 mm^2 in females. At the margin of one of the lesions, a small fragment of stone ingrown in bone was detected (Chultukov Log-2, kurgan 5, burial 1). Linear fractures of the vault were found only in a few cases (Tytkesken-6, burial 92/1). Traumas of both facial skeleton and vault are slightly more often found in the left than in the right side of skull (11 vs. 8 in males, 7 vs. 3 in females).

In most cases, the healed cranial injuries were single. Three males and one female displayed two fractures each (of the nasal and frontal bones), but those could have been a result of one episode of violence. In four male skulls, a healed injury was accompanied by a perimortem trauma. This means that at least 9.8 % of the males who had cranial injuries participated in conflicts repeatedly.

In terms of interpopulation variation, the rate of antemortem cranial trauma in both males and females is high in southern areas of the Pazyryk culture territory, while it is medium in northern areas (Fig. 3).

Bulan-Koba culture (Tables 3, 4). In the sample of the Xiongnu-Sarmatian period, 26.4 % of male and

Table 2. **Cranial injures in female samples of the Pazyryk culture***

Sample	Antemortem injures				Lethal	Total
	nose	face	vault	skull		
Southeastern and Southern Altai						
Ak-Alakha-1, -3–5	2/2	2/2	0/2	2/2	0/2	2/2
Alagail-1, -2	1/2	1/2	0/3	1/3	0/3	1/3
Baratal-1, -2	0/2	0/3	0/3	0/3	0/3	0/3
Barburgazy-1, -2	2/7	2/8	0/8	2/8	1/8	3/8
Buraty-8	0/1	0/1	0/1	0/1	0/1	0/1
Verkh-Kaldzhin-1	…	…	0/1	0/1	0/1	0/1
Dzholin-1–3	0/3	0/3	0/3	0/3	0/3	0/3
Kaldzhin-6	0/1	0/1	0/1	0/1	0/1	0/1
Kurai Steppe	0/1	0/1	0/1	0/1	0/1	0/1
Kyzyl-Dzhar-1–5, -8	0/5	0/6	0/6	0/6	0/6	0/6
Maltalu	1/2	1/2	1/2	1/2	0/2	1/2
Moinak-2	0/1	0/1	0/1	0/1	0/1	0/1
Ulandryk-1–4	1/10	1/10	0/14	1/14	0/14	1/14
Yustyd-1, -12, -22	2/6	2/7	0/8	2/8	0/8	2/8
Total	*9/43 (20.9 %)*	*9/47 (19.1 %)*	*1/54 (1.9 %)*	*9/54 (16.7 %)*	*1/54 (1.9 %)*	*10/54 (18.5 %)*
Central, Northern, and Northwestern Altai						
Balyk-Sook	0/1	0/1	0/1	0/1	0/1	0/1
Bike-3	0/1	0/1	0/1	0/1	0/1	0/1
Bike-2	0/2	1/3	0/3	1/3	0/3	1/3
Kaindu	0/2	0/4	0/4	0/4	0/4	0/4
Maima-4	0/5	0/5	1/11	1/11	1/11	2/11
Tavdushka	1/6	1/7	0/8	1/8	0/8	1/8
Tytkesken-6	0/7	0/10	0/13	0/13	0/13	0/13
Khankarinsky Dol	0/4	0/5	0/7	0/7	0/7	0/7
Choburak-2	0/1	…	…	…	…	…
Chultukov Log-1, -2	0/8	1/10	1/22	2/22	0/22	2/22
Yabogan-3	0/1	0/1	0/1	0/1	0/1	0/1
Total	*1/38 (2.6 %)*	*3/47 (6.4 %)*	*2/71 (2.8 %)*	*4/71 (5.6 %)*	*1/71 (1.4 %)*	*6/71 (8.5 %)*

*See notes to Table 1.

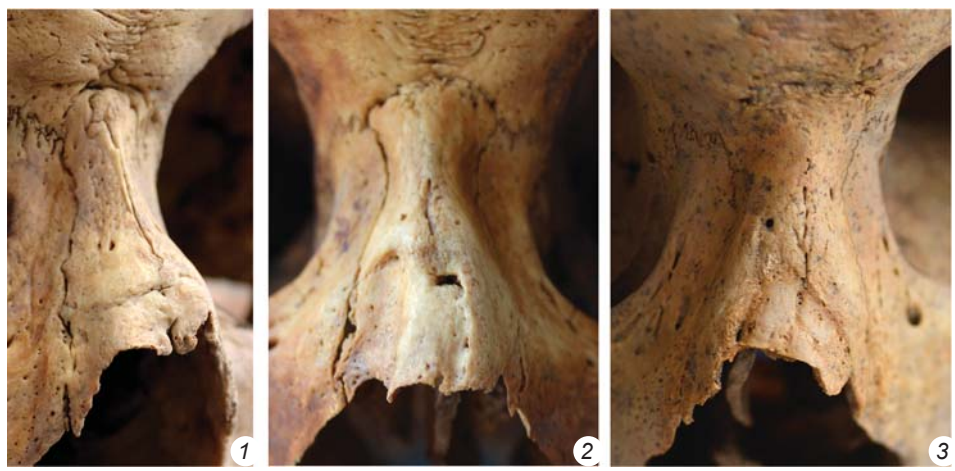

Fig. 1. Examples of healed fractures of the nasal bones in the Pazyryk sample from Southeastern Altai.
1 – Bertek-10, kurgan 3, male, *maturus*; *2* – Ulandryk-2, kurgan 7, burial 1, male, *maturus*; *3* – Maltalu, kurgan 25, female, *senilis*.

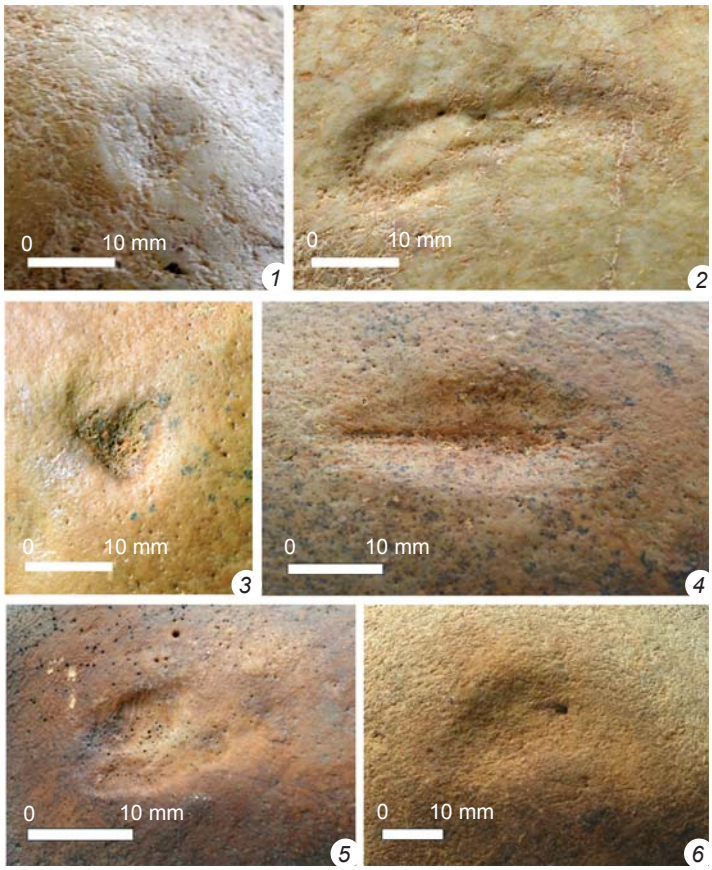

Fig. 2. Examples of healed depressed fractures of the cranial vault in the Pazyryk and Bulan-Koba samples. *1* – right frontal eminence, male, *maturus*, Airydash-1, kurgan 44; *2* – anterior part of the right parietal bone, male, *maturus*, Bulan-Koby-4, kurgan 2, burial 2/1; *3* – frontal bone, male, *adultus*, Kyzyl-Dzhar-1, burial 9 (joint burial); *4* – right parietal bone, female, *senilis*, Maltalu, kurgan 25; *5* – left part of the frontal bone, male, *adultus*, Ak-Alakha-5, kurgan 3, burial 1; *6* – area of the right parietal tubercle, male, *adultus*, Bosh-Tuu-1, burial 10.

7.4 % of female skulls display healed injuries. The sex differences are highly statistically significant ($p = 0.000$). Facial injuries, including fractures of nasal, maxillary, and zygomatic bones, supra-orbital ridge, glabella region, orbit, and mandible, were detected in 15 % of male and 6.1 % of female skulls (Fig. 4). Injuries to nose are the most prevalent and are significantly more often found in males than in females (14.8 % vs. 4.5 %, $p = 0.047$). These nasal fractures are in a number of individuals accompanied by trauma of other facial bones (5 out of 13 cases).

Injuries to the vault are mostly small depressed fractures of oval or round shape. These are observed in the males as often as facial injuries (see Fig. 2, *1–3*, *6*); but they are not found in the females. Sex differences in this indicator are statistically significant ($p = 0.000$). The area of the depressed fractures is highly variable in males (20 to 1980 mm^2); the mean area of lesions in parietal bones is larger than in the frontal bones (149.9 vs. 284.8 mm^2). In some cases, depressed fractures of the vault were accompanied by linear fractures (Airydash-1, kurgan 124; Stepushka-1, kurgan 15, burial 1; Ust-Edigan, burial 3, 3a).

Healed trauma is most often localized in the anterior part of the skull: 46 vs. 18 cases in males ($p = 0.018$), 7 vs. 1 in females ($p = 0.282$). No differences between the left and right sides of the skull were observed (27 : 26). Some skulls displayed two or three healed injuries, which, however, could have been received during the same episode of violence. But in 8 males, mostly young, specific localization of the antemortem lesions, as well as differences in their shape and size, suggest their possible emergence at different times. In 9 other male skulls, healed fractures are accompanied by perimortem trauma. If these cases of repeated injury are considered together, it can be concluded that 27 % of the males who had cranial injuries had participated in multiple encounters.

No differences in prevalence of cranial trauma between local Bulan-Koba groups were observed. However, during the late Xianbei-Zhouzhan period, as compared to the Xiongnu-early Xianbei times, the level of nonlethal violence slightly

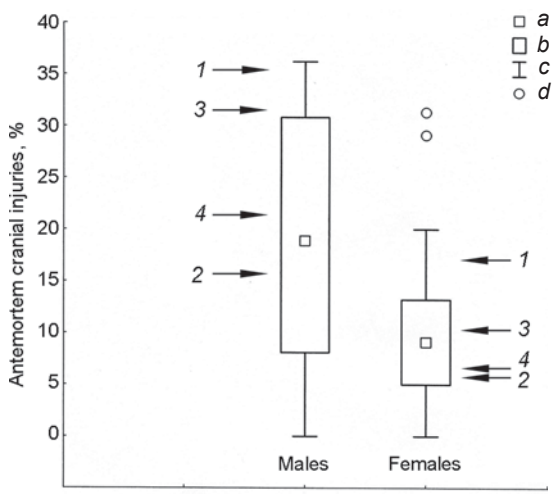

Fig. 3. Range of prevalence of healed cranial injuries across the studied samples.
1, *2* – Pazyryk culture: *1* – Southeastern and Southern Altai, *2* – Central, Northern, and Northwestern Altai; *3*, *4* – Bulan-Koba culture: *3* – Xiongnu-early Xianbei period, *4* – late Xianbei-Zhouzhan period.
a – median; *b* – 25–75 %; *c* – range excluding outliers; *d* – outliers.

Table 3. **Cranial injures in male samples of the Bulan-Koba culture**

Sample	Antemortem injures				Lethal	Total
	nose	face	vault	skull		
Airydash-1	0/12*	2/27	6/31	8/31	7/31	11/31
Bely Bom-2	2/6	2/9	0/10	2/10	1/10	3/10
Biyke	…	…	0/1	0/1	0/1	0/1
Boochi	0/2	0/2	1/3	1/3	1/3	2/3
Bosh-Tuu-1	5/29	6/33	8/32	12/32	1/32	12/32
Bulan-Koby-4	5/17	5/16	3/16	6/16	0/16	6/16
Verkh-Elanda-2	0/1	0/1	0/1	0/1	0/1	0/1
Verkh-Uimon	0/2	1/2	0/6	1/6	2/6	2/6
Dyalyan	0/1	0/1	0/3	0/3	0/3	0/3
Kara-Bom-11	0/2	0/2	1/2	1/2	0/2	1/2
Karban-1	0/2	0/4	1/6	1/6	1/6	2/6
Kuraika	0/5	0/6	1/6	1/6	2/6	3/6
Kyzyl-Dzhar-1	…	0/1	1/1	1/1	0/1	1/1
Saldyar-2	0/1	1/1	0/2	1/2	0/2	1/2
Stepushka-1, -2	2/13	3/23	3/26	6/26	6/26	10/26
Tytkesken-6	…	0/1	0/1	0/1	0/1	0/1
Ulita	0/4	0/7	1/12	1/12	1/12	2/12
Ust-Balyktyul	0/1	0/1	0/1	0/1	0/1	0/1
Ust-Edigan	2/10	2/12	3/13	4/13	2/13	5/13
Yabogan-3	1/3	1/4	0/4	1/4	0/4	1/4
Yaloman-2, west. gr.	0/2	0/2	1/3	1/3	0/3	1/3
Yaloman-2, centr. gr.	0/2	0/2	0/2	0/2	0/2	0/2
2nd century BC to early 3rd century AD	7/43 (16.3 %)	9/52 (17.3 %)	13/55 (23.6 %)	18/55 (32.7 %)	4/55 (7.3 %)	20/55 (36.4 %)
Late 3rd to 5th century AD	9/63 (14.3 %)	13/90 (14.4 %)	14/113 (12.4 %)	25/113 (22.1 %)	19/113 (16.8 %)	37/113 (32.7 %)
Total	17/115 (14.8 %)	23/157 (14.6 %)	30/182 (16.5 %)	48/182 (26.4 %)	24/182 (13.2 %)	63/182 (34.6 %)

Note. Number of skulls with injures / total number of observations.

decreases in males ($p = 0.075$). On the world scale, the rate of healed cranial injuries is medium in both male and female Bulan-Koba samples, while it is high in males of the Xiongnu-early Xianbei period (see Fig. 3).

Discussion

In all the studied samples, the rate of antemortem cranial trauma is higher in males than in females, which is a universal rule for all regions and historical periods (Knüsel, Smith, 2014). The level of nonlethal traumatism in the Altaian pastoralists in general is medium, but during the Scythian period it displays a substantial local variation, while in the Xiongnu-Sarmatian period there are chronological differences observed (Fig. 5). The higher prevalence of healed cranial injuries in southern area of the Pazyryk culture can be hypothetically explained by an imbalance between population density (and/or the size of livestock) and limited natural resources in highland areas of the Southeastern and Southern Altai. Such an imbalance could have led to conflicts for pastures. Furthermore, the rate of lethal cranial injuries in males is high in this region (see Table 1). A similar situation was described for southern periphery of the Pazyryk area in Western Mongolia (Jordana et al., 2009).

In the Xiongnu-Sarmatian period, a peak of nonlethal traumatism coincides with the early Bulan-Koba period, while that of lethal traumatism coincides with its late period. The high rate of healed cranial trauma in Central Altai during the Xiongnu-early

Table 4. **Cranial injures in female samples of the Bulan-Koba culture***

Sample	Antemortem injures				Lethal	Total
	nose	face	vault	skull		
Airydash-1	0/14	0/21	0/22	0/22	2/22	2/22
Bely Bom-2	0/5	0/8	0/8	0/8	1/8	1/8
Bosh-Tuu-1	1/11	2/11	0/11	2/11	0/11	2/11
Bulan-Koby-4	1/10	2/11	1/11	3/11	1/11	4/11
Verkh-Uimon	…	…	0/4	0/4	0/4	0/4
Dyalyan	0/1	0/1	0/1	0/1	0/1	0/1
Kara-Bom-11	0/1	0/1	0/1	0/1	0/1	0/1
Karban-1	1/2	1/3	0/3	1/3	0/3	1/3
Kuraika	0/3	0/4	1/5	1/5	0/5	1/5
Stepushka-1, -2	0/4	0/4	0/4	0/4	0/4	0/4
Ulita	0/2	0/5	0/7	0/7	0/7	0/7
Ust-Balyktyul	0/1	0/1	0/1	0/1	0/1	0/1
Ust-Edigan	0/10	0/9	0/14	0/14	2/14	2/14
Yabogan-3	0/1	0/1	0/1	0/1	0/1	0/1
Yaloman-2, west. gr.	0/2	0/2	0/2	0/2	0/2	0/2
2nd century BC to early 3rd century AD	2/25 (8.0 %)	3/25 (12.0 %)	0/30 (0.0 %)	3/30 (10.0 %)	2/30 (6.7 %)	5/30 (16.7 %)
Late 3rd to 5th century AD	1/40 (2.5 %)	2/55 (3.6 %)	2/63 (3.2 %)	4/63 (6.3 %)	4/63 (6.3 %)	8/63 (12.7 %)
Total	3/67 (4.5 %)	5/82 (6.1 %)	2/95 (2.1 %)	7/95 (7.4 %)	6/95 (6.3 %)	13/95 (13.7 %)

*See note to Table 3.

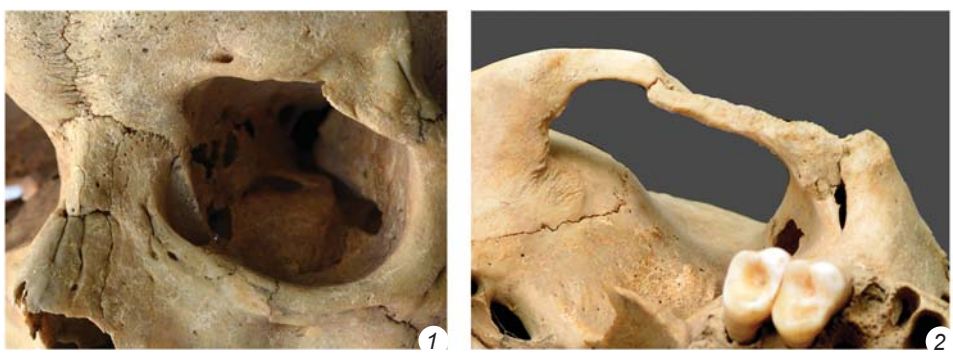

Fig. 4. Examples of healed trauma of the facial skeleton on the skulls of the Bulan-Koba samples.
1 – fracture of the nasal bones and left zygomatic process of the frontal bone male, *adultus*, Bulan-Koby-4, kurgan 1, burial 2;
2 – fracture of the right maxilla and zygoma, female, *maturus*, Bulan-Koby-4, kurgan 2, burial 3.

Xianbei period might be also explained by the influx of migrants, which is documented by archaeological data (Tishkin, 2007: 177–179; Seregin, Matrenin, 2016: 144–147, 158–163; and others). The rise of military activity in the late Xianbei-Zhouzhan times was likely an outcome of the change of political situation in Central Asia, i.e. the collapse of the Xianbei Empire and escalation of the internecine struggle for power (Tur, Matrenin, Soenov, 2018).

According to the localization of injuries in the skeletal samples, the blows were often directed to the face or vault (Walker, 1989, 1997; Lessa, Mendonça de Souza, 2006; Baustian et al., 2012; Cohen et al., 2014; Monge, Selinsky, 2016: 151; and others), which is in good agreement with both ethnographic and clinical data on ethnocultural specific of interpersonal violence (Walker, 1989, 1997; Brickley, Smith, 2006). The main target for the Altai Mountains pastoralists during a conflict was the face of

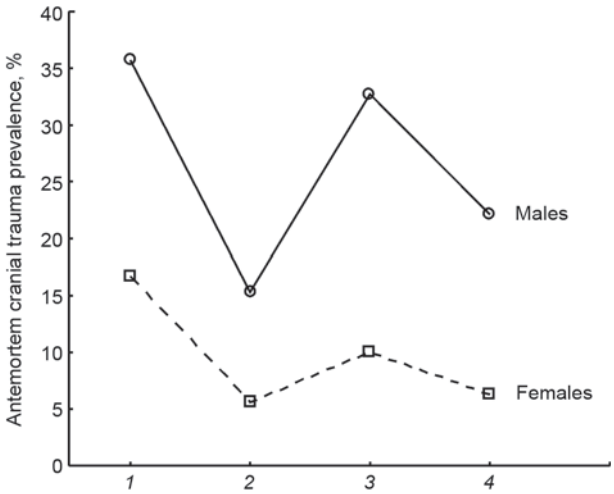

Fig. 5. Spatial and chronological variation of the healed cranial trauma prevalence in male and female subsamples of the Altai Mountains pastoralists.
1–4 – see Fig. 3.

the opponent, and only in Bulan-Koba males was the cranial vault affected as often as the face.

Localization of healed trauma in the anterior vs. posterior, or in the left vs. right parts of the skull can be used as an indicator of position of the sides of a conflict. In most male skulls of both Pazyryk and Bulan-Koba people, the majority of antemortem injuries are found in the facial and frontal bones, which implies a "face to face" type of encounters. A subtle predominance of left-side lesions (i.e. caused mostly by the right hand) is only observed during the Scythian period. The shape and size of the depressed fractures vary, but large and deep lesions are rare. The smaller size of frontal bone fractures than those of the parietal bone is explained by a higher hardness of the former (DeGrood, 1975).

"Traumatic recidivism" is a feature of the male samples of the Altaian pastoralists. This term was borrowed from clinical practice and is used in bioarchaeology to describe any case of repeated trauma (Harrod et al., 2017). However, in skeletal samples, it is not always possible to determine the sequence of appearance of two or more healed traumas. These can be synchronous and related to the same episode of violence, but they might equally have been caused on different occasions. The presence of both an antemortem and perimortem cranial trauma in an individual is a reliable indicator of "traumatic recidivism". If these cases are taken into account, it can be concluded that the level of "traumatic recidivism" was higher in the Xiongnu-Sarmatian period than in the Scythian period (27 % vs. 9.8 %). Repeated head trauma can point towards a systemic character of interpersonal violence, but might also suggest a dependent status of the injured individuals. The later version does not find support in the archaeological context of the Pazyryk and Bulan-Koba cultures. Another explanation of "traumatic recidivism" can be the occupational activity of males of the population.

The prevalence of antemortem as compared to perimortem trauma in the male samples of the Altaian pastoralists might suggest that the use of force in solving interpersonal conflicts was predominantly aimed at injuring rather than killing the enemy. One of the sources of nonlethal traumatism in males in traditional societies is so-called "controlled violence"—ritualized individual or collective fights, which were observed in many ethnic groups (Chagnon, 1988: 986; Walker, 1989: 319–320; Abbink, 1998: 280–281; Gorbunov, 1999: 4–218; Herdt, 2006: 33–36; Lessa, Mendonça de Souza, 2006: 136; and others). Such fight pursued various purposes: rise of individual prestige, solving inter- and intragroup conflicts. In some cases it was a ceremony. The fights were performed publically and according to rules decreasing the probability of a fatal result. For example, blunt weapons were often used. Serious injuries were not rare, but murder of the opponent was penalized.

Another widespread tradition in pastoralist societies was collective herd raising. Such actions were usually undertaken by people who had lost their own flocks owing to adverse climatic condition, or as a punishment for a crime, or as a compensation for damage. The use of lethal violence was avoided during such encounters so as not to provoke blood feud (Pershitz, 1994: 168–169, 191–192).

In the female samples of the Pazyryk and Bulan-Koba cultures, injuries are mostly localized on the face. The women having traces of beatings were buried in a full compliance with burial traditions, which points towards their equal status in the group. In modern industrial society, facial injuries in females of reproductive age are an indicator of domestic violence (Greene et al., 1999; Novak, 2006; Allen, Novak, Bench, 2007). A fist blow to the face is very painful and often leads to an abundant bleeding, which can have not only a strategic but also a symbolic meaning (Walker, 1997: 160). According to clinical data, most women who suffered from spousal battering have only soft tissues injured; fractures of facial bones are only observed in 7–9 % of cases (Fonseka, 1974: 400; Novak, 2006: 242). However, ethnographic studies show that the rate and localization of cranial trauma in victims of domestic violence can vary substantially between different cultures. For instance, among the Turkana pastoralists of Kenya, 50 % of female victims of domestic violence had cranial traumas, usually in the form of small depressed fractures inflicted by expedient weapons such as stones, kitchen utensils, or herding sticks (Harrod, Liénard, Martin, 2012: 70).

Domestic violence has deep historical roots. In patrilineal and patrilocal societies, physical punishment of a woman by her husband or his relatives was socially sanctioned and was considered a means of controlling her behavior (Dobash R.E., Dobash R., 1979: 31–47). The level of domestic violence depends on many factors, including the general level of violence in the society. The latter apparently holds true for the society of the Altai Mountains pastoralists of the Scythian and Xiongnu-Sarmatian periods (Fig. 5).

Conclusions

The increased prevalence of antemortem trauma of the facial skeleton and cranial vault may characterize the level of the interpersonal violence aimed rather at injuring than killing the opponent. On the world scale, the Altai Mountains pastoralists display a moderate frequency of healed cranial trauma. But during the Scythian period, a substantial territorial variation of this indicator can be observed, while during the Xiongnu-Sarmatian age, a temporal trend is evident. In the southern part of the Pazyryk area, as well as during the Xiongnu-early Xianbei period of the Bulan-Koba culture, the prevalence of antemortem cranial injuries was high. In all cases, males were more affected by nonlethal violence than females. In the Xiongnu-Sarmatian period, as compared to the Scythian period, repeated injuries became more frequent. The main target for blows in interpersonal conflict was the face of the opponent. Only Bulan-Koba males were less "picky" when hitting the head of their opponents. Healed facial traumas in females were probably the results of domestic violence.

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