

Weapons Related Perimortem Injuries in an Individual From the Krbava Cathedral Cemetery in Croatia - Possibly Sustained During the Battle on Krbava Field in 1493

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ABSTRACT

Recent archaeological excavations of the historic period Krbava cathedral cemetery in the Lika region of Croatia revealed the presence of an individual with an antemortem fracture typical of interpersonal violence as well as a large number of perimortem sharp force injuries located in the cranial and postcranial skeleton. The cemetery is located just 500 meters south of the field of Krbava where a large battle between an Ottoman and Croatian army was fought in 1493. Archaeological evidence and radiocarbon dating indicate that this individual was buried during the youngest phase of the site which dates from the first decades of the 15th until the end of the first quarter of the 16th century. The aim of this paper is to evaluate whether he may have been a soldier who perished in the battle. Osteological analysis of the skeleton shows the presence of several occupational stress markers associated with high physical activity during life, as well as numerous perimortem injuries that were produced by sharp objects similar to a saber. Their location in the shoulder, arm, neck, and cranial area suggests that the head was the main target of attack demonstrating the intention to incapacitate the victim as quickly as possible. Other potential hypotheses for this individual's death, such as judicial execution, or a tavern brawl are also explored but cumulatively the collected osteological data, in conjunction with the available archaeological and historical evidence, suggest that he was a professional soldier who was killed in the battle fought on the field of Krbava in 1493.

Key words: perimortem injury, trauma analysis, paleoanthropology, osteological markers of physical stress, medieval battle, Croatia

Introduction

On September 8th 1493, a large Ottoman raiding party that pillaged and looted as far west as Celje in modern Slovenia, approached the western entrance to the field of Krbava in the Lika region of modern Croatia¹. Burdened with a large number of captured slaves and booty they were returning to their recently conquered province of Bosnia. On entering the field, they realized that a Croatian army on the eastern side of the field blocked their way to safety. After unsuccessful negotiations between the Ottoman leader Jakub paša and Croatia's commander-in-chief ban Derenčin, in which the Ottomans attempted to bribe the Croatian army to retreat², the two armies prepared for battle that began in the morning of the following day.

Contemporary sources differ significantly in their approximations of the strengths of the two armies with the number of Ottoman soldiers given between 6000 to 11000 warriors, with the most likely number being approximately 8000 warriors the majority of whom were light cavalry, while the Croatian army is said to have numbered between 8000 to 15000 warriors, with the most likely number being approximately 11600 warriors, most of whom were infantry³. Another uncertainty pertains to the type of men-at-arms that made up the Croatian army. While there is no doubt that the Ottoman army consisted of hardened, battle tested warriors, traditional historiography describes the majority of Croatian soldiers as peasants and farmhands, in other words as strong but poorly equipped and militarily untrained individuals with no knowledge of battle tactics and strategy¹. However, recent

interpretations of historical sources suggest that the bulk of the Croatian army consisted of well-armed, professional soldiers belonging to the lower nobility⁴. What is beyond doubt is that the battle was a catastrophic defeat for the Croats who lost not only almost all of their men, but also most of the nobles leading them including ban Derenčin who was captured and taken to Istanbul for ransom. The number of Croatian casualties is approximated to have been between 5000 to 13000 with the most likely number being 9600 warriors³ and contemporary historians bemoaned not only the horrific loss of men, but also the virtual annihilation of the Croatian high nobility.

Little is known about what happened to the bodies of those slain in battle. The Ottoman dead were almost certainly transported back to Bosnia, while the fate of the slain Croats is unclear. There are historical reports that as much as two weeks after the battle the field of Krbava was still covered with unburied bodies¹, and the high casualties of the Croatian army likely precluded the survivors from returning to bury their dead. No mass graves containing the bodies of the slain have as yet been found, but excavations of the medieval Krbava cathedral, situated on a small hill just 500 meters south of the battleground, suggest that some of the deceased may have been buried in the graveyard surrounding the cathedral. One of these burials contains the well-preserved skeleton of an adult male with numerous perimortem cutting injuries. Here we present the results of detailed osteoarchaeological analyses carried out to obtain an osteobiographical profile of this individual with the aim of determining if his characteristics and manner of death are consistent with those of an individual who died in the battle on the field of Krbava.

Materials and Methods

The cemetery adjacent to the cathedral of Krbava was in use from the second half of the 13th to the first quarter of the 16th century⁵. Remains of an older, significantly smaller church have been discovered under the cathedral resulting in burials that have been recovered not only outside of the cathedral, but also in it. Archaeological excavations of the site began in 2000 and successive campaigns revealed the presence of 507 burial units. Stratigraphic analysis of the burials and the recovered archaeological finds – primarily jewelry, dress accessories and coins, indicate the presence of three distinct burial horizons⁵. The oldest horizon is dated from the mid-13th century to the last decades of the 14th century, the following horizon from the late 14th to the early 15th century, while the youngest horizon is dated from the first decades of the 15th to the end of the first quarter of the 16th century. In this horizon, that encompasses the time that the battle on Krbava field was fought, the skeleton of an adult male was recovered from grave number 318. Radiocarbon dating of a sample from the left ulna of this skeleton is consistent with the archaeological data and returned an estimated date range of between AD 1434 and AD 1520 (95.4% prob-

ability). The burial was a simple inhumation buried directly into earth, with no evidence of grave architecture, that contained a well-preserved skeleton with only some small bones of the hand and foot missing.

Preservation and completeness of the skeleton was assessed following Buikstra and Ubelaker⁶. Sex assessment is based on the methodology proposed by Brickley and McKinley⁷. Age-at-death was estimated using the morphology of the pubic symphysis⁸, auricular surface of the ilium⁹ and sternal rib end changes¹⁰. Stature was estimated based on the formula developed for both sexes by Sjøvold¹¹. The identification and description of pathological conditions in the skeletons are based on Brothwell¹² and Ortner¹³.

In view of the fact that perimortem injuries are key to identifying this individual as a potential participant in the battle on Krbava field, special attention was given to recording bone injuries.

Injuries to bone can be antemortem, perimortem or postmortem and are identified by the characteristics of the fracture margins^{14,15}. Antemortem injuries are defined as non-lethal wounds that occurred earlier in an individual's life and are identified by the presence of healing around the wound. Perimortem injuries are those that occur at, or near the time of death and are identified by the absence of healing and fracture margins that are characteristic of fresh bone breaks. Postmortem injuries occur after an individual's death. They exhibit different fracture margins than perimortem wounds that are usually lighter in color than the surrounding bone. They can be caused by a variety of factors including ground pressure, plant roots, carnivore or rodent gnawing, and equipment damage. Sharp force traumas were macroscopically analyzed and recorded by location, and their morphological characteristics such as edges, cross-sections, and surfaces¹⁶. Their angle and striation were used to determine the direction of the blow^{17,18}. The anatomical position of the lesions, and presence and direction of internal striations, and other morphological features were also recorded to determine direction of the force of the trauma. The skeleton is curated in the Osteological collection of the Croatian Academy of Sciences and Arts.

Results

The skeleton interred in grave No. 318 is that of an adult male aged between 25 to 30 years with a stature of 168 (+/- 4.5) centimeters. The following pathological features are noted in the skeleton. On the proximal third of the diaphysis of the right humerus there is a shallow defect with a slightly porous floor at the insertion side of the *pectoralis major* muscle that is generally referred to as a benign cortical defect. Bilateral benign cortical defects are also noted on the inferior-medial parts of both clavicles. These irregular, deep defects are sometimes referred to in paleopathological literature as rhomboid fossae and are located at the insertion of the costo-clavicular liga-

ment. The individual also has five Schmorl's defects on his thoracic vertebrae, as well as bilateral new hypertrophic bone on the attachment sides of the Achilles' tendons on the posterior parts of the calcanei.

The skeleton displays a healed blunt force trauma in the shape of an oval depression fracture with a maximum diameter of 9 millimeters that is located on the left side of the frontal bone, approximately 51 millimeters superior of the middle of the superior margin of the left orbit. There are also nine perimortem injuries all inflicted by a sharp bladed weapon. There is a superficial blade wound on the posterior part of the left parietal that removed a thin section of cortical bone without exposing the underlying diploe producing a clean surface with no irregularities. The lesion is roughly oval in shape (Figure 1) and was caused by a blade blow inflicted from above and in a right (medial) to left (lateral) direction. Two perimortem injuries with different angulations, one coming from the right side and the other from the left, are located in the cervical and upper thoracic spine. The lesion on the right side is a sharp force cutting injury on the right arch of the second thoracic vertebrae that continues and terminates in the inferior/posterior body of the first thoracic vertebra (Figure 2). The injury was caused by a blade blow inflicted from a right-handed assailant who was standing behind the victim. The cut was delivered from a right (lateral) to left (medial) direction. The lesion on the left side of the neck is a sharp force cutting injury to the left posterior side of the body of the sixth cervical vertebra that completely detached the left posterior arch and left inferior articular facet from the body of the vertebra (Figure 3). The injury was inflicted from behind in an inferior to superior direction. There is also a long, relatively shallow cutting injury to the superior, lateral side of the right clavicle delivered in an almost horizontal plane. The injury sheared off a triangular piece of bone approximately 34 millimeters long and 5 millimeters wide exposing the underlying trabecular bone (Figure 4). The cut was deliv-

ered from a right (lateral) to left (medial) direction. Another postcranial injury is located in the posterior/superior part of the right scapula (Figure 5). This injury also sheared off a triangular piece of bone and exposed the underlying trabecular bone and was delivered by a right-handed assailant who was, as the direction of the blow is from the inferior to the superior side, standing above the victim. Perimortem cutting injuries are also present on the posterior/superior parts of the first and second right ribs (Figure 6). In both cases the posterior/superior parts of the ribs, including the necks and parts of the bodies but not the articular surfaces, were sheared off exposing trabecular bone and in both cases the blow was inflicted from above and in a medial to lateral direction suggesting that both injuries were the result of a single blow that was administered from a right-handed assailant who was standing behind and above the victim.

Finally, there is deep cutting injury on the posterior side of the proximal third of the diaphysis of the right humerus that was inflicted from behind and in a slight superior to inferior direction (Figure 7). A small square piece of bone approximately 12x8 millimeters on the inferior side of the cut broke off when the weapon was withdrawn from the wound.

Discussion and Conclusion

The purpose of this paper is to evaluate whether the individual recovered from grave number 318 was a soldier who perished in the battle on Krbava field in 1493. To this end we will match osteological data from the skeleton with the available archaeological and historical data related to the battle, as well as with other potential scenarios that can result in perimortem injuries such as



Fig. 1. Superficial sharp force cutting injury to the skull of the individual from grave 318.



Fig. 2. Sharp force trauma to the upper thoracic spine (the second and first thoracic vertebrae).



Fig. 3. Cutting injury to the sixth cervical vertebra



Fig. 4. Cutting injury to the superior, lateral side of the right clavicle. The injury sheared off a triangular piece of bone approximately 34 millimeters long and 5 millimeters wide exposing the underlying trabecular bone.



Fig. 5. Cutting injury to the posterior/superior part of the right scapula.



Fig. 6. Perimortem cutting injuries to the posterior/superior parts of the first and second right ribs that were the result of a single blow inflicted by an assailant who was standing behind and above the victim.

tavern brawls, judicial execution, and other unknown armed conflicts.

Both stratigraphic analysis of the site and radiocarbon dating confirm that the individual lived during the time when the battle was fought. This is important evidence as inhumation in the Krbava cathedral cemetery began in the second half of the 13th and lasted to the first quarter of the 16th century. There is no historical evidence for other large battles having been fought in the vicinity of the cemetery during this time period although, obviously, during such a long time period numerous smaller armed conflicts may have gone unreported.

The skeleton exhibits several indicators of occupational stress associated with intense physical activity during life that are compatible with the lifestyle of a professional soldier. There is a large benign cortical defect at the insertion side of the pectoralis major muscle on the right humerus as well as at the attachment sites of the costo-clavicular ligaments of both medial clavicles. These defects are musculoskeletal stress markers caused by chronic mechanical stress^{19,20}. In essence, they are shallow depressions at the insertion sites of muscles and are consid-

ered to be reliable indicators of heavy physical labor. Nowadays benign cortical defects are relatively rare and are usually incidental findings in the X-rays of young athletes. In prehistoric and antique populations their frequency was significantly higher because of the lack of labor-saving devices. The predisposing requirements for their development are a restricted series of movements that are energetically carried out for long periods of time, usually on a daily basis, and from a relatively young age.

The pectoralis major muscle is a strong, broad triangular muscle that inserts on the lateral lip of the intertubercular groove of the humerus. It rotates the upper arm to the front and medially and places it in front of the thorax. If the arm is raised, the muscle pulls it downwards and in front. On the assumption that the individual from the Krbava cemetery was, as most people are, right-handed, this muscle participated in almost all military exercises and activities: fighting with a shield and



Fig. 7. A deep cutting injury on the posterior side of the right humerus. A small square piece of bone approximately 12x8 millimeters on the inferior side of the cut broke off when the weapon was withdrawn from the wound.

sword, throwing a javelin, and firing arrows. The costoclavicular ligament attaches to the costal impression of the clavicle. It limits elevation of the pectoral girdle and acts as a fulcrum during clavicular elevation. The etiology of this defect is associated with strenuous activity of the pectoral girdle^{19,21}. The presence of Schmorl's defects in this individual's vertebra may be related to the fact that soldiers typically wear heavy armor as well as other, heavy loads. These defects are seen as shallow, oval, or kidney-shaped lesions on the superior or inferior surfaces of the vertebra, and result from herniations of the nucleus pulposus into the body of neighboring vertebrae. Bioarcheological studies suggest that the occurrence and patterning of Schmorl's nodes in archaeological populations is depended on factors including trauma and long-term mechanical loading^{13,22-25} while modern clinical studies report a wide range of possible causes such as trauma, congenital or developmental defects of the cartilaginous end plate, various forms of metabolic bone diseases, neoplastic disease, degenerative disc disease or lesions of unknown origin²⁶⁻³³. Age, repetitive mechanical loading, and movement are believed to be the main factors influencing the presence and severity of Schmorl's nodes in archaeological populations and as there is no osteological evidence for the presence of trauma or other diseases in the vertebral column of the individual from the Krbava cathedral cemetery, it is most likely that they reflect the

high levels of mechanical stress his vertebral column was subjected to. The presence of new hypertrophic bone on the insertion sites of his Achilles' tendons is common in elderly individuals while in younger individuals they suggest chronic micro-traumas of the Achilles' tendon that cause bleeding and inflammation and are most likely the result of prolonged marching, an activity that is, again, associated with the lifestyle of a professional soldier.

Interestingly, similar osteological changes – including the presence of benign cortical defects, Schmorl's defects and new hypertrophic bone on the insertion sites of the Achilles' tendons have been reported in an antique period roman legionary dated to the 2nd century AD recovered not far away from Krbava field, in the small town of Resnik in Dalmatia³⁴.

Additional evidence that the individual from grave 318 was a soldier is seen in the presence of a small, well healed, depression fracture on the left side of his frontal bone. These injuries are usually interpreted as the result of fact-to-face fighting between two right-handed opponents and thus suggest previous violent encounters^{17,35}.

The morphology of the perimortem injuries on the skeleton suggests they resulted from strong vertical and/or horizontal forces applied by a weapon or weapons with long sharp edges similar to swords or sabres that penetrated, and in some cases sheared off, bone structures leading to V-shaped notches and/or exposed trabecular bone. Unfortunately, the lack of interconnecting fracture lines prevents determination of the sequence in which the wounds were inflicted. Additionally, there is always the possibility that soft tissue injuries that left no mark on bone were at some point also inflicted. What is beyond doubt is that all of the recorded injuries were inflicted by an assailant who was standing behind, and in most cases above the victim, and that the injuries are located in a relatively small area, on the back of the head and neck, and in the right shoulder and upper right forearm regions. According to Ingelmark³⁶ multiple sharp force traumas located in the same region are an indication of deliberate and well-aimed blows. The patterning of wounds recorded in the individual from grave 318 is compatible with a scenario in which he was first rendered incapable of resistance by the injury to his right forearm, after which he was repeatedly hacked from behind on his upper right torso, right shoulder area and back of the head. The injury to the neck and upper thoracic area that penetrated cervical and upper thoracic vertebrae from both the left and right side and therefore severed the carotid arteries and jugular veins were most likely final coup-de-grâce injuries whose intention was to make sure that the opponent was dead.

These findings are in accordance with what historical sources report about the battle on Krbava field. Both Ottoman and Croat sources state that fighting began early on the morning of September 9th, 1493, and that that the main strategic plan of Jakub paša was to encircle and destroy the left wing of the Croatian army¹⁻³. To this end he sent a detachment of cavalry during the night to hide

in a forest behind the Croatian left wing and then feigned a frontal attack on it. When the Croatian wing advanced to repulse this attack the Ottoman cavalry hidden behind them attacked from the rear and routed, first the left wing, and subsequently the rest of the Croat army³. As the left wing of the Croatian army was positioned on the southern edge of the field of Krbava, and thus closest to Krbava cathedral, and historical sources report that the survivors of Croatia's left wing tried to escape, it is most probable that they fled in the direction of Krbava cathedral as there was a small maned fortress adjacent to it. Very few managed to get that far but some may have come close enough to the cathedral to be buried in its cemetery after the battle was over.

In other respects, the distribution of perimortem injuries in the individual from grave 318 is compatible with a surprise attack from behind. This manner of fighting, luring an enemy with a feigned attack and then encircling them and attacking from behind is a staple of Ottoman battle tactics and typically results in high frequencies of injuries inflicted from behind. A temporally almost congruent attack by Ottoman light cavalry on the inhabitants of Čepin in the continental part of Croatia carried out in 1441, resulted in a distribution of injuries in which the majority (7/9) of cranial wounds in males were located in the posterior region of the skull, while at the level of the complete skeleton more than half (13/25) of the perimortem injuries in males were located on the posterior side³⁷. The predominance of injuries to the cranial and cervical areas of the body is indicative of the intention of the attackers to dispatch their victims as quickly and efficiently as possible, and the distribution of perimortem injuries on both the cranium and postcranium is very common in Ottoman period skeletal assemblages. This pattern is recorded in the Ottoman period sites Sóly in

western Hungary³⁸ – where this distribution was noted in two males, in Čepin from Croatia³⁷ – where it is recorded in two males and one female, and in Bucharest in Romania³⁹ where it is seen in three males.

In conclusion, the collected osteological data strongly suggests that the individual recovered from grave 318 was, indeed, a professional soldier who lost his life in the battle of Krbava field. Other interpretations seem less likely. Injuries sustained in a tavern brawl or similar type of scenario would typically not be as numerous and would likely include stabbing wounds from daggers or knives and nor large cutting injuries inflicted by a sword or saber. Similarly, the distribution of perimortem injuries is not compatible with a judicial execution of beheading. For one thing the head was not completely severed from the body and while there are two cutting injuries to the cervical and upper thoracic spine, both are located much lower than perimortem injuries than are usually associated with judicial beheadings. In these cases, most of the injuries are located either in the mid-cervical region or on the first and second cervical vertebrae^{18,40,41} and not, as in the individual from grave 318, on the 6th cervical and 1st and 2nd thoracic vertebrae. Additionally, the cutting injuries to the shoulder area and upper right torso and forearm of this individual are hard to reconcile with a judicial beheading. Finally, there is always the possibility that the individual recovered from grave 318 died in an armed conflict that occurred in a similar time to that of the battle on Krbava field, but that was not recorded in historical sources but the preponderance of evidence deems this unlikely. Further osteological analyses of the individuals interred in the cemetery of Krbava cathedral will help to resolve this mystery.

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PERIMORTALNE OZLJEDE NANESENE ORUŽJEM KOD OSOBE POKOPANE U KRBAVSKOJ KATEDRALI POTENCIJALNO ZADOBIVENE U BITCI NA KRBAVSKOM POLJU 1493. GODINE

SAŽETAK

Nedavna arheološka iskopavanja vođena na području srednjovjekovne Krbavske katedrale u Lici, Hrvatska otkrila su prisutnost jednog kostura koji je imao antemortalnu traumu indikativnu za namjerno međuljudsko nasilje te veliki broj perimortalnih ozljeda nanesenih oštro bridnim oružjem. Katedrala je locirana na svega 500 metara udaljenosti od Krbavskog polja na kojemu je 1493.g. vođena velika bitka između Osmanske i Hrvatske vojske. Stratigrafska analiza groblja kao i datiranje radioaktivnim ugljikom pokazali su da je osoba kojoj je pripadao kostur pokopana u vrijeme najranijeg horizonta groblja koji se datira od prvih desetljeća 15. do kraja prve četvrtine 16. stoljeća. Cilj ovoga rada je procijeniti da li su osteološki podatci dobiveni detaljnom biološko antropološkom analizom kostura sukladni s hipotezom da se radi o vojniku koji je poginuo u Krbavskoj bitci. Osteološka analiza pokazala je prisutnost većeg broja osteoloških pokazatelja fizičkog stresa koji su bili posljedica svakodnevnog napornog fizičkog rada ili vježbanja te veliki broj perimortalnih ozljeda nanesenih oštro bridnim oružjem poput sablje. Činjenica da su rane locirane u području lubanje, vrata, ramena i ruke pokazuje da je glava protivnika bila glava meta napadača i demonstrira njegovu nakanu da što prije onemogućiti svog protivnika. U radu su istražene i druge potencijalne hipoteze o prirodnoj smrti ove osobe kao što su na primjer kavanska tuča ili sudsko pogubljenje ali prikupljeni osteološki podatci, zajedno s arheološkim i povijesnim podacima kumulativno sugeriraju da se u ovom slučaju doista radi o vojniku koji je poginuo u bitci na Krbavskom polju 1493.godine.

