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Blunt weapons in the roman imperial army. A multidisciplinary approach to the *clava* from experimental archaeology to forensic anthropology

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Abstract. The wooden club (*clava*) is rarely associated with the image of Roman soldiers, perhaps because it was considered an unconventional weapon with ethnic attributes and/or specific combat roles. Nonetheless, it is attested in the archaeological record and some ancient texts. The panoply and the military career of the soldiers represented on the tombstones of *Catavignus* son of *Ivomagus* (1st century AD) and *Marcus Aurelius Alexis* (early 3rd century AD) offered us the possibility to reconsider the use of the club as an offensive weapon within the Imperial Roman army. The authors made a replica of the *clava* using historical tools and manufacturing techniques. A series of tests have then been performed to investigate the use of the club in combat. The possible traumas on human targets were also evaluated with a forensic anthropological approach. The results suggest the essential role of flexion and rotation of the kinetic chain «hip/shoulder/arm» in wielding the *clava*. This movement requires a much more mobile combat style that can prove very effective against heavily armoured targets due to the weapon's high-impact force and a more extended reach than more conventional Roman sidearms.

Keywords: military equipment, funerary tombstone, blunt force trauma, trauma analysis.

The context and the sources

Blunt weapons are not usually part of the Roman soldier's panoply. Only a few sources have evidence of possible use of this type of weapons inside the Roman legions or auxiliary cohorts.

One of the rare iconographic representations comes from the tombstone of *Catavignus* son of *Ivomagus* (Fig. 1): a funerary limestone stele found in the 19th century in the metropolitan area of the city of Cuneo, north-west of Italy, and dated to the 1st century AD (Ferrua, 1948; Giorcelli, 2015; Spaul, 2000).

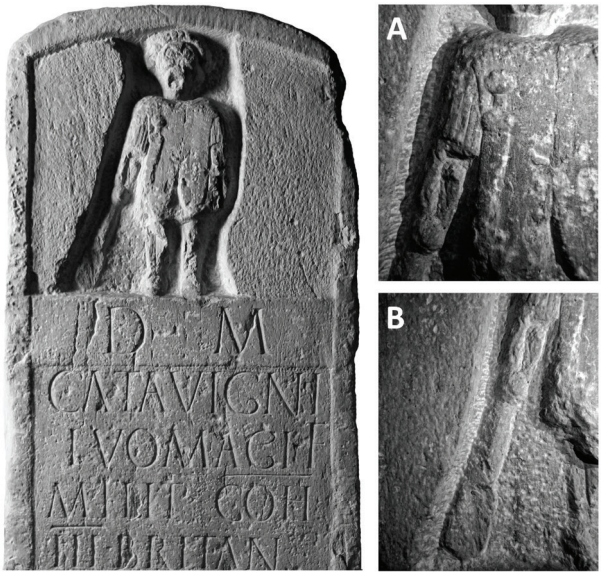

Fig. 1. *The tombstone of Catavignus, Museo Civico di Cuneo (Italy). A. Detail of the gladius and the right shoulder ptéryges; B. Detail of the club. Photo by the authors with the authorization of the Museo Civico di Cuneo that own copyrights.*

On the gravestone is portrayed *Catavignus*, a Roman auxiliary soldier of Celtic origin who served in the *Cohors III Britannorum* and died after only six years of military service. The figure seems to wear the *paenula* and some sort of *subarmalis* with *ptéryges* showing on the right shoulder and is armed with a long *gladio*, carried with a shoulder strap, and a massive club wielded with the right hand (Franzoni, 1987; Holder, 1980; Marchiaro and Bongioanni, 2020).

From Sparta, dated to the early 3rd century AD, comes the gravestone of *Marcus Aurelius Alexys* (Fig. 2), to the best of authors' knowledge at the time of the present publication the only other known funerary monument that shows a Roman soldier armed with a heavy club. Alexys took part and found his

death in Caracalla's military campaigns of 214-217 AD against the Parthians and is depicted with a heavy club held head-down with his right hand along with the most usual spatha and a rounded/oval shield (Kaltsas, 2006).

Fig. 2. *The tombstone of Marcus Aurelius Alexys, National Archaeological Museum of Athens (Greece). Photo by Giovanni Dall'Orto, Wikimedia Commons.*

The tactical use of auxiliaries armed with clubs is also attested in the written sources of the later Roman Empire, where the persistent presence of heavy cataphract cavalry in the eastern theatres of war raised the need inside the Roman military to efficiently deal with armoured foes.

Zosimus in the *New History* identifies club and stick as the weapon chosen by Aurelian's Palestinian soldiers to counter Zenobia's armoured cavalry, naturally less vulnerable to the shooting of an arrow, javelins, and the trusting of blades (Gnoli, 2017; Suski, 2007).

Light infantry armed with blunt weapons probably fought in open order, as skirmishers, able to dodge the charge of much heavier horse-mounted opponents, and still be able to strike in motion the assailants:

> «[…] *αὐτὸς δὲ τὸν ἔποχον ῥοπαλῷ παίων ἐπὶ κόρρης ἀνέτρεπέ τε καὶ τὸ λοιπὸν εὐκητῶς εἰργάζετο*».
> «These (soldiers), moving sideways, hit the rider with a club on the side of the skull, then, after they drag him down from the saddle, they easily finished the work» (Libanius, *Orations* 59, 110).

Also, the emperor Constantine employed foot soldiers armed with wooden clubs reinforced with iron studs to counter the *clibanarii* of is rival Maxentius during the battle of Turin in 312 AD (Cowan, 2015; Ross, 2018).

The written sources show us how the hitting power of these weapons made the thick armour of the opponents less effective:

> *«ita nostri proditos sibi clauis adoriuntur quae grauibus ferratisque nodis hostem uulneri non patentem caedendo defatigabant ac maxime capitibus applicata; quos ictu perturbauerant; ruere cogebant».*
> «So our soldiers attacked with clubs reinforced with heavy iron studs, wearing down the enemies when they are not able to wound them; and when they managed to hit the head, the unfortunate (enemy) was stunned and made him fall to the ground» (*Panegyrici Latini* X, 24, 3).

Recreating the weapons

While studying the *Catavignus* tombstone as part of a research project on the Roman auxiliaries in Piedmont during the High Empire led by the Archaeological Museum of Turin and the «Okelum» History Society, the authors focused on the use of the club and its effectiveness in the combat environment. The first step of the investigation was to reproduce the weapon using historical tools and manufacturing techniques.

Data from the Bronze Age battlefield of the Tollense Valley (north-eastern Germany) (Jantzen *et al.*, 2011) and the weapons recovered in the bog of the Alken Enge wetlands in the Illerup Ådal river valley (East Jutland, Denmark) (Jensen, 2018; Søe *et al.*, 2017) have been used to figure the overall size and the raw material of the weapon.

An oak branch was selected (1 m length; 9 cm diameter); after removing the imperfections at the edges, the wood was debarked with a small axe and then shaped with a knife, sparing the 25 cm long weapon barrel, which retains the significant diameter of 7.5 cm. Afterwards, materials was progressively removed from the base of the barrel toward the end of the handle, creating an elongated V shape outline.

The finished object (Fig. 3) has a length of 87 cm, weighs 1420 g; the handle has an oval shape section like a modern axe straight handle, where the thickest part has a maximum width of 3 cm. The entire fabrication process, performed by a long experienced experimental archaeologist, took approximately 4 hours.

Fig. 3. *The reconstructed weapon.*

Although the weight is not excessive, even for single-handed use, the centre of gravity of the weapon is located 60 cm from the handle. There-fore, to be efficient on the battlefield is essential to have an adequate amount of space to be maneuvered since most of the hitting power is generated from wide hips and shoulder rotation. Display quotations of over 40 words, or as needed.

The battlefield use: hypothesis of combat techniques

For the experimental reconstruction of the mace use, an adult male of 1.78 m of height and 75 kg weight, with good muscular endurance and trained in the use of bladed and pole weapons have been used.

The weapon's single (right) hand use has been tested, in combination with an oval wooden shield of 2.8 Kg of weight, worn on the left hand. The shield's choice and shape came from the study of the Trajan column, where in six different scenes of the helical frieze, bare-chested and bearded club wilding soldiers are depicted. Those figures are interpreted as Germanic tribesmen fighting for the Romans as light auxiliary troops or the emperor's bodyguard elements (Depeyrot, 2008; Lepper and Frere, 1988).

After repeated tests against a forward-facing on foot target, the authors identified four model moves for the use of the club on a battlefield:

1. Diagonal right-to-left swing
2. Diagonal left-to-right swing over the shield
3. Horizontal right-to-left swing
4. Strait thrust

Before performing each movement, the subject stands in a starting position (SP) with the weapon resting on his right shoulder. After initial experiments, the posture was chosen to indicate how the subject has more

difficulty holding the weapon «on guard» for an extended period as it requires continuous muscular effort. Instead, maintaining the «shoulder port» for a prolonged period (standing, marching, running) is less fatiguing. Although this handling is a resting attitude without any significant muscular activity, it is a position of complete readiness allowing the weapon to start any swing from an elevated point, taking advantage of the gravity.

Move 1: Diagonal right-to-left swing

The first move (Fig. 4) is the easiest to set up and successfully perform. From a SP with the weapon resting on the shoulder and the shield close to the body, the subject takes a left forward step, simultaneously extending the left arm to create a defensive stance. The propulsive use of the off-hand provides cover to the upper torso and the head, generating an active distraction for the opponent.

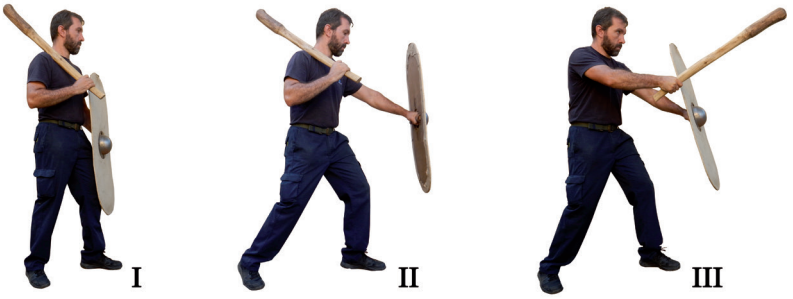

Fig. 4. *Diagonal right-to-left swing: I. Weapon resting on the right shoulder, flexed elbow and neutral shoulder position; II. Left front step, slight torso rotation to the right, rear right arm extension and shoulder abduction; III. Extension parallel to the neutral plane creates a 140 degrees angle between wrist and weapon.*

With the right arm, using the movement of the whole kinematic chain (leg-hip), the weapon hit the target after a diagonal swing on the sagittal plane.

The ideal targets of this technique are the opponent's head and the left shoulder. The arms are challenging or utterly invalid targets due to the protection offered by a shield and/or the use of the opponent's primary offensive weapon as an active defense.

Move 2: Diagonal left-to-right swing over the shield

From the SP, the subject starts with the same propulsive forward movement of the previous procedure. The right arm performs a broad rotation around the head with the weapon close to the back, facing the ground.

Subsequently, the attack targets the unprotected opponent's right side (upper torso and head) with an arc almost parallel to the horizontal plane and passing over the upper edge of the user shield (Fig. 5).

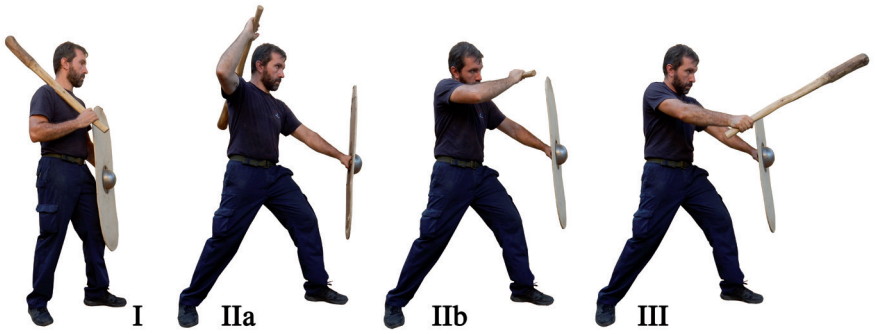

Fig. 5. *Diagonal left-to-right swing over the shield: I. Weapon resting on the right shoulder, flexed elbow and neutral shoulder position; IIa. Left front step, extended rotation of the torso to the right, rear extension of the right arm with heavy abduction and internal rotation of the shoulder; IIb. Front extension and external shoulder rotation; III. Elbow extension and an angle of 140 degrees between wrist and weapon.*

This technique aims to hit the most unprotected part of the opponent body, the one not covered by the shield, while creating a surprising effect due to the unexpected direction of the blow.

Move 3: Horizontal right-to-left swing

From the SP, the subject starts with the same propulsive forward of the first technique.

Then, similar to step II of the diagonal right-to-left swing, the right arm goes behind the back and using the movement of the whole kinematic chain (leg-hip), the weapon hit the target with a horizontal right-to-left swing parallel to the ground (Fig. 6).

Due to the weight of the weapon's shaft, this move generates much power and, therefore, impact force.

The action can also be carried out with a left side step, effective to deny any target area at the opponent and use the strength of the rotation to impress even more power to the swing.

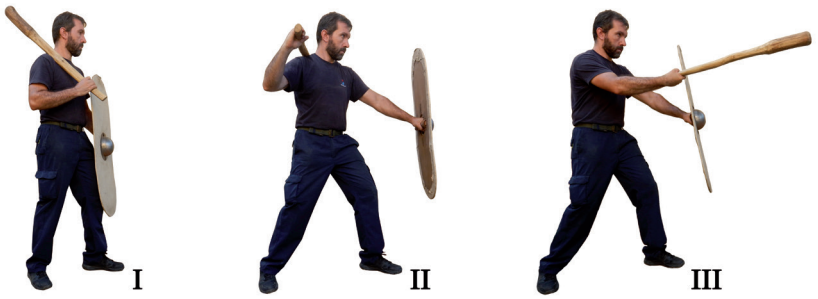

Fig. 6. *Horizontal right-to-left swing: I. Weapon resting on the right shoulder, flexed elbow and neutral shoulder position; II. Left front step, broad rotation of the torso to the right, rear extension of the right arm with heavy abduction of the shoulder; III. Internal rotation of the shoulder, elbow extension and wrist supination with a 180 degrees angle with the weapon.*

Move 4: Strait thrust

Simultaneously with the shield forwarding from the SP, the weapon is brought close to the right side, almost parallel to the ground, with the barrel slightly extended upwards.

Then, a forward lunge is executed with the left foot, pushing the body onward and at the same time extending the right arm to full length (Fig. 7).

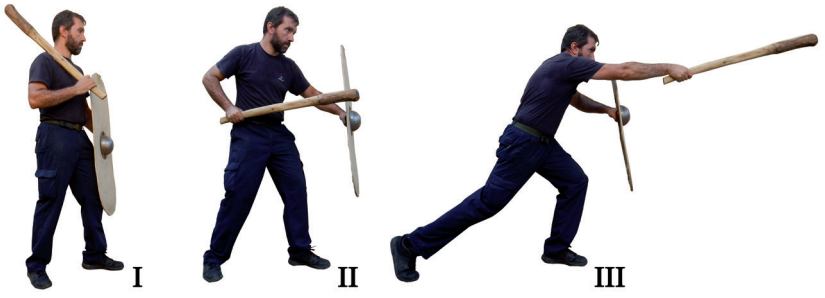

Fig. 7. *Strait thrust: I. Weapon resting on the right shoulder, flexed elbow and neutral shoulder position; II. Left front step, broad rotation of the torso to the right, the elbow is flexed, a rear extension of the shoulder with no rotation in the transverse plane; III. Left rotation followed by a heavy forward flexion of the upper torso and the left knee, elbow extension and an angle of 165 degrees between wrist and weapon.*

Although this technique exposes more of the user's body than a modern fencing lunge, the overall size and protection offered by the shield must be taken into account. The shield has constantly to be held forward to provide an effective defense, facing the opponent even if the dynamic of the movement forces the user to retract the arm naturally.

In this scenario, the enemy's head and torso are the ideal targets. The broad reach of this thrust, in addition to the remarkable accuracy of the blow, could also be used to create space, pushing the opponent backwards with constant pressure on them.

Possible combat injuries inflicted with a wooden club

The wounding power of ancient weapons can be easily studied when the victims are available, whether they are notorious (Borrini, 2013) or anonymous (Brinker *et al.*, 2018; Jantzen *et al.*, 2011; Valoriani *et al.*, 2017). Nonetheless, the effectiveness of armaments can also be reconstructed in the absence of human remains with a forensic anthropological approach to historical sources (Borrini *et al.*, 2011; Borrini *et al.*, 2012).

First, it is necessary to identify the type of injury that the examined instrument could cause. Since the club, as previously explained, was a hand-swinging tool without sharp edges and cutting surfaces, it can be classified as a weapon that produces blunt force trauma.

The wounding power in this type of trauma must be evaluated based on the intensity force possessed by the armament: it results from half the product of its mass by the square of the speed (Kinetic energy =1/2m x V2). The mass results from the product of the weapon's volume by its weight. Since the present research is not focused on a ballistic trauma where the central element is represented by the speed impressed on the moving object, the most significant factor in a blunt injury is the mass of the striking object.

Another dynamic to consider is the pressure applied by the weapon when strikes (P = force/surface), inversely proportional to the targeted area. Consequently, an impacting object delivers more substantial damage to the human target as narrower the beaten surface is (Otero and Béguelin, 2019).

Due to the physical characteristics and the use described so far, the club can be considered a blunt type weapon, entirely similar to a baseball bat.

The club's impact, in addition to barely significant outcomes such as abrasions and contusions, could undoubtedly cause lacerations. Due to the tearing and crushing components of this type of wound, the club could lacerate the skin and subcutaneous tissues when lying over skeletal structures (e.g. the scalp).

From a pathognomonic point of view, the external lesion would usually have an elongated shape, with irregular and retracted edges surrounded by contusions. The skin could be detached from the underlying planes. Where the tissues had resisted the tearing action of the blunt instrument, it would be possible to appreciate, between the sides of the wound, strands of fascial bands, vessels and nerves fibres (Maestri, 2002; Saukko and Knight, 2015).

The direction of the tissue flaps peeled by the rubbing action of the club in a tangential impact would allow determining the directionality of the stroke (Borrini, 2007).

From a history of medicine and healthcare point, it is worthy of mentioning how lacerations usually have in themselves elements of greater severity than weapon wounds, especially if from cuts, due to the contusion of the edges, which delays the tissue repair processes and favours the development of pathogenic germs (Canuto and Tovo, 1996).

These outcomes undoubtedly were an aspect that both armies and military physicians had to consider, also given the general hygienic conditions of the battlefields in which such damaging events occurred.

In addition to the external trauma, whose severity may not be lethal, the blow inflicted with the club could lead to internal injuries, such as ruptures of organs' vessels and tissues underlying the impact area. These lesions would have been associated with extravasation, internal blood loss in the form of deep bruising in the muscles, and percolation of blood in the surrounding tissues (Di Maio and Di Maio, 2001). The rupture of blood vessels would have been more significant if the blow had occurred during a contraction phase of the muscles. In cases of particularly violent impacts (e.g. on areas not protected by the armour), visceral bruises could appear on organs directly underneath the targeted site. Above all, injuries to the thorax that could compromise the integrity of the chest wall and consequently the respiratory functions or cause bleeding into pleural cavities (haemothorax) would have been the most significant internal trauma.

A separate mention should be reserved for cerebral contusions and damages to the cortex vessels among the internal lesions. The coup mechanism could lead to deep haemorrhages with haematoma between the dura mater and arachnoid (subdural h.) or, less frequently, the intracranial wall and the dura mater (extradural/epidural h.). Any damage to the brain cortex consequent to an even moderate impact of the mace could also have caused subarachnoid bleeding and haemorrhage.

In addition, even if it is a rare occurrence, it should not be excluded that the tip of the club hitting the chest would have caused a *contusio cordis* or a *commotio cordis* with a primary ventricular arrhythmia (Links, 2012). Such an injury could have been obtained swinging the weapon as in the reconstruction of Move 4: Straight thrust.

It is interesting to note that, in the context of the effectiveness of the club in battle, damaging outcomes of a certain severity are hardly counted among the ancient literature. This shortage of information could mean a moderately limited vulnerable power of the club, especially considering it was used essentially against armoured troops and that its constituent material was

wood, whose structure absorbs part of the energy at the moment of impact (Reddy *et al*., 2011).

In the *Panegyrici Latini* mentioned above, it seems evident that the ultimate purpose of the club was to weaken the opponents rather than kill them. Due to the complexity of the underlying bones structure and the limited thickness of the tissues, the facial area was unquestionably the most vulnerable target. Extensive bleedings, splitting of the skin, and multiple fractures would be expected after impacting this area.

Finally, it must not be forgotten how an assault with such a weapon could also cause non-negligible damages to the cephalic region and the limbs. When instinctively risen to protect the head from a blow, the forearms could be reached by the club's swing, resulting in defence fractures of the ulna and radius.

The reconstructed action sequences show that the attacks' preferred target should be the head and the upper part of the trunk (Moves 1,2,3) or the face (Move 4). Clinical and forensic practice indicate the severity of consequences that an attack with a mace cause and the ancient written sources confirmed it. Libanius (see above) recalls how the mounted troops were hit in the temporal area (where the neurocranium is particularly vulnerable due to the reduced thickness at the pterion level) before being slain once on the ground. The author did not clarify if the final stroke was delivered with the club or other supplementary tools suggested by the sword in the panoply of *Catavignus* and *Alexis* tombstone. For sure, the club was per se sufficient to neutralize the human target (killing or invalidation power), causing injuries to internal organs, extensive haemorrhages or brain traumas. Also, it should not be forgotten how extra efficiency could be provided by roughness and tips as mentioned in the *Panegyrici Latini*. Sharp metal points could increase the weapon's weight and provide it with an albeit limited, penetrating power.

In this case, it would be possible to observe penetrating, small and circular (except for rubbing movements of the weapon on the target) wounds affecting the soft tissues and bones. Again, if the targeted area was the skull, more extensive and lethal damages would be delivered to the neural tissues and the surrounding.

Conclusions

From the analysis of written sources of the later Roman Empire and the panoply pictured in the gravestone of *Catavignus* (1st century AD) and *Marcus Aurelius Alexis* (early 3rd century AD), the authors reconstructed the use of blunt weapons in the Roman imperial army and its possible traumatic outcomes.

The reconstruction demonstrated how the flexion and rotation of the whole kinetic chain «hip-shoulder-arm» was the key to the wooden club's successful use. The club consistently generates a considerable impact force on the target, mainly if a two-handed grip is adopted.

The series of experiments performed by the authors confirmed what was reported in the written sources about the effectiveness of blunt weapons against heavily armoured targets, even horse-mounted. In the battlefield, spears and swords could have a limited efficiency against metal plates and chain mail armours, or strong horses' muscle structures. On the contrary, the heavy club could create severe damage and traumas only by their own weight and the impact force generated by a trained user.

Although the sword is a much faster, lethal, and standard weapon among Roman legions, the wooden club could be more easily manufactured and replaceable if damaged. It was an inexpensive weapon, easy to provide and to supply a large contingent of auxiliaries troops. Through limited training, it could be used relatively efficiently against various opponents (high impact force and more extended reach than other sidearms). However, a fair amount of space and considerable muscle strength were required to manoeuvre it.

In conclusion, the club proved to be an excellent weapon for light infantry troops, not yet trained or culturally accustomed to fighting in close ranks, but more used to loose formations and a much more mobile combat style.

Bibliographical references

Borrini, M. 2007. *Archeologia forense: metodo e tecniche per il recupero dei resti umani: compendio per l'investigazione scientifica*. Milano: Lo scarabeo edizioni.

Borrini, M. 2013. L'attentato a Giuliano de' Medici il 26 aprile 1478. Analisi antropologico-forense della dinamica dei fatti e dell'arma del delitto. In: A. Wieczorek, G. Rosendahl, D. Lippi, C. Acidini Luchinat (eds.), *Die Medici: Menschen, Macht und Leidenschaft.* Mannheim: Schnell & Steiner: 98-108.

Borrini, M., Marchiaro, S., Mannucci, P. 2011. La lesività delle armi antiche: il pilum pesante repubblicano, *Archivio per l'antropologia e la etnologia*, CXLI: 105-115.

Borrini, M., Marchiaro, S., Mannucci, P. 2012. La lesività delle armi antiche: la frombola a mano, *Archivio per l'antropologia e la etnologia*, CXLII: 27-42.

Brinker, U., Harten-Buga, H., Staude, A., Jantzen, D., Orschiedt, J. 2018. Perimortem Lesions on Human Bones from the Bronze Age Battlefield in the Tollense Valley: An Interdisciplinary Approach. In: A. Dolfini, R.J. Crellin, C. Horn, M. Uckelmann (eds.), *Prehistoric Warfare and Violence. Quantitative and Qualitative Approaches*. Quantitative Methods in the Humanities and Social Sciences Series. Cham: Springer: 39-60.

Canuto, G., Tovo, S. 1996. *Medicina legale e delle Assicurazioni*. XII edizione. Padova: Piccin.

Cowan, R. 2015. *Roman Legionary AD 284-337: The age of Diocletian and Constantine the Great*. Oxford: Osprey Publishing.

Depeyrot, G. 2008. *Légions romaines en campagne: La colonne Trajane*. Paris: Éditions

Errance.
Di Maio, V.J.M., Di Maio, D.J. 2001. *Forensic Pathology*. Boca Raton: CRC Press, LLC.
Ferrua, A. 1948. *Inscriptiones Italiae, IX, f. 1 (Augusta Bagiennorum et Pollentia)*. Roma: Istituto Poligrafico dello Stato.
Franzoni, C. 1987. *Habitus atque Habitudo militis. Monumenti funerari di militari nella cisalpina Romana*. Roma: L'Erma di Bretschneider.
Galletier, E. 1949 (ed.) *Panegyrici Latini*. Edition of Paris: Les Belles Lettres.
Giorcelli, S. 2015. Un soldato britanno a Cuneo: appunti di storiografia epigrafica, *Quaderni del Museo Civico di Cuneo*, III: 17-21.
Gnoli, T. 2017. Palmyrena. In: V. Neri, B. Girotti (eds.), *Bilanci e prospettive. In memoria di Antonio Baldini. Atti del Convegno (Bologna, 3-4 giugno 2016)*. Milano: LED Edizioni Universitarie: 65-98.
Holder, P.A. 1980. *The auxilia from Augustus to Trajan*. BAR International Series 70. Oxford: BAR Publishing.
Jantzen, D., Brinker, U., Orschiedt, J., Heinemeier, J., Piek, J., Hauenstein, K., Kruger, J., Lidke, G., Lubke, H., Lampe, R., Lorenz, S., Schult, M., Terberger, T. 2011. A Bronze Age battlefield? Weapons and trauma in the Tollense Valley, north-eastern Germany, *Antiquity*, 85: 417-433.
Jensen, P. 2018. Semantically Enhanced 3D: A Web-based Platform for Spatial Integration of Excavation Documentation at Alken Enge, Denmark, *Journal of Field Archaeology*, 43: 31-44.
Kaltsas, N. 2006. *Sculpture in the National Archaeological Museum*. Athens: Kapon Editions.
Lepper, F., Frere, S. 1988. *Trajan's Column: A New Edition of the Cichorius Plates. Introduction, Commentary and Notes*. Gloucester: Alan Sutton Pub Ltd.
Libanios. 1955. *Orations*. Edition of L. Harmand. Paris: Presses Universitaires de France.
Link, M.S. 2012. Commotio Cordis: Ventricular Fibrillation Triggered by Chest Impact-Induced Abnormalities, *Circulation: Arrhythmia and Electrophysiology*, 5(2): 425-432.
Maestri, A. 2002. *Elementi di Medicina Legale e delle Assicurazioni*. Roma: Edizioni CieRre.
Marchiaro, S., Bongioanni, G. 2020. La clava come arma offensiva delle truppe ausiliarie Romane: il caso della stele funeraria di Catavigno, *Quaderni del Museo Civico di Cuneo*, VIII: 9-13.
Otero, F., Béguelin, M. 2019. Experimental Study of Cranial Injuries Due to Blunt Force Trauma: Sus Scrofra Domestica Model, *Journal Forensic Sciences and Criminal Investigation*, 13(2): 555856.
Reddy, S.S.J., Kaushik, A., Prakash, S. 2011. Clinical applications of reverse panoramic radiography, *Dental Hypotheses*, 2(3): 190-198.
Ross, I. 2018. An invulnerable enemy. Countering the clibanarii at Turin, *Ancient Warfare*, XII(3): 22-32.
Saukko, P., Knight, B. 2015. *Knight's forensic pathology*. London: CRC press.
Søe, N.E., Odgaard, B.V., Hertz, E., Holst, M.K., Kristiansen, S.M. 2017. Geomorphological setting of a sacred landscape: Iron age post battle deposition of human remains at Alken Enge, Denmark, *Geoarchaeology*, 32(5): 521-233.
Spaul, J. 2000. *COHORS 2: The evidence for and a short history of the auxiliary infantry units of the Imperial Roman Army*. BAR International Series 841. Oxford: BAR Publishing.
Suski, R. 2007. Aurelian, Club and Herodotus. The Weapons of troops from Palestine in the Battle of Emesa (272 AD), *Eos*, XCIV: 121-133.
Valoriani, S., Eliopoulos, C., Borrini, M. 2017. Sharp force trauma death in a young

individual from medieval Gloucester, *The American journal of forensic medicine and pathology*, 38 (2): 111-114.
Zosimus. 2000. *New History*. Edition of F. Paschoud. Paris: Les Belles Lettres.