



Case Report

A crossbow suicide



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ABSTRACT

The crossbow is an ancient ranged weapon originally conceived for war and hunting. Although nowadays its use in warfare has been surpassed by firearms, it continues to be used in hunting, sports and recreation. The authors present the case of a 40-year-old man who suffered from severe depression. When his condition further deteriorated, doctors ordered a forced hospitalization but, just a few hours before the measure became effective, the man committed suicide using a crossbow.

The autopsy and police investigation showed possession of the crossbow darts which the man used to shoot himself in the head.

The forensic pathologist found the dart stuck in the skull: the entry wound was in the suprahyoid region while the arrow tip emerged in the left parietal region meaning the arrow crossed the tongue, the middle fossa, the brain and the cranial wall. All the wounds presented a three-pointed star shape consistent with the three sharp blades of the dart. An extensive blood infiltration affected the subdural and subarachnoid space, particularly where the dart had passed.

The severe brain injury, extensive subdural and subarachnoid bleeding and brain swelling following the trauma caused the death.

Even though the use of the crossbow is only permitted in sporting/hunting contexts, the reported case highlights the sharp contrast between its potential for harm and the easy access to this kind of weapon, even for those affected by mental illness.

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1. Introduction

The crossbow is a ranged weapon which can use arrows, darts, projectiles or stones. Compared to the bow, it has a better grasp, a wider range and it is considerably easier to use; there is no need for training or strength, although its weight can affect the weapon handling and accuracy [1,2]. It continued to be used in military settings until the 16th century, when it was replaced by firearms. Today, the only remaining uses are for hunting, sports and recreation [3,4].

Lethal crossbow injuries are a rarity in the forensic field today despite being common in the past [5,6]. There are very few reported cases in forensic literature and those which exist refer mainly to suicides or accidental deaths rather than homicide cases. Similarly to firearm suicides, the chest or the head are often the favoured areas in self-harm cases and the subject often suffers

from a mental illness or a drug/alcohol dependence. The characteristic morphological effects depend on the type of arrows and particularly the tips used rather than on the type of weapon. Entrance wounds from a field-tipped arrow are often virtually indistinguishable from gunshot wounds. The V-shaped broadhead has two or more (often three) cutting edges and therefore produces an entry wound which corresponds to the arrowhead geometry (a two or three-pointed star shape).

In many countries, crossbows can be easily acquired via mail order/internet without the need for a permit or background check [5]. For example, in Italy, the government only allows crossbow use for sporting purposes. For this reason, it is considered by law to be “sports equipment” rather than a “weapon”, meaning that anyone over the age of 18 can freely buy and own one without needing a licence.

There are very few reported cases of crossbow death worldwide [7–9]. We present a suicide committed by a self-inflicted crossbow shot. The thorough inspection, autopsy, X-ray study and toxicological examination all helped to rule out the involvement of a third party.

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2. Case report

The decedent of a 40-year-old man was found lying in a field in the countryside near his house, with a crossbow arrow stuck in his skull.

Investigations revealed that he had a difficult relationship with his partner and he consequently developed a depressive disorder treated with benzodiazepines (alprazolam, triazolam), antidepressants (escitalopram) and herbal supplements. The doctor ordered a forced hospitalization the same day of death given that the man was showing signs of suicidal ideation. Unfortunately it was already too late.

When sweeping the area, police officers found a compound crossbow (Fig. 1) next to the corpse. On initial inspection, the forensic pathologist established that the arrow had entered the suprahyoid region and remained stuck in the skull with the sharp tip sticking out of the left parietal region by 2 mm.

An autopsy was demanded by the magistrate. Before beginning the autopsy, an X-ray was taken which showed a leftward oblique direction of the arrow, which passed through the skull for a length of 27 cm (Fig. 2). The arrow had entered the suprahyoid region and remained stuck in the skull with the sharp tip sticking out of the left parietal region by 2 mm.

The crossbow used in the presented case was a Barnett, Commando II, with a telescopic sight Konus 7227–magnifying power 3–7 × 20.

Before opening the skull and examining the damage to the brain, we removed the arrow by unscrewing the tip and extracting the remaining part of the arrow from the suprahyoid region.

The dart was 56 cm long and had a three-blade tip (Figs. 10 and 11), rather than the field-tipped type which is allowed in Italy.

The subsequent entry wound examination revealed a three-pointed star shape, consistent with the three sharp blades of the



Fig. 1. The crossbow used in the presented case.

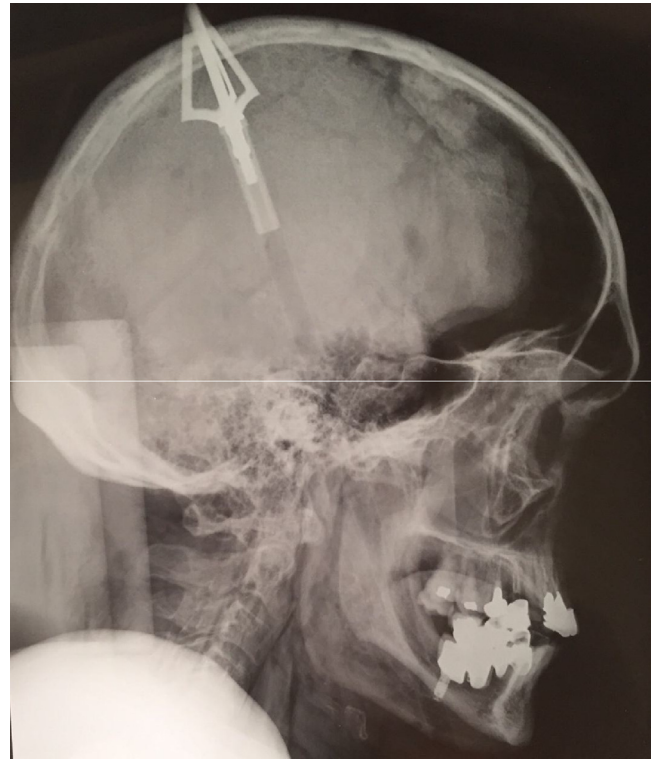


Fig. 2. X-ray showing the three-bladed arrow stuck in the skull.

dart with clear cut and blood-infiltrated edges (Figs. 3 and 4). The tongue presented a similar injury in the middle-posterior region (Fig. 5), as well as the scalp, where the exit wound was located (Fig. 6). The skull dissection showed several fractures originating from the bone lesion, where the arrow tip was stuck, both in the left parietal region (Figs. 7 and 8) and in the middle fossa. The dura mater presented a wound in shape of a three-pointed star (Fig. 9). There was an extensive subdural and subarachnoid haemorrhage, particularly where the dart crossed this area. The arrow passed through the entire brain, from the inferior area of the left temporal lobe to the left parietal region.

The post-mortem examination did not reveal any other significant findings, beyond the arrow-related cranial injuries.

Histopathological analysis highlighted extensive subdural and subarachnoid bleeding and brain swelling, in addition to a



Fig. 3. Entry wound.



Fig. 4. Entry wound after the removal of the arrow.

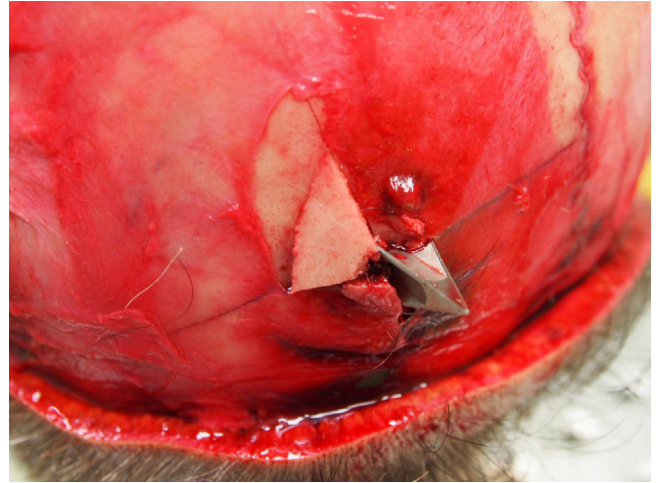


Fig. 7. Skull wound on the left parietal region.

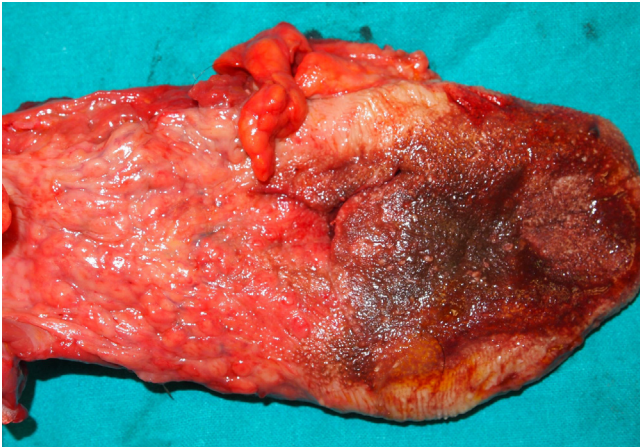


Fig. 5. Tongue: three-pointed star shape of the wound.

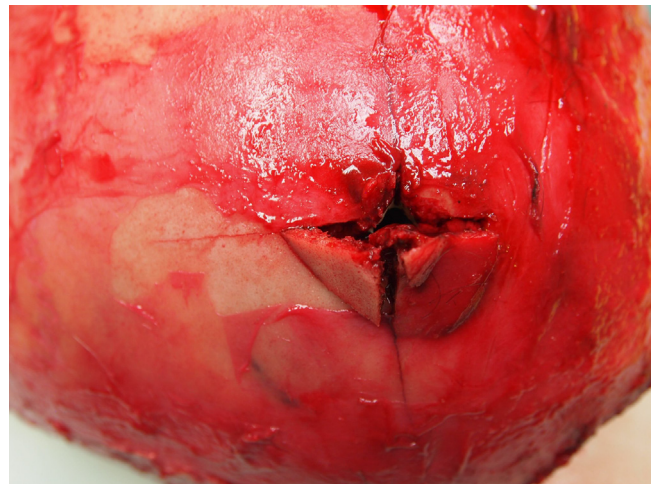


Fig. 8. Skull wound on the left parietal region after the removal of the arrow.

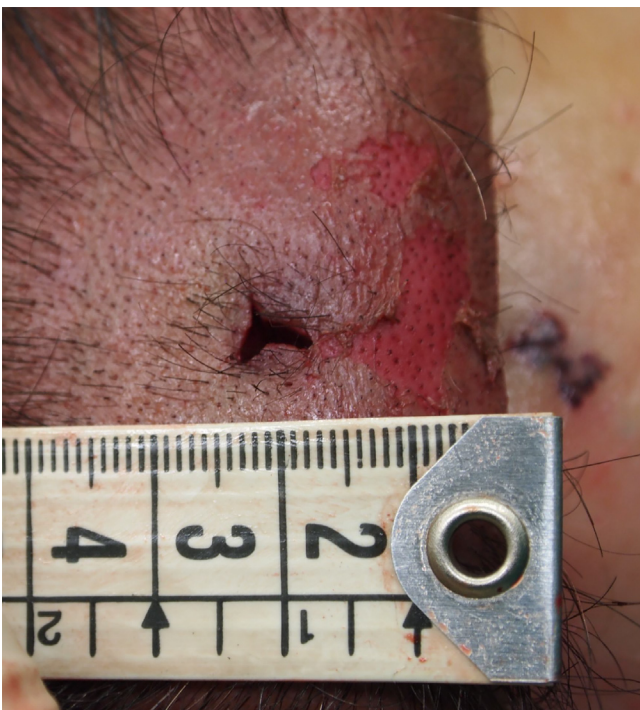


Fig. 6. Exit wound on the scalp.

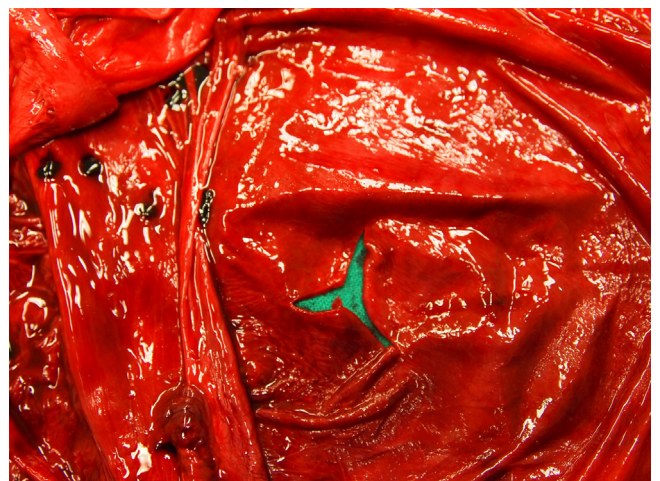


Fig. 9. Dura mater: three-pointed star shape of the wound.



Fig. 10. The arrow extracted from the wound.



Fig. 11. The three-bladed tip of the arrow.

localized intra-parenchymal haemorrhage affecting the areas around the arrow.

There was diffuse axonal injury associated with prolonged tissue hypoperfusion which produced extensive and irreversible damage to nerve cells with encephalic impairment.

3. Discussion

The presented case shows a psychiatric patient who committed suicide in an unusual way: with a crossbow. The dart was stuck in the skull with the entry wound in the suprahyoid area and the exit wound in the left parietal region. The main findings on initial inspection were the three-pointed star shape of both lesions. During the autopsy it was noted that the lesions in body parts which the arrow crossed, presented the same shape as the entry and the exit wounds. The skull presented many fractures originating from the middle fossa and from the emergent site on the left parietal region. The forensic pathologist described an extensive subdural and subarachnoid bleeding originating from the passage of the arrow and global brain swelling which were confirmed from the histopathological examination.

Traumatic injuries caused by crossbows are a rarity and the victims are normally male and aged between 31 and 58 [2,5,6,8,12,14].

Our case has many typical characteristics of suicides in reported literature and highlights several concerns regarding the accessibility of weapons.

According to forensic literature, the head is the preferred area in suicides followed by the chest [10–14]. In homicides, the perpetrator generally hits the chest or the head [2,3,7,8,14] while accidental events often affect the lower extremities [15] although in these cases many different sites have been reported such as the

head [16,17], the neck [18] and the shoulder [19]. This case reflects the literature, as the head was the involved area.

However, wounds caused by the crossbow can sometimes raise doubts regarding the type of weapon involved. The entry and the exit wound features are directly dependant on the type of dart tip. A field-tipped profile is associated with either a round or oval lesion shape with abraded and regular edges since this kind of arrow causes a puncture wound quite similar to a gunshot [3,5,25]. From a forensic point of view, crossbow lesions may represent a challenge in these cases, since they may be confused with a long range firearm shot due to the appearance of the wounds [10,25,27]. This is a particular problem in cases where the arrow has been removed from the body. On the other hand, as in this case, the three-blade tip produces stab and puncture wounds. Accordingly, a three-pointed star shape lesion with clear-cut and blood-infiltrated edges is generally found [2,3,5,25]. This close correlation between the arrow tip and the wound appearance, as well as the lack of typical firearm shot features such as gunshot residue and tattooing, helps when stating the kind of weapon used [2,8,14]. In the presented case, the dart had a three-blade tip and it produced typical entry and exit wounds corresponding to the arrowhead geometry (a three-pointed star shape).

Another aspect of crossbow injury is that which arises from the low kinetic energy of the dart. Some reported cases have shown that it is possible to survive and even make a satisfactory recovery [3,10,12,13,16,20], despite severe injuries in critical areas such as the head or the chest. This surprising outcome is possible due to the low kinetic energy of a crossbow arrow, which provides characteristics similar to a low-speed projectile [2,3,10,11,21,23]. While an arrow tip is often sharp, thus allowing the dart to penetrate deep into the tissues [2,10,21], thanks to the low transmission of energy to nearby areas, it does not cause as much damage as a firearm projectile. Furthermore, when the arrow is stuck in the body, it acts as a plug and together with the natural elastic retraction of the tissues, it slows the bleeding [3,11,22,23]. Therefore, a person may show very few symptoms, despite the extensive involvement of the skull, and may have an ongoing capacity for action and unaltered consciousness [3,6,12,14,24,26]. The mentioned effects provide an explanation for the cases of double self-inflicted crossbow shots [11,27]. Finally, it appears clear that, in most cases, there is a range of time in which medical intervention might be effective. If death occurs, it is rarely fast and for this reason, in murders, the killer may firstly prefer to stop the victim with the crossbow and then to use a different weapon to ensure death [2,7]. In our case, the man died as result of the lesions produced by the arrow, probably because he did not want to or because he could not ask for help. The autopsy revealed perilesional haemorrhage of the entry wound and the tissue where the arrow passed; the histological findings of the entry wound and of the tongue wound confirmed a perilesional haemorrhage without relevant inflammatory. Nobody heard the crossbow shot, given that it is relatively silent. His relatives started to call him one hour after he left home and then went out looking for him. However, when they found him, it was already too late.

This case highlights the issue of accessibility to weapons: it is easy for people to buy crossbows from hunting/sports shops without having to undertake any tests regarding mental or physical health or produce ID which proves they are adults.

The release of a health certificate, focusing on the person's mental status in addition to their physical condition, might be the answer in helping to reduce these kinds of deadly events, given that psychiatric patients are more likely to cause harm to themselves or others.

A crossbow is a noiseless and accurate distance weapon which is easy to operate, does not require practice yet guarantees deep penetration of tissue and is therefore not a toy or a simple piece of

sports equipment. Consequently it is necessary to introduce stricter restrictions or controls in the sale of these items, particularly in the current era of the global market where it is possible to buy items which increase the harmfulness of the crossbow, via the internet, without any real or effective control.

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References

- [1] R.I. Burns, The medieval crossbow as surgical instrument: an illustrated case history, *Bull. N. Y. Acad. Med.* 48 (8) (1972) 983–989.
- [2] B. Karger, H. Bratzke, H. Grass, G. Lasczkowski, R. Lessig, F. Monticelli, J. Wiese, R.F. Zweihoff, Crossbow homicides, *Int. J. Leg. Med.* 118 (6) (2004) 332–336.
- [3] D. Jain, G. Aggarwal, P. Lubana, S. Moses, Penetrating craniofacial arrow injury, *J. Neurosci. Rural Pract.* 1 (1) (2010) 17–19.
- [4] G.A. Franklin, J.K. Lukan, Self-inflicted crossbow injury to the head, *J. Trauma* 52 (5) (2002) 1009.
- [5] D. Smyk, Crossbow injuries: a case report, *J. Forensic Leg. Med.* 16 (6) (2009) 343–345.
- [6] L. Zátoková, P. Hejna, Fatal suicidal crossbow injury—the ability to act, *J. Forensic Sci.* 56 (2) (2011) 537–540.
- [7] C.A. Clerici, E. Muccino, G. Gentile, M. Marchesi, L. Veneroni, R. Zoja, An unusual case of homicide with a crossbow and a hunting knife, *Med. Sci. Law* 55 (2) (2015) 86–89.
- [8] C. Pomara, S. D'Errico, M. Neri, An unusual case of crossbow homicide, *Forensic Sci. Med. Pathol.* 3 (2) (2007) 124–127.
- [9] C. Pomara, S.B. Karch, F. Mallegni, A. Marrone, S. Ricci, I. Riezzo, V. Fineschi, A medieval murder, *Am. J. Forensic Med. Pathol.* 29 (1) (2008) 72–74.
- [10] R.W. Byard, B. Koszyca, R. James, Crossbow suicide: mechanisms of injury and neuropathologic findings, *Am. J. Forensic Med. Pathol.* 20 (4) (1999) 347–353.
- [11] K. Opeškin, M. Burke, Suicide using multiple crossbow arrows, *Am. J. Forensic Med. Pathol.* 15 (1) (1994) 14–17.
- [12] A. Weymann, C. Sebening, A rare, combined cardiac and hepatic crossbow injury, *Ann. Thorac. Cardiovasc. Surg.* 20 (Suppl) (2014) 813–815.
- [13] K. Besler, M. Kleiber, H.R. Zerkowski, K. Trübner, Non-lethal penetrating cardiac injury from a crossbow bolt, *Int. J. Leg. Med.* 111 (2) (1998) 88–90.
- [14] W. Grellner, D. Buhmann, A. Giese, G. Gehrke, E. Koops, K. Püschel, Fatal and non-fatal injuries caused by crossbows, *Forensic Sci. Int.* 142 (1) (2004) 17–23.
- [15] E. Vogels, A. Mahajan, J. Klana, Crossbow injuries to the thumb, *J. Sports Med. Phys. Fitness* 55 (7–8) (2015) 756–760.
- [16] Z. Hengzhu, X. Enxi, S. Lei, W. Xiaodong, D. Lun, A rare case of penetrating brain injury by crossbow in a 22-month-old child, *Pediatr. Emerg. Care* 30 (6) (2014) 421–423.
- [17] C. Hessler, W. Hamel, S. Kluge, U. Mayer, U. Grzyska, M. Westphal, K. Püschel, Fatal crossbow injury in an adolescent, *Arch. Kriminol.* 229 (3–4) (2012) 90–95.
- [18] C.K. Salvino, T.C. Orogitano, D.J. Dries, J.F. Shea, M. Springhorn, C.J. Miller, Transoral crossbow injury to the cervical spine: an unusual case of penetrating cervical spine injury, *Neurosurgery* 28 (6) (1991) 904–907.
- [19] W.K. Chang, L.C. Hsee, Crossbow injury in a developed country, *Injury* 41 (10) (2010) 1090–1092.
- [20] G. Fradet, B. Nelems, N.L. Müller, Penetrating injury of the torso with impalement of the thoracic aorta: preoperative value of the computed tomographic scan, *Ann. Thorac. Surg.* 45 (6) (1988) 680–681.
- [21] B. Karger, H. Sudhues, B.P. Kneubuehl, B. Brinkmann, Experimental arrow wounds: ballistics and traumatology, *J. Trauma* 45 (3) (1998) 495–501.
- [22] M.G. Krukemeyer, W. Grellner, G. Gehrke, E. Koops, K. Püschel, Survived crossbow injuries, *Am. J. Forensic Med. Pathol.* 27 (3) (2006) 274–276.
- [23] A.A. Salam, K.S. Eyres, A.D. Magides, J. Cleary, Penetrating brain stem injury from crossbow bolt: a case report and review of the literature, *Arch. Emerg. Med.* 7 (3) (1990) 224–227.
- [24] V. Tremayne, Pistol crossbow injuries, *Emerg. Nurse* 17 (3) (2009) 28–30.
- [25] C. Rogers, S. Dowell, J.H. Choi, L. Sathyavagiswaran, Crossbow injuries, *J. Forensic Sci.* 35 (4) (1990) 886–890.
- [26] T. Karlssona, S. Ståhlingb, Experimental blowgun injuries, ballistic aspects of modern blowguns, *Forensic Sci. Int.* 112 (1) (2000) 59–64.
- [27] J.C. Downs, C.A. Nichols, D. Scala-Barnett, B.D. Lifschultz, Handling and interpretation of crossbow injuries, *J. Forensic Sci.* 39 (2) (1994) 428–445.