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Case Report

Crossbow injuries: A case of suicide

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ABSTRACT

We are reporting the case of a 65 year-old man who suffered a severe depression and committed suicide using a crossbow. The death happened at his home. The suicide victim was on his knees, with of a crossbow leveled at his thorax and located facing him on the sofa. He shot it by pulling the trigger with the bended end of a ramrod. The arrow entered between the third and the fourth rib on the left side, with a downwards and slightly outwards direction. It went through the lung and the tip of the arrow came out the back.

The arrow was removed when the body was lifted, and the wounds had a three-pointed star shape which corresponded to the head of the arrow crossbow. Police enquiry and forensic investigation confirmed a suicidal manner of death.

This paper presents different issues of the case, such as the attestation of tears in clothing, the morphology of the wounds or the arrow track. The case is compared with other cases in the medical forensic literature involving the use of crossbows. Finally, it is highlighted how easy it is to purchase these weapons despite their obvious power and accuracy, factors that seriously recommend legislative regulation to be increased and its use more restricted.

1. Introduction

The crossbow is known since the Metal Ages in China and Greece. In Europe, it was used widely between the 11th and the 16th centuries, and then it was gradually replaced by firearms [1]. At present, its use is limited to sport practice and hunting, even though bows and arrows are still used by people in tribal fights in developing countries such as Nigeria [2–4] and India [5].

Crossbows are basically made up of a bow fixed on a stock. At both ends a bowstring is joined, which shoots the arrow when a gun-like trigger is pulled. Crossbows are made from different materials; nowadays plastics and wood are the most used materials.

Currently, arrowheads types are reduced to conical-shaped ones, field-pointed arrowheads for sports activities, and the broadheads with two or more razor-edged metal blades, which radiate outward from a central shaft with a small conical tip or primary blade at the very tip [6]. Mechanical arrowheads are a variation of the latter, where the blades

are folded until they impact on the target.

Although crossbow injuries are generally an infrequent cause of death and cases involving crossbows are not abundant in the medical forensic literature [7–9], their current popularity seems to have increased their use for criminal purposes [6,10–13].

So, its use has been reported in suicides and homicides, as well as in injuries resulting from accidental shootings. After reviewing forensic literature, out of a total of fatal and nonfatal 52 cases, 53.8% corresponded to suicides, 36.5% to homicides, and 9.6% to accidental shootings.

In the present case, the investigation established a suicidal manner of death judging by the body posture of the victim, who was kneeling in front of a crossbow held by the sofa cushions. The man shot the weapon using an extension cord or modified ramrod.

The examination of the clothing is also interesting, in addition to the characteristics of the entry and exit wounds.

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2. Case background

The dead body of a male aged 65 was found at his home. The corpse was in the prone position in a large pool of blood (Fig. 1). An arrow crossed the left hemithorax and came out of his back, but therein it did not tear his clothing. The body was in front of a sofa with a crossbow held by cushions. Next to the crossbow there was a ramrod with an end which had been modified as a trigger mechanism. This device would have been used to shoot the weapon by the individual (Fig. 2).

As for his medical history, we knew he was diagnosed with depression, had financial problems, and he had told occasionally his thoughts of ending his life. Apparently, he did not undergo any medical treatments.

The weapon he used was a Barnett crossbow, in good functional order. It was 87 cm length, including the head, and the distance between both ends of the bows was 67.5 cm.

The arrow was 40.7 cm in length and weighted 28 g and it included three plastic fins. The diameter of the rod was 0.75 cm. The steel tip was very sharp, and it had three symmetrical radial-shaped blades, each 51 mm long and 1 mm thick. The separation between the blades at the back was 23.5 mm. (Fig. 3).

3. Autopsy report

The individual was wearing pyjamas, with a triangle-shaped tear in the jacket and the vertex was pointing down, with an upper horizontal side of 24 mm and two lower sides of 30 mm. (Fig. 4).

In the body, it was established that the entry wound was between the third and the fourth left ribs, at about 30 mm left from the midsternal line. It was also triangle-shaped with the lowest vertex pointing down, with a superior side of 25 mm, and two lower edges 30 mm long. Later, with the skin fixed in a preservative fluid, it was possible to observe clearly the geometry of the arrow blades (Fig. 5). The wound sides were smooth and slightly bruised.

Cartilages of the third and fourth ribs were exposed under the cutaneous flap.

In its intrathoracic trajectory, the arrow travelled downwards at an angle of approximately 20° and slightly outwards (Fig. 6). One of the blades touched tangentially the left ventricle (Fig. 7), and the upper lobe of the left lung was punctured with the result of a hemothorax of over 700 cc.

Injuries in the skin, bone and viscera were of sharp and cutting nature, in accordance with the morphology of a three-bladed arrowhead.

The exit wound was located at the back, 180 mm under the scapula and at 65 mm to the left of spinal midline (Fig. 8). The eroding edges of the wound were everted. It was also triangular in shape with the lowest



Fig. 2. Crossbow with a modified ramrod to trigger the weapon.

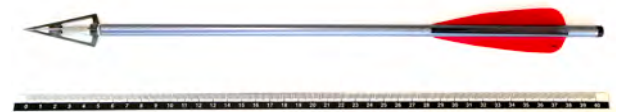


Fig. 3. Arrow used in the commission of the suicidal act.



Fig. 4. Clothes tear at the entry point.



Fig. 1. General view of the scene.



Fig. 5. Entry injured area after being fixed in preservative fluid.



Fig. 6. Intrathorax trajectory caused by the arrow.

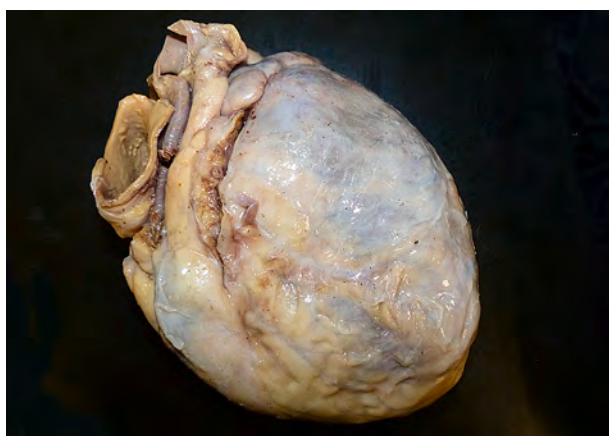


Fig. 7. Heart injury.



Fig. 8. Exit wound in the victim's back.

vertex pointing down, although more irregularly shaped than in the entry point. The upper edge measured 22 mm, and the two lower edges 20 mm. It was verified that the arrow passed through the 8th and the 9th rib, leaving a small bony step in the lower border of the 8th rib. (Fig. 9).

Toxicological screening did not provide any interesting findings.



Fig. 9. Fracture on lower edge of the 8th rib in left hemithorax.

4. Discussion

The case shown here corresponds to a 65 year-old male who committed suicide by a highly unusual method, as is the use of an arrow shot with a crossbow.

We have analysed similar case studies of injuries that resulted from crossbow use, the percentage of males being higher [6,7,9–46]. Out of 48 cases, 82% of the victims in homicides were males, 100% in suicides, and 80% of them died in accidents by crossbow. The average age of the victims was 36.6 years old in homicides, with an age range from 14 to 61. As regards to suicides, the average age was 40.4 years old and the age range was from 12 to 67. As for accidents, the average death age was 37.6 years old, with an age range of 24–60 years old.

Relatives of the decedent informed the authors that he was affected by depression and had serious economic problems. He had previously mentioned that he wanted to commit suicide. In the decedent's residence, some notes on the use of drugs for suicide were found, although toxicological analysis was negative.

In some of the other cases of suicide involving crossbow, we have found histories of depression [9,28,34,38,40], schizophrenia [10,36], some other mental illnesses [23,41], and domestic violence incidents [7,26].

Clothing showed a tear whose morphology corresponded to the shape of the head of the arrow. In this case, it is clear that the wounds and the arrow examined show clearly the origin and mechanism of the injuries. However, the examination of the clothing can be of high value when the arrow is not found because it has gone out through the body, when it has been removed, or when the body is in a state of advanced decomposition [23]. It might be the case that investigators only had clothing as the only evidence for investigation (46). On the other hand, tears in the tissues may be affected by different factors such as how tight the clothing were after the arrow had been shot [20].

Similarly, when interpretations are only based on the study of the skin, injuries caused by arrows can be confused occasionally with gunshot wounds or stab wounds, especially in the cases of field tips. In order to exclude gunshot wounds, apart from the study of both clothing and morphology of the wound, investigators should search for gunshot residue, bullet fragments, and wipe-off material [7,20,43,44].

In the case under study here, the entry wound was located at the left hemithorax, between the third and the fourth ribs, which is a priority area due to its potential vital risk. In the above-mentioned review [6–7,9–46] in suicides, thorax was chosen in 44.4% of all the cases, head in 37%, and far ahead the abdomen or neck as targets. Thus, the preferred place in homicides were thorax in 45% of the cases, and the head in 15%, while the rest was distributed between the neck, the arms and the abdomen. In the accidents, the entry wound was located in the head in 80% and in the thorax in 20% of all the cases.

The wound reflects the shape of the tip of the arrow. Whilst the broadhead tips produce entry wounds that correspond to the arrowhead geometry, the conical field tips produce entry wounds with either circular or oval shape, with abraded skin edges [22,44].

In this case the shape of the entry wound in the skin corresponds to an upper base isosceles triangle. The main length of the lower sides with respect to the upper one of around 6 mm, proves that the tip had cut the body surface with a very slight inclination from top to bottom. Therefore, the varying the shape depends on the input angle [42]. The trajectory of the arrow was up to 20 degrees tilt downwards and outwards, indicating. This means that the body was inclined forward when the crossbow was shot, assuming that the trajectory of the arrow when it left the crossbow was horizontal.

The tissues were injured by the trajectory of the sharp blades and by the tip of the arrow, combining forces by cutting and stabbing [6]. No injuries were caused by cavitation, such as in gunshot wounds, because of the low kinetic energy of the arrows.

The weapon used in this case is a Barnett crossbow, with a butt and three fibre blades, prepared for sport shooting and hunting.

Crossbows are easy to operate and, together with its scope and noiseless handling [18,22], make them an ideal weapon from “man hunting” (K), so it would be advisable to exercise a stricter control on their purchase. It is indeed shocking to see that restrictions are very poor in countries such as Italy, Germany, and USA [6,9,32], where we find only age limits for their acquisition. In Switzerland [30], they are allowed for private use, and in Japan for sporting activities (45). On the other hand, internet sales facilitate more their purchase [9]. On the internet you can even find easy instructions for its construction.

In Spain, crossbows are rated in the seventh position within the weapon category together with underwater fishing guns, anaesthetic injection guns, and bows. An E Gun License is required to purchase and handle a crossbow, and some basic examinations have to be passed in order to prove theoretical and practical use of this weapon.

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