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## Crossbow homicides

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**Abstract** A total of eight cases of homicide by crossbow are reported, including six intentional, assault-like killings and one hired killer. The bolts showed a high penetration capacity despite the rather low kinetic energy (<100 J): a field-tip traversed one upper arm and the thorax (36 cm) and two broadheads caused perforating injuries of the thorax (25–26 cm). This was due to the high sectional density and the split-like penetration mechanism. Wound morphology was especially important if the perpetrator had extracted the bolt, which occurred in half of the cases. The shape of the entrance wound depended on the type of

arrowhead: broadheads produced star-shaped to triangular wounds, field-tips caused circular, oval or slit-like injuries. Foreign material from the arrowhead was found inside two injuries. In assaults, the crossbow was used to hunt the victim down from a short distance which does not require practice but still has the advantage of a distance weapon. However, immediate incapacitation occurred rarely so that additional violence was frequently applied. The noiseless character of the weapon explains why many victims were taken by surprise and why the corpses initially remained unnoticed. Crossbows can therefore be considered ideal weapons for man hunting and some were bought for the very purpose of the killing.

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### Introduction

Both ancient and modern bows and crossbows have a considerable penetration capacity in soft tissue and flat bone sufficient to cause perforating wounds in big game and man [16, 26]. For centuries, arrow injuries have been a major stimulus in the development of surgery [17] and although the bow and crossbow have been replaced by firearms almost universally, this type of weapon is still in use today in tribal or guerrilla warfare [9, 16, 18, 30, 32, 33].

Numerous reports of accidents [e.g. 10, 11, 20, 28], also involving children [e.g. 23, 24], hunting accidents [e.g. 14, 19], and suicides [e.g. 1, 3, 5, 6, 8, 13, 22, 25, 29] have been published whereas the number of homicides with this type of weapon appears to be small [4, 5, 7, 12, 13, 27, 31]. This paper contributes eight homicides and examines the question whether this easy to purchase weapon is suitable for intentional killing.

## Case reports

### Case 1

The former 38-year-old lover of a wife assaulted her and her 31-year-old husband in their home. The husband fled into a kennel where he was killed by a broadhead (hunting) bolt from a Barnett crossbow (draw weight 82 kg) with a telescopic sight. The perpetrator then stabbed the wife to death because she suddenly emerged from the kennel but he only had a single bolt with him. The triangular entrance wound of the man was located in front of the right axilla. The arrow then perforated the 4th intercostal space leaving a notch in the 4th rib. After perforation of the lower and middle lobe of the right lung (1,350 ml haemopneumothorax), the wound tract continued through the 7th intercostal space leaving a notch in the 7th rib and ended just below the skin of the back. The total length of the wound tract was approx. 25 cm and the cause of death was exsanguination from the right lung. The perpetrator stated later that he had removed the bolt from the man when he was still alive and that he had bought the crossbow a few months before. He received a combined sentence of 15 years for manslaughter of the man and murder of the woman.

### Case 2

During a neighbourhood brawl because of noise and waste, a 52-year-old man with a known paranoid disorder confronted a 25-year-old neighbour who was standing in his front door. The perpetrator fired a sharp field-tip bolt from a Barnett Veloci Speed Class crossbow from a distance of 2.5–3 m. After perforation of the left upper arm, the bolt re-entered the left thorax and then perforated the diaphragm twice so that both thoracic cavities, the pericardium and the abdominal cavity were opened. Among the major organs, the stomach and the liver were perforated and there was an exit wound at the right side of the thorax. The total length of the wound tract was 36 cm including the arm (7 cm) and trunk (29 cm). No additional injuries were present, the cause of death was exsanguination from the multiple organ injuries and the survival time including thoracic and abdominal surgery was 6.5 h. The perpetrator was sentenced to 8 years for manslaughter, reduced criminal liability was taken into consideration.

### Case 3

A 37-year-old wife had a love affair with a 36-year-old man and both decided to kill the husband. The walls in the apartment were covered with polythene sheets to avoid traces. When the husband entered through the front door, the man fired a field-tip bolt from a Horton Super Mag compound crossbow (draw weight 150 lbs=68 kg) from a distance of 4–5 m. The oval entrance wound (Fig. 1) in the front side of the thorax showed fine blueish deposits from

the arrowhead. The wound tract continued perforating the 8th rib on the right side and it ended after perforation of 11 cm of liver tissue. Both perpetrators stated that the victim fell to the ground but was still able to move so that the male perpetrator killed him by knife stabs to the neck and heart and blows to the head. The corpse was then wrapped in the polythene sheets and was submerged in a river. The cause of death was exsanguination from the liver and heart. The crossbow had been purchased from a mail order company for the very purpose of the killing. Both perpetrators received life sentences for murder.

### Case 4

The wife of a 35-year-old man hired a 20-year-old man to kill her husband. The killer took the victim by surprise: he fired a field-tip bolt from a distance of 2–3 m just as the victim was sitting up in his bed. The bolt entered through the left eye, perforated the back wall of the orbital cavity and penetrated 6 cm deep into the temporal lobe. The victim was nevertheless able to put up a fight and was choked and killed by knife stabs including injuries to the heart. The cause of death was exsanguination from the heart. The perpetrator removed the bolt and devastated the rooms to fake a robbery. He had bought a crossbow 1 month before the incident from an arms dealer after he had been unsuccessful in obtaining a gun and he later sank the bolt and crossbow in a lake where divers were unsuccessful in recovering them. The perpetrator was sentenced to 7 years for murder and the wife received a life sentence for instigation to murder.

### Case 5

A 14-year-old girl was assaulted by a 24-year-old man in his home when she collected money for magazine subscriptions. The assailant first strangled her in an



**Fig. 1** Oval entrance wound (case 3) in the thorax from a field-tip with blueish deposits in the skin originating from the black oxide finish of the arrowhead (compare Fig. 3)

attempted rape but genital injuries were absent and later investigations for spermatozoa were negative. When the girl managed to scream, the man fired 3 field-tip bolts into her back and right chest and finally inflicted multiple stab wounds. The cause of death was exsanguination from the multiple injuries. The perpetrator had removed the bolts which, like the crossbow, were never recovered. He committed suicide before the trial so that further information was not available.

#### Case 6

A 61-year-old businessman was assaulted in front of his house by a man who fired a bolt from an unknown distance. The bolt, which was never recovered, caused a perforating wound of the right upper arm with circular skin defects. Abundant bloodstains continued from the front door into the bathroom where the corpse was found additionally showing multiple stabbing and cutting injuries to the head, neck and both arms. The house had then been robbed. Obviously, the assassin had wounded the victim with the bolt when he was about to enter his house. The numerous additional injuries indicated that the victim was still able to resist and was thus killed with a knife. The suspected perpetrator died before the trial so that the type of crossbow and tip used are not known. It is known, however, that the perpetrator had injured another man with a crossbow 1 year before in the context of a drugs deal.

#### Case 7

A 19-year-old man killed his 24-year-old girlfriend in a domestic dispute. She was in the kitchen with her back to the living room where he sat drinking alcohol with friends. He wanted to impress them by pretending to shoot her with a Barnett Delta-Force crossbow (draw weight 150 lbs=68 kg). He later stated that he believed the security device to be active when he pulled the trigger but the three-bladed broadhead bolt discharged from a distance of 2.5–3 m. The triangular entrance wound (2×4×4 cm) was located in the left side of the back. The wound tract took an ascending course perforating the 11th rib, the lower and upper lobe of the left lung (haemopneumothorax 400 ml), and the left clavicle. The triangular exit wound was located at the base of the neck on the left side where the tip of the bolt was visible. The total length of the wound tract was 26 cm and there were no additional injuries. The cause of death was exsanguination from the large pulmonary arteries and the survival time was 10 min. The blood alcohol concentration of the perpetrator was 1.6 g/l. The man was convicted of manslaughter and sentenced to 3.5 years. The juvenile law was applied due to developmental immaturity.

#### Case 8

After 8 robberies in his company within 1 year, the 26-year-old owner had bought a crossbow in a weapon shop for protection. Two months later, two men attempted to rob the company at night but were confronted by the owner in the yard with his crossbow. The Barnett Kommando crossbow was discharged from a distance of several metres and the bolt perforated the left upper arm of a 40-year-old robber. The three-bladed broadhead tip severed the brachial artery and a metallic blade-like fragment of the tip was later recovered from close to a notch in the bone shaft. The wounded robber fled from the scene together with his companion, who brought him to a hospital approximately 10 min later where he died from exsanguination despite immediate resuscitation. In court, the defendant stated that he had no intention to shoot. He received a suspended sentence of 1 year and 4 months and a fine of 1,250 Euro for involuntary manslaughter.

Table 1 shows summaries of the cases.

### Discussion

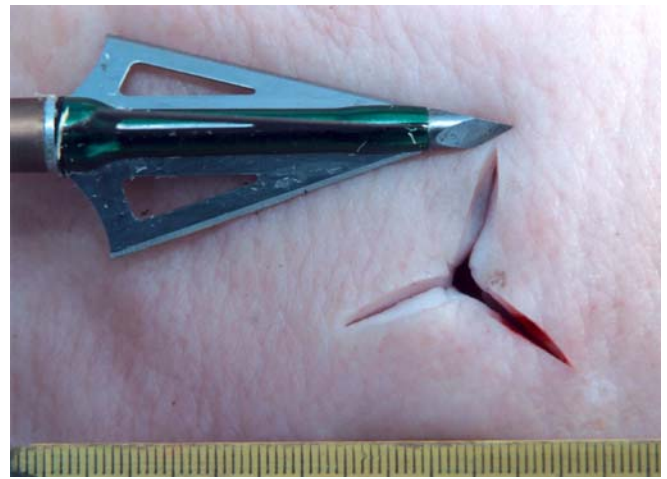
The cases reported originated from different regions in Germany and all occurred within recent years. While no epidemiological conclusions can be drawn, this compilation of cases demonstrates that the apparently old-fashioned type of weapon is still used to kill people. In all homicides reported here and in all but two homicides from the literature [7, 13], crossbows and not bows were used. Contrary to the bow, the crossbow can be carried, laid down and picked up in a loaded condition and no skill or practice is necessary for accurate aiming and shooting within a reasonable distance. A crossbow, therefore, is ideal for inexperienced persons who wish to operate a distance weapon.

Another distinctive feature of the crossbow is that it is noiseless. The victim can be taken by surprise (cases 1, 2, 3, 4, 6) and no attention is attracted so that the violent killing can initially remain unnoticed (cases 1, 3, 4, 5, 6). These heinous characteristics contributed to the murder convictions in cases 3 and 4 (no trial in cases 5 and 6), which occurs rather infrequently in Germany. In addition, the crossbows were purchased a short time period before and for the very purpose of the killing in cases 1, 3 and 4 and this planning indicated a clear intention to kill.

The penetration and wounding potential of bolts is substantial despite the relatively low kinetic energy, which commonly does not exceed 100 J [16]. Broadhead bolts caused perforating injuries of the thorax 25–26 cm in length in cases 1 and 7, a field-tip traversed one upper arm and the thorax (36 cm) in case 2 and flat bones were easily perforated (cases 3, 4, 5, 7). This high penetration capacity is due to the high sectional density, i.e., the high mass per cross-sectional area, and the split-like penetration mechanism, a combination of stabbing and cutting. Compared to a pistol bullet, therefore, a larger mass pushes onto a smaller but sharp frontal surface.

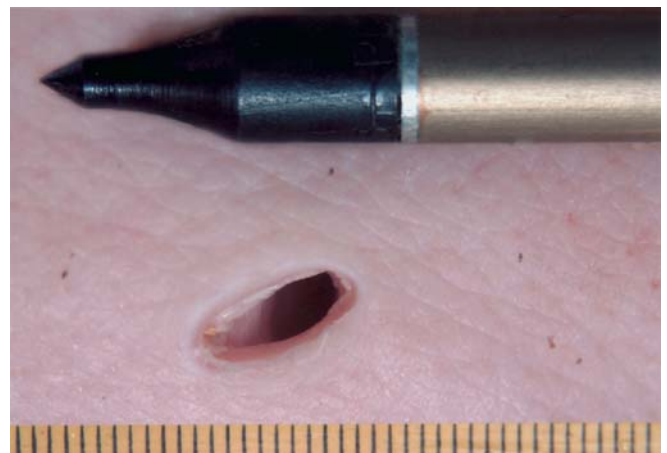
**Table 1** Summary of cases

No	Victim (age/ sex)	Perpetrator (age/ sex)	Crossbow	Bolt/ tip	Bolt injuries	Range	Additional injuries	Cause of death	Setting	Court decision (outcome)
1	31/m	38/m	Barnett 82 kg	Broadhead	Thorax	Several metres	Excoriations	Exsanguination	Killing of a couple	Murder, 15 years
2	25/m	52/m	Barnett	Field-tip (sharp)	Thorax	2.5–3 m	/	Exsanguination	Neighbourhood quarrel	Manslaughter, 8 years
3	41/m	36/m	Horton Super Mag 68 kg	Field-tip	Abdomen	4–5 m	Severe sharp and blunt force	Polytrauma	Killing of a rival	Murder, life
4	35/m	20/m	Not recovered	Field-tip	Eye, brain	2–3 m	Strangulation, stabs	Exsanguination	Killer hired by wife	Murder, 7 years
5	14/f	24/m	Not recovered	3 Field-tips	Thorax (3x)	Unknown	Multiple stabs	Exsanguination	Attempted rape	Suicide of perpetrator
6	61/m	?/m	Not recovered	Not recovered	Upper arm	Unknown	Stabs	Air embolism	Armed robbery	perpetrator deceased
7	24/f	19/m	Barnett Delta Force 70 kg	Broadhead	Thorax	2.5–3 m	/	Exsanguination	Showing off	Manslaughter, 3.5 years
8	40/m	26/m	Barnett	Broadhead	A. bra- chialis	Several metres	Excoriations	Exsanguination	Repulse of a bur- glar	Manslaughter, suspended sentence

**Fig. 2** Star-shaped entrance wound from the three-bladed broad-head arrowhead. Scale in mm

In cases 1–4 and 6, the crossbow was used to hunt the victim down from a short distance of 1–5 m. This almost guarantees a hit but incapacitation of the victims did not occur in cases 3, 4, 6 and 8, and also most likely in cases 1 and 5. In assaults (cases 1–6), most perpetrators reacted by inflicting additional violence to make the killing successful. However, additional bolts were fired only once in the case of the young girl (case 5)—the loading procedure may be too long if the resistance of the victim is not broken by the first shot.

Similar to injuries from other unusual distance weapons, such as nailguns [2] or air rifles [21], bolt injuries can be difficult to diagnose if the wounding agent has been extracted (cases 2, 4, 5, 6) or if the bolt exits completely (case 8). The entrance wound morphology depends primarily on the shape of the arrowhead [15, 16, 27]. The broadhead, a hunting weapon, has three or more razor-edged metal blades radiating outwards from a central shaft and therefore produces star-shaped or triangular entrance wounds depending on the anatomical region and the tissue tension (Fig. 2). The field-tip arrowhead has a

**Fig. 3** Oval entrance wound from the field-tip arrowhead. The black oxide finish of the arrowhead can be seen but has not left deposits in the skin in this case. Scale in mm



conical shape and therefore causes circular, oval or even slit-like wounds (Fig. 3). Also, the shape of the tip was frequently reflected by the clothing defects. The wound tract presented as a channel-like and clean-cut deep sharp force injury and an impression of the tip in bone can be another indication. The black oxide finish of the arrow-head (case 3) and the vanes [27] as well as the fragmentation of the tip (case 8) can leave trace evidence inside the wound.

## Conclusion

It appears clear from the cases presented that a crossbow is not a toy or simply a piece of sports equipment—it is also a noiseless and accurate distance weapon which is easy to operate, does not require practice, and guarantees deep penetration of tissue. These characteristics make the crossbow an ideal weapon for “man hunting”. Since crossbows are legally sold without restrictions to persons over 17 years of age in most countries, legal restrictions on the sale may be appropriate.

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