

Suicides with captive bolt pistols in Siena province: entrance wound analysis

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Abstract: Captive bolt pistols are a rare source of harm for humans, almost always limited to suicidal events. In scientific literature only a few old cases have been described reporting its particular offensive mode. This case series, completed with a recent case of suicide, offers the description of the particular entrance wound generated by this weapon and provides information about the legislative regulation on its use.

The authors describe three cases of suicide, caused by a shot exploded from captive-bolt pistols, between 1968 and 2015 that were investigated by the Department of Forensic Medicine of Siena.

The victims shot themselves in the head in two cases (two male subjects); in the third case a woman shot herself in the left hemitorax region.

The aim of this study is to analyse these cases describing the characteristics of the entrance wounds produced by this type of weapon, distinguishing them from those of the typical firearms and making recommendations in order to differentiate between suicidal events, homicides or accidental deaths.

Key Words: Stun bolt gun, captive-bolt pistol, atypical firearms, penetrating cranial wound, suicide, gunshot.

INTRODUCTION

Captive-bolt pistols are weapons used to kill animals that are immobilized, or otherwise unable to escape, in order to prevent them unnecessary suffering, in accordance to the rules of the Council Regulation, EU Regulation n.1099 / 2009, issued on, 24th of September, 2009, (adopted in Italy in 2013). This legislation provides that operators, or any person involved in killing animals, take the necessary measures to prevent and minimize suffering during slaughtering or killing processes. The law allows the use of projectile penetrating devices, for slaughtering purposes or selection, for all species of animals. These devices, called "humane killers" [1], are currently used by cattle ranchers, butchers, and veterinarians.

As previously mentioned, these weapons are only used in the livestock sector and fatal cases - principally suicides - involving humans are rarely described [2].

The statistics provided by ISTAT (Italian National

Statistic Institute), do not report the number of suicides committed with slaughter guns, because they are too rare to create a specific subcategory within the firearms [3]. In addition there is no specific legislation for the license of using of these weapons, according to the European legislation (EC Directive 477 of 06/18/91) or according to Italian law (Decree 527 of 12/30/92 and (Decree) 635 of 10/30/96) [2]. Therefore it is particularly hard to know how many people can use them.

This lack of legislation is common in most of the countries of Central and South America. In the Anglo-Saxon countries, instead, there are restrictive rules which equate these devices to all other weapons that require a licence for their possession [1]. In addition it is important to underline that the number of violent deaths, linked to the use of this weapon, in countries which have imposed specific legislation, is considerably lower than those recorded in all other countries.

It is very rare to observe lesions produced by this type of weapon and it is important for medical

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examiners to know the entrance wound features, in order to differentiate from suicides, murders and accidental deaths [2].

Cattle gun consists of a metal cylinder, open at the top, in which there is a piston with circular cross section, and a concave or grooved conical tip. A charge of powder, contained in a cartridge, is placed in the base of the weapon. The firing of the cartridge generates a violent and rapid expulsion of the piston. After the shot, the piston is withdrawn back into the cylinder by a spring. Symmetrically next to the central hole, from which the piston protrudes, there are two circular openings, (four in some models), divergent, which constitute the outlet for the exhaust fumes and the explosion gases [4]. There are two main models, produced by the Kerner and Schermer companies, along with other less popular models.

The "Kerner" has a caliber of 10.5 mm and its piston protrudes, during firing, for a length of 9 cm; the "Schermer" model has 12 mm caliber, and extends out to a length of 7.5 cm. The maximum speed of firing is 50 m / sec [1]. The action of this weapon, that must be placed in contact with the head, generates serious and irreversible damage to the brain, deriving from the shock and the penetration of the piston. The skin lesion that is created by the action of the piston, is quite peculiar: it generally consists of an entrance wound, circular in shape, with a diameter of about 1 cm, surrounded by sharp excoriation with an average height of more than two mm [5-6], and a diameter slightly smaller than that of the piston [7].

Generally the weapon is placed with an oblique angle to the body, generating a slight asymmetry of the entrance wound, which presents sharp margins at the bottom of the lesion, and irregular and obtuse ones in the upper portion [8]. In the skin portion surrounding the lesion there is a particular soot pattern created by the smoke arising from the gases generated in the explosion of the cartridge. When the gun is placed in contact with the skin the lesion is flanked by two or four symmetrical circular areas of deposits of soot corresponding to the number of the holes located on the muzzle [7]. According to the method proposed by Pollak [9], knowing the angle formed by the ducts of the waste gas, with the central axis of the weapon and the distance between the smoke and the lesion, it is possible to calculate the angle of the shot of the captive bolt pistol in the sagittal plane, with a greater soot pattern below the obtuse angle, and a smaller soot pattern under the acute angle [4]. The Janssen and Stieger formula [10] is based on the same principle and can be used to calculate the slope of the gun in the sagittal plane but not in the transverse plane [8].

Cases with small "powder tattooing" in the portion of the skin between the piston and the lateral gas outlets [5] and others without any appreciable traces of burns or powder tattooing, were reported in the literature [6].

In cases where the gun is placed in contact to

the head, the piston once expelled, with a speed of about 56m/ sec, (only slightly greater than that of a piercing dagger) [11] penetrates the skull for a length that varies from 6 to 9 cm, depending on both the different gun models, whether the shot is in contact or at very short distance from the body [1- 12].

The length of penetration is a few centimetres more than the length of the piston, [7] because its action creates bone fractures in less resistance regions such as the orbital regions, the temporal bones, the cribriform plate and the middle cranial fossa. The presence of bone fragments deepens the wound. The appearance of indirect bone lesions is explained by the shock wave accompanying the penetration of the piston and the increase of the intracranial pressure [13].

A case series analysed by the Department of Forensic Medicine in Siena, describing the characteristics of the entry holes generated by the action of a slaughter gun, is presented in the current work.

CASES PRESENTATION

Case 1 (External examination n. 48, 28th November 1968)

In the morning of the 28th of November 1968, the body of a man, seventy years old, was found in a field near his house, in the countryside of Siena, Italy. He was a married retired farm worker. Beside his corpse there was a captive bolt pistol that the man used to kill his animals. The man was suffering from metastatic gastric cancer and had not returned home the previous evening.

The man was found in poor general condition, with reduced muscle mass and thin adipose tissue. His height was 185 cm. Stiffness was present and recognized throughout his body. Hypostasis were scarce, pale, and disappeared with digital pressure. The temperature of his body was identical with that of the environment. There were no putrefactive signs. During the external examination of his body, a circular wound of 1 cm in diameter, with sharp margins, slightly inverted and excoriated, from which flowed blood and cerebral material, was found in the right temporal region, 4 cm far from the external margin of his right eyebrow. His death was caused by an encephalic lesion produced by a shot fired from a captive bolt pistol.

Case 2 (external examination n.82, 7th November 1988)

At 17.30 on the 7th of November 1988, a 41 aged woman, divorced, sheep farmer was found lifeless by her partner. Her body was lying on a bed in her bedroom in a farm in the Siena countryside. Beside her corpse there was a stun bolt gun that she routinely used to kill lambs. In the room a few farewell letters to her family and partner were found.

Her corpse was supine on a bed. The external

examination of the body showed scarce hypostasis in the regions of the trunk and limbs, not subjected to compression, completely disappearing with digital pressure. The rectal temperature was 30° C, the surrounding temperature 14° C. Muscle stiffness was present and valid in all muscle groups. On the left hemithorax, in submammary region, at the level of the fifth intercostal space, on the midclavicular line, there was a wound circular in shape with inverted and bruised margins, with excoriation of height of 0.2 cm and diameter of cm 1. The wound was distant 121 cm from the sole of the left foot, 18 cm from the upper margin of the sternum and 46 cm from the vertex of the head; it was



Figure 1. Entrance wound with soot patterns.



Figure 2. Entrance wound after washing with water.



Figure 3. Captive-bolt pistol.

surrounded by smoke deposits more pronounced above with height of 2 cm and by linear reddish semicircular shaped area, more evident in the right side of the lesion, where it had a height of 0.3 cm, and less evident to the left where it became discontinuous and had a lower height. The cause of death was identified in heart and lung lesions produced by a shot from a captive bolt pistol.

Case 3 (external examination n.15 6th June 2015)

An agricultural worker, retired, who raised animals for domestic use, aged 77, was found dead in the woods near his home in Siena on the 6th of June 2015. The man had been reported missing by his family the day before. After having been operated for prostate cancer, he suffered from urinary incontinence and was forced to constantly wear a sanitary diaper. He was found by the bank of a brook, in supine position, with his head thrown back, and in the right temporal region there was the retractable piston of a bolt gun that penetrated the skin and bone surfaces. The external examination of the corpse detected a temperature of 25 ° C, hypostasis was represented by purple colored spots, in the regions of trunk and limbs, that did not disappear with digital pressure. Stiffness was present and valid in all his body areas. On the scalp, in the occipital and right temporal region, there was dried blood and clusters of fly eggs.

In the right temporal region, there was a round shaped wound, with the diameter of 1 cm, with bruised and inverted margins, oozing blood. It was surrounded by irregular shaped soot pattern, obliquely oriented, directed from the right external acoustic meatus to the upper outer of the eyebrow region, more accentuated on the top, where it had a length of 6 cm, while on the bottom it had a length of 4 cm. The black soot pattern disappeared after washing with water.

The lesion was surrounded by excoriation, with an average height of 0.2 cm, more accentuated in correspondence of the upper concavity of the lesion. This wound was distant 11 cm from the top of the head, 159 cm from the sole of the right foot and 10 cm from the external acoustic meatus of the right (Figs 1 -2). The examination of the weapon showed that it was a metal cylinder of 20 cm in which there was a piston with a circular cross section of diameter of 1 cm and length of 13 cm. The piston tip was concave with very sharp edges. Symmetrically to the outlet hole of the central piston, there were two circular apertures of 0.3 cm diameter placed at a distance of 3 cm between them. The weapon was rusty and there was no trademark (Fig. 3).

DISCUSSION

The main medico-legal issues that emerge from the presented cases primarily concern the recognition of the specific injury linked to the action of captive-bolt,

because of the particularity of its mechanism of action and the scarcity of cases. Almost the totality of the cases reported in literature describe wounds placed at the right temporal region, feature that we found in the first and the third case of our study. The lesions we found in the first one (wound with rounded shape, diameter of 1 cm and bruised and inverted margins) and the third case (wound with rounded shape diameter of 1 cm with bruised and inverted margins, surrounded by soot deposits disappearing after washing), are broadly comparable to those described in literature [5-6]. Furthermore, in the third case we reported, the piston of the gun remained in the skull after penetration, an event that can occur because of the low speed of impact and insufficient strength of the retraction spring [14]. There are significant differences between entrance wounds caused by captive-bolt pistols compared to those provoked by large calibre weapons with a single load; in fact, in the first case the entrance wound was similar to a punched hole, lacking of the star shape aspect, with the arrangement of the two different zones of soot deposits, corresponding to the two ducts that divert the exhaust gases [4]. In addition it is not possible to find the bullet, unlike what happens when typical weapons are used [6].

In the second case we examined the wound was placed in a different body region: the left thoracic region. This localization is rarely reported in the cases described in literature [15]. The entrance wound consisted of a wound quite similar to those described in correspondence of the head, circular in shape, with inverted, regular and bruised margins, surrounded by soot and a contusion area, of the height of 0.2 cm and diameter of 1 cm. Also in this case, the differences with a bullet exploded by a typical firearm are represented by the absence of an exit hole, the different soot patterns, the dead-end bullet path and the bullet absence.

A second issue to be analysed is the event classification as suicide, homicide, accidental death, or occupational injury. It is important to take into account circumstantial data, such as the weapon inability to cause harm if it is not used at close range, employment, job and psychological background of the victim. All our cases are due to suicidal events. Fundamental to operate this classification in our cases were the on-the-spot investigations and surveys on weapon's position related to the corpse: in the second case the weapon was found a few centimetres from the body with the piston tucked up, in line with the fall following the shot, in a room with doors and windows locked from the inside. In the third case, however, the weapon had the piston into the skull and the cylinder of the gun tightened by the right arm, a few centimetres apart from the right hand, in line with a shot exploded with the gun held by the right hand and angled obliquely to the temporal region, as evidenced by the particular soot pattern. It was also taken in account that the latest generation guns (captive stylus) are

incapable of causing offense except when fired at close range (under 10 cm) [5, 7]: this makes the murder very unlikely as compared to nail guns.

Gender, occupation, place of residence and psychological state, were then analysed as important factors in choosing the suicidal mode [2].

Epidemiological data show that the average age of the suicides with this weapon is of 40.5 years [1] consisting mainly of suicides of male subjects with low levels of education, from rural areas.

This last parameter was observed in all the cases we examined; as regards the age and sex there were two male seventy years old and a 41 year old woman.

All subjects used the weapon to kill animals bred by them and, in all the cases, they were affected by psychological problems, arising in the cases 1 and 3 from serious state of illness, and, for the case 2, from emotional problems.

The strength of our study is to furnish photographic information and description about a kind of weapon that is rarely used in suicidal cases and provide indications on how to recognize the particular entrance wound generated by this weapon.

The limits of our study are represented by the availability of photographs inherent only the last case we described, as the photographic archive of our Institute of Legal Medicine does not contain photographic documentation prior to 1990, and the lack of autopsy related data. In the cases we described for the clarity of the circumstantial data and the causes of death identified during the external examination of the corpse, the magistrate decided not to proceed to further autopsy investigations, as established by the Italian Law. Another limit of our study is not to provide any indication about GSRs. Because the described circumstances were certainly suggestive of self infliction, the magistrate did not proceed with further analyses in the last case. For the other cases this kind of analysis was not available.

In conclusion, captive bolt pistols are a rare source of harm for humans, almost always limited to suicidal events. In the presented cases, all the data collected during the inspection and the evidence found during external examinations were indicative of suicidal events. Those who use bolt guns in suicides, are people who know how to use them, because of their occupation, in particular environmental conditions (rural areas, livestock breeding), and often with serious psychological backgrounds. In many countries, including Italy, there is no legislation governing the license to use such devices, even though the cases we described stress the need for psychological assessment to permit their possession and utilization.

Conflict of interest. The authors declare that there is no conflict of interest.

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