



## Case Report

## An unusual exit wound as a result of a shotgun suicide to the head



S.N. Kunz

Department of Forensic Medicine, Landspítali University Hospital, v/Barónstíg 101, Reykjavík, Iceland

## ARTICLE INFO

## Article history:

Received 31 January 2017

Received in revised form 2 March 2017

Accepted 22 March 2017

Available online 30 March 2017

## Keywords:

Forensic science

Firearm fatality

Suicide

Reconstruction

Shotgun

## ABSTRACT

The location of a gunshot entrance wound as well as the wound path trajectory are the main findings that help to determine the position from which a weapon was fired and thus distinguish firearm suicides from homicides and accidents. We present a case of a 28-year old man, who was found dead in his car. Because of an unusual position of the firearm, which was clamped into the steering wheel, and an unclear entrance/exit wound, an autopsy was performed.

The deceased showed typical signs of a contact shotgun wound to the head with an entrance wound in the right temporal region and an exit wound in the midface. With the help of gunpowder attachments and a muzzle imprint at the entrance site, a wound channel from the right lower posterior part of the temporal region to the left anterior part of the mid-facial region could be reconstructed. The stellate wound in the midface was assessed as an atypical exit wound.

The cause of death was a contact shotgun shot to the right temple with a consequent central regulatory failure due to extensive brain injury. The manner of death was concluded to be a suicide.

© 2017 Elsevier B.V. All rights reserved.

The assessment of fatal gunshot wounds to the head is a common task for the forensic pathologist. The identification and interpretation of typical and sometimes unusual pathomorphological findings at the entrance and exit wound as well the wound path trajectory play an important part in reconstructing the position of the shooting hand and the firearm [1]. In most cases characteristic autopsy features reveal typical skin lacerations that can be defined as a gunshot entrance or exit wound [2]. Due to the high velocity of the projectile, its rotational spin and thus its interaction with the highly elastic skin, the entrance wound has a centered substance defect with a diameter approximately matching the penetrating projectile. Its margins are covered with a ring of dirt, which was rubbed off from the projectile onto the skin during the penetrating process. In the immediate surrounding an abrasion ring can be detected. This finding is a loss of superficial skin layer and epidermis as a result of the transmitted energy into the skin and the underlying soft tissue. In addition, the temporary overstretching of the skin causes an additional reddish-bluish circular bruising around the entrance wound, the so-called contusion zone. The exit wound, on the other hand, can be quite variable. It is mainly characterized by the absence of these typical

entrance wound morphologies. Its margins are adaptable and frequently irregularly shaped (Table 1).

The anatomical site of an entrance and exit wound [3] as well as the shooting distance are important details that help to determine the manner in which a weapon was used [4]. Gunpowder residues and specific bloodstain pattern such as backspatter are additional important parts of a crime scene reconstruction [5,6]. The actual extent of a shotgun injury correlates with the interdependency between the pellets, their spread, the tissue and in case of close-range shots also with the gas pressure. Depending on the nature of the bullet (its caliber, mass, velocity, shape, material, construction, etc.) and the target (its density, elasticity, viscosity, etc.) different degrees of soft tissue damages occur in the affected body region [7]. In this context, however, it should be pointed out that in contrast to long-range shots, close-range shots cause more intense injuries, which could make a differentiation between an entrance and exit wound quite difficult. Due to a number of mostly unknown variables such as shooting angle and distance, as well as the position of the shooting hand and the firearm, a broad experience is needed when examining such events.

The same applies to blast wave injuries, which sometimes could mimic a gunshot wound pattern [8].

In addition to the morphological findings, a detailed physiological [9] and psychological [10] background analysis of the victim

E-mail address: [sebastian@lsh.is](mailto:sebastian@lsh.is) (S.N. Kunz).

**Table 1**  
Morphological characteristics of a shotgun entrance and exit wound.

	Skin laceration	Wound margin	Immediate wound surrounding	Further wound surrounding	Skull
Entrance wound	Central tissue defect	Bullet wipe mark	Abrasion ring	Contusion ring	Cone-shaped outward beveling in the shooting direction
Exit wound	Wound edges can be approximated	Irregular, torn, slit-like	No abrasion ring	No contusion ring	

can assist to distinguish between a suicide, an accident or a homicide.

In the present case, a shotgun wound to the head caused an unusual laceration wound in the midface and a circular skin defect in the right temporal region. On scene it was not possible for the physician to clearly differentiate the entrance from the exit wound, which is why he declared an unknown manner of death. In consequence, the district attorney ordered a forensic autopsy.

### 1. Case background

A 28-year old man was reported missing by his mother. He had a medical history of depression, for which he took antidepressant drugs. According to his mother, her son was right-handed. Four months ago he had tried to commit suicide with a knife, but had been caught in time. Eventually the man was found sitting in the driver's seat of his car, which was parked in an uninhabited territory. A shotgun was positioned between his legs and at the same time firmly fixed in the steering wheel of the vehicle (Figs. 1 and 2). Brain tissue mixed with blood and some lead pellets were found on the center console of the car. Bloody soft tissue was widely spread over the ceiling. Suicide notes were found in the car, addressed to his wife and child.

### 2. Weapon

The weapon used was a Russian Baikal double-barrel over-under 12-gauge shotgun with a 71 cm (28 inch) long barrel (Fig. 3a). The shotgun was in the lawful possession of the father of the deceased and it was apparent that his gun cabinet had been broken into with a crow bar and the weapon had been stolen. A few uncharacteristic bloodstains could be detected at the end of the barrel, however no clear backspatter was identifiable. On examination of its inside, atypical soft tissue particles were found. An angle of incidence could not be calculated. No bloodstains were seen in the lower parts of the weapon.



**Fig. 1.** Final position, in which the deceased was found.

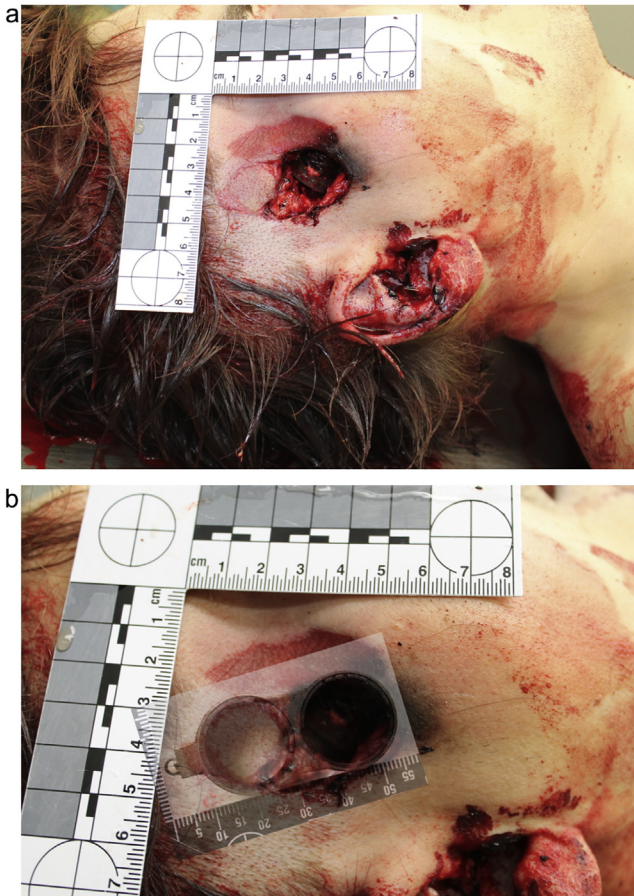


**Fig. 2.** Position of the shotgun at the crime scene.

Upon opening the barrel two shotgun 12/70 cartridges of the company "Lyalvale Express" had been placed in both barrels, of which the lower cartridge had been fired (Fig. 3b). The ammunition contain lead pellets with a weight of 36 g.



**Fig. 3.** (a) Weapon, which was found in the car next to the body. (b) Cartridge, which was found in the weapon.



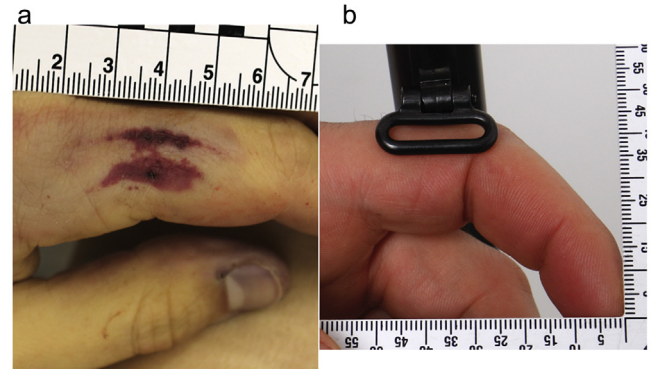
**Fig. 4.** (a) Entrance wound. (b) Entrance wound with muzzle imprint, matching the barrel of the shotgun.

### 3. Autopsy report

The autopsy findings suggested a contact shotgun wound to the right temple. The bullet trajectory was from the right lower posterior part of the skull to the left upper anterior part of the midface region toward the left eyebrow. The wound channel led intracranially from the right temporal area slightly oblique to the midsection of both frontal lobes with a large destruction path of



**Fig. 5.** Stellate exit wound.



**Fig. 6.** (a, b) Sling swivel at the shotgun and resulting injury.

brain tissue and skull bone. Within the destroyed brain tissue several widely spread lead pellets were found, some of which showed irregular surface damages.

The examination of the circular wound in the right temporal region with a stereomicroscope revealed a muzzle imprint, an abrasion rim and short radial skin tears in the upper margin of the defect (Fig. 4a,b). Furthermore a rather large soot cavity appeared within the underlying soft tissue of the defect.

In the midface, an irregular stellate wound with three radial tears could be detected. No soot cavity or abrasion ring was present (Fig. 5).

In the area of the right temple, several star-shaped direct fracture lines had developed. However, due to the high amount of bone fragments, no characteristic external or internal beveling could be identified. In addition, the skull showed several secondary fracture lines in the neurocranium, reaching in various directions with their center located in the forehead and frontobasal region. Here, several irregularly and partially polygonally shaped bone fractures were seen.

All other organs were age appropriate and unremarkable. No signs of trauma or relevant pathophysiological changes were seen here.

The armlength of the deceased (measured from the armpit to tip of the middle finger) was 72 cm. On the lateral side of the index finger of the left hand two parallel and slightly arched superficial abrasion marks with a distinct dark red skin discoloration were detected (Fig. 6a).

A performed toxicological analysis revealed therapeutic blood levels of sertraline (130 ng/ml), an antidepressant of the selective serotonin reuptake inhibitor class. Otherwise the results of the analyses do not give any further information regarding the man's death.

The cause of death was a contact shotgun shot to the right temple with a consequent central regulatory failure due to extensive brain injury. The manner of death was concluded to be a suicide.

### 4. Discussion

The average resident doctor or emergency physician is not trained in the various aspects of forensic medicine, yet alone in the assessment of shotgun injuries [11]. This can become a problem when general practitioners have to perform a post mortem external inspection of a body and fill out a death certificate [12]. Especially in shooting incidents, when the presumed entrance wound does not have the expected typical wound morphology or is located at an unusual anatomical location, a high level of special knowledge is expected from the examining physician [13]. For



Fig. 7. Reconstructed position of the shooting hand and of the firearm.

instance, an unusual handling of a weapon or the use of unconventional, sometimes self constructed shooting devices can lead to exceptional injuries that complicate a forensic assessment [14]. Furthermore, atypical entrance wounds can be the result of multiple shots [15], extremely short-range shots [16] or bullet instability due to ricochet [17] and intermediate targets [18,19]. The condition of the firearm [20] as well as the ammunition [21] is also essential.

In such cases, where the common morphological features of a shotgun wound are not apparent and thus the manner of death is questionable, it is not enough that the general physician on scene performs the post mortem external examination and concludes that an autopsy is necessary. In order to prevent any shortcomings of post-mortem examinations on out-of-hospital deaths in cases like this one, it is essential that a forensic expert is called to the crime scene [22].

In accordance with several previous analyses, the deceased at hand showed typical characteristics that indicate a suicide. As a right-handed white male, he is overrepresented in most studies [1–5,23]. The right temporal region is the most common choice of the anatomical site of an entrance wound in several suicide studies [23–26]. He had a clear muzzle imprint from the weapon, which indicated a close-range contact shot [26]. The abrasion injury on the left index finger was interpreted as an atypical gun-slide wound. Even though it was not caused by the typical movement of the slide, but by the recoil, this injury helped to determine the position in which the weapon was held at the time of the shot

(Figs. 6 b and 7 ). Taking into account the position in which the weapon was fixed to the steering wheel as well as the muzzle imprint, the weapon must have been held in a slightly forward bended, sitting position. The right hand was on the trigger and the left hand supported the gun whilst holding onto its sling swivel (Fig. 7). This reconstruction is supported by the gun-slide injury on the left index finger, the incomplete and slightly oblique muzzle imprint as well as the unusual wound channel.

## 5. Conclusion

This case is a remarkable example of the importance of a detailed forensic analysis not only on the crime scene, but also during autopsy. Especially for a physician, who is not experienced in shotgun injuries, an external postmortem examination can be challenging. In these cases, a forensic pathologist should always be consulted and an autopsy should be performed.

## Conflict of interest

This article is a result of forensic reconstruction work, which was done for the police. The research was not funded and there is no actual or potential conflict of interest in relation to this article.

## References

- [1] S.N. Kunz, H.J. Meyer, S. Kraus, *Gerichtsmedizinische Aspekte suizidaler Schussverletzungen—eine Übersichtsarbeit am Beispiel Deutschlands*, *Wien. Med. Wochenschr.* 163 (2013) 541–548.
- [2] B. Karger, E. Billeb, E. Koops, B. Brinkmann, *Autopsy features relevant for discrimination between suicidal and homicidal gunshot injuries*, *Int. J. Leg. Med.* 116 (2002) 273–278.
- [3] H. Druid, *Site of entrance wound and direction of bullet path in firearm fatalities as indicators of homicide versus suicide*, *Forensic Sci. Int.* 88 (1997) 147–162.
- [4] D.K. Molina, L.E. Wood, V.J. DiMaio, *Shotgun wounds: a review of range and location as pertaining to manner of death*, *Am. J. Forensic Med. Pathol.* 28 (2007) 99–102.
- [5] B. Karger, *Forensic ballistics: injuries from gunshots, explosives and arrows*, in: B. Madea (Ed.), *Handbook of Forensic Medicine*, John Wiley & Sons, Ltd., Oxford, 2014, pp. 328–366.
- [6] S.N. Kunz, H. Brandtner, H.J. Meyer, *Characteristics of backspatter on the firearm and shooting hand—an experimental analysis of close-range gunshots*, *J. Forensic Sci.* 60 (2015) 166–170.
- [7] B. Karger, *Gunshot injuries from shotguns*, *Rechtsmedizin* 20 (2010) 75–79.
- [8] S.N. Kunz, B. Zinka, O. Peschel, S. Fieseler, *Accidental head explosion: an unusual blast wave injury as a result of self-made fireworks*, *Forensic Sci. Int.* 210 (2011) e4–e6.
- [9] S. Nikolic, V. Zivkovic, D. Babic, F. Jukovic, *Suicidal single gunshot injury to the head: differences in site of entrance wound and direction of the bullet path between right- and left-handed—an autopsy study*, *Am. J. Forensic Med. Pathol.* 33 (2012) 43–46.
- [10] W. Feigelman, Z. Rosen, B.S. Gorman, *Exploring prospective predictors of completed suicides, evidence from the general social survey*, *Crisis* 35 (2015) 233–244.
- [11] P.E. Lantz, *An atypical, indeterminate-range, cranial gunshot wound of entrance resembling an exit wound*, *Am. J. Forensic Med. Pathol.* 15 (1994) 5–9.
- [12] S.N. Kunz, A. Manthei, H. Meyer, *Morphological particularities of gunshot wounds from self constructed shooting devices*, *Kriminalistik* 11 (2014) 667–670.
- [13] J.D. Apfelbaum, L.W. Shockley, J.W. Wahe, E.E. Moore, *Entrance and exit gunshot wounds: incorrect terms for the emergency department?* *J. Emerg. Med.* 16 (1998) 741–745.
- [14] M.A. Rothschild, *Problems with the external postmortem examination. From the view of resident doctors, clinicians, emergency physicians and the police*, *Rechtsmedizin* 19 (2009) 407–412.
- [15] L. Tattoli, S. Schmid, M. Tsokos, *Three rounds as “tandem bullets”: unusual findings in a case of suicidal gunshot to the head*, *Forensic Sci. Med. Pathol.* 10 (2014) 613–618.
- [16] W. Rabl, W. Eller, *Wound ballistics of extremely short-range shotguns*, *Arch. Kriminol.* 192 (1993) 43–48.
- [17] S.N. Kunz, S. Kirchhoff, R. Eggersmann, D. Stiefel, M. Gessinger, A. Manthei, S. Eichner, M. Graw, O. Peschel, *Ricocheted rifle and shotgun projectiles: a ballistic evaluation*, *J. Test. Eval.* 42 (2014) 277–284.

- [18] C. Gulmann, H.P. Hougen, Entrance, exit, and reentrance of one shot with a shotgun, *Am. J. Forensic Med. Pathol.* 20 (1999) 13–16.
- [19] K. Cail, E. Klatt, The effect of intermediate clothing targets on shotgun ballistics, *Am. J. Forensic Med. Pathol.* 34 (2013) 348–351.
- [20] D.K. Molina, J.J. Rulon, E.I. Wallace, The atypical entrance wound: differential diagnosis and discussion of an unusual cause, *Am. J. Forensic Med. Pathol.* 33 (2012) 250–252.
- [21] D. Luchini, M. Di Paolo, G. Morabito, M. Gabbrielli, Case report of a homicide by a shotgun loaded with unusual ammunition, *Am. J. Forensic Med. Pathol.* 24 (2003) 198–201.
- [22] A.S. Schröder, S. Wilmes, S. Sehner, M. Ehrhardt, H. Kaduszkiewicz, S. Anders, Post-mortem external examination: competence, education and accuracy of general practitioners in a metropolitan area, *Int. J. Leg. Med.* (2017), doi:<http://dx.doi.org/10.1007/s00414-017-1559-9> (Epub ahead of print).
- [23] R. Blumenthal, Suicidal gunshot wounds to the head: a retrospective review of 406 cases, *Am. J. Forensic Med. Pathol.* 28 (2007) 288–291.
- [24] M.M. Blessing, P.T. Lin, Suicide by shotgun in Southeastern Minnesota, *J. Forensic Sci.* 61 (2016) S159–162.
- [25] J.W. Eisele, D.T. Reay, A. Cook, Sites of the suicidal gunshot wounds, *J. Forensic Sci.* 26 (1981) 480–485.
- [26] M.J. Thali, B.P. Kneubuehl, R. Dirnhofer, U. Zollinger, The dynamic development of the muzzle imprint by contact gunshot: high-speed documentation utilizing the “skin-skull-brain model”, *Forensic Sci. Int.* 127 (2002) 168–173.