

## ORIGINAL ARTICLE

M. A. Rothschild · B. Karger · H. Strauch · H. Joachim

**Fatal wounds to the thorax caused by gunshots from blank cartridges**

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**Abstract** Lethal injuries of the thorax due to shots fired from blank cartridges calibre 8 mm are reported in three cases. The muzzle of the weapon was in contact with the left side of the breast (contact discharge) and injuries to bones were absent in all three cases. In two of the cases the pericardium was not involved but the anterior wall of the right heart ventricle was ruptured and death was due to cardiac tamponade. In the third case the pericardial sac and the left ventricle were both ruptured and the victim died due to rapid exsanguination. The cases demonstrate that the gas pressure from the exploding propellant of blank ammunition can be powerful enough to penetrate the thoracic wall.

**Key words** Wound ballistics · Starter's pistols · Blank cartridges · Fatalities

**Introduction**

Guns loaded with blank cartridges can result in severe and even lethal injuries when fired at close or contact range. In most fatalities published the head [4, 6, 7, 9] or the neck [4, 6] were the target areas and the most common cause of death was rapid exsanguination from ruptured blood vessels which had been injured by the gas pressure

of the exploding propellant. The gas pressure caused by shots fired from blank cartridges can also cause fractures of the skull [4, 7, 9] but cases involving the thorax have rarely been reported [1, 2, 10]. Three cases of lethal injuries to the thorax are reported where neither the gun nor the blank cartridges had been manipulated.

**Case reports****Case 1**

An 18-year-old man was accidentally killed by a contact gunshot from a gas pistol (Rhöner, model SM 15, cal. 8 mm, PTB-No. 83) loaded with a calibre 8 mm blank cartridge (Fig. 1). In the presence of other persons an 18-year-old friend placed the weapon underneath the T-shirt onto the skin of the left breast of the victim and pulled the trigger. He later stated that he had believed that the safety device was locked. The victim died at the scene lying in a pool of blood. The T-shirt did not show any damage. A circular de-



**Fig. 1** The starter's pistol used in case 1: Rhöner, mod. SM 15, cal. 8 mm, PTB-No. 83. Underneath the muzzle an 8 mm blank cartridge

M. A. Rothschild (✉)  
Institute of Legal Medicine, Freie Universität Berlin,  
Hittorfstrasse 18, D-14195 Berlin, Germany  
Fax: +49 (30) 8383 684

B. Karger  
Institute of Legal Medicine, University of Münster,  
Von-Esmarch-Strasse 62, D-48129 Münster, Germany

H. Strauch  
Institute of Legal Medicine, Humboldt Universität zu Berlin,  
Hannoversche Strasse 6, D-10115 Berlin, Germany

H. Joachim  
Institute of Legal Medicine, Ruprecht-Karls-Universität,  
P.O. Box 103069, D-69020 Heidelberg, Germany

fect of the skin 15 mm in diameter with short radial tears was located 2 cm below the left mamilla. Soot covered only the margin of this defect and was surrounded by a brownish excoriation zone 9 mm wide representing a muzzle imprint. Radiology of the corpse did not reveal any foreign body. The subcutaneous tissues underneath the skin defect were undermined and the greater pectoral muscle was lacerated and showed a light red colour. The intercostal muscles between the third and the fourth rib showed a lacerated defect approximately 20 mm in diameter. The subcutaneous cavity and the intercostal muscles were partially covered with soot. The anterior surface of the pericardial sac was torn open and the anterior wall of the left ventricle showed an oblique and jagged rupture 2 cm in length surrounded by small haemorrhages. The pericardial sac contained 70 ml of blood. The pleura of the left lung was intact but a small zone of extravasation was located below the pleura of the medial aspect of the left upper lobe. A haemothorax (400 ml) had developed at the left side. There were hardly any livores and the organs were pale.

Additional injuries or pathological organ findings could not be detected. The blood alcohol concentration was 1.38 g/l, additional toxicological examinations showed negative results.

Cause of death: exsanguination.

## Case 2

A 21-year-old man was killed by another young man during a brawl by a contact shot with a pistol (Röhm, model RG 800, cal. 8 mm, PTB-No. 414) loaded with calibre 8 mm blank cartridges. The 21-year-old perpetrator pressed the muzzle of the pistol against the left side of the chest (contact discharge) and fired the gun. The victim collapsed immediately. Attempts at resuscitation remained unsuccessful and the victim died at the scene.

A star-shaped laceration 3.5 cm in diameter with frayed and blackened rims of the textile was located below the chest pocket of the shirt and the fabric was melted at the edges. A 16 × 13 mm oval shaped defect of the skin was located in the medial part of the left chest within a reddening of the skin 4 cm in diameter (Fig. 2). A black rim 2 mm wide surrounded the entrance wound and a ring-shaped excoriation (imprint from the lower half of the pistol's bolt) was located 15 mm from this entrance defect. Radiological examinations showed no foreign bodies.



**Fig. 2** Case 2. The chest of the victim with an oval gunshot wound surrounded by a ring-shaped excoriation representing an imprint mark from the bolt of the pistol



**Fig. 3** Case 2. The anterior aspect of the heart with a rupture of the heart muscle (30 mm) including opening of the right ventricle

A large wound cavity covered with soot was located in the soft tissues of the chest. The intercostal muscles between the sixth and seventh rib showed a defect measuring 10 × 12 mm. The left lung had collapsed and the left pleural cavity contained approximately 50 ml of blood. The anterior aspect of the pericardium showed intensive haemorrhages but no ruptures. The pericardial sac was filled with 250 ml of blood. The anterior wall of the heart was ruptured for 30 mm which resulted in a wide opening of the right ventricle (Fig. 3) and numerous parts of the trabecular system were ruptured. The cranial part of the right hepatic lobe below the pericardium showed superficial tears in an area of 30 × 20 mm. The peritoneal cavity contained 50 ml of blood.

No additional injuries or pathological changes of the inner organs could be detected. The blood alcohol concentration was 1.93 g/l and urine alcohol 2.78 g/l. Additional toxicological investigations were negative.

Cause of death: cardiac tamponade.

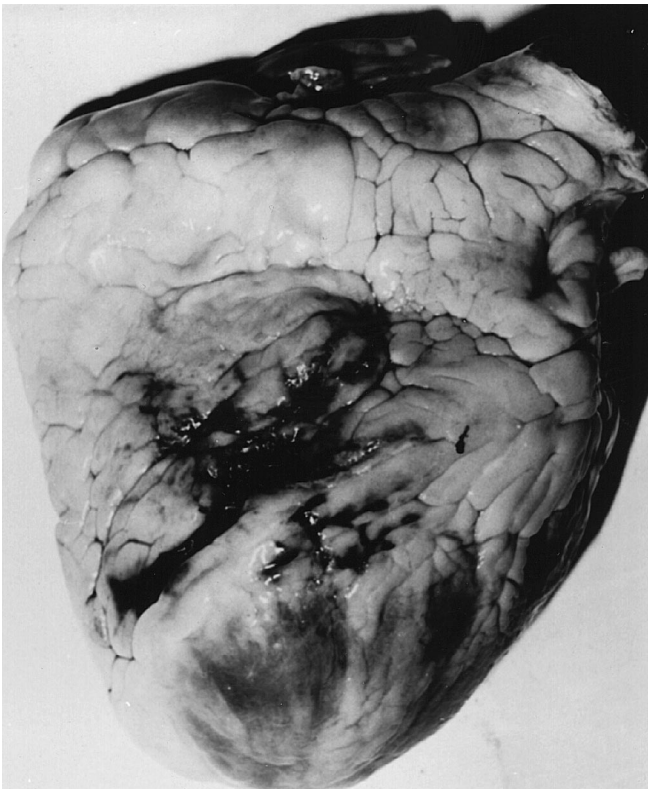
## Case 3

A 69-year-old woman killed herself in her apartment with a pistol (Melcher, model ME 8 Detective II, cal. 8 mm, PTB-No. 100/2) loaded with calibre 8 mm blank cartridges. The body was found in a supine position on the kitchen floor with the right hand lying above the gun. A suicide note was found in the living room.

The clothing (T-shirt and vest) was pushed up but undamaged [3]. A circular defect of the skin 7 mm in diameter was located in the parasternal region of the left chest (Fig. 4). The wound was surrounded by a circular excoriation 20 mm wide representing a contact muzzle imprint. The skin around the wound showed a reddening 4 cm in diameter. Radiological examination of the body did not reveal any projectile or fragments.



**Fig. 4** Case 3. Contact gunshot wound in the parasternal region of the left chest. The central circular defect is surrounded by a circular excoriation representing a contact muzzle imprint



**Fig. 5** Case 3. The anterior aspect of the heart including a rupture of the anterior wall of the right ventricle

In the subcutaneous tissues underneath the wound there was a rupture 6 cm in diameter and the wound cavity was filled with destroyed tissue and powder soot. The major pectoral muscle, which was ruptured, had a light red colour due to the effect of CO-Hemoglobin. Close to the sternum, the intercostal muscles between the sixth and seventh rib showed a defect 20 mm in diameter with soot at the wound margins. The ribs were not injured and the ventral part of the mediastinum showed intensive haemorrhages and ruptures of the soft tissues. Haemorrhages and soot were also located at the anterior aspect of the pericardium but the pericardial sac showed no ruptures. The left lung had collapsed (pneumothorax) and the pericardial sac was filled with 350 ml of blood due to a rupture of the anterior wall of the right heart ventricle measuring approximately  $60 \times 20$  mm (Fig. 5).

Apart from the gunshot wound there were no additional injuries. Pathological organ findings included old infarction scars in the left ventricle of the heart and general arteriosclerosis. The toxicological screening showed negative results: only subtherapeutic concentrations of phenylbutazone could be identified.

Cause of death: cardiac tamponade.

## Discussion

The German weapon law allows the purchase of starter's pistols without a license. While carrying these guns, the holder only has to have a valid ID. The hazard of shots with starter's pistols fired at close or contact range is well documented [2, 4, 6, 7, 9] but severe or even lethal injuries due to shots with blank cartridges against the thorax have rarely been reported [1, 2, 10]. The cases presented in this report give an impression of the potential effects of the gas pressure of the exploding propellant from shots fired from blank cartridges and show several common features:

- The starter's pistols and also the blank ammunition were not manipulated and the guns did not contain any projectiles or other solid material. In all three cases blank cartridges of calibre 8 mm were used.
- The muzzle of the weapon was in contact (contact discharge) with the left side of the chest.
- Bones were not injured. The flow of the exploding propellant powder gas passed through the intercostal muscles into the mediastinum.
- There were large ruptures of the cardiac walls with opening of the ventricles.

The cardiac findings in cases 2 and 3 are remarkable because of the ruptures of the right heart ventricle in the absence of tears of the pericardial sac. The pericardium only showed intensive haemorrhages. Severe compression of the thoracic wall during resuscitation cannot have caused the ruptures of the heart because there were no fractures of the ribs or sternum [5]. Obviously the jet of the exploding propellant impacted the pericardium onto the cardiac walls. Since the jet of gas acts like a projectile due to the high density of the energy flow [8], this injury pattern can be explained by the different density and elasticity of the tissues involved (i.e. pericardium, heart muscle). Consequently, the cause of death in these two cases was not due to exsanguination but due to cardiac tamponade. In contrast the same type of blank cartridge ruptured the

pericardial sac in case 1. Factors such as the thickness, density and elasticity of the tissues of the thoracic wall, the amount and quality of the propellant of the blank cartridges and the angle of incidence of the jet hitting the pericardium may be important for this different penetration behaviour.

The cases demonstrate that severe and lethal injuries are not restricted to the head or the neck in cases of gunshots from guns loaded with blank cartridges but can also cause massive and lethal wounds to the thorax. At contact range, the gas pressure of the exploding propellant can be powerful enough to penetrate the intercostal muscles and to cause severe injury to the heart.

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