Homicide due to gunshot wound to the shank and shoulder with arterial bullet embolization

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Abstract: Penetration of the bullet into the vascular bed in a gunshot wound resulting in embolism is rarely described in the medical literature. Bullet embolism may be a diagnostic and therapeutic challenge and a source of serious subsequent complications. The aim of this paper is a case report of a criminal assault on a 67-year-old man who sustained two fatal gunshot wounds during the robbery. An autopsy revealed a large comminuted fracture of the right humerus with destruction and massive bleeding to the soft tissues, damage to the a. axillaris dextra with bullet embolism in the bifurcation area of a. ilica communis sinistra and a comminuted fracture of the left tibia with destruction and massive bleeding to the soft tissues. The cause of death was haemorrhagic shock due to massive external bleeding. The victim was not affected by foreign substances. Whole-body examination by imaging methods within autopsy is necessary even in seemingly trivial peripheral gunshot wounds to the extremities.

Key Words: gunshot wound, arterial bullet embolization, whole-body imaging.

Gunshot wounds are associated with major morbidity and mortality rates [1]. Bullet embolism within the vascular stream is a rare but important consequence of penetrating gunshot injuries [2-4]. It presents unexpected sequelae to the otherwise predictable injury pattern of penetrating missile injury mechanism and poses a challenging diagnostic and therapeutic dilemma. The potential complications can be devastating including limb-threatening ischemia, sepsis, endocarditis, cardiac valvular incompetence, pulmonary embolism, stroke, and even death [5]. The first bullet embolism was reported in 1834 [6]. To date, there have been fewer than 200 published cases of a bullet embolism [7]. The exact incidence of bullet embolism is unknown, but it was estimated to be 0.3% during the Vietnam War [8] and 1.1% in the conflict in Afghanistan and Iraq [5]. According to the literature, more than 70% of cases of missiles penetrate into the arterial circulation either through the thoracic or abdominal aorta or even through the heart, only a few cases occurred following a gunshot wound to the upper extremity [2, 9].

The aim of this paper is to present a homicide case with right shoulder gunshot wound penetrating to the a. axillaris dextra and the a. subclavia dextra to the aortic lumen with subsequent bullet embolism to the a. ilica communis sinistra. This is an unusual case of bullet embolization in the systemic blood circulation after the injury of a peripheral artery.

CASE HISTORY

A 67-year-old man was assaulted with a firearm during the robbery in his goldsmiths. The attacker used a submachine gun Model 61-Scorpion made in

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Czechoslovakia. The victim sustained two gunshot wounds – a penetrating wound in the right shoulder and a perforating wound in the left shank. Despite a skilled resuscitation, he died at the scene of a shooting.

**METHODS**

An external examination of the body, autopsy and additional laboratory examinations including X-ray examination were performed.

**RESULTS**

On autopsy, an entrance wound was found on the lateral surface of the right shoulder. No exit wound was found. The bullet penetrated the skin tangentially through a wound sized 0.8x0.5 cm with a margin of abrasion up to 3x1.8 cm (Fig. 1). There was found a large comminuted fracture of the right humerus with destruction and massive bleeding to the soft tissues (Fig. 2). Blood vessels in the area of the fracture were damaged and through the right a. axillaris there was a penetration of the calibre projectile 0.765 cm into the vascular bed with its embolization into the bifurcation of the left a. iliaca communis or more precisely a. iliaca interna (Figs. 3, 4). No damage to the thoracic and abdominal aortic wall in its entirety was found. In the area of the left shank, there was found a perforating wound with a comminuted fracture of tibiae and massive bleeding to the soft tissues. The cause of death was haemorrhagic shock due to massive external bleeding from gunshots. The victim was not affected by ethanol or other foreign substances.

**DISCUSSION AND CONCLUSION**

Bullet embolism is very rare in everyday forensic medicine practice. The low incidence of bullet embolism has been explained by Patel et al. [10]. For a projectile to become an embolus, two major prerequisites need to be satisfied. First, the bullet should have little kinetic energy remaining at the precise instant it enters the blood vessel. Second, the diameter of the bullet must be less than the diameter of the blood vessel it penetrates. This occurs most commonly with small calibre projectiles, airgun pellets or shotguns ammunition which scatters multiple small metallic pellets [11]. Forces, which then influence
the migration of an intravascular foreign body include: hydrostatic pressure from blood flow, gravity, victim's body position, and vascular anatomy. The diagnosis of bullet embolism is often demonstrated on imaging evaluations. Bullet embolism may also be suspected when there is no exit wound and the expected location of a missile, based on its projected trajectory, is discordant with the radiographic findings. In the past, arteriography was used to increase diagnostic confidence [12].

The case presented here is unusual because the autopsy study revealed that the bullet entered the systemic circulation through the wall of a. axillaris. First, it migrated counter to the direction of blood flow through the a. axillaris towards the a. subclavia and into the aortic arch and then it travelled in the direction of blood flow into the bifurcation of a. iliaca or more precisely into the lumen of a. iliaca interna sinistra, where it was eventually lodged.

Our case confirms the fact that if there is suspicion of bullet embolism, a complete radiologic search should be undertaken even in seemingly trivial peripheral gunshot wounds to the extremities with the emphasis on the peripheral vascular system, heart, and pulmonary system, as embolization to these areas has been previously described. Multiple radiographs should be initially evaluated to locate the bullet embolus, followed by CT examination to identify bullet track, and to determine the extent of organ injury [13].

Taking into consideration a possibility of bullet embolism before or on autopsy could shorten the dissection time required to retrieve the bullet [14]. Discovery of the bullet is an obligatory part of investigation in order to positively identify the responsible firearm. In cases of missile embolism, without searching complete trajectory of the bullet in the body by thorough medico-legal autopsy, confusion may arise as to the true track of the bullet.

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

References