Bullet embolism to the pulmonary artery

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Abstract

Bullet embolization of the pulmonary artery is a very rare event. When a bullet enters the pulmonary vasculature, it may cause haemorrhage, thrombosis, sepsis, intimal erosion and eventually occlusion. Locating the bullet with several imaging methods is important to confirm the diagnosis. If due care is taken, the appropriate surgical technique for removing the bullet embolus will be uncomplicated and safe. We report our experience of bullet embolism to the left pulmonary artery.

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1. Introduction

Three types of bullet embolism are known: arterial, venous and paradoxical types. Bullet embolism to the pulmonary artery is a rare complication of penetrating gunshot traumas. An embolism to arterial system is more common than a venous embolism. X-ray, computerized tomography (CT), transthoracic and/or transesophageal echocardiography (TTE, TEE) clarify the diagnosis. There are still controversies about the removal of the bullet. According to the literature, most authors do not recommend removal of the bullet if the patient is asymptomatic. The appropriate surgical procedure must be selected according to the exact location of the bullet [1–3].

2. Case report

A 24-year-old soldier was admitted with a long-distance, 9 mm caliber gunshot wound to the left thigh. Because it was a long-distance shot, we can evaluate this injury as a low kinetic energy wound. At first the patient was admitted to the General Surgery Department of our academy. The entry hole was at the posterior of the left thigh in the middle line 15 cm above the popliteal region but there was no exit site. There was a fracture at the 1/3 distal part of the femur bone and left pedal pulses were present. From the patient’s medical records and at first physical examination, the patient was found to be in a preshock condition. An abdominal roentgenogram showed the bullet (Fig. 1). The patient underwent an emergency laparotomy at the General Surgery Department. A retroperitoneal haematoma was drained; during an examination of the great arteries and veins, no active bleeding and no rupture of the vasculature were found. Additionally the bullet could not be found. Repeat abdominal roentgenogram did not reveal the bullet. On the same day, the chest film showed a metal density in the left hilar area. The patient was asymptomatic for 2 days postoperatively, but then he complained of dyspnea and was transferred to our department. Thoracic CT, TTE and pulmonary angiography were performed and the bullet was located in the lower branch of the left pulmonary artery (Fig. 2).

3. Surgical procedure

Following a median sternotomy, we operated with the heart beating on a cardiopulmonary bypass (CPB). A longitudinal pulmonary arteriotomy incision was extended to the left pulmonary artery. An embolectomy catheter was inserted in the lower branch of the left pulmonary artery, but was not able to engage the bullet. Therefore, the left pleura was opened in order to gain access to the left pulmonary artery from the lower branch of the left hilar region. We identified the bullet by
palpation in the lower branch of the left pulmonary artery. A small arteriotomy directly over this site enabled the bullet to be retrieved using forceps. The arteriotomy was closed and the CPB was terminated. The patient remained intubated for 24 h, but recovered without complication and was discharged from the hospital on the 10th postoperative day.

We administered anticoagulant therapy for prophylaxis of pulmonary thromboembolism which may develop due to the endothelial damage of the pulmonary vasculature. He still does well with functional capacity class I (NYHA) at follow-up.

4. Discussion

Although in most gunshot injuries there are usually two holes, at the entry and exit sites of the bullet, in cases where no exit site is present the physician must consider the bullet embolism. Therefore complete radiographic examination of the body and TTE or TEE of the heart and the great vessels should be performed when necessary.

Two important factors determine the final destination of the bullet. These factors are kinetic energy and the diameter of the bullet. In our case, the bullet was a 9 mm parabellum and had a velocity of 340 m/s. Vascular anatomy, gravity, position of the patient and flow dynamics also affect the destination. Occasionally bullets embolize against the direction of blood flow from the left pulmonary artery to the right ventricle or right subclavian vein to the hepatic vein [4,5]. In our case, the bullet entered from the left thigh 15 cm above the popliteal region, hit the femur at the 1/3 distal part and caused a fracture, and then by changing course passed through the muscle tissue and under the inguinal ligament to enter the venous system at the level between the femoral and iliac veins. Since the distal part of the venous system was not checked, the entry hole of the bullet was not found. Because of the support provided by the muscular tissue and intact posterior wall, we assume that bleeding was limited. Thus, only a retroperitoneal haematoma was drained.

When a bullet enters a vessel, it may cause haemorrhage, thrombosis, sepsis, erosion or vascular occlusion. Preoperative identification of the exact location of the bullet is very important in planning management. Authors still have different ideas on treatment of venous bullet embolism. When the patient is asymptomatic most authors recommend conservative methods. If the patient has symptoms such as dyspnea, conduction disturbances, valve dysfunction, suspicion of endocarditis, deterioration of vital signs and cardiac neurosis, authors suggest surgical removal of the bullet [6,7]. In our case, the patient’s vital signs deteriorated after admission to our clinic; so we performed surgery under emergency conditions.

The ideal surgical strategy should be individualised to the patient. Removal of the bullet with fluoroscopic guidance using a basket catheter is another procedure that may have great value when used in suitable cases. But the surgeon must keep in mind the possibility of the bullet dropping to the opposite pulmonary artery when the patient is positioned for thoracotomy [8].

Percutaneous extraction of the embolized bullet may also be tried. If possible this type of extraction can be performed
under local anaesthesia, thus avoiding the risk of mortality and morbidity relating to open heart surgery. But complications, such as movement of the bullet to wedge position and intimal damage, may occur during this type of extraction. Adhesion of the bullet to the pulmonary arterial wall or thrombus formation will affect the successful removal of the bullet [9,10].

Extrpation of the bullet via local pulmonary arteriotomy is a safe and reliable method and usually uncomplicated, provided precautions are taken before the operation [1–7].

5. Conclusion

The exact location of the bullet is very important for determining the type of management. Sometimes conservative medical treatment can be administered to asymptomatic patients. For symptomatic patients, or if there is any difficulty in correctly locating the bullet despite the many imaging methods, surgical treatment should be considered.

This was our first such case. We did not have any experience of percutaneous extraction of an embolized bullet. Thus, we preferred to make the operation on CPB, but, as mentioned previously, there are some easier and less traumatic methods for extraction.

References