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Bullet on the Run: Bullet Embolism to the Right Ventricle after Abdominal Shot Gun Injury with Bowel Perforation

M. Palmen, J.A. Bekkers, P.L. de Jong and A.J.J.C. Bogers
Department of Cardiothoracic Surgery, Thorax Center, Erasmus Medical Center Rotterdam, Rotterdam, Netherlands

Abstract: An 18-year old female is presented with the diagnosis of bullet embolism to the right ventricle after an abdominal shot-gun injury. The bullet was removed through a right atriotomy and beating heart, using normothermic cardiopulmonary bypass.

Key words: Right ventricle, abdomin, shot gun injury, cardiopul monay

CASE REPORT

Recently an 18-year old female sustained an abdominal shot wound injury. The bullet entered the abdomen in the left lower quadrant and emergency laparotomy demonststrated penetration of the small bowel for which two small-bowel resections were performed. No exit wound could be identified, but the bullet could not be found in the abdominal cavity. Post-operative chest X-ray demonstrated that the bullet projected in the cardiac silhouette on both the lateral and the frontal X-ray films (Fig. 1 and 2). After laparotomy, the patient was in good condition, both hemodynamically and respiratory stable and had a good urinary output. Both the CAT scan and two-dimensional echocardiography revealed that the bullet was localized apically in the right ventricle, near the interventricular septum. Importantly, no pericardial fluid collection was observed and no wall motion abnormalities were present. Cardiac valves were intact and functioning normal, while no ventricular septum defect could be demonstrated. Considering the fact that no pericardial effusion was present and the patient showed no signs of direct cardiac penetration, a venous bullet embolism to the right ventricle was suspected. Because of the risk of endocarditis due to contamination of the bullet after bowel perforation and because of the risk of pulmonary embolism, the decision was made to operate upon her.

A median sternotomy was performed. No hemopericardium was present and careful examination of both the pericardial cavity and the epicardial surface revealed no signs of violation. Intra-operative trans-esophageal echocardiography demonstrated that the bullet was still localized in the right ventricular apex. Using double venous canulation and normothermic cardiopulmonary bypass, the right atrium was opened on the beating heart and the right ventricle was inspected through the tricuspid valve. The bullet, 8 mm in calibre, was retrieved from the apex of the right ventricle. It had been trapped in the tricuspid papillary apparatus and the trabecles of the right ventricle. Careful inspection and palpation of the right ventricle did not reveal any lesions. The right atriotomy was closed with a 4-0 Prolene running suture. The patient was weaned quickly from cardiopulmonary bypass. Postoperative convalescence was uncomplicated and the patient was discharged from the hospital after 5 days.

Fig. 1: Chest X-ray demonstrating the bullet overlying the cardiac silhouette on both the frontal and the lateral film

Corresponding Author: A.J.J.C. Bogers, Department of Cardiothoracic Surgery, Thorax Center, Erasmus Medical Center Rotterdam, Molewaterplein 40, 3015 GD Rotterdam, Netherlands

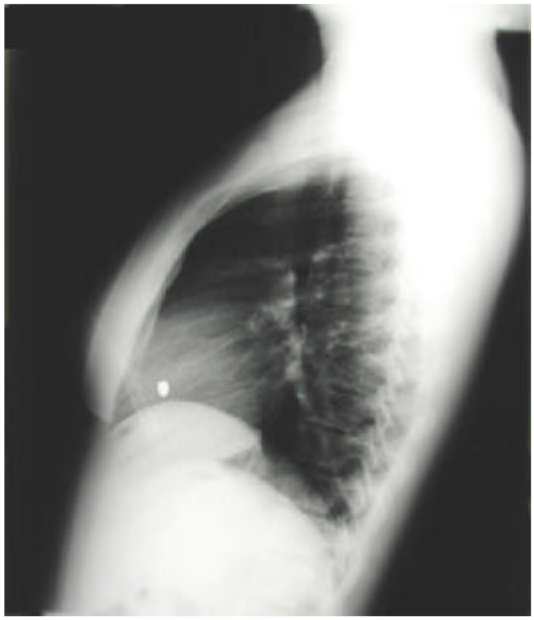

Fig. 2: These pictures demonstrate the bullet inside the right ventricle, trapped in the papillary apparatus and the 8 mm calibre bullet after removal

COMMENT

Gunshot wounding may be a major traumatic event. It is rare that a bullet enters a large blood vessel and is transferred along with the blood flow to a remote area of the body. This is described in 0.3% of all cases of vascular trauma due to gun-shot wounding and accounts for both arterial and venous embolisation (Nagy *et al*., 1994). In venous embolism, the bullet embolises to the heart or to the liver and is symptomatic in only one third of the cases (Michelassi *et al*., 1990). In arterial embolism, when the bullet enters the arterial system or the left heart, the bullet embolises distally until it is trapped in peripheral arterioles, causing acute peripheral arterial occlusion symptomatology in 80% of cases (Michelassi *et al*., 1990). In 15% of the cases, venous bullet emboli cause paradoxical retrograde migration, instead of antegradely in the direction of the blood flow, further complicating the issue (Michelassi *et al*., 1990).

Symptomatic venous bullet emboli cause symptoms like chest pain, dyspnea, hemoptysis, or dysrhythmias (Graham and Mattox, 1981). Only a limited number of cases of venous bullet embolism to the right heart have been describe (Best, 2001; Harirchi and Sararzadeh, 2004).

In our study, chest X-ray, CT scan and echocardiography revealed that the bullet was localized in the heart and that pericardial effusion and cardiac dysfunction was absent. Intraoperatively, the pericardium and myocardium showed no signs of violation. Most probably, the bullet entered the RV due to venous embolisation after it entered a large abdominal venous vessel.

When no exit wound is present and the bullet is not found at the site of injury, bullet embolism should be suspected. Accordingly, diagnostic tools for detection of the bullet in remote body parts should be performed in order to exactly localize the bullet. When on the X-ray, the bullet is found in the thoracic cavity with the bullet overlying the cardiac silhouette, then the exact localisation should be determined using echocardiography and CAT-scan.

When a venous bullet embolus is symptomatic, surgical intervention is mandatory (Graham and Mattox, 1981). Whether or not patients with asymptomatic right ventricular or peripheral pulmonary artery bullet emboli should be treated, is still a point of debate in literature. The widespread opinion is that with the small risk of cardiac surgery, all right ventricular bullet emboli should be removed, because of the risk of pulmonary embolism (Michelassi *et al*., 1990; Patel *et al*., 1989). In our patient, the bullet perforated the intestines before it entered the circulation, thereby enhancing the risk of endocarditis.

In our patient, we chose to extract the bullet from the right ventricle through a right atriotomy using total cardiopulmonary bypass, on a beating heart. This technique proved to be quick, simple and effective (Hiebert and Gregory, 1974).

Other groups recently reported a transvenous extraction of the bullet under fluoroscopic guidance, using a snare that was introduced percutaneously through the right internal or right femoral vein (Best, 2001; Pecirep and Hopkins, 1994). This is a safe and simple technique omitting the need for thoracotomy with obvious advantages. However, this method may carry the risk of dislodging the bullet after which it may enter the pulmonary circulation and prohibits inspection of the heart.

Recently, a conservative approach for asymptomatic patients with a proven right ventricular or pulmonary arterial bullet embolus was presented (Nagy *et al*., 1994; Gandhi *et al*., 1996). In this patient, the conservative approach was considered. However, because of the history of bowel penetration, enhancing the chance of endocardial infection, this option was rejected.

CONCLUSION

We presented an 18-year old female suffering from an abdominal shot wound with bowel perforation. The bullet embolised to the RV and was removed through a right

atriotomy, using CPB. This technique proves to be simple and effective. However, when suspicion for direct bullet entrance is low, transvenous removal of the bullet may be an option. In a selected group of asymptomatic patients with bullet embolisation to the right heart or distal pulmonary arteries, conservative management may be considered.

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