A journey straight through the heart: the story of a bullet

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Received 5 December 2008; accepted after revision 14 March 2009; online publish-ahead-of-print 2 April 2009

Shunt malformations caused by a prior cardiac gunshot accident are a very rare cause for late deterioration of ventricular function. This case describes the long-term echocardiographic findings in a patient with a cardiac gunshot at age 13, presenting with progressive signs of congestive heart failure 25 years later.

KEYWORDS
Cardiac gunshot; Shunt malformation; Case report

A 38-year-old man presented with progressive dyspnoea (NYHA class III) and a left bundle-branch block on the ECG. Upon inquiry, the patient reported a near-distance gunshot accident with a 4 mm airgun at age 13 while playing with his father’s weapon. The accident resulted in an acute pericardial tamponade with a subsequent emergency operation and closure of the pericardial and right ventricular perforation. The patient recovered quickly and was discharged 14 days later, free of symptoms.

Echocardiography

Echocardiography showed an enlarged left ventricle with severely reduced left-ventricular function (ejection fraction of 28%) and mild to moderately reduced right-ventricular function (see Supplementary data online, Movie S1). Other findings included severe aortic regurgitation (see Supplementary data online, Movie S2), a small ventricular septal defect (left ventricular outflow tract to the right ventricle) (see Supplementary data online, Movie S3), a systolic/diastolic jet from the left ventricular outflow tract into the left atrium and moderate mitral regurgitation (Figure 1; see Supplementary data online, Movie S4). Elevated volume flow (stroke volume index: 75 mL) was calculated over the aortic valve (aortic valve area × aortic velocity time integral).

These findings were confirmed by transoesophageal echocardiography (see Supplementary data online, Movie S5), which further showed a perforation of the aortic valve (as the cause for aortic regurgitation) (see Supplementary data online, Movie S6) and a small pseudoaneurysm of the acoronary aortic sinus with perforation into the left atrium (Figure 2; see Supplementary data online, Movie S7).

Other findings

The coronary angiogram was unremarkable, the chest X-ray showed an enlarged cardiac silhouette and a bullet in the left lower lobe of the lung (Figure 3).

The patient underwent cardiothoracic surgery. Intraoperative inspection showed severe epicardial and pericardial adhesions as a result of the operation at age 13. Furthermore, a 6 mm large punched-out looking fistula between left ventricular outflow tract and left atrium and a 5 mm large circular defect in the non-coronary cusp of the aortic valve were found. Both were closed with an autologous pericardial patch, whereas the 4 mm large ventricular septal defect was closed using a direct patch-suture. The patient recovered well, and his clinical status remained stable. The echocardiogram at discharge showed minimal aortic regurgitation, mild-to-moderate mitral regurgitation, and mild tricuspid regurgitation. No residual shunt lesions were present (Figure 4). Left ventricular function did not fully recover (see Supplementary data online, Movie S8).

Discussion

The echocardiography allowed the reconstruction of the ballistic trajectory.

The bullet entered the chest anteriorly, perforated the right ventricle (which was closed at the emergency operation), passed through the basal inter-ventricular septum (resulting in a ventricular septal defect), perforated the non-coronary cusp of the aortic valve (resulting in aortic...
regurgitation), crossed the left ventricular outflow tract into the left atrium (resulting in a fistula between the left ventricular outflow tract and the left atrium), and left the heart through the left atrium. The position of the bullet in the left lower lobe caudal of the initial trajectory can be explained by migration and/or growth since adolescence.

Reduced left-ventricular function and cardiac failure were the results of chronic volume overload caused by shunt-flow, mitral regurgitation, and aortic regurgitation.

Although multiple case reports on cardiac gunshot wounds can be found in the literature,1–3 we could not retrieve any previous reports with similar defects or any particular case in which a patient with a through and through cardiac gunshot survived for such an extended period (25 years). Mortality rates following cardiac gunshot wounds are high (~81%).4,5 The small calibre of the bullet in our patient was probably a favourable factor. Small-calibre weapons simply cause less tissue damage than their larger counterparts.6 Nevertheless, this case shows that even small-calibre gunshot wounds can lead to significant injuries and perforate the entire heart. Probably, the close proximity of the weapon to the chest also contributed to the deep penetration of the bullet.

This case also shows the diagnostic accuracy of echocardiography to confirm the diagnosis7 but also that it is possible to reconstruct the ballistic trajectory of the bullet. Echocardiography as we know it now was not available at the time of the accident. In addition, the surgical potential of correcting such decent defects were limited, particularly in a primary care centre. Nevertheless, the initial surgical procedure allowed the patient to survive. Retrospectively, echocardiographic follow-up and surgical re-intervention could have prevented irreversible cardiac dysfunction.

**Supplementary data**
Supplementary data are available at European Journal of Echocardiography online.

**Conflict of interest:** none declared.

**References**