SHORT REPORT

Nail Gun Injury to the Heart with Peripheral Embolization, Case Report and Review of the Literature

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We report a case of a 32-year-old male who was accidentally shot by a nail gun. He had 1 cm entry wound over the middle of the sternum, with no exit wound. Angiography showed nail shadow in left thigh and an occluded superficial femoral artery. The nail was removed and the patient was discharged home after 10 days.

Keywords: Nail gun; Heart; Embolization.

Introduction

Nail gun injuries are rare. Any part of the body can be injured but injuries to the extremities are the most common. The majority of the patients survive. Penetrating nail gun injuries to the heart although has been reported before. Our case is the first to report distal nail embolization.

Report

A 32-year-old male was accidentally shot at work by a nail gun into his chest. He was brought to the Emergency Department by his coworkers. On arrival he was fully conscious with a complaint of pain over the anterior chest wall and over his left groin and upper thigh. He had no previous significant medical or surgical history.

On initial assessment, he was fully conscious, alert with patent airway and normal respiration. He was haemodynamically stable (B.P. 130/80, Pulse 110/min, R.R. 18/min) with no evidence of external bleeding. He had 1 cm entry wound over the middle of the sternum, which was bleeding minimally. There was no exit wound (Fig. 1).

The secondary survey revealed weak left femoral pulse, with absent popliteal and pedal pulses. Insonation with a hand-held Doppler revealed with monophasic signals over the pedal arteries. There were no motor or sensory deficits.

A chest radiograph showed a widened mediastinum with mild right-sided tracheal shift. There was no evidence of haemothorax, pneumothorax, or cardiac shadow abnormalities. No foreign body could be found. A left thigh radiograph showed a foreign body in the upper medial part of the thigh, with no evidence of bony fractures or other injuries (Fig. 2).

Computerized tomography (CT) of chest, abdomen, pelvis and upper thigh showed a fractured sternum, restrosternal haematoma, foreign body (nail) in the left adductor canal with small left haemothorax, but no evidence of pneumothorax or pericardial effusion. Angiography showed a normal aorta and its branches. On the left side, the common femoral artery and profunda femoris were patent. The superficial femoral artery (SFA) was occluded with an intra luminal nail, with reconstitution at the level of proximal popliteal artery. The point of entry to the vascular system, and the possibility of cardiac or major vascular injury were still unclear, therefore, a team approach was followed and cardiac surgery, thoracic surgery, cardiology and...
general surgery were consulted. Transthoracic echocardiography showed a normal cardiac anatomy. The patient was cleared by the cardiac, thoracic and general surgeons.

The vascular team performed an exploration for the site of the nail in the left SFA, intra operative X-ray was used to plan the incision. The nail has migrated in 1 h to lodge at the distal SFA which was explored and the nail was removed through transverse arteriotomy.

The patient was transferred to the intensive care unit for continuous monitoring. On the 3rd day a transoesophageal echo (TEE) showed normal cardiac anatomy. The patient was transferred to the ward on the 3rd day. CT scan of chest on the 2nd and 7th postoperative days showed normal anatomy with disappearance of the retrosternal haematoma and the left haemothorax. On 10th postoperative day, the patient was discharged home in a stable general condition. One month later a follow-up CT of the chest showed no abnormality.

Discussion

Nail guns are construction tools used to fire nails into steel, concrete, and wood. The growing popularity of these tools has been associated with a rise in the incidence of nail gun injuries.1 Surgical removal of nails can be complicated by numerous barbs or glue placed along the length of the shaft, with serious iatrogenic damage to the surrounding structures.1,2 They have been reported in various sites including head and neck, chest, abdomen, extremities, vertebral column and spinal cord.1–5 The literature on penetrating injuries to the heart is fairly extensive. The common causes are gunshot and stab wounds. In 1999, Vosswinkel et al. reported a case of suicidal nail gun injury to the heart. He reviewed the literature in the period from 1962 to 1996 and found only 15 cases reported.6 According to his report, the mortality of gunshot wounds to the heart was 60–93%, and for stab wounds 22–62%, whereas the mortality of nail gun injuries to the heart was around 25%. This indicates that nail gun injuries to the heart are survivable and have mortality similar to stab injuries. Treatment of penetrating cardiac injuries often requires operative exploration. It may be conservative only in cases of low velocity injury (e.g. stab wound) with no cardiac tamponade and no haemodynamic instability. In 1985, Schowengredt et al., reported a case of an air pellet injury to the heart with popliteal embolus, together with a comparison of the different patterns of embolization of pellets and other heavier missiles (e.g. bullets).7 Both follow the same physical laws of distribution. The important variables are: The force and direction of the blood flow, the arterial lumen including size and take-off angle, missile size and weight, patient’s body position immediately after injury, and finally the point of entry to the cardiovascular system.7,8

When the pellet size is ≤3 mm, embolus formation occurs most often in the head and neck. Lodging preferentially at the origin of the middle cerebral artery with a mortality rate of about 25–33%.7,8 In 1990, Slim et al., reviewed 20 cases of missile embolization in children ≤16 years (in the period 1961–1988) and noticed that embolization were mainly to the left leg. Upper extremity embolization was exclusively to the right.7

Fig. 1. Patient on arrival. Note the nail entry wound mid sternum.

Fig. 2. X-ray left thigh. Note the nail at the femoral region.
Conclusion

Nail gun cardiac injuries are survivable and have mortality similar to stab injuries. Team approach and appropriate timely investigations in a stable patient could be all what is needed. Embolization does occur and embolectomy should be performed at the site of the nail to prevent further intimal injuries. Intraoperative use of X-ray for locating the foreign body before incision is recommended.

References


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