

CASE REPORT

Cardiac injury by a nail gun

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ABSTRACT

We describe a 25-year-old carpenter who was accidentally injured by a nail gun. The nail penetrated the left side of the chest and settled behind the sternum. After stabilizing the patient, transthoracic echocardiography and Computed Tomography (CT) scan of the chest accurately diagnosed the cardiac injury and determined the site of the nail. Through median sternotomy, the nail was extracted and hemopericardium was evacuated. Fortunately, the lesion found in the right ventricle was non-penetrating. The patient had uneventful postoperative course and discharged in stable condition.

Key words: chest trauma, nail gun injury, penetrating cardiac injury.

INTRODUCTION

Injuries by nail guns most frequently affect the extremities. Cardiac and great vessel injuries by nail gun are rare but life threatening.¹ The right ventricle is the most commonly affected chamber because of its anterior location.² The entry wound may be tiny and the resulting injuries may be underestimated. Proper evaluation and urgent intervention could save those patients. Here we present a case of cardiac injury accidentally caused by a nail gun.

CASE REPORT

A 25-year-old male carpenter was received in Emergency Department (ED) after nail gun injury. A nail gun while being used by his coworker, accidentally misfired a nail which stroked the wall and returned back and penetrated the chest. On clinical examination, the patient was conscious, with blood pressure 80/50 and heart rate 120/min. There was a small entry point about 2 cm in the left 2nd intercostal space at midclavicular line. Supplementary oxygen and fluid resuscitation improved the hemodynamic state. Portable chest X-ray showed a nail overlying the cardiac area (Fig. 1). Besides, transthoracic echocardiography revealed pericardial effusion about 1 cm all around the heart with no evidence of tamponade. The valves and septae were intact. The patient was stable so we requested for him chest CT with contrast to accurately determine the site of the nail and diagnose any associated injuries if present. Chest CT showed the nail with its head behind the sternum and the sharp tip directed upward to the right ventricle (Fig. 2). Mild left sided hemothorax was identified in addition to pericardial effusion. The patient was shifted

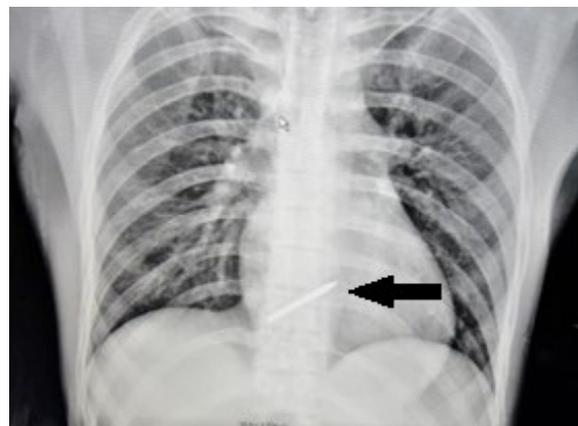


Figure 1, Plain chest X-ray showing a nail overlying the cardiac shadow (black arrow pointing to the nail).

urgently to the operating room. Median sternotomy was done and the nail was found impacted into posterior table of the sternum with its sharp tip penetrating the pericardium (Fig. 3, 4). While we were elevating the two sides of the sternum gently for exposure we could identify the tip of the nail coming out of the pericardium. The nail was removed. It was about 5 cm in length. We found anterior mediastinal hematoma. The pericardium was rapidly opened. A large blood clot was found and free blood was suctioned. The heart was carefully inspected. Two injury sites were found in the right ventricle. They were partial, non-penetrating and not bleeding. A piece of absorbable hemostat (Surgicel®) was applied to them. A small entry wound was found in the left lateral wall of the pericardium depicting the pathway of the nail. The left pleura was opened and about 200 mL was suctioned. Hemostasis was done. Mediastinal and pleural tubes were inserted. The chest was closed. The patient was transferred to the intensive care unit (ICU) intubated. He was hemodynamically stable and extubated within 6 hours. Transthoracic echocardiog-

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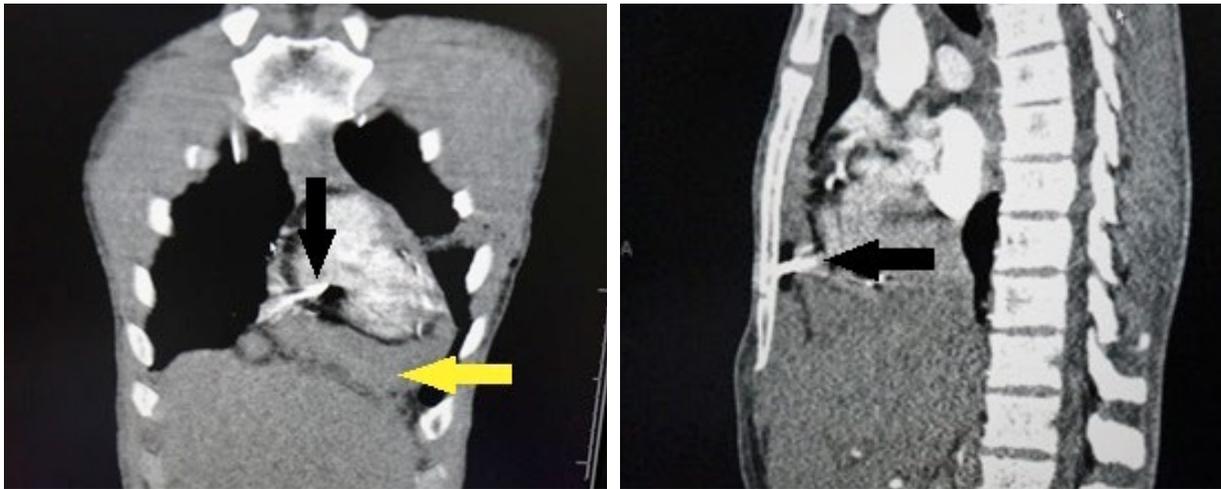


Figure 2, Chest CT with contrast, coronal view (left) and sagittal view (right) showing the nail impacted in sternum with sharp end toward right ventricle. There is evidence of pericardial effusion (Yellow arrow).

raphy was done postoperatively and was normal. A course of intravenous broad spectrum antibiotics was given. The patient was discharged in stable condition after 7 days. He was followed in outpatient clinic, his wound healed nicely and he is doing well.

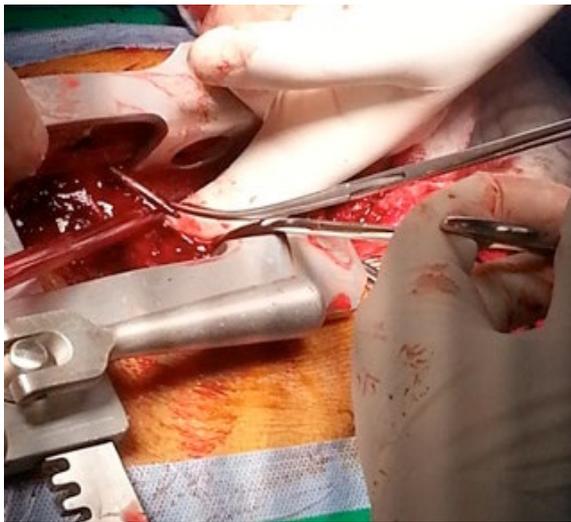


Figure 3, Intraoperative after median sternotomy, the nail impacting in the back of sternum with its tip penetrating the pericardium. A hematoma can be seen in the anterior mediastinum.

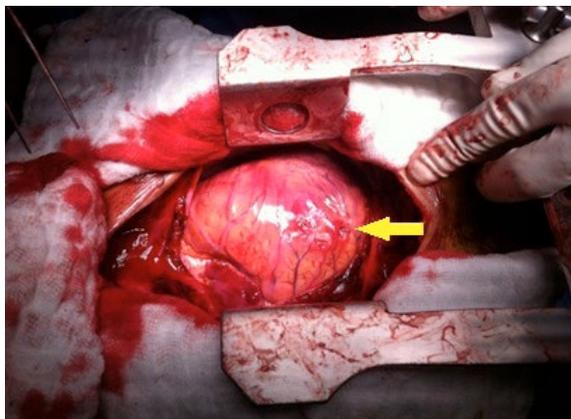


Figure 4, Yellow arrow pointing to the site of non penetrating injury in the right ventricle.

DISCUSSION

Nail guns are important tools in construction works used to drive nails into wood or concrete. They can be activated pneumatically or by explosive cartridge. High velocity nail guns shoot nails like a rifle while low velocity only press on nail head.³ Injuries occur accidentally but the incidence of self-inflicted cases is rising.⁴ The mechanism of the injury can be over penetration, inappropriate triggering or ricochet from a hard surface as in our case. The severity of the injury depends on the force applied to the nail, the length of the nail and the organ injured. Nail gun injuries mainly involve the extremities especially the non-dominant arm. Few cases of cardiac injuries were reported and the right ventricle was the most commonly affected chamber because of its anterior location.³ Small nails could embolize distally resulting in vascular occlusion.⁵ Entry points to the skin may be nearly invisible and do not reflect the severity of injury, hence thorough clinical examination and high index of suspicion are mandatory in order not to miss such injuries.⁶ The site of injury raised our suspicion about cardiac injury. Imaging modalities are important to localize the nail, give an idea about its path, diagnose resulting injuries and help determine plan for management. The hemodynamic state of the patient decides for the suitable diagnostic tool. Initially plain chest x-ray gives an idea about the site of nail and shows any pleural or pulmonary injuries. Besides, echocardiography can detect pericardial effusion and diagnose intracardiac injuries. It is a definitive accurate diagnostic modality in hemodynamically unstable patients. Intraoperative transoesophageal echocardiography is greatly helpful in diagnosis of cardiac injuries and assessment of surgical repair.⁷ CT scan of the chest is valuable in stable patients and accurately determines the location of the nail and the resulting intrathoracic injuries although the artifact of the metallic nail may affect the accuracy of the image.⁸ We preferred median sternotomy since the nail was located behind the sternum. It is also the ideal approach in cases of expected cardiac

injuries as it gives excellent access to the heart and great vessels and facilitates use of cardiopulmonary bypass if needed.⁹ Fortunately the tip of the nail did not penetrate the right ventricle. It seems that the nail penetrated the left side of the chest in a downward direction to the right entering the pericardium anterior to the heart and impacted into the back of the sternum. The injuries found in the right ventricle might probably caused by movement of the heart against the tip of the nail. The nail is not sterilized by the heat of firing, so infection should be anticipated and carefully prevented by a course of broad spectrum antibiotics. Patients injured by nail gun could be survived. Wedging of nail into the tissue prevents massive bleeding and permits valuable time to interfere.³ However, the mortality of nail gun injuries to the heart was around 25% as reported by Vosswinkel et al.¹⁰ Strict safety measures, better training and modification of the design of nail guns are crucial to prevent such serious injuries.¹¹

CONCLUSION

Nail gun injuries are serious mostly affecting the extremities and rarely the heart and great vessels. Careful clinical evaluation, echocardiography and CT scan when possible help decision making. Urgent intervention could improve survival.

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