

## Pulmonary nail embolus after penetrating cardiac injury

*Penetran kardiyak yaralanma sonrası gelişen pulmoner çivi embolisi*

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Penetrating nail injuries may occur accidentally and penetrating heart injuries by the nails are uncommon. Finding foreign bodies in the heart may be challenging during the operation due to the movement of the foreign body. A 34-year-old construction worker was brought to the emergency department with a history of accidental injury with a nail. A transthoracic echocardiogram showed pericardial effusion with tamponade. An urgent operation was performed via median sternotomy. The whole thoracic organs including the heart and the right lung was palpated, but no foreign body was able to be detected. Perioperative transesophageal echocardiography did not show any foreign body. The operation was finished. In the day of surgery a computed tomography scan of the thorax showed a foreign body in the right posterior basal segment of the lung. The second operation was performed via a right thoracotomy at the postoperative fifth day. Foreign body was palpated in the posterior basal segment of the right lung and it was removed.

**Keywords:** Embolus; foreign body migration; heart.

Penetrating nail injuries may occur accidentally, but heart injuries caused by nails are uncommon. Finding foreign bodies localized in the heart during surgery may be difficult because of the movement of the foreign body. However, migration of the foreign body to the lung from the heart is rare in the literature. Herein, we present our surgical approach for managing the case of a nail penetrating the heart and then migrating to the lower lobe of the right lung.

### CASE REPORT

A 34-year-old construction worker was brought to the emergency department with an accidental injury

Penetran çivi yaralanmaları kaza ile olabilir ve çivi nedeni ile oluşan penetran kalp yaralanmaları seyrekdir. Kalbe yerleşen yabancı cisimleri ameliyat esnasında bulmak yabancı cismin hareketi nedeni ile zor olabilir. Otuz dört yaşında inşaat işçisi çivi ile kaza eseri yaralanma öyküsü ile acil servise getirildi. Transtorasik ekokardiyografisinde tamponad oluşturan perikardiyal efüzyon görüldü. Median sternotomi ile acil ameliyat uygulandı. Kalp ve sağ akciğer dahil bütün torasik organlar elle muayene edildi, ancak yabancı cisim bulunamadı. Ameliyat sırasında yapılan transözofageal ekokardiyografisinde de herhangi bir yabancı cisim görülmedi. Ameliyat sonlandırıldı. Ameliyat günü yapılan toraks bilgisayarlı tomografi taramasında sağ akciğer posterobazal segmentinde yabancı cisim saptandı. Ameliyat sonrası beşinci gün sağ torakotomi ile ikinci ameliyat yapıldı. Sağ akciğerin posterobazal segmentinde palpe edilen yabancı cisim çıkarıldı.

**Anahtar sözcükler:** Emboli; yabancı cisim migrasyonu; kalp.

involving a nail that he had been extracting from a timber. On examination, his vital signs were unstable, and his blood pressure was 80/50 mmHg. In addition, there was a circular puncture wound measuring 0.2 cm in diameter in the right parasternal region in the sixth intercostal space. Transthoracic echocardiography (TTE) showed pericardial effusion with tamponade, and a plain posteroanterior (PA) radiograph of the chest showed that the nail was in the right juxtacardiac position. An urgent operation was then performed via a median sternotomy. The pericardium was opened, and about 400 ml of fresh blood from the pericardial cavity was aspirated. An examination of the nail path revealed



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that it had traversed the anterobasal (AB) segment of the right lung and penetrated the pericardium and the myocardium. Furthermore, when examining the heart, we found a nail hole penetrating the anterior surface of the right ventricle without an exit hole in the posterior section of the heart. A small collateral of the right coronary artery (RCA) was lacerated, and there was active bleeding from this vessel. At the same site, the myocardium was penetrated into the right ventricle. After the collateral of the RCA was repaired, the active bleeding stopped. All of the thoracic organs, including the heart and right lung, were palpated, but no foreign body could be seen or felt. A perioperative chest roentgenogram had shown a metallic foreign body within the cardiac shadow, but the exact relationship between the foreign body and the cardiac structures was not apparent. Additionally, perioperative transesophageal echocardiography (TEE) showed no foreign body. The right ventricle wound was repaired with a Teflon-pledgeted 3-0 polypropylene suture, and the operation was deemed to be complete since the foreign body could not be found or localized during the surgery. On the same day, after the surgery, a CT scan of the thorax was carried out which showed a foreign body in the right posterior basal segment of the lung (Figure 1). A second operation was then performed via a right thoracotomy on postoperative day five, and the foreign body was palpated at that location. A pneumotomy was subsequently performed, and the object was successfully removed. The foreign body was identified as a rusty nail that was 2.5 cm long and 2 mm thick (Figure 2). The patient's postoperative course was

uneventful, and he was discharged four days after the second operation without any complications.

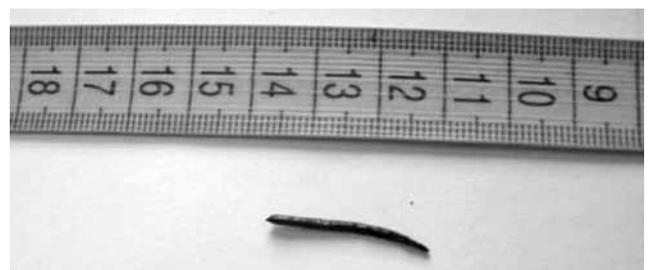
## DISCUSSION

Penetrating foreign bodies to the heart are a rare but serious form of cardiac injury. Objects such as bullets, acupuncture needles, fragments of Kirschner wires, and even sewing needles have been found.<sup>[1-3]</sup> Nail injuries of the heart may occur accidentally or be self-inflicted and are commonplace in the construction industry. Because of their sharpness, nails with a small dimension can rapidly migrate through the tissues, resulting in cardiac tamponade from the hemopericardium, hemothorax, and/or pneumothorax.<sup>[2]</sup> Computed tomography (CT), TTE, and TEE are useful for locating the exact position of a foreign body and determining its relationships with the surrounding tissues.<sup>[1-4]</sup> The use of intraoperative TEE can especially be useful for identifying foreign bodies in the cardiac muscle, including bullets or needles.<sup>[4]</sup> However, even when intraoperative imaging is used, finding an intracardiac foreign body can be difficult because of the probability of migration. In our case, intraoperative chest roentgenography revealed a foreign body, but we could not determine its exact location during the first operation. In addition, neither a chest X-ray nor TEE revealed the exact location of the foreign body in the heart because it had already migrated from the right ventricle to the right lower lobe of the lung.

Surgical delays should be avoided because of the possibility of migration.<sup>[4]</sup> The unceasing motion of the heart against the sharp point of the fixed foreign body may result in repetitive wounding with bleeding and consequent cardiac tamponade.<sup>[3]</sup> In cases featuring a penetrating cardiac nail gun injury, the spectrum of presentation can vary from unstable patients requiring urgent intervention, as in our case, to hemodynamically stable patients for whom there is time to assess the extent of the injury. As previously mentioned, CT is commonly used to locate foreign bodies,<sup>[1,3]</sup> but in our case, this was not



**Figure 1.** Computed tomography revealing a foreign body in the right posterior basal segment of the lung.



**Figure 2.** The rusty nail was 2.5 cm long and 2 mm thick.

possible because the patient was not stable. If a nail has penetrated the precordial area, a sternotomy is the most appropriate approach because the heart and great vessels are ideally exposed and surgeons have the flexibility to use cardiopulmonary bypass (CPB) in the rare situations when this might be required.<sup>[5]</sup> We removed the foreign body via a right thoracotomy because of bleeding, the migration of the nail, and the infection risks of the foreign body. In the end, we determined that the nail had migrated to the right lung via the pulmonary artery from the right ventricle space.

In conclusion, serious cardiac complications may occur in patients with a penetrating cardiac nail injury. As with our patient, small dimensional foreign bodies, such as nails or needles, may migrate into the lung from the right ventricle via the pulmonary artery and be difficult to locate. Intraoperative TEE provides beneficial help during the operative course and may also prevent unjustifiable CPB in cases involving foreign body migration during the operation.

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