



CASE REPORT

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Avoiding lethal mediastinal injuries, Steinmann nail migration

Evadiendo lesiones letales de mediastino, migración de clavo de Steinmann

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ABSTRACT

We present the case of a 29-year-old male, who was admitted with respiratory distress with unsatisfactory evolution. With the history and complementary studies, an intrapulmonary foreign body was diagnosed with involvement of the main bronchi. He underwent surgery, extracting a foreign body (Steinmann nail) in the upper lobe of the right lung. Because of its presentation, location and challenging treatment, the case is presented to show the most relevant clinic-surgical and pathological aspects.

Keywords: foreign body, lung, bronchus, bronchoscopy, Steinmann nail.

RESUMEN

Se presenta el caso de paciente masculino de 29 años, el cual ingresó por cuadro de dificultad respiratoria con evolución no satisfactoria. Con los antecedentes y estudios complementarios, se diagnosticó un cuerpo extraño intrapulmonar con afectación de bronquios principales. Fue intervenido quirúrgicamente, extrayendo cuerpo extraño (clavo de Steinmann) en lóbulo superior del pulmón derecho. Por su presentación, localización y dificultad para su tratamiento, se expone este caso para mostrar los aspectos clínico-quirúrgicos y patológicos más relevantes.

Palabras clave: cuerpo extraño, pulmón, bronquio, broncoscopia, clavo de Steinmann.

INTRODUCTION

Bronchial foreign bodies in adult patients are a rare clinical entity in contrast to pediatric age.¹ The initial aspiration is usually manifested by cough, dyspnea, asphyxia and/or cyanosis, although sometimes the clinical manifestations are not so striking and can go unnoticed or be confused with other pathologies such as bronchitis,

bronchiectasis and pneumonia.² In patients with a history of osteosynthesis, the risk of migration of the material exists and multiple cases have been described since 1943, some involving mediastinal structures with fatal outcomes.³ Our work aims to reflect the challenge involved in the diagnosis and treatment of an atypical cause of foreign body in the tracheobronchial area, with a clinical picture of cough and dyspnea in an adult patient, associated with a previous surgical intervention.

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CLINICAL CASE

We present here the case of a 29-year-old male patient, who denies chronic degenerative diseases of importance, important surgical history about trochiter fracture and right shoulder dislocation in September 2022, managed conservatively; later with fracture displacement, being operated in March 2023. He was taken to his local General Hospital where closed reduction and immobilization were performed, with a review appointment at two months, where surgical management was decided, and he underwent surgery in March 2023, performing arthrodesis with placement of Steinmann nail. One month after surgery, he began with episodes of isolated chest pain, as well as non-productive cough and dyspnea of medium efforts, as well as gradual migration of the Steinmann nail. He went for follow-up evaluation and a control X-ray was performed, showing migration of the nail to the thorax, for which reason he

was referred to our institution for evaluation by thoracic surgery.

Initial chest X-ray showed a metallic object in the thorax involving right and left hemithorax and mediastinum. There was no evidence of pleuropulmonary syndromes. Chest tomography demonstrated a metallic object in the thorax with involvement of the right lung which passes through the right main bronchus, carina, lodging in the left main bronchus (*Figure 1*).

The patient was admitted to the emergency room without dyspnea at rest or desaturation, hemodynamically stable. In the operating room, a bronchoscopy was performed in which a foreign body was observed in the right main bronchus passing through the carina and left main bronchus, without other apparent lesions (*Figure 2*). It was decided to perform a median sternotomy approach. Dissection of the superior cava, aorta and right pulmonary artery was performed to expose the trachea, site of perforation. Tracheal perforation closure is repaired with prolene. Right pleura was opened to remove the nail under direct vision by

Figure 1:

A) Anteroposterior thoracic radiograph showing a foreign body (Steinmann nail) at mediastinal level. **B)** Coronal section of tomography showing a foreign body (Steinmann nail) which is introduced at the level of the carina towards the left pulmonary bronchus.

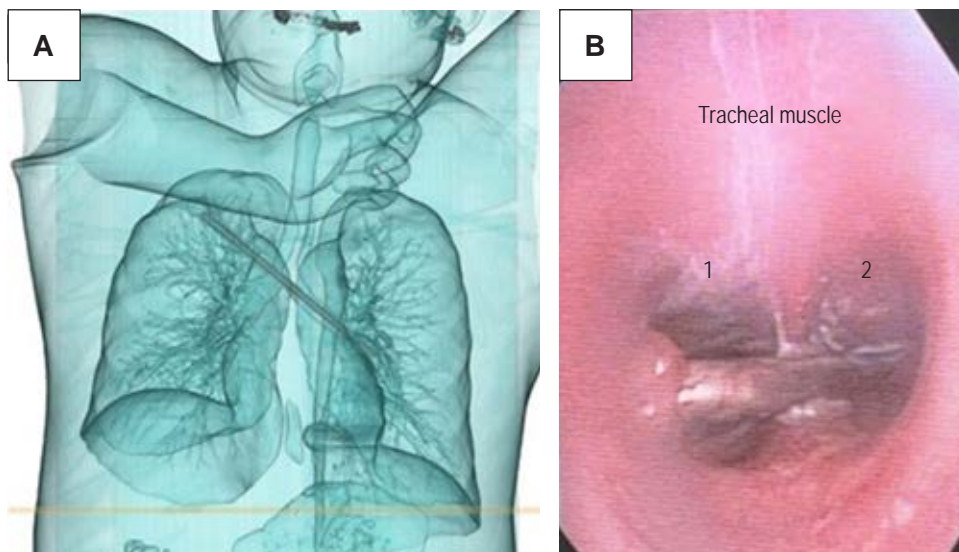
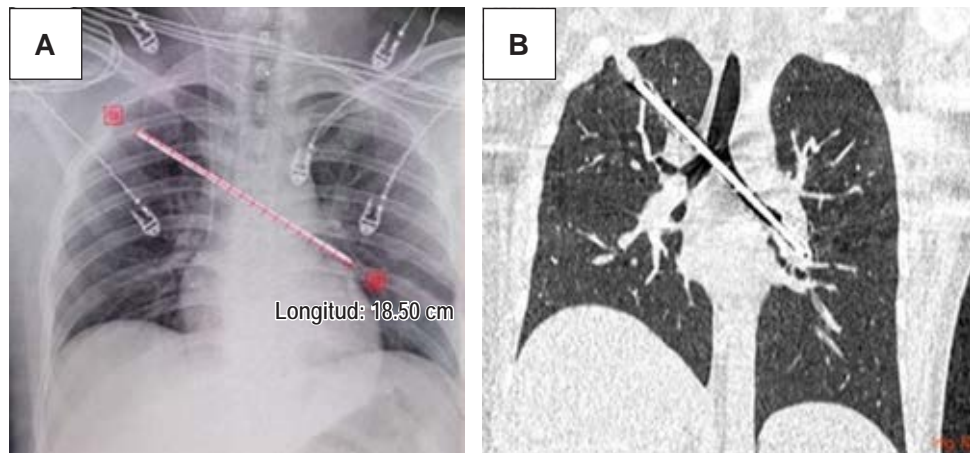


Figure 2:

A) 3D reconstruction of the tracheobronchial tree in which a nail is observed at the level of the carina, heading to the left bronchus. **B)** Bronchoscopy where a nail is observed at carina level. 1) Right main bronchus. 2) Left main bronchus.

a counter opening in the right hemithorax. Right upper lobe exit orifice was repaired with absorbable suture. Adequate closure of the trachea was verified with a new perioperative bronchoscopy and two mediastinal tubes were placed. Conventional sternotomy closure was performed (*Figure 3*).

Patient with adequate postoperative evolution. Mediastinal tubes were removed on the fourth postoperative day and the patient was discharged from our institution (*Figure 4*).

COMMENT

Bronchial foreign bodies are an infrequent and occasional pathology in the adult population, as opposed to children. In Hollinger's classic 1978 study, only 6% of all airway foreign bodies occur in patients older than 14 years of age.⁴

If the foreign body is small and non-irritating, symptoms may be minimal, with an asymptomatic interval of hours, days

or months, followed by chronic cough and increased secretions. Then, with local inflammatory reaction, erosion, perforation and infection, purulent or hemoptotic sputum, fever and prolonged or recurrent bronchopneumonia may occur.⁵

Regarding the location in the airway, most published series report the following locations according to frequency: right main bronchus (60-65%), left main bronchus (25-30%) and subglottic-trachea (9-12%). Distribution is similar to that found in pediatric age.⁶

Any undiagnosed bronchial foreign body will inexorably go through this period, which in turn goes through several states: a) the foreign body behaves as a bypass or free passage valve (bronchial pseudo asthma); b) as a one-way valve (air admission); c) as a total closure valve or airflow strangulation.⁷

This case described is an unusual bronchial foreign body presentation, which was secondary to migration of osteosynthesis material. Migration of nails and fixation wires is most likely to occur in the joints and bones of the rib cage, such as the clavicle, humerus, sternoclavicular joint, and acromioclavicular joint.⁸ Migration sites include the spinal canal, trachea, spleen, pulmonary artery, heart, mediastinum, lung, subclavian artery, and ascending and abdominal aorta.⁹

Several theories have been proposed to explain the migration of nails and fixation wires, including muscle activity, regional bone resorption, and the great freedom of motion of the shoulder. Muscle activity and regional bone resorption may cause nails and wires to break, which may facilitate their migration. The great freedom of motion of the shoulder may contribute to migration by allowing the nails and wires to move.⁹

Although bending the free end of the nails may help prevent migration, it is not always effective. The duration of device implantation is also a risk factor.⁹ It has been reported that nails and fixation wires can migrate from the site where they were placed, even up to six years later.¹⁰ Internal fixation devices should be removed at the appropriate time to avoid loosening, infection, or migration. The appropriate time to remove nails is when the fracture has healed, usually four to six weeks after

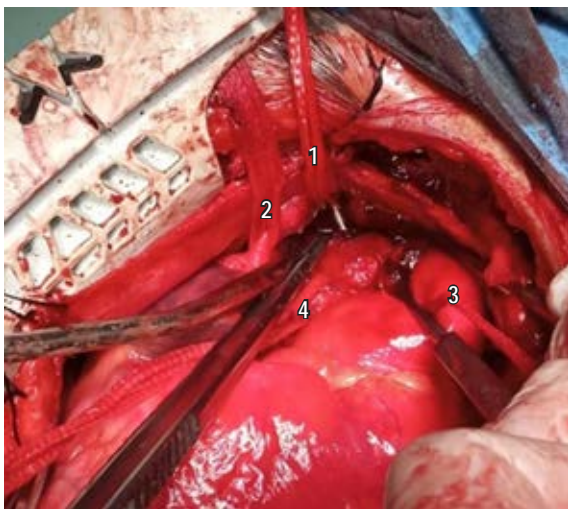


Figure 3: 1) Referred Steinmann nail. 2) Superior vena cava. 3) Ascending aorta. 4) Pulmonary artery.

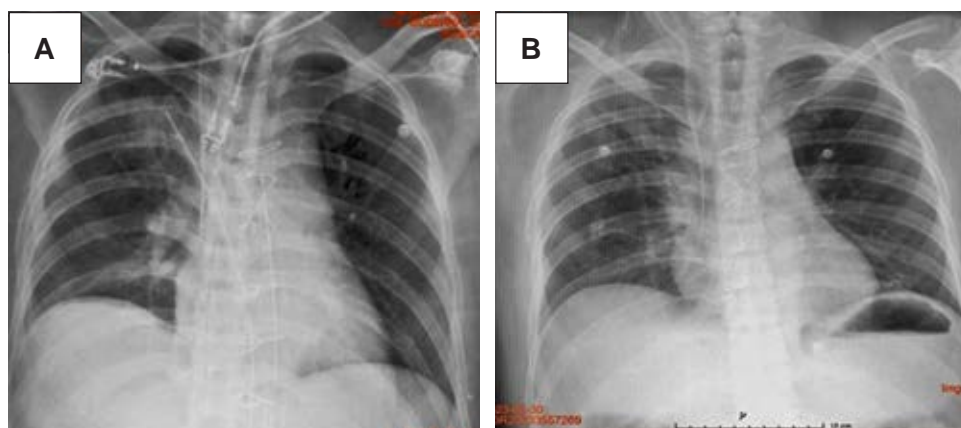


Figure 4:

A) Postoperative radiography after removal of Steinmann nail, showing drainage tube at mediastinum level without presence of emphysema and pneumomediastinum. **B)** Control X-ray prior to discharge of the patient.

placement. If a device breaks or changes position, it should be removed immediately.⁸

Symptoms may include chest pain, back pain and hemoptysis. Serious complications include perforation of major blood vessels, such as the innominate vein, ascending aorta, and superior vena cava, as well as pneumothorax.¹⁰

In 2015, 102 cases of fixation nails that moved to different parts of the mediastinum had been reported. Most of these cases occurred after fixation of trauma to the shoulder girdle. Eleven patients died due to severe cardiovascular complications, and 15 patients had aortic perforation, some of whom had cardiac tamponade resulting in the death of four patients.³

Treatment of choice, after a high clinical and radiological suspicion, consists of performing laryngoscopy or bronchoscopy, under maximum safety conditions and with minimal trauma. It is important to initially revise the upper esophagus and always be prepared for an emergency tracheotomy or cricothyrotomy, due to the possibility of the foreign body moving during the surgical procedure and producing a complete and fatal obstruction. When all these procedures are unsuccessful, the surgical approach should be resorted to either by thoracotomy or video-assisted thoracic surgery.¹¹

Thoracoscopic removal of intrathoracic foreign bodies can be performed safely if it does not cross the mediastinum and if the patient can tolerate single-lung ventilation. Otherwise, thoracotomy and sternotomy (as in this case described) are safe and could be used to remove migrated nails. Sternotomy may be considered more appropriate in the presence of injury to the heart or great vessels.⁹

CONCLUSIONS

As a conclusion, migration of osteosynthesis material is a rare problem. Even so, several cases of migration to the thorax and mediastinum have been described in patients with joint fixation in the thoracic cage. Some of these cases have had fatal consequences. In our case, the factors contributing to the development of this complication were the prolonged time

since fixation and the fact that the free end of the Steinmann nail had not been bent. This highlights the importance of close follow-up and fixation of the osteosynthesis material to avoid this type of complication. Fortunately, the patient presented image on radiography that allowed an integral approach, from the bronchoscopy to the surgical procedure, with adequate post-surgical evolution, achieving the extraction of the foreign object (Steinmann nail), without presenting lesions in adjacent structures, allowing a quick recovery and discharge.

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