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Case report

Kirschner wire migration from subcapital humeral fracture site, causing hydropneumothorax

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ABSTRACT

Migration of wires or pins around the shoulder is a known complication, though their migration within the chest is uncommon. We report an unusual case of hydropneumothorax due to migration of a bent Kirschner wire from the right proximal humerus in a 63 year-old man. We reviewed his clinical history, physical examination, imaging findings, surgical method and outcome. We also reviewed the literature on orthopaedic wire migration and latest technique in removal of the wires. Chest radiographs and chest computerized tomography are useful in detection and diagnosis of this disorder. Regular radiographic follow-up is needed for patients with internal fixation devices; any fractured or migrated pins or wires must be removed immediately to prevent dangerous complications. It is always important to remove the wires at the end of the treatment. Early removal of fixation wires and regular follow-up if wires are retained are essential to prevent serious complications.

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Introduction

Pins and wires are widely used in orthopedic practice for fixation of fractures and dislocations around the shoulder girdle. Migration of pins after operations on the shoulder and the resultant complications are well known. Such migration usually follows a retrograde path and the wires protrude near their entry point into the native bone. Occasionally, the migration occurs in an antegrade manner and produces injury.¹ The chest cavity, with its vital organs, is the site where the life-threatening risk of pin migration is highest.² To the best of our knowledge, pin migration from proximal humerus presenting as hydropneumothorax has heretofore not been reported in the biomedical literature. Furthermore, there is a notable steady increase in the number of reports about the risk of migration of pins into vital cavities. This necessitates formulation of strict guidelines regarding the use of wires and pins around the shoulder girdle.

Case report

A 63 years old man presented in the emergency department of our hospital with acute onset of right sided chest pain and shortness of breath. History suggested that, three years ago, he had a fracture of the neck of right humerus which was treated from a peripheral hospital by closed reduction and percutaneous fixation with three Kirschner wires (K-wires, Fig. 1). Forty-two days after the operation, two of the K-wires were removed. One K-wire was left in situ probably due to technical difficulty in removing it (Fig. 2). After the surgery, patient did not attend scheduled outpatient appointments.

Chest movement was diminished on the right side with hyper resonance on percussion. Air entry was diminished and chest radiography showed a small volume pneumothorax on the right side with a K-wire on the right apical lobe (Fig. 3A, B).

Computerised tomography (CT) of the chest showed migrated K-wire from proximal humerus, lying obliquely in the posterior segment of right apical lobe (Fig. 4). The cranial end of the wire was touching the inner cortex of lateral aspect of the right second rib in the mid-axillary line and its caudal end near the upper part of right middle lobe. CT demonstrated hydropneumothorax on the right side.

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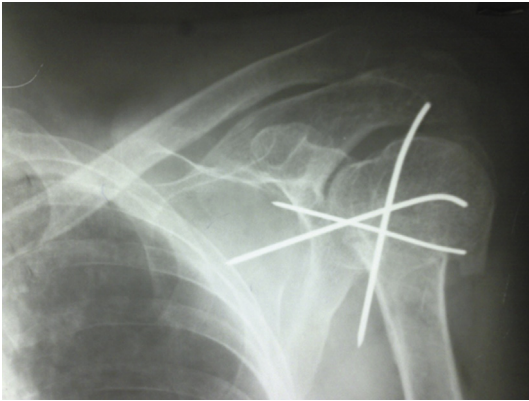


Fig. 1. Fracture of the neck of right humerus with three K-wires penetrating the head of humerus.



Fig. 2. Radiograph showing united proximal humeral fracture with retained K-wire.

An exploratory video–assisted thoracoscopy was performed via the second intercostal space and the K-wire from the right apical lobe was removed using a ring forceps (Fig. 5A, B). The patient has remained completely asymptomatic at 24 weeks follow-up and chest radiogram was normal (Fig. 5B).

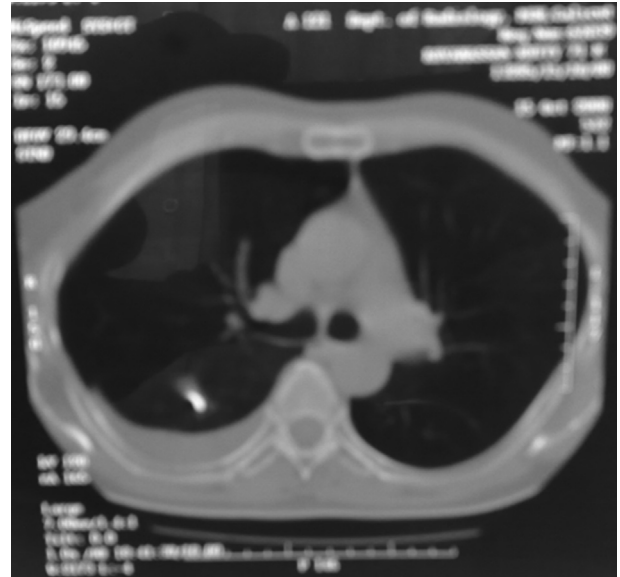


Fig. 4. Computed tomography of the chest showing migrated K-wire extending from the inner cortex of right second rib to the upper part of right middle lobe with a hydropneumothorax.

Discussion

Displaced fractures of the surgical neck of the humerus are usually treated by closed reduction unless the fracture is severely comminuted. If the reduction is unstable, percutaneous pinning needs to be performed.³

Percutaneous multiple K-wire fixation is an accepted method for fixation of displaced proximal humerus fractures.⁴ Mazet et al⁵ first reported the migration of K-wires and other fixation devices from shoulder region into thorax in 1943. Since then, sporadic case reports have recorded remarkable journey of wires from the shoulder region. The location of the migrated pins varied, and it included the heart, aorta, pulmonary artery, brachiocephalic artery, oesophagus, trachea, thoracic duct, lungs, spleen and the spinal canal.^{1,6–22} The

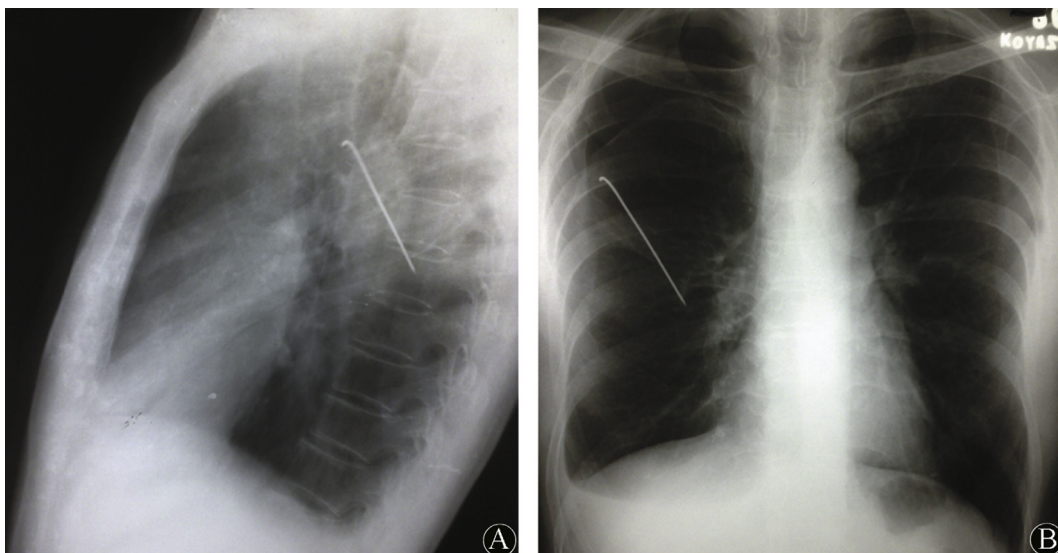


Fig. 3. A and B. Radiograph showing full length of migrated bend K-wire in lateral and anteroposterior views.

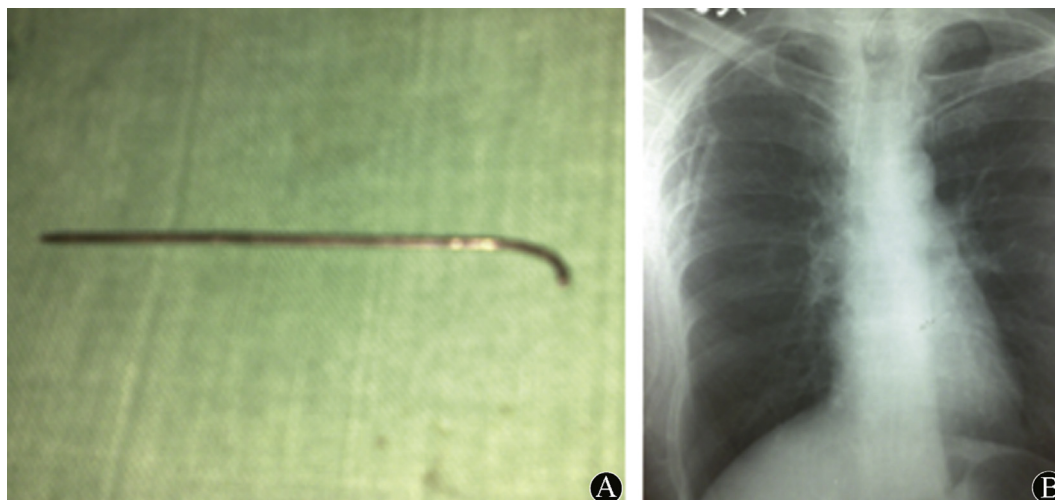


Fig. 5. A and B. Removed K-wire and immediate postoperative radiograph.

pins that migrated were inserted for cases like sternoclavicular joint dislocation, acromio clavicular joint dislocation, fractures of the clavicle, arthrodesis of the shoulder, unstable posterior dislocation of the shoulder, proximal humeral fractures, distal radius, phalanges and the femoral head.^{1,5}

Why should K-wires, used in this way, migrate into the thorax? Theories include muscle action, the great freedom of movement of the shoulder, negative intrathoracic pressures associated with respiration, regional resorption of bone, gravitational force, insufficient measures taken to secure the fixating devices and even capillary action.^{5,8,18} According to Kim³ and Lyon⁵ the pins used for fixation should be terminally threaded and free end bent to prevent migration. Yet wires migrated irrespective of the type (threaded or smooth) of pin and whether terminally bent or not.⁵

Most of the reported cases of pin migration in the literature are linked with the sternoclavicular joint as the primary location of fixation, followed by the clavicle, the acromioclavicular joint, and the proximal humerus.¹ This implies that the closer the location of the pin, the more chances of its migration to the chest cavity. The duration of the implantation of the device has also been implicated as a significant risk factor for migration. Therefore, the internal fixation devices that are used should be removed at the appropriate time to prevent loosening, infection, or migration. The appropriate time to remove the pins is when there is radiographic evidence of fracture stability, usually from 4 to 6 weeks after placement.³

Furthermore, most of the pins that migrated were noted within eight months after the index operation, and all of those in patients who died suddenly were discovered within this interval. Pins migrating from the sternoclavicular joint⁵ and proximal humerus¹ were the only ones reported to be the ascertained cause of death. In all of the cases, death occurred within 3 months of the initial operation (there are no available records of autopsies performed in these cases). So patients should be followed both clinically and radiographically until the internal fixation devices are removed. If the wires are found to have migrated they must be removed as a matter of urgency, regardless of lack of symptoms.⁵

It is noteworthy that, only eight of the 70 K-wires migrated were from the proximal humeral fractures.¹ It is interesting that migration of a pin to the lung in most reports was asymptomatic and symptomatic migration of a pin to the lung was not necessarily associated with pneumothorax.⁵

The patient in this report had a proximal humerus fracture, which is a rare but known site from where pins can migrate to chest

cavity. Radiogram taken after initial fixation shows that the K-wires were penetrating the head of humerus. Such K-wires are more likely to migrate antegradely from initial site of insertion. Moreover, at the time of implant removal, one of the K-wires used for fixation was left in situ. The pin migration might have occurred at any time between one and three years causing hydropneumothorax after the second surgery for implant removal.

We believe that hydropneumothorax following K-wire migration to the chest cavity is rare and that the patient in this article represents the first such case described in the literature. Removal of the migrated K-wires from the chest cavity can be done via video-assisted thoracoscopy.⁶ This case is an illustration for all of us to follow certain guidelines regarding the use of pins and wires around the shoulder to prevent serious complications. Seven point guidelines regarding the use of pins and wires around the shoulder girdle are summarized as follows:

1. Fixation of the sternoclavicular joint with pins should be avoided.
2. Closer the location of the pin more is the chances of its migration to the chest cavity.
3. The pins used for fixation should be terminally threaded and free end bent to prevent migration. Pin head should never penetrate outside of the far cortex.
4. The patient must be followed up very closely, both clinically and radiographically, until the internal fixation devices are removed.
5. The appropriate time to remove the pins is when there is radiographic evidence of fracture stability, usually from 4 to 6 weeks after placement.
6. Migration of a pin to the lung can be asymptomatic and symptomatic migration of a pin to the lung need not necessarily be associated with pneumothorax.
7. If the wires are found to have migrated they must be removed as a matter of urgency, regardless of lack of symptoms and difficulty in removal of the pin.

In short, antegrade pin and wire migration to the chest cavity from proximal humerus is rare but can cause serious consequences. Furthermore, K-wire migration from proximal humerus causing hydropneumothorax is still rarer. To avoid complications, it is important that pins and wires should be used around the shoulder with utmost care, preferably following the wisdom of knowledge and guidelines derived from the literature. Finally, the risk of migration

after fixation of the sternoclavicular joint with pins is so great and grave that the use of pins to fix that joint should be avoided.

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