

K-wire migration to unexpected site

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Submission date: 20-Sep-2018 06:50PM (UTC+0800)

Submission ID: 1005244716

File name: 7._K-Wire_-_Dr_Komang,_dr_Mouli_IJSO_2018.pdf (1.42M)

Word count: 2823

Character count: 14766



Contents lists available at ScienceDirect

International Journal of Surgery Open

journal homepage: www.elsevier.com/locate/ijso



Case Report

K-wire migration to unexpected site

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ARTICLE INFO

Article history:
Received 27 March 2018
Received in revised form
8 April 2018
Accepted 10 April 2018
Available online 12 April 2018

Keywords:
K-wire migration
Protocol of K-wire
Failure implant
Case report

ABSTRACT

Kirschner wire migration is a notorious incident in orthopedic surgery. Efforts to avoid it was carried out by several standard procedures, including bending the wire and reporting the cases all around the world in many journals. Nevertheless, the incident still happens, and some include symptoms that amazed doctors as to how the wire travelled.

We reported a migration of forgotten wire to contra lateral region presented as corpus alienum of the lung in a 34-year-old woman after distal clavicular fracture surgery three years previously. We also reported a migrating wire fragment after a fall accident in sport activity of a 28-year-old male; which travelled from clavicular region to cervical 6–7 region in 4 days. Both cases were successfully managed without extravagant surgery or serious damage, helped by meticulous history taking, physical examination, precise imaging, and prompt management. These cases render lessons and discussion for further understanding of the wire migration and the exact protocol in handling K-wire patient.

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1. Introduction

Kirschner wire, which was introduced in 1909, is a simple orthopedic implant tool to stabilize fracture [1]. It is well accepted, relatively cheap and easy to implant. The first versions of the Kirschner wire were hammered through a predrilled hole into the bone. Since 1943 until recently, there have been reports that the wire could migrate into the thorax cavity, contralateral, and even to abdomen [2–4]. Theories include muscle action, the great freedom of movement of the joint, negative intrathoracic pressures associated with respiration, regional resorption of bone, gravitational force and even capillary action [5–7]. Migration of K-wires have been reported as early as the day after fixation and as late as 21 years [4] (see Figs. 1 and 2).

Albeit all the reports, surgeons and other medical doctors sometimes forget to realise that K-wire could migrate and cause several signs and symptoms mimicking other acute or chronic diseases, and even the patient sometime does not remember the previous K-wire insertion [5,6]. We report two cases of K-wire migration and discuss the applicable theory for several incidents from different case reports from journal reviews. This work has been reported in line with SCARE criteria [8].

2. Case report I: main complaint: chronic coughing and bloody sputum

A female patient with chronic coughing, chest pain during deep inspiration, and bloody sputum was referred to orthopedic department of Dr Soetomo General Hospital, Surabaya when the routine X-ray found a foreign metal object in the right lung region. After checking her medical history, we found out that the patient underwent pinning with Kirschner wire (K-wire) for close fracture of the distal left clavicular bone three years before, in a rural hospital. The patient presumed that the clavicular case has been solved and cannot remember whether she should come for another surgery to remove the implant. The patient lost all the documents and X-ray of the previous surgery.

The patient is a 34-year-old housewife with regular household activity. Since the surgery, the patient has never complained about any serious pain or sickness. The coughing started in the past month without fever, malaise or decreased body weight. Other than pain in the right chest upon deep aspiration, no other pain was felt including in the left shoulder. The laboratory evaluation findings, except the ESR (95mm/hour), were within normal value. X-ray of thorax and further CT scan revealed tension band wiring with two intact K-wire in the distal left clavicular bone and corpus alienum (8 cm metal wire) in the right thorax cavity, attached in the superior lobe of the right lung with reactive reaction surrounding it. A joint surgery with a thorax surgeon to extract the wire in the lung and the clavicle was performed on the third day. Intraoperative

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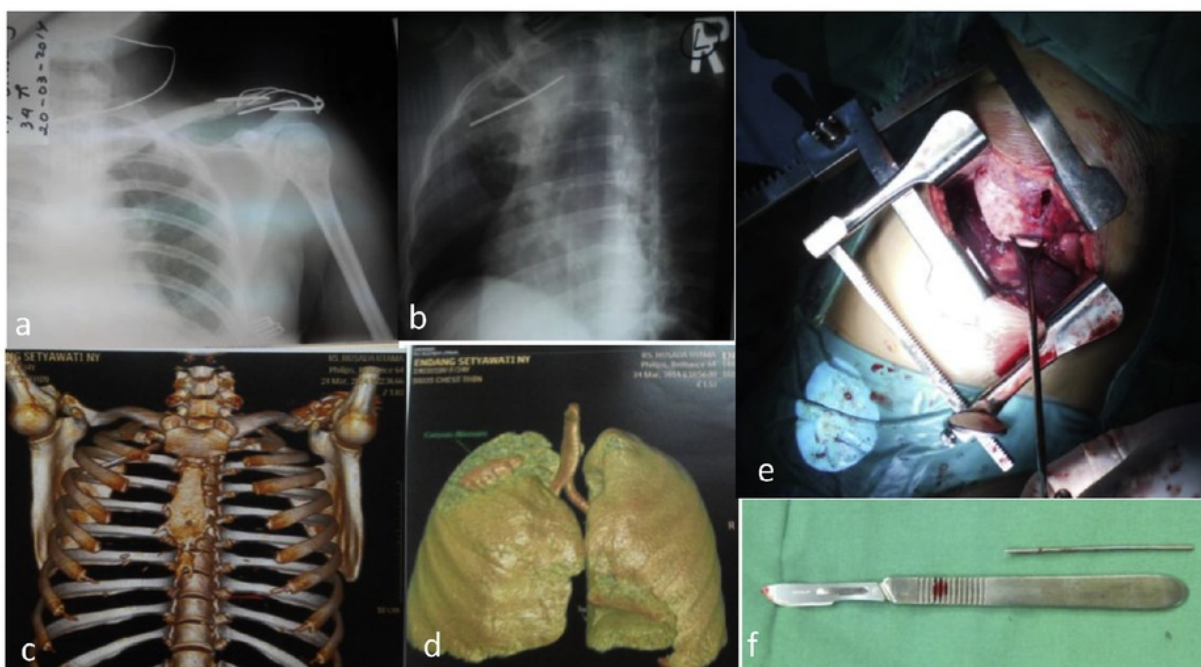


Fig. 1. Trans thoracal migration of K-wire. (a) Tension Band Wire after 1 year (b) X Ray picture one K wire migrate to the right lung (c) CT Scan show location of K wire in right thorax (d) MRI showed K wire in the right lung (e) K-wire in lung parenchym (f). Length of K-wire after removal.

evaluation disclosed that the lung parenchyme does not need to be excised; the wire was easily removed and then debridement was performed to clear the granulation tissue surroundings. Post-operatively patient was well with normal lung function capacity. Patient was discharged on the fifth day.

There were three similar cases where failure of K-wire was reported where it migrated to contralateral site in the thorax cavity [5,6,9]. All cases were from healthy adults and the complaint started after more than 30 months of the insertion; and the migrating wire was found un-bended or bowed/curved. The wire is so sharp that the migration process does not trigger any pain until it stabs a solid plane. After the wire is loosened from the bone, it may be pushed along the muscle bundle by the contraction force; henceforth when stabbing the thoracic wall or mediastinum, it would be sucked up by the negative pressure of respiration, propelled and

then jabbed in the end target, which could be anything inside the cavity. Therefore, it is not unusual for the migration wire to be present in the collateral site of the initial insertion.

3. Case report 2: broken K-wire migrate from right distal clavicle to C6-7 in 4 days

A 28-year-old male came to an orthopedic surgeon after he fell in a badminton session. He fell on his right torso side where a year previously was fractured and treated by surgery. On X-ray evaluation, implant failure of the previous surgery was revealed. Surgery to remove the implant was performed urgently yet only 2 out of 3 K-wire were found and extracted. Patient was told that if nothing happen, then the missing wire would do no harm. Only if some complaints arise, the second surgery would be planned. Patient

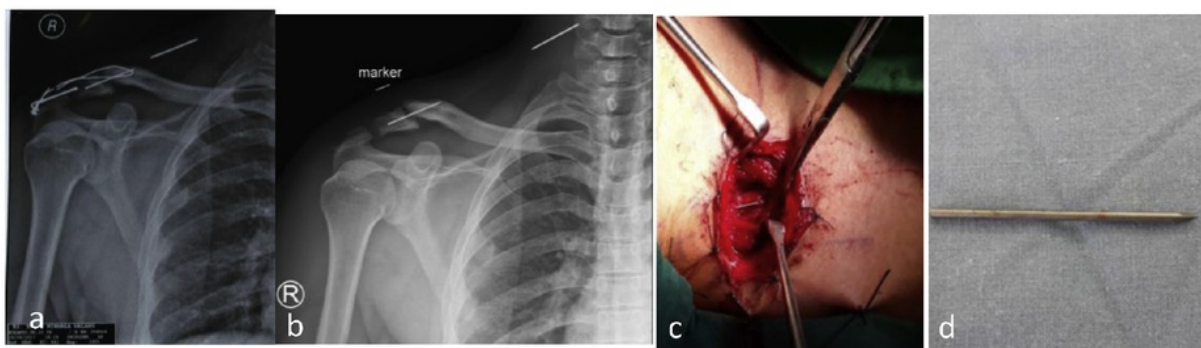


Fig. 2. Cervical migration of K wire. (a) Broken K-wire 1 year after surgery; (b) 4 days after first surgery; (c) K-wire migrate to cervical 6–7; (d) K-wire after removal.

proceeded to be active as usual including resuming his sport activity, but starting to complain of right neck pain especially when rotated to left side. The patient got worried.

On the fourth day of the accident, the patient arrived in Surabaya Orthopedic & Traumatology Hospital, and was prepared for immediate surgery, after the X'ray of cervical spine found the missing wire fragment in Cervical 6–7 region. The neurological status was within normal findings. All necessary laboratory evaluation was within normal value. Incision by anterolateral approach in cervical C6-7 region was conducted under general anesthesia. Guided by intraoperative imaging, the wire was seen resting above the spinal foramen. Layer by layer, the muscle was incised. Fragmented wire was seen inside the muscle belly of scalenus muscle, the end tip of the wire was facing the spinal foramina. Wire was easily extracted without resistance. The patient was stable, the pain was gone, and he was discharged overnight.

The migrated wire was fragmented because of the fall. Even when the wire was bended according to our standard procedure, once it is fragmented, the wire could migrate along the muscle contraction depending on the function and the location of the muscle. In this case, it went along the trapezius muscle and levator scapulae muscle. One case that reported similar migrating through muscle contraction was a case of an 83-year-old woman with pinning of left column humerus, which loosened within a month. The wire then migrated through the pectoralis and external oblique muscle, and stabbed inwardly to thorax region and the upper left abdominal region just superficial to the spleen [3].

4. Discussion

Kirschner wire is famous because it is cheap and easy to insert. The wire is 1.5–1.8 mm in diameter and could be bend and twist, making it suitable to stabilize some small bone fragment without anchoring [10]. It is used in small bone in the hand and also in small part of long bone or pelvic bone, even as an adjunct in arthroplasty procedure [7]. Sporadic reports since 1943 until recent 2017 in more than 89 articles have alerted the orthopedic surgeon for the possibility of the migration routes, how early it can migrate, how urgent the management should be, and the suggested recommendation to handle K-wire patients [4,9].

In cases reported from before 1990, most wire migrations were supervened in less than 4 months and mostly were fatal cases. Those were times when the wire did not bend on insertion. Other short time-lapse of less than 1 month was reported in old osteopenia patient [3,11] and 7 months in a 70-year-old male with history of pneumoconiosis which gave him hard deep exertion breathing [12]. Recently, a very detailed meta analytic study by N'da et al. describes several reported serious complications due to K-wire migrations [13]. In several journal, K-wire was reported passing across the sigmoid colon; such as in a case of death due to intra-aortic migration of K-wire from the clavicle, a migration of K-wire from the femur in the right ventricle and in the right pulmonary hilum, and spinal migration of K-wire; but the mechanism is not well explained.

There are several theories of why and how this migration proceeded, including regional resorption of bone, muscle action, and negative intrathoracic pressures associated with respiration. When the wire is drilled into the bone, the heat initiate bone necrosis and hinder the osteoblast reaction [14]. In osteopenic bone, without enough physiologic bone reaction, the wire is easily loosened then exposed to muscle action. When the position is parallel enough the wire could travel along the muscle contraction. Or when the sharp needle-like end was pushed by muscle action into neighbouring space of thorax cavity, the negative pressure of heavy exertion breathing could send the object flying and stab the first solid plane

target. The target could be anything in the cavity; lung [2,9], trachea [12], aorta [4–6], pericardia [7], or spinal vertebra [15]; depending on the angle of the wire position; including the contralateral target similar to our first case. When the sharp wire stabs into a large vessels, it could be sucked-up and flow intravascular until it struck or end up in a solid plane as in the right ventricle [16]. Movement from bone, within muscle, in the cavity, or intravascular would not provoke prolonged pain entitled to the sharp end and diameter of the wire. Only when it stab and induce injury then the pain, and other inflammatory reaction such as swelling, extravasation, and further to granulation reaction is triggered [6,9,16].

Although bending the wire has been advocated as the prevention of the migration; 8 out of 12 cases were reported un-bend wire [13] or some not reported un-bend wire cases which probably due to devastating consequences and litigation reasons [4]. Those are evident that the advice may not work, especially when the wire is loosened or when the wire breaks because of vigorous joint movement or fall, in the same way as our second case. It is still strongly encouraged to bend the wire in spite of the age of the patient. When osteopenia is suspected, close radiological follow-up need to be planned. Bone healing takes around 4–6 months; K-wire should be removed as soon as the bone healed and united, and function well; for the latest, a year after the surgery is recommended. Surgeon should never reckon a wire left missing will do no harm especially when it is close to large vasculature or thorax cavity. Even when there is asymptomatic case, immediate surgery to remove the wire should be conducted without any hesitation.

5. Conclusion

We reported two cases of K-wire migration to unexpected site, one travelled trans thoracic to contralateral lung parenchyme, and the other migrated through muscle contraction from clavicular to cervical spine C6-7 in 4 days' time. Both cases taught us not to underestimate the necessity of surgeon's awareness in bending the cutaneous part of the wire, and also to remind the patient about the removal of wire after clinical union and the dangerous impact of not doing so.

5 Ethical approval

Institutional review board approval was exempt from our institution because all data were collected from clinical records and imaging system for routine pre-post-operative planning and follow up.

4 Funding

There are no funding resources for this paper.

Author contribution

Komang Agung Irianto do surgery and wrote this paper; Mouli Edward and Angga Fiandana attended the surgery; all authors read this paper.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Guarantor

Komang Agung Irianto.

Research registration number

Researchregistry3893.

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Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

6

Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.ijso.2018.04.003>.

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