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Migration of a Kirschner wire into the spinal canal after acromioclavicular joint repair (case report)

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Abstract

Introduction Fixation of the acromioclavicular joint with Kirschner wires (K-wire) has been widely used by orthopeadic and trauma surgeons in the recent past. Now the technique is less common. Migration of Kirschner wires is a common complication being limited to the fixation area in the majority of cases and can be a devastating event in rare cases. The objective was to explore K-wire migration into the spinal canal after acromioclavicular joint repair. **Material and methods** A clinical case of a broken K-wire migrated into the spinal canal is reported. An unsystematized literature analysis on the topic was performed. **Results and discussion** A routine examination revealed a K-wire fragment migrated into the spinal canal at the cervical level 7 years after acromioclavicular joint fixation in a 36-year-old man. The pin fragments were removed from the spinal canal and from the acromioclavicular joint site. The postoperative period was uneventful. A good clinical result was obtained, the wounds healed by primary intention. Migration of K-wires into the spinal canal is a rare but severe complication that can lead to injury to the dura mater, the spinal cord and the vertebral artery. There are cases of wire migration reported outside the insertion site: into the lung, mediastinum, esophagus, spleen, intestines, aorta, and heart with the timing of wire migration ranging from 11 days to 12 years of surgery. **Conclusion** The case report and literature review have shown a risk of K-wire migration into the spinal canal when used for fractures and dislocations. The technique requires dynamic observation of the patient throughout the treatment period. The pins should be removed after fracture healing or dislocation repair. The manipulations can minimize the risk of a fracture and migration of the K-wires.
Keywords: Kirschner wire, wire migration, spinal canal, acromioclavicular joint, cervical spine

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INTRODUCTION

Cases of migrated Kirschner wires (K-wire) have been reported as rare after acromioclavicular restoration [1-5, 6, 7]. This is due to the development of modern implants with the design solutions ruling out the occurrence of such a formidable complication. Despite new technologies and implants, the cases are encountered in the surgical practice. There are reports of wire migration that can cause injury to the esophagus, major vessels of the neck, lung, aorta, and heart [1, 3, 8-15]. The injuries can be fatal. The wires migrated to the spine can be associated with injury to the spinal cord and the vessels leading to neurological and vascular complications. The objective was to explore the problem of spinal K-wire migration after acromioclavicular repair and perform a non-systematic literature review.

MATERIAL AND METHODS

A case report includes description of a 36-year-old male patient who was admitted to the hospital 7 years after an injury with spinal Kirschner wire migration. Physical examination, surgical details and outcome are described in detail. In addition to the case report, a non-systematic literature review on the topic is presented in the Discussion.

RESULTS

A 28-year-old man sustained an injury resulting from a fall on his right shoulder. A closed dislocation of the acromioclavicular joint was diagnosed on the right. He was admitted to the trauma department and underwent an operation including open reduction, fixation of the dislocated acromioclavicular joint with two Kirschner wires. The postoperative period was uneventful and the patient was discharged for outpatient

care after 7 days. The dislocation appeared to be reduced with the Kirchner wires being adequately positioned at 3 months. The patient did not show up for follow-up examinations after that.

A routine radiography of the right shoulder involving the cervical spine performed at the age of 36 demonstrated a broken Kirschner wire that had migrated into the spinal canal. The patient had neither complaints nor clinical manifestations at the time of examination. The patient was transported to the Regional Clinical Hospital No. 2 in Tyumen with an ambulance and examined by a trauma and neurosurgeon on admission. The patient had no complaints and no neurological deficit. Radiograph of the right shoulder joint and CT scan of the cervical spine were performed. The CT scan showed a wire migrated anteriorly off the spinal cord penetrating into the spinal canal through the right intervertebral foramen and reaching the opposite side at the level of the right intervertebral foramen of the C6 vertebra (Fig. 1, 2).

Description of the operation

The patient was positioned on the left side after preoperative preparation under endotracheal anesthesia. The operating field was marked using the image intensifier. With three sterile processing of the surgical field performed, a 5 cm longitudinal incision was made along the posterior edge of m. sternocleidomastoideus (Fig. 3 a, b). The skin, subcutaneous fat, subcutaneous muscle of the neck, and the superficial layer of the deep cervical fascia were dissected in layers. An access to the tip of the Kirchner wire was produced with an obtuse and sharp technique using the image intensifier. Hemostasis was provided throughout the operation. The Kirchner's wire was removed using a clamp, no liquor flow was detected at the Kirchner's wire (Fig. 3 c, d). The wound was sutured layer-by-layer and cleaned, an aseptic bandage applied.

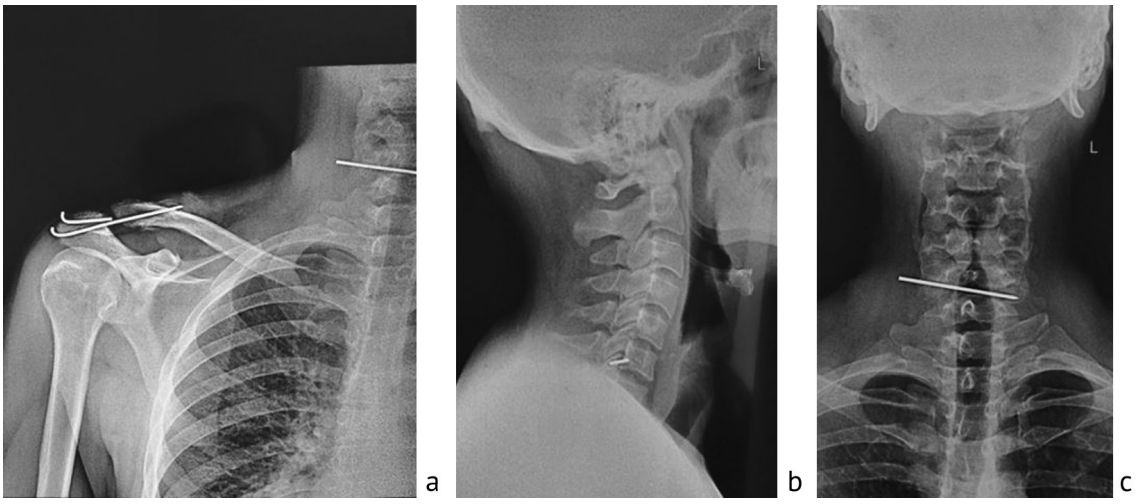

Fig. 1 Radiographs showing the right shoulder (*a*); the cervical spine on the lateral and anteroposterior views (*b, c*). The pictures show the acromioclavicular joint repaired with two Kirschner wires with a wire broken and migrated into the right intervertebral foramen of the C6 vertebra

Fig. 2 Computed tomography scan showing the cervical spine at the level of the C6 vertebra with the wire migrated anteriorly to the spinal cord and penetrating into the spinal canal through the right intervertebral foramen and reaching the opposite side of the vertebra (*a*); *b* – CT topogram showing the Kirschner wire migrated from the right acromioclavicular joint to the spinal canal at the level of the C6 vertebra

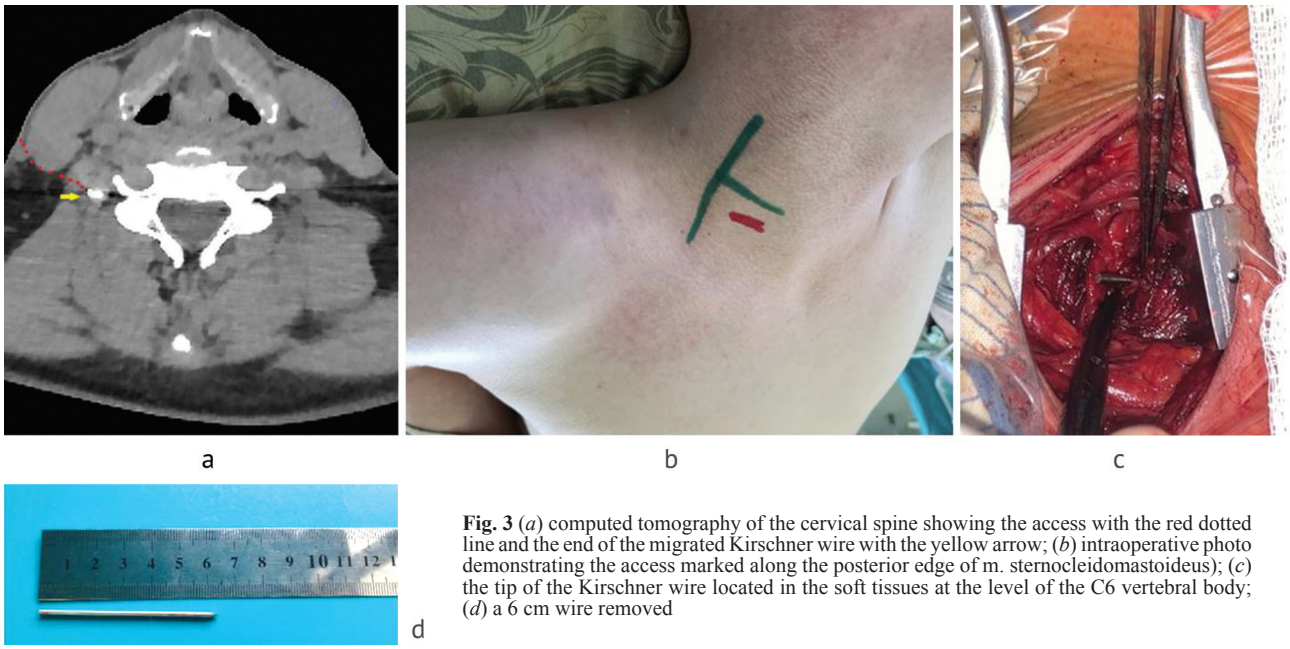

Fig. 3 (*a*) computed tomography of the cervical spine showing the access with the red dotted line and the end of the migrated Kirschner wire with the yellow arrow; (*b*) intraoperative photo demonstrating the access marked along the posterior edge of m. sternocleidomastoideus); (*c*) the tip of the Kirschner wire located in the soft tissues at the level of the C6 vertebral body; (*d*) a 6 cm wire removed

With three sterile processing of the surgical field at the second stage, a 5 cm longitudinal incision was made at the site of the postoperative scar in the projection of the acromioclavicular joint on the right at the second stage. The ends of the Kirschner wires were exposed using a clamp. Hemostasis was provided during the operation. The wound was sutured layer-by-layer and cleaned, an aseptic bandage applied.

Reconstruction MRI and CT scans of the cervical spine performed postoperatively (Fig. 4) showed no complications. The wounds healed by primary intention, the sutures removed after 12 days. The patient was discharged in a satisfactory condition for outpatient treatment. The patient presented no complaints being in a satisfactory condition at 1 month.

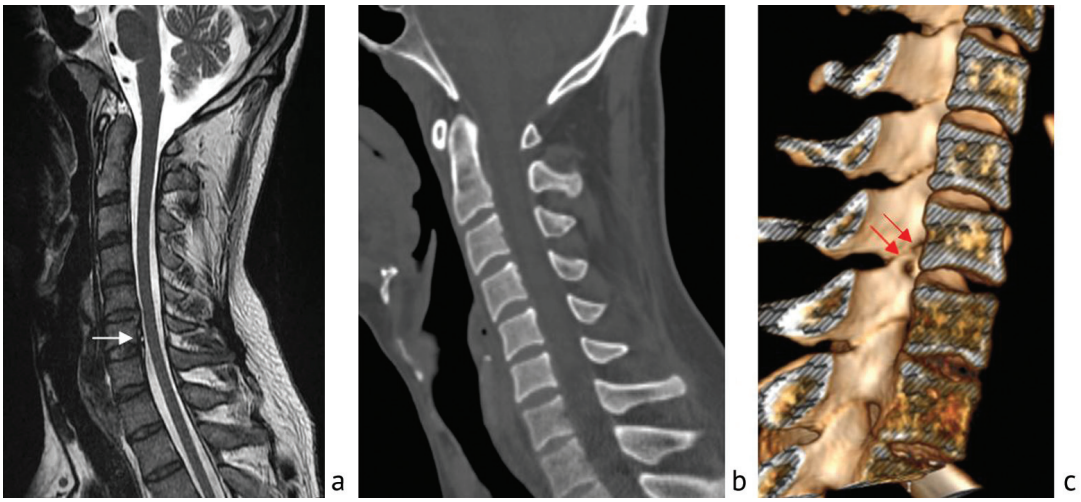

Fig. 4 Postoperative images: (*a*) MRI scan showing the wire located under the posterior longitudinal ligament (white arrow); (*b*) CT scan; (*c*) CT reconstruction showing a wire defect with the red arrow

DISCUSSION

Kirschner wires were most commonly in traumatology and orthopaedics for osteosynthesis of the surgical neck of the shoulder, femoral neck, the clavicle and for acromioclavicular restoration [1-4]. Kirschner wire migration is a well-known complication first described by Mazet R.J. in 1943 [2, 5, 6]. Flinkkilä T. et al. [20] reported the Kirschner wire migration in 54 % of the cases. Wires can migrate to the chest, abdomen, small pelvis and spine depending on the site of surgical intervention [1, 10, 13-15]. This can lead to an injury to internal organs including lungs, mediastinum, esophagus, spleen, intestines,

aorta, and heart [1, 3, 8-15]. Internal organs injured by migrated wires can result in adverse events and lethal outcome in some cases [8, 12, 18, 19]. Migration of Kirschner's wires into the spinal canal is a rare but quite serious complication [21, 22]. This can lead to injury to the dura mater, the spinal cord and the vertebral artery [23]. Wire migration into the spinal canal is not accompanied by neurological symptoms in the majority of cases [24-28]. The case of Kirschner's wire migration into the spinal canal was first reported by Hinzpeter T. et al. in 1977 [29]. The intervertebral foramen [24, 27, 29-31] at the level of C7-Th1 [25, 30] and Th2-3 [5, 26, 32] is most common point of entry into the spinal canal. The level of C6-7 vertebrae was the entry point in our case. According to the literature data, the timing of wire migration ranges from 11 days [16] to 12 years [17]. So far, there is no exact reason for the wire migration. The factors contributing to this phenomenon include greater mobility in the shoulder joints [33, 34], muscle contraction [7], negative chest pressure, respiratory activity [33-35], capillary adhesion and electrolysis [36].

The choice of technique for removing migrated wires depends primarily on the available facilities clinic. If the patient has no neurological symptoms, the surgical field is marked under radiological control, and access is produced over the end of the wire to ensure good visualization and appropriate exposure [23, 26, 27]. Laminectomy [25] or interlaminectomy [37] can be recommended to detect a nerve injury in the presence of neurological deficiency. There were no neurological symptoms in our case and the access was limited to above-the-wire area and the wire was removed after exposure and rigid fixation with a clamp.

Mamane W. et al. (2009) suggested radiography to be performed every 2 weeks after surgery to prevent the Kirschner wire migration, secure immobilization of the limb after surgery and wire removal at 6 weeks of fixation [26]. Hinzpeter T. et al. (1977) and Regel Jp. et al. recommended wire removal with any signs of wire migration prior to the symptoms [29, 38]. Minić L. et al. [39] suggested the use of wires with threaded ends, and Fransen P. et al. suggested bending wires at an angle of 90 degrees. [25]. Liberski J. et al. suggested nonsurgical treatment as the right procedure for less demanding patients (alcohol, drugs, mental subnormality) [40]. With the variety of methods used to prevent migration of Kirschner wires in osteosynthesis of the clavicle and restoration of the ACL, the complication cannot be completely avoided [32] and modern fixators are practical for preventing disastrous consequences.

CONCLUSION

Migration of Kirschner's wires into the spinal canal is a rare and formidable complication. Prophylaxis of fractures and wire migration is essential with surgical use of the wires. Dynamic observation of the patient throughout the treatment period, radiographic control and timely removal of the fixation wires can reduce the complication rate. Prevention of wire migration should be an integral part of postoperative management of patients.

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Paskov R.V. – coordination of the research, review of publications on the topic of the article, analysis of the data, editing of the article.
Bazarov A.Yu. – coordination of the research, data analysis, article editing.
Prokopiev A.N. – review of publications on the topic, analysis of the data, editing of the article.
Svinoboev S.L. – review of publications on the topic, analysis of the data, editing of the article.
Mezentsev A.A. – treatment of the patient, collection and processing of the material, editing of the article.

All authors read and approved the final version of the manuscript. All authors agreed to be responsible for all aspects of the work to ensure proper consideration and resolution of all possible issues related to the correctness and reliability of any part of the work.