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Transforaminal Migration of K-Wire From Clavicle to Cervical Spinal Canal: A Case Report and Review of Literature

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Learning Point of the Article:

Even though K-wires in shoulder injuries are still associated with loosening and migration to spine and other vital structures, early identification can aid for easy removal and prevent drastic consequences.

Abstract

Introduction: Kirshner wires are commonly used for orthopedic surgical fixation for shoulder injuries, particularly around the acromioclavicular joint. They are versatile, cheap, and minimally invasive in stabilizing bone fragments. However, there have been cases of secondary migration of K-wires from the clavicle to surrounding tissues, particularly around the cervical spine.

Case Report: We present a case of a 60-year-old female with left-sided neck pain and radiation to the left upper limb, a K-wire was found to have migrated through the C7-T1 foramina left side into the spinal canal posterior to the vertebral body in a transverse trajectory. The patient underwent surgical removal of the K-wire, and post-operative pain improved without neurological complaints.

Conclusion: Even though Kirshner wires are versatile, cheap, and minimally invasive in stabilizing bone fragments, but migration to unexpected anatomical sites remains a concern. This paper reviews the literature and discusses clinical presentation, diagnostic modalities, and surgical approaches related to spinal canal migration of K-wires.

Keywords: Kirshner wire, migration, spinal canal, clavicle fixation, acromioclavicular repair.

Introduction

Unstable fractures around the shoulder girdle involving the acromioclavicular joint or lateral end clavicle are usually managed by reduction and stabilization with Kirschner's wires (K-wires) [1] and tension band wires or sutures. K-wires are thin, malleable, and can break easily compared to plates and screws, hence cause loosening and migration to surrounding tissues [2]. K-wires are usually cut/bend at the skin surface externally or over the bone surface internally, most of them requiring removal of the wire after fracture healing is complete [3]. Migration of K-wire from joints to deep visceral organs/tissues is rare. It can cause complications, primarily when originating from acromioclavicular and clavicle fixations [4,5] as their usage around the shoulder is associated with migration into thoracic cavity, soft tissues/vessels in the neck/thoracic region, and thoracic/cervical spine [6]. Migration into the spinal canal is rare but can lead to neurologic complications.

Probable reasons for these complications were breakage/loosening and migration of implant to surrounding tissues, especially K-wires. Certain factors associated with increased incidence of these complications around the shoulder joint due to the inherent mobility of the shoulder girdle, and negative intrathoracic pressure.

We report here a case of Transforaminal migrated K-wire from

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Author's Photo Gallery


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Figure 1: Anteroposterior view X-ray showing broken K-wire in clavicle and migrated k-wire to cervical spine.

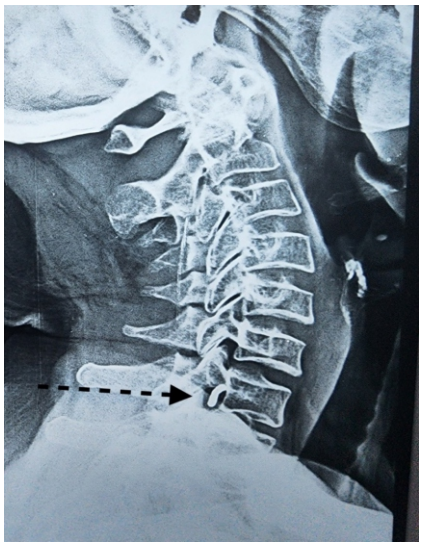

Figure 2: X-ray lateral view showing (dotted arrow) K-wire located in neural foramina C7-D1 level.

the lateral end clavicle to C7-T1 foramina lying in to cervical spinal canal managed by surgical removal with no neurological deficit.

Case Report

A 65-years-old female had presented to us with complaints of chronic pain around the left side of the neck with mild radiation of pain to shoulder region for 1 year with VAS(visual analoge scale) around 6/10. She does not have any paresthesia/numbness over upper limb. She had a previous history of surgery of her left shoulder operated 8 years ago for lateral end clavicle fracture by K-wires and tension band wire fixation.

On radiological evaluation X-ray (Fig. 1 and 2) and Computed tomography (CT) Cervical spine (Fig. 3 and 4) there were 2 K-wires of unequal sizes and stainless-steel wire in lateral end clavicle across acromioclavicular joint. Another K-wire was lying at the level of C7 vertebral body lying posterior to vertebral body in the canal. A part of K-wire was lying in the spinal canal across the foramina(C7-T1) in the transverse trajectory toward transverse process. Possibly the wire from the lateral end clavicle was broken and migrated toward cervical spine in transverse trajectory. Measurements were made to localize the tip of the K-wire lying anterior to the transverse process; the lateral end of the wire was lying at 1.5–2 cm from skin surface.

Surgical exploration was planned with the possibility of need for corpectomy and wire retrieval from the spinal canal and simultaneous supraclavicular exploration to trace the tip of K-wire and release the adhesions around the K-wire. Patient was counseled about the same and went ahead for surgery.

Intraoperatively, through a mini-open incision over supraclavicular region K-wire tip was explored (Fig. 5) under image guidance. Wire tip was freely mobile and free from any soft-tissue adhesions. Slow movements allowed K-wire to be extracted backward in the same trajectory as wire was loose and removed completely out of the wound (Fig. 6). No cerebrospinal fluid (CSF) leak was noticed. Other K-wires over lateral end clavicle and acromion were removed through separate incision. Moreover, manipulation of the shoulder was

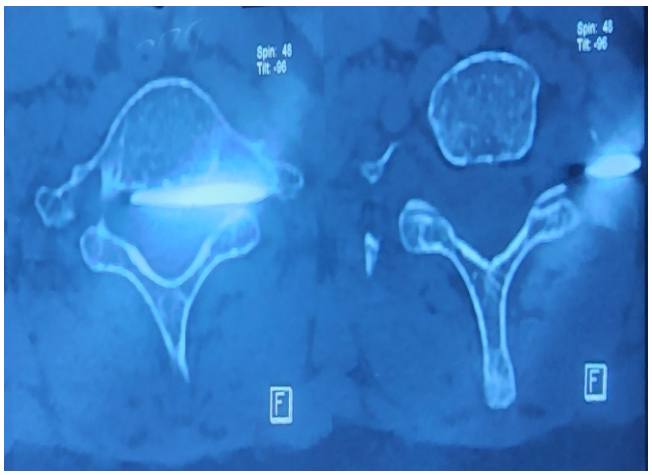

Figure 3: Axial CT showing K-wire with tip in spinal canal posterior to C7 vertebral body and wire lying across left neural foramina.

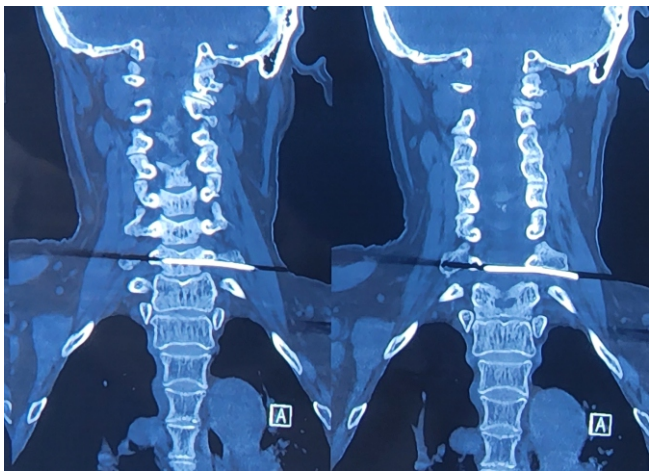

Figure 4: Coronal CT showing K-wire migrated in transverse direction lying in the spinal canal

Figure 5: Intraoperative image showing mini-open supraclavicular access(inset distant image of patient under anesthesia) showing exposed tip of k-wire.

attempted to improve range of movement. Postoperatively patient was asymptomatic with resolved pain over the neck and shoulder region. VAS improved to zero and no post-operative neurological symptoms were reported. The patient was on regular follow-up until 1 year and asymptomatic with no recurrence of similar complaints.

Literature Review and Discussion

Clinical features

Migration of K-wires is rare but possible, with the prevalence of 5.8 to 54% [3]. The slow movement may be unnoticed due to the sharp tip, which can dissect the tissue planes. Spinal migration occurs around the transverse process, lamina, and anterior to vertebral bodies. Migration through neural foramen into the spinal canal is rare; only 20 cases are reported in the literature (Table 1). Most of them occurred in males and only two females, including the present case. The initial surgery was related to shoulder girdle in almost all cases except Furuhata et al. [6], reported after sternal repair for cardiac surgery. The duration between initial surgery and diagnosis of migration was the earliest in 26 days [7] and the longest in 19 years [4]. Clinical features varied from asymptomatic with incidental detection on follow-up in three cases [7-9]. Most of the cases reported neck pain/headache and radiating to the shoulder and

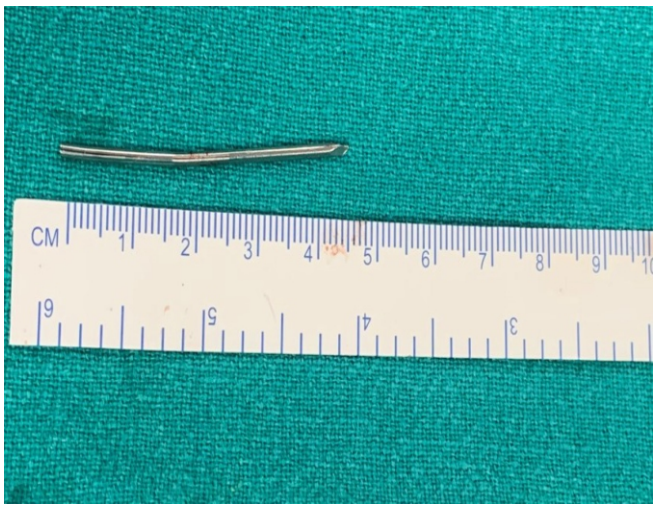

Figure 6: Showing removed broken k-wire of 45–50 mm length found slightly bent at the center.

upper limb without neurological deficits. Only five cases reported neurological deficits causing quadriparesis, Brown-sequard syndrome, and bowel and bladder involvement [10-14]. Furuhata et al. described a case of K-wire used for sternum fixation after cardiac surgery migrating to the spinal canal after piercing through the vertebral body [6]. Etiology is unknown but is attributed to movements of the shoulder girdle, negative intrathoracic pressure, breathing movements, etc. Older case reports have frequently noted a high incidence of paraparesis and quadriparesis. Interestingly, no paraparesis has been reported since the case report of Fransen et al. in 2007 [14].

Investigations

CT scan helps to know the lesion's anatomy and identify the sharp tip's exact location. CT angiography is recommended in case of suspicion of vessel involvement. We did a CT angiogram to check proximity or injuries to vertebral vessels. MRI is usually avoided to prevent loose metal oscillation from the magnetic field. MRI done in a study by Al Rhaazi et al. [15] reported no neurologic deterioration after the scan.

Surgical procedure

All reports removed the migrated wire except Liberski and Ficek [16] due to the patient's refusal of surgery. Bennis et al. [8] reported that approaching the tip of the K-wire and removal along the axis of penetration was necessary to avoid neurologic complications. Loncán et al., in their patient with Brown-Sequard syndrome, did not consider exposing dura due to uncertain benefits and risks associated. Longitudinal traction was used to pull the wire. The patient recovered sphincter control, could walk independently with a cane by 2 months, and

S. No	Author	Age/Sex	Symptoms	Initial Surgery	Migration vertebral Level and wire trajectory	Time from initial surgery to Intraspinal migration	Management	Outcome
1.	Loncán et al. 1998	22/M	Brown-Sequard syndrome	Clavicle fixation	T2/3 transverse	2 Months	Removal by supraclavicular incision. No cord decompression	Full recovery in 4 months
2.	Regel et al. 2002	50/M	Tetra paresis with loss of bladder function	Right Clavicle fixation	Intraspinal C5/6 Transverse	3 Months	Removal through clavicular incision	Fully recovered
3.	Priban et al. 2005	47/M	Lower limb paraparesis	Chronic Acromioclavicular repair	Through the cord at C7/T1. Transverse Foramen at T4	2 Years	Emergency removal+ Methylprednisolone	Partial recovery in gait and continence with Permanent sexual dysfunction
4.	Fransen et al. 2007	30/M	Paraparesis, bilateral pyramidal syndrome	Clavicle fixation	Through cord at T2 Transverse	1 Year	T1, T2 laminectomy, and wire removal. Fibrin glue for CSF† leak	Recovered
5.	Bennis et al. 2008	57/M	Asymptomatic	Clavicle fixation	C7/T1 Tranverse	4 Months	Surgical removal	No neurological sequelae
6.	Mamane et al. 2009	34/M	Pneumothorax, no neurologic deficits	Non-union Clavicle fixation	T2/3 Transverse	2 Months	Supraclavicular access removal of wire	No neurological deficits
7.	Tsai et al. 2009	49/M	Upper chest pain	Clavicle fixation	C7 lamina Transverse	8 Years	Open removal of threaded wire	No
8.	Was et al. 2010	66/M	Asymptomatic	Humeroscapular fixation(shoulder subluxation)	T8 Neural foramina Transverse	26 Days	Wire removal by posterolateral thoracotomy	Uneventful
9.	Mian et al. 2012	41/M	Neck pain, C8 burning sensation	Left Clavicle fixation with Steinmann pin	C8 Neural foramen	2 Years	left C7 hemilaminectomy, foraminal decompression, and first rib resectionfor pin removal	Uneventful
10.	Li et al. 2013	35/M	Shoulder pain	Acromioclavicular repair	Spinal canal at T2/3	2 Months	Emergent VATS* assisted wire removal. CSF† leak was managed conservatively	Uneventful
11.	Liberski et al. 2013	31/M	Shoulder pain	Right Acromioclavicular repair	Spinal canal at C7 vertebra through C7 neural foramina	6 years	Patient denied for wire removal;	No follow-up
12.	Lee et al. 2014	72/F	Radiating pain	Left Clavicle fixation	C7-T1	2 Months	Removal through supraclavicular incision	Symptom-free
13.	Minic et al. 2015	30/M	Numbness in all four limbs Headache.	Right Clavicle fixation	Intraspinal T2/3 anterior to cord	4 Months	Surgical removal through posterior approach	Recovered
14.	Mankowski et al. 2016	34/M	Neck and shoulder pain.	Acromioclavicular repair	C6/7 tip near vertebral artery	7 Years	Supraclavicular approach removal of wire and revision plating for clavicle	Recovered
15.	Gonsales et al. 2017	42/M	Upper thoracic pain	Clavicle fixation	T2/3	3 Months	Transthoracic periscapular approach for K wire removal	Recovered
16.	Gulyaev et al. 2018	64/ND	Neck pain and UL radiation	Acromioclavicular fixation	C6/7	19 Years	Supraclavicular and Rt hemilaminectomy facetectomy for wire removal; Dural repair with Tachocomb plates	Recovered
17.	Furuhata et al. 2020	68/M	Neck and upper limb pain and numbness	Sternum fixation after coronary artery bypass graft.	Anteroposterior trajectory Through C6 vertebral body and spinal cord	7 Years	Wire removed by cutting to pieces t avoid aorta injury-through anterior approach; CSF† leak repaired;	Recovered
18.	Farion et al. 2023	36/M	Asymptomatic	Right Acromioclavicular repair	Right C6/7 neural foramina	8 years	Supraclavicular removal	Uneventful
19.	Rhaazi 2023	51/M	Neck pain	Clavicle fixation	C6/7 Neural foramina Spinal canal	3 years		
20.	Our case	55/F	Neck pain with mild upper limb pain	Acromioclavicular joint fixation	Spinal canal at C7, C7-D1 foramen,	8 years	Mini-open supraclavicular access	Uneventful

*VATS: Video-assisted thoracoscopic surgery, †CSF: Cerebrospinal fluid

Table 1: Literature review of previously reported cases of K wire migration into spinal canal.

was asymptomatic by 4 months [10]. Li et al. [17] reported using thoracoscopy to remove the K-wire while being prepared for an open procedure. Fransen et al. performed a laminectomy of T2/3, exposed both ends of the wire, and removed it with traction. They faced CSF leakage, which stopped with fibrin glue [14]. Gulyaev et al. [4] used a combined posterior and lateral approach in a patient with C6/7 involvement to avoid secondary spinal cord injury and CSF leakage. Several case reports have used extensive exposures to expose the lateral part of the wire. We approached with minimal incision exposing the tip of the wire, dissected and separated from surrounding tissues, extracted the wire along the axis of trajectory without any complications.

Outcomes

Improvement in symptoms in patients is seen in all patients after surgery, and none have reported surgery-related secondary spinal cord injury or vascular injuries. Improvement in neurologic status, including quadriparesis, and Brown-Sequard syndrome in the case reports suggests the need for prompt diagnosis and early treatment can give excellent results. Residual neurological deficits were minimal reported by Priban et al with permanent sexual dysfunction.

Conclusion

Plate fixation methods are preferred over K-wire fixation in the shoulder region. Otherwise, early removal of wires is essential to avoid complications. Migration into the spinal canal is sporadic but has been reported increasingly in recent years. Removal of K-wire is preferable even in asymptomatic patients. Minimal invasive longitudinal removal is safe after thorough investigations. In neurologic involvement, a combined posterior and lateral approach can be necessary. CT angiography is essential to rule out vertebral or spinal artery involvement. It helps in planning alternate approaches for K-wire removal.

Clinical Message

K-wire fixation was widely used for injuries around the shoulder girdle. A possible complication is loosening and migration of K-wires to visceral structures or spinal canal. Cases operated years back must be actively followed up for any possible consequences and counseled for implant removal if required. This case again emphasizes to wisely choose proper implant to prevent such complications.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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