Case report

Tracheoinnominate artery fistula caused by migration of a Kirschner wire

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Abstract

Iatrogenic injury is an underreported but potentially devastating complication of orthopedic wire migration. We report a 48-year-old man with a tracheoinnominate artery fistula caused by migration of a Kirschner wire that was inserted for fixation of a left clavicle fracture nine years before. Following surgical removal of the wire and repair of both trachea and innominate artery, the patient recovered eventually. Although migration of orthopedic wire to the trachea has been reported twice in previous literature, such a complication involving both the trachea and arch vessel was not previously described. Physicians who care for patients with orthopedic wires in place should be aware of migration with tracheoinnominate artery fistula and other iatrogenic injuries as potentially lethal complications.

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Keywords: Trachea; Innominate artery; Tracheoinnominate artery fistula; Kirschner wire migration

1. Introduction

Orthopedic wires were simple yet efficacious tools in shoulder surgery. Given the number of wires used in orthopedic surgery, iatrogenic injury due to orthopedic wire migration is a rare disease entity that limits the clinical use of orthopedic wires [1]. We herein report our experience in the management of a tracheoinnominate artery fistula (TIAF) due to Kirschner wire migration.

2. Case report

A 48-year-old man was transferred to our hospital, having presented with an episode of massive hemoptysis. He was hemodynamically stable, but the hemoglobin level was only 5.8 g/dl. A chest X-ray showed two bent Kirschner wires (Fig. 1A); one was located above the distal third of the left clavicle, and the other was almost parallel to the left clavicle with its tip across the tracheal shadow. The patient’s medical history was insignificant except for a left clavicle fracture in a motorcycle accident nine years before for which he underwent open reduction with Kirschner wires at another hospital. Some of the Kirschner wires were removed thereafter, but two were left in place. The patient did not attend any medical appointment until this episode. Computed tomography (CT) revealed that Kirschner wire migration had resulted in through-and-through penetration of the trachea (Fig. 1B) and a left para-tracheal hematoma. Possible injury to the arch vessels was therefore suspected preoperatively.

For fear of another episode of massive hemoptysis, we performed an emergency sternotomy with left supraclavicular extension. We explored the aortic arch vessels and dissected the nearby vital structures. After meticulous dissection, we noted a fibrous adhesion between the trachea and innominate artery following the track of the Kirschner wire, which penetrated through the trachea with its tip across the tracheal shadow. The patient’s medical history was insignificant except for a left clavicle fracture in a motorcycle accident nine years before for which he underwent open reduction with Kirschner wires at another hospital. Some of the Kirschner wires were removed thereafter, but two were left in place. The patient did not attend any medical appointment until this episode. Computed tomography (CT) revealed that Kirschner wire migration had resulted in through-and-through penetration of the trachea (Fig. 1B) and a left para-tracheal hematoma. Possible injury to the arch vessels was therefore suspected preoperatively.

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3. Discussion

TIAF has long been a notorious complication after tracheotomy [2] or complex tracheal surgery. In our patient, the TIAF was caused by migration of the Kirschner wire that was inserted for fixation of a left clavicle fracture nine years ago. Based on the imaging findings, sternotomy would be the surgical approach of choice. Because of possible injury to the arch vessels, proximal control of each branch would be helpful for subsequent dissection. The relative locations of the Kirschner wire and the TIAF suggested that, if the bent tail of the wire were not encased by the left brachial plexus, the wire could possibly advance further through the innominate artery and result in a fistula.

Fig. 1. (A) Chest X-ray showed migration of two bent Kirschner wires. The medial wire (arrow) was 9 cm in length, with its tip across the tracheal shadow. The lateral one was located above the distal third of the left clavicle. (B) CT showed that the migrated Kirschner wires (arrowhead) resulted in through-and-through penetration of the trachea and a left para-tracheal hematoma (arrow).

Table 1

<table>
<thead>
<tr>
<th>Reference</th>
<th>Primary fixation site</th>
<th>Pathology caused by migration of orthopedic wire</th>
<th>Manifestation</th>
<th>Interval from placement to migration</th>
<th>Patient outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kremans and Glauser [4]</td>
<td>Left clavicle</td>
<td>Tracheal perforation</td>
<td>Mild sticking sensation in the neck</td>
<td>4 weeks</td>
<td>Expectorated</td>
</tr>
<tr>
<td>Sethi and Scott [8]</td>
<td>Left acromioclavicular joint</td>
<td>Left subclavian artery laceration</td>
<td>Left arm pain</td>
<td>7 months</td>
<td>Surgical removal and direct ligation of the subclavian artery (axilloaxillary bypass 3 months later due to claudication)</td>
</tr>
<tr>
<td>Grauthoff and Klammer [6]</td>
<td>Left clavicle</td>
<td>Left subclavian artery occlusion (subclavian steal syndrome)</td>
<td>Left arm ischemia</td>
<td>4 years</td>
<td>Surgical removal</td>
</tr>
<tr>
<td>Gerlach et al. [5]</td>
<td>Right sternoclavicular joint</td>
<td>Perforation through aortic arch and pulmonary artery</td>
<td>Sudden death due to cardiac tamponade (autopsy diagnosis)</td>
<td>3 months</td>
<td>Died</td>
</tr>
<tr>
<td>Foster et al. [3]</td>
<td>Left acromioclavicular joint</td>
<td>Tracheal perforation</td>
<td>Sticking sensation in the neck, hemoptysis</td>
<td>5 years</td>
<td>Surgical removal</td>
</tr>
<tr>
<td>Wada et al. [9]</td>
<td>Right clavicle</td>
<td>Innominate artery pseudoaneurysm and esophageal perforation</td>
<td>Hematemesis</td>
<td>2 years</td>
<td>Surgical removal via incision in right shoulder (grafting of the innominate artery via sternotomy in another operation)</td>
</tr>
<tr>
<td>Hamano et al. [7]</td>
<td>Right clavicle</td>
<td>Innominate artery penetration</td>
<td>—</td>
<td>5 months</td>
<td>Surgical removal via sternotomy</td>
</tr>
<tr>
<td>Wu and Lai et al. (present case)</td>
<td>Left clavicle</td>
<td>Tracheoinnominate artery fistula</td>
<td>Massive hemoptysis</td>
<td>9 years</td>
<td>Surgical removal via sternotomy (primary repair of innominate artery and trachea)</td>
</tr>
</tbody>
</table>

We performed literature review by searching within PUBMED. We used the key words wire, pin, trachea, innominate artery, brachiocephalic artery, carotid artery, and arch vessels. The references from the selected papers were also reviewed.
exsanguinating hemorrhage. Although migration of orthopedic wires to the trachea [3,4] or arch vessels [5—9] has been reported, such a complication involving both the trachea and arch vessels has not previously been described. Our report corroborated the potential danger of Kirschner wire migration, as reported previously [1,3—9].

The incidence of iatrogenic injury due to orthopedic wire migration is believed to be underestimated because of the potential for subsequent litigation. Such complications, if not lethal, are associated with morbidities and necessitate surgical intervention. In a comprehensive review of migrated orthopedic wires, the mortalities were all attributed to catastrophic cardiac tamponade [1]. Notably, 56% of the wires that migrated were noted within three months and 74% within eight months after placement [1]. Migration within hours has also been reported [10]. The short time interval may suggest that migration of orthopedic wires is a technique-related problem (i.e., inadequate engagement of the orthopedic wire in the bone cortex), although many factors (e.g., respiratory excursion, physical activities or gravitational forces) may contribute to such a complication [1,3].

We also reviewed the literature on iatrogenic injuries to the trachea or arch vessels due to orthopedic wire migration, as listed in Table 1. Most of the patients presented with certain herald manifestations. Although reconstruction for injured sites was inevitably required, most of these patients survived surgery without major complications. The only mortality was a case of sudden death without preceding symptoms three months after the orthopedic wires had been placed at the sternoclavicular joint [5]. The patient died of cardiac tamponade due to pulmonary artery perforation. Catastrophic events may occur in case migration of orthopedic wire is not timely identified.

In summary, we report a rare case of tracheoinnominate artery fistula caused by Kirschner wire migration successfully treated by surgery. Because of the risk of migration, orthopedic wires should be used with caution. Orthopedic surgeons should follow the wires very carefully, especially during the first months. Once migration occurs, removing the wire immediately may avoid disastrous consequences. Physicians who care for patients with orthopedic wires in place should recognize migration producing a tracheoinnominate artery fistula and other iatrogenic injuries to adjacent or remote structures as potentially lethal complications.

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References