Intravascular Migration of a Broken Cerclage Wire Into the Left Heart

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abstract

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This article describes a patient in whom a broken cerclage wire migrated from the left hip into the left ventricle. A 71-year-old woman was admitted to the authors' hospital for preoperative examination before femoral hernia repair. Chest radiograph showed a metallic wire in the left ventricle. Twenty-four years earlier, she had a revision arthroplasty. During revision surgery, fragments of the osteotomy were fixed to the femur with multiple cerclage wires. During the past 5 years, radiographic follow-up showed progressive multiple ruptures of cerclage wires. The cerclage wiring was not removed because the patient had no related clinical symptoms. Radiograph of the left hip showed a well-fixed cemented acetabular ring and an uncemented femoral stem with a healed trochanteric osteotomy. All cerclage wires were broken into multiple parts, and it was very difficult to determine which part had migrated into the heart. Thoracic computed tomography scan showed wire that had migrated into the anterior left ventricular myocardial wall at the atrioventricular level. The patient had no clinical symptoms. Electrocardiogram showed a normal sinus rhythm and right bundle branch block. Because of the high risk of surgical left ventriculotomy associated with searching for wire that had migrated into the myocardial wall, patient monitoring was planned. Definitive management of this complication constitutes a dilemma. Although this complication is highly unusual, the possibility of intracardiac migration of broken wire should be considered when deciding on prophylactic surgical removal of hardware after fracture or osteotomy healing.

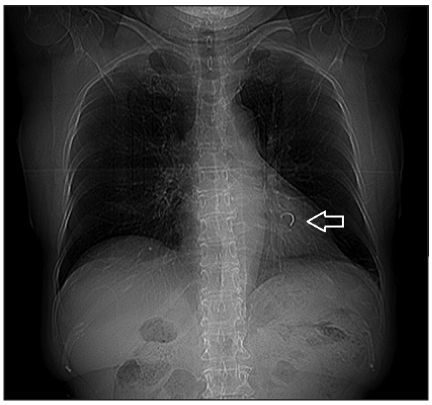

Figure: Chest radiograph showing a metallic wire in the left ventricle (arrow).

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The authors have no relevant financial relationships to disclose.

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Received: December 24, 2013; Accepted: March 4, 2014; Posted: October 8, 2014.

doi: 10.3928/01477447-20140924-90

Wire cerclage is one of the oldest forms of internal fixation. During hip replacement and hip revision, the bone fragments often require additional support. In these cases, cerclage wires help the bony fragments of osteotomy to reunite. Mechanical stress over time can cause breakage of wires, and fragments of broken wire can migrate into soft tissue. In some cases, broken wire can enter the circulatory system and drift away from the fixation site through the bloodstream.[1,2] Migration from the lower extremity and regions other than the shoulder has rarely been reported.[3,4] The prevalence of wire migration is unknown, although the literature describes complications with potentially devastating consequences.[4-8] The authors report a case in which a broken cerclage wire migrated from the left hip into the left ventricle.

Case Report

A 71-year-old woman was admitted to the authors' hospital for preoperative examination in preparation for femoral hernia repair. Chest radiograph showed a metallic wire in the left ventricle (**Figure 1**). Twenty-four years earlier, the patient underwent revision arthroplasty that included a revision ring acetabular component and a distally fixed uncemented femoral stem. During revision surgery, extended trochanteric osteotomy was performed. Fragments of osteotomy were then fixed to the femur with multiple cerclage wires. The patient was examined annually with clinical and radiographic follow-up. Since hip revision surgery, the patient had no subsequent hip pain. During the past 5 years, radiographic follow-up showed progressive multiple ruptures of cerclage wires. Cerclage wiring was not removed because the patient had no related clinical symptoms.

Current radiographs of the left hip showed a well-fixed cemented acetabular ring and an uncemented femoral stem with a healed trochanteric osteotomy (**Figure 2**). All cerclage wires had broken into multiple parts, and it was difficult to determine which part had migrated into the heart.

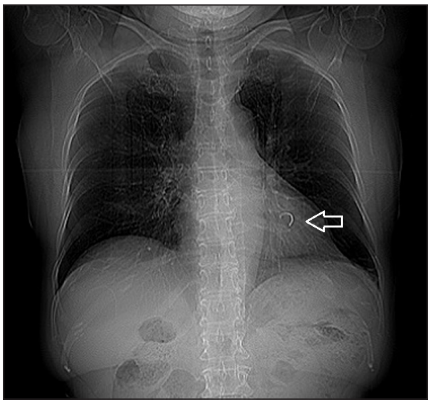

Figure 1: Chest radiograph showing a metallic wire in the left ventricle (arrow).

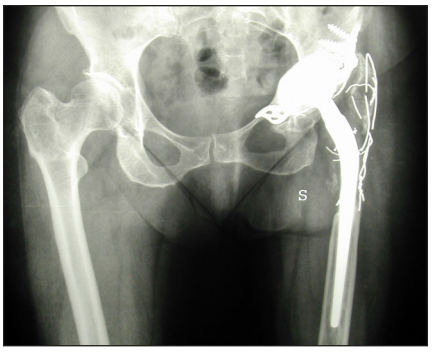

Figure 2: Anteroposterior radiograph of the pelvis showing well-fixed revision hip components. The cerclage wire is broken into multiple parts. Abbreviation: S, left.

Thoracic computed tomography scan showed wire that had migrated into the anterior left ventricular myocardial wall at the level of the atrioventricular septum (**Figure 3**). Migrated wire was seen deep in the myocardial muscle.

The patient had no clinical symptoms. Electrocardiogram showed a normal sinus rhythm and right bundle branch block. Echocardiography excluded mitral valve abnormality.

The patient was immediately referred to the cardiothoracic surgery service. She was informed about the complication and the possible treatments. Because of the high risk of surgical left ventriculotomy associated with searching for wire that had migrated into the myocardial wall, monitoring of the patient was elected. Scheduled follow-up consisted of thoracic radiographs within 2 months to check the position of the migrated wire.

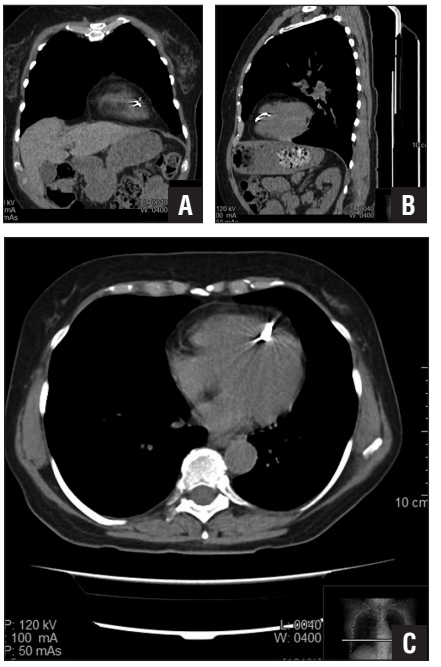

Figure 3: Anteroposterior view thoracic computed tomography scan showing a migrated wire in the anterior left ventricular myocardial wall (A). Lateral view thoracic computed tomography scan showing a migrated wire in the anterior left ventricular myocardial wall (B). Coronal view thoracic computed tomography scan showing a migrated wire in the anterior left ventricular myocardial wall (C).

Discussion

Cerclage wires are routinely used in elective procedures, such as trochanteric or diaphyseal osteotomy in revision hip arthroplasty. Broken wires are frequently observed on follow-up radiographs. This complication is usually well tolerated, and surgical removal of broken parts of wire is not necessary. Sometimes the wire causes localized clinical symptoms by irritating the surrounding soft tissue. A rare complication is migration from the fixation site. Distal migration can occur via soft tissue or through the bloodstream.

Since 1943, several cases of migration of metallic hardware from both the

upper and lower limbs after orthopedic surgery have been reported.[6,7,9,10] Lyons and Rockwood[6] reported a larger series of cases in which pins migrated from the shoulder into the heart, subclavian artery, ascending aorta, and pulmonary artery. They reported 8 cases of death.

In most published reports, migration was related to a long and rigid wire, such as a K-wire[4-10] or Steinmann pin.[6-11] In these cases, migration occurred through slow advance of a piercing sharp tip into the surrounding soft tissue. Consequences of extravascular migration depended on the internal organs encountered. In contrast, small-diameter cerclage wire or the short part of a pin can enter the circulation. The mechanism of vessel perforation is unknown, but it is probably very slow, allowing the formation of a repairing fibrin layer around the site of vessel lesions. Platelets and activated factors in plasma can promote temporary repair of the vessel tear, limiting bleeding. After a peripheral vein is penetrated, a fragment of wire can drift to the caval system and then into the heart. Only 5 cases of intravascular migration of wire drifting through the venous circulation have been reported.[1,4,12-14]

The first case of intravascular migration of orthopedic wire into the heart was described by Anic et al[12] after chest radiograph showed a metal foreign body in the heart. The patient underwent open-heart surgery, and a 5-cm-long K-wire was removed from the right ventricle through right atriotomy.

Haapaniemi and Hermansson[4] reported a patient with a history of atrial fibrillation. Chest radiographs showed a metallic pin into the heart. A 24-mm-long metallic pin was removed by open thoracic surgery from within the right ventricle. Postoperative examination of the pin showed that it was 1 of the 0.8-mm K-wires used for finger osteosynthesis in the patient's left hand 31 months previously.

Seipel et al[13] documented loosening of a K-wire used in the distal radius to supplement fixation of a complex intra-articular fracture, migration of the implant along tissue planes, penetration into a peripheral vein, and continued migration of the implant to the heart.

Biddau et al[1] described migration of the superior portion of a circumferential cerclage wire from the patella to the heart, likely through the venous system. The patient underwent sternotomy and right atriotomy while on cardiopulmonary bypass.

The most recent case of a broken K-wire that drifted through the bloodstream into the right ventricle was reported in 2011.[14] The broken wire had been used 25 years earlier for pelvic fracture fixation.

The mechanism of migration in the current case is probably similar to the mechanisms supposed for cases already described.[1,12-14] The authors believe that the piece of cerclage wire entered the venous circulation near the hip and migrated through the caval system to reach the right ventricle. At this stage, the cerclage wire probably penetrated the myocardial muscle entering the anterior ventricular left wall. To the best of the authors' knowledge, this is the first case describing intracardiac migration from the right to the left ventricle.

Definitive management of this complication is a dilemma. Previous hip radiographs do not help to identify the start of cerclage migration. Further, cardiothoracic surgeons consider open surgery for removal of a wire from the left ventricular myocardial muscle a dangerous procedure. The consequences of further migration can be devastating, and serious cardiopulmonary complications can occur.

The patient was warned about the possible risks of further migration of the broken wire, but refused surgical removal. While the authors waited for the patient to make a decision about prophylactic surgical removal, the patient underwent close follow-up with clinical and radiographic examination every 2 months, and computed tomography scan reviews every 3 months were planned.

Although this complication is highly unusual, intracardiac migration of broken wire can be prevented with hardware removal. As suggested by Biddau et al,[1] multiple factors are needed to predict the potential risk of distant migration. The size, shape, and nature (blunt or sharp) of the wire and its relationship to the nearby vessels as well as the age and activity level of the patient should be considered when deciding whether to perform prophylactic surgical removal.

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