A 71-year-old man was admitted to our hospital with new onset of typical symptoms of angina on exertion corresponding to a Canadian Cardiovascular Society functional class III. The patient had undergone mitral valve replacement with a mechanical bileaflet valve (ATS medical prosthesis, ATS Medical Inc., Minneapolis, Minn.) in December 1997 and transvenous pacemaker implantation for intermittent high-degree atrioventricular node block (Biotronik Philos II DR, ventricular demand inhibited pacemaker mode VVIR0, Biotronik SE & Co. KG, Berlin, Germany) in 2006. Medical history revealed chronic kidney disease and diabetes mellitus. He had chronic atrial fibrillation and was taking oral anticoagulants. The ECG showed discrete ST depression in leads I, II, III, and aVF (Figure 1). Cardiac troponin T on admission was slightly elevated (0.046 ng/mL; reference value at our institution is <0.0014 ng/mL), and his creatine kinase-MB was negative. Anterior-posterior and lateral chest x-ray showed a fracture of the sixth sternal wire with the lateral view showing a protrusion of the cerclage loop into the anterior mediastinum (Figure 2). Transthoracic echocardiography revealed moderately reduced left ventricular function with mediobasal septal akinesia and good right ventricular function; the mechanical mitral valve was functioning well. No right ventricular regional wall movement abnormalities suggestive of wire protrusion were detectable on echocardiography. The patient underwent cardiac catheterization. Left ventriculography revealed moderately reduced systolic function. Coronary angiography showed no signs of left coronary artery stenosis. However, a significant proximal stenosis of the right coronary artery was detected by virtue of extrinsic compression caused by the protruding fractured sternal wire (Figure 3). Primary percutaneous coronary intervention with stent implantation resulted in a gradual improvement of coronary blood flow and symptom relief. For planning of surgical wire removal, a contrast-enhanced computed tomography (Siemens Somatom Definition Flash 2×64, Siemens...
Three-dimensional reconstruction in volume rendering technique corroborated the marked compression of the proximal portion of the right coronary artery (Figure 4). Wire removal was performed in a surgical hybrid operating room under fluoroscopic control. Before final removal, a guidewire was placed in the right coronary artery, passing the stenosis, in case of an emergent intervention. Consequently, a right coronary angiogram was done, revealing unobstructed blood flow with no sign of extravasation (Figure 5). The postoperative course was uneventful, and the patient was discharged without any residual symptoms. A video including all imaging coronary angiograms for Figures 3 and 5 and the 3-dimensional volume rendering technique computed tomography modalities is available in the online-only Data Supplement.

Discussion

Postoperative instability and dehiscence of the sternum occurs in 1% to 3% of patients after open chest cardiac surgery with complete median sternotomy.1 Displacement, rotation, and fracture of sternal wires can be identified on chest radiographs in most cases. Sternal wire fractures are relatively common after sternotomy and may not necessarily be related to sternal dehiscence, as was the case in our patient. A study by Boiselle and colleagues2 on fractured sternotomy wires described parasternal wire displacement of 20 mm (range, 6 to 45 mm) from the midline. A mean of 2.3 wires (range, 1 to 5 wires) were displaced in that study. Other studies examining sternotomy wire migrations described wire displacement between 1 and 40 days (median, 9 days) after sternotomy. Serious to fatal complications may occur.

Figure 2. A and B, Posterior-anterior chest x-ray showing a fracture of the sixth sternal wire loop. The lateral view reveals a marked protrusion of displaced sternal cerclage into the anterior mediastinum.

Figure 3. Right coronary angiography. A, Left anterior oblique, 38.8°; cranial, 23.8°. B, Left anterior oblique, 81.3°; cranial, 0.4°. C, Right anterior oblique, 43.6°; cranial, 7.3°. Note a marked compression of the proximal portion of the right coronary artery with compromised blood flow by the protruding loop of the sixth sternal wire loop. See also Movie I in the online-only Data Supplement.
secondary to wire migration. A literature review found single cases of sternotomy wire migrations into the ascending aorta and right pulmonary artery and wire erosion into the right main bronchus and right pulmonary artery that resulted in death caused by massive pericardial and mediastinal hemorrhages.\(^3,4\)

Computed tomography evaluation is the diagnostic modality of choice to allow precise localization when more distant migration of wires occurs and mediastinal structures are threatened. Moreover, important detailed anatomic information can be gained when surgical removal of wires is planned.

In conclusion, in patients presenting with chest pain after previous open chest surgery, sternal wire complications secondary to displacement or disruption are rare but potentially fatal complications and therefore should be considered the underlying cause, especially when regular chest radiography reveals dislocation of sternal wires. Precise wire location and risk assessment with computed tomography are more appropriate when wire location cannot be clearly delineated by plain film radiography.

**Disclosures**

None.

**References**

Figure 5. Right coronary angiography (left anterior oblique, 31°; cranial, 6°) after surgical wire removal. Coronary blood flow was completely restored. See also Movie I in the online-only Data Supplement.
Unexpected Cause for Chest Pain: Compression of the Right Coronary Artery Caused by a Protruding Sternal Wire
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