Ascending aortic injury caused by a fractured sternal wire 28 years after surgical intervention of pectus excavatum

Shigetoshi Mieno, MD, Hideki Ozawa, MD, and Takahiro Katsumata, MD, Takatsuki, Osaka, Japan

Cardiovascular injury induced by foreign materials is a rare but potentially life-threatening complication. The most frequent cause of death is cardiac tamponade. We report a successful surgical case of ascending aortic injury caused by a fractured sternal wire 28 years after surgical intervention for pectus excavatum.

CLINICAL SUMMARY

A 34-year-old man complained of sudden anterior chest pain after light exercise and went to a hospital on October 3, 2008. He had undergone an operation consisting of sternal turnover for pectus excavatum at 6 years of age. He went to the hospital again the next day because of extended chest pain and dyspnea. A cardiologist noticed an increase in the cardiothoracic ratio and a change in the direction of a piece of sternal wire by means of comparison of 2 consecutive chest roentgenographs (Figure 1). Ultrasonographic echocardiographic analysis demonstrated 15 mm of echocardiographic free space around the heart. After 160 mL of pericardial drainage, the hemoglobin level of the fluid was 12.9 g/dL. Because of the hemorrhagic cardiac tamponade, he was admitted to our hospital for an emergency operation. Vital signs on admission were maintained.

After achievement of general anesthesia, we carefully divided the sternum and paid attention to the location and

From the Department of Thoracic and Cardiovascular Surgery, Osaka Medical College Hospital, Takatsuki, Osaka, Japan.

Disclosures: None.

Received for publication June 11, 2009; accepted for publication July 5, 2009; available ahead of print Sep 10, 2009.

Address for reprints: Takahiro Katsumata, MD, Department of Thoracic and Cardiovascular Surgery, Osaka Medical College Hospital, 2-7 Daigaku-machi, Takatsuki-city, Osaka, 569-8686 Japan (E-mail: katsumata@poh.osaka-med.ac.jp).

J Thorac Cardiovasc Surg 2010;140:e18-20

0022-5223/\$36.00

Copyright © 2010 by The American Association for Thoracic Surgery

doi:10.1016/j.jtcvs.2009.07.008

FIGURE 1. Change in the findings determined by means of chest roentgenography. A, Chest roentgenograph on October 3, 2008, at the time of the first visit. B, Chest roentgenograph on October 4, 2008. The cardiothoracic ratio is larger than that seen in panel A. C, Magnification of the roentgenograph from panel A. D, Magnification of the roentgenograph from panel B. Arrows indicate the change in direction of the sternal wire. E, Preoperative computed tomographic scan: short thoracic distance and ascending aorta in contact with the sternum.

FIGURE 2. Operative findings. A, A fractured wire toward the ascending aorta. B, A hole penetrated by the fractured sternal wire on the pericardium. C, Injury is shown around 4cm longitudinally in the ascending aorta. Arrows indicate the injury site. D, Removed sternal wires.

direction of the sternal wires fixing the sternum. A fractured wire perforated the pericardium through mediastinal tissue and reached the ascending aorta about 4 cm longitudinally (Figure 2). We tried to repair the injury site of the ascending aorta by using a simple suture without cardiopulmonary bypass (CPB). However, the aortic tissue around the injury site was fragile, so that we resected the injured site and replaced it with a 25 × 15-mm Haemashield woven double velour fabric patch (Boston Scientific, Tokyo, Japan) during 29 minutes of aortic crossclamping with CPB. The patient's postoperative course was uneventful.

DISCUSSION

Cardiovascular injury induced by fracture of sternal wires is a rare but potentially life-threatening complication. Cope and Rodda¹ reported an adult case of cardiac tamponade caused by pericardial puncture by a fractured sternal wire 2 years after an operation for pectus excavatum. Hazelrigg and Staller² also reported an asymptomatic case of migration of a fractured sternal wire, which partially entered the ascending aorta 9 years after coronary artery bypass grafting. The fractured wires in these 2 cases migrated into the mediastinal space. In this case, however, the fractured wire did not migrate but directly scratched and injured the ascending aorta. Although the cause of wire fracture is unclear, the operative findings in this case indicated that thoracic movement by means of respiration, as well as heart beat, is associated with extension of the injury region in the aortic wall. In addition, the anatomic peculiarity of a shorter thoracic distance between the sternum and vertebra in patients with pectus excavatum contributes

to the aortic injury. To the best of our knowledge, a case of direct aortic injury caused by a fractured wire has not been previously reported, even in patients with pectus excavatum.

The use of CPB is a safe and reliable option for the repair of cardiovascular injury caused by foreign materials. A direct suture without CPB is a simple and quick treatment for the aortic injury.² The region of injury might be more extended than what we actually see outside of the ascending aorta. In case of extended aortic injury, the direct suture might generate tension in the repair site and might leave the injury of the aortic wall unrepaired. This remaining injury of the aortic wall could be at risk of subsequent aortic dissection, pseudoaneurysm, and rupture. Therefore we completely resected the injury site during aortic crossclamping and chose the patch repair in this case.

The original position of pins and wires should be ruled out in all patients, particularly those presenting with chest pain after previous sternotomy and orthopedic surgery. If there is a change in the location and direction of sternal wires and a risk of cardiovascular complication, the wire should be removed, even if clinically silent. In addition, we also pay attention to migration of pins and wires from the shoulder region.³ Muscular activity, respiratory exertion, negative intrathoracic pressure, and regional resorption of bone, gravitational forces, and the great freedom of motion of the upper extremity are considered factors responsible for the migration of pins and wires.⁴ The overall mortality caused by pins and wires reaching the cardiovascular system is about 50%, and acute cardiac tamponade is the dominant cause of death.⁵ In this case we rescued the patient from hemorrhagic cardiac tamponade

resulting from a direct aortic injury caused by a fractured wire by means of emergency surgical intervention.

References

1. Cope SA, Rodda J. Cardiac tamponade presenting to the emergency department after sternal wire disruption. *Emerg Med J*. 2004;21:389-90.
2. Hazelrigg SR, Staller B. Migration of sternal wire into ascending aorta. *Ann Thorac Surg*. 1994;57:1023-4.
3. Freund E, Nachman R, Gips H, Hiss J. Migration of a Kirschner wire used in the fixation of a subcapital humeral fracture, causing cardiac tamponade: case report and review of literature. *Am J Forensic Med Pathol*. 2007;28:155-6.
4. Lyons FA, Rockwood CA Jr. Migration of pins used in operations on the shoulder. *J Bone Joint Surg*. 1990;72:1262-7.
5. Schechter DC, Gilbert L. Injuries of the heart and great vessels due to pins and needles. *Thorax*. 1969;24:246-53.

Mediastinoscopy-assisted ligation of an aberrant right subclavian artery through a supraclavicular approach

Narain Moorjani, MD, FRCS,^a Nancy Mohsen, MD,^b and Percy Boateng, MD,^a Philadelphia, Pa

Video clip is available online.

An aberrant right subclavian artery occurs in approximately 0.5% of the population.¹ Compression of the esophagus and trachea might result from a retromediastinal course of the aberrant artery. Surgical treatment in symptomatic patients usually involves ligation of the artery close to its origin from the aortic arch followed by right common carotid–subclavian artery bypass. This report describes the use of a cervical mediastinoscope through a right supraclavicular incision to aid access and visualization of the aberrant right subclavian artery at its origin from the distal aortic arch, without the need for a left thoracotomy.

CLINICAL SUMMARY

A 28-year-old woman presented with a 2-month history of progressive dysphagia to solids. An esophagram demonstrated indentation of the upper esophagus with transient delay of contrast, which is consistent with extrinsic compression (Figure 1, A). Subsequent contrast-enhanced computed tomographic analysis revealed an aberrant right subclavian artery originating from the aortic arch, distal to

the left subclavian artery, and passing posterior to the esophagus (Figure 1, B, and Video 1). The origin of the aberrant artery measured 1.1 cm, with no aneurysmal dilatation or Kommerell's diverticulum. A common origin of the left and right common carotid arteries (truncus bicaroticus) from the aortic arch was also observed (Figure 1, B).

In view of her symptoms, surgical treatment was performed by using a 6-cm right supraclavicular incision and division of the clavicular head of the sternocleidomastoid muscle. After mobilization of the right internal jugular vein, the right common carotid artery was identified in the carotid sheath while protecting the vagus nerve. The aberrant right subclavian artery was identified posteriorly, coursing behind the esophagus and right recurrent laryngeal nerve. Because access to the origin of the aberrant right subclavian artery was limited, a standard cervical mediastinoscope was used to aid visualization of the proximal part of the artery (Figure 1, C). By using blunt dissection through the mediastinoscope, the artery was mobilized free from the esophagus (with an orogastric tube in situ) down to its origin from the aortic arch. After systemic heparinization, the right subclavian artery was ligated and oversewn at its origin. Intraoperative Doppler scanning and direct visualization through the mediastinoscope ensured that the ligation was proximal to the vertebral artery. The distal free end of the right subclavian artery was then sutured to the right common carotid artery by using an end-to-side anastomosis (Figure 1, D). Intraoperative Doppler examination of the right common carotid, subclavian, and vertebral arteries demonstrated excellent flows. The patient was discharged on the fourth postoperative day, with normal swallowing, vocal cord function, neurological status, and perfusion of the right upper limb. Postoperative computed tomographic analysis demonstrated the right subclavian–common carotid artery bypass and the ligated aberrant subclavian artery on the distal aortic arch (Figure 1, E and F, and Video 2).

From the Department of Cardiothoracic Surgery^a and Radiology,^b Hahnemann University Hospital, Drexel University College of Medicine, Philadelphia, Pa.

Disclosures: None.

Received for publication March 10, 2009; revisions received June 4, 2009; accepted for publication June 28, 2009; available ahead of print Aug 26, 2009.

Address for reprints: Narain Moorjani, MD, FRCS, Department of Cardiothoracic Surgery, Hahnemann University Hospital, Drexel University College of Medicine, Philadelphia, PA 19103 (E-mail: narain.moorjani@doctors.org.uk).

J Thorac Cardiovasc Surg 2010;140:e20-1

0022-5223/\$36.00

Copyright © 2010 by The American Association for Thoracic Surgery

doi:10.1016/j.jtcvs.2009.06.026