without takedown of conduit, to the lateral side will be effective.

Of course, careful follow-up will be needed though our early result is acceptable. Valve-sparing root surgery for the truncal valve is a meaningful option for adult patients, especially young adults.

References

Safe Sternal Reentry in Patients With Large Thoracic Aortic Pseudoaneurysms
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Sternal reentry for ascending aorta pseudoaneurysm repair presents a formidable challenge because of the risk of aneurysm rupture and hemorrhage. We describe two cases of large pseudoaneurysms at high risk for rupture during sternal reentry in which the chest was safely entered by use of an anterior sternal retraction technique. Several other methods for sternal reentry have been reported; however, the reliability and efficiency of the described technique make it the preferred method for sternal reentry for pseudoaneurysms at our institution.


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Ascending aortic pseudoaneurysm formation after cardiac surgical procedures is a rare but serious postoperative complication [1]. Reentry into the sternum in patients with pseudoaneurysms poses a significant challenge because of the risk of rupture and subsequent hemorrhage. Here we present our preferred sternal reentry technique, originally described by Eddy and colleagues [2], using two examples for large ascending thoracic aortic pseudoaneurysms.

Case Reports

Patient 1
A 62-year-old man with hypertension, diastolic heart failure (left ventricular ejection fraction 65%), and a history of a mechanical aortic valve replacement in 2005 presented to his cardiologist with a chest roentgenogram that showed a wide mediastinum. Computed tomography demonstrated a chronic Debakey type II thoracic aortic dissection with a 9-cm ascending aortic pseudoaneurysm (Fig 1), and he was transferred to our institution for repair. He underwent successful ascending and hemiaortic arch replacement with a 30-mm Gelweave graft (Terumo, Ann Arbor, MI) with a modified Bentall root replacement, by use of a 30-mm Carbomedics Valsalva conduit (Sorin, Milan, Italy). He had an uneventful hospital course and was discharged on postoperative day 11.

Patient 2
A 71-year-old woman with chronic kidney disease and a history of aortic root and ascending aorta replacement in 2006 presented to her local emergency department with back pain and dyspnea. Computed tomography revealed a 13-cm ascending aortic pseudoaneurysm with compression of the pulmonary artery, trachea, and esophagus (Fig 2). She underwent successful ascending and hemiaortic arch replacement by use of a 26-mm Gelweave graft (Terumo). A previously placed Medtronic Freestyle root (Medtronic, Minneapolis, MN) was

Fig 1. Computed tomographic scan of 9-cm ascending aortic pseudoaneurysm after prior aortic valve replacement.
intact and was therefore left in situ. Postoperatively, she experienced acute kidney injury and required temporary dialysis; however, her renal function later recovered, and she was discharged home on postoperative day 20.

**Sternal Reentry Technique**

The patient is anesthetized, and a radial arterial line and a Swan-Ganz catheter are placed for hemodynamic monitoring. Disposable gel pads are placed in the midaxillary line on each side for external cardioversion if necessary. After standard surgical preparation and draping, a femoral arterial monitoring line is placed for expedient initiation of cardiopulmonary bypass (alternatively, either the femoral artery or the axillary artery can be exposed).

A standard incision is then made over the previous midline scar and is extended 6 cm below the xyphoid process. The sternal wires are dissected free, cut, and retracted laterally and left in place. The subxyphoid plane is developed widely to include the diaphragmatic surface and rectus muscle. A Weitlaner retractor is placed to help with subxyphoid exposure. A Rultract skyhook IMA retractor (Rultract, Cleveland, OH) with an extension bar is positioned with retraction rakes placed on either side of the subcostal cartilage to elevate the inferior sternum (Figs 3, 4) [2]. Alternatively, the Rultract retractor can be hooked directly to an intact sternal wire to elevate the sternum.

A subperiosteal plane can be created in densely adhered areas, periosteum of the posterior sternum actually being left on the surface of the heart. Once the dissection has been carried as far cephalad as possible, a thin malleable retractor is placed underneath the midline sternum for mediastinal protection while the sternum is divided with a hand-held oscillating redo saw. The wires can be removed before sternal division or left in place as added protection. If the sternum is not fully divided, the retraction rake can be positioned more cephalad, and dissection is continued in a similar manner. Once the sternum is divided completely, the sternum edges are freed with electrocautery so that a standard sternal retractor can be positioned.

Cannulation and surgical technique are performed according to the surgeon’s routine, typically with a right atrial two-stage 29/37F venous cannula (Edwards, Inc, Irvine, CA) and a Sarns softflow 7 mm (Terumo) in the proximal arch aorta. The ascending aorta can be replaced under cross-clamping or, in the case of arch involvement, by use of hypothermic circulatory arrest. When a flatline electroencephalogram after cooling to 18°C is reached, the hemiarch aorta is replaced by use of a Gelweave Anteflo graft with a sidearm branch (Terumo, Ann Arbor, MI), which allows for immediate resumption of cardiopulmonary bypass through the sidearm.

**Comment**

With the described technique, both of our patients underwent sternal reentry to expose their large pseudoaneurysms without rupture. Neither patient required cardiopulmonary bypass or deep hypothermic circulatory arrest before or during sternal reentry, which has been
described for patients at high risk of rupture [3]. Other reported methods to facilitate safe sternal reentry include adjunctive carotid cannulation, endocardio-pulmonary bypass, thoracoscopy for improved visualization, and endovascular techniques [1, 4–6]. The present technique allows for safe entry of the mediastinum while avoiding the risks associated with carotid cannulation and prolonged periods of cardiopulmonary bypass and systemic hypothermia.

The size of the ascending aortic aneurysm (>55 mm) has been shown to be a predictor of catastrophic hemorrhage during sternotomy [7]. Our 2 patients had massive 9-cm and 13-cm pseudoaneurysms, respectively, and would be considered at high risk for hemorrhage during reentry. We have found that the described technique is safe, efficient, reliable, and reproducible, and uses surgical equipment that is readily available at most centers. It is now our preferred technique for all of our redo operations.

References

Anomalous Origin of the Left Coronary Artery From the Pulmonary Artery, Scimitar Syndrome, and Aortic Coarctation
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