Published in final edited form as:

Plast Reconstr Surg. 2010 August ; 126(2): 95e–97e. doi:10.1097/PRS.0b013e3181de25a7.

Sternal Stenting and Vascular Conduit Coverage with Combined Interposition/Overlay Rib Grafts

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Sir

During cardiac surgery, increased intrathoracic volume from edema or prominent conduits can cause difficulties with sternal closure. Although delayed closure after resolution of pericardial edema may be possible, early closure of the chest with interpositional rib grafts,¹ vascularized sternal flaps,² methyl methacrylate,³ or hydroxyapatite blocks⁴ has been reported. We describe a combined interposition and overlay technique for situations where a portion of the conduit graft lies between the sternal edges, prohibiting interposition grafting alone for bony graft coverage.

A 15-year-old boy with a complex cardiac history initially presented with progressive dyspnea and hypoxia. His symptoms were attributed to a partially thrombosed, previously placed 19-mm conduit between the right ventricle and main pulmonary artery. Cardiac surgery upsized the conduit to a 23-mm aortic allograft/Gore-Tex (W. L. Gore and Associates, Flagstaff, Ariz.) graft connecting the right ventricle and main pulmonary artery. The allograft projected 1 cm above the level of the sternum (Fig. 1, *above, left*), which could not be closed without causing graft compression. Plastic surgery consultation was requested for sternal stabilization to prevent graft compression between the sternal edges and provide anterior bony coverage of the conduit.

During a second operation, we harvested the right sixth and seventh ribs for bone grafting. KLS 2.7-mm Thread-Lock plates (KLS Martin, Jacksonville, Fla.) with a slight curvature were secured to three 4.5-cm sections of rib graft. These grafts were then interposed between the inferior sternal edges (Fig. 1, *above, right*). Superiorly, split-rib overlay grafts were secured over the most prominent portion of the pulmonary artery conduit with the lag screw technique using KLS 2.0 plates as washers to prevent splitting the rib grafts. The inherent rib curvature was oriented to maximize the intrathoracic volume (Fig. 1, *below, left*). The rib grafts were noted to prevent transmission of all external compressive forces. A protective bovine pericardium graft was placed under the rib graft reconstruction to prevent conduit abrasion. After medi-astinal drain placement, bilateral pectoralis and rectus muscle flaps were used to provide midline closure (Fig. 1, *below, right*). Tension-free skin closure was achieved. The patient's postoperative course from a reconstructive perspective was

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Disclosure: The authors have no financial interest to declare in relation to the content of this article.

uncomplicated and he was discharged to home 3 weeks later. Nine months after surgery, the patient had resumed his preoperative activity level without wound complications.

Using a combination of interpositional and overlay rib grafts, we were able to provide increased intrathoracic volume, sternal stability, and bony coverage over a prominent conduit graft in this complex reconstruction. Compared with alloplastic materials, native rib graft decreases the risk of infection and allows for osteoconduction. Our reconstruction required use of the interposition grafts to prevent compression of the conduit between the sternal edges during respiration. However, without the addition of the overlay grafts superiorly, the conduit would have been directly under the thin musculocutaneous coverage of the anterior chest and vulnerable to compressive trauma during low-impact events or extrusion with flap breakdown. By combining both interpositional and overlay placements of the rib grafts, we were able to accomplish all of our goals in sternal reconstruction.

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Fig. 1.

These images demonstrate the sequence of reconstruction, including the prominent pulmonary artery conduit (*above, left*), interposition rib grafting preventing compression of the conduit (*above, right*), overlay split rib grafts covering the conduit (*below, left*), and soft-tissue coverage with bilateral pectoralis muscle flaps (*below, right*). The right side of the pictures is cranial.