Editorial

Sternal reconstruction—a rare but challenging issue for thoracic surgeons

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Sternal tumors are rare, and most thoracic surgeons will only see a few cases, during their careers. For this reason, large prospective studies, to determine the optimal method of reconstruction are lacking. The largest experiences tend to be retrospective, from major medical centers, with relatively small numbers of cases accumulated over long periods of time (1,2). It is difficult therefore to draw definitive conclusions as to what is the best approach.

Choices for reconstruction include pedicled muscle flap coverage, prosthetic or biological mesh, cadaveric allograft, or titanium plates which are often created using 3D printing (1-5). Wang *et al*. have added to this discussion, recently reporting an alternative approach using a multi-functional modular titanium prosthesis (6). In their report, an 80×70 mm^2 sternal osteochondroma was resected, along with adjacent costal cartilages and ribs. The modular system was made of titanium alloy, with standardized width and thickness, but variable length for each segment. This allows tailoring of the prosthesis to better fit the sternal defect. In addition to the sternum being reconstructed in a modular fashion, individual rib modules are then attached to the sternal modules, with a gear structure, that allows the ribs modules to be placed at the most optimal angle to fit the thoracic defect. The patient in their report, was discharged without issues and had an uneventful follow-up of 32 months, demonstrating treatment success.

Generally, the goals of successful chest wall reconstruction are to restore chest wall rigidity, so preserving pulmonary mechanics and to protect intrathoracic organs. Most surgeons would agree that when a defect exceeds 5×5 mm^2 that reconstruction is justified. No studies have compared the impact of reconstruction choice on pulmonary function and mechanics, however intuitively a rigid construction is likely to better protect underlying mediastinal structures. Titanium implants have been used for a number of years after orthopedic and maxillo-facial surgery, and, more recently for rib reconstruction (7). Titanium is well suited as a prosthetic material, as it has a high-resistance to corrosion, is biologically inert and due to its paramagnetic properties, unaffected by MRI. Disadvantages of rigid systems are that screws may loosen, and the prosthesis may dislodge. Infection is also a potential issue.

A major advantage of the modular system used by Wang *et al*. is that this can be immediately available, and also can be tailored to fit the defect at the time of surgery. This avoids the delay that may be required to plan and then 3D print a custom prosthesis, in addition to the availability and expense of having appropriate 3D printers in many institutions.

Further study with more patients and longer follow-up are needed. Ideally future studies could compare techniques, using end-points of pain, pulmonary function, the ability to return to normal activity, as well as the more traditional end-points of adverse events and survival. However, this will be challenging given the relative low incidence of sternal tumors, and the variability of clinical presentation of affected patients. The modular system used by Wang *et al*., may be ideal for prospective study, as this could potentially be more easily adopted by other centers, and for this reason is a welcome addition to the literature.

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