Rigid Rib Fixation and Polymethylmethacrylate Spacer for Salvage After Total Sternectomy

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INTRODUCTION: Deep sternal wound infection (DSWI) complicated by osteomyelitis remains a catastrophic challenge after cardiothoracic surgery. This problem parallels post-traumatic osteomyelitis with massive segmental bone loss: definitive success depends on radical debridement, skeletal stability, local antimicrobial delivery, and vascularized soft-tissue coverage. We present a salvage sternectomy reconstruction employing orthopedic techniques—rigid plating and antibiotic polymethylmethacrylate (PMMA)—combined with omentoplasty to restore chest wall integrity.

METHODS: A 52-year-old woman with extensive sternal osteomyelitis and nonunion following aortic root replacement underwent serial radical debridements with negative-pressure wound therapy. After near-total sternectomy, reconstruction was achieved using pre-contoured rib-spanning titanium plates anchored to healthy ribs, spanning a custom antibiotic-impregnated PMMA spacer fashioned as a load-sharing anterior strut. A pedicled omental flap provided vascularized coverage.

RESULTS SECTION: Rigid rib-to-rib fixation across three intercostal levels with a central antibiotic PMMA spacer restored chest wall mechanics without paradoxical motion. The PMMA spacer functioned dually as a space filler and antimicrobial delivery system. The omental flap provided robust vascularized coverage. The patient recovered without reinfection, achieved stable anterior chest wall integrity, and demonstrated satisfactory functional recovery at follow-up.

DISCUSSION: This case underscores the cross-disciplinary extension of core orthopedic reconstruction principles to chest-wall salvage. Rigid plate fixation—long established in long bone nonunions and segmental defects—was successfully adapted to re-establish rib-to-rib stability after total sternectomy, restoring physiologic mechanics under respiratory load. The antibiotic-impregnated PMMA spacer mirrored its proven role in limb osteomyelitis by simultaneously filling dead space and providing high local antimicrobial delivery within a contaminated mediastinal bed. This combination of rigid fixation and local elution addressed the shortcomings of wire cerclage and soft tissue–only closures, which often collapse under dynamic thoracic forces. The integration of vascularized tissue coverage further parallels orthopedic strategies for complex open fractures, where durable soft-tissue reconstruction is indispensable to protect implants and secure long-term infection control. Ultimately, this case demonstrates how orthopedic reconstructive tenets—mechanical stability, biologic reinforcement, and targeted antimicrobial strategies—can be adapted to rescue patients from otherwise catastrophic chest-wall failure.

SIGNIFICANCE/CLINICAL RELEVANCE: Rigid fixation combined with antibiotic-impregnated PMMA spacers can be successfully adapted to chest-wall reconstruction, restoring stability and controlling infection in a contaminated field. Beyond the sternum, this strategy has broad clinical utility across orthopedics, including long bones, pelvis, and spine, where it can provide both structural support and local antimicrobial delivery in high-risk reconstructions.

Figure 1. Arrival wound showing DSWI with exposed bone and mediastinal contamination consistent with osteomyelitis.

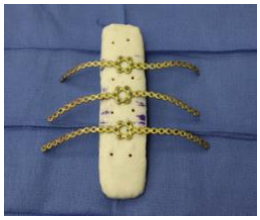

Figure 2. Rib-spanning titanium plates secured over a molded PMMA spacer.

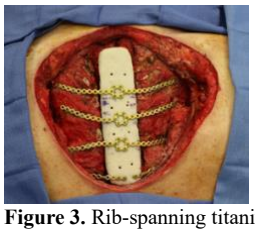

Figure 3. Rib-spanning titanium plates anchored bilaterally with a central PMMA spacer.