The Use of Titanium Mesh Cage in Reconstruction of Segmental Long Bone Defects: A Multicenter Study

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Purpose: The treatment of segmental long bones defects after trauma, atrophic nonunion, or after radical debridement for infection is challenging. The options include vascularized fibular graft, distraction osteogenesis through bone transport, or acute shortening combined with lengthening, Masquelet technique, and allograft. There is no ideal option that can fit every patient. The decision making varies according to patient's preference, the size of the defects, and the surgeon's surgical skill set. The aim is to report the use of titanium mesh cage in reconstruction of posttraumatic segmental bone defects.

Methods: This retrospective study was approved by the IRBs at two institutions. Our patients' database was reviewed for patients with posttraumatic bone defects. The study included patients with posttraumatic segmental bone defects due to fractures with bone loss, atrophic nonunion, and after radical debridement for infection. We only included patients treated with titanium mesh cages (Synthes) for segmental bone defects. The study period was between 2007 and 2014. The medical records and radiographs were reviewed. Medical records were reviewed for patients' demographics (age, side of injury, and gender), the anatomic location, mechanism of injury, initial treatment, classification of open fractures, length of segmental defect (cm), time from injury to bony reconstruction (months), time of external fixator removal to bony reconstruction, length of used cages (cm), past surgical history and the need for secondary procedures after the index surgery, and the time from injury to last follow-up. The study excluded patients who were treated with other treatment options rather that titanium mesh cages. Complications encountered during surgery and postoperative treatment course were recorded. The radiographs were reviewed for size of bone defect and alignment at last follow-up.

Results: A total of 17 patients were available for the study. The mean age at surgery was 35 years (range, 17-61). The majority of the study population are male (13; females, 4/17). The anatomic bony segments were: tibia 8/17, femur 5/17, radius 2/17, and humerus 1/17. Motor vehicle collision (MVC) was the most common mechanism of injury (10/17); other mechanisms of injury included gunshot wound (GSW) 5/17, crush injury 1/17, and unknown mechanism 1/17. All patients received initial surgical treatment before definitive index procedure. Irrigation and debridement (I&D) with external fixator application was the most common initial treatment (11/17). Other forms of initial treatment were initial internal fixation (6/17: plate 3 and intramedullary nail [IMN] 3). Antibiotics cement spacer was used in three patients (3/17). Soft-tissue reconstruction was necessary in the majority of patients (13/17). The average time of patients' presentation after initial injury was 15 months (range, 2-110). The external fixators were removed before definitive reconstruction to allow healing of pin sites. The range of time between external fixator removal and definitive bony reconstruction was between 2 and 9.5 weeks. The intraoperative cultures were

negative (12/17), positive (3/17), and not taken (3/17). The average length of segmental bone defect was 8 cm (range, 2.2-13 cm). The average length of titanium mesh cage was 8 cm (range, 2-13 cm). The average time between the time of injury and last follow-up was 43 months (range, 6-118). There were no intraoperative complications. The postoperative complications included: residual limb length discrepancy (LLD) 3/17; residual deformity (1/17); nerve palsy (5/17); common peroneal palsy (4/17: postinjury [2] and postoperative [2]); postinjury radial nerve palsy (1/17); hardware loosening or failure (2/17); recurrent infection (3/17); wound dehiscence required reconstruction (1/17); and chronic patello-femoral knee pain (1/17). All patients healed clinically and radiographically.

Conclusion: The use of titanium mesh cages is a viable alternative option for reconstruction of segmental bone defects. The procedures does not require a special surgical skill set compared to distraction osteogenesis or vascularized fibular graft. The procedure can be performed by general trauma orthopaedic surgeons. The cages can be combined with internal fixation (plates or nails) to provide structural support. Bone grafting around the cages is possible to improve bone biology. Eradication of infection is mandatory for successful outcome.

See pages 49 - 106 for financial disclosure information.