

Metaphyseal Clamshell Osteotomy for Long Bone Deformity

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Purpose: Metaphyseal malunions and nonunions of the lower extremity pose a challenging problem especially in the setting of complex deformity and/or poor bone quality. When deformity centers are periarticular and in compromised bone, surgical correction and fixation is particularly challenging. The clamshell osteotomy has been described as a treatment for long bone diaphyseal malunions. When performing a clamshell osteotomy, fixation with an intramedullary nail provides a stable construct for earlier weight-bearing, particularly with newer nail designs that improve stability in short bone segments and compromised bone. The purpose of this study is to report union rates and complications from clamshell osteotomies in metaphyseal, metadiaphyseal, and periarticular deformity.

Methods: After obtaining IRB approval, a retrospective chart review was performed. Inclusion criteria were patients age >18 years and a metaphyseal or metadiaphyseal clamshell osteotomy of the tibia or femur for malunion or nonunion. Exclusion criteria were <6 months of follow-up or a different osteotomy. Radiographs were used to investigate union of the osteotomy, defined using the modified radiographic union scale in tibial fractures (mRUST) score.

Results: A total of 18 patients met inclusion criteria. Two patients were excluded due to lack of follow-up; therefore, 16 patients were included. 13 of 16 patients achieved union by 16 months (union rate of 81.3%). 11 of 16 (68.8%) healed after the primary procedure with healing at an average of 8.75 months (range, 3-13). 4 of 16 (25%) required a secondary procedure to achieve union (exchange intramedullary nails). Two of these 4 revisions achieved union, while the other 2 patients did not have union at final follow-up. One of 16 (6.3%) was lost to follow-up at 8 months and did not have radiographic union yet. Reamed irrigator aspirator (RIA) was used for bone graft in 13 of 16 patients (81.3%) and 2 of 16 (12.5%) had bone morphogenetic protein (BMP) used for bone graft. Two patients had a postoperative pulmonary embolus, 1 patient had a gastrointestinal bleed, and 1 patient developed a nondisplaced fracture from the RIA. Seven patients had wound healing issues, with 3 of these requiring surgical intervention. One patient required an irrigation and debridement and skin graft, while the other 2 had sinus tract excisions.

Conclusion: The clamshell osteotomy is one potential tool for treating complex metaphyseal deformities. To the best of our knowledge, this is the first report on union rates and complications with the clamshell osteotomy for metadiaphyseal and metaphyseal deformities. A high union rate can be seen using modern nail designs and atraumatic technique; however, union times can be long, complications are not uncommon, and some patients will require secondary procedures.