Δ Definitive Treatment Alternatives After First Stage Masquelet: Many Options Available to Achieve a Common Goal

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Purpose: Our objective was to evaluate the many potential alternatives for definitive reconstruction during staged treatment following a solid PMMA (polymethylmethacrylate) antibiotic spacer as the initial step toward the Masquelet-induced membrane technique (MIMT).

Methods: This was a retrospective review of a consecutive series from a single major metropolitan trauma center of staged management of infected nonunions or open long bone fractures. Over 6.5 years, a total of 91 distinct cases were managed in a staged fashion with a solid PMMA antibiotic spacer, initiating the MIMT. Medical records and serial radiographs were reviewed to assess clinical outcomes. Age, sex, etiology, and time interval between stages was recorded, and data analyzed using descriptive statistics.

Results: The average age was 42.8 years, and the cohort was predominantly male (78%). The femur and tibia made up 91% of procedures that completed the induced membrane technique; 32% of patients had segmental bone defects with an average length of 4.8 cm (range, 0.9-10.7 cm); average volume of the defect was 31.5 cc (3-146 cc); average time between stages was 87 days (28-231 days); average time to union was 4.5 months (3-12 months); complications occurred in 13%. A total of 52 subsegmental defects underwent exchange with cancellous autograft (32 tibia, 9 femur, 6 upper extremity, 5 other), as did another 12 small/moderate segmental defects, recapitulating the Masquelet technique. An additional 18 cases with major/massive defects (OTA OFC D3B/C) were managed by either bone transport (7), or with 3D-printed patient-specific titanium scaffolds (11). Microvascular bone transfers were used in selected cases (4; 3 free fibula and 1 hemi femur). A repeat first stage was employed in 9 cases, including: treatment failure following initial Masquelet second stage procedure (4; 2 infected, 2 nonunion); recurrent infection after the first stage (1); suspected recurrent infection (culture negative) (2); and planned repeat first stage (identified difficult to treat organisms) (2). Segmental intra-articular defects (5) are a separate special case excluded from further analysis here. Of the 4 cases with initial treatment failure after the second stage procedure, 3 of 4 were successfully re-treated. Following our standard MIMT protocol, 3 of 12 failures were observed in patients with segmental defects, and all 3 were >8 cm; for those <8 cm 7 of 7 were successful, and for those >8 cm only 2 of 5 were successful.

Conclusion: After the first stage MIMT is completed many options are still available to pursue definitive reconstruction, with an initial success rate of 95.6% and an overall success rate of 98.9% following re-treatment.

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