

## Prospective Evaluation of Functional Outcome Along with Histological Features of Induced Membrane in Patients with Infective Nonunion Managed with the Masquelet Technique

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**Purpose:** The reconstruction of critical sized bone defects that occur after removal of dead and sequestered bone in infective nonunions is a major challenge for the orthopaedic community. The induced-membrane technique as proposed by Masquelet is a promising approach for this complex problem. This study aims to analyze the overall clinical, functional, and radiological outcome of patients with infective posttraumatic nonunion treated by the Masquelet technique along with studying the morphology and osteogenic properties of the membrane thus formed.

**Methods:** A prospective study was conducted from January 2016 to December 2018 in 19 patients with posttraumatic infected nonunion of lower limb bones. In stage I, radical debridement of bone was done along with antibiotic cement spacer insertion. Stage II was performed after a minimum of 6-8 weeks based on the biochemical and clinical features suggestive of cessation of infection. In this stage, the cement spacer was removed and bone grafts taken from iliac crest; autogenous fibula mixed with bone substitutes was used to fill the bone defect as reamer-irrigator-aspirator (RIA) is not available in our region. Size of defect, timing to stage II surgery, and time to bone union along with any complications were analyzed in this study. Histological properties of the induced-membrane sample taken during stage II were also studied using light microscopy.

**Results:** 19 patients underwent Masquelet's staged procedure with 14 tibial and 5 femoral defects. After stage I, the mean defect created was  $7.1 \pm 2.3$  cm (mean  $\pm$  standard deviation [SD]) with range 4-11 cm. Average time to stage II was  $11.56 \pm 4.64$  weeks (mean  $\pm$  SD). At the end of the study period, 15 patients had united clinically as well as radiologically and the mean time to union was 11.5 months. Three patients had recurrence after stage II of the Masquelet technique. These patients were then managed with the Ilizarov technique of corticotomy and bone transport. Histological examination of the membrane revealed a 2-layered architecture with inner cellular layer and outer fibrous layer. Average membrane thickness was  $4.78 \pm 2.19$  mm (mean  $\pm$  SD) and the mean microvessel density/hpf (40x) was  $9.68 \pm 4.99$  (mean  $\pm$  SD). 68.7% of the membranes depicted presence of acute/chronic inflammatory infiltrates with foreign body giant cells and 25% of the samples showed new bone formation. The thickness as well as the microvessel density of the membrane was maximum between 8 and 12 weeks.

**Conclusion:** The Masquelet technique is an effective way of managing large bone defects especially due to infective nonunions. Our study provides evidence regarding successful clinical outcomes of this technique. Moreover, the study also characterizes the induced membrane as osteogenic with features similar to periosteum in histology with peak biological properties between 8 and 12 weeks. However, the issue of reactivation of infection despite normal biochemical and clinical markers still remains a major issue in this technique. Procurement of adequate amount of good quality bone grafts also remains a concern where RIA is not available.

See the meeting app for complete listing of authors' disclosure information.