Induced Membrane (Masquelet) technique in treatment of long bone defects

A Systematic Review / Meta-Analysis

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List of Abbreviations

Abb.	Full term
BMP-2	Bone morphogenic protein -2
CBFA-1	Core binding factor alpha -1
COL-1	Collagen type-1
CSD	Critical size defect.
DSSI	Deep surgical site infection
IM	Intramedullary nailing
IMT	Induced membrane technique.
MSC	Mesenchymal cells
PMMA	Poly methyl metha acrylate
PTSBD	Post traumatic segmental bone defects.
RIA	Reamer irrigator aspirator
SSSI	Superficial surgical site infection
TEBC	Tissue engineered bone constructs.
TGF-b1	Transforming growth factor b1.
VEGF	Vascular endothelial growth factor

INTRODUCTION

Reconstruction of large segmental bone defects is often challenging because of the complex mechanics and biology. Traditionally, patients with significant soft tissue injury associated with bone loss underwent amputation; however, limb salvage has become increasingly common, with reported clinical outcomes comparable to those of amputation at short term follow up. The goal is to achieve a functional, stable extremity in an expedient manner that will be well tolerated. However, most techniques for reconstruction of significant bone loss are associated with lengthy healing or rehabilitation times and unpredictable union rates. [(1)]

Autogenous bone graft remains the optimal graft for management of these defects because of its osteoinductive, osteoconductive, and osteogenic properties. However, this graft has several drawbacks and limitations, including a definitive supply and risk of significant morbidity or iatrogenic injury with harvest. In addition, outcomes associated with massive cancellous autograft of large segmental defects are often poor due to substantial graft resorption, even in noninfected, well-vascularized surgical sites. [(2)]

Current management options include intercalary bone transport and distraction osteogenesis, vascularized bone transfer, massive cancellous autograft transfer, and synthetic calcium-based fillers. These options may be supplemented with

the addition of demineralized bone matrix, allograft, or bone morphogenetic protein (BMP). [3]

Masquelet and colleagues developed the use of induced membrane-assisted massive autograft for segmental bony defects and successfully managed defects ≤ 25 cm with associated severe soft-tissue injury by use of this technique. [4]

A bio-active membrane is created via placement of a temporary polymethyl methacrylate (PMMA) spacer, and the membrane is later filled with cancellous autograft. Reported advantages of this technique include protection against autograft resorption, relative maintenance of graft position and prevention of softtissue interposition.[5]

Several animal studies have been done to detect the properties of this membrane. It was confirmed that it secretes substances that increase bone healing (e.g. bone morphogenetic protein). It is a fibrous membrane with high vascularity and looks like the periosteum. [6]

In the traditional technique described by Masquelet, external fixation was used with insertion of morcellized iliac cancellous graft. Recently many authors use internal fixation and the new technique of harvesting medullary graft (Reamer Irrigatoer Aspirator or RIA) has overcome the limited amount of graft. [7]

The complications of this technique include reinfection, donor site morbidity, graft resorption (complete or partial) and refracture. It is a valid technique in management of segmental bone defect without the need of microsurgery. [8]

AIM OF THE STUDY

The aim of this study is to assess the results of the induced membrane technique in management of segmental bone defects caused by trauma or infection.