

# MANAGEMENT OF INFECTED GAP NON-UNION OF LONG BONES BY MASQUELET TECHNIQUE

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### Abstract:

Management of post traumatic, Primary and Secondary Infected Gap Non-Union is a challenging problem for Orthopedic Surgeons. Masquelet has proposed a technique, using a temporary cement spacer in the significant Gap non union in preliminary stage to induce the Bio-membrane followed by delayed bone grafting inside the bio-membrane after removal of cement spacer as second stage procedure . In our study 9 patients having tibial bone defect in 5 cases and femoral bone defect in 4 cases ,6 males and 3 females between the age group of 18 years to 60 years are managed by masquelet technique during the period of April 2015 to December 2017 with the mean follow up of 1½ Years.

Pre requisite condition for Masquelet technique are ,Infection free, vascularised bone with defect ,an intact soft tissue coverage and relative stability furnished by appropriate fixation device .We have taken into consideration the extent Of defect, time elapsed after trauma for insertion of spacer ,duration of spacer to keep inside for induction of Bio-membrane ,Time of delayed bone grafting inside Bio-membrane & type of implant for fixation as pre-operative planning.

Antibiotic impregnated cement spacer is implanted after an average of 12(4to60) weeks after accident. Prerequisite conditions required prior to insertion of spacer are achieved by thorough bone and soft tissue debridement, toileting and administration of appropriate broad spectrum antibiotics .Average bone loss was 4(3to 9) cm in tibia and 3(2to8) cm in femur.

The spacer was kept inside for an average time of 7(4to10) weeks. Radiological union was observed in 8 cases after an average duration of 48(28to82) weeks. In one case union did not occur at all and it was re operated and bony union was achieved by application of illizarov ring fixator.

**Key words** :- Infected gap non-union ,cement spacer, Induced Bio membrane Masquelet .

### Introduction

Severe crush injuries and compound fractures of lower limb give rise to segmental bone loss and soft tissue injury .Infection remains a crucial challenge to manage these cases. There are various treatment modalities available to treat

these patients<sup>1</sup>. Non vascular autografts require a viable and adequately perfused recipient site for successful graft integration and union. longer bone grafts are at greater risk of resorption and less suitable for longer bone defect . Donor site morbidity is another disadvantage of this procedure. Segmental transport by illizarov or rail road

fixator is another option to manage these cases.

Masquelet technique, induction of bio membrane followed by autologous bone grafting was described in 1986<sup>2</sup>. It is easy, reproducible method to treat the segmental bone loss in long and other bones also.

Meticulous, repeated debridement are done to remove all infected and necrotic tissue and an antibiotic impregnated cement spacer is temporarily implanted in this well prepared viable environment. Repeated superficial debridement can be made during the period of implanted spacer in situ. The induced membrane is made of a type-1 collagen –heavy matrix with fibro elastic cells and contains high concentration of growth and osteo inductive factor.<sup>3-4</sup>

During cement spacer removal ,the induced membrane is opened for insertion of bone grafts & then it is closed by absorbable sutures. It acts as barrier to out ward diffusion of growth and osteoinductive factors. It also prevents reabsorption of autograft .The definitive fixation can be done either with inter locking nail or plate & screws .

## Material & Methods

In this multi centric study 9 patients having tibial bone defect in 5 cases and femoral bone defect in 4 cases ,6 males & 3 females ,between the age group of 18 years to 60 years are managed by masquelet technique during the period of April 2015 to December 2017 with average follow up of 1½ years.

## Procedure

Pre operative evaluation of patient are done. Radiological assessment is done to evaluate the extent of bone loss .all the requisite laboratory investigation one done and patient are taken in OT for thorough debridement and toileting to remove all infected & dead tissue. Both bony ends of gap should be viable. Method of fixation depends upon, extent of compounding & infection. After appropriate definitive fixation, defect is measured and filled with antibiotic impregnated cement spacer. We have used to mix vancomycin powder in 40 gram bone cement to prepare the cement spacer.

In two cases antibiotic cement spacer was exchanged

before second phase of autologous bone grafting in order to confirm the eradication of infection by bacterial biopsy and culture of material.

In one case bacterial infection was not eradicated even after repeated debridement and exchange of antibiotic impregnated cement spacer and ultimately non union persisted and this case was managed by illizarov technique.

In another case eradication of bacterial infection was achieved by exchange of antibiotics cement spacer and union was achieved in it by subsequent delayed autologous bone grafting inside bio membrane in 2<sup>nd</sup> phase.

The second phase of autologous bone grafting is performed after average time of 7(4-10)weeks of first surgery. The bone graft is harvested from iliac crest. The fracture is re-approached through the previous incision and meticulous dissection is performed to expose the defect.

The bio membrane encapsulating the cement spacer is carefully incised after that cement spacer is removed and bio membrane capsule is irrigated to remove any residual debris. With the defect being open, the bone graft is placed to fill the entire defect. Once the defect is filled .the bio membrane is closed with absorbable sutures. Full weight bearing was achieved after an average time of 15(range 12 to 23) weeks. Radiological union was observed in 8 cases after an average duration of 48 (28 to 82) weeks.

In one case which was managed by illizarov technique, radiological union was achieved in 56 weeks.

## Discussion

Management of infected gap non union of long bones, remains challenge to orthopedic surgeons. We have managed 9 patients having of infected non union tibial bone defect in 5 cases and femoral bone defected in 4 cases with 2 stage bone reconstruction technique described by masquelet.

The procedure of masquelet is technically non demanding and advantageous as the soft tissue and osseous infection subside during the time of spacer in situ .Bone grafting of these defects is often delayed after primary fixation to allow soft tissue healing, decrease the risk of infection and prevent graft resorption<sup>5</sup>. Advantage of inserting a spacer

include maintaining a well defined void to allow for later placement of graft, providing structural support off loading the implant and inducing the formation of bio membrane.

Maswquelet & Begue proposed that the membrane prevent graft resorption and improves vascularity and corticalization. After the initial placement of antibiotics impregnated spacer an interval of 4-5 weeks is required for development and maturation of a biologically active membrane that is suitable for grafting. The spacer also maintains the defect and inhibits fibrous in growth<sup>6</sup>.

Recent literature has shown this bio membrane can be 0.5 to 1mm thick<sup>7</sup> and has been described as both hyper vascular and impermeable<sup>8</sup>.

In our study the mean interval between the first and second phase of masquelet technique is 7 weeks which is comparable to other studies. Accadbled et al<sup>9</sup>. Reported a case using a cage and nail construct, resulting in successful eradication of methicillin resistant staphylococcus aureus infection and reconstitution of 17 cm diaphyseal defect in tibia<sup>10</sup>. **Biau at al.**<sup>11</sup> used both iliac cortico cancellous autograft and a medial tibial cortical strut autograft to fill the defect. In our series we used auto grafts harvested from iliac crest only.

There remains little evidence in literature regarding the results of the technique according to masquelet in large homologous groups except those described by masquelet.<sup>12,13,14</sup> Definitive fixation with interlocking nail was achieved in 5 cases and with plate in 3 cases and one case was managed by illizarov technique. No difference was observed in healing due fixation by different implant. In our study we have treated post traumatic, primary and secondary infection gap non union of long bones successfully.

## Conclusion

Technique of inducing bio-membrane by implantation of antibiotic impregnation cement spacer in bone void followed by delayed autologous grafting is a reliable, safe and reproducible alternative modality for treating the challenging problem of significant bone loss with infected non union of long bones.

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