DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20231996

Original Research Article

Use of fibular graft in Masquelet technique in osteomyelitis of long bones- a novel modification in the technique

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Received: 17 April 2023
Revised: 31 May 2023
Accepted: 08 June 2023

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ABSTRACT

Background: Improper treatment of acute osteomyelitis mostly leads to chronic osteomyelitis. In the year 2000, Alain C. Masquelet described the Induced membrane technique for the first time. In this study, we aimed to determine the clinical efficiency of the Masquelet technique for bone loss due to osteomyelitis in the long bones.
Methods: This study was conducted at our tertiary care centre Shri Vasantrao Naik medical college and hospital, Yavatmal between August 2016 and September 2020. Masquelet technique with some modification was performed in all cases.
Results: In first stage, the defects were filled with antibiotic-loaded polymethyl methacrylate (PMMA) cement after radical debridement. In second stage after 6 to 8 weeks we used a combination of fibular strut graft with iliac cancellous graft. X-rays were taken before second stage and after 3 months, 6 months and 1 year to see for the union. The study included 10 patients, with 6 males and 4 females with mean age of 34 years (20 to 54). The mean duration of bone infection was 4 months (range: 3-5 months). All patients had an average follow-up period of 16 months (range, 12-24 months). Radiographic evidence of bone union was seen in 6 months (3 to 9 months) infection was not seen in any case.
Conclusions: This modified Masquelet is an effective method for the treatment of chronic osteomyelitis of the long bones.

Keywords: Chronic osteomyelitis, Induced membrane technique

INTRODUCTION

Osteomyelitis (Figure 1) is a form of inflammation involving the bone tissue or marrow caused by a pathogenic organism.[1] Chronic osteomyelitis mainly occurs in the long bones. A two-stage surgical method for the treatment of bone defects has been reported by Masquelet in recent years, which is called the induced membrane technique.[2] This induced membrane technique has been used for the treatment of osteomyelitis.[3] If the gap is more than 4–5 cm, stand-alone bone autografts generally do not integrate well. Most often this is due to graft resorption even in a good muscular envelope.[4]

Figure 1: Pre op osteomyelitis.

So, in this study, to reduce the period of morbidity and increase the chances of union and to see the clinical efficiency of this modified technique, we used a combination of fibular strut graft (Figure 6) with iliac cancellous graft instead of using only the cancellous graft.

In this study, we aimed to determine the clinical efficiency of the modified Masquelet technique for bone loss due to osteomyelitis in the long bones.

METHODS

This prospective study was conducted in our tertiary center Shri Vasantrao Naik medical college and hospital, Yavatmal between August 2016 and September 2020 and consisted of 10 patients (6 males and 4 female). All patients were treated using the induced membrane technique. Our study included patient from 20 to 56 age group and with chronic osteomyelitis. Acute osteomyelitis and polytrauma patients were excluded.

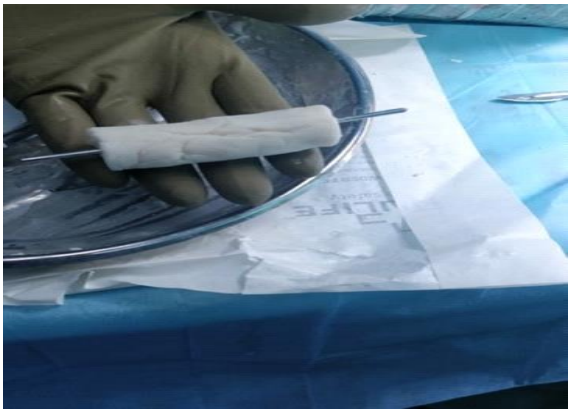

Figure 2: Preparation of cement spacer.

Figure 3: Filling bone defect.

In the first stage, antibiotic-loaded PMMA cement (Figure 2) was used to fill the bone defects (Figure 3) after radical debridement. In the second stage (Figure 7), bone grafts were implanted to rebuild the bone defects. After 6-8 weeks, infection assessment was performed before grafting. The cement was removed, the wound washed, and a graft of appropriate size was cut. We used a fibular strut graft along with cancellous bone graft. The membrane was then grafted and sutured.

Figure 4: Closure of defect.

Figure 5: Induced membrane formation.

Figure 6: Use of fibular graft.

The patients underwent follow-up at 3, 6, 12, and 24 months. Assessment of functional outcome by range of movement of internal rotation and abduction was done and also assessment by radiographic healing was done with evidence of infection if any.

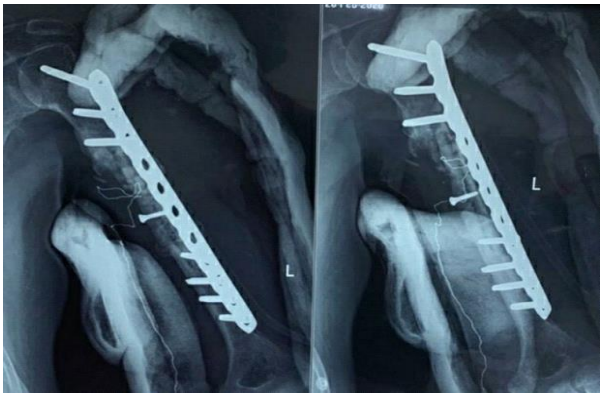

Figure 7: After 2nd stage: graft + final fixation.

RESULTS

Our study included 10 patients, of whom six were males and 4 females. The mean age of the patients was 34 years (range: 20-54 years). The mean duration of bone infection was 4 months (3 to 5 months). The average follow-up period was 16 months (range: 12-24 months).

Satisfactory range of movement was achieved with average internal rotation of 5 degrees, 10 degrees, 15 degrees and 20 degrees at 3 months, 6 months, 12 months and 24 months and average abduction of 45 degrees, 60 degrees, 75 degrees and 100 degrees at 3 months, 6 months, 12 months and 24 months.

Radiographic evidence of bone union was seen in 6 months (3 to 9 months). There was no recurrence of infection in any case.

Table 1: Sex distribution of patients.

Male	Female	Total
6	4	10

60 percent patients were males.

Table 2: Age distribution of patients.

Age group	Number
20-31	2
32-43	5
44-54	3
Total	10

Most patient were of the age group 32-43.

Table 3: Duration of infection.

Duration	Number
3 months	1
4 months	6
5 months	3
Total	10

Mean duration of infection was 4 months.

Table 4: Average internal rotation.

Average internal rotation		Degrees
Average internal rotation	3 months	5 degrees
	6 months	10 degrees
	12 months	15 degrees
	24 months	20 degrees

Post operative satisfactory internal rotation of 5 degrees, 10 degrees, 15 degrees and 20 degrees was achieved on an average with each follow up.

Table 5: Average abduction.

Average abduction		Degrees
Average abduction	3 months	45 degrees
	6 months	60 degrees
	12 months	75 degrees
	24 months	100 degrees

Post operative satisfactory abduction of 45 degrees, 60 degrees, 75 degrees and 100 degrees was achieved on an average with each follow up.

Figure 8: New bone formation (1 year follow up).

Figure 9: Functional outcome: internal rotation.

Figure 10: Functional outcome: abduction.

DISCUSSION

The lack of a generally accepted treatment method for chronic osteomyelitis is a serious problem for orthopedicians. Ilizarov technique, one stage bone grafting and vascularised fibula graft are some of the classic techniques for chronic osteomyelitis, but these are often associated with long-term recurrence rates and high complications.[5-7] For the reconstruction of long bone defects, a procedure for induced membrane formation was described by Masquelet et al to promote the consolidation of conventional cancellous bone autografts. In this technique, there was good integration of the donor graft into the bone, as the induced membranes prevented the resorption of the graft. In his study of 15 patients, El-Alfy obtained satisfactory results when treated with a free nonvascularized fibula graft. The average time to bone union was 7 months, which was approximately the same as that in our study (6 months).[8] In the case series of Woon et al and Scholz et al, infected non-union was the etiology.[9,10] In the study done by Woon et al,1 case united after 11.5 months, may be due to using corticocancellous graft which has less healing properties than pure cancellous graft and union occurred after 4.5 months (range: 2.8-5.6 months) in the study done by Scholz et al.[9,10]

Masquelet technique has the advantages of easy learning, lesser complications, shorter bone union time, and wide application in any long bone when compared with other bone restoring procedures.[7,11]

CONCLUSION

The induced membrane technique is a reliable method for the treatment of long-bone osteomyelitis. The addition of a fibular strut graft significantly reduced the time taken by cancellous bone to be converted to cortical bone and the time for union. There was also a lower incidence of infection, but more studies are needed to support this finding.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Kharat A, Aher D. Use of fibular graft in Masquelet technique in osteomyelitis of long bones- a novel modification in the technique. Int J Res Orthop 2023;9:747-50.