

Outcome of Bridge Technique with Fibular Graft in Patients with Distal Tibial Non-Union

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ABSTRACT

Background: Non-union is an inevitable consequence in many circumstances of compound distal tibial fracture. In many recent research papers, now-a-days, it has been claimed that bridge graft with fibula is good treatment option for management of such cases of non-union in clinical situations with distal tibial fracture. **Methodology:** This prospective study was conducted with a total number of 12 patients with non-infected distal tibial non-union were treated with fibular graft technique from October, 2014 to September 2020 in Khulna Medical College Hospital and in private hospitals. To select sample, convenient purposive sampling was used. **Results:** Among the study population, 58.3% (07) patients were male. 33.3% (04) of male patients were in 30-40 years age group, whereas in female patients, majority of the patients (25%) were in 40-50 years age group. Road traffic accident was found as the commonest mode of injury in 50% (06) patients of distal tibial fracture. Gustilo-Anderson grade IIIA was the most common type (58.3%). Excellent outcome was observed in 75% (09) patients. In 58.3% (07) patient, there was no chronic pain in follow-up. However, chronic pain at donor site was found in approximately 33.3% (04) patients. Only in 1 patient (8.3%) persistent chronic pain was observed donor site. Healing occurred fairly by primary intention in 83.3% (10) patients, whereas in 16.7% (02) patients, healing occurred by secondary intention. Overall in 75% (09) patients, no obvious complication was observed. Refractory complication was observed in only 1 patient (8.3%). **Conclusion:** Bridge graft with fibula for managing distal tibial non-union is a resilient treatment option with fewer and manageable complications.

Keywords: Bridge graft, fibular graft, tibia nonunion, bone graft.

(The Planet 2020; 4(2): 29-34)

INTRODUCTION:

Distal tibia is common sites of aseptic non unions and delayed unions, especially in

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compound wounds with extensive soft tissue injury^{1,2}. These are difficult to treat and various techniques are utilized to treat these fractures. Two factors dictate the further management in aseptic cases, mobility at fracture site and healing response from the bone. In cases with fibrous union or a stiff non union only bone grafting with immobilization may be adequate to achieve union³. In cases with abnormal mobility an internal fixation is required. Intramedullary nailing is used in cases with sufficient distal fragment to offer rigid fixation^{4,5}. Compression plates can be used for angulated distal fractures; and ring fixators are preferred in cases with bone loss⁶. In certain cases, specially with poor local skin condition, distal fibula can be used to bridge the nonunion tibia site and provide advantage of both bone grafting and internal fixation. Such use was first described in 2005 by James and Santrock in an abstract presented at foot and ankle surgery course 2008⁷. Here the ultimate aim of this study is to assess the outcome of similar technique in patients with non-infected tibia non-union.

METHOD AND MATERIAL:

A total number of 12 patients with non-infected distal tibial non-union were treated with fibular graft technique from October, 2014 to September 2020 in Khulna Medical College Hospital and in private hospitals. This study was conducted prospectively. Elderly patients (age over 70 years) with incapacitating co-morbidities (uncontrolled diabetes mellitus, unstable angina, uncontrolled hypertension, frail patients, severe cardio-respiratory problem etc.) were excluded from study population. A minimum 06 of follow-up is done in each patient. All data was collected and analyzed retrospectively. Convenient purposive sampling was used as a method of selecting sample. Informed written consent was taken from individually from each patient and ethical clearance was taken properly from ethic review committee of Khulna Medical College Hospital, Bangladesh. Two assessing tools have been used in this study. Gustilo-Anderson classification^{8,9} has been used to assess the grade and severity of open tibial fracture.

Grade	Details
I	Clean skin opening of <1 cm, usually from inside to outside; minimal muscle contusion; simple transverse or short oblique fractures.
II	Laceration >1 cm long, with extensive soft tissue damage; minimal to moderate crushing component; simple transverse or short oblique fractures with minimal comminution.
III	Extensive soft tissue damage, including muscles, skin and neurovascular structures: often a high energy injury with severe crushing component.
IIIA	Extensive soft tissue laceration, adequate bone coverage; segmental fractures, gunshot injuries, minimal periosteal stripping.

IIIB	Extensive soft tissue injury with periosteal stripping and bone exposure requiring soft tissue flap closure; usually associated with massive contamination.
IIIC	Vascular injury requiring repair.

Table I: Gustilo-Anderson classification.

Another assessment tool that is used in this research is “Criteria for assessment of results¹⁰” to assess the overall outcome.

Grade of result	Pain at donor site	Adjacent joint motions	Wound healing	Complications
Good	Nil	Full	Primary	Nil
Fair	Occasional	Partial restriction	Secondary	Present, managed with treatment
Poor	Constant	Significant stiffness or instability	Secondary with persistent sinus	Refractory complications

Table II: Criteria for assessment of results.

RESULTS:

The age and sex distribution of 12 patients of distal tibial non-union is given in table 1. 58.3% (07 patients) were male, among whom 33.3% (04 patients) were in 30-40 years age group. Whereas, in case of female patients, most of the patients (25%) were in 40-50 years age group.

Age (year)	Male		Female	
	n1	%	n2	%
20-30	02	16.7	00	00
30-40	04	33.3	01	8.3
40-50	01	8.3	03	25.0
>50	00	00	01	8.3
Total	07	58.3	05	41.7

Table 1: Age & sex distribution of study population.

Causes of fracture are depicted in figure 1. Road traffic accident is observed to be the most common mode of distal tibial fracture.

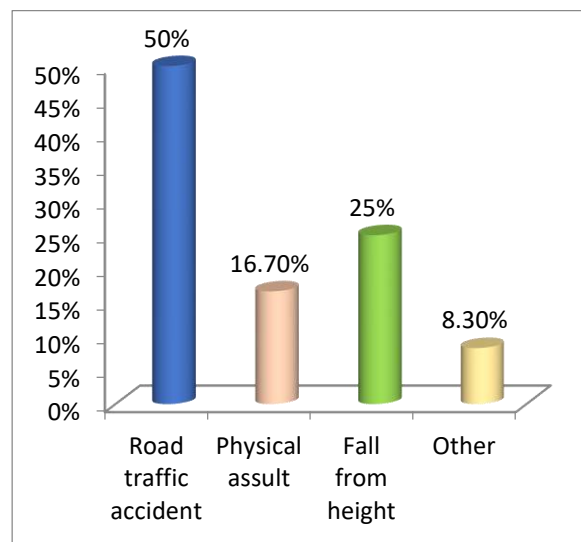


Figure 1: Cause of distal tibial fracture.

Gustilo-Anderson classification was used to address the nature and severity of initial type of open tibial fracture. The findings are mentioned in figure 2.

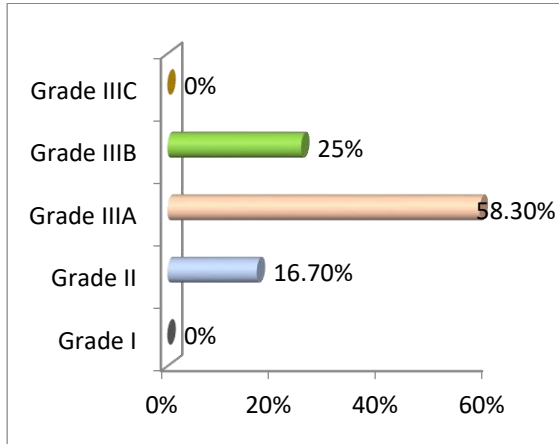


Figure 2: Gustilo-Anderson classification of tibial fracture.

In this study, the results are assessed by utilizing the “Criteria for assessment of results”. The findings are tabulated in the table 2.

Grade of result	Good	Fair	Poor
n	09	03	00
%	75.0	25.0	00
Pain at donor site	Nil	Occasional	Constant
n	07	04	01
%	58.3	33.3	8.3
Adjacent joint motions	Full	Partial restriction	Significant instability
n	10	02	00
%	83.3	16.7	00
Wound healing	Primary	Secondary	Persistent sinus
n	10	02	00
%	83.3	16.7	00
Complications	Nil	Managed with treatment	Refractory complications
n	09	02	01
%	75	16.7	8.3

Table 2: Observation assessed by the “Criteria for assessment of results.”

DISCUSSION:

In this research, 12 patients with distal tibial non-union eventually went for fibular bridge graft. Among them 58.3% (07)

patients were male and 41.7% (05) patients were female. Among the male patients 33.3% (04) were in 30-40 years age group, followed by 16.7% (02) were in 20-30 years age group. On the other hand, in female

patients, majority of the patients (25%) were in 40-50 years age group. Regarding the cause of fracture, road traffic accident was found as the most common cause. In 50% (06) patients tibial fracture occurs due to road traffic accident, followed by in 25% (03) patients it was associated with fall from height. Gustilo-Anderson grade IIIA was the most common type (58.3%).

Tibia fibular synostosis has been first used by Milch in 1939¹¹. He performed posterolateral cancellous bone grafting between tibia and fibula creating a cross union between the bones. After him many have reported the success of this method; however the indication is limited to fibrous nonunions with limited mobility and no requirement of additional stability⁶. In cases where additional stability was required transfer of ipsilateral fibula by osteotomy at both ends and fixation of the fibular strut graft across the non-union is reported. This is similar to Huntington procedure which was done in two steps¹²⁻¹⁴.

Approximately in 75% (09) patients, good union occurs with best outcome. And in case of rest of 25% (03) patients, union is fair. In 58.3% (07) cases, no chronic pain has been observed after the graft. However, 33.3% (04) patients were associated with occasional chronic pain at donor site. Only in 1 patient (8.3%) persistent chronic pain was observed donor site. Approximately in 83.3% (10) cases healing occurred fairly by primary intention, whereas in 16.7% (02) patients, healing occurred by secondary intention. Overall in 75% (09) patients, no obvious complication was observed. But in

16.7% (2) patients complications occur those were successfully managed accordingly. Refractory complication was observed in only 1 patient (8.3%). In a case report in 2013, it has been claimed that after such graft complete union was achieved at 7 months post surgery. The patient was walking full weight bearing and was able to carry out all activities. The medial soft tissue scar was healthy. Five years follow-up in that particular patient showed good clinical and functional outcome without any complications¹⁰.

CONCLUSION:

The overall result of fibular bridge graft for managing distal tibial non-union is fairly good with limited and manageable complications. Fibular bridge graft may be considered as a resilient treatment option in many clinical circumstances.

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