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## Early Posterolateral Bone Grafting in Fresh Open and Infected Fractures of Adult Tibia.

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### ABSTRACT

Fresh open and infected fractures lose their fracture hematoma. They have associated injury to the periosteum with significant loss of blood supply to the ends of the fractured bone. There is also loss of bones through the defect in soft tissue and skin leading to loss of contact between the main fragments and hence have less chance of union. The dilemma is the decision whether should one need to wait for the arbitrary period of nine months to predict union? In this paper twelve fractures of both bones fractures with bone loss or infection were initially fixed either external or internal fixations, were later treated with early Poster lateral Bone Grafting. All fractures united. The grafting was done without waiting for any progress in fracture healing on its own when the patient consented so that the patient stands a good chance of union in the waiting period.

**Keywords:** posterolateral bone, grafting, tibia, fracture

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**INTRODUCTION**

Postero-lateral Bone Grafting is a procedure recommended for non unions of the fractures of both bones of legs. Fresh open and infected fractures with no sign of radiological healing are a challenge to treat. Obviously these fresh open fractures lose their fracture hematoma and also have associated injury to the periosteum with significant loss of blood supply to the ends of the fractured bone. Further there is also loss of bones through the defect in soft tissue and skin leading to loss of contact between fragments and hence have less chance of union. The main problem which will complicate the position further is a high potential for infection. In such cases when will one need to intervene and treat? The dilemma is the decision whether should one need to wait for the arbitrary period of nine months to predict union? We felt any intervention should be at an early phase of time so that the patient is given a good chance of union in the waiting period. In this paper fractures of tibia with bone loss or infection were treated primarily with either external or internal fixations and not waiting for any progress in healing on its own , were also treated with early Poster lateral Bone Grafting and their outcomes were studied.

**MATERIALS AND METHODS**

Between 2004 to 2010 twelve cases of open and infected fracture of tibia bone presented to our department were included in the study. They were in the age group of 40 to 60 years (of these nine were males and three were females). There were three infected fractures and three bone defects of 3cms in average. Two cases were primarily treated with interlocking nail while one case had plating. Ten cases were primary open fractures treated with external fixator (figure 1). Flap cover was done in two cases which underwent external fixation. One case of external fixator later conversion to Ilizarov ring fixator. These patients were informed regarding the indirect way of healing of the fracture of forming a syndesmosis between the fibula and the fracture site especially the lower fragment of the fracture. These patients were assessed for anesthesia. They were positioned with a sand bag under the ipsilateral buttock, both for aiding the harvesting of bone graft and also for the postero-lateral approach of the leg bone grafting. By an incision over the thickest part of the iliac crest, the iliac crest bone graft was harvested (figure 2). By a postero lateral approach between the peroneii and soleus, the fracture site was exposed (figure 3). Troublesome bleed from the middle peroneal artery was sometimes encountered and it was addressed. The posterior surfaces of fibula and tibia were made raw with rongeurs and the bed was prepared for accepting the harvested cancellous bone graft. The above mentioned graft was placed in the roughened area and wound closed. (Figures 4 and 5) post operatively intravenous antibiotics were given for 5 days followed by discharge of the patient from the hospital after change of dressings. The sutures were removed after 12 days as out-patient. One and half months later the external fixator was removed and an above knee plaster cast was applied which was later at 3 months replaced by a patellar tendon bearing plaster. On every visit the plaster was removed and the leg was clinically assessed with the ability to squat climb on stairs, walk on uneven ground sit cross-legged. During every month’s visit, X-rays were taken preferably while changes of plaster to assess the fracture union. On acceptable callus formation in the radiographs, matching the ability of the patient to load the limb, the plaster was completely discarded and patient was given a removable splint made up of synthetic material. The details of all the cases are presented in table 1.

**RESULTS**

**Table 1: details of cases treated with posterolateral bone grafting**

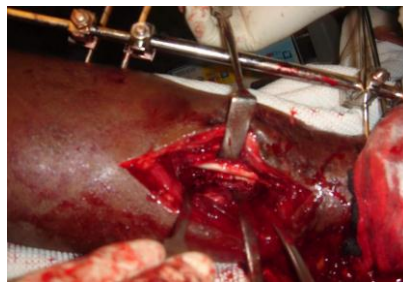
S.no	Name	Fracture stabilization technique	Time of the posterolateral graft application	Time of union in months
1	L	External fixator	Third week	5
2	S	External fixator followed by Ilizarov ring	Third month	8
3	J	External fixator and flap cover	Fourth week	6 ½
4	T	External fixator followed by ILN	Sixth week	6
5	A	External fixator	Sixth week	5
6	SA	Tibia plating	Sixth week	7
7	FI	External fixator and Fibula plating	Fourth week	5
8	BI	External fixator for both sides	Fourth week Fifth week	5.5 RT 6 LT
9	G	External fixator	Fourth week	5
10	H	External fixator and flap cover	Sixth week	7
11	P	External fixator	Fourth week	5.5
	Average		71.5/12	5.958 months



**Figure 1: Two months after injury and external fixator application**



**Figure 2: Bone graft being harvested from the iliac crest**



**Figure 3: Fracture site exposed through postero lateral approach**



**Figure 4: Harvested bone graft ready for application**



Figure 5: Graft placed in fracture site from the posterolateral aspect



Figure 6: Wound closed with drain



Figure 7: Post-operative X-rays



Figure 8: Patient able to stand without support



**Figure 9: Patient able to squat**

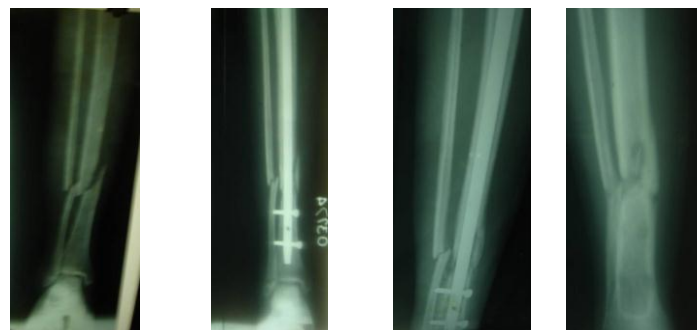


**Figure 10: Patient able to sit cross legged**



**Figure 11: Post-operative X-rays of the patient three months after removal of the fixator.**

The first illustrated case is a vehicular accident victim who had external fixation for an open fracture. Figure 1. He consented for an early posterolateral bone grafting and the procedure is illustrated in figures 2 to 6. The post operative radiograph is seen in figure 7. The patient was able to walk without support at 3 months when the fixator was removed. The patient is seen standing, squatting and sitting cross legged in figures 8, 9 and 10. His post-operative radiograph after removing the apparatus showing solid union at a 1 year follow up is seen in figure 11.



**Figure 12: Radiograph of the second patient with a closed fracture lower third both bone leg.**

**Figure 13: Radiograph of the same fracture seen in figure 12, two months after interlocking nail (ILN)**

**Figure 14: Radiograph after postero lateral bone grafting**

**Figure 15: Radiograph after nail removal and bone formation strong enough for the patient to weight bear.**

The details of the second illustrated case is seen from figures 12 to 15. The patient is a known diabetic. The interlocking nail got infected in the early post operative period. Hence at 6<sup>th</sup> week the patient had the posterolateral bone grafting. He went on to unite by 6<sup>th</sup> month.

The third illustrated case figures 16 to 26 is a 40 year old mechanic Mr. S sustained open fracture in a bike accident. His initial X-rays showed an irregular fracture of right mid tibia with bone loss on the inner side. The same day under anesthesia his leg wound was debrided and a rod type external fixator was applied. Later on 10-1-2006 under spinal anesthesia his fracture was exposed and reduced and a 4 ring Ilizarov construct was fixed with Ilizarov wires and wire fixation bolts. His post-operative period was uneventful and his wound healed well. He was made to weight bear from the 1<sup>ST</sup> post-operative day. Immediate post operative radiographs are seen in figure 16. Patient was not willing for a bone grafting when offered as a routine. But since his X-rays did not show callus or new bone at 1 ½ month to 4 months follow up radiographs (figures 17-22), a postero lateral bone grafting was done (figure 23). This time the patient accepted the procedure. Radiographs taken after, started showing consolidation of the fracture site figure 24,25. After 118 days of posterolateral bone grafting but 8 months after the initial ring application, his Ilizarov rings were removed with a clinical assessment of fracture union. The patient is seen comfortably standing in figure 26.



Figure 16: X-rays taken 4 days after application of rings. (14-1-06).



Figure 17: X-rays taken 17 days after application of rings (27-1-06).



Figure 18: X-rays taken 32 days after application of rings (11-2-06).



Figure 19: X-rays taken on 11-3-06, 60 days after application of rings.



Figure 20: X-rays taken 62 days after application of rings (13-3-06).



Figure 21: X-rays taken 76 days after application of rings (27-3-2006).



Figure 22: 116 days after application of rings (6-5-06).



Figure 23: X-rays taken immediately after postero-lateral bone grafting (26-5-06) 136 days after application of rings.

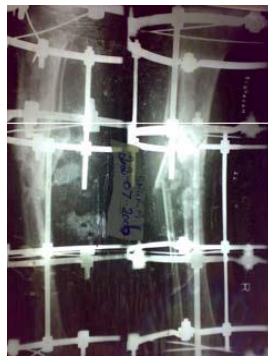


Figure 24: X-rays taken 1 ½ month after postero-lateral grafting (22-7-06) 163 days after application of rings. 33 days after plbg



Figure 25: X-rays taken 3 ½ months after postero-lateral grafting on 6-10-2006.239 days after application of rings, the apparatus was removed after dynamization- (allowing the patient to walk with loosened nut for 15 days ) i.e.totally 254 days after application of rings.



Figure 26: Patient after removal of rings



All the 11 cases (twelve fractures) were available for follow up till the treatment was over and the fracture healed. All our cases united in an average period of 5.9 months, with all of them returned to their work. We had 7 good and 5 fair results. We did not have excellent cases as we did have some degree of shortening and minimal angulations in our cases.

### DISCUSSION

Usual criticism that the surgeon has “not waited for enough time for union ”.is always common. [1] But open fracture losing hematoma with other factors, it is not wise to wait for union. It is wiser to be aggressive and intervene earlier specifically in these situations. The treatment of choice in such cases is Ilizarov ring fixation. But in set-ups where implants are not available, posterolateral bone grafting (PLBG) is handy .The basic principle is a formation of a syndesmosis between tibia and fibula [2]. It needs an intact or plated fibula. This is a biological procedure and takes advantage of the fact that no rotation between tibia and fibula unlike that in the forearm. However in our series we included fractures of tibia with associated fractures of the fibula also.

Though experimentally freeze dried grafts give acceptable results [3] and autologous grafts have complications like infection, prolonged wound drainage, large hematomas, reoperation, and persistent pain in donor site more than six months, sensory loss and unsightly scars , [4] autologous bone grafting is the preferred graft for PLBG procedure. [2, 5-7] This method is effective in managing defects in the tibia and hence un-united fractures of tibia. It exploits the virgin portal of posterolateral aspect of leg where a large amount of cancellous bone graft can be placed to form a synostosis above and below the level of the fracture site i.e. between the tibia and fibula even with bone loss. This aims to achieve stability to the fracture and unite in five months, if done routinely in all high energy tibial fractures within six weeks of the trauma. This is even with acute infection and draining sinuses from the front of the leg if fibrous barrier across fracture is left intact. [5] However this method is not an option if the fibula was excised for docking the tibia, as synostosis above and below the fracture site, cannot form. [5] Also this procedure is not recommended for upper tibial fracture for fear of neurovascular injury. [5] In one of our cases (The first illustrated case) we did this for a middle third fracture with no complications. The surgical approach for the graft placement should not pass through an active or recently infected area. [5] In a series 28 in traumatic segmental tibial bone defects, inter-tibio fibular graft (ITFG), or posterolateral bone graft, achieved healing quickly in all the cases. This method can be used as a preferred technique where bone defects are less than 4cm, either alone or with another tibial reconstruction procedure. [6]

In two of our cases we did this procedure even in the presence of fibular fracture. The fibula eventually united in the same period of consolidation of the graft and went on to result in consolidation of the fracture. Thus it was found that this technique can be used in cases of fracture of the fibula without disturbing the fibular fracture.

Another method of fresh autogenous iliac crest bone graft application is described but in the antero-lateral aspect of the fibula for persistent non unions of 48 tibia fractures. This method is called central grafting-performed through a lateral approach, anterior to the fibula, forming a bridge between the tibia and fibula above and below the fracture site. In this series only one failure is reported. [8]

The principle in the posterolateral bone grafting basically is syndesmosis between tibia and fibula thus requiring intact fibula or plated fibula. This is a biological procedure. Unlike in forearm where rotation between the constituent bones is a must, in leg there is no rotation between tibia and fibula. This procedure reduces treatment time in regular fracture fixation. This procedure routinely can be used as adjunct to interlocking nailing and plating or external fixation in lower one third of tibia fracture.

### CONCLUSION

The treatment of choice in infected tibial fractures even in early period following trauma is Ilizarov ring fixator. But in set ups where implant is not available, posterolateral bone grafting is useful. This method is definitely preferred if union is delayed. The method can be used in cases of tibial fracture of the associated fractures of fibula, without disturbing the fibular fracture.



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