# Retrospective Analysis of Donor Site Morbidity Following Partial Fibular Resection

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## ABSTRACT

**Introduction**: The use of fibula as either vascularised or free graft has increased in recent times. However it is necessary to weigh the usefulness of the procedure against the background of its associated morbidity. We wanted to evaluate the functional outcome in terms of pain and motor weakness at residual donor side associated with the removal of fibula at different level.

**Materials and methods:** Retrospective study of 85 cases were done to determine prevalence of donor site morbidity after fibular resection. Pain, motor weakness, sensory abnormality and ankle or knee instability were recorded. Average duration of follow up was three years.

**Results**: Thirty eight (44.70%) cases were completely free of symptoms. At three year follow up 35 cases (41.17%) had mild to moderate pain.Forty three (50.58%) cases had extensor hallucis longus weakness out of which 27 cases (31.76%) had isolated extensor hallucis longus weakness while 16 cases (18.82%) had EHL weakness with other muscles. All recovered within 6 months to 2 years. Out of 9 cases with fibular resection in proximal third, 5 (55.55%) had motor weakness and out of 76 cases with fibular resection in middle third, it was found that 38 cases (50%) had motor weakness. The prevalence of subjective sensory abnormality increased with duration of time. At three year post operative visit, 12 patients (14.11%) had intermittent dysesthesia, 5 (5.88%) had numbness of medial foot and 1 (1.17%) had numbness of dorsum of foot. None of the cases had ankle or knee instability. Most significant radiological finding was osteoporosis of distal fibular remnant.

**Conclusion**: Donor-site morbidity following simple and marginal resection of the proximal fibula is acceptable.


**Keywords:** Fibular graft, Donor site morbidity, motor weakness, ankle instability, knee instability

## INTRODUCTION

In recent years the fibula has been used as a free graft and as a vascularised transplant to bridge large bony defects. Taylor et al[1] first reported on vascularised fibular transfers in 1975 and this technique is now extensively used for reconstruction of bony defects secondary to trauma and tumor related resection. Many authors have studied the static and dynamic function of fibula in stability of ankle and load transfer.[2,3] Thus removal of a portion of fibula can result in donor site morbidity. We have used a large number of free fibular grafts in the treatment of fracture neck of femur, nonunion of long bones, tumour resection, avascular necrosis of femur and congenital pseudoarthrosis of tibia. We believe that the removal of portion of fibula is associated with acceptable morbidity when weighed against the potential benefits of the graft. The purpose of this study was to present our clinical experience with problems related to donor site that we have encountered after these grafts have been obtained.

## MATERIAL AND METHODS

Retrospectivly 85 patients with age above 18 years, who were treated with fibular bone graft either for traumatic or tumor reconstruction procedure, between May 2009 to June 2014, were included in the study. Patients having compound fractures or with pre-existing neurological deficits were excluded. This study was approved by ethical committee of university and infromed consent was taken from patients.

Average age of patient was 45 years. Fifty seven (67.05%) of the cases were male and 28 (32.94%) were female. The male to female ratio was 2.03: 1. Average duration of followup was three years. In 50 (58.82%) cases fibular graft was taken from right side and in 35 cases (41.17%) fibular graft was taken from left side. Middle third of fibula was harvested in 76 patients (89.41%) while only in 9 patients (10.58%) had proximal third fibular resection. None of the patient had distal third fibular resection. In all the cases length of distal fibular remnant was more than 7.5 cm.

The patients were examined postoperatively at three month, six month, one year, eighteen month and yearly there after. At these postoperative visits, the patients were asked about any subjective sensory abnormality and whether they had any pain at or in the vicinity of donor site, either while they are at rest or when they were active.The pain was graded accordingly as mild, moderate and severe. All the patients were examined for knee,ankle or hind foot instability and range of motion was also recorded.Any detectable weakness of the extensor hallucis longus, flexor hallucis longus,or peroneal muscles were graded for strength according to the MRC scale.

Plain anteroposterior and lateral radiographs of donor site were made in almost all patients. In cases with proximal third fibular resection, varus and valgus stress view of knee was done. The length of resected fibula and the length of proximal and distal fibular remnants were measured.

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The standard posterolateral approach of Henry was used in all cases. The muscles were reflected gently from the fibula by subperiosteal dissection using a periosteal elevator starting at the distal end.

## STATISTICAL ANALYSIS

The sample characteristics were described with its mean±SD/ percentage (95% Confidence levels), as applicable. The data was analysed by using SPSS 16.0 version.

## RESULTS

### Early Complications

In our series of 85 patients, early complications found were thromboembolic complications in 1 (1.17%), haematoma formation in 1 (1.17%), superficial infection in 2 (2.35%) and compartment syndrome in 1 (1.17%). Two patients had lateral popliteal nerve palsy and had foot drop.

In early postoperative period hypoesthesia in isolated anatomical area like dorsum of foot in 2 patients, lateral border of foot in 4, lateral part of calf in 1 and first web space in 2 patients. Numbness of medial foot was complained by 2 patients.

### Late Complication

### Pain

The prevalence of pain after activity increased substantially with time. No patient compained of rest pain at follow up. Fifty patients (58.82%) rated themselves as pain free. Only 18 cases (21.17%) complained of pain at three month follow up which increased to 35 cases (41.17%) at three year follow up. There was pain at donor site in 17 cases (20%) and at ankle in 1 case (1.17%) at three month postoperatively which increased to donor site pain in 28 cases (32.94%), at ankle in 5 cases (5.88%) and at knee in 2 cases (2.35%) at three year follow up. No patient had severe pain to limit daily activities.

### Motor Weakness

The most frequent complication after the fibular grafts had been obtained was muscle weakness. Forty three (50.58 %) of the 85 cases had extensor hallucis longus (EHL) weakness, out of which 27 cases (31.76%) had isolated extensor hallucis longus weakness while 16 cases (18.82%) had EHL weakness with other muscles (Figure-1). The flexor hallucis longus (FHL) and extensor digitorum longus (EDL) were affected in 11 (12.94%) and 6 (7.05%) cases respectively. Six cases (7.05%) had weakness of peroneii and 2 (2.35%) cases had tibialis anterior weakness.

**Figure-1:** Extensor hallucis longus weakness (lt) immediate post op.

All recovered within 6 months to 1 year except in 2 patients with deep peroneal nerve injury which found to be recovered by 2 year postoperatively and at three year postoperative visit none of the cases had residual weakness of extensor hallucis longus and other muscles.

### Sensory Abnormality

The prevalence of subjective sensory abnormality also increased slightly with duration of time. Intermittent dysesthesia was complained by 3 patients (3.52%) at three month follow up which increased to 12 patients (14.11%) at three year follow up. Numbness of medial foot was present in 2 patients (2.35%) at three month postoperatively, which increased to 5 (5.88%) at three year follow up. Numbness over dorsum of foot in 1 case (1.17%), which was not present at three month follow up, appeared late and persisted when last seen at three year. Hypoesthesia were specifically located in discrete and isolated anatomical areas, such as lateral border of foot in 4 patients (4.70%), dorsum of foot in 3 (3.52%), lateral part of calf in 1 (1.17%), and first web space in 2 patients (2.35%) at three month follow up, with decreasing prevalence recorded over time, but symptoms had resolved in all of them by 18 months to 2 years postoperatively.

### Ankle And Knee Instability

None of the patient evaluated had ankle and knee instability.

Range Of Motion Of Ankle And Knee

There were no differences in range of motion between operated and nonoperated side except in 2 cases where limitation of active dorsiflexion of ankle was present due to lateral popliteal nerve palsy, but at 3 year post-operative visit no patient had limitation of range of motion. However, average muscle strength was lower on the operated than the nonoperated side.

### Radiographic Follow Up

The most significant finding was osteoporosis of distal fibular remnant (Figure-2) in patients with fibular resection in 65 patients (76.47%). The radiograph showed roundening of cut ends of fibula in 48 cases (56.47%) and irregular new bone formation at cut ends in 11(12.94%). There was thin bridged bone formation in fibular bed in 9 cases (10.58%). None of the cases had varus and valgus instability of knee and ankle (Figure-3). None of the cases had proximal migration of fibula.

## DISCUSSION

Many authors have studied the static and dynamic function of fibula in stability of the ankle and load transfer.[2-9] It has been shown that from 10%[5,6] to 16%[4,7] of the total weight bearing load is transmitted through the fibula. It also serves as an attachment for ligaments of knee and ankle, the interosseous membrane of leg, and muscles of lower extremity.

Gore,[10] 1987, followed 41 patients for an average of twenty seven months. Only sixteen (39%) of their patients were asymptomatic, and six (15%) complained of moderate or severe pain associated with donor site, 11 mild pain and three complained of pain in the ankle. This study demonstrates that most patients will have subjective complaints and mild muscular weakness after removal of a portion of fibula.

Lee et al,[11] 1990, studied on ten adults after resection of fibula. All knees and ankle were clinically and radiologically stable,

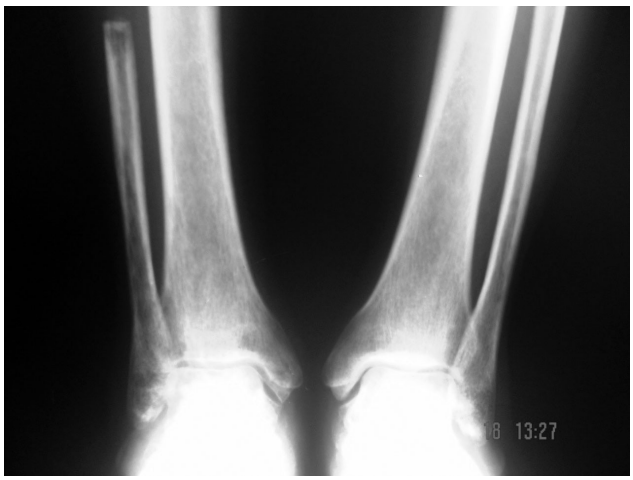


**Figure-2:** One year post op x-ray showing osteoporosis of distal fibular remnant

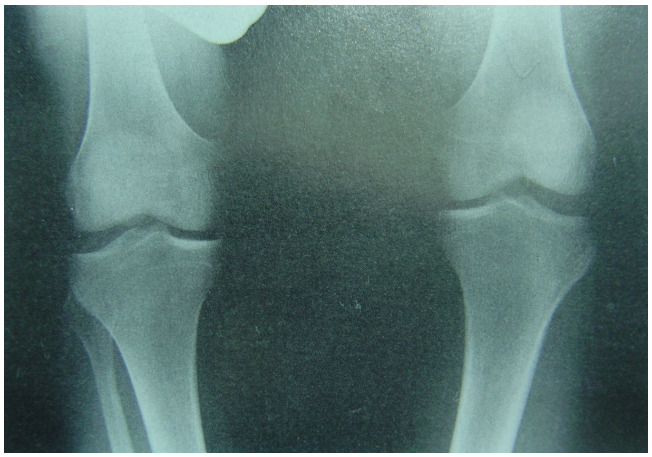

**Figure-3:** Varus stress view of both knee showing no change in lateral joint space following proximal fibular resection

but the distal fibular remnant was osteoporotic in nine patients. In our series out of 85 cases with fibular resection, 38 (44.70%) were completely free of symptoms. No patient complained of rest pain at follow up. The prevalence of pain increased substantially with time. Fifty patients (58.82%) rated themselves as pain free, 27 patients (31.76%) had mild pain, and 8 patients (9.41%) had moderate pain. All of the patient relate their pain to specific functional activities.

Various other authors[10-16] also reported pain or discomfort during walking in their series. We attributed prevalence of pain and weakness or discomfort during walking to one of the following causes:

1. Average age of patient in our series was more as compared to the series of Gore et al[10] and T. Parker Vail et al.[14] This age difference may be a factor in rate of complication.
2. Our most of the patient had severe debilitating condition of the ipsilateral hip which necessitated 6 – 12 week period of non-weight bearing and possibly a lower initial level of activity.
3. May be probably due to reduced load transfer following resection of fibula.[4-7]

Many authors[17-25] have studied the course of motor branch to the extensor hallucis longus and they were of opinion that following dissection of fibula in upper and middle one third, carries a risk of injury to the nerves innervating the extensor hallucis longus and they recommended that fibular osteotomy should be carried out at the junction of middle and distal third of fibula[17,23] and in proximal fibula up to 20.5 mm distal to the tip of fibular head.[21] Shingade et al,[18] 2004 studied the branching pattern of the deep peroneal nerve in detail on 40 specimens of cadaver. In all the specimens a single branch was found supplying extensor hallucis longus. There were two variations in its course and site of entry in to muscle:

a. The tibial variation in which the nerve branch to EHL runs close to the tibia and then enters in to muscle on the tibial side.
b. The fibular variation in which the nerve branch to EHL runs close to the fibula and enters the muscle on the fibular side.

They found that those in which the nerve to extensor hallucis longus ran close to the fibular periosteum,were at risk**.** Most frequent complication, in our series, obtained was muscle weakness. Forty three (50.58%) cases had extensor hallucis longus weakness out of which 27 cases (31.76%) had isolated extensor hallucis longus weakness while 16 cases (18.82%) had extensor hallucis longus weakness with other muscles.

S. S. Babhulkar et al,[12] in their series of 104 cases, 48 had muscle weakness out of which 35 had isolated extensor hallucis longus weakness and 13 had extensor hallucis longus with other muscles.

Various other authors[10,11,14,15,17,18,26] also reported motor weakness mainly extensor hallucis longus ranging from 10 – 55% of the cases in their series.

We have harvested fibula either in the proximal third or in the middle third portion of fibula i.e. in the danger zone of fibula. We attributed decreased motor function or sensory abnormality in our series to the following factors**:**

1. Complications occurred probably due to direct damage to the nerve or due to pressure or tension on the nerve by Hohman retractor.
2. May be due to the variation in the course of nerve (V. U. Shingade et al[18] and Kirgis et al[17]).
3. Functional lengthening of muscle, especially if its site of origin has been removed[14].

Many other authors (Pho,[27] E. H. Lee et al,[11] S. S. Babhulkar et al[12] and Marco Innocenti et al[28]) reported no knee instability in their series following proximal fibular resection. whereas others[29,30] reported moderate, symptomatic, lateral laxity as a complication in one-half of their patients who had excision of the proximal fibula. However, in our series none of the cases had knee instability or lateral ligament instability.Many authors have suggested that all attempts should be made to preserve the distal 6-8 cm of the fibula to maintain the lateral stability of the ankle.[1,10,12-15] Distal fibular remnant, in our series, was at least 7.5 cm or more and none of the cases evaluated had ankle instability.

The most significant radiological finding in our series was osteoporosis of distal fibular remnant in 65 patients (76.47%) and is probably due to reduced load transmission.

## CONCLUSION

The fibula has the dual biomechanical role of providing a site of origin for the muscles and of serving as a rigid body in load transfer, and is critical structure in ankle stability. Although the fibula is an invaluable source of graft, this study demonstrates

that most patients will have subjective complaints and mild muscular weakness after removal of a portion of the fibula, but these symptoms are not considered significant to discourage the use of large segments of fibula. However, it may be wise to inform the patient that some morbidity may result from the resection of the fibula from the donor leg.

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