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Retrospective Assessment of Donor Site Morbidity after Partial Fibula Resection

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Learning Point of the Article:

Free fibular graft harvesting provides good functional outcomes, but donor-site complications may occur and can be minimized through meticulous dissection and adherence to standard surgical protocols.

Abstract

Introduction: The fibula has been used as a bone graft in different reconstructive orthopedic procedures, namely core decompression, limb salvage surgery in giant cell tumor of the distal end of the radius, like a strut graft for bone defects, etc. Despite this widespread use of the fibula, there is very limited literature available on the donor site morbidity. The purpose of our study is to assess the complications related to bone grafting site of the fibula that we have encountered after this graft had been obtained and to evaluate morbidity following free fibular bone grafting.

Materials and Methods: We conducted a Prospective and Retrospective Study from January 2015 to August 2019, comprising 54 patients with a mean age of 34 years who underwent 60 free fibular grafting, with follow-up at 1 month and 6 months.

Results: The average ankle-hind-foot score for the 54 patients evaluated was 92.33 of a possible 100 (range 55–100). Radiographic analysis of donor and contralateral sides showed no difference in the ankle joint.

Conclusion: Harvesting a fibular strut graft is not without complications, although which can be minimized by following standard protocols and meticulous soft tissue dissection.

Keywords: Fibula, bone graft, donor site, morbidity.

Introduction

The bone graft is the second most commonly implanted material in the body, after blood Transfusion. Taylor et al., in 1975 [1], first described the use of a two-free microvascular fibula graft for reconstructing tibial bone gaps. The vascularized free fibula flap, popularized by Hidalgo in 1989 [2], is currently used to reconstruct bone defects, particularly during limb reconstruction. The fibula has been used as a bone graft in different reconstructive orthopedic procedure, namely core decompression, limb salvage surgery in giant cell tumor of distal end radius using proximal fibula [3,4,5], like a strut graft for bone defects, bridging defects in long bones resulting from tumor or trauma, etc., [6,7,8,9].

The fibula bone graft efforts many advantages: Long length of donor bone (>25 cm), adequate bone stock, bone strength permits good screw fixation and solid reconstruction, bony reconstruction can be shaped with multiple segmental osteotomies, thin, pliable overlying skin, very little soft tissue

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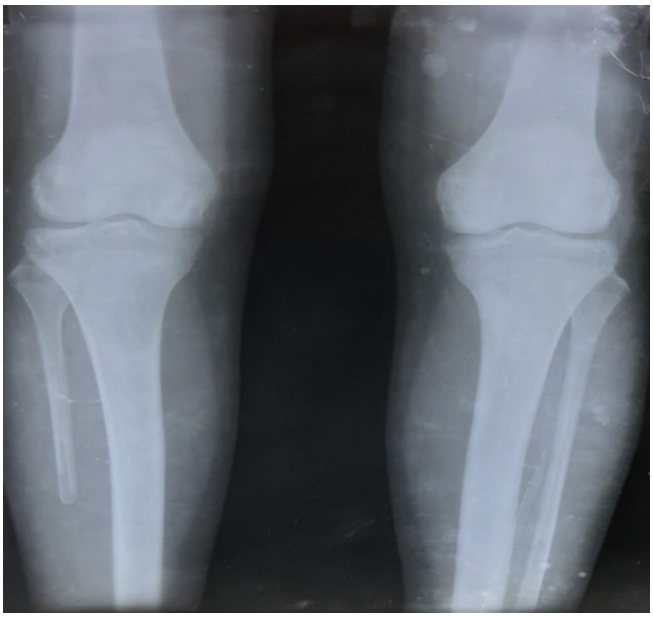


Figure 1: Anteroposterior radiograph of both knees demonstrating the proximal fibular remnant following fibular graft harvesting.

bulk, resemblance in shape to the distal end of radius [10].

However, harvesting fibula is not without complications. Some complications, such as donor site pain, hematoma, transient peroneal nerve palsy, ankle instability, and sensory deficit, were reported in previous studies.

Despite the widespread use of fibula as a bone graft, there is very limited literature available on the donor site morbidity.

The purpose of our study is to assess the complications related to bone grafting site of the fibula that we have encountered after this graft had been obtained and to evaluate morbidity following free fibular bone grafting by evaluating patient satisfaction using the ankle-hind-foot scale (Kitaoka et al) and radiographic analysis [11].

Material and Methods

Fifty-four patients (60 cases) were included in this study protocol was approved by the Institutional Ethics Committee, and written informed consent was obtained from all patients prior to inclusion in the study after explaining the necessity of the surgery, complications likely to occur and prognosis about the bone grafting outcome.

It is a prospective and retrospective study, with a duration period from 2015 to 2019. Patients aged >18 years and <60 years were included in the study (mean age 34.83). Patients had a follow-up of at least 6 months. A significant number of patients had long-term follow-up. In 27 (45%) cases, a fibular graft was taken from the right side, and in 33 (55%) cases, a fibular graft was taken from left side. Middle third of the fibula was harvested



Figure 2: Lateral radiograph of the right leg showing the post-operative appearance following fibular graft harvesting, with fixation hardware in the recipient bone and the residual fibular segment.

in 42 cases (70%) while only in 18 cases (30%) had proximal third fibular resection. None of the patients had distal third fibular resection. In all the cases, the length of distal fibular remnant was more than 7.5 cm. All patients were thoroughly investigated and underwent free fibula (non-vascularized) grafting surgery. No patient had any motor or sensory impairment in the leg before harvesting the graft.

The reasons for harvesting a fibular graft were core

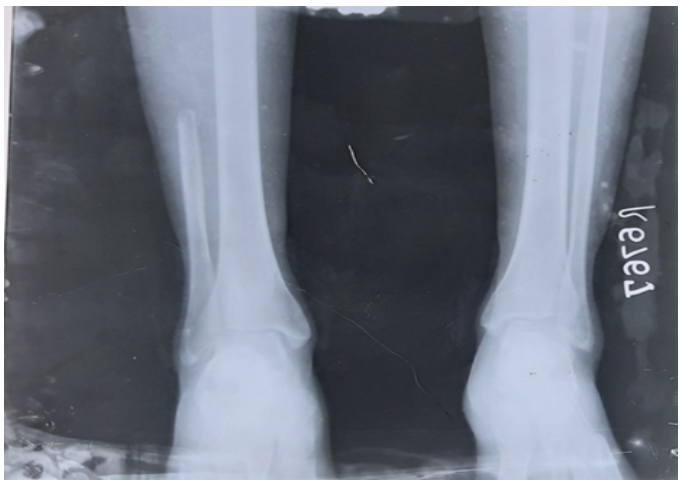


Figure 3: Anteroposterior radiograph of both ankles at follow-up after fibular graft harvesting, demonstrating the post-operative appearance of the distal fibulae and ankle alignment. Recipient bone and the residual fibular segment.



Figure 4: Regeneration seen in anteroposterior and lateral view X-ray after 6th-month follow-up.

decompression for avascular necrosis of the head of femur, limb salvage surgery in giant cell tumor of the distal end of the radius using proximal fibula, like a strut graft for bone defects, bridging defects in long bones resulting from tumor or trauma, etc.

The standard posterolateral approach of Henry was used in all cases [12]. The fibula was approached in the plane between peroneus longus and soleus. Medium-sized right-angled retractors were used for retracting the peronei anteriorly and soleus posteriorly. The peroneal and extensor muscles were reflected gently from the fibula by subperiosteal dissection using a periosteal elevator starting at the distal end. The length of fibula required was measured and small multiple drill holes were made at the proximal and distal ends of the graft. Bone-cutting forceps were used to complete the osteotomy. Neither a saw, osteotome, cautery, nor tourniquet was used. Direct subcuticular and skin sutures were applied to prevent compartment syndrome.

The mean length of the fibula harvested was 6.25 cm. In all cases, the proximal and middle third of the fibula were excised, preserving the most proximal and distal portions. In the immediate post-operative period, a detailed neurological examination of the donor and opposite limb was carried out in this study, and follow-up was recorded at immediate post-operative, at 1st month and 6th month.

We used the Kitaoka ankle-hind-foot score to assess functional outcome. With 100 available points, this score incorporates both subjective and objective factors into numerical scale to design pain (40 points), function (50 points), and alignment



Figure 5: Regeneration seen in anteroposterior and lateral view X-ray after 6th-month follow-up.

(10 points).

Radiological parameters were assessed on X-ray films of anteroposterior and lateral views, including both the knee and ankle of the same side and contralateral side; radiological signs are seen at donor-site regeneration and osteoporosis at the graft site were observed, and varus and valgus instability of both knees and ankles were assessed. The length of fibula resected and the length of the proximal and distal fibular remnants were measured.

Statistical analyses were described with its mean±SD/percentage (95% confidence levels), as applicable. The data were analyzed using the Statistical Package for the Social Sciences 16.0 version. The Pearson correlation coefficient was calculated as well as the t-test was carried out with $P < 0.05$ considered significant.

Results

In our study, the maximum number of patients was in the age group of 18-30 years (43.3%) whereas the least number of cases (10%) were found in 51–60-year age group. Out of the 60 cases, 78.3 % were men and 21.7% were women; thus, in this study, men dominated with an M:F ratio of 3.6:1 (Table 1).

Table 1: Age-wise distribution of study cases

S. No.	Age Group	Frequency	Percentage
1.	18–30 yrs	26	43.3
2.	31–40 yrs	15	25
3.	41–50 yrs	13	21.7
4.	51–60 yrs	6	10
	Total	60	100

Kitaoka ankle-hind-foot score

In our study, there was a significant rise in total ankle-hind-foot-scale scores during follow-up period mean 74.07 at 1st month and 92.33 at 6th month (t-test applied and P-value found to be <0.0001 and hence statistically significant). 57 (95%) patients had excellent and 3 (5%) good results (Table 2).

Radiographic follow-up

The most significant finding was osteoporosis of the distal fibular remnant (Fig. 1) in patients with fibular resection in 17 patients (28.3%). The radiograph showed rounding of the cut ends of fibula (Fig. 2 & 3). There was a thin bridged bone formation in the fibular bed in 9 cases (10.58%). None of the cases had varus and valgus instability of the knee and ankle. None of the cases had proximal migration of the fibula. In our study, 11 (18.3%) cases were found to have proximal fibula regeneration (Fig. 4 & 5).

Donor site related complication

In our series of 60 cases, mainly minor complication was found like cosmesis linear scar in 36 cases, minor pain in 11 cases, wound healing minor complication in 22 cases, and neuroma and sensory deficit in 14 cases. The most frequent complication after the fibular grafts had been obtained was cosmesis related (Table 3).

Table 3: Frequency of complication at donor site

Complications	No. of patients (%)	
	Moderate (%)	Minor (%)
• Cosmesis	2 (3.3)	36 (60)
• pain	-	11 (19)
• Wound healing	-	22 (36.7)
• Iatrogenic injury	-	14 (23.3)

Table 2: Number of patients according to grade of Kitaoka score

Kitaoka score (Points)	Number (%) of donor site	
	At 1st month (%)	At 6th month (%)
• Excellent (90–100)	2 (3.3)	57 (95)
• Good (75–89)	22 (36.6)	3 (5)
• Fair (60–74)	35 (58.3)	0
• Poor(<60)	1 (1.6)	0

Discussion

The donor site morbidity is considered to be low in the existing published studies. However, most of these studies did only a subjective evaluation of the functional consequences [7,8,9,10], so the incidence of donor site complications has been variable, ranging from 10% to 40%. The paucity of Indian literature regarding donor site morbidity following free fibular bone graft compelled us to investigate it. We used a non-vascularized fibular graft to fill bone defect.

The results of the Kitaoka ankle hindfoot score showed about 95% excellent and 5% poor results were with 6th month follow up. Results were compared to Garrett et al., (2006) studies showed the mean average score to be 84.82 in 14 patients [13]. Peter Sieg et al., (2009) studies showed mean average score to be 93 in 62 cases [14]. Catalá-Lehnen et al. (2012) reported a mean average score of 85.7 in 42 patients [15] and Feuvrier et al., (2015) reported 78 in 11 patients [16].

The most significant radiological finding in our series was osteoporosis of the distal fibular remnant in 17 patients (28.3%) out of 60 and is probably due to reduced load transmission.

Lee et al., (1990) studies showed that 90% of patients had radiological osteoporosis of the distal fibular remnant which is a direct result of a decrease in load transmission [17].

The resected part of fibula may be regenerated completely or in part from the periosteum, especially in younger patients. In our study, 11 (18.3%) cases were found to have proximal fibula regeneration.

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 [1,18,19,20,21,22]. Distal fibular remnant, in our series, was at least 7.5 cm or more, and none of the cases evaluated had ankle instability.

Conclusion

On the basis of our clinical observation, a non-vascularized

fibular graft is associated with minor clinical morbidity related to pain, numbness, range of motion, osteoporosis of the distal fibular remnant, and muscular weakness.

Careful soft-tissue dissection may decrease the morbidity, and a distal fibular remnant of at least 8–10 cm should be retained for ankle stability. Attention to wound closure and meticulous wound care are required to further reduce donor leg complications.

Clinical Message

Free fibular graft harvesting is a reliable reconstructive option with good functional outcomes. Meticulous surgical technique and preservation of ankle stability are essential to minimize donor-site morbidity and ensure optimal post-operative recovery.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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