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Assessment of Donor Site Morbidity after Non-Vascularised Fibula Bone Grafting

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Abstract: ***Introduction: Fibula has been used as a bone graft in different reconstructive Orthopaedic procedures viz, core decompression, limb salvage surgery in giant cell tumour of distal end radius, like a strut graft for bone defects etc. Despite this widespread use of 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 these graft had been obtained and to evaluate morbidity following free fibular bone grafting. Materials and Methods: The study was performed at tertiary centre after taking necessary approval from institutional ethics committee. We conducted a Prospective and Retrospective Study from January 2015 to August 2019, comprising of 54 patients with a mean age of 34 years who underwent 60 free fibular grafting, with follow up at 1 month and 6 months. The results were evaluated by 2 subjective functional validated scores - "Point Evaluation System And Visual Analogue Score" and radiological analysis. Study design: Prospective and retrospective cohort study. Results: The study included 78% males and 22 % females and the most common indication for taking graft in our study was AVN femoral head. Comparison was done between VAS and PES score using Pearson correlation coefficient (p value <0.05) and the mean PES score was 2.56 Conclusion: Harvesting fibular strut graft is not without complications. On the basis of our clinical observation we found that most common morbidity at the end of 6 months is pain followed by functional loss and muscular weakness. Donor site Complication can be minimized by following standard protocols and meticulous soft tissue dissection.***

Keywords: Fibula, Bone graft, Donor site, Morbidity

1. 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 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 defect, particularly during limb reconstruction. The fibula has been used as a bone graft in different reconstructive Orthopaedics procedure viz, core decompression, limb salvage surgery in giant cell tumour of distal end radius using proximal fibula[3,4,5], like a strut graft for bone defects, bridging defects in long bones resulting from tumour or trauma[6-9] etc.

The fibula bone graft efforts many advantage[10]:- 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 bulk, resemblance in shape to distal end of radius.

However, harvesting fibula is associated with some complications. Some complication like donor site pain, haematoma, transient peroneal nerve palsy, ankle instability and sensory deficit were reported in previous study.

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 these grafts had been

Obtained and to evaluate morbidity following free fibular bone grafting by

Evaluating patient satisfaction using by 2 subjective functional validated scores

"Point evaluation system and visual analogue score" and radiological analysis.

2. Material and Methods

Fifty-four patients (60 cases) were included in this study after taking approval from the institutional ethics committee. Written & informed consent was obtained from the patient 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, duration period from 2015 to 2019. Patients with age >18 years and <60 years were included in the study (mean age 34.83). Patient with follow-up of at least 6 months. A significant number of patients had long term follow-up. In 27 (45%) cases fibular graft was taken from right side and in 33 (55%) cases fibular graft was taken from left side. Middle third of fibula was harvested in 42 cases (70%) while only in 18 cases (30%) 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. All patients were thoroughly investigated and underwent free fibula (non-vascularised) grafting surgery. No patient had any motor or sensory impairment in the leg before harvesting the graft.

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

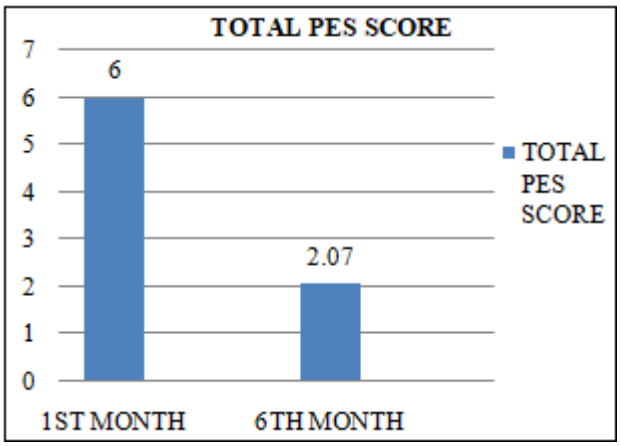
The standard postero-lateral approach of Henry was used in all cases[12]. The fibula was approached in the plane between peroneus longus and soleus. Medium-sized right-angled retractors were used for retracting the peronei anteriorly and soleus posteriorly. The peroneal and extensor muscles were reflected 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 osteotomy. 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, 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-op,at 1st month and 6th month.Donor Site Morbidity was assessed using the Enneking Point Evaluation System (PES) based on five criteria's viz. Cosmesis, Functional loss, Wound healing complications, Iatrogenic injury & Pain.

Radiological parameters were assessed on X-ray films of anteroposterior and Lateral view including both knee and ankle of the same side and contralateral side, radiological signs are seen at donor-site regeneration, osteoporosis at graft site were assessed. The length of fibula resected and the length of the proximal and distal fibular remnants was measured.

Statistical analyses were described with its mean±SD/ percentage (95% Confidence levels), as applicable. The data were analysed by using SPSS 16.0 version. The Pearson correlation coefficient was calculated as well as the T-test was carried out with $P < 0.05$ considered significant.

3. Result



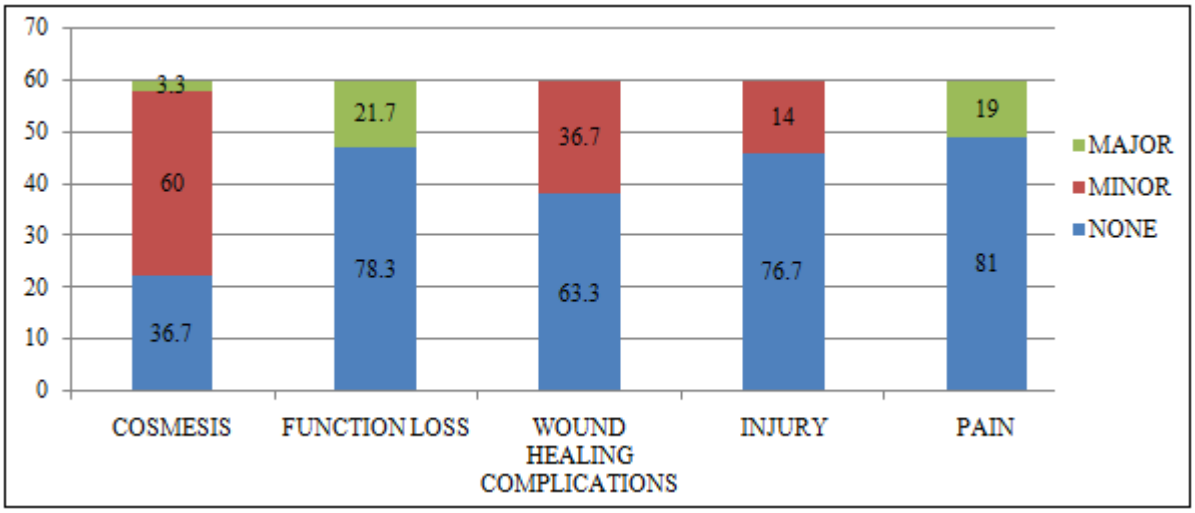
Graph 1

In our study, there is a significant decline in the total PES scores between 1st month and 6th month from 6.00 to 2.07(t-test was applied and p-value <0.0001 which is statistically significant) (graph 1)

Table 1: Donar Site Complication After Free Non Vascularised Fibular Bone Graft

Score	Cosmesis	Function Loss	Wound Healing	Injury	Pain
0	22/60 (36.7 %)	47/60 (78.3%)	38/60 (63.3%)	46/60 (76.7%)	49/60 (81.0%)
1	36/60 (60%)	-	22/60 (36.7%)	14/60 (23.3%)	-
2	2/36 (3.3%)	13/60 (21.7%)	-	-	11/60 (19.0%)
Average Mean	0.67	0.45	0.37	0.23	0.37

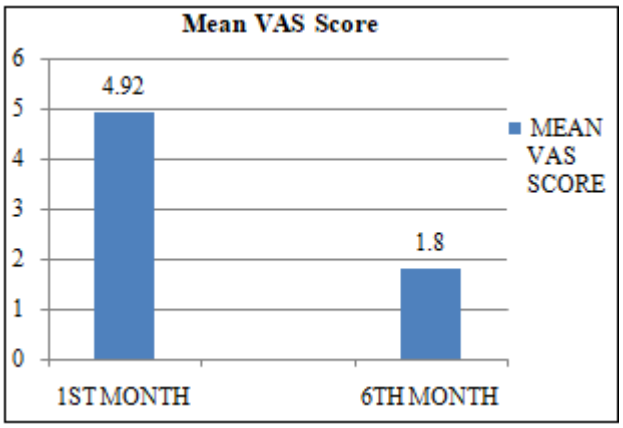
In our study 36.7% has no cosmesis (linear scar), 60 % has minor cosmesis (slight scar depression) & 3.3% has major cosmesis (spread scar). 78.3% case has no functional loss & 21.7 % has major functional loss (deficit). 63.3% has zero wound healing complication, 36.7% has minor complication. 76.7% has no injury & 23.3% has minor injury. 81% has no pain and 19% has major pain, based on the study of Enneking point evaluation system, our study comes under low morbidity.(table no 1) (graph no 2)



Graph 2

Donar site complication frequency after free non vascularised fibular bone graft

Our study shows a significant decline in VAS scores between 1st month and 6th month follow up from 4.92 to 1.8 respectively. T-test applied and p-value found to be <0.0001and hence statistically significant (Graph no 3).



Graph 3: Graph Showing Significant Decline in Vas Criteria Scores during Follow-Up

Intra-op pic showing landmark Marking for fibula harvesting

Picture showing fibula graft through Henry approach

Showing spread scar

Wound dehiscence

Showing strength of EHL and deep scar

Post op x-ray after 1 month

Post op X-ray after 6th month

4. Discussion

In recent years, the fibula has been used as a free graft and as a vascularised transplant to bridge large bony defects. Non-vascularised autogenous bone grafts have been used for the past 100 years, particularly for reconstruction after resection of a bone tumour[13].

In our retrospective and prospective study, we have analysed 60 cases of age group 18-60 year old for non-vascularized fibular graft which is used in various surgeries like avascular necrosis of femoral head, tumor & large bony defect, during our study period from January 2015 to August 2019 in the Department of Orthopaedics, N.S.C.B. Medical College, Jabalpur.

In our study, there was a significant decline in the total PES scores from 1st month (6.00) to 6th month (2.07). T-test was applied and p-value was found to be < 0.0001, which is statistically significant. The total average PES score at 6 months follow-up was 2.07/ 16, and the donor site morbidity was calculated to be 13%, which signifies low morbidity.

Christine L Tang et al[14] (1998) reported the total average PES score mean was 2.1/ 16 in 46 cases, whereas James P Anthony[12] (1994) showed immediate post-op morbidity to be very low (17%), Sradan Babovic[15] (2000) showed immediate post-op morbidity to be very low (21%), Timothy R Daniels[16] (2005) studies showed overall donor site complication to be 23% and Trevor R Gaskill[17] (2009) reported donor site complication to be 11.49%.

In our study, there is a significant decline in the mean PES scores by comparing the proximal part of fibula at 6th month which is 2.56 and for mid part is 3.05 and by comparing the graft size of fibula at 6th month for 1-9cm which is 6.53 and for 10-18cm is 2.27. T-test was applied and p-value >0.005 which is statistically insignificant.

Our study shows a significant decline in VAS scores during follow up period from 1st month (4.92) to 6th month (1.8). T-test applied and p-value found to be <0.0001and hence statistically significant

In our study the VAS scores by comparing the proximal part of fibula and mid part and by comparing the graft size of fibula is statistically insignificant.

5. Conclusion

Non-vascularised fibular grafts are a useful alternative to vascularized grafts, especially where there is good coverage of soft tissue and good blood supply. Use of fibular graft harvested subperiosteally in the management of defects of a long bone is relatively simple, inexpensive and straight forward procedure, requiring no microsurgical expertise.

On the basis of our clinical observation, non-vascularized fibular graft is associated with minor clinical morbidity related to pain, numbness, range of motion. Attention to wound closure and meticulous wound care are required to further reduce donor leg complication.

We conclude that donor site morbidity following free non-vascularised fibular grafting may be evident at 1st months, but decreases significantly at 6 months. Also the morbidity is not significantly dependent upon the part of fibula resected (either Proximal or Distal) and also not significantly dependent on the length of the fibula resected.

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