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RESEARCH ARTICLE

Versatility of Free Vascularised Fibular Flap in Extremity Reconstruction: A Retrospective Study

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ABSTRACT

Introduction: Complex wounds of the extremities have always been a challenge for the reconstructive surgeon. Non-vascularized methods for the reconstruction of bony defects are associated with more complications. So the free vascularised fibular flap (FVFF) has become a workhorse flap for the reconstruction of these defects. In this study we aim to share our experience of reconstruction of such defects using free vascularised fibular flap.

Material and methods: We performed a retrospective study of the 18 patients who underwent extremity reconstruction with free vascularised fibular flap at our hospital i.e. Yenepoya Medical College and Hospital, Mangaluru during a five-year period i.e. from January 2019 to December 2023. In all these patients, we studied and evaluated the cause and location of defects, type of free vascularised fibular flap, choice of the recipient vessels, type of the anastomosis, the survival rate, functional outcomes and complications.

Results: Totally 18 patients with a mean age of 39.4 years had undergone extremity reconstruction with a free vascularised fibular flap with complete bone viability. The defects were present within the humerus, radius, femur, tibia and metatarsal. Union at the osteotomy sites was noted radiologically at an average time of five months. The average period to return function was 14 months.

Conclusions: The use of a free vascularised fibula flap is the best modality for the reconstruction of the bony defects of the limb and is proved to have a high bony healing rate, early return to ambulation, good function of the extremity and less incidence of complication regardless of the cause of the bony defect. One or more skin paddle can be taken along with the bone for the coverage in case of exposure of deeper tissue.

Keywords: Free vascularised fibular flap / Extremity defect / Microsurgery / Upper limb / Lower limb

Introduction

The introduction of microvascular techniques in flap surgeries has made a revolutionary change in the recent era giving both functional and cosmetic advantage. These surgeries are very useful in reconstruction of complex and composite defects [1]. In 1975, Taylor, Miller, and Ham published the first report on the application as a free vascularized fibular graft for reconstruction of bony defect [2]. Trauma, tumours, infections, and congenital anomalies can all cause bony deformities and defects. Clinically, they pose a severe risk that frequently results in morbidity, impairment, and in rare cases, amputation of a limb for the patient. For femoral head avascular necrosis and failed spinal fusion (AVN), the circumstances stay the same. For the healing and treatment of such skeletal deformities and defects, free vascularized fibular bone grafts (FVFGs) and flaps are very advantageous because of the following reasons [3-5]. Due to the meagre soft tissue surrounding the bone that prevents the necessary vascularity for the graft's incorporation and only allows the non-vascularized bone graft gradually revascularize through the process of creeping substitution, conventional bone grafts utilised in skeletal restoration of bony defects have a higher failure rates. Vascularized bone grafts use osteocyte-rich living bone for restoration rather than the bone graft itself. By a mechanism akin to fracture union, such bone grafts can take part in the process of bone repair. Consequently, bony union can be achieved sooner and more efficiently, irrespective of the span of the bone transplant [6]. In regards to remodelling, hypertrophy, rigidity, bone healing, or consolidation, vascularized bone grafts have been demonstrated to be better than non-vascularized bone grafts, offering a number of advantages [5,7]. The purpose of our study is to evaluate the results of free vascularized fibular flaps, which are utilised to repair and reconstruct defects caused by various causes in the extremities.

Materials and Methods

A retrospective study of 18 [Table one] free vascularised fibular flap for the reconstruction of bony defects of extremities was conducted at our centre from January 2019 to December 2023. A total of eighteen patients who had significant bone abnormalities in their limbs had free vascularized fibula grafts or flap surgeries. Out of these six women and twelve males were present. In these, twelve incidents involved the right side, and six included the left. At the time of the procedure, the average age was 39.94 (range: 22–68) years. The development of a bone deformity had multiple origins. A total of twelve patients had severe trauma-related bone abnormalities that needed to be treated by an orthopaedic surgeon using an external fixator, extensive debridement, and ORIF (open reduction and internal fixation) and plating. Out of these twelve patients, six experienced post-traumatic non-union as a result of multiple prior attempts at bone grafting and fracture repair. Bony defects occurred in four cases after the cancer in the radius bone was removed. After debridement, a patient who had been bitten by a snake experienced osteomyelitis of the first metatarsal bone and had a bony and cutaneous deformity. After minor trauma, one patient developed a bone defect of the humerus due to a pathological fracture. In these a total of eight out of the 18 patients had problems with their tibia, four with their radial bone, three with their humerus, two with their first metatarsal, and one with their femur. The length of the fibula that was harvested had an average length of 13.56 cm (minimum of 10 cm and maximum of 20 cm), and the average defect size (length) was 12.33 cm (minimum of 9 cm and maximum of 18 cm). Every time, the harvested fibula had a greater length than the bone deficiency. When compared to the defect, a greater length of fibula is initially taken and then trimmed as needed. Longer fibular length harvesting facilitates easier dissection of the peroneal pedicle, leading to longer pedicle length. The graft was stabilised by appropriate internal fixation with a mix of plates, screws, and K-wires. Out of the eighteen patients, five required skin paddle in addition to the fibular graft to cover the soft tissue defect. In these, three of the five patients that needed skin paddle had tibial deformities, and two had metatarsal deformities. After tumour excision, the four patients with radial bone defects had histopathological diagnoses of giant cell tumour in two cases, fibrous histiocytosis in one case, and osteosarcoma in one case.

Prior to surgery, the location, extent, and involvement of the soft tissues were discussed with orthopaedic and oncology colleagues. Prior to surgery, the patients' limb function, vascularity, and feeling were assessed. A radiologist performed a preoperative duplex scan or CT peripheral angiography. Each patient was able to perform the fundamental movements and had good limb function. Out of all, one patient with osteosarcoma of the distal portion of the radius had loss of several flexor and extensor tendons, while two patients with first metatarsal defects had accompanied loss of extensor tendon, i.e., of EHL and EDC of the second and third toes. As a secondary treatment, three of these patients had their tendon rebuilt at a later time. After treatment, a patient who had a partial radial nerve injury from a humerus fracture gradually recovered. Patients with severely impaired vascularity or non-functioning extremities were not allowed to participate in this study. Numerous patients were referred from other facilities for additional care. Two months on average (range, one–three) passed between the trauma/diagnosis and the referral to our hospital.

Statistical data were mentioned as follows: Continuous data using means and range. Categorical data with the help of percentages.

Surgical technique:

Depending on whichever limb is to be operated, the patient is put in a supine position and given either a spinal/epidural or general anaesthesia. Depending on the requirement, a tourniquet is placed on the lower or upper limb. The femur, tibia, humerus, and radius recipient vessels is identified with the anterior approach, and the metatarsal recipient vessels is found with the dorsal foot approach. The ultimate size of the skin paddle and bony defect is measured using a standard centimetre scale after patients with cancer undergo frozen section of the excised specimen or after the final defect is generated in trauma patients. Depending on the circumstances, either the right or left leg is supposed to be flapped. The patient is made to lie down on his or her side. The donor leg was fastened to the table using adhesive tapes to facilitate the harvesting of the flap. Using a portable Doppler probe (Minidop), the fibula perforator is mapped, and if needed, the skin island is marked too. A tourniquet and loupe magnification is used for flap harvesting. The skin paddle that is mapped and marked is incised along its anterior edge, extending all the way to the anterior compartment muscles. The tibialis anterior and the extensor digitorum longus muscle of the anterior compartment, as well as the peroneus longus and brevis muscles of the lateral compartment, are lifted off the skin island, preserving the superficial peroneal nerve. Afterwards, the incision was extended to the posterior border of the indicated skin paddle when there are enough septocutaneous perforators. Subsequently, the skin island separated from both the lateral gastrocnemius and soleus muscles up to the posterior fibula, maintaining the integrity of the sural nerve and the smaller saphenous vein. After the brevis and peroneus longus muscles are separated from the fibula, osteotomies are performed, resulting in a proximal end of the fibula with 6 cm remaining and with 6 cm remaining from the ankle joint at distal end. The anterior compartment muscles are then located, isolated from the fibula, and drawn back. The tibialis anterior, extensor digitorum longus, and extensor hallucis longus are among these muscles. The interosseous membrane is divided lengthwise. Then the distal peroneal artery and the venae comitantes found, sealed and cut. The tibialis posterior muscle is then separated from the fibula, leaving the underlying peroneal artery and its accompanying venae comitantes intact. Once the remainder of the gastrocnemius and soleus muscles are severed from the bone, a cuff of flexor hallucis longus muscle remained attached to the fibula. A long pedicle is created by dissecting till the tibioperoneal trunk. The tourniquet is then removed, the skin flap and bone are assessed for vascularity, the pedicle is cut, and the flap is positioned to the desired spot. If only a vascularized bone graft is needed and no skin paddle is needed, an incision down the centre is made over the lateral part of the fibula. Scratch dissection is done between the peroneus longus muscle anteriorly and the soleus muscle posteriorly. During circumferential dissection, the diaphysis of the fibula is cautiously exposed to preserve the periosteum and periosteal blood flow. The peroneal pedicle is traced along the posterior edge of the fibular bone. When the fibula is osteotomized both proximally and distally, the peroneal artery and its veins are protected, and the pedicle is removed after the vascularity of the graft has been confirmed. K (Krishner) wires, screws, and reconstruction plates are used to stabilise the bone. The skin is then sutured, and anastomosis is performed under a microscope. In cases where there is a skin paddle, a glove drain is kept in place after flap inset. After bone fixation and anastomosis, primary closure with an in situ drain is carried out in cases requiring solely a fibular graft. Due to the growth potential of the proximal fibula's epiphysis, bony restoration in the immature bony imperfections of the skeleton which needed it to correspond with the growth of healthy bone, especially in defects of the distal radius, are covered by the vascularized epiphyseal transfer. The fibula's epiphyseal region receives blood supply from the anterior tibial artery. Sustaining the graft's growth potential involves sustaining the proximal epiphyseal blood supply. The arterial pedicle supplying the epiphysis, like the musculoperiosteal branches supporting the diaphysis, begins at the major tibial artery just before it enters the anterior compartment of the leg. Consequently, these ATA branches are included in epiphyseal transfer cases. A loose dressing and splint are applied. The colour, texture, and anastomosis of the free flap are noted.

Using a microscope and eight 0 and 10/0 nylon microsurgery sutures, the donor artery supplying the graft/flap was anastomosed end to end to the recipient artery in 14 cases, and end to side in 4 cases. A single vein anastomosis from the donor vein to the recipient vein was finished end to end in each case.

The radiologists determined that FVFG was united if the bridging callus was visible on three of the 4 cortices as appeared on the lateral & anteroposterior angles of the X-ray, or if the osteotomy lines were not visible at both ends of the graft. Data on the functioning outcome, radiological union, challenges, recurrence of the disease, and patient survival status were documented during the follow-up period. Clinical follow-up was provided to each patient for a minimum of one year.

Results:

The mean follow-up was for 2.3 years (range: one to four). No recurrence noted in all four patients who underwent VFFG following tumour excision. The surgical margins post wide local excision of these cases were clear. One patient with osteosarcoma of radius and one patient with fibrous histiocytosis of radial bone underwent chemotherapy post excision. Two patients with first metatarsal defect had associated extensor tendon loss i.e. of EHL and EDC of second and third toes. They underwent tendon reconstruction as secondary procedure using tensor fascia lata graft after three months. They achieved satisfactory function at three months follow up. One patient with osteosarcoma of the distal radius had loss of few flexor and extensor tendons. This patient underwent tendon transfer of flexor carpi ulnaris to finger and thumb extensors. One patient with humerus fracture had partial radial nerve injury which improved over time after repair.

Table 1: Epidemiological data and patient characteristics

No.	Age	Gender	Diagnosis	Bone	Follow-up (Years)
1	68	M	Trauma	Tibia	2
2	48	M	Trauma	Tibia	1
3	51	F	Trauma	Tibia	2
4	64	M	Trauma	Humerus	3
5	22	F	Giant cell tumour	Radius	1
6	23	M	Trauma	Tibia	2
7	24	M	Trauma	Metatarsal	2
8	24	M	Snake bite	Metatarsal	4
9	24	M	Osteosarcoma	Radius	2
10	25	M	Trauma	Femur	3
11	28	F	Giant cell tumour	Radius	2
12	65	F	Trauma	Humerus	2
13	56	F	Fibrous histiocytosis	Radius	1
14	38	F	Trauma	Tibia	3
15	42	M	Pathological fracture	Humerus	3
16	60	M	Trauma	Tibia	2
17	34	M	Trauma	Tibia	4
18	23	M	Trauma	Tibia	3

Source: Files from hospital Yenepoya Medical College Hospital, Mangaluru, India. F: Female M: Male

FUNCTIONAL OUTCOME: Partial weight-bearing was initiated following radiographic bone union in lower limb repair instances. Walking aids were initially used for guarded partial weight-bearing as soon as there were indications of bony union. Three months was the typical amount of time after surgery. The patient's training in partial weight-bearing was referred to a physiotherapist. Over the course of the following six to eight weeks, it gradually advanced to full weight-bearing. The average age at which radiological evidence of union at osteotomy sites appeared in the lower limb was 0.8 (0.5 to 1.25 years), whereas the average age in the upper limb was 0.6 (0.5 to 0.75 years). The average time to reach full weight-bearing was 0.92 years (0.67 to 1.17 years). In comparison to femoral or metatarsal reconstructions, which took an average of 1.67 years or 1.17 years to reach full weight-bearing, tibial reconstructions healed more quickly (mean: 1.01 years). At the last follow-up, two patients (11.1%) out of the 18 developed non-union. Of the two, one was located in the middle of the humerus and the other in the distal third of the tibia. At the mid-humerus, the mean time to union was 0.63 (0.5 to 0.75) years, while at the distal radius, it was 0.58 (0.5 to 0.67) years. For the union of the upper, middle, and lower third of the tibia, the computed mean times were 0.58 years, 0.92 years, and 0.73 (0.5 to 1) years, in that order. The mid femoral reconstructive union took an average of 1.25 years to complete. For the reconstructions of the metatarsals, it ranged from 0.67 to 0.83 years. Regarding the origin of the defect, the reconstruction site, or the timing of the reconstructive surgery, no discernible differences were discovered. (Refer to Table 2)

COMPLICATIONS: In two cases of non-union i.e. one of mid-humerus and another of distal tibia, secondary iliac autogenous bone graft was used to achieve union. Immobilization using the cast was continued for extra three months, until bony union was noted. There was no complication of graft fracture, but malunion occurred in one case at the distal end of the distal radius reconstruction in a case of giant cell tumour. This patient required a secondary surgery i.e. osteotomy because of restriction in wrist joint movement. In these, one of the patient who underwent FVFF for upper tibial fracture, developed superficial necrosis of the proximal 2 cm of the skin paddle and small graft loss at the fibula donor area . She underwent debridement of the necrotic area and coverage with split skin graft which healed eventually. Donor area healed with regular dressing (Figure four). One patient with mid-tibial reconstruction had chronic pain at the operated site which subsided eventually with physiotherapy and analgesics. None of the study case needed re-exploration in view of vascular compromise or anastomotic problems. Thus, success rate of free flap was 100%. No study cases were infected post vascularised free fibular flap surgery. All infected cases were treated with antibiotics and debridement before taking up for definitive surgery.

Table 2: Study results

Patient	Location	Bony defect dimension (cm)	Flap dimension (cm)	Flap components	Vessels anastomosed	Complications	Follow-up (years)	Time to Deambulation(months)	Bony union (months)
1	Distal third of right tibia	13 × 4.5 × 3	15 8 × 4	Bone + Skin paddle	Peroneal + Anterior tibial	None	2	4	6
2	Mid-third of right tibia	11× 5 × 3	13	Bone	Peroneal + Anterior tibial	None	1	7.5	11
3	Upper half of right tibia	15 × 4 × 3.5	16 14 × 6	Bone + Skin paddle	Peroneal + Anterior tibial	Superficial necrosis of 2 cm proximal skin paddle + small SSG loss at flap donor area	2	5	7
4	Mid-third of left humerus	12 × 6 × 4	14	Bone	Peroneal + Brachial	None	3	NA	6
5	Distal third of left radius	10 × 4 × 3	11	Bone + proximal epiphyses	Peroneal + Radial and cephalic vein	Restriction of wrist movement	1	NA	7
6	Distal third of right tibia	14 × 5 × 4	15	Bone	Peroneal + Anterior tibial	None	2	6	8
7	Right first metatarsal	10 × 6 × 4	10 5 × 4	Bone + Skin paddle	Peroneal + Dorsalis pedis and Great saphenous vein	None	2	6	8
8	Right first metatarsal	9× 6 × 4.5	10 8 × 4	Bone + Skin paddle	Peroneal + Dorsalis pedis and Great saphenous vein	None	4	7	10
9	Distal half of right radius	11 × 4 × 4	12	Bone	Peroneal + Radial	None	2	NA	7
10	Mid-third of left femur	18 × 5.5 × 5	20	Bone	Peroneal + Femoral	None	3	8	15
11	Distal third of right radius	10 × 4 × 3.5	11	Bone	Peroneal + Radial and cephalic vein	None	2	NA	6
12	Mid-third of right humerus	13 × 5.5 × 4	14	Bone	Peroneal + Brachial	None	2	NA	9
13	Distal third of right radius	9 × 5 × 4	10	Bone	Peroneal + Radial	None	1	NA	8
14	Distal third of left tibia	13 × 5 × 4.5	14	Bone	Peroneal + Anterior tibial	Non-union	3	14	Non-union
15	Mid-third of left humerus	13 × 6 × 5	14	Bone	Peroneal + Brachial	Non-union	3	NA	Non-union
16	Mid-third of left tibia	16 × 6 × 5.5	17	Bone	Peroneal + Anterior tibial	Chronic pain	2	6	10
17	Distal third of right tibia	12 × 7 × 5	14 7 × 8	Bone +Skin paddle	Peroneal + Anterior tibial	None	4	5	9
18	Distal third of right tibia	13 × 6 × 5	14	Bone	Peroneal + Anterior tibial	None	3	6	12

Case 1 (Figure 1)

This 56-year-old female patient had a swelling over distal third of right forearm of one year duration gradually progressing. She underwent biopsy of the swelling and CECT of the right upper limb. It was diagnosed as benign fibrous histiocytosis of distal radius of right forearm. Radial and ulnar artery were well palpable and preoperative Doppler study showed tri-phasic flow in both radial and ulnar artery. She had undergone previous surgery for similar complaint two years back at an outside hospital where she underwent excision of the lesion followed by plating and bone grafting. But after one year of the surgery, swelling recurred and gradually progressed. She had to undergo wide local excision of the lesion followed by reconstruction of the distal radial defect with a free vascularised fibular graft. The fibular graft was fixed with plate, screws and k wire. The following microsurgical anastomoses were done: end to end anastomosis of the peroneal artery to the radial artery and its associated venae comitantes to the cephalic vein. Histopathological examination of the excised specimen reported as benign fibrous histiocytosis with free margins. She underwent chemotherapy post-surgery. Complete union of the bone was achieved in eight months following which there was acceptable hand function. The patient was able to use her hand for activities of daily living at her last follow up. Implants were removed after 11 months of surgery.

Figure 1: FVFG for defect in the distal radius. 1A. Tumour in the distal radius of right forearm. 1B. Exposed tumour after raising the skin flaps intraoperatively. 1C. Bony defect in the distal radius following wide local excision with specimen alongside (with plate of previous surgery along with the specimen). 1D. Fixation of the FVFG with plate and screws with vascular anastomosis. 1E. Donor lower limb with fibular graft before detachment of the pedicle. 1F. X-ray of the recurrence of the tumour following previous surgery.

Three other patients with distal radial defect following tumour excision were reconstructed with free vascularised fibular graft. In one of these patients (Figure five) with wrist joint involvement, proximal fibular head based on anterior tibial vessels was harvested in continuity with the vascularised fibular graft for distal articular surface reconstruction.

Case 2 (Figure 2)

This 64-year-old man had a flail left arm with non-union of mid-third of left humerus which occurred due to a motor vehicle accident. He underwent several surgery including an external fixator application and also excision of dead unhealthy bone as a primary surgery followed by plate and screw fixation including bone graft. But he developed non-union at mid-third of left humerus, for which he underwent debridement followed by free vascularized fibular graft for mid humeral defect reconstruction. The vascularised bone graft was fixed with reconstruction plate and screws. It took six months to achieve complete bone union. Both the donor or recipient site healed well without any complications. Patient achieved full range of movements at elbow and shoulder joints as noticed in the follow-up period.

Figure 2: FVFG for the bony defect of left humerus. 2A. Patient with good elbow movement on the operated side. 2B. Healed scar on the left arm without restriction of joint movement. 2C. Healed donor area without any complications. 2D. X-ray of the left arm with complete bony union of the FVFG with plate and screw in situ at one year followup.

In our study two other patients underwent vascularised free fibular graft for fracture mid-shaft humerus. One of this patient had non-union at even 20 months of followup. He underwent debridement and iliac bone grafting for the same and achieved bony union in eight months with good function.

Case 3 (Figue 3)

This 68-year-old man presented with a complex defect with both skin and bony defect in the distal third of right tibia with external fixator in situ. He had history of severe motor vehicle accident following which he had bone loss in the right tibia. He underwent an external fixator application and several debridements previously. Duplex ultrasonography reported patent and tri-phasic flow in all peripheral arteries i.e. in anterior tibial, posterior tibial and also dorsalis pedis arteries. Radiographs showed large defect in the bone in the distal tibia. A free vascularised osteocutaneous fibular flap was used to reconstruct this defect. Microsurgical anastomoses in an end to end fashion to the anterior tibial vessels was done. Plate and screws were used for fixation of the bone to the tibia and skin paddle was used for covering the soft tissue defect. A stable bony union with entirely healed skin and no infection was seen in six months. Patient was able to weight bear and walk after six months.

Figure 3: 3A. FVFF for distal third of the tibia defect of right leg with skin paddle at seven months followup. 3B. Totally healed skin paddle over the right leg. 3C. Donor area over left leg with completely healed split thickness skin graft (SSG). 3D. X ray of the right leg showing complete bony union of FVFF with plate and screw insitu at seven months followup.

In this study, seven other patients underwent vascularised free fibular flap for tibial defect. One for proximal tibial defect (Figure four), two for mid-tibial defect (Figure six) and four for distal tibial defect. Two out of these seven cases needed skin paddle along with fibular graft.

Figure 4: 4A & 4B. FVFF for proximal tibial defect of right leg with well healed skin paddle at one and three months followup. Initially post surgery patient developed superficial necrosis of proximal 2 cm of the skin paddle which was debrided and covered with SSG. 4C & 4D. Donor area over the left leg with small strip of SSG loss which healed by regular dressings

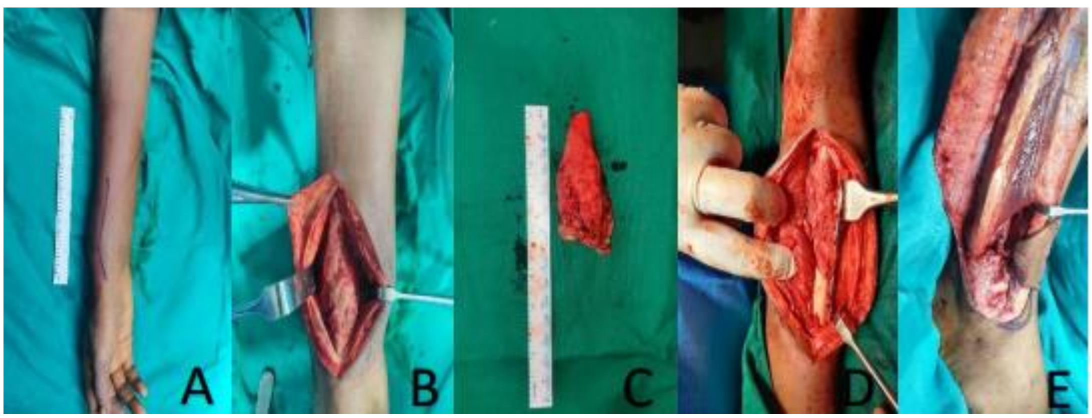

Figure 5: 5A. Tumour over the distal third of right radius. 5B. Exposed radius with tumour after raising the flaps. 5C. Excised specimen of tumour including distal articular surface. 5D. FVFG with proximal fibular head for reconstruction of the distal radial defect. 5E. Donor leg for FVFG harvest

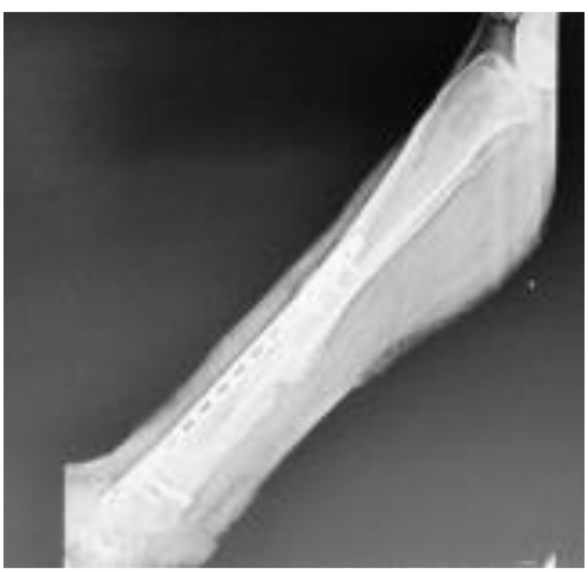

Figure 6: X-ray showing complete union of the FVFG with plate and screws in situ at 10 months follow up

Discussion:

The main goal of extremity reconstruction is to gain and recover function and to maintain it, for which bony reconstruction with stable soft-tissue coverage is important. Various extremity bone reconstruction techniques have been used. Some of them are usage of cancellous bone graft and allografts, to use the prostheses and also the application of external fixator. But they are suitable for small bony defects with good soft tissue cover and also requires long period for revascularisation [8]. Vascularized bone usage is the best reconstruction method which varies from the other techniques because of immediate revascularisation of the flap after the anastomosis. It retains the viability of the bone having both osteoblastic as well as osteoclastic activity that helps in easy and quick flap incorporation [9]. The vascularized free fibula flap was initially thrown light by Taylor in the year

1975 and then popularized by Hidalgo in the year 1989 [10,11]. The free fibular flap has been widely used in plastic surgical, orthopaedic and oncosurgical practice since then. The free vascularized fibular flap is a workhorse flap for the extremity bony defect reconstruction [12]. The advantages being, fibula can be harvested as a long bone with adequate length, can be easily dissected and is associated with low morbidity of the flap donor area. Recipient vessels must be appropriately selected for successful outcomes of the reconstruction of defects in the extremities using free flap [13]. If there is trauma to the vessels at recipient sites, dissection of the proximal part of the vessels is done and anastomosed to the vessels with normal perfusion. Single vein anastomosis were done in all cases with 100% flap survival rate.

Our results are favorably comparable with those of other studies using free fibular flaps in the extremity bone reconstruction. The mean length of the fibula in our study was 13.56 cm in comparison to other studies being 19.4 cm (P.J. Belt 2005) [14], with the range in other mentioned reports being 119–189 mm [9,15,16] (Ozaki 1997, Hsu 1997, Ihara 1998).

In series using vascularised free fibular flaps as the only modality, fibular union was seen to occur in 74–100% of cases reported [15-18]. In other series that used the vascularised free fibula flap for extremity bony defect reconstruction, bony union occurred in more than 75% of cases [19]. Our rate of fibular union is 88.89% and falls within this 'range. Out of 18 cases, two had non-union in our study. These cases underwent previous surgeries and delayed reconstruction with FVFF. The cause for non-union may be associated fibrosis following inflammation due to previous surgeries. Similar reason as ours is quoted for non-union in some studies and providing a robust, well perfused vascularized bone results in an enriched wound-healing environment [20].

The use of the epiphysis of the proximal fibula successfully to reconstruct the distal radial defect in children is been reported in a study done by Innocenti and his colleagues. Wrist with around 70% of its function in comparison to the contralateral side was attained in their study [21]. Similar results was achieved by other authors who used epiphysis of the proximal fibula to reconstruct the distal radius [22,23]. In a similar case done in our study following excision of gaint cell tumour of distal radius, minimal restriction of wrist joint movements was noted.

The rate of stress fracture with vascularised free fibular flaps is 7.7–22.2% in the quoted studies, [15,16,24,25] but none of our cases reported stress fractures.

In our series there was no loss of free fibular flap whereas flap loss rates as high as 15.4% are noted [17].

Microvascular complications was not noted in our patients in comparison with the rates of up to 22% of microvascular complications needing flap revision [16]. But one patient had superficial necrosis of the proximal skin paddle for about 2 cm unrelated to the anastomosis.

Meantime for full weight-bearing in our study was 0.92 (0.67 to 1.17) years, in comparison to the results in a study done by Ihara,[16] in 1998 which was recorded it to be five months.

The rate of infection in our study is zero as compared to 4% in the studies by Hsu RWW et al. and Yoshimura M et al. [15,24].

Deformity of the ankle at the donor leg i.e. valgus deformity is a common reported complication [26]. There is no relation between the level of distal fibular osteotomy and the occurrence of the valgus deformity, if the osteotomy is performed leaving atleast 5 cm of the distal fibula as measured from the tip of the lateral malleolus. None of our study patients developed this problem as we usually do distal osteotomy 6cm from the lateral malleolar tip. Common peroneal nerve palsy as a complication is noted to occur in four % to five % of patients and is mostly transient [27,28]. But our patients didn't present with this problem.

Hence, free vascularised fibular flap can be considered a versatile flap for bony defect reconstruction in the extremities with good functional outcome and less complication rate.

Conclusion:

The free vascularized fibula flap can be considered a reliable and versatile option for reconstruction of any extremity bony defect, demonstrating a good union rate, thereby achieving good functional outcome with low complication rate. Proper planning and meticulous surgical techniques can provide many functional limbs.

Conflicts of Interest:

The authors have no conflicts of interest to declare.

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