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Original article

A RETROSPECTIVE STUDY ON TREATMENT OF CHRONIC DIABETIC FOOT ULCERS WITH VASCULAR SURGERY, MICROSURGERY, AND SUPRAMICROSURGERY FOR PREVENTION OF AMPUTATION.

Prakash Kumar[a], Sanjay Kumar[b,*]

[a] *Patna Medical College Hospital, Patna, Bihar, India.*
[b] *Patna Medical College Hospital, Patna, Bihar, India.*

Abstract

Introduction:

About 2.5% of people with diabetes develop diabetic foot ulcers, which can cause serious infections and necessitate amputation. These ulcers are to blame for extended hospital stays and comorbidities brought on by untreated diabetic foot ulcers. Simple, conservative methods can be used to treat small, superficial ulcers. However, surgery is necessary to treat exposed bones or tendons in order to avoid osteomyelitis. Reconstructive surgery is frequently required, occasionally in conjunction with revascularization of the foot.

Methods:

Free tissue transfer was used to address chronic deformities and diabetic foot disease in 41 patients. It required 44 microvascular flaps. The patients were 64.3 years old on average. Revascularization was needed in 18 individuals. Two microvascular flaps were required for 3 individuals. The supramicrosurgical approach was applied in 6 cases.

Results:

Two flap losses resulted in amputation. Due to serious infection or bypass failure, 4 additional patients needed to have their legs amputated within 6 months of their surgeries. Four further patients passed away within a year of their repair. All of the other patients were ambulated.

Conclusion:

By transferring free microvascular myocutaneous or fasciocutaneous tissue, large foot deformities can be repaired. However, small free microvascular flaps can be used in the case of abnormalities that are too small to be covered by local flaps and expose tendons or bones. The morbidity at the donor site is relatively minimal with these flaps. Another method for defect closure is venous flaps that have been arterialized. Amputation lowers quality of life and increases the risk of postoperative mortality.

Keywords: Vascular surgery, Microsurgery, Supramicro surgery, Chronic diabetic foot ulcers and Amputations, Submitted: 2023-06-22 Accepted: 2023-06-25

1. Introduction:

The St.-Vincent Declaration set the goal that the amputation rate for diabetic patients should

* Corresponding author.
Email address: sanjaymch17@gmail.com (Sanjay Kumar)

decrease by 50% in five years [1]. That objective was never attained. Given that there were 65.700 major amputations in the USA in a year, according to the Centres for Disease Control (CDC), the number of people with diabetes mellitus is increasing. In future, it is predicted that 300 million people would have diabetes worldwide [2]. Although it is merely speculation, this also suggests that the number of amputations connected to diabetes will increase.

Along with endocrinologists, plastic and vascular surgeons have taken a key role in the treatment of diabetes-related issues that result in diabetic foot syndrome. It is commonly known that ulcers are mostly brought on by diabetic neuropathy. It has been demonstrated that identifying these patients and administering neurolysis to them can avoid ulcers and, consequently, amputations [3]. Vascular disease is another factor in ulcer development. Peripheral vascular disease was observed in practically every diabetic patient who had undergone a major amputation [4]. Local wound therapy can be used to treat mal perforans or local wounds. In use are a variety of wound dressings. Autologous platelet topical usage has also been discussed [5]. The majority of clinical research concentrate on the Wagner/Armstrong stadium 1 and 2 abnormalities. Local wound therapy is sometimes not necessary, particularly in infected wounds with exposed bones, tendons, arteries, or nerves. Wagner/Armstrong classifies these wounds as 3D or 4D. The presence of persistent osteomyelitis complicates treatment in many cases. Many of the affected patients continue to receive amputation treatments. After a major amputation, it is quite possible that the opposite extremity will also need to be amputated or that a higher level of amputation will be necessary. A substantial lower extremity amputation also carries a high death rate. Only 39% of patients continue to be alive 7 years after surgery [6, 7]. The aim of this study was to evaluate the prevention of amputation during treatment of chronic diabetic foot ulcers with supramicrosurgery, microsurgery and vascular surgery.

2. Methods:

This Indian-based retrospective outcome study was carried out within two years from May 2020 to June 2022. Furthermore, in accordance with section 6(2) of the NRW health data privacy legislation, patients' informed consent was not required for using routine data for scientific purposes. However, all participants gave their written or verbal agreement and were in favour of publicising the study's findings. If oral consent was obtained, the approval was recorded in the patient's records.

74 people with diabetic foot syndrome have received treatment. For the purpose of covering the wounds, 44 flaps were necessary for 41 of them. The age range between 31 and 85 years was 64.3. Two flaps were used to treat three patients. One patient required an additional free flap for the contralateral foot, while two of them required two flaps each for the ipsilateral foot. 18 individuals received vascular reconstruction either in advance of or concurrently with the reconstruction. The vascular surgeon underwent bypass surgery in accordance with the requirements for revascularization. Due to the various sizes, locations, and vascular conditions of the defects, the whole amount of surgery time was not examined.

Defects were found in the malleolar region (3), plantar (16), and heel (16). The patients, the location of the defect, the reconstructive process, and the vascular reconstruction are all shown in Table 1. According to the American Society of Anesthesiology, the patients received an ASA 3 classification. Three patients required hemodialysis due to end-stage renal disease. On the opposite leg of another patient, a significant amputation already existed. Due to heart failure, one patient required spinal anaesthetic for treatment. There were several types of microvascular flaps used: There were 23 parascapular flaps, 3 gracilis muscle flaps covered in split thickness skin graft (STSG), 6 latissimus dorsi muscle flaps covered in STSG, and anterior lateral thigh flaps (ALT). A free arterialized venous flap from the thigh was used to reconstruct one patient, a free extensor digitorum brevis muscle flap with STSG was used

to treat one patient, and 4 patients were treated with a free peroneus muscle brevis flap (1 of them with a skin island, 3 with an STSG). One patient had to have their contralateral instep of the contralateral foot amputated. Flap arteries were end-to-side anastomosed to the bypass in each case of bypass reconstruction. Large flaps, typically in an end-to-side approach, were anastomosed to the pedal arteries (posterior tibial artery, dorsalis pedis artery) if a bypass wasn't required. These flaps included the parascapular, latissimus dorsi, gracilis, and ALT.

3. Results:

Due to a late venous thrombosis that resulted in amputation, two flaps were lost. Despite efforts to save them, neither flap could be saved. One parascapular flap and one peroneus brevis muscle flap both experienced this. In addition, 4 patients required an amputation within 6 months of reconstruction, with 2 of them experiencing bypass failure and lower extremity ischemia. Two further patients required removal of significant portions of the foot skeleton due to a foudroyant infection of the foot, creating an unstable scenario that required an amputation. Prior to reconstruction, both had severe phlegmonous infections; one of them was a patient receiving hemodialysis for end-stage renal illness. Following the microvascular repair, a total of 6 amputations were necessary.

Four further patients passed away within a year of their repair. In a rehabilitation facility, 3 people passed away from heart disease and strokes, while one patient passed away from a cerebral haemorrhage a year after reconstruction. Table 2 shows perioperative death and amputation as examples of serious complications.

The outcomes of the three patients who required hemodialysis due to end-stage renal illness are mentioned as follows, given that hemodialysis is thought to have a pretty poor impact on reconstructive outcome: One patient required an amputation, while the other passed away a year after reconstruction (Table 2). Healing went without incident for the other sufferer.

Five individuals had hematomas or modest superficial necrosis of the flap that slowed the healing process. After a débridement, the subsequent healing process went smoothly. Ten days after surgery, ambulation started in the other patients. Only one patient had a lengthier waiting period before being able to walk, and they had an above knee amputation on the other side. Five patients needed to be readmitted again within six months of their surgery. On the ipsilateral foot, they got fresh ulcers. One new microvascular flap was required for two of them. Due to inadequate footwear, 3 of them experienced flap surface ulcers. Local wound care could be successfully used following surgical débridement.

4. Discussion:

It's crucial to both prevent and treat foot ulcers in diabetes people. There have been numerous published strategies and innovations. They include treatment for peripheral vascular disease and neuropathy, which are the main contributors to foot ulcers in diabetic individuals. Neuropathy of the foot can be successfully treated by decompression of the nerves [3,8,9,10]. Revascularization of the extremities is a method of treating vascular illness that is intended to enhance the healing of chronic wounds [11]. However, a thorough debridement is required as a first step. The debridement can be as harsh as necessary, keeping in mind that the vascular status can be improved by bypass repair and that free flap covering is an option.

Even though it enhances foot circulation and repairs defects in a single operation, the combination technique of bypass reconstruction and free flap transfer is rarely carried out. Additionally, by lowering distal resistance, the flap hooked on the bypass improves flow through [12,13,14,15,16]. Over 50% of limbs can be saved with combined bypass surgery and free flap repair, according to long-term findings. These findings are significant because healing of an ulcer with exposed bones or other functional features does not necessarily happen through vascular repair of an ischemic limb alone. If the defect is still there, a postoperative

Table 1: **Demonstrating patients age and sex, defect localization, vascular and plastic surgery procedures**

Sex	Age	Localization	Bypass	Flap
Male	55	Plantar	No	Parascapular
Male	62	Heel	No	Parascapular
Male	54	Heel	Popliteo-Pedal	Arterialized Venous Flap
Female	68	Heel	Popliteo- Malleolar	Parascapular
Male*	60	Plantar	Popliteo- Pedal	Parascpular
Male**	65	Malleolus lateralis	No	Peroneus brevis
Female	31	Plantar	No	Peroneus brevis
Male	67	Heel	No	Latissimus dorsi
Male***	57	Heel	No	Parascapular
Female	58	Plantar	No	Contralateral Instep
Male	66	Plantar	Popliteo- Pedal	ALT
Female	80	Malleolus lateralis	No	Gracilis
Male	69	Plantar	No	Latissimus dorsi
Female	49	Plantar	No	Extensor digitorum brevis

*. patient with an additional flap on the contralateral foot
**. patient with an additional flap on the ipsilateral foot
***. patient with an additional flap on the ipsilateral foot

Table 2: **Demonstrating major complications in the population of 41 diabetic patients (44 flaps)**

Major complications	Amputation due to thrombosis of the flap vessels	Amputation due to foudroyant infection	Perioperative mortality
Amputation due to bypass failure			
Number of patients 2	2	2	0

infection of the bypass may also develop. According to Illig et al.'s study, 60% of patients survived overall after 5 years, and 57% of their limbs were salvaged [16]. 65 percent of their patients who would have had limbs amputated continued to be mobile. According to the author, a main single staged surgery may be preferable than a combined surgery.

The inability to clearly demonstrate the graft's patency is a prevalent issue. Illig et al. have added their thoughts to that [16]. We were able to demonstrate this phenomena in a patient from our cohort who required angiography after developing a contralateral ulcer two years following surgery. It was also possible to see the repaired popliteopedal bypass with the hooked parascapular flap. The perfusion of the foot was improved, and the bypass and flap anastomoses were patent [12].

Patients with Wagner/Armstrong stadium 3D and 4D diabetic foot syndrome typically have ongoing chronic sores or still require amputations. We were able to show that amputation can still be avoided at these stages, though. Endocrinologists, vascular surgeons, and plastic surgeons must work together to treat patients [17,18]. Free tissue transfer must be carried out if necessary. This can be accomplished successfully in elderly diabetes individuals, according to several research [19,12,20]. However, these patients have serious co-morbidities. The hyperglycaemic state renders their entire circulatory system inadequate. Numerous them suffer from chronic renal insufficiency and cardiac disease [16]. Free tissue transfer was viewed as a procedure with a poor prognosis in individuals with diabetes and end-stage renal disease [16,21]. However, nephritis is also

to blame for slow healing of wounds [22,23]. One of the causes for the potential need for surgical operations is this. The outcomes in our study show that flap loss need not always occur in patients receiving hemodialysis for end-stage renal illness. However, they must be closely watched for postoperative infections and bleeding. One of the patients experienced postoperative amputation due to a follicular infection five days after surgery. Important was the flap. Furthermore, current research supports limb salvage in these individuals [24].

5. Conclusion:

A well-established and secure method for covering abnormalities after trauma and malignancy is free tissue transfer. Co-morbidities include cardiovascular and renal illness act as barriers to effective treatment. But with diabetic patients, every effort should be made to avoid serious amputations. We can accomplish this with interdisciplinary care. For other diabetic individuals, the findings in this study are quite encouraging.

6. Limitations:

The limitations of this study include that a small sample size had been included in this study due to which the findings and conclusion cannot be generalised for a larger population.

7. Recommendations:

For wound closure, diabetic individuals with diabetic foot syndrome frequently require surgical intervention. Free tissue transfer may be required in addition to a radical débridement and vascular surgery to avoid a significant amputation. It is also conceivable to use smaller flaps with smaller vessels for coverage in addition to well-established free flaps. They aid in lowering donor site morbidity and spare the major foot vessels.

8. Acknowledgement:

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9. List of abbreviations:

STSG- Split thickness skin graft
ALT- Anterior lateral thigh

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Author biography

Prakash Kumar Senior Resident, Patna Medical College Hospital, Patna, Bihar, India.

Sanjay Kumar M.Ch Plastic Surgery, Patna Medical College Hospital, Patna, Bihar, India.