ORIGINAL ARTICLE

DISTALLY BASED SUPERFICIAL SURAL ARTERY FLAP FOR FOOT AND ANKLE RECONSTRUCTION IN CHILDREN

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Background: Wheel spoke injury of the ankle and foot is very common in children and its reconstruction is challenging. Reverse sural artery flap is very useful to cover these defects. Free tissue transfer is an option in children which needs a micro-vascular expertise, expensive equipment and long operating time. **Methods:** Sixteen cases with ankle and foot defects were operated during a period of 18 months at the Children Hospital and Institute of Child Health Lahore. The efficacy of sural artery flap for the coverage of these defects was evaluated. **Results:** Sixteen children presented with defects of foot and ankle, 62.5% were male and 37.5% were female. Their age ranged from 2–13 years. All patients had trauma to the foot, most of them having wheel spoke injury. Some had roadside accidents and glass injury. Fascio-cutaneous flaps were used in 9 patients and fascia only flap in 7 patients with split thickness skin graft. Flaps were used to cover tendoachilles, malleoli, dorsum of foot, calcaneus, amputation stump and to reconstruct heel. Fifteen flaps survived whereas one necrosed. There was loss of skin graft in two cases of adipofascial flaps. Mean follow-up was 6 months. **Conclusion:** Sural artery flap is quick and safe with wide arc of rotation and minimal donor site morbidity and it does not sacrifice major extremity vessel.

Keywords: Superficial sural artery flap, reconstruction, foot and ankle trauma, wheel-spoke injury

INTRODUCTION

Foot and ankle defect coverage is difficult because distal most location, tight skin, subcutaneous tendons and bones and limited local flap options. The neuro-cutaneous flaps[1–3] are newly described and are based on the close association between the blood vessels accompanying the superficial sensory nerves to the extremities and deeply situated major arteries of the leg through septo-cutaneous or musculo-cutaneous perforators. In large complex wound with exposed fracture site, free tissue transfer may be considered,[4] but in uncomplicated small and medium defects local flaps are more appropriate. Because of the better understanding of vascular anatomy of the limbs local flaps have regained popularity. Several reports have been published describing many distally based fascio-cutaneous (FC) flaps for reconstruction of this area.[3,5]

The neuro-cutaneous arteries during their superficial course give off several perforators that ramify in the subcutaneous tissue forming sub-dermal and dermal vascular networks and supply the overlying skin. These are well described anatomical sites where the perforators from the deep arteries anastomose with superficial neuro-cutaneous arteries. The other similar flaps are saphenous,[6] lateral sural artery, and distally based superficial sural artery flap[7].

Distally based sural artery flap is very useful in adult but not well establish in children. We decided to conduct a study at our centre to evaluate its reliability in paediatric population.

MATERIAL AND METHODS

This case series study was carried out in the Department of Plastic Surgery, The Children Hospital and Institute of Child Health, Lahore, from Oct 2007 to Apr 2009. Sixteen children below 13 years of age were treated with distally based superficial sural artery flap. All patients had wound on ankle and foot with exposed bones, tendons, joints or loss of heel.

Course of median sural nerve is axis of the flap which is marked according to first point, 5 Cm above the tip of the lateral malleolus. Preoperative Doppler is helpful but not mandatory. At the proximal end of the flap, median superficial sural artery, small saphenous vein and sural nerve were divided and ligated. The pedicle was exposed through zigzag incision and raised with a cuff of 2 to 3 Cm. Deep fascia was tacked with skin ensuring inclusion of the sural nerve and saphenous vein in the pedicle. Visualisation of the perforators is not essential unless extra length is needed to cover distal defects. Flap was transferred to the defect by incising the skin bridge. Tunnel was not used to avoid risk of compression. Donor site was primarily closed if size was less than 3 Cm, and skin grafted for larger defects. Fascia only flap reduced donor site morbidity especially in girls when thinner flap was required. Fascia takes graft better than fat and delay of few days in grafting helps take of the graft.

RESULTS

Mean age of the patients was 7.37 years, male to female ratio was 1.6:1. All defects were post-traumatic. Size of flap varied from 3×4 Cm to 5×9 Cm. One patient had

traumatic amputation of foot. Another had cut tendoachilles. One had foot degloving with exposed lateral melleolus. Nine children got their feet struck in the wheel of motorcycle; one patient had fracture of lateral malleolus. Heel injury was seen in 6 cases. Three patients got preoperative Vacuum Assisted Closure (VAC) treatment followed by flap coverage. Fascio-cutaneous (FC) flaps were used in 9 cases and 7 patients were covered with fascia/adipofascial (AF) with skin graft. All cases were treated after 2 weeks because of delayed referral from other departments. One child underwent tendoachilles repair followed by fascia flap cover. Fifteen flaps survived completely while one flap had total necrosis. Another had distal necrosis which required debridement and wound healed with dressings. One patient developed donor site scar hypertrophy. One flap was bulky causing contour deformity which was debulked after six months.

A 7-year-old boy presented with wheel spoke injury of one month duration. He had 10×8 Cm ranulating wound on the right heel and posterior ankle with necrosis of insertion of Tendoachille's and exposure of calcaneus. After wound debridement the defect was covered with fasio-cutaneous reverse sural artery flap. (Figure-1–4).

Figure-1: Pre-op exposed calcaneum

Figure-2: After wound debridement

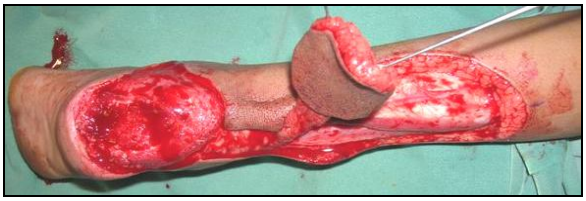

Figure-3: Reverse fascio-cutanoeus sural flap elevation

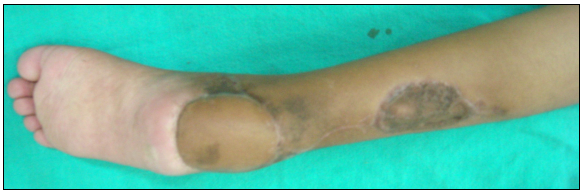

Figure-4: Three months post operatively

A 10-year-old boy presented with glass injury to the right lower leg for 2 weeks. He had 3×3 Cm non healing wound in posterior mid line just above the ankle. He was unable to walk properly. On wound debridement his Achilles tendon was cut. Repair and draping with fascial sural flap was done with a Split thickness skin graft (SSG) on it. Wound healed completely and full weight bearing was allowed 3 weeks after injury. (Figure-5–8).

Figure-5: Division of Tendoachilles due to trauma

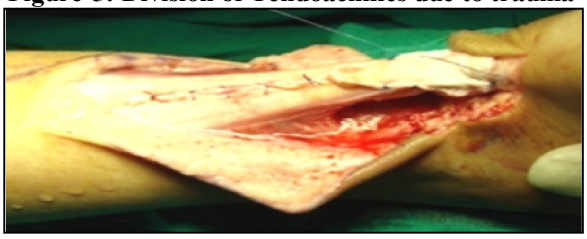

Figure-6: TA repaired

Figure-7: Fascia only flap inset over repaired TA

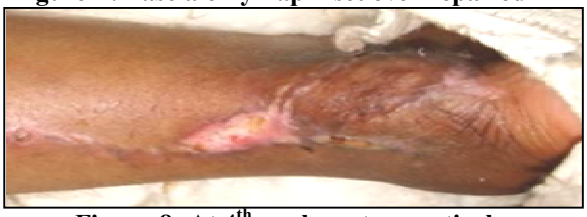

Figure-8: At 4th week post-operatively

DISCUSSION

Heel and foot injury is common in children in our part of the world due to open type of foot wear and multiple pillion riding. A large number of flaps[4] have been reported for reconstruction of this difficult area. The pros and cons of local versus free flap have been well reviewed.[8] Free tissue transfer requires expertise, sophisticated equipment including operating microscope and long operating time. Local fascio-cutaneous flap for reconstruction of ankle and foot defects has regained popularity in recent years since description by Ponten.[9] Vascular studies have revealed the excellent vascular

connections between the superficial system and deep main arteries through musculo-cutaneous and septo-cutaneous perforators. These vascular connections via perforators make each of it a potential pivot point for flap rotation.[10] Due to rich anastomosis between peroneal artery perforators and longitudinally oriented median superficial sural artery both proximally[11] and distally based flaps can be elevated[3,5,12]. Masqualet *et al* named these flaps neuro-cutaneous in 1992 and several reports were published.[13–15] In our series of 16 patients we reconstructed defects around the ankle with good success rate. If the thinner flap is required the fascia alone was used to cover the defect with split skin graft on it. Fascia can be rotated to cover the defect or turned upside down like page of a book and its under surface takes the graft readily. Fascial flap also helps to reduce the donor site morbidity. Delay in grafting for couple of days enhances its take. Distally based superficial sural artery flap is a single stage procedure conserving the major extremity vessels. It is safe, quick to elevate with wide arc of rotation. Vascular anatomy is quite constant and preoperative Doppler is not mandatory if arc of rotation is kept above 5 Cm from tip of lateral malleolus.

Similar flaps were also described based on anterior perforators of the peroneal artery like the lateral supra malleolar flap[16] and saphenous flap[17]. Shalaby[18] described a flap based on same posterior peroneal perforators and island is taken more laterally overlying the posterior intermuscular septum. The vascular axis of the flap is an anastomotic arcade formed by longitudinal connections between neighbouring septo-cutaneous vessels in the same septum. Flap has a short pedicle and seems to be more suitable for above the ankle defect. Oberlin *et al*[7] described the posterolateral malleolar flap with the pivot point at the tip of the lateral malleolus. This short flap depends on the communication between lateral calcaneal and lateral tarsal artery and is useful for coverage of in-defects around lateral malleolus and posterior heel region.

Main demerit of distal based sural artery flap is a scar on calf which can be reduced by making use of fascia flap wherever possible. Neurological deficit caused by division of nerve is minimal and tends to improve with time.

CONCLUSION

Distally based sural artery flap is reliable, safe, easy and quick to execute and durable having minimal donor site morbidity for the reconstruction of this challenging area in the children. It is a good alternative to free tissue transfer in suitable patients.

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