



RECONSTRUCTION OF THE SOFT TISSUE OF THE HEEL: OPTIONS IN RECONSTRUCTIVE SURGEONS ARMAMENTARIUM

Plastic Surgery

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ABSTRACT

The soft tissue defect of the heel is a challenging problem faced by many plastic surgeons. There is a paucity of reconstructive options in this region due to lack of elastic soft tissue in this anatomic region.

We have divided the heel region into anterior and posterior parts and present a simple algorithm for management of post-traumatic posterior heel defect. We covered these with various flaps depending upon the defect size, its exact location, associated injuries, extent of zone of trauma, and complexity of the defect. The aim was to select the most suitable method for soft tissue coverage for heel reconstruction

KEYWORDS

Introduction:

The heel and sole of the foot is a unique function of weight bearing and ambulation with particular histologic characteristic presenting with thick epidermis and dermis, thin subcutaneous tissue and very sound adherences between the dermis and the muscle below¹. The tissue used to reconstruct this area should be well vascularized, resistant, adapted to bear the weight and sensate. These characteristics make the reconstruction of this area challenging problem. The different reconstructive options are free flaps, locoregional flaps like reverse sural flap and medial plantar artery flap, perforator based flaps, cross – leg flaps and skin graft.

This study was carried out to select the most suitable method of reconstruction and to present a simple algorithm for management for various post-traumatic posterior heel defects. This helped to select the method with least morbidity of recipient and donor site and best possible way of rehabilitation of the patient.

MATERIALS AND METHODS:

This was a prospective study conducted at the Plastic Surgery department, SMS Jaipur, between January 2016 and March 2019. 58 consecutive cases of heel defect were taken in the study. The institutes review board approved the study design. Patient's demographic data, cause of soft tissue defect, presence or absence of sensation of the foot, size and location of the lesion, management of wound, wound healing time and complications on follow-up were recorded.

Thorough wound toilet and debridement, fixation of fractures (if required done by orthopedic unit) and immobilization was done. Paraffin gauze dressing was done, and limb elevation was given, daily dressings were carried out and coverage was given with Split thickness skin graft or flap. Most of the patients were operated under spinal anesthesia (except free flaps and few other patients). Immobilization was done depending upon the flap, but in most of the instances dorsal below knee slab was given.

Isolated injuries to the anterior heel were present in 8 (13.7%) cases and injuries only over the posterior heel were present in 30 patients (51%) and combined injuries (injuries to heel and surrounding regions) in patients 20 cases (34%) [Table 1]. Isolated injuries were covered with Split thickness skin grafting (n=8), medial plantar artery flap (n=12), distally based superficial sural artery flap (n= 15), Free flap (n=2) and Perforator based flap (n=1). Combined injuries were covered with distally based superficial sural artery flap (n= 12), Cross leg flap (n=2), free flap (n=4) and Split thickness skin grafting (n=2)[Table 1].

Pressure dressings (Elastocrepe bandage) was started on the 10th day with gradual dependency (if no complications) started on the between 12 to 15 days and increasing it till the 21st day. Active and passive

physiotherapy of joints around ankle was also started on the 10th day. After 21 day gradual mobilization was started with intermittent weight bearing, making the patient to do all his activities at around one and half months. In between the weight bearing, patients were advised elevation of limbs. Patients were also advised to keep a constant watch over the graft for congestion and breakage and in flaps, for congestion and softening. Daily massage and use of special footwear (silicone) were also explained to the patient.

RESULTS:

The patients studied were in the age group from 9 to 64 years with the mean age 28 years with a preponderance of male patients (n=43). The mode of injury was road traffic injury (68%), spoke wheel injury (18%), railway track injuries (10%) and others(4%).

Minimal donor site graft loss occurred due to minor haematomas in 5 patients of medial plantar artery artery flap, 1 patient of distally based fasciocutaneous posterior calf flap, 1 patient of radial forearm free flap and 1 patient of cross leg flap which healed by secondary intention. Minor distal flap necrosis occurred in 1 patients of distally based fasciocutaneous reverse sural flap, and 1 patient of cross leg flap which did not require any further intervention as no important structures were exposed and graft loss was less than 2 cm.

Discussion

The reconstruction of the heel is a challenging problem for the reconstructive surgeon. This is the weight bearing part of the body and requires a well vascularised reconstruction having a good durability and sensation because of its location and repeated friction by footwear.

The skin of both the heel and the sole of the foot has particular histologic characteristics, presenting a thick epidermis and dermis, with a complex dermo-epidermal relationship. The dense septa from the skin to the underlying aponeurosis with the subcutaneous tissue form fatty bags that work like an impact-absorbing cushion. Although the posterior heel is not a weight-bearing zone, the anterior heel supports 80% of the total body weight in standing position.¹ The posterior heel is not a weight-bearing zone but has a thin skin. It is a very frequent localization of pressure sores and wounds on this area that leaves the Achilles tendon and the calcaneus bone exposed

Different options have been described through out the history like the reverse sural flap, the instep flap, the lateral supramalleolar flap, the lateral calcaneal flap, the dorsalis pedis flap, the flexor digitorum brevis muscle flap, and different options of free flaps like fasciocutaneous (radial forearm) and muscle flaps (gracilis, serratus, latissimus dorsi) with skin grafts.

Criteria that were used for the selection of method of reconstruction in our study are

- Size of defect
- Location of the defect
- Complexity of the injury i.e. exposed bone or

Surgeons agree that the main reconstruction goal of the heel is to provide a durable coverage with a normal appearance and allow the patient to walk properly and wear normal shoes. To accomplish this objective, numerous surgical options have been described.

Skin Grafts:

This option can be used in patients with good soft tissue padding. The patients who are treated with skin graft have shown remarkable sensate recovery. In follow up these patients had stable reconstruction which was sensate.

Lateral calcaneal artery flap originally described by Grabb and Argenta² in 1981 is an axial pattern Fasciocutaneous flap that is simple, stable and sensate. It is preferred in small sized isolated posterior heel defects with exposed Tendoachilles or Calcaneum and normal skin in flap vicinity. Peroneal vessels are least to be affected by age, Diabetes mellitus or smoking, making it a safe flap in these patients. Disadvantage of the flap are that donor site requires grafting, which is put on the periosteum giving a depression, and causes a poor cosmetic appearance.³ Patients also have sensory disturbance at the lateral part of the dorsum of foot.

Reverse sural fasciocutaneous flap:

Originally described by Masquelet⁴ in 1992 is a skin island flap that has reliable blood supply, easy and quick to elevate and major arteries are not sacrificed. This flap is useful in moderate sized Posterior heel defects with exposed Tendoachilles or Calcaneum which cannot be covered by Lateral calcaneal artery flap (size of requirement is more or if the trauma extends in to territory of lateral calcaneal artery flap. The disadvantages of this flap is that it has an inferior donor site aesthetics and there is loss of sensation over the lateral aspect of the foot^{5,6,7}.

MEDIAL PLANTAR ARTERY FLAP:

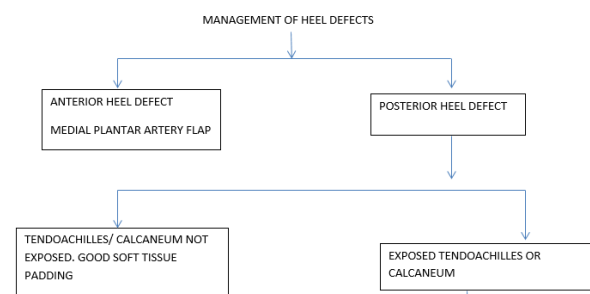
Shanahan and Gingrass⁸ first described the medial plantar sensory flap for resurfacing the defects of the heel. The medial plantar artery flap with its arc of rotation incorporates the in-step glabrous skin, maintaining an intact tissue over the weight-bearing area of the sole. Medial plantar flap is the flap of choice in terms of sensation and early ambulation. Tissue type and texture are similar to that of the heel.

CROSS LEG FLAP initially described by Hamilton in 1854 and Stark(1950)⁹ standardized the procedure and summarized its usefulness for lower extremities trauma. Crossleg flap is useful as a salvage procedure, for reconstruction in patients with comorbidities and for large defects in areas where microvascular facilities are absent. Disadvantages with this flap are discomfort, two- staged procedure, problems related to prolonged immobilization and long hospital stay.

Free microvascular flap is considered when the injury to same limb is extensive. In case of free microvascular tissue transfer for posterior heel defect reconstruction, a suitable recipient vessel is required. It has the advantage of being a single stage procedure with variety of donor sites of various sizes and avoids other disadvantages of cross leg flap

CONCLUSION:

We present a simple algorithm for the management of the heel defects. The most simple procedure which satisfies the reconstructive goal of providing sensate, stable and glabrous skin and makes the limb functional whereby patient can bear weight and wear shoes is the ideal procedure for heel reconstruction.



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