Nervus cutaneus femoris posterior pedicle flap for repairing large soft tissue defects at the heel or inferior segment of the shank

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Objective: To investigate the clinical effect of the nervus cutaneus femoris posterior pedicle flap on repairing large soft tissue defects at the heel or inferior segment of the shank.  

Methods: Totally 14 cases were followed up for 8-22 months (mean 15.5 months) to observe the clinical effects of nervus cutaneus femoris posterior pedicle flap on repairing large soft tissue defects of the heel or inferior segment of the shank. Among them, there were 3 patients afflicted with infection and cutaneous defects in the middle and inferior segment of the shank after internal fixation of open fracture, 4 patients with soft tissue defects of the ankle and uncovered tendo calcaneus, and 7 patients with soft tissue defects of the heel and exposed calcaneus.  

Results: The flaps survived well in 13 cases and partial necrosis occurred in 1 case that was thereafter cured with changing dressing. Various extents of pain and stiffness of the knee joints were present in all cases and disappeared through 1-8 weeks’ (mean 3.2 weeks) functional exercises. The last follow-up showed that all the flaps kept good texture and satisfactory appearance.  

Conclusions: The nervus cutaneus femoris posterior pedicle flap, having the advantages of simple surgical procedures, anastomosing the nerves and restoring the sensation of recipient site, can be used for recovering large soft tissue defects of the shank and ankle.  

Key words: Surgical flaps; Soft tissue injuries; Heel  

METHODS  

Clinical data  
A total of 14 patients (9 males, 5 females, aged 16-65 years with mean 31.9 years) with soft tissue defects at the heel and foot or inferior segment of the shank were treated with nervus cutaneus femoris posterior pedicled flap. Among them, 3 patients were afflicted with infection and cutaneous defects on the inferior segment of the shank after internal fixation of open fracture, 4 with soft-tissue defects of the ankle and exposed tendo calcaneus, and 7 with soft-tissue defects of the heel and exposed calcaneus. The sizes of soft tissue defects and flaps were 7.0 cm×20.0 cm-11.0 cm×23.0 cm and 7.0 cm×17.0 cm-8.0 cm×24.0 cm, respectively. The duration of follow-up was 8-22 months (mean 15.5 months).  

Design of the flap  
(1) The swivel point of the flap was located at the middle point of the gluteal fold. (2) The axis of the flap was along the line of cutaneous nerve of thigh posterior.
(3) The flap should be designed based upon the position, size and shape of the recipient area. The dimension of the flap should be 0.5-2.0 cm larger than that of the defect, with the length of 15.0-24.0 cm and the width of 7.0-15.0 cm. The flap should be dissected below the deep fascia and separated between the deep fascia and muscular membrane. (4) A skin tube should be formed in the root of the flap.

**Dissection of the flap**

Dissection began from the distal end of the flap. Incision was made along the designed line to the deep fascia and thereafter the cutaneous nerve of thigh posterior and its comites were included in the flap. In order to protect the integrity of the flap, subcutaneous tissue should be interruptedly sutured to the deep fascia as the tissue was cut bit by bit. After the pedicles were separated completely, a skin tube was formed at the root of the flap. Donor site could be directly put together by interrupted sutures. The articular genu was flexed with the heel close to the buttocks and fixed temporarily at the genuflex position with bandage. Transfer the flap to the recipient site to cover the recipient area of the heel or inferior segment of the shank, and remove the temporary anchor suture gradually while sewing up by interrupted sutures. A window was opened in the dressing to expose the island flap for postoperative observation. Fix the knee joint at a genuflex position by long leg plaster support at the front of the lower limb.

**Preparation for recipient sites**

Epidural anesthesia was adopted. Under the control of pneumatic tourniquet, debridement was performed to remove the infected skin, necrotic subcutaneous tissue and deep fascia completely. All the scar tissues caused by injury or inflammation located at nonunion or defect bone site together with the sequestra were cut out. The exposed bone was debrided thoroughly till reaching the fresh and blood-oozing facies ossea. After the reconstruction of blood supply was confirmed in the recipient flap 3 weeks after operation, the pedicle was cut off and the pediced skin was sutured under local anesthesia.

**RESULTS**

The flaps survived in 13 cases and the distal end of a flap developed partial necrosis in 1 case that was healed after changing dressings. After 8-22 months’ follow-up (mean 15.5 months), all the flaps kept good texture and satisfactory appearance. Varying degrees of pain and stiffness of the articular genu occurred after operation and became normal through functional exercises within 1-8 weeks (mean 3.2 weeks).

**Typical cases**

**Case 1**
A male, aged 65, with the left heel and bottom skin being torn up by a traffic accident. The size of defect was 11.0 cm × 23.0 cm, and the calcaneal bone was exposed. Debride the recipient site and clear the devitalized tissue including unhealthy tissue at the edge of injury. He was treated with nervus cutaneus femoris posterior flap (8.0 cm × 17.0 cm) to cover the exposed calcaneus and major defect area. After operation, the affected limb kept a flexed position with a plaster slab for 2 weeks and the pedicles were cut off in the third week. Then the following 2 weeks’ functional exercises contributed to the recovery of range of movement of the knee. Twelve-month follow-up showed a good blood supply and satisfactory color and texture of the flap. The shape of the left foot and the motility of his left knee achieved good recovery. (Figs.1-5)

**Case 2**
A 19-year-old male with an open fracture at the middle and lower part of the right tibiofibula caused by a traffic accident. The wound was infected accompanied by skin defect after internal fixation. The size of the defect was about 7.0 cm × 20.0 cm. After debridement, a nervus cutaneus femoris posterior flap (7.0 cm × 24.0 cm) was used to cover the major defect area. Around the proximal end of the flap, a triangle defect (3.0 cm × 4.0 cm) was covered by a full thick skin graft. The tip of the flap (2.0 cm × 2.0 cm) was necrotic after operation and healed by changing dressing. Fifteen-month follow-up showed a satisfactory color and texture of the flap and a fine functional recovery of the injured extremity. (Figs. 6-7)

**DISCUSSION**

It has been proved that each cutaneous nerve must be accompanied by an axial artery. Some nutrient vessels of the cutaneous nerve may not be a main branch, but segmental supply. These vessels form a vascular network by anastomosing its ascending branch with descending branch. Through communicating branches, the cutaneous nerve nutrient vessels anastomose with the vascular networks of the deep fascia, subcutane-
ous part and skin so as to nourish the skin, which forms the anatomical basis of the neurocutaneous vascular flaps. The accompanying artery of the nervus cutaneus femoris posterior derives from the inferior gluteal artery, with 100% of frequency. The main branch is about 20 cm long, which nourishes not only the nerve, but also the skin through some small communicating branches, and anastomoses intensively with posterior thigh branches of the surrounding perforating artery and obturator artery. The accompanying vessel of the nervus cutaneus femoris posterior is not the main branch of the lower extremity. It will not decrease the blood supply of the affected extremity after the flap is obtained. It is reported in the literature that the nervus cutaneus femoris posterior anterograde flap can be used to repair soft tissue defects at the sacroiliac, buttocks, greater trochanter and perineum, and the retrograde flap is commonly used to repair defects of the skin and soft tissue at the popliteal

Fig.1. The defect area of the left heel was 11.0 cm × 23.0 cm, and the calcaneal bone was exposed. Fig.2. The design of the flap. Fig.3. The position before the flap cut off. Fig.4. Recovery of the left heel defect. Fig.5. The function of the knee joint two weeks after the pedicle was cut off.

Fig.6. The defect area was about 7.0 cm × 20.0 cm in the middle and lower part of the right tibiofibula. Fig.7. The position after operation.
fossa, medial or lateral knee joint.

For large soft tissue defects at the heel and lower leg, cross-leg flap or the anterolateral thigh free flap is the main way to repair defects. The patients have to keep long-term compulsive position after cross-leg flap. They have difficulty in walking, and hardly do any out-of-bed activity. Furthermore, the traumatic surface of the opposite limb usually should be covered by free skin grafts. If the anterolateral thigh free flap is used, surgeons would face complicated and exhausting vascular anastomosis under operating microscope, difficult operation, complicated postoperative treatment, and increased risk of operating failure as a result of thrombosis-induced flap necrosis.

The advantages of the flap lie as follows: (1) The color, thickness and texture of the flap are satisfactory. (2) With a reliable blood supply, constant anatomy, and without sacrificing a major artery, this kind of flap can be easily harvested and separated conveniently between the deep fascia and muscular membrane. (3) It need not dissect the vessel pedicle and damage the major vessels of legs. (4) Owing to obscure donor site and the lax skin of posterior region of the thigh, the defects can be directly put together for suturing after flap transfer rather than closing the defects by free skin graft, which makes the operation easy to accomplish. (5) It is easy to turn around the flap due to the gross artery and long pedicle with formation of skin tube at its root. (6) It can restore sensory function of recipient site by neurorrhaphy. (7) After operation, the patients can do some out-of-bed activities early with double crutches. However, this kind of flap is clumsy. Partial sensation of posterior thigh may be lost postoperatively. And the pain and stiffness of the knee joint are apparent during 3-week fixation of the knee joint. Therefore functional exercise is required after pedicle division.

According to the result of this series, the nervus cutaneus femoris posterior pedicle flap provides favorable results for large soft tissue defects at the heel and inferior segment of the shank. The operative procedure is easy to carry out in primary-level hospitals. It can be preferably used to manage large soft tissue defects at the heel or inferior segment of the shank.

REFERENCES


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