Bilateral Knee Coverage Tissue Reconstruction with Perforator Fasciocutaenous Flap in A Child

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ABSTRACT

A 5-year-old male patient came to our hospital with injuries on both knees. He got his knees injured when he was clinging to the back of a moving van and his knees were rubbing against the ground. The wounds were sutured primarily in an emergency room. When separation started on both the sutured areas, the parents decided to come to us. After a couple of days of wound care and debridement, we operated the patient on both knees following the same procedure with 1-week interval.

The bilateral perforator fasciocutaneous island flaps were elevated using descending genicular artery, and then the flaps were rotated by a 90° angle on its pedicle area. The donor area was repaired primarily and closed up partially by a split thickness skin graft. Our postoperative observation showed that the reconstruction allowed the patient to sit up and sit down comfortably.

Key words: Descending genicular artery, knee, knee reconstruction, island flap, farsciocutaneous flap

INTRODUCTION

The knee region poses some unique problems when any method is considered to solve local wound deficiencies. Flexion and extension of the knee joint create variable forces on the skin envelope that can alter the static size and configuration of anterior and posterior coverage tissue defects. This may impose certain constraints on the flap design to avoid undesirable tension of a local flap. Moreover, local flaps transferred to cover knee defects must be designed with an orientation that prevents compromise of their pedicles during the dynamic excursion of the knee joint (1).

The case and the technique

A 5-year-old male patient came to our hospital with injuries on both his knees. Upon listening to the patients history, we learned that the injuries happened as he clung with his hands to the back of the small van his father was working on. He did not let go the van when it started moving and moved with his knees rubbing on the ground. His father stopped the car upon the warnings of some people on the street who noticed the little boy clinging. We learned that the wounds opened on his knees due to rubbing on the ground. The wounds were sutured primarily in an emergency room. Since a separation started on the sutured areas of both knees, the parents decided to visit our hospital. After a couple of days of wound care and debridement, we operated the patient on both knees by the same procedure with 1-week interval.

Figure 1 presents the drawings and planning regarding the procedure we applied. After elevating the bilateral perforator fasciocutaneous island flaps, the flaps were rotated by a 90 angle on the pedicle area. The donor area was repaired primarily and closed up partially by a split thickness skin graft. Our postoperative observation showed that the reconstruction allowed the patient to sit up and sit down comfortably.

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FIGURE 1: Appearance of both knees at the first time with dehiscence following primary suturing in an emergency department.

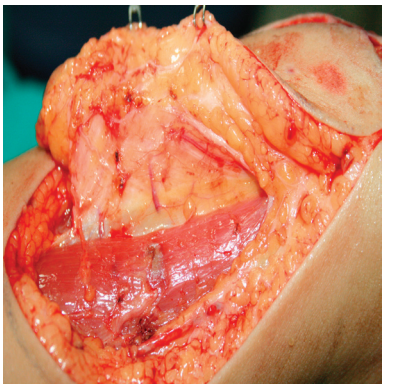

FIGURE 3: Perforator vessels from the undersurface of the flap.

DISCUSSION

The knee region poses certain problems when any methods that could be used to solve local wounds and tissue defects. Flexion and extension of the knee joint create variable forces on the skin that can alter the static feature of anterior coverage tissue defects. This may impose certain constraints on the flap design to avoid undesirable tension of a local flap (1).

The distally based anterolateral thigh flap has been generally used for coverage (6). Reverse-flow anterolateral thigh perforator flap has been confirmed as a safe and reliable method for reconstructing defects around the knee after using the flap in 17 cases (9).

A series of 32 free flaps were reconstructed using the descending genicular branch of the femoral artery in the adductor canal for covering complex injuries of the knee involving the distal femur, the knee joint, and the upper tibia. The authors of the mentioned study have stated that the use of the descending genicular artery as the recipient vessel in the free flap reconstruction around the knee has various advantages as follows: it is remote from the zone of trauma, it is constant in location, the recipient vessels are an excellent size match for end-to-end anastomosis, and there is lesser possibility to change the position of the patient when using most free flaps commonly used for knee reconstruction (2).

FIGURE 2a and 2b: Bilateral knee defects exposing the patellar bone and knee joint after debridement.

The blood supply to the thigh is shared between musculocutaneous and fasciocutaneous perforators. The fasciocutaneous perforators are located in four main regions: (1) anteromedially they lie along the edges of sartorius muscle, (2) posteriorly they emerge between the hamstring muscles, (3) laterally they pass along the lateral intermuscular septum, and (4) anterolaterally they emerge between rectus femoris and vastus lateralis at the anterior edge of the lower half of the iliotibial tract. The fasciocutaneous perforators passing round the anterior and posterior borders of sartorius have multiple sources of origin. The largest of these is the saphenous artery, which arises from the descending genicular artery, a branch of superficial femoral artery just above the adductor hiatus (3).

The descending genicular artery perforator flap, also known as the saphenous flap, has been used as a free flap to reconstruct a defect of the medial calf region in a 13-year-old boy with Ewing sarcoma (7).

To investigate the feasibility of free descending genicular artery perforator flaps in the soft tissue defects at extremities, 11 patients with skin defects at the distal part of extremities were treated including six flaps pedicledwith the descending genicular artery and the others pedicled with the perforator of the descending genicular artery. All flaps were transferred by endto-end anastomosis (8).

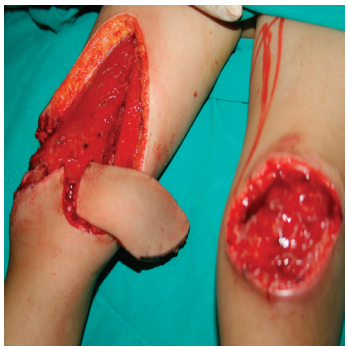
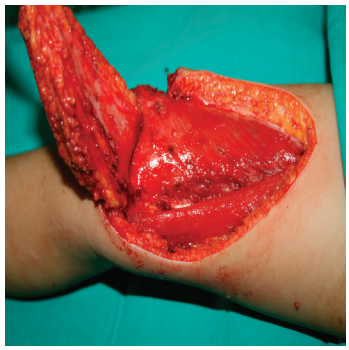
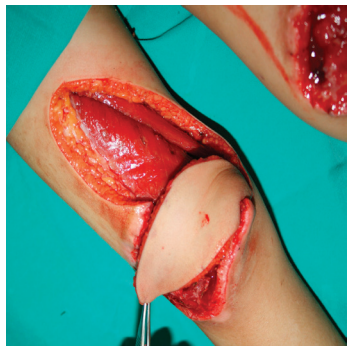

FIGURE 4a, 4b and 4c: Elevation and transposition of the flap.

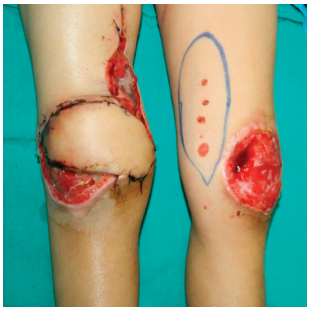


FIGURE 5a and 5b: Early postoperative result with skin grafting on both donor sites. Dotted areas show the visible perforators with Doppler ultrasound probe.


FIGURE 6a and 6b: Late result leaving full knee movements.

In a cadaveric study,after dissecting a total of 204 perforators in 16 lower extremities, it has been stated that perforators with the largest diameter were the ones arising from the intermuscular septa between the adductor (longus and magnus) and sartorius muscles (4).

Following a study of 16 cryopreserved inferior limbs for detecting the perforators of the distal anteromedial thigh and their source vessels, a series of 6 patients requiring the reconstruction of the peripatellar region and upper leg soft tissue defects has been presented with the same flap and it has been named the propeller distal anteromedial thigh perforator flap (5). All these patients needed a skin graft to cover the donor site because all flaps exceeded 10 cm in width. The authors further stated that being a perforator flap, it has the following advantages: decreases donor site morbidity and preserves muscles both with their functions by sparing the main vascular trunks; like-tolike soft tissue replacement (3). Although the donor site can be closed primarily in smaller defects or in a V-Ydesigned flap, skin grafting may be unavoidable. Therefore, we needed skin grafting to cover donor areas in both thigh regions.

An early coverage of the subacute wound, after minimal debridement, minimized inappropiate sequela by avoiding the enhanced risk when the wound became contaminated. A contaminated wound poses a challange regardless of the reconstructive method. In the presented case, waiting for a longer period to observe the granulation tissue to cover the defects with skin grafts would have been risky for contamination.

An objection to the use of a distally based medial thigh perforator fasciocutaneous flap may be the non-esthetic donor deformity that might accrue. Direct closure is possible if the flap size is small when oriented along the long axis of the thigh. The donor defect for larger flaps may warrant recovering with a split thickness skin graft. A graft take does not exist as a problem since the donor bed is well vascularized with the muscle fibers.

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