

Resurfacing Patella Using Pedicled Soleus Perforator Flap

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21 Short running head: Knee resurfacing using soleus perforator flap

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23 **Conflict of interest statement**

24 There are no conflicts of interest, including financial, consultant, institutional,
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26

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28 There were no external sources of funding in the form of grants supporting the
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30

31 **Ethical considerations**

32 The procedures followed were in accordance with the ethical standards of our
33 institutional committee on human experimentation and with the Helsinki
34 Declaration of 1975, as revised in 1983.

35

36 This manuscript has not previously been presented at any meeting.

37 This article is original and has not previously been published.

38

ABSTRACT

Soft-tissue reconstruction in the knee area requires thin, pliable, and tough skin. To resurface the wound, many flaps are utilized, including free flaps, musculocutaneous flaps, axillary flaps, local flaps, and sometimes distant flaps. However, each flap has disadvantages. In this report, we present 2 cases of soft-tissue defects on the surface of the patella reconstructed with a pedicled soleus perforator flap, resulting in a successful outcome. Pedicled soleus perforator flaps enable the reconstruction of local soft-tissue defects of the patella without microvascular anastomoses and with minimal donor-site morbidity.

We conclude that the pedicled soleus perforator flap is a favorable option for defect coverage around the knee, because of its fast and easy harvesting and very good esthetic results.

Key words:

Knee reconstruction, peroneal artery perforator flap, patella resurfacing

INTRODUCTION

Soft-tissue reconstruction in the knee area requires thin, pliable, and tough skin. The availability of local soft tissue, which meets the requirements most effectively, is limited. [1] For resolving these problems, application of the pedicled perforator flap concept has many advantages, including: the source artery and underlying muscles are preserved, the need for microvascular anastomoses is avoided, flap harvest is easy, and the flap has a similar texture and thickness. [2-4]

We present 2 cases of soft-tissue defects on the surface of the patella, reconstructed with a pedicled soleus perforator flap, resulting in a successful outcome.

Elevation of the soleus perforator flap

The location of peroneal vessels was assessed preoperatively using a Doppler flowmeter. A few cutaneous perforators were recognized on the proximal third of the lower leg along the fibula. The flap was designed to include these points according to the size of the defect. The first incision was made along the posterior border of the flap. Dissection was carried out below the fascia until the perforator vessel, which penetrated the soleus muscle or

sometimes ran through the intramuscular septum, could be seen (Figure 1). The perforator vessels were dissected deeply through the muscle. The flap was elevated anteriorly. The donor site could be closed with direct suture if the width was less than 4 cm; otherwise, it required a free skin graft for resurfacing.

[5]

Case reports

Case 1: An 82-year-old female who lived alone and was found by her family lying on the floor after a fall from her bed, believed to have been lying left side downwards for about 2 days because she had sustained 4th and 5th thoracic vertebral fractures. She was brought to our emergency unit immediately. On the first examination, the patient had sustained deep pressure ulcers to the left cheek, trochanter, and knee, which were classified as stage 4 (National Pressure Ulcer Advisory Consensus Development Conference), as shown in Figure 2. Necrotic tissue of all wounds was removed, and wound management was performed conservatively with impregnated ointment (Ekizalbe®) gauze application. Two weeks later, she underwent reconstruction surgery for these soft-tissue defects, including a local flap for cheek ulcer resurfacing, tensor fascia lata musculocutaneous flap transfer for trochanter ulcer resurfacing, and pedicled soleus perforator flap transfer for

trochanter ulcer resurfacing. A soleus perforator flap with a 15x7-cm elliptical skin island was harvested from the lateral aspect of the right lower leg and transferred to the wound.

The viability of all flaps was favorable, without infection or necrosis (Figure 3).

One month later, she was discharged on foot.

Case 2: A 52-year-old male was referred to our office complaining of an ulcer on the right knee, which had enlarged over a 2-month period. He had undergone surgical abrasion and free skin grafting involving the same area for the treatment of squamous cell carcinoma 2 years previously.

At the first examination, the patient had a 3.0 × 2.5-cm ulcer, which was revealed to be recurrence of SCC by the histological analysis of a biopsy specimen. General examination revealed no evidence of local or remote metastasis; thus, radical abrasion of the tumor was decided upon. The operation consisted of an en bloc resection with a 2-cm margin, containing periosteum of the patella. The raw surface of the bone was covered with artificial dermis. After the recognition of complete resection of SCC by means of histological analysis of a specimen, he underwent reconstruction surgery for the soft tissue defects of the knee using a soleus perforator flap with an 18x8-cm elliptical skin island (Figure 4).

The viability of the skin flap was favorable, and he was discharged on foot

two weeks later (Figure 5).

Discussion

Reconstruction of bone- or tendon-exposed wounds around the knee is challenging for reconstructive surgeons because it requires thin, flexible, and tough skin. [1] To resurface the wound, a local flap is used for a small defect; however, more complicated flaps, including free flaps, musculocutaneous flaps, axillary flaps, and sometimes distant flaps, are required if the wound size is large.

Several musculo- and fascio-cutaneous flaps are available for the resurfacing of such bone-exposed knee skin defects, including superior and inferior lateral genu flaps, superior and inferior medial genu flaps, anterior and posterior tibial recurrent flaps, saphenous flaps, sural flap,s anterio genu flaps, and popliteo-posterior thigh flaps, which have a rich blood supply through the major arteries. [6, 7] Harvesting these flaps requires the scarification of major vessels, which vascularizes muscles, skin and bones of the lower leg.

Microsurgical free flap transfer is also considered for repairing soft tissue defects of the knee when a skin graft or local flap is not available. However, regrettably, it leads to high-level morbidity at the donor site. Also,

microvascular anastomoses have the potential disadvantage that they require considerable surgical skill and prolong the operative period. [8]

Perforator flaps are defined as flaps consisting of skin and/or subcutaneous fat, with a blood supply from isolated perforating vessels of a stem artery. [9] This new concept highlights again that local flaps are a good option for the coverage of a difficult area of the lower legs. Recently, anatomical understanding of the perforator and angiosomes of the lower leg has increased, which allowed regional flaps to cover skin defects, providing an alternative to free flaps. [2-4]

The lateral aspect of the lower leg is one of the most suitable areas for harvesting perforator flaps because many perforator vessels arise from the peroneal artery. [10]. The clinical application of a peroneal perforator flap is similar to the peroneal flap, of which the vascular pedicle is a main artery of the lower leg; the peroneal artery [11]. However, the most significant advantages of the perforator flap are that there is no need to sacrifice any main arteries in the lower leg, and, thus, there is minimal morbidity at the donor site. This flap is thin in comparison to the gastrocnemius muscle flap, and vascularity is more reliable and its dissection is easier than the use of a reversed flow anterolateral thigh flap, which is suitable for resurfacing the patella. [5, 12]

Perforator vessels in the distal and middle thirds of the lateral lower leg usually arise from the peroneal artery; however, the most proximal perforator vessel does not always arise from the peroneal artery. Its origin was reported as the peroneal artery in 40%, the posterior tibial artery in 21%, the tibioperoneal trunk in 28%, and trifurcation of the posterior tibial and peroneal arteries in 11%. [5] In any case, this perforator vessel penetrates the soleus muscle and fascia, and reaches the skin. Thus, this perforator flap, based on the most proximal perforator of the lateral leg, was not called the peroneal perforator flap, but the soleus perforator flap. [5]

Regarding the limitation of the length and width of soleus perforator flap, no studies have been reported. The peroneal perforator flap, with a single perforator in the middle of the leg, provides up to a 24X10-cm skin paddle. A soleus perforator flap could be expected to be the same size, being of a suitable length and width for reconstruction of patella surface. [13] In our cases, the skin defects of the knee could be resurfaced completely with a 15x7 and 18x8-cm perforated flap. As the pivot point is on the proximal side of the leg, a 20x10-cm flap is sufficient to cover the patella, and can be elevated with a favorable blood supply through single perforator vessels.

An ideal flap is thought that to be a good vascularized skin paddle with the

172 same thickness and width as the wound, which minimizes negative impacts on
173 walking, creates a natural esthetic appearance, and requires a single-stage
174 operation. [13] The soleus perforator flap fully satisfies these requirements;
175 thus, it should be recommended as the first choice when the patella requires
176 resurfacing.

178 CONCLUSION

179 Pedicled soleus perforator flaps enable reconstruction of local soft tissue
180 defects of the patella without microvascular anastomoses and with minimal
181 donor-site morbidity. They provide the surgeon with a simple solution to
182 difficult problems in soft-tissue defect coverage around the knee.

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LEGENDS

221

222 Figure 1: Intraoperative view of the flap elevation. The perforator vessel,
223 which penetrated the soleus muscle, can be seen (arrows).

224 Figure 2: On the first examination, the patient had sustained a stage 4
225 pressure ulcer to the knee, measuring 9 × 6 cm.

226 Figure 3: View of the knee 1 month after surgery revealed a good skin
227 contour.

228 Figure 4: Preoperative view of reconstructive surgery. The patella bone
229 with a raw surface measuring 10 × 8 cm was observed in the right knee.

230 Figure 5: View of the knee 1 month after surgery revealed favorable
231 coverage of the wound.

Figure 1

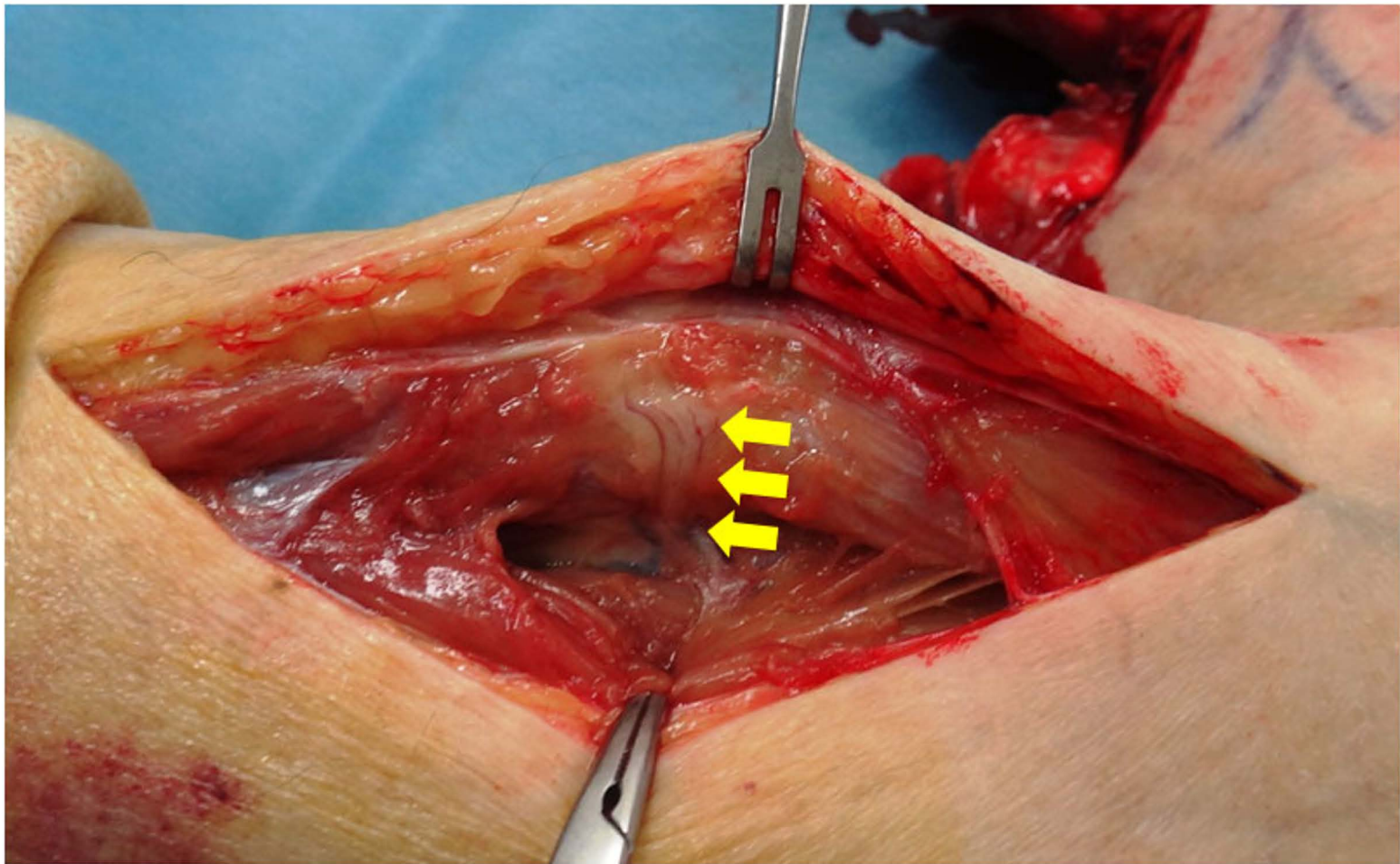


Figure 2



Figure 3



Figure 4



Figure 5

