



Descending genicular artery free flaps: Multi-purpose tissue transfers in limb reconstruction

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KEYWORDS

Free flap;
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Compound flap;
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Vascular bone graft

Summary *Background:* The descending genicular artery supplies skin, muscle, tendon, and bone structures in the medial knee area. Three types of skin perforator including musculocutaneous perforators through the vastus medialis (descending genicular artery perforator (DGAP)-vm), direct cutaneous perforators (DGAP), and saphenous artery perforators (SAP) can be elevated for the skin flap component.

Methods: This study included a prospective cohort of all patients in whom a descending genicular artery free flap was attempted in our center since January 2009. Data on patients' characteristics, type of injuries, the surgical procedures, and their outcomes were obtained for a minimum of 6 months postoperatively.

Findings: This cohort includes 22 descending genicular artery flaps for skin, bone, and tendon reconstruction after extensive soft tissue injury and/or bone nonunion. Of these, six were medial femoral condyle bone grafts, seven were skin flaps from the medial knee, and nine composite osteocutaneous or tendo-osteocutaneous flaps. Favorable outcome was achieved in 20 of 22 cases. We use the DGAP and DGAP-vm in 15 of 16 cutaneous and osteocutaneous flaps.

Conclusion: The descending genicular artery flap offers a wide range of simple and composite flaps. Recognition of all types of skin perforators should enhance the options, the chance of success, and the popularity of the flap.

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Introduction

The descending genicular artery (DGA) supplies skin, muscle, tendon, and bone structures in the medial knee area. Free saphenous skin flap from the medial knee area using the saphenous artery (SA) arising from the DGA was first described by Acland et al., in 1981.¹ A decade later, a vascularized medial femoral condyle flap from the same area was reported for a reconstructive procedure.^{2,3} Following these pioneering reports, several clinical series have used DGA for several purposes including composite flaps. However, universal acceptance of DGA free flaps has been somewhat limited by significant variations in the vascular anatomy especially skin perforators of the pedicle. Over a period of 5 years, we have gained clinical experience, using three skin perforators, including musculocutaneous perforators through the vastus medialis (descending genicular artery perforator (DGAP)-vm), direct cutaneous perforators (DGAP), and saphenous artery perforators (SAP), which can be safely elevated for free skin or composite flaps from the medial knee area. Increasing knowledge in anatomical variation and dissection method of the pedicle should enhance the options, the chance of success, and the popularity of the flap.

Patients and methods

The current clinical series is a prospective cohort of all patients in whom a DGA free flap was attempted at the Chiang Mai University Hospital, Thailand, during the period between 1 January 2009 and 30 October 2013. Information regarding patients' characteristics, preoperative evaluation, surgical procedures, postoperative course, and outcome was retrieved from the appropriate hospital and outpatient clinic records until a minimum of 6 months postoperatively. Of these 23 attempts, the DGA was absent in one scaphoid nonunion case. The superomedial genicular artery (SMGA) was used instead, and the patient was excluded from this study. Of the 22 cases, the osteoperiosteal flap was used in six cases (all scaphoid nonunion), cutaneous in seven (skin necrosis five, burn one, and wide tumor excision one), osteocutaneous in seven (extensive bone and soft tissue damage four, chronic osteomyelitis two, and tumor resection one), and tendo-osteocutaneous in two (bone, tendon, and skin damage after injury and infection). The patients' age ranged between 13 and 63 years (average 34); 17 were males and five were females. The hand and/or wrist were involved in 16 cases, the forearm in one, the ankle or foot in three, and the leg in two. The most common mechanism of injury in our case series was traumatic (motor vehicle accident), followed by surgical excision of tumor, burn, and snakebite. The condition was chronic in 10 of the 22 patients (45%), who suffered from it between 3 and 84 months prior to the DGA flap procedure; it persisted between 2 and 11 weeks in nine patients (41%); and it was acute (within 1 week of injury) in three patients (14%). In 16 of our patients (73%), other surgical procedures were attempted before the DGA flap was carried out, and in 12 patients (55%) the number of prior procedures ranged between two and six. Bone fixation was required in 16 cases (plate or screws), tendon repairs were carried out in four, and tenolysis in three.

Surgical technique

The patient was placed in the supine position with the leg externally rotated and flexed at the hip and knee under tourniquet ischemia for the donor flap elevation. For scaphoid nonunion using a medial femoral condyle vascular bone graft, we followed the technique described by Jones et al.⁴ For a skin flap, handheld Doppler was required to mark the major skin perforators of the medial knee area. The first skin incision was made on the anterior border of the skin flap, just medial to the patella. Different dissection methods depend on three types of skin perforators reaching the skin anterior to the posterior site, as follows. For the vastus medialis muscle perforator (DGAP-vm), the fascia of the vastus medialis muscle was incised, while observing for the presence of skin perforators passing through the muscle. Distal-to-proximal intramuscular dissection was required to preserve the muscle perforator until its origin at the DGA (Figure 1A). For the direct

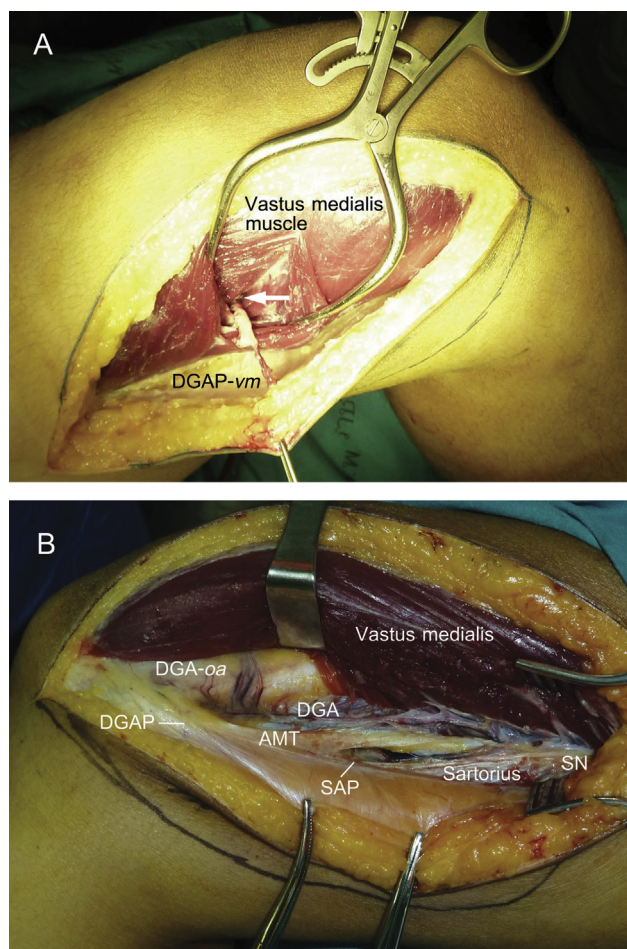


Figure 1 The dissection of skin perforators. A) DGAP-vm during intramuscular dissection. The main trunk of DGA is at the bottom of the muscular dissection (white arrow). The knee is to the right. B) DGAP and SAP dissection. DGAP arises from the distal third of the DGA and passes anterior to the adductor magnus tendon (AMT). The saphenous artery arises from the proximal part of the DGA adjacent to the saphenous nerve (SN). Distal dissection of SAP is along with the sartorius muscle posteriorly until it reaches the skin. The knee is to the left.

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