Versatility of Anterolateral Thigh Perforator Flap as a Pedicled Flap

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Abstract

The pedicled anterolateral thigh (ALT) flap based on septocutaneous or musculocutaneous perforators of the lateral circumflex femoral system is a reliable flap.

The use of ALT flap as a pedicled flap is relatively unpopular if compared with its use as a free flap.

The flap can be raised as a fasciocutaneous or muscle flap or myocutaneous flap.

The pedicled flap has got a lengthy pedicle with a liberal arc of rotation.

The pedicled flap can be used for coverage of locoregional defects in the groin, perineum, trochanteric region, medial aspect of the thigh and knee.

It can play an important role for penile reconstruction.

Key Words: Pedicled ALT flap – Anterolateral thigh flap – Perineal reconstruction – Genital reconstruction.

Introduction

IN 1984, Song and colleagues introduced the anterolateral thigh flap based on septocutaneous branches of the descending branch of the lateral circumflex femoral artery. Since that time, the anterolateral thigh flap has gained popularity for use as a soft tissue flap for reconstruction of regional as well as distant defects [1].

The ALT flap has a well known role as a free tissue transfer for reconstruction of defects in the head and neck region and the upper and lower extremities. There are only a few reports in the literature explaining the use of this flap for regional reconstruction [2].

The flap can be used as a pedicled flap for local coverage in the groin, perineum, knee and gluteal region [3].

The pedicled flap can be based proximally, with the most proximal pivot point located just distal to the origin of the LCFA off the profunda femoris artery, usually about 2cm below the inguinal ligament [4].

The main perforating arteries are derived from the descending branch of the lateral circumflex femoral artery either as a musculocutaneous or septocutaneous to the fascia lata. There are two to five perforators in the anterolateral thigh. These perforators usually lie within a 5cm circle on the mid-point of the line extending between ASIS and lateral patellar border [5].

The anterolateral thigh flap can be thinned to a significant degree without compromising blood supply and can provide long pedicle with large diameter vessels [1].

Patients and Methods

This study was done on 20 patients, 17 males and 3 females presented to Kasr Al-Ainy Hospital in the period from October 2010 till August 2013.

The study included patients with defects in groin or trochanteric region or male patients with ambiguous genitalia with preserved anterolateral thigh region.

Patients with chronic ischemia, diabetes, previous vascular surgery in ipsilateral thigh region, scarring in the anterolateral thigh region, knee instability, and those whose body mass index >40 are excluded from the study.

Preoperative preparation includes functional evaluation of knee extension as the vastus lateralis muscle is a large component of quadriceps function. Patients with impairment in knee extension or with knee instability may have increased functional deficit after anterolateral thigh flap harvest and intramuscular dissection of the vastus lateralis.
The thickness of the thigh tissue should be assessed preoperatively. Male patients with thick hair may need to shave the hair for certain types of reconstruction.

In cases of ambiguous genitalia, several investigations were done in a form of hormonal profile including FSH, LH, Estradiol & Testosterone, and radiological investigations was done in a form of pelvic U/S and MRI pelvis, and also buccal smear was taken for karyotyping, all patients who were subjected to penile reconstruction are (46XY) and approval from Egyptian medical syndicate was taken prior the operation.

Pre-operative detection of the perforator by the hand held Doppler, the pedicle is then marked and the proposed flap is designed in relation to the detected perforator, and pre operative photos were taken Figs. (1,2).

**Operative technique:**

The patient is placed in the supine position and the leg is circumferentially prepared. The defect was surgically created. The flap is redesigned accordingly with the preservation of the relation to the perforator previously marked by a Doppler.

The anterolateral thigh flap can be harvested in either a subfascial or suprafascial plane, in our study all the flaps are elevated in subfacial plane. This approach allows for easier identification of skin vessels and for better exposure of the inter-muscular septum and descending branch of the LCFA (lateral circumflex femoral artery), providing the surgeon with a general map of the vascular anatomy of the area before beginning the skin vessel and pedicle dissection.

The medial incision is made down to and through the deep fascia, exposing the rectus femoris muscle. The dissection proceeds in a lateral direction until the septum separating the rectus femoris from the vastus lateralis is visualized. The septum is exposed by retracting the rectus femoris medially. At the medial aspect, the descending branch of the LCFA can be seen running over the vastus lateralis muscle. The perforators arising from the descending branch are observed either traveling within the septum Fig. (3) or perforating the vastus lateralis muscle Fig. (4) to reach the skin of the anterolateral aspect of the thigh. For septocutaneous vessels, the dissection is performed in a retrograde fashion and the vessel is dissected away from the surrounding tissues. If the skin vessel is a musculocutaneous perforator, then intramuscular dissection is performed in the following manner: the point of exit of the perforator is exposed and the muscle fibers anterior to the vessel are “lifted up” using teeth forceps; the tenotomy scissors are used to spread in a transverse plane over the perforator, and the muscle fibers are cut. Perforator dissection proceeds until its take-off from the descending branch of the LCFA or further until adequate pedicle length is achieved. The main nerve and nerve branches supplying the vastus lateralis and the rectus femoris are carefully dissected away from the vessels and preserved.

When the perforator vessels are freed from surrounding tissues reaching to the main trunk of descending branch of LCFA, the descending branch is transected distant to the point of perforator emergence, dissection of the descending branch is completed in a proximal direction in the inter-muscular septum between rectus femoris muscle and vastus lateralis muscle up to the lateral circumflex femoris artery. If more length is required, transection of transverse branch of LCFA can be done. Dissection can be done up to the level of profunda femoris artery (2cm below the mid in-
guinal point). Then the flap is rotated and placed in the recipient site and skin closure with monocryl 3/0 was done Fig. (5).

The donor site was closed either by primary closure Fig. (6) with defects less than 10 cm width or covered by split thickness graft Fig. (7) when the defect was large (more than 10 cm width).

Early post-operative evaluation included assessment of the flap viability and early detection of hematoma, dehiscence or wound infection.

Photos were taken at 10 days, 3 months and 6 months later.

The late postoperative assessment includes assessment of the flap texture and colour match to the surroundings, donor site morbidity as regards scaring and type of closure.

The aesthetic outcome was assessed by patient satisfaction and two senior professors not involved in the operation.

Results

This study included 20 patients in which 20 flaps were done over the period from October 2010 till August 2013.

17 flaps were done in 17 males and 3 flaps were done in the 3 female. 9 flaps were done for groin defects, 7 flaps were done for trochanteric, 4 flaps were done for penile reconstruction.

The defect size was 8.5 cm in the average width and 15 cm in the average length (Table 1).
The Doppler study was done in all patients with pre-operative marking on the corresponding point on the skin. A line is drawn from the anterior superior iliac spine to the lateral aspect of the patella. A circle with 5 cm diameter is drawn with the center of the circle at the midpoint of the line. In 18 flaps the perforators were found to be within the aforementioned circle and only in 2 cases the perforators were found to be outside the circle.

In 16 cases, the perforator was musculocutaneous (80%) and only in 4 cases the perforator was septocutaneous (20%). The length of pedicle was 18 cm in average.

Donor site closure was done in 16 flaps (80%) primarily after adequate undermining of the anterior and posterior skin flaps. In the 4 remaining flaps, closure was done using split thickness graft.

The average operative time was 3-6 hours.

The early complications were in the form of hematoma in one patient, 3 cases of wound dehiscence, and infection was in 2 wounds, 1 case with partial flap necrosis and 1 case with total flap necrosis occurred and conversion to free flap in a single case.

Late complications were in the form of widening of the donor site scar in 10 flaps. Trap-door deformity in the flap had been recorded in 2 flaps and keloid formation at the edge of the flap was present in 4 patients.

The average follow-up was 6 months and the overall patient satisfaction was excellent in 4 patients, good in 4 patients, and fair in 1 patient. 1 patient required revisional surgery.

Table (1): Patients summary (MC=Musculocutanous, SC=Septocutanous, STSG=Split thickness skin graft).

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age</th>
<th>Indication</th>
<th>Flap length</th>
<th>Flap width</th>
<th>Pedicle length</th>
<th>Type of perforator</th>
<th>Donor site closure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29</td>
<td>Groin defect</td>
<td>12 cm</td>
<td>7 cm</td>
<td>17 cm</td>
<td>MC</td>
<td>Primary</td>
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<tr>
<td>2</td>
<td>27</td>
<td>Groin defect</td>
<td>14 cm</td>
<td>10 cm</td>
<td>18 cm</td>
<td>MC</td>
<td>Primary</td>
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<tr>
<td>3</td>
<td>20</td>
<td>Ambiguous genitalia</td>
<td>18 cm</td>
<td>12 cm</td>
<td>22 cm</td>
<td>SC</td>
<td>STSG</td>
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<tr>
<td>4</td>
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<td>Trochanteric defect</td>
<td>16 cm</td>
<td>8 cm</td>
<td>16 cm</td>
<td>MC</td>
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Case illustration:

Case 1 (Figs. 8-10):

A 35-year-old male patient was presented with severe hidradenitis suppurativa affecting his left groin. He took daily oral antibiotics in order to reduce flare ups, which nevertheless occurred regularly. The pain associated with these made it difficult for him to walk, and he was often embarrassed by the foul-smelling discharge. We decided to perform a radical excision and reconstruction using pedicled ALT flap. The surgery was uncomplicated and the wounds have healed well. The patient has no ongoing symptoms and has returned to a full and active life.

Case 2 (Figs. 11-13):

A 29 male patient presented to the casualty department with shot gun to right trochanteric region with extensive tissue loss, debridement was done leaving a defect over trochanteric region about 7cm width and 18cm length, Anterolateral thigh flap was raised with musculocutaneous perforator and then rotated and insitted over the defect. The surgery was uncomplicated and the wounds have healed well. The patient has no residual symptoms and has returned to a full and active life.

Case 3 (Figs. 14-16):

A 21 years male patient had congenital aphallia with a 46 XY karyotype. At birth there was a small skin tag anterior to the anus, a well formed scrotum containing two testes and a shallow pit where the penis was meant to be. The urethral opening was on the left of the anal verge. He was assigned the female gender in his ID. He was unhappy as a girl, psychological assessment was done and it reveals that he is male gender, the further investigations were done in a form of MRI pelvis which revealed absence of any gynecological organs, and then
buccal smear was taken for karyotyping which revealed (46XY). After that, approval was taken from the Egyptian medical syndicate prior the procedure. In July 2011 at the age of 20 he underwent a pedicled anterolateral thigh flap phalloplasty. His postoperative course was complicated by wound dehiscence at the dorsal aspect of the neophallus. This responded to dressings. Currently he is awaiting his second stage urethral reconstruction.

Fig. (14): Preoperative photo showing a patient with congenital aphantia.

Fig. (15): One month postoperatively photo showing viable flap, minimal wound dihescence and donor site covered with STSG.

Fig. (16): Four months postoperatively photo showing a viable flap and good cosmetic results.

**Discussion**

It has been used mainly for free tissue transfer of the head and neck region, upper extremity, and lower extremity. However there were only few reports present in the scientific literature about the use of an ALT flap for regional reconstruction [6].

The anterolateral thigh (ALT) flap has a great popularity for soft tissue reconstruction because of its long vascular pedicle and adequate size vessels, and the availability of different tissues for resurfacing of medium and large size defects. Also the donor site morbidity is minimal and most of the wounds can be closed primarily [7].

There are many advantages if the ALT flap is used as a pedicle flap. First of all there is no microvascular anastomosis required. The flap has a wide arc of rotation, which allows it to be transposed to either side of the pedicle and to resurface a more distal defect. This long pedicle allows the flap to be transferred up to the umbilicus level [8].

The flap can provide a durable skin and soft-tissue coverage for reconstruction of the groin and perineal wound, which is better than skin grafts because of frequent urinary and faecal contamination causing tissue maceration and damage [9].

Many have postulated their successful scrotal reconstruction by ALT flap with excellent results after Fournier's gangrene [10].

Sun et al., have reported their use of a pedicled ALT flap for reconstructionof the vulva after vulvectomy in 14 cases [11].

The length of the vascular pedicle should be about 120% of the distance between the pivot points of the vascular pedicle and the proximal edge of the defect to avoid kinking of the pedicle when the flap is transferred. Moreover, when a longer pedicle is needed, an additional length can be gained by dissection proximally to the level of the profunda femoris artery and vein [12].

A variety of regional flaps have been described for the reconstruction of groin defects. These include the tensor fascia lata flap (TFL) and the vertical rectus abdominus flap. Both flaps are reliable and provide good quality soft tissue. The TFL usually causes a dog-ear and the donor site can be closed primarily or by split skin grafting. Harvesting a vertical rectus abdominus flap involves a major surgery to the abdominal wall, producing postoperative abdominal weakness and the possibility of postoperative abdominal bulging and hernia formation [4].

In phalloplasty cases, the ‘ideal’ flap should provide good length, a hidden donor site, sensate, have enough space for applying penile implant and allow completion in a single stage. The pedicled ALT flap has two major benefits over the free RFFF. Its donor site is hidden in everyday clothing and it does not require a microvascular anastomosis.

In this thesis, surgery was performed on 20 patients, 17 males and 3 females in which 20 flaps in the period from October 2010 till August 2013.

9 flaps were done for groin defects, 7 flaps were done for trochanteric, 4 flaps were done for penile reconstruction.

In groin defect cases, 5 cases with hidradenitis suppurativa, 3 cases with post traumatic defect over the groin and a single case with lymphoedema following vascular surgery. The 9 flaps passed with good outcomes with minimal complications with primary closure in the donor site in all cases.

In trochanteric defects cases, 4 cases with bed sore and 3 cases with traumatic defects. The flap was raised and the flap was dissected till adequate length was reached. Five flaps passed with acceptable results and a single flap with partial necrosis with primary closure in the donor site in all cases.

In phalloplasty cases, 4 patients presented with ambiguous genitalia, 3 cases passed with acceptable results, one case with total loss with closure of the donor site with split thickness grafting in all cases.

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الملخص العربي

إن السديلة المعقلة الأمامية الجانبية للفخذ سديلة موثوق فيها، وهي تعتمد من الأساس على النظام الفخذي المنعطف الجانبي.

إن الشريانين الجانبين ينبعان من الفرع الساطع المنبع من الشريان الفخذي المنعطف الجانبي، ثم يمر من خلال العضلات أو من خلال الحاجز بين العضلات.

إن السديلة الحرة الأمامية الجانبية للفخذ هي صيلة معنوية في كثير من المراكز، وبالرغم من هذا فإن استخدامها كسديلة معقلة قليل وغير مشهور.

يمكن استخدام هذه السديلة كسديلة فعالة - جلدية أو عضلية - جلدية.

تمتلك هذه السديلة عمق طويل مع وجود مدى واسع للدوران.

يمكن استخدام هذه السديلة لتفتيح الأماكن المجاورة مثل المنطقة الإربية، منطقة العجان، منطقة الحرككي (المنزوري)، الجانب الداخلي من الفخذ والركبة.

بالإضافة لدورها في تغطية الأماكن المجاورة، فإن لها دور مهم في إعادة بناء القضيب.