

# 以旋股外侧动脉斜支为蒂的逆行股前外侧皮瓣临床应用研究



蒋丽雅, 刘元波, 臧梦青, 朱珊, 陈博, 李杉珊

中国医学科学院整形外科医院整形十一科(北京 100144)

**【摘要】** 目的 探讨以来自旋股外侧动脉降支的斜支为蒂的逆行股前外侧皮瓣(distally based anterolateral thigh flap, dALT)修复下肢皮肤软组织缺损的可行性及技术要点。方法 2010年7月—2016年7月实施的18例dALT皮瓣手术中,应用以来自旋股外侧动脉降支的斜支为蒂的dALT皮瓣修复下肢皮肤软组织缺损7例。男4例,女3例;年龄3~58岁,平均26.7岁。膝关节附近血管纤维脂肪瘤、恶性纤维组织细胞瘤、软组织肉瘤各1例,病程分别为13年、1年、8个月;烧伤后膝关节周围瘢痕挛缩4例,病程6个月~35年。术中切除病变组织后遗留缺损范围为8 cm×6 cm~24 cm×8 cm,皮瓣切取范围为9 cm×7 cm~24 cm×8 cm;血管蒂长度为12~22 cm,平均16.6 cm;皮瓣旋转点至髌骨外上缘距离为9.5~14.0 cm,平均11.8 cm。供区直接拉拢缝合6例,植皮修复1例。结果 术后皮瓣及植皮均顺利成活,受区创面及供区切口均I期愈合。患者均获随访,随访时间5~54个月,平均30.7个月。皮瓣颜色、质地与受区周围皮肤相似。随访期间肿瘤患者无肿瘤复发,关节周围瘢痕挛缩患者伸屈功能及外观明显改善。结论 如斜支来自旋股外侧动脉降支,具有足够长度共干血管,同时斜支发出皮肤穿支血管至股前外侧区,则可以选择以斜支为蒂的dALT皮瓣修复下肢皮肤软组织缺损。

**【关键词】** 逆行股前外侧皮瓣;旋股外侧动脉;斜支;降支;下肢;软组织缺损;创面修复

## Clinical applications of distally based anterolateral thigh flaps based on perforating vessels from lateral circumflex femoral artery oblique branch

JIANG Liya, LIU Yuanbo, ZANG Mengqing, ZHU Shan, CHEN Bo, LI Shanshan

No.11 Department of Plastic and Reconstructive Surgery, Plastic Surgery Hospital, Chinese Academy of Medical Sciences and Peking Union Medical School, Beijing, 100144, P.R.China

Corresponding author: LIU Yuanbo, Email: ybpumc@sina.com

**【Abstract】 Objective** To explore the feasibility and technical points of soft tissue defect reconstruction of the lower extremity using the distally based anterolateral thigh (dALT) flap based on perforating vessels from the lateral circumflex femoral artery (LCFA) oblique branch. **Methods** Between July 2010 and July 2016, 7 patients underwent defect reconstruction of the lower extremities using the dALT flap based on perforating vessels from the LCFA oblique branch. There were 4 males and 3 females with an average age of 26.7 years (range, 3-58 years). The etiologies included angiofibrolipoma in 1 case, malignant fibrous sarcoma in 1 case, soft tissue sarcoma in 1 case, and post-burn scar contracture in 4 cases. The disease duration was 13 years, 1 year, and 8 months in 3 patients with tumors respectively, and was from 6 months to 35 years in 4 patients with post-burn scar contracture. After resection of lesion tissues, the defect size ranged from 8 cm×6 cm to 24 cm×8 cm. The flap size ranged from 9 cm×7 cm to 24 cm×8 cm. The length of the pedicle ranged from 12 to 22 cm (mean, 16.6 cm). The distance from the flap pivot point to the superolateral border of the patella ranged from 9.5 to 14.0 cm (mean, 11.8 cm). The donor sites were directly closed in 6 cases and covered with the split-thickness skin graft in 1 case. **Results** All flaps survived after surgery without any major complications. All wounds at the donor and the recipient sites healed primarily. The patients were followed up from 5 to 54 months (mean, 30.7 months). The color, texture, and thickness of the flaps were similar to those of the surrounding skin. No tumor recurrence was observed. The range of motion of flexion and extension of the knee joint were greatly improved in

the patients with post-burn scar contracture. **Conclusion** For patients who have the oblique branch from the LCFA descending branch which sends out perforating vessels to the skin of the anterolateral thigh region, a dALT flap could be used to reconstruct soft tissue defects of the lower extremities.

**【Key words】** Distally based anterolateral thigh flap; lateral circumflex femoral artery; oblique branch; descending branch; lower extremity; soft tissue defect; wound repair

1990年,张功林等<sup>[1]</sup>首次报道了逆行股前外侧皮瓣(distally based anterolateral thigh flap, dALT),目前这一皮瓣已成为修复膝关节周围皮肤软组织缺损的常用皮瓣。2009年,Wong等<sup>[2]</sup>首次报道了旋股外侧动脉斜支及其临床应用;迄今罕见斜支在dALT皮瓣中应用的报道。2010年7月-2016年7月,我们共实施18例dALT皮瓣手术,其中应用以来自旋股外侧动脉降支的斜支为蒂的dALT皮瓣修复下肢皮肤软组织缺损7例,获得满意效果。报告如下。

### 1 临床资料

#### 1.1 一般资料

本组男4例,女3例;年龄3~58岁,平均26.7岁。膝关节附近血管纤维脂肪瘤、恶性纤维组织细胞瘤、软组织肉瘤各1例,瘤体大小分别为8 cm×6 cm、12.0 cm×6.5 cm和12 cm×8 cm;病程分别为13年、1年、8个月。烧伤后膝关节周围瘢痕挛缩4例,其中2例术前膝关节可基本伸直,2例膝关节最大伸直角度分别为120°和90°;病程6个月~35年。

#### 1.2 手术方法

**1.2.1 皮瓣设计** 连接髌前上嵴和髌骨外上缘画一直线(AP线),大致相当于大腿外侧肌间隔位置,标记该线中点;本组AP线长22~44 cm,平均33 cm。沿AP线,应用超声多普勒探测穿支血管并标记,并与术前CT血管造影结果进行对照。

**1.2.2 皮瓣切取及创面修复** 全麻下,患者取仰卧位手术。首先切除膝关节周围病变组织,遗留缺损范围为8 cm×6 cm~24 cm×8 cm。根据缺损大小和形状设计皮瓣。作股直肌上内侧切口,深达大腿深筋膜下,自内向外进行剥离,找到外侧肌间隔;自远端打开外侧肌间隔,由远端向近端进行剥离,逐步显露旋股外侧动脉降支,注意保护有可能在外侧肌间隔内走行的肌间隔穿支血管;外侧肌间隔全部打开后,观察旋股外侧动脉、尤其是降支的分支分布情况。

如果存在斜支、来自降支,且有皮肤穿支血管分布至股前外侧区,则以斜支为蒂掀起dALT皮

瓣;如果皮肤穿支血管为肌间隔穿支血管,则直接游离穿支血管,一直达斜支在降支上的发出点;如果皮肤穿支血管为肌皮穿支血管,则首先在股外侧肌内剥离穿支血管,然后剥离斜支,一直达斜支在降支上的发出点。剥离降支血管,一直达降支在股外侧肌上的进肌点,为避免过度剥离造成血管痉挛和损害,不选择在股外侧肌内对降支进一步剥离以增加血管蒂长度,因此降支进肌点即为皮瓣的旋转点;对降支动脉和伴行静脉口径进行观测。此时,在降支发出斜支血管的近端结扎并切断降支,完全掀起皮瓣,血管蒂剥离过程中,注意保护支配肌肉的运动神经,见图1。通过明道(4例)或皮下隧道(3例)将皮瓣转移至受区,观察皮瓣血运可靠,血管蒂无受压、打折、扭曲后,关闭缝合切口。本组皮瓣切取范围为9 cm×7 cm~24 cm×8 cm;血管蒂长度为12~22 cm,平均16.6 cm;皮瓣旋转点至髌骨外上缘距离为9.5~14.0 cm,平均11.8 cm;来自斜支的皮肤穿支血管包括肌皮穿支血管4支,肌间隔穿支血管3支。供区6例直接拉拢缝合,1例采用腹部全厚皮片植皮修复。

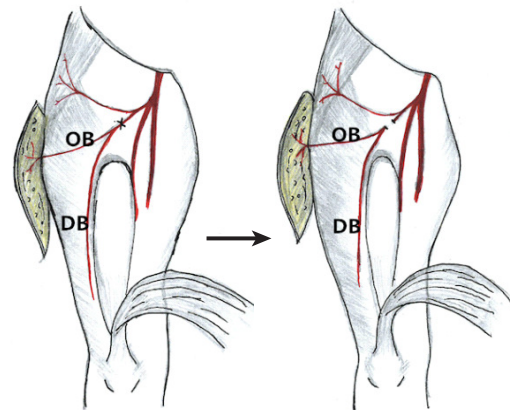


图1 皮瓣切取示意图 DB:旋股外侧动脉降支;OB:斜支

Fig.1 Diagrammatic sketch of the anatomical basis of the dALT flap DB: LCFA descending branch; OB: Oblique branch

#### 1.3 术后处理

术后常规给予低分子右旋糖酐行抗凝治疗3~5 d,术后5 d内定时观察皮瓣颜色和指压反应,

监测皮瓣血运。术后 14 d 拆除切口缝线，鼓励患者下地活动。

## 2 结果

本组术后皮瓣均顺利成活，创面 I 期愈合；供区切口 I 期愈合，1 例游离植皮顺利成活。患者均获随访，随访时间 5~54 个月，平均 30.7 个月。皮瓣颜色、质地与受区周围皮肤相似。随访期间肿瘤患者无肿瘤复发；膝关节周围瘢痕挛缩患者术后膝关节基本可伸直，伸屈功能及外观明显改善。

## 3 典型病例

患儿 男，3 岁。因右侧下肢烫伤后瘢痕形成、膝关节屈曲畸形 6 个月入院。入院检查：右侧臀部、右下肢后侧增生性瘢痕，膝关节伸直受限，最大伸直角度 90°。术中首先切除部分膝关节后侧瘢痕，彻底松解挛缩，遗留缺损面积为 16 cm×7 cm；切取来自旋股外侧动脉降支的斜支为蒂

的 dALT 皮瓣，明道转移至膝关节后侧和大腿外侧修复缺损。皮瓣切取面积为 17 cm×8 cm；血管蒂长度(降支和斜支总长度)为 12 cm，穿支蒂长度 5 cm，AP 线长 23 cm，皮瓣旋转点至髌骨外上缘距离为 9.5 cm。供区上方直接拉拢缝合，下方取对侧腹部中厚皮片修复。术后皮瓣及植皮均顺利成活，创面 I 期愈合。患儿获随访 6 个月，皮瓣颜色、质地和膝关节周围皮肤相似，膝关节可以完全伸直，膝关节伸屈功能明显改善。见图 2。

## 4 讨论

一般认为，股前外侧皮瓣的血供来自旋股外侧动脉降支<sup>[3]</sup>；也有学者注意到股前外侧皮瓣的穿支血管也可以来自其他源血管，而非降支<sup>[4-5]</sup>。2009 年 Wong 等<sup>[2]</sup>首次明确提出“旋股外侧动脉斜支”的存在，作者通过对 89 块皮瓣的回顾性分析，发现 34% 的患者存在斜支，斜支为股外侧肌和股前外侧皮肤提供血供；斜支可以来自降支(35.5%)、横支



图 2 典型病例 a. 术前皮瓣设计；b. 术前瘢痕范围及膝关节屈曲畸形；c. 术中见来自旋股外侧动脉降支(黑色箭头)的斜支(黄色箭头)，且有肌间隔穿支血管分布至股前外侧区；d. 术中在旋股外侧动脉降支发出斜支的近端切断降支，掀起皮瓣；e, f. 术后 1 个月皮瓣成活，供区植皮成活，膝关节伸屈功能明显改善

Fig.2 A typical case a. Preoperative flap design; b. Preoperative view, showing severe scar contracture and flexion deformity of the knee; c. Intraoperative view, showing that the LCFA oblique branch (yellow arrow) originated from the LCFA descending branch (black arrow), and a septocutaneous perforator to the anterolateral thigh region; d. Intraoperative view, showing the flap was completely raised after ligation of the proximal portion of the LCFA descending branch; e, f. The flap and free skin graft at donor site all survived completely and the range of motion of flexion and extension of the right knee joint were obviously improved at 1 month after operation



(51.6%)或旋股外侧动脉(6.5%),甚至可直接来自股深动脉(3.2%)或股动脉(3.2%);并证实以斜支为蒂,可以安全地掀起股前外侧皮瓣或肌皮瓣。虽然,有学者就斜支是否真正存在提出质疑,并认为斜支可能是低位横支<sup>[6]</sup>,但是近年来以斜支为蒂掀起带蒂或游离股前外侧皮瓣的报道逐渐增多<sup>[2,7-9]</sup>,并被称为股前外侧皮瓣研究领域的最新进展<sup>[10]</sup>。

结合既往文献报道,我们总结旋股外侧动脉斜支的临床意义及潜在应用价值主要有以下方面:

①在掀起一个股前外侧肌皮瓣时,供养股前外侧区皮肤的穿支血管可能来自斜支,而非降支,因此即使将大量股外侧肌包括在肌皮瓣内,也有可能出现皮肤坏死<sup>[2,11-12]</sup>;为避免出现上述情况,Wong等<sup>[7]</sup>提出了一种切取股前外侧肌皮瓣的改良方式,建议在切断肌肉前,完全打开外侧肌间隔,向近端对1~2支粗大的穿支血管进行解剖剥离,清楚显示穿支血管的来源血管。如果穿支血管来自降支,则可按传统方法切取肌皮瓣;如果穿支血管来自斜支,后者与降支汇合,构成共干血管,则可以选择这一共干血管作为肌皮瓣的血管蒂;而一旦斜支和降支分别来自不同的源血管,并分别为股前外侧皮肤和股外侧肌提供血供,那么就要以斜支和降支为蒂切取肌皮瓣,如为游离移植,则需要吻合上述2组血管。

②在掀起股前外侧皮瓣或肌皮瓣时,如果斜支来自降支,且创面修复不需要较长血管蒂时,就可以仅以斜支为蒂掀起皮瓣,而不切断降支,从而降低供区继发损害<sup>[2]</sup>。

③对于牵涉不同组织类型的复杂缺损时,嵌合皮瓣是较好的选择,而斜支的存在,使得在股前外侧区切取嵌合皮瓣变得更灵活<sup>[9]</sup>。

④应用游离皮瓣修复大腿软组织缺损的难点之一是理想的受区血管匮乏;切断旋股外侧动脉降支,其近端断端和反向供血的远端断端都可以作为显微血管吻合的受区血管<sup>[13-14]</sup>;如果斜支存在,且口径适当,也可以作为显微外科血管吻合潜在的受区血管。

⑤无论是近端蒂股前外侧皮瓣<sup>[15-16]</sup>,还是dALT皮瓣<sup>[17-18]</sup>,可以分别用于自腹壁到小腿近端范围缺损的修复;以斜支为蒂掀起近端蒂股前外侧皮瓣,最大优点是无需切断降支;而以斜支为蒂的dALT皮瓣,尚罕见文献报道。

dALT皮瓣是修复膝关节周围皮肤软组织缺损的常用皮瓣之一,这一非生理性皮瓣的解剖学基础已得到深入研究<sup>[1,17-19]</sup>,而以斜支为蒂的dALT皮瓣尚未见临床应用报道。在我们实施的18例dALT皮瓣手术患者中,有7例(38.9%)dALT皮瓣以来自旋股外侧动脉降支的斜支为蒂;我们发现与来自

降支的穿支血管相比,来自斜支的穿支血管中,肌间隔穿支血管的出现率比较高;而且,即使来自斜支的穿支血管为肌皮穿支血管,其上也仅覆盖很薄的一层股外侧肌,穿支血管的解剖剥离相对较简单<sup>[2]</sup>;Lakhiani等<sup>[10]</sup>甚至将这种类型的肌皮穿支血管称作肌肉肌间隔或半肌间隔穿支血管。由于斜支在降支的发出点更加靠近近端,以之为蒂切取的dALT皮瓣具有更长的血管蒂,皮瓣的修复范围得以扩大,这成为以斜支为蒂的dALT皮瓣的最大优点。

斜支解剖学变异和缺如是以斜支为蒂的dALT皮瓣的主要缺点,我们收治的18例患者中,有7例(38.9%)存在来自旋股外侧动脉降支的斜支,斜支的出现率与Wong等<sup>[2]</sup>报道相似。CT血管造影可以清楚显示旋股外侧动脉的分支分布情况,显示斜支是否存在及其来源。如果斜支来自旋股外侧动脉横支,从理论上讲仍然可以掀起dALT皮瓣,但是游离血管蒂需要切断众多营养股前外侧肌肉的肌支,供区损害较大。如果斜支不是来自旋股外侧动脉及其分支,则不能直接掀起dALT皮瓣,在这种情况下,可以考虑:①以来自降支的穿支血管为蒂掀起皮瓣;②将dALT皮瓣转化为游离皮瓣,即切断斜支和降支,以反流供血的降支为受区血管,对降支和斜支进行血管吻合。许多学者观察到在毗邻血管体区和穿支体区之间,各自的穿支血管在口径方面存在互反关系<sup>[20]</sup>或穿支优势现象<sup>[21]</sup>。我们通过观察本组患者,发现来自降支的斜支血管至少可以分成两种类型:仅有皮肤穿支的斜支和同时具有分布到股外侧肌肌支的斜支,如果来自斜支的肌支粗大,那么来自降支的分布到股前外侧区皮肤穿支和肌支可能相对比较细小,反之亦然。但是由于本组病例数有限,是否真正存在这一关系,有待进一步研究。

总之,如果斜支存在且来自降支,并发出皮肤穿支血管分布到股前外侧区,则可以斜支为蒂切取dALT皮瓣,用于膝关节周围皮肤软组织缺损的修复;与传统的以来自降支的穿支血管为蒂的dALT皮瓣相比,以斜支为蒂的dALT皮瓣具有血管蒂解剖相对容易,血管蒂长,可以转移更远的距离,用于膝关节周围和小腿近端缺损的修复。

#### 参考文献

- 1 张功林,葛宝丰,姜世平,等.逆行股前外侧岛状皮瓣和肌皮瓣移植术.中华医学杂志,1990,70(12):676-678.
- 2 Wong CH, Wei FC, Fu B, et al. Alternative vascular pedicle of the anterolateral thigh flap: the oblique branch of the lateral circumflex femoral artery. *Plast Reconstr Surg*, 2009, 123(2): 571-577.

- 3 Xu DC, Zhong SZ, Kong JM, *et al.* Applied anatomy of the anterolateral femoral flap. *Plast Reconstr Surg*, 1988, 82(2): 305-310.
- 4 Kimata Y, Uchiyama K, Ebihara S, *et al.* Anatomic variations and technical problems of the anterolateral thigh flap: a report of 74 cases. *Plast Reconstr Surg*, 1998, 102(5): 1517-1523.
- 5 Shieh SJ, Chiu HY, Yu JC, *et al.* Free anterolateral thigh flap for reconstruction of head and neck defects following cancer ablation. *Plast Reconstr Surg*, 2000, 105(7): 2349-2360.
- 6 Hubmer MG, Feigl G. Alternative vascular pedicle of the anterolateral thigh flap: does an oblique branch really exist? *Plast Reconstr Surg*, 2010, 125(5): 1560-1581.
- 7 Wong CH, Kao HK, Fu B, *et al.* A cautionary point in the harvest of the anterolateral thigh myocutaneous flap. *Ann Plast Surg*, 2009, 62(6): 637-639.
- 8 Wong CH, Ong YS, Wei FC. The anterolateral thigh-Vastus lateralis conjoint flap for complex defects of the lower limb. *J Plast Reconstr Aesthet Surg*, 2012, 65(2): 235-239.
- 9 Liu WW, Guo ZM. Reconstruction of wide-apart double defect using a branch-based chimeric anterolateral thigh flap. *Plast Reconstr Surg Glob Open*, 2014, 2(1): e96.
- 10 Lakhiani C, Lee MR, Saint-Cyr M. Vascular anatomy of the anterolateral thigh flap: a systematic review. *Plast Reconstr Surg*, 2012, 130(6): 1254-1268.
- 11 da Costa AC, Lancelotti CL. Oblique branch of the lateral circumflex femoral artery also found in 32 percent of cadavers in Brazil. *Plast Reconstr Surg*, 2009, 124(3): 1011-1012.
- 12 Wong CH. The oblique branch trap in the harvest of the anterolateral thigh myocutaneous flap. *Microsurgery*, 2012, 32(8): 631-634.
- 13 Hallock GG. The vascular pedicle of the anterolateral thigh flap as an alternative recipient site for thigh free flaps. *J Reconstr Microsurg*, 2008, 24(2): 131-136.
- 14 Gao SH, Feng SM, Chen C, *et al.* A new recipient artery for reconstruction of soft-tissue defects in the lower limb with a free anterolateral thigh flap: the reversed descending branch of the lateral femoral circumflex artery. *Plast Reconstr Surg*, 2012, 130(5): 1059-1065.
- 15 Cadenelli P, Bordoni D, Radaelli S, *et al.* Proximally based anterolateral-thigh (ALT) flap for knee reconstruction: an advancement propeller perforator flap. *Aesthetic Plast Surg*, 2015, 39(5): 752-756.
- 16 Ding Q, Zang M, Yu S, *et al.* Nearly total unilateral buttock reconstruction with a proximally pedicled anterolateral thigh flap: a case report. *J Plast Reconstr Aesthet Surg*, 2013, 66(6): e166-168.
- 17 Zhou G, Zhang QX, Chen GY. The earlier clinic experience of the reverse-flow anterolateral thigh island flap. *Br J Plast Surg*, 2005, 58(2): 160-164.
- 18 Demirseren ME, Efendioğlu K, Demiralp CO, *et al.* Clinical experience with a reverse-flow anterolateral thigh perforator flap for the reconstruction of soft-tissue defects of the knee and proximal leg. *J Plast Reconstr Aesthet Surg*, 2011, 64(12): 1613-1620.
- 19 Pan SC, Yu JC, Shieh SJ, *et al.* Distally based anterolateral thigh flap: an anatomic and clinical study. *Plast Reconstr Surg*, 2004, 114(7): 1768-1775.
- 20 Yu P. Inverse relationship of the anterolateral and anteromedial thigh flap perforator anatomy. *J Reconstr Microsurg*, 2014, 30(7): 463-468.
- 21 Rozen WM, Grinsell D, Koshima I, *et al.* Dominance between angiosome and perforator territories: a new anatomical model for design of perforator flaps. *J Reconstr Microsurg*, 2010, 26(8): 539-545.

收稿日期: 2016-12-20 修回日期: 2017-03-13

本文编辑: 刘丹