·经验交流·

不同节段的穿支蓄腓肠神经营养血管皮瓣修复下肢缺损

孟朝晖, 梁钢, 孙建平
(绍兴第二医院暨浙江大学附属第一医院绍兴分院烧伤整形外科, 浙江　绍兴　312000)

【摘要】 **目的**: 探讨不同节段的穿支蓄腓肠神经营养血管皮瓣修复下肢缺损的适应证和临床效果。**方法**: 2004 年至 2012 年治疗 13 例下肢软组织缺损患者, 男 8 例, 女 5 例; 年龄 15~76 岁, 平均 38.6 岁。采用 3 种不同节段的穿支蓄腓肠神经营养血管皮瓣进行修复, 包括外踝尖后上 4~7 cm 处腓动脉穿支蓄腓肠神经营养血管皮瓣修复足、踝部缺损 8 例; 外踝尖后上 9~11 cm 处腓动脉穿支蓄腓肠神经营养血管皮瓣修复小腿下段缺损 3 例; 外踝尖后上 1~2 cm 处外踝后动脉穿支蓄腓肠神经营养血管皮瓣修复足跟缺损 2 例。皮瓣切取面积为 4.5 cm×2.5 cm~16 cm×10 cm。供瓣区创面移植皮片修复。**结果**: 13 例皮瓣术后均未发生血管危象及切口感染, 皮瓣均顺利成活, 切口均Ⅰ期愈合。8 例患者获得随访, 时间 1~12 个月, 平均 6 个月, 皮瓣色泽、质地良好, 厚薄适中, 无烫伤及溃疡发生; 供、受区外形及功能恢复较为满意。**结论**: 灵活选用不同节段的穿支蓄腓肠神经营养血管皮瓣修复下肢缺损, 可获得理想效果。

【关键词】 软组织损伤;　外科皮瓣;　腓肠神经;　下肢;　修复重建外科
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Utility of different levels of perforator-based sural neurofasciocutaneous flaps in repairing lower limb defects　*MENG Chao-hui, LIANG Gang, and SUN Jian-ping. Department of Burns and Plastic Surgery, the Second Hospital of Shaoxing City, Shaoxing* 312000, *Zhejiang*, *China*

ABSTRACT　**Objective**: To investigate the indications and effects of different levels of perforator-based sural neurofasciocutaneous flaps in repairing lower limb defects. **Methods**: From 2004 to 2012, 13 cases of soft tissue defects of lower extremity were successfully reconstructed using different levels of perforator-based sural neurofasciocutaneous flaps, included 8 males and 5 females with an average age of 38.6 years old ranging from 15 to 76 years old. Perforator-based sural neurofasciocutaneous flaps located at 4 to 7 cm above the tip of the lateral malleolus were used to resurface ankle and foot defects in 8 cases, perforator-based sural neurofasciocutaneous flaps located on 9 to 11 cm above the tip of the lateral malleolus were used to resurface lower third leg defects in 3 cases, as well as perforator-based sural neurofasciocutaneous flaps located on 2 cm above the tip of the lateral malleolus were used to repair heel defects in 2 cases. The area of the transferred flaps ranged from 4.5 cm×2.5 cm to 16 cm×10 cm. The donor sites were covered with skin grafts. **Results**: All the flaps survived uneventfully with primary healing. Eight patients were follow-up for 1 to 12 months with an average of 6 months. The color, luster and texture of flap were good, thickness of flaps was fair. No empyrosis and ulcer occurred. The contour and function were satisfied with both the donor and recipient site. **Conclusion**: Satisfactory functional results can be achieved by using different segment of perforator-based sural neurofasciocutaneous flaps for repairing lower extremity defects.

KEYWORDS　Soft tissue injuries ; Surgical flaps;　Sural nerve;　Lower extremity;　Reconstructive surgical procedures
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穿支蓄皮神经营养血管皮瓣因综合了皮神经营养血管皮瓣和穿支皮瓣的优点而备受关注, 在临床上获得了广泛的应用[1-3]。自 2004 年至 2012 年, 笔者先后采用 3 种不同节段的穿支蓄腓肠神经营养血管皮瓣为 13 例小腿下段和足踝部缺损的患者进行了修复, 效果较为满意, 现介绍如下。

1　临床资料

本组 13 例中, 男 8 例, 女 5 例; 年龄 15~76 岁, 平均 38.6 岁。致伤原因: 排气管烫伤 4 例, 热压伤 3 例, 电烧伤 2 例, 慢性溃疡 2 例, 交通伤 1 例, 炽热物体烫伤 1 例。缺损部位: 踝背及足背 3 例, 小腿下段 3 例, 足跟 3 例, 踝背侧 2 例, 足背 2 例。损伤程度: 均伴有不同程度的骨关节、肌腱、神经血管束等外露或损伤。缺损面积: 3.5 cm×2 cm~14 cm×9 cm; 皮瓣面积: 4.5 cm×2.5 cm~16 cm×10 cm。

2　手术方法

2.1　皮瓣类型　外踝尖后上 4~7 cm 处的腓动脉穿支蓄腓肠神经营养血管皮瓣修复足踝部缺损 8 例;

通讯作者: 梁钢　E-mail: tianyiliangyuan@163.com

外踝尖后上 9~11 cm 处的腓动脉穿支蒂腓肠神经营养血管皮瓣修复小腿下段缺损 3 例；外踝尖后上 1~2 cm 处的外踝后动脉穿支筋膜蒂腓肠神经营养血管皮瓣修复足跟部缺损 2 例。

2.2　皮瓣设计　以腘窝中点至跟腱与外踝连线的中点为轴线设计皮瓣。旋转点可根据小腿下段和足部缺损的位置定位于以下 3 个节段，即外踝尖后上 1~2 cm，外踝尖后上 4~7 cm 以及外踝尖后上 9~11 cm。术前可借助超声多普勒血流探测仪帮助确定不同节段穿支的浅出点。对皮瓣紧邻创面者，直接以穿支蒂或穿支筋膜蒂为轴逆转即可；对皮瓣与创面之间有一定距离者，先在旋转点与皮瓣远端之间携带一皮肤筋膜蒂（皮蒂宽 1~2 cm，筋膜蒂宽 3~4 cm），再以穿支蒂或穿支筋膜蒂为轴逆转。

2.3　皮瓣切取及转移　先切开皮瓣远端或皮肤筋膜蒂两侧，于深筋膜下向旋转点处寻找相应的腓动脉穿支和腓肠神经-小隐静脉及其营养血管。确定其存在后，切开皮瓣的近端并切断腓肠神经-小隐静脉及其营养血管，此处应注意将腓肠神经于高位以锐刀离断，然后在深筋膜与肌膜之间向旋转点处逆行分离皮瓣，边分离边间断缝合皮下与深筋膜缘，以免皮神经和浅静脉干与皮瓣分离。最后视穿支的情况，决定蒂部的处理方式。若存在明确而又粗大的穿支，尤其是外踝上 4~7 cm 及以上的穿支，则可切断与肢体远端相连的筋膜组织蒂，并将影响穿支蒂自由旋转的筋膜组织也切断，形成仅以此粗大穿支为蒂的腓肠神经营养血管皮瓣。若穿支较为细小，尤其是接近外踝的穿支，则不应该切断上述筋膜组织蒂，而应该形成以穿支筋膜组织为蒂的腓肠神经营养血管皮瓣，以确保皮瓣的血运。为了避免浅静脉干对皮瓣的倒灌作用，还应该结扎蒂部的浅静脉干。至此，皮瓣已经分离完毕，将其直接转移或通过开放隧道转移至受区。

3　结果

本组 13 例患者术后皮瓣均未发生血管危象及切口感染，切口均Ⅰ期愈合。术后 8 例患者获得了 1~12 个月随访，平均 6 个月，皮瓣及蒂部色泽、质地良好，厚薄适中，未行皮瓣修薄术，患者获得了一定的保护性感觉（指皮瓣转移后，随着时间的推移，受区神经末梢逐渐长入而获得的粗略感觉，其可较好地避免烧、烫伤以及外伤等；而两点辨别觉等精细感觉的满意恢复，必须建立在神经精确吻合的基础上）无烫伤及溃疡发生；供瓣区外观尚可，无痛性神经瘤，患足遗留一定的感觉缺失。患者足、踝部功能恢复满意。典型病例见图 1-2。

4　讨论

皮神经营养血管皮瓣本质上是一种特殊类型的筋膜皮瓣，其轴线上存在由节段性营养血管沿皮神经走行方向相互沟通形成的纵向链式神经营养血管丛，此为远距离供血和切取长皮瓣提供了解剖基础，这种链式供血最终将依赖穿支血管来实现[4-5]。柴益民等[6]在临床上应用穿支蒂皮神经营养血管皮瓣获得了满意的效果，并提出深部动脉主干→穿支动脉→皮神经营养血管网→相应皮瓣→皮下静脉网→穿支伴行静脉→深静脉干的完整皮瓣循环系统，由此可见，皮神经营养血管皮瓣也一种特殊类型的穿支皮瓣。鉴于该类皮瓣具有上述独特的优势，故笔者结合小腿下段和足部缺损的具体部位，选用了 3 种不同节段的腓动脉穿支蒂腓肠神经营养血管皮瓣修复相应部位的创面，取得了满意的效果。

对于大多数足踝部缺损的患者，本组选用以外踝尖后上 4~7 cm 处的腓动脉穿支蒂腓肠神经营养血管皮瓣进行修复，由于其穿支蒂较为明确而又粗大，故切断与肢体远端相连的筋膜蒂和一切影响穿支自由旋转的筋膜组织，以形成仅以单一穿支为蒂的腓肠神经营养血管皮瓣，这既保留了皮神经营养

图 1　患者，女，51 岁，左小腿下 1/3 段炽热物体烫伤后创面　**1a.** 术前创面情况　**1b.** 胫后神经血管束外露创面的扩创及外踝尖后上 10 cm 处腓肠神经营养血管皮瓣的设计　**1c.** 术后 2 个月，皮瓣色泽、质地良好，供、受区外形和功能恢复较为满意

Fig.1　A 54-year-old female patient with a wound on the distal third of the lower leg as a result of a severe burn injury caused by a hot object　**1a.** Preoperative wound surface　**1b.** Radical debridment of the wound with exposure to posterior tibial neurovascular bundle and design of the sural neurofasciocutaneous flap located on 10 cm superior to the tip of the lateral malleolus　**1c.** At 2 months after operation, the color, texture, and thickness of the transferred flap were excellent, and the contour and function of the donor site and recipient area were satisfied as well

图 2　患者，男，46 岁，左足踝部交通伤所致组织缺损　**2a.** 术前创面情况　**2b.** 骨、肌腱外露创面的扩创及外踝尖后上 5 cm 处腓肠神经营养血管皮瓣的设计　**2c.** 术后 1 个月，皮瓣色泽、质地良好，供、受区外形和功能恢复较为满意

Fig.2　A 46-year-old male patient suffering from soft tissue defect over the ankle and foot by a traffic accident　**2a.** Pre-operative wound surface　**2b.** Radical debridment of the wound with bone and tendon exposure and design of the sural neurofasciocutaneous flap located on 5 cm on the tip of the lateral malleolus　**2c.** At 1 month after operation, the color, texture and thickness of the transferred flap were excellent, and the contour and function of the donor and recipient sites were satisfied as well

血管皮瓣的优点，又吸取了穿支皮瓣的优点，较好地解决了传统术式易造成穿支扭转或卡压、皮瓣转移欠灵活以及蒂部较臃肿的问题，是修复踝周、足跟及足近、中段中、小面积缺损的理想选择。对于小腿下段缺损的修复，因为外踝尖后上 4~7 cm 处的腓动脉穿支及其供瓣区常无法应用，所以笔者选用以外踝尖后上 9~11 cm 处的腓动脉穿支蒂腓肠神经营养血管皮瓣进行修复，由于术中发现该处穿支也较为粗大，故同样形成仅以单一穿支为蒂的腓肠神经营养血管皮瓣，其供瓣区距创面较近，旋转修复小腿下段缺损非常方便，且无效部分所占比例也较小，不失为修复小腿下段缺损的较佳选择。当遇到外踝尖后上 4~7 cm 处的腓动脉穿支细小或缺如时，不要轻易放弃手术，可根据“压力平衡规律”，若上方的穿支细小，则其下方的穿支口径必然会代偿性增大，以保证该区域血供恒定[7]，继续向远端寻找位于外踝尖后上 1~2 cm 处的外踝后穿支，并形成以此为蒂的腓肠神经营养血管皮瓣，该皮瓣除了可作为一种备用方案之外，其最大的优势是避免了皮瓣的浪费，从而显著地降低了对小腿的破坏程度，是对外踝尖后上 4~7 cm 处的腓动脉穿支蒂腓肠神经营养血管皮瓣的一种较好的补充。

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