

doi: 10.13241/j.cnki.pmb.2018.10.030

数字化血管三维模型对烧伤患者面部修复术后皮瓣存活的影响 *

郭 群 张颖佳 王继华 何永静 杨 云[△]

(昆明医科大学第二附属医院整形外科 云南 昆明 650101)

摘要 目的:探讨数字化血管三维模型对烧伤患者面部修复术后皮瓣存活的影响。**方法:**选择 2012 年 4 月至 2017 年 4 月在我院接受组织瓣转移面部修复术的烧伤患者 146 例,分为对照组($n=64$)和研究组($n=82$)。对照组术前采用超声多普勒探测患者供区皮瓣的血管位置,走向并标记探测结果,根据多普勒探测结果结合术前设计行皮瓣转移术。观察组术前 3~5 d 采用 CTA 技术检查患者供区皮瓣面部受区血管位置、血管走向等,将检查结果通过计算机进行血管三维重建,根据皮瓣血管与受区血管重建模型修订手术方案后行皮瓣转移术。观察和比较手术时间、术后感染发生率、皮瓣断蒂时间、皮瓣血运障碍发生率和术后皮瓣坏死率。**结果:**研究组手术时间显著短于对照组($P<0.01$),两组术后感染发生率分别为 7.81%和 1.21%,研究组明显低于对照组($P<0.01$)。研究组的皮瓣断蒂时间为 17.1 ± 2.5 d,明显短于对照组(21.3 ± 2.8 d, $P<0.01$);对照组皮瓣血运障碍发生率为 17.19%,研究组并未发现血运障碍病例。对照组术后皮瓣坏死率为 7.81%,而研究组未出现皮瓣坏死病例,存活率为 100%,明显高于对照组($P<0.05$)。**结论:**术前数字化血管三维模型的建立用于烧伤患者面部修复术可缩短手术时间,提高手术效率,降低术后皮瓣供血障碍的发生率及皮瓣死亡率,有利于患者术后恢复。

关键词:数字化血管三维模型;面部烧伤;组织瓣转移术;皮瓣存活

中图分类号:R644 文献标识码:A 文章编号:1673-6273(2018)10-1952-04

Effect of Digital Vascular 3D Model on Flap Survival after Facial Reconstruction in Burn Patients*

GUO Qun, ZHANG Ying-jia, WANG Ji-hua, HE Yong-jing, YANG Yun[△]

(Plastic Surgery Department, The Second Affiliated Hospital of Kunming Medical University, Kunming, Yunnan, 650101, China)

ABSTRACT Objective: To investigate the effect of digital vascular 3D model on the flap survival after facial reconstruction in burn patients. **Methods:** A total of 146 cases of burn patients who were treated by tissue flap transfer facial prosthesis from April 2012 to April 2017 were selected and divided into the control group ($n=64$) and the study group ($n=82$). In the control group, ultrasound doppler was used to detect the vascular position of flap in the area of skin flap. The observation group of patients was given CTA technology for facial area flap by area, blood vessels, blood vessel position towards, etc 3~5 d preoperativon, 3D reconstruction results were got through the computer's blood vessels, the blood vessels and the vessels according to flap reconstruction model revision surgery after flap transfer operation. The time of operation, the incidence of postoperative infection, the time of the skin flap, the incidence of blood transport disorder, and the necrosis rate of skin flap after operation were observe and compared between two groups. **Results:** The operation time of study group was significantly shorter than that of the control group ($P<0.01$), the incidence rate of postoperative infection of study group and control group were 7.81% and 1.21%, which was significantly lower in the study group than that of the control group ($P<0.01$). The flap pedicle breaking time of study group was 17.1 ± 2.5 d, which was significantly shorter than that of the control group (21.3 ± 2.8 d, $P<0.01$); The incidence rate of flap blood circulation disorder of the control group was 17.19%, while none was found in the study group. The flap necrosis rate of control group was 7.81%, while there was no necrosis case in the study group, the survival rate was 100%, which was significantly higher than the control group($P<0.05$). **Conclusions:** Preoperative blood vessel 3D digital model can shorten operation time, improve operation efficiency, reduce the postoperative mortality, the incidence rate of skin flap blood disorders of burn patients with facial prosthesis and flap is beneficial to patients with postoperative recovery.

Key words: Digital three-dimensional model of blood vessel; Facial burns; Tissue flap transfer; Flap survival

Chinese Library Classification(CLC): R644 **Document code:** A

Article ID: 1673-6273(2018)10-1952-04

前言

颜面部是人体最主要的显露部位,颜面部外观或功能异常严重影响患者的生活质量。颜面部烧伤等创伤引起食物瘢痕挛

* 基金项目:云南省医疗卫生单位内设研究机构科研项目(2016NS266)

作者简介:郭群(1971-),女,硕士,副主任医师,研究方向:美容及修复整形,E-mail: guoqun_1971@papmedline.club

[△] 通讯作者:杨云(1978-),女,硕士,主治医师,研究方向:美容及修复整形,E-mail: yangyun_1978@papmedline.club

(收稿日期:2017-11-06 接受日期:2017-11-30)

缩严重影响患者的日常生活、学习和工作^[1,2]。目前,皮瓣转移术是临床上治疗创伤或肿瘤引起面部外观异常的首选治疗方案,但修复术后皮肤色泽差异或继发挛缩是影响治疗效果最主要的因素之一^[3,4]。在颜面部皮瓣转移修复术中,面部受区血管走向、血运能力及移植皮瓣的血管蒂长度、皮瓣薄厚、皮瓣血运是否丰富等十分关键^[5],影响皮瓣转移术供受区血管吻合情况,进而影响术后皮瓣血运能力和存活率^[6]。常见的皮瓣血管评估的方法有:超声或彩色多普勒,核磁共振血管成像(magnetic resonance angiography,MRA),数字减影血管造影技术(digital subtraction angiography,DSA)和血管CT造影(Computed tomographic angiography,CTA)^[7-9]。其中,CTA操作简单、耗时短、准确性和敏感性较高,通过计算机得到的三维重建模型可清晰呈现血管动静脉及与周围骨和软组织之间的空间关系,且空间分辨率较高^[10,11]。随着CTA技术不断完善,其在临床上应用越来越广泛。本研究筛选146例在我院接受组织瓣转移面部修复术的烧伤患者,分析通过CTA检查建立的数字化血管三维模型

对烧伤患者面部修复术后皮瓣存活的影响,以期为临床应用提供参考。

1 资料与方法

1.1 研究对象

纳入2012年4月至2017年4月在我院接受组织瓣转移面部修复术的烧伤患者146例,其中男80例,女66例,年龄13~58岁,平均年龄 29.48 ± 15.67 岁;肩胛皮瓣转移64例,背阔肌皮瓣转移50例,额部皮瓣转移32例。面部缺损面积 $6.3 \text{ cm} \times 4.1 \text{ cm} \sim 23.4 \text{ cm} \times 9.2 \text{ cm}$;平均面积 $12.4 \text{ cm} \times 5.1 \text{ cm}$;病程5 d~3个月,平均病程 43.5 ± 13.2 d。排除瘢痕体质,合并糖尿病、肝、肾、肺等代谢系统疾病。根据治疗时间分为2组,2012年4月至2014年4月接受诊治的患者为对照组($n=64$);2014年5月至2017年4月接受诊治的为研究组($n=82$)。两组患者年龄、性别、病程等一般资料相比差异无统计学意义($P>0.05$),见表1。

表1 两组患者的一般资料比较

Table 1 Comparison of the general data between the two groups

Groups	n	Sex(male/female)	Age	Flap type (shoulder blade/latissimus dorsi/frontal part)	Course of disease
Control group	64	37/27	28.07 ± 14.29	33/20/11	43.8 ± 13.2 d
Study group	82	43/39	31.11 ± 13.67	31/30/21	41.9 ± 12.6 d
P		0.517	0.193	0.222	0.378

1.2 术前血管检查

两组均按照患者面部缺损部位、大小及烧伤程度制定手术计划。

对照组:术前采用超声多普勒探测患者供区皮瓣的血管位置,走向并标记探测结果,根据多普勒探测结果结合术前设计行皮瓣转移术。

观察组:术前3~5 d采用CTA技术检查患者供区皮瓣面部受区血管位置、血管走向等,将检查结果通过计算机进行血管三维重建,根据皮瓣血管与受区血管重建模型修订手术方案后,行皮瓣转移术。

1.3 手术方法

根据术前设计结合血管检测结果,切开皮瓣上缘和两侧缘,按照皮瓣筋膜及和血管位置切取皮瓣,直接缝合。切取的皮瓣必须大于受区缺损面积;切取皮瓣后移植到受区,吻合受区和供区血管,缝合,注意血管保护。术后两组均给予镇痛、抗感

染及常规护理

1.4 观察指标

观察并统计两组手术时间、皮瓣断蒂时间、术后皮下感染情况、术后皮瓣血运障碍发生率及皮瓣死亡率、患者满意度。

1.5 数据分析

选择SPSS20.00软件进行分析,计量数据采用均数 $\pm$ 标准差($\bar{x} \pm s$)表示,两组间比较采用t检验,计数数据采用百分比、率或者例数表示,组间比较采用卡方检验,以 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 两组手术时间及术后感染情况的比较

研究组手术时间显著短于对照组($P<0.01$),两组术后感染发生率分别为7.81%和1.21%,研究组明显低于对照组($P<0.01$)。见表1。

表2 两组手术时间及术后感染发生情况的比较

Table 2 Comparison of the incidence of postoperative infection and operation time between the two groups

Groups	n	Operation time(min)	Infection
Control group	64	173.67 ± 22.67	5(7.81%)
Study group	82	150.79 ± 20.73	1(1.21%)
P		0.000	0.017

2.2 两组皮瓣断蒂时间及皮瓣血运障碍发生率的比较

研究组的皮瓣断蒂时间为 (17.1 ± 2.5) d,明显短于对照组

$(21.3 \pm 2.8 \text{ d}, P<0.01)$;对照组皮瓣血运障碍发生率为17.19%,研究组并未发现血运障碍病例。

表 3 两组皮瓣断蒂时间及皮瓣血运障碍发生率的比较

Table 3 Comparison of the incidence of flap blood circulation disorder and flap pedicle breaking time between two groups

Groups	n	Flap pedicle breaking time(d)	Flap blood circulation disorder
Control group	64	21.3± 2.8	11(17.19%)
Study group	82	17.1± 2.5	0(0.00%)
P		0.000	0.000

2.3 两组术后皮瓣存活状况的比较

死病例,存活率为 100%,明显高于对照组(P<0.05)。

对照组术后皮瓣坏死率为 7.81%,而研究组未出现皮瓣坏

表 4 两组术后皮瓣存活状况的比较

Table 4 Comparison of the survival of flap after operation between two groups

Groups	n	Survival	Decease
Control group	64	59(92.19%)	5(7.81%)
Study group	82	82(100.00%)	0(0.00%)
P			0.000

3 讨论

面部烧伤后造成面部缺损及瘢痕严重影响患者视觉、听觉、饮食、表情等重要功能,甚至导致患者生理及心理严重后遗症^[12-14]。游离皮瓣移植修复术是目前临床上治疗颜面部瘢痕的最佳方案之一^[15]。研究表明皮瓣血管蒂较短、皮瓣较薄更利于皮瓣成活。肩胛皮瓣由于供区较为隐蔽、血管走向恒定、便于解剖、皮下脂肪较薄且供区面积大是面颈部游离皮瓣移植修复的首选^[16]。另外,背阔肌皮瓣血运丰富,切取范围大,抗感染能力强,是头皮损伤后大面积颅骨外露皮瓣修复主要供区^[17,18]。同时,额部皮瓣与颜面部病变区相邻,颜色及质地与缺损区相近,也是颜面部皮瓣修复术较为理想的皮瓣材料^[19,20]。面部烧伤后,经过多次手术,损伤区周围的组织及血管系统均受到不同程度的损伤,而超声多普勒、MRA、DSA 等技术只能显示二维血管的走向及解剖结构,不能为供受区血管吻合提供直观的参考依据^[21-23]。研究表明 CTA 技术可以面动脉进行解剖学研究,可以清晰显示双侧面动脉的起源,走行、分布及中止部位^[24,25],结合计算机软件对供受区血管等进行三维重建,为外科手术医生提供详细的资料,有利于术者术前手术方案的设计及改进,提高手术成功率,改善手术效果^[26,27]。

本研究主要分析通过 CTA 检查建立的数字化血管三维模型对烧伤患者面部修复术后皮瓣存活的影响,研究结果显示研究组手术时间、皮瓣断蒂时间均显著短于对照组,术后感染发生率明显低于对照组;对照组皮瓣血运障碍发生率为 17.19%,术后皮瓣坏死率为 7.81%,而研究组并未发现血运障碍病例及皮瓣坏死病例,存活率为 100%,均明显高于对照组。这些研究结果表明通过 CTA 检查建立的数字化血管三维模型可缩短手术时间,减少术后感染率的发生,降低皮瓣血运障碍发生率,提高皮瓣存活率。Rose^[28]发现面部烧伤游离皮瓣移植术前 CTA 检查有利于手术开展,可提高手术效率,与本研究结果相似。He 等^[29]研究血管影像解剖学颌面部重建的临床应用,发现 CTA 可提高术后皮瓣存活率,改善手术效果, Moss-

abasha 等^[30]发现术前 CTA 有利于乳房皮瓣修复术。

总之,术前数字化血管三维模型的建立可缩短手术时间,提高手术效率,降低术后皮瓣供血障碍和皮瓣死亡的发生率,有利于患者术后恢复。

参考文献(References)

- [1] Bharadia D, Sinha I, Pomahac B. Role of Facial Vascularized Composite Allotransplantation in Burn Patients[J]. Nature Cell Biology, 2017, 44(4): 857
- [2] Villaverde DME, Simón-Sanz E, Delgado-Ruiz T, et al. The challenge of free flap transfers in burn patients. What is the best timing of surgery [J]. Cirugia Plastica Ibero-Latinoamericana, 2015, 41 (2): 117-126
- [3] Eser C, Kesikta E, Gencel E, et al. An alternative method to free flap for distal leg and foot defects due to electrical burn injury: distally based cross-leg sural flap [J]. Ulusal travma ve acil cerrahi dergisi Turkish journal of trauma & emergency surgery: TJTES, 2016, 22(1): 46
- [4] Garza RM, Press BH, Tyan DB, et al. Immunological Effect of Skin Allograft in Burn Treatment: Impact on Future Vascularized Composite Allotransplantation [J]. Journal of Burn Care & Research Official Publication of the American Burn Association, 2017, 38(3): 169
- [5] Klein HJ, Schanz U, Hivelin M, et al. Sensitization and desensitization of burn patients as potential candidates for vascularized composite allotransplantation[J]. Burns, 2016, 42(2): 246-257
- [6] Roche NA, Vermeersch HF, Stillaert FB, et al. Complex facial reconstruction by vascularized composite allotransplantation: the first Belgian case [J]. Journal of Plastic Reconstructive & Aesthetic Surgery Jpras, 2015, 68(3): 362-371
- [7] Lange CJ, Thimmappa ND, Boddu SR, et al. Automating Perforator Flap MRA and CTA Reporting [J]. Journal of Digital Imaging, 2017, 30(3): 350-357
- [8] Watanabe T, Kawai K, Kimata Y. Pre- and Intraoperative Identification of Perforator Vessels Using MRA/MDCTA, Doppler Sonography, and ICG Fluorescence Angiography [M]. ICG Fluorescence Imaging and

Navigation Surgery. Springer Japan, 2016

- [9] Swanson EW, Hsu YC, Cheng HT. CTA and contrast-enhanced MRA are equally accurate for localizing deep inferior epigastric perforator flap arteries: A systematic review[J]. *Journal of Plastic Reconstructive & Aesthetic Surgery*, 2015, 68(4): 580-581
- [10] Chae MP, Huntersmith DJ, Rozen WM. Comparative study of software techniques for 3D mapping of perforators in deep inferior epigastric artery perforator flap planning [J]. *Gland Surgery*, 2016, 5(2): 99
- [11] Akinlolu AA. Facial biometrics of Yorubas of Nigeria using Akinlolu-Raji image-processing algorithm[J]. *Journal of Medical Sciences*, 2016, 36(2): 39-45
- [12] Mclean LM, Rogers V, Kornhaber R, et al. The patient-body relationship and the "lived experience" of a facial burn injury: a phenomenological inquiry of early psychosocial adjustment [J]. *Journal of Multidisciplinary Healthcare*, 2015, 8(8): 377-387
- [13] Richard R, Jones JA, Parshley P. Hierarchical decomposition of burn body diagram based on cutaneous functional units and its utility[J]. *Journal of Burn Care & Research Official Publication of the American Burn Association*, 2015, 36(1): 33
- [14] Kowalske K, Helm P. Visionary leadership in burn rehabilitation over 50 years: major accomplishments, but mission unfulfilled[J]. *Pm & R the Journal of Injury Function & Rehabilitation*, 2014, 6(9): 769
- [15] Wang HY, Wang MG, Yu G, et al. Free perforating branch flap for primary repairing the huge soft-tissue defects on the scalp and face[J]. *J Dermatolog Treat*, 2016, 27(6): 505
- [16] Shaw R J, Ho M W, Brown J S. Thoracodorsal artery perforator-scapular flap in oromandibular reconstruction with associated large facial skin defects[J]. *British Journal of Oral & Maxillofacial Surgery*, 2015, 53(6): 569-571
- [17] Teisch LF, Gerth DJ, Tashiro J, et al. Latissimus dorsi flap versus, pedicled transverse rectus abdominis myocutaneous breast reconstruction: outcomes[J]. *Journal of Surgical Research*, 2015, 199(1): 274-279
- [18] Ong HS, Ji T, Zhang CP. The pedicled latissimus dorsi myocutaneous flap in head and neck reconstruction[J]. *Oral & Maxillofacial Surgery Clinics of North America*, 2014, 26(3): 427-434
- [19] Zelken JA, Reddy SK, Chang CS, et al. Nasolabial and forehead flap reconstruction of contiguous alar-upper lip defects[J]. *Journal of Plastic Reconstructive & Aesthetic Surgery*, 2017, 70(3): 330
- [20] Ghassemi A, Ahmed SS, Ghanepur H, et al. Three-layer reconstruction of lower third nasal defects using forehead flap, reversed nasolabial flap, and auricular cartilage [J]. *International Journal of Oral & Maxillofacial Surgery*, 2016, 46(1): 36-40
- [21] Mine B, Pezzullo M, Roque G, et al. Detection and characterization of unruptured intracranial aneurysms: Comparison of 3T MRA and DSA[J]. *Journal of Neuroradiology*, 2015, 42(3): 162-168
- [22] Shih MC, Hagspiel KD. CTA and MRA in Mesenteric Ischemia: Part I, Role in Diagnosis and Differential Diagnosis [J]. *American Journal of Roentgenology*, 2015, 188(188): 452-461
- [23] Lawson BR, Ram R, Pandey T, et al. Preoperative MRA for Patient Selection in Free Fibula Flap: Is a Venous Phase Indicated [J]. *Otolaryngology Head & Neck Surgery*, 2014, 151(1 Suppl): P142-P143
- [24] Gangopadhyay N, Villa MT, Chang EI, et al. Combining Preoperative CTA Mapping of the Peroneal Artery and Its Perforators with Virtual Planning for Free Fibula Flap Reconstruction of Mandiblectomy Defects[J]. *Plastic & Reconstructive Surgery*, 2015, 136(4 Suppl): 8-9
- [25] Kuekrek H, Machens HG, Mueller D. The Significance of Preoperative CT Angiography in Breast Reconstruction with DIEA Perforator Flaps [M]. *Breast Reconstruction Springer International Publishing*, 2016, 60 (2): 181-188
- [26] Eder M, Raith S, Jalali J, et al. Three-dimensional prediction of free-flap volume in autologous breast reconstruction by CT angiography imaging[J]. *International Journal of Computer Assisted Radiology & Surgery*, 2014, 9(4): 541-549
- [27] Probst F A, Metzger M, Ehrenfeld M, et al. CAD/CAM procedures facilitate the lingual application of mandible reconstruction plates[J]. *Journal of Oral & Maxillofacial Surgery*, 2016, 74(9): 1879-1895
- [28] Rose EH. Aesthetic reconstruction of the severely disfigured burned face: a creative strategy for a "natural" appearance using pre-patterned autogenous free flaps[J]. *Burns & Trauma*, 2015, 3(1): 16
- [29] He Y, Jin S, Tian Z, et al. Superficial circumflex iliac artery perforator flap's imaging, anatomy and clinical applications in oral maxillofacial reconstruction [J]. *J Craniomaxillofac Surg*, 2016, 44 (3): 242-248
- [30] Mossabasha M, Lee C. Impact of Preoperative Computed Tomography Angiogram on Abdominal Flap Breast Reconstruction Outcomes: A Systematic Review [J]. *Journal of Reconstructive Microsurgery*, 2017, 33(05): 328-335

(上接第 1972 页)

- [25] Xiao J, Yu K, Li M, et al. The IL-2/Anti-IL-2 Complex Attenuates Cardiac Ischaemia-Reperfusion Injury Through Expansion of Regulatory T Cells[J]. *Cell Physiol Biochem*, 2017, 44(5): 1810-1827
- [26] Lv LF, Jia HY, Zhang HF, et al. Expression level and clinical significance of IL-2, IL-6 and TGF- β in elderly patients with goiter and hyperthyroidism [J]. *Eur Rev Med Pharmacol Sci*, 2017, 21 (20): 4680-4686
- [27] 李红林,高美华,郑云会,等.细胞因子 IFN- γ , IL-6, IL-17 和 TGF- β 1 在 Graves 病发病中的作用 [J]. *中国免疫学杂志*, 2015, 31(2): 253-256
- [28] Li Hong-lin, Gao Mei-hua, Zheng Yun-hui, et al. Study on levels of IFN- γ , IL-6, IL-17 and TGF- β 1 in patients with Graves' disease[J]. *Chinese Journal of Immunology*, 2015, 31(2): 253-256
- [28] Da Silva MA, Valgôde FG, Gonzalez JA, et al. Cytogenetic and dosimetric effects of (131)I in patients with differentiated thyroid carcinoma: comparison between stimulation with rhTSH and thyroid hormone withdrawal treatments [J]. *Radiat Environ Biophys*, 2016, 55 (3): 317-328