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负压封闭引流与传统加压包扎法在治疗前臂皮肤脱套伤中的临床效果

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[摘　要]　**目的：**对比皮肤原位回植结合负压封闭引流术(vacuum sealing drainage，VSD)和皮肤原位回植结合加压包扎法治疗前臂皮肤脱套伤的临床效果。**方法：**回顾2003年1月至2017年1月急诊采用皮肤原位回植结合VSD技术和皮肤原位回植结合加压包扎治疗80例前臂皮肤脱套伤的病例，其中男48例，女32例，年龄16~71(平均38)岁。受伤原因：交通事故12例，机器挤伤68例。脱套面积(271.2±60.4) cm^2。40例接受VSD结合皮肤原位回植术为研究组，40例接受传统加压包扎结合皮肤原位回植术为对照组。对比两组植皮成活率、创面感染率、皮下血肿发生率、手术用时、住院时间、换药次数及二次手术率。**结果：**研究组术后回植皮肤成活率(89.0%±9.2%)高于对照组的(72.6%±16.0%)，研究组的住院时间和换药次数少于对照组，差异均有统计学意义(P<0.05)。研究组的感染率、皮下血肿发生率、二次手术修复率低于对照组，差异均有统计学意义(P<0.05)。**结论：**急诊采用皮肤原位回植结合VSD负压吸引技术治疗前臂皮肤脱套伤相较于传统的皮肤原位回植结合加压包扎法，可以提高回植皮肤成活率，减少皮肤创面感染和产生皮下血肿率，降低二期手术修复率，缩短住院时间和换药次数。

[关键词]　皮肤脱套伤；负压封闭式吸引；原位植皮；加压包扎技术

Clinical efficacy of vacuum sealing drainage and traditional pressure dressing technology in the treatment of the degloving injury of forearm

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Abstract　**Objective:** To compare the clinical efficacy of vacuum sealing drainage (VSD) and traditional pressure dressing technology respectively combining with skin in situ replantation for the treatment of skin degloving injury of forearm. **Methods:** From Jan. 2003 to Jan. 2017, 90 patients of the degloving injury of forearm were treated by the method of VSD and traditional pressure dressing technology respectively combining with skin in situ replantation. There were 48 male and 32 females, aged 16–71 years (mean 38 years). Twelve cases were caused

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by traffic accidents, 68 cases by machine injuries. The study group included 40 patients who underwent VSD combining with skin in situ replantation operation, the other 40 patients accepted traditional pressure dressing technology combining with skin in situ replantation operation were the control group. The survival rate of skin graft, the length of hospital stay, the time of operation, the reoperation rate, the number of dressing change, the rate of wound infection and subcutaneous hematoma were compared between the two groups. **Results:** After the one-stage operation, the survival rate of skin of study group is 89.0%±9.2% and the control group is 72.6%±16.0%; the hospitalization time and the number of dressing change of study group were significantly shorter than those of the control group, the differences were all statistically significant (P<0.05). The reoperation rate and the rate of wound infection and subcutaneous hematoma of study group were lower than that in the control group, the differences were all statistically significant (P<0.05). **Conclusion:** The one-stage operation that uses skin in situ replantation combining with VSD technical to repair the degloving injury of forearm comparing to pressure dressing method can increase the survival rate of skin graft and reduce the incidence of wound infection and subcutaneous hematoma . This method could reduce the reoperation rate and it also could reduce the hospitalization time and the number of dressing change.

Keywords degloving injuries; vacuum sealing drainage; skin in situ replantation; pressure dressing technology

随着我国经济的高速发展，工业事故和交通事故呈增多趋势，工业事故中的滚轮挤压和交通事故中的车轮挤压有时可造成人员的前臂皮肤脱套伤。目前有两种方法治疗这种损伤——皮肤原位回植结合传统的加压包扎技术与皮肤原位回植结合负压吸引技术[1]。本研究旨在对比两种治疗前臂皮肤脱套伤方法的优劣性。

1 对象与方法

1.1 对象

回顾2003年1月至2017年1月来解放军89医院就诊的96例前臂皮肤脱套伤病例，选取标准为腕横纹至肘横纹处的皮肤脱套伤，纳入标准为患者无上肢主要动脉及深静脉的损伤，无糖尿病，无血管缺血性疾病，无慢性皮肤病，无免疫缺陷类疾病。筛选出80例前臂皮肤脱套伤病例，其中男48例，女32例。年龄16~71(平均38)岁。其中左侧38例，右侧42例。损伤范围：腕横纹至肘横纹。受伤原因：交通事故12例，机器挤伤68例。其中40例采用VSD联合原位打薄植皮治疗为研究组，40例采用传统加压包扎法联合原位打薄植皮治疗为对照组。比较两组前臂脱套皮肤面积、年龄、性别、损伤侧别等基本资料，差异均无统计学意义(P>0.05，表1)，两组病例具备可比性。

表1 两组的术前资料比较(n=40)

Table 1 Comparison of preoperative data between the two groups (n=40)

组别	性别		年龄/岁	损伤侧别		脱套皮肤面积/cm^2
	男	女		左侧	右侧	
研究组	25	15	41.6 ± 13.7	22	18	272.5 ± 52.4
对照组	23	17	36.4 ± 12.1	16	24	269.8 ± 68.2
χ^2 /t	χ^2=0.208		t=1.821	χ^2=1.80		t=2.128
P	>0.05		0.07	>0.05		0.843

1.2 方法

选用臂丛麻醉，安装驱血带，首先对前臂创面进行刷洗，用双氧水、生理盐水连续冲洗3遍，同时用软毛刷将创面内的泥土、油污初步清除，再用洗必泰溶液5 000 mL冲洗创面，后用碘伏冲洗。

常规消毒铺巾，驱血带充气。首先对创面进行清创，清理皮缘，掀起创面表面的一层筋膜，从创面近端至远端依次清创。清除失活的、颜色暗红的肌肉，保证植皮的基床是健康有活力的筋膜或肌肉组织(图1)。之后用双氧水、生理盐水冲洗创面3遍，碘伏水、生理盐水冲洗1遍，将创面内被碘伏附着无法冲洗去的失活的筋膜及肌腱表面组织清除。更换器械，更换无菌手套，手术台铺新的无菌单。对于伴尺、桡骨骨折的将尺、桡骨折复位后用外固定架固定，使用临近健康的筋膜或肌肉对裸露的肌腱、骨组织、关节进行覆盖，这些重要的深部结构必须良好的覆盖以防止因裸露导致的感染和坏死，在肌腱、骨组织、关节上植皮不会成活。后加压包扎，松驱血带。

10 min后打开创面，将创面内的活动性出血点予以结扎。将前臂的脱套皮肤都打薄成全厚皮片原位植皮。植皮打薄的过程使用组织剪或手术刀手动打薄，保留全部真皮层，将反面脂肪及筋膜组织全部清除。

研究组在修薄处理后原位植皮处密集打孔，后用VSD材料封闭，术后用200~400 kPa的压力给予负压吸引，并用0.9%的生理盐水以6滴/min予VSD内冲洗，吸引7 d后打开VSD辅料(图2)。

对照组修薄处理后原位植皮处密集打孔，后使用传统加压包扎法。术后每3 d换药1次，直至第14天拆线。两组术后的一般治疗相同，抗生素应用5 d(感染病例除外)。

1.3 观察指标

术后第14天记录回植皮肤的成活率(植皮成活面积与总植皮面积的比值)、术后感染的发生率(创面有分泌物，分泌物经细菌培养结果为阳性)、术后皮下血肿发生率、二次手术修复率、手术用时、平均住院时间、术后换药次数。

1.4 统计学处理

数据用统计学软件SPSS 19.0进行统计学分析，分别用率和均数±标准差($\bar{x}\pm s$)表示计数资料和计量资料。分别用卡方检验和两独立样本的t检验进行组间比较。检验水准α=0.05，P<0.05为差异有统计学意义。

图1 患者女，15岁，被汽车撞倒，遭车轮碾压左前臂。术前情况为前臂皮肤整体脱套，无尺、桡骨骨折，前臂肌肉有大范围的挫伤

Figure 1 The patient was a fifteen years old girl who was hit down by a truck and her left foream was crushed by the wheel. The preoperation condition was the complete avulsion of the forearm skin,accompanied by extensive of the muscles, without ulna and radius fracture

(A)创面的原始状态；(B)皮肤脱套的探查。

(A)The original condition of the wound；(B) The condition of skin avulsion.

图2 术中给予广泛清创，清除坏死肌肉。后对脱套皮肤修薄回植，表面覆盖VSD辅料。术后VSD负压吸引7 d。拆除VSD后原位回植皮肤全部成活

Figure 2 Extensive debridement was performed during surgery and removed the necrotic muscles.After that the avulsioned skin has been thinned and replanted in stiu.On the surface of the wound has been covered VSD.Negative pressure attracted 7 days after operation.After the removal of VSD,all the replanted skin was recovered

2 结果

研究组术后脱套皮肤成活率为89.0%±9.2%，对照组为72.6%±16.0%，差异有统计学意义(t=5.644，P<0.05)。研究组的手术时间(229.5±87.3) min，对照组为(227.4±78.6) min，差异无统计学意义(t=0.114，P>0.05)；研究组的住院时间(29.25±21.9) d少于对照组的(47.0±28.8) d，差异有统计学意义(t=−3.105，P<0.05)；研究组的换药次数2.28±0.63 少于对照组的5.28±1.46，差异有统计学意义(t=−4.147，P<0.05)。研究组的感染率、皮下血肿发生率、二次手术修复率低于对照组，差异有统计学意义(P<0.05，表2)。所有病例回访6个月以上，皮肤外观好，无破溃，无明显瘢痕挛缩。前臂、腕关节、手部功能恢复良好。典型病例见图1~5。

表2 两组感染率、皮下血肿发生率、二次手术修复率的比较(n=40)

Table 2 Comparison of the reoperation rate, the rate of wound infection and subcutaneous hematoma between the two groups (n=40)

组别	感染率/[例(%)]	皮下血肿发生率/[例(%)]	二次手术修复率/[例(%)]
研究组	4 (10.0)	3 (7.5)	15 (37.5)
对照组	14 (35.0)	16 (40.0)	24 (60.0)
χ^2	7.17	11.66	4.05
P	<0.05	<0.005	<0.05

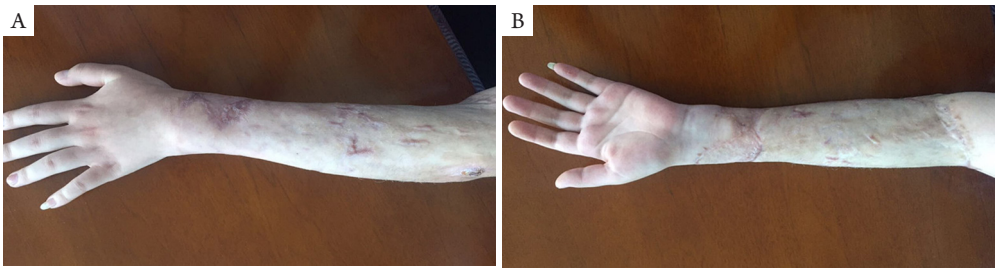

图3 术后6个月患者前臂创面愈合良好，无破溃和瘢痕挛缩

Figure 3 The forearm wound healed well at 6 months after operation,without any rupture or scar contracture

(A) 前臂背侧的状态；(B)前臂掌侧的状态。

(A) The condition of the dorsum of the forearm; (B)The condition of the volar side of the forarm.

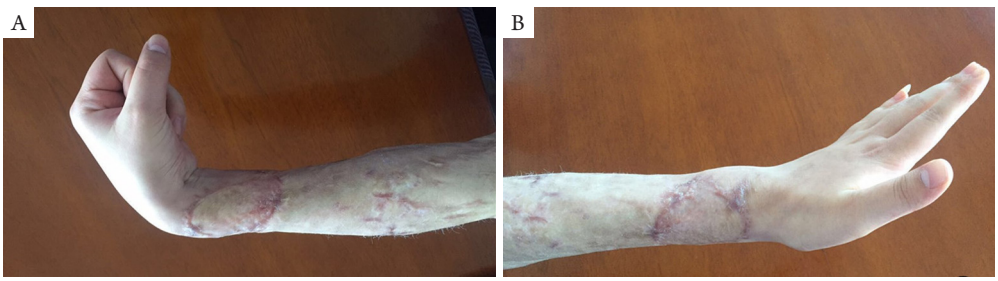

图4 患者伤肢腕关节的活动度恢复到正常范围

Figure 4 Mobility of wrist joint reached normal range

(A)屈腕功能恢复正常；(B)伸腕功能恢复正常。

(A)Wrist flexion function returned to normal; (B)Wrist extension function returned to normal.

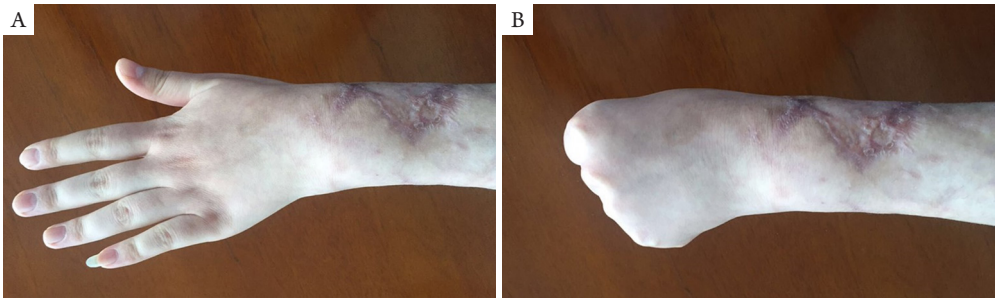

图5 患者伤肢手指屈伸功能恢复良好

Figure 5 Flexion and extension function of fingers recovered well

(A)伸指功能恢复正常；(B)屈指功能恢复正常。

(A)Finger extension function returned to normal; (B)Finger flexion function returned to normal.

3 讨论

脱套伤是肢体在遭遇外来暴力，如机械滚筒碾压或车轮碾压时，自身保护性条件反射导致肢体强力回缩造成皮肤软组织的套状撕脱。脱套伤有以下特点：1)由于肢体受到挤压，皮下组织层受到挤压碾挫，其内的血管挫伤严重。2)损伤平面多位于深筋膜上层，从深筋膜发出供应皮肤的穿支血管断裂、牵拉或碾挫。为提高脱套皮肤急诊手术的成活率，处理脱套伤采用脱套皮肤打薄成全厚皮或刃厚皮原位回植的方法，之后有两种方法来固定回植皮肤即VSD法和加压包扎法。

加压包扎法的应用有较长的历史，在VSD技术大规模临床应用之前是处理脱套伤的主要方法。它存在较多弊端：回植皮肤受力不均、加压施加的压力大小不可控且难以保持、易产生皮下血肿、皮下积液难以排出、引流不充分、回植皮肤易与辅料黏连、住院期间需要频繁换药且每次换药患者疼痛难忍，甚至因环形包扎导致肢体血运不良需解除植皮区的加压包扎。这些缺陷导致高感染率、高皮下血肿率和低回植皮肤成活率，常需二期手术植皮。

VSD技术自发明以来即用于治疗四肢创面感染及腹腔感染，后在治疗各种软组织缺损和感染得到良好的疗效[2]。经过多年的发展及临床应用，现VSD技术用于治疗多种皮肤缺损[1]，多种难以愈合的伤口[3-4]，以及低感染率的开放骨折[5-6]，证明其相对传统的治疗方法更加安全有效[7-8]。经过多年临床应用，VSD技术已经成为治疗四肢软组织缺损安全、有效的方法[8]。

本研究中研究组脱套皮肤成活率明显高于对照组，原因总结为VSD技术具备如下优点：1)预防和治疗感染[9]，VSD装置在早期封闭创面，阻止外部细菌侵入创面，并且将渗出物引流，减少创面内细菌繁殖[10]。VSD装置可以降低创面内细菌数量，特别是革兰阴性菌数量有明显减少[11]。Labanaris等[12]在临床上应用VSD技术治疗手外伤，发现其预防和治疗创面感染效果良好，且能使创面疼痛减轻。Perceau等[13]发现VSD在治疗因组织坏死和感染导致的慢性溃疡中有良好的疗效。2)改善创面血运，创面组织的体液在持续的负压吸引之下，不断引流出，导致组织间的压力梯度，从而减小微循环的后负荷，增大微循环血液流速，从而使创面组织得到更多的营养及氧气，清除滞留的炎性因子，这对组织的修复愈合十分有利[14]。3)减轻水肿，水肿是影响组织愈合的负面因素，它使细胞间距加大，阻碍物质交换，导致组织缺氧和中毒。水肿的程度和创面愈合率呈负相关。VSD能将创面的体液不断引流至引流管方向，降低创面的渗透压，减轻水肿[15]，从而缩小细胞间距离，有利于细胞营养的摄入和废物的排出，加快微循环速度，从而增加创面愈合所需的营养。4)均匀加压，不留腔隙。VSD技术可以防止产生皮下血肿，防止因回植皮肤未与创面紧密接触而致植皮不能成活。VSD产生的负压均匀，能随创面形态而变，使移植皮片与创面紧贴，防止皮下血肿产生[1,16]。5)不需换药减少创面激惹。对照组至少需要换药4次，每次换药将辅料打开，辅料与回植皮肤之间因血痂的存在产生粘连，在分离粘连部位时回植皮肤与创面产生游离，这是植皮难以成活原因之一，每一次换药都是对创面修复过程的干扰。在VSD组中，在VSD拆除之前不需要

换药，能保证植皮成活的自然进程没被打断。

使用VSD法要注意以下事项：1)在VSD辅料固定之前，止血要彻底，创面内不能有活动性出血，创面内的活动性出血必须结扎，大的创面渗血用电凝止血。否则术后在负压的吸引下出血量大，术后要严密观察术后引流瓶的引流量及引流物的性质，如发现出血>300 mL/h，则为活动性出血，应紧急处理，防止产生大量出血引发失血性休克[17]。2)在创面污染范围大且深的情况下要彻底清创。术后创面的深部感染，创面表面的VSD无法将深部的渗出及污染清理(VSD覆盖于创面表面，仅仅对治疗浅 部感染有效)，此时VSD将起到反作用，其会阻碍创面内的坏死物及感染渗出物的排出，不及时拆除VSD及贴膜，坏死物及感染渗出物及细菌吸收入血，可能会产生脓毒血症及败血症，危及患者生命。

综上所述，对前臂因挤压导致的前臂皮肤脱套伤，急诊采用皮肤原位回植加VSD技术治疗相较于传统加压包扎回植皮肤，能明显提高回植皮肤成活率，减少皮肤创面感染和产生皮下血肿率，缩短住院时间，减少换药次数，减少二次手术修复率。全厚皮原位回植极少的产生瘢痕挛缩现象，减少患者的腕关节及手部功能受限。VSD在术后要注意患者病情变化，防止产生严重的并发症。

参考文献

1. Kakagia D, Karadimas E, Drosos G, et al. Vacuum-assisted closure downgrades reconstructive demands in high-risk patients with severe lower extremity injuries[J]. Acta Chir Plast, 2009, 51(3/4): 59-64.
2. Senchenkov A, Petty PM, Knoetgen J 3rd, et al. Outcomes of skin graft reconstructions with the use of Vacuum Assisted Closure [VAC(R)] dressing for irradiated extremity sarcoma defects[J]. World J Surg Oncol, 2007, 5: 138.
3. Leclercq A, Labeille B, Perrot JL, et al. Skin graft secured by VAC (vacuum-assisted closure) therapy in chronic leg ulcers: A controlled randomized study[J]. Ann Dermatol Venereol, 2016, 143(1): 3-8.
4. Ellis G. How to apply vacuum-assisted closure therapy[J]. Nurs Stand, 2016, 30(27): 36-39.
5. 张美光, 李志清, 王甲汉, 等. 负压封闭引流联合含氧液冲洗修复糖尿病患者慢性创面的效果观察[J]. 中华烧伤杂志, 2014, 30(2): 116-123.
   ZHANG Meiguang, LI Zhiqing, WANG Jiahan, et al. Effects of vacuum sealing drainage combined with irrigation of oxygen loaded fluid on chronic wounds in diabetic patients[J]. Chinese Journal of Burns, 2014, 30(2): 116-123.
6. Yuan XG, Zhang X, Fu YX, et al. Sequential therapy with "vacuum sealing drainage-artificial dermis implantation-thin partial thickness skin grafting" for deep and infected wound surfaces in children[J]. Orthop Traumatol Surg Res, 2016, 102(3): 369-373.
7. Govea-Camacho LH, Astudillo-Carrera A, Hermosillo-Sandoval JM, et al. Impact of vacuum-assisted closure management in deep neck abscesses[J]. Cir Cir, 2016, 84(4): 275-281.
8. Beltzer C, Eisenächer A, Badendieck S, et al. Retrospective analysis of a VACM (vacuum-assisted closure and mesh-mediated fascial traction) treatment manual for temporary abdominal wall closure—results of 58 consecutive patients[J]. GMS Interdiscip Plast Reconstr Surg DGPW, 2016, 5: Doc19.
9. Shi B, Sun J, Cao Y, et al. Application of vacuum sealing drainage to the treatment of seawater-immersed blast-injury wounds[J]. Int Wound J, 2016, 13(6): 1198-1205.
10. Wang J, Zhang H, Wang S. Application of vacuum sealing drainage in the treatment of internal fixation instrument exposure after early postoperative infection[J]. Minerva Chir, 2015, 70(1): 17-22.
11. Weed T, Ratliff C, Drake DB. Quantifying bacterial bioburden during negative pressure wound therapy: does the wound VAC enhance bacterial clearance?[J]. Ann Plast Surg, 2004, 52(3): 276-279.
12. Labanaris AP, Polykandriotis E, Horch RE. The effect of vacuum-assisted closure on lymph vessels in chronic wounds[J]. J Plast Reconstr Aesthet Surg, 2009, 62(8): 1068-1075.
13. Perceau G. Negative pressure therapy in the treatment of leg ulcers[J]. Soins, 2014(782): 42-44.
14. 任高宏, 黎健伟, 黎润光, 等. 桥式皮瓣联合游离植皮负压封闭引流修复下肢大面积环形软组织缺损[J]. 中华外科杂志, 2012, 50(1): 39-44.
   REN Gaohong, LI Jianwei, LI Runguang, et al. Treatment of large circular soft tissue defect in lower extremities with a combination of bridge flaps and free skin graft covered by vacuum sealing drainage[J]. Chinese Journal of Surgery, 2012, 50(1): 39-44.
15. Rennie A, Hanu-Cernat LM. Simple technique for transferring the contour of the skin defect from the recipient site to the donor site when harvesting full thickness skin grafts in the head and neck[J]. Br J Oral Maxillofac Surg, 2013, 51(8): 983-984.
16. 温皇鼎, 李志清, 张美光, 等. 负压封闭引流联合含氧液冲洗对下肢慢性静脉性溃疡患者创面的影响[J]. 中华烧伤杂志, 2015, 31(2): 86-92.
   WEN Huangding, LI Zhiqing, ZHANG Meiguang, et al. Effects of

vacuum sealine drainage combined with irrigation of oxygen loaded fluid on wounds of pa-tients with chronic venous leg ulcers[J]. Chinese Journal of Burns, 2015, 31(2): 86-92.

17. 王秀. 四肢创面应用负压封闭引流的护理[J]. 护理与康复, 2011, 10(3): 211-212.
WANG Xiu. Limbs application closed negative pressure drainage the nursing of the wound[J]. Nursing and Rehabilitation Journal, 2011, 10(3): 211-212.

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