

脑卒中慢性期患者高强度重复步行训练的效果

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【摘要】 目的 探讨高强度重复训练对卒中慢性期患者步行能力的有效性和安全性。方法 选取 2020-09—2021-08 慢性期脑卒中患者 60 例为观察对象,对照组和治疗组各 30 例,治疗组接受以训练时靶心率和步数为目标的步行训练,每周 5 d,每天 2 h 康复训练,期间高强度重复性步行训练时间不少于 1.5 h。对照组接受常规康复训练,每周 5 d,每天 2 d 康复训练。分别于训练前和训练后 2 周后采用功能性步行分级量表 (FAC)、Berg 平衡量表 (BBS)、10 m 最大速度步行测试 (10MWT)、6 min 步行测试 (6MWT) 等指标评价治疗有效性。记录 2 组训练中发生的不良事件评价治疗的安全性。结果 治疗组中因陪护原因未坚持训练而脱落 1 例,其余均完成 2 周治疗。训练 2 周后,治疗组恢复独自步行能力 (FAC \geq 4) 21 例,明显高于对照组的 10 例 ($P<0.01$); 治疗组 BBS 评分 (44.52 \pm 10.31) 分,明显高于对照组的 (34.67 \pm 12.54) 分 ($P<0.01$); 治疗组 10MWT 为 (0.69 \pm 0.31) m/s,明显高于对照组的 (0.45 \pm 0.28) m/s ($P<0.01$); 治疗组 6MWT 为 (192.14 \pm 89.96) m,明显高于对照组的 (129.63 \pm 70.77) m ($P<0.01$)。治疗组患者治疗期间除出现 1 例臀部肌肉酸痛外,其余无不良反应。结论 高强度重复步行训练可以明显改善慢性期脑卒中患者的步行能力,且训练过程安全,无严重不良反应。

【关键词】 脑卒中;高强度训练;高重复训练;慢性期;步行训练

【中图分类号】 R743.3 **【文献标识码】** A **【文章编号】** 1673-5110 (2022) 04-0493-05

基金项目:北京市西城区优秀人才拔尖团队项目(编号:202155)

Effect of high intensity and high repetition walking training for chronic stroke patients

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【Abstract】 Objective To explore the availability and security of high intensity and high repetition in walking ability of chronic stroke patients. **Methods** A total of 60 patients with chronic stroke from September 2020 to August 2021 were selected as the observation subjects and randomly divided into two groups, control group and treatment group each of 30 cases. The treatment group received walking training with the target heart rate and step number during training and 2 hours a day, 5 days a week during that time the high intensity repetitive walking training not less than 1.5 hours. The control group was given routine rehabilitation training 2 hours a day, 5 days a week. The functional walking scale (FAC), Berg balance scale (BBS), 10 m maximum speed walking test (10MWT) and 6 min walking test (6MWT) were evaluated before and 2 weeks after training. Adverse effects during training were recorded to evaluate the safety of treatment group. **Results** In the treatment group, 1 case was removed due to the accompanying reason and others completed 2 weeks treatment. After 2 weeks of training, 21 patients in the treatment group recovered their walking ability (FAC \geq 4), which was significantly higher than that in the control group ($P<0.01$). The BBS score of the treatment group was (44.52 \pm 10.31) points, which was significantly higher than that of the control group ((34.67 \pm 12.54) points, $P<0.01$). The 10MWT of the treatment group was

DOI: 10.12083/SYSJ.212013

收稿日期 2021-12-24 本文编辑 关慧 夏保军

本文引用信息:陆敏杰,田园,吴长伟,王裕行,王冬缘,侯亚静,王泳. 脑卒中慢性期患者高强度重复步行训练的效果[J]. 中国实用神经疾病杂志, 2022, 25(4): 493-497. DOI: 10.12083/SYSJ.212013

Reference information: LU Minjie, TIAN Yuan, WU Changwei, WANG Yuxin, WANG Dongyuan, HOU Yajin, WANG Yong. Effect of high intensity and high repetition walking training for stroke patients [J]. Chinese Journal of Practical Nervous Diseases, 2022, 25(4): 493-497. DOI: 10.12083/SYSJ.212013

(0.69±0.31) m/s, which was significantly higher than that of the control group ((0.45±0.28) m/s, $P<0.01$). The 6MWT of the treatment group was (192.14±89.96) m, which was significantly higher than that of the control group ((129.63±70.77) m, $P<0.01$). In the treatment group, there were no adverse reactions except 1 case of hip muscle soreness. **Conclusion** The high intensity and high repetition walking training can improve significantly the walking ability of patients with chronic stroke, and the training process is safe without serious adverse reactions.

【Key words】 Stroke; High intensity training; High repetition training; Chronic stage; Walking training

脑卒中具有高发病率、高致残率和高病死率的特点,是导致长期残疾的主要原因^[1]。步行能力是卒中后功能独立和长期生存的重要预测指标。尽管经过早期的积极治疗, > 80%的卒中慢性期患者会遗留不同程度步行功能障碍,所以重获步行能力是卒中患者最主要的目标^[2],故脑卒中恢复期康复训练成为关键的治疗手段,有效的康复方案与治疗效果密切相关。常规康复训练主要通过循序渐进的训练方案改善患者的运动功能及感觉功能,但常规训练所需周期长、效果欠佳,需要消耗大量人力及物力^[3],给家庭和社会带来极大的经济负担。如何快速有效改善脑卒中慢性期患者的步行活动能力,提高步行速度及距离,减少跌倒风险,让其尽快回归家庭和社会,是物理治疗师工作中的重要目标。既往研究^[4]显示,高强度重复的康复训练可以改善脑卒中慢性期患者的步行功能,但其有效性和安全性一直受到质疑,所以未被临床广泛认可和应用。同样 KLASSEN 等^[5]认为,高强度训练应用于脑卒中患者能取得良好的临床效果,但针对高强度运动方案目前没有统一标准。本研究采用高强度重复步行训练方案治疗脑卒中慢性期患者,观察此方案是否能有效改善步行能力且 not 增加不良事件。

1 对象和方法

1.1 研究对象 纳入 2019-09—2021-08 于首都医科大学附属复兴医院康复中心接受康复治疗的慢性期脑卒中患者 60 例为观察对象。纳入标准:(1)符合 1995 年中华医学会第四届脑血管病学术会议制订的脑卒中诊断标准^[6];(2)首次发病且病程 6 个月

以上;(3)认知能力可以接受评价及训练[简易精神状态评定量表(mini-mental state examination, MMSE)评分 21 分以上];(4)功能性步行分级量表(functional ambulation classification, FAC)≥2 级。

排除标准:(1)严重的心血管疾病(NYHA IV 级心力衰竭患者、严重主动脉狭窄);(2)无法控制的高血压、糖尿病;(3)下肢截肢;(4)合并小脑损伤、帕金森病。治疗组和对照组各 30 例,2 组一般资料对比差异无统计学意义($P>0.05$),见表 1。患者或家属签署知情同意书,研究获得医院伦理委员会批准(批准号:2021FXHEC-KSP002)。

1.2 干预方法 对照组接受常规康复训练,内容以患侧下肢关节活动度训练、患侧下肢力量训练、躯干力量训练、平衡功能训练、步行训练为主,每天训练 2 h。

治疗组接受高强度重复步行训练,训练内容根据病人步行能力实际情况,选择治疗师搀扶/监督下室内步行训练;跑步机步行训练(渐进提高跑步机速度、坡度及时间);上下楼梯训练(普通楼梯)中 1~2 项为主要训练内容。根据 MEGHAN 等^[7]的研究为依据制定本研究方案的具体运动量:(1)高强度采用靶心率为观察指标,每日训练 2 h 且期间至少 1.5 h 运动强度达到运动靶心率下限,靶心率=(最大心率-静息心率)×0.6+静息心率。(2)高重复采用计步器(华为手环 4e 活力版)记录步数,步行步数逐渐增加,第 1 周步数 1 000~2 000 步/d,第 2 周步数达到 2 000~4 000 步/d。根据病人实际情况,允许使用手杖、踝足矫形器(ankle-foot orthosis, AFO)^[8]等辅助具,帮助完成高强度、高重复性训练。

1.3 观察指标及评价标准 于训练前、2 周训练结

表 1 2 组一般资料比较

Table 1 Comparison of general data of two groups

组别	n	性别		年龄/岁	病程/月
		男	女		
治疗组	29	14(48.0)	15(52.0)	60.45±9.46	10.41±2.44
对照组	30	15(50.0)	15(50.0)	61.53±9.53	9.40±2.44
t/χ ² 值		0.018		-0.439	1.593
P 值		0.800		0.864	0.117

束后对 2 组病人进行评定,参与评定的治疗师均经过评价标准一致性的培训,确保评定标准实施的一致性。

1.3.1 FAC: 针对患者的步行能力进行评定,共分 6 级,其中 5 级表示患者任何地方均可独立步行;4 级表示在斜坡或爬楼梯时需要帮助,但户外平地能独立步行;3 级表示步行过程需要 1 人进行语言指导或看护,但不需要身体接触;2 级表示步行过程需要 1 人间断性地接触患者身体以维持平衡;1 级表示全程需要 1 人搀扶才可步行;0 级表示无法步行^[9]。

1.3.2 Berg 平衡量表(Berg balance scale, BBS): 共 14 项功能性活动,每项最低 0 分,最高 4 分,总分 56 分,40 分以下提示有跌倒风险,分值越高,平衡功能越好^[10]。

1.3.3 10 m 步行测试(10 meters walk test, 10MWT): 在室内走廊完成 3 次最快步行 10 m 的平均速度测量步行速度^[11]。

1.3.4 6 min 步行测试(6 minutes walk test, 6MWT):

在室内走廊绕 10 m 标线以最快最安全的速度来回步行 6 min,记录最终步行距离,单位以米(m)表示^[12]。

1.3.5 不良事件: 包括一般不良事件,如肌肉拉伤、头晕、心绞痛等;严重不良事件,如训练中跌倒、需要住院治疗的心血管事件。

1.4 统计学分析 采用 SPSS 23.0 统计学软件进行分析和处理数据,计数资料以频数(%)表示,采用 χ^2 检验和非参数检验;计量资料用均数 \pm 标准差($\bar{x}\pm s$)表示,组间对比采用独立样本 t 检验, $P < 0.05$ 为差异有统计学意义。

2 结果

训练前 2 组 FAC、BBS、10MWT、6MWT 对比差异均无统计学意义($P > 0.05$)。训练 2 周结束后,2 组 FAC、BBS 评分、10MWT、6MWT 均较训练前改善,且治疗组 FAC、BBS 评分、10MWT、6MWT 优于对照组,差异均有统计学意义($P < 0.01$)。见表 2~3、图 1。

表 2 2 组训练前后 FAC 各级分布

Table 2 FAC levels were distributed in both groups before and after training

组别	n	2级		3级		4级		5级		χ^2 值		P值	
		训练前	训练后	训练前	训练后	训练前	训练后	训练前	训练后	训练前	训练后	训练前	训练后
治疗组	29	5	1	20	7	4	14	0	7	0.494	12.827	0.781	0.005
对照组	30	4	2	20	18	6	10	0	0				

表 3 2 组训练前后步行能力对比 ($\bar{x}\pm s$)

Table 3 Comparison of walking ability between the two groups before and after training ($\bar{x}\pm s$)

组别	n	BBS 评分/分		10MWT/(m/s)		6MWT/m	
		训练前	训练后	训练前	训练后	训练前	训练后
治疗组	29	35.21 \pm 13.60	44.52 \pm 10.31	0.41 \pm 0.29	0.69 \pm 0.31	125.31 \pm 76.81	192.14 \pm 89.96
对照组	30	32.53 \pm 12.70	34.67 \pm 12.54	0.40 \pm 0.28	0.45 \pm 0.28	119.77 \pm 72.86	129.63 \pm 70.77
t 值		0.781	3.289	0.053	0.478	0.284	2.972
P 值		0.44	0.002	0.96	0.002	0.78	0.004

3 讨论

中枢神经可塑性是神经康复的理论基础,积极主动的康复训练可以促进大脑重塑,从而改善神经支配^[13]。脑卒中后的早期康复效果较好,而超过 6 个月则康复治疗效果明显下降^[14]。其主要原因:针对慢性期患者,常规治疗模式强度普遍较低,多以低强度、低重复性训练为主,缺乏运动量,从而影响脑神经重塑^[15]。然而,高强度、高重复性训练能在短时间内增加患者运动强度,有效改善患者肌肉力量、平衡能力以及心肺功能,从而进一步提高步行能力^[16-19],

且在训练过程中安全可靠。

本研究显示,2 组患者训练前各项数据差异均无统计学意义($P > 0.05$),训练 2 周结束后 2 组 FAC、BBS 评分、10MWT、6MWT 均较训练前改善,且治疗组治疗效果更明显($P < 0.01$),说明强度和重复性是提高步行能力的一个重要因素^[20-22]。脑卒中后由于步行功能障碍,患者总运动量减低,活动范围受限,心肺功能约只有同性别、同年龄段健康人群的 50%^[5]。目前脑卒中后传统康复治疗方案大多以低强度的肢体动作诱发、核心控制、姿势稳定为主要训练内容,并未

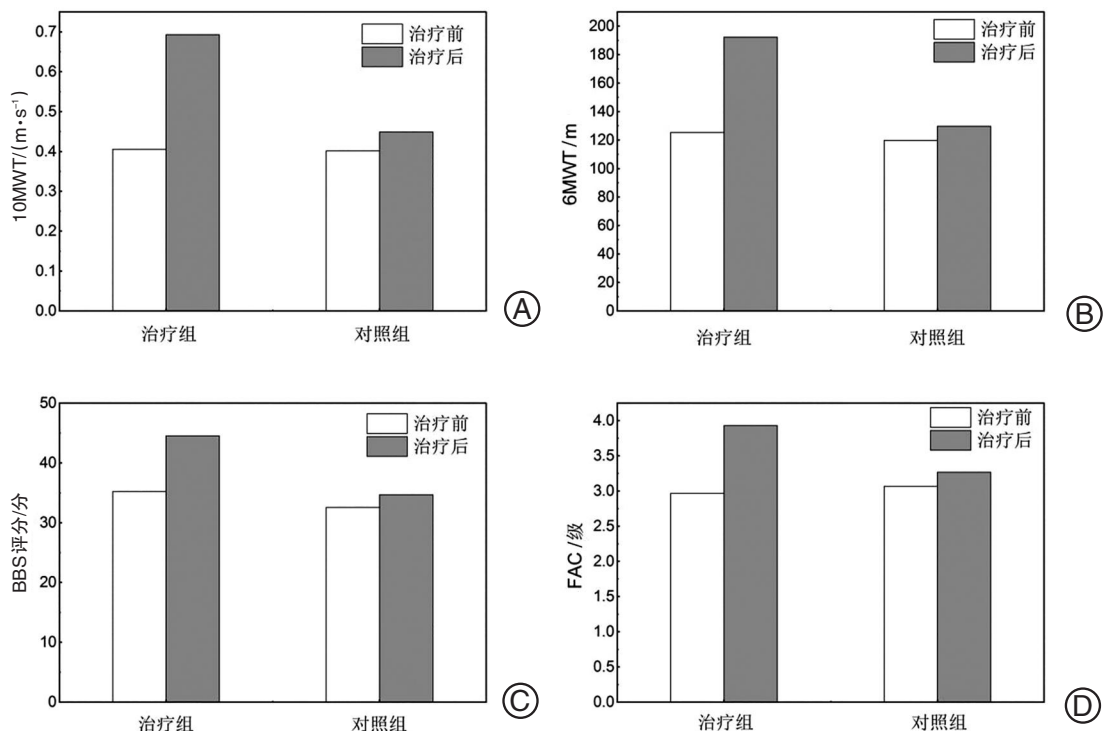


图1 2组治疗前后10MWT、6MWT、BBS、FAC对比

Figure 1 Comparison of 10MWT, 6MWT, BBS scores and FAC results between the two groups before and after treatment

涉及训练过程中心肺适应能力的干预。但越来越多的研究^[23-27]显示,高强度的训练可以改善患者有氧运动能力减低和活动受限的状况。本研究以心率作为治疗组强度的观察指标,每日步行总量(步数)作为重复性指标,结果发现,除1人外,其余患者均恢复独立步行能力(FAC≥3),其中21例达到室外步行能力(FAC≥4),提示慢性期脑卒中病人接受高强度高重复性训练能更有效改善步行能力,主要是因高强度、高重复性训练强调在不同环境中进行有技巧的功能性步行训练,改善心肺功能^[28]的同时,也增加了患侧肢体力量和心理适应度。

本研究发现,治疗组通过高强度重复性训练后BBS评分明显高于对照组,提示高强度重复性训练2周可有效改善慢性期脑卒中患者步行中的躯干稳定性和平衡能力,主要原因为为在跑台或地面上进行密集性、重复性训练,有效激活了患侧下肢和躯干肌肉的兴奋性,反复摆腿、落足、蹬地的模式化动作有助于患者感觉-运动回路形成,从而提高步行平衡能力。另外,治疗组步行速度(10MWT)明显优于对照组,提示抗重力体位下的跑台、上下楼梯训练能有效改善与速度相关下肢肌群力量。以踝跖屈肌群为例,步行中完成较多次数的迈步、蹬地动作,一方面减少蹬地所用时间,另一方面提高了蹬地所需力量,从而减少了双侧肢体支撑期所耗时间,增加了双下肢步

频和步长,最终提高了步行速度。同样, WILLIAMS等^[29]研究发现,步行速度与踝跖屈力量有关,踝跖屈的角速度约200°/s,非步行下的踝跖屈肌肉力量训练无法达到其角速度要求,这一点与本研究结果一致。本研究还发现,高强度、高重复性步行训练干预后步行距离(6MWT)显著高于对照组,提示在大量重复性行走训练后,不但提高了患者的心肺适能,可能患侧血管床氧运输能力也显著提高,患侧和非患侧肌肉协调运动模式发生改变,三者共同作用导致整体运动耐力增加,从而改善了步行的距离。HOLLERAN等^[30]应用抗阻力步行训练以达到高强度的效果,结果发现,相比低强度组,高强度组步行距离(6MWT)也显著提高,其研究结果支持了脑卒中慢性期患者接受高强度高重复性步行训练能较快提高步行活动能力。除治疗组1例发生臀部肌肉酸痛外,其余患者并未发生其他不良事件,训练过程安全。

高强度高重复性步行训练可以在较短时间内明显改善慢性期脑卒中患者的步行能力,且训练过程是安全的。本研究样本量偏小,干预周期有限,有待扩大样本量进一步研究。

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