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低频重复经颅磁刺激联合等速肌力训练模式干预对脑卒中的影响 *

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摘要 目的:探讨等速肌力训练与低频重复经颅磁刺激对脑卒中患者下肢肌力的影响。**方法:**选择 2020 年 2 月到 2021 年 8 月在本院住院诊治的脑卒中患者 96 例作为研究对象,采用完全随机化 1:1 信封抽签原则把患者分为联合组与对照组各 48 例。对照组给予等速肌力训练,联合组在对照组治疗基础上给予低频重复经颅磁刺激治疗。两组在 4 周后记录下肢肌力变化情况。**结果:**(1)两组治疗后的美国国立卫生院神经功能缺损评分(NIHSS)低于治疗前,联合组低于对照组(P<0.05)。(2)两组治疗后的简化 Fugl-Meye 下肢评分高于治疗前,联合组高于对照组(P<0.05)。(3)两组治疗后的 120 °/s 时膝关节的伸肌与屈肌峰力矩体重比都高于治疗前,联合组高于对照组(P<0.05)。(4)两组治疗后的运动诱发电位潜伏期低于治疗前,波幅高于治疗前,联合组与对照组对比有差异(P<0.05)。**结论:**等速肌力训练联合低频重复经颅磁刺激在脑卒中患者的应用能促进改善神经功能与运动诱发电位,从而提高患者的下肢肌力与运动能力。

关键词:等速肌力训练;低频重复经颅磁刺激;脑卒中

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Effects of Isokinetic Training and Low Frequency Repetitive Transcranial Magnetic Stimulation on Muscle Strength of Lower Limbs in Patients with Stroke*

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ABSTRACT Objective: To explore the effect of isokinetic muscle training and rTMS on the muscle strength of the lower limbs of stroke patients. **Methods:** From February 2020 to August 2021, 96 cases of stroke patients who were hospitalized in our hospital were selected as the research objects, and the patients were divided into combination group and control group of 48 cases in each groups used the principle of fully randomized 1:1 envelope drawing. example. The control group were given isokinetic training, and the combination group were given rTMS on the basis of the control group. Both groups were treated and observed for 4 weeks, and the changes in lower limb muscle strength were recorded. **Results:** (1)After treatment, the National Institute of Health stroke scale (NIHSS) of the two groups were lower than before treatment, and the combination group were lower than the control group (P<0.05). (2)The simplified Fugl-Meye lower limb scores after treatment in the two groups were higher than before treatment, and the combination group were higher than the control group (P<0.05). (3)After treatment, the weight ratio of the knee joint extensor and flexor peak moments in the two groups were higher than before treatment at 120 ° /s, and the combination group were different with control group (P<0.05). (4)The latency of motor evoked potentials after treatment in the two groups were lower than before treatment, and the amplitude were higher than before treatment, the difference compared between the combination group and the control group were also significant (P<0.05). **Conclusion:** The application of isokinetic muscle training combined with rTMS in stroke patients can promote the improvement of neurological function and motor evoked potentials, thereby improving the lower limb muscle strength and exercise ability of patients.

Key words: Isokinetic muscle training; Low frequency repetitive transcranial magnetic stimulation; Stroke

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前言

脑卒中是导致社区居民致残与死亡的重要原因之一。近些年,医学技术在不断革新,随着这一技术的发展,脑卒中患者的存活率逐渐升高,但脑卒中所产生的后遗症会严重影响患者的生活[1,2]。肢体功能障碍是脑卒中最常见的临床表现之一,主要表现为肌肉无力,约有 70.0 %脑卒中患者存在残余肢体功能的障碍,因此,脑卒中康复中核心目标之一为恢复下肢自主运动功能[3]。肌力训练被认为是恢复脑卒中患者下肢肌力的重要方法之一,等速肌力训练是指关节运动的角速度恒定不变,可提高脑卒中偏瘫患者肌肉功能及活动能力,但该方法对于患者的依从性要求较高,且所要求的训练周期较长,很难取得良好的长期疗效[4,5]。低频重复经颅磁刺激（Repetitive transcranial magnetic stimulation, rTMS)具有操作简便、无衰减、无创等优势[6]。其是通过调节大脑局部皮质兴奋性,影响皮质代谢及脑血液循环,从而改善患者脑组织可塑性,促进脑功能康复[7,8]。当前重复低频重复经颅磁刺激已广泛应用于治疗睡眠障碍、精神分裂、抑郁症等疾病,也取得了较好的效果[9,10]。本文具体探讨了等速肌力训练联合低频重复经颅磁刺激对脑卒中患者下肢肌力的影响,以明确低频重复经颅磁刺激的应用效果与机制。

1 资料与方法

1.1 一般资料

选择 2020 年 2 月到 2021 年 8 月在滨州医学院烟台附属医院住院诊治的 96 例脑卒中患者作为研究对象，采用完全随机化 1:1 信封抽签原则将其分为联合组与对照组,且各 48 例。纳入标准:生命体征稳定,伴随有单侧肢体功能障碍,由脑卒中引起;首次发病,符合脑卒中的诊断标准,并经过头颅磁共振成像确诊[11];美国国立卫生院神经功能缺损评分(National Institute of Health stroke scale, NIHSS)在 5~20 分之间[12];无感觉性失语、癫痫;患者知情并签署同意书;经医院伦理委员会批准。

排除标准:带有心脏起搏器、电子耳蜗等其他植入设备者;不配合训练与治疗的患者;存在出血倾向及凝血功能障碍等疾病者:再发脑血管疾病者;存在下肢深静脉血栓者;认知功能障碍或者精神疾病患者。

1.2 治疗方法

对照组:给予等速肌力训练,采用等速肌力测试训练系统(BIODEX 公司),选择等速向心训练。使患者取正常坐位,对患者双肩进行固定、腰腹部及大腿充分,将阻力垫固定在患侧内踝上方。根据下肢具体肌力设定 60 ° /s-150 ° /s 等速度,进行膝关节伸、屈训练,并于每次速度改变时休息 30 s 左右,总训练强度以患者感到患侧股四头肌适度疲劳即刻,1 次 /d,5 次 / 周,连续应用 4 周。

联合组:在对照组治疗的基础上给予低频重复经颅磁刺激治疗,刺激部位为患侧大脑原始运动皮质区,刺激参数:刺激频率 1 Hz,刺激强度 100 %静息运动阈值,刺激个数 900 个。嘱患者坐位,使身体处于放松状态,将低频重复经颅磁刺激的线圈垂直放于患者刺激部位，固定线圈位置，每次刺激 15 分钟,1 次 /d,5 次 / 周,连续应用 4 周。

两组在治疗过程中均给予常规基础药物治疗、作业治疗与站立训练、步行训练等。

1.3 观察指标

1.3.1 NIHSS 评分统计分析 于治疗前后,进行 NIHSS 评分,判断患者神经功能障碍的程度,分数与神经功能成反比。

1.3.2 FMA-LE 评分统计分析 于治疗前后，采用简式 Fugl-Meyer 下肢运动功能评分量表（Fugl-Meyer assessment of lower extremity, FMA-LE)进行评分,满分为 34 分,分数与下肢运动功能成正比。

1.3.3 下肢肌力检测 于治疗前后,进行下肢肌力检测,使用 Easytech 多关节等速测试训练系统，使患者尽全力伸屈膝关节,记录 120 ° /s 时膝关节的伸肌与屈肌峰力矩体重比。

1.3.4 神经电生理测定 于治疗前后，进行神经电生理测定,记录运动诱发电位的潜伏期与波幅。

1.4 统计学方法

采用 SPSS21.00 进行统计分析，显著性水平为 α=0.05, P<0.05 代表对比差异有统计学意义,计量资料均用均数± 标准差表示(对比为配对 t 检验),计数数据以率表示(对比为卡方 x^2 分析)。

2 结果

2.1 一般资料对比

两组一般资料对比无差异(P>0.05)。见表 1。

表 1 一般资料对比

Table 1 Comparison of general data

Groups	n	Gender (Male/female)	Age (years)	Right-handed (n)	Location of onset (left/right)	Body mass index (kg/m²)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Combination group	48	28/20	54.66± 4.11	57(91.9 %)	25/23	22.76± 1.57	127.01± 14.75	78.92± 3.57
Control group	48	24/24	54.29± 3.19	58(93.5 %)	24/24	22.19± 2.24	128.76± 14.47	78.67± 4.11

2.2 NIHSS 评分变化对比

与治疗前相比,两组治疗后的 NIHSS 评分较低,联合组较对照组低(P<0.05)。见表 2。

2.3 简化 Fugl-Meye 下肢评分变化对比

两组治疗后的简化 Fugl-Meye 下肢评分高于治疗前,联合组高于对照组(P<0.05)。见表 3。

2.4 膝关节峰力矩体重比变化对比

两组治疗后的 120 ° /s 时膝关节的伸肌与屈肌峰力矩体重比都高于治疗前,联合组高于对照组(P<0.05)。见表 4。

表 2 NIHSS 评分变化对比(分,均数± 标准差)

Table 2 Comparison of NIHSS scores (score, mean ± standard deviation)

Groups	n	Pretherapy	Post-treatment
Combination group	48	12.11± 1.48	3.02± 0.44*#
Control group	48	12.87± 1.22	5.54± 0.87#

Note: Compared with control group, *P<0.05; compared with Pretherapy, #P<0.05, the same below .

表 3 简化 Fugl-Meye 下肢评分(分,均数± 标准差)

Table 3 FuGL-MeYE lower extremity score (score, mean ± standard deviation)

Groups	n	Pretherapy	Post-treatment
Combination group	48	20.15± 2.48	30.84± 3.55*#
Control group	48	20.76± 3.11	26.98± 4.15#

表 4 膝关节峰力矩体重比变化对比(%,均数± 标准差)

Table 4 Comparison of peak moment weight ratio of knee joint (%, mean ± standard deviation)

Groups	n	Extensor		Flexor	
		Pretherapy	Post-treatment	Pretherapy	Post-treatment
Combination group	48	59.22± 3.18	71.65± 2.57*#	27.44± 3.18	33.28± 2.57*#
Control group	48	59.28± 5.11	65.20± 3.47#	27.10± 2.57	30.11± 4.55#

2.5 运动诱发电位潜伏期与波幅变化对比

两组治疗后的运动诱发电位潜伏期低于治疗前,波幅高于治疗前,联合组与对照组对比有差异(P<0.05)。见表 5。

表 5 运动诱发电位潜伏期与波幅变化对比(均数± 标准差)

Table 5 Comparison of latency and amplitude of EMP (mean ± standard deviation)

Groups	n	The incubation period (ms)		Amplitude (mv)	
		Pretherapy	Post-treatment	Pretherapy	Post-treatment
Combination group	48	24.30± 3.57	20.11± 2.57*#	1.11± 0.14	1.57± 0.22*#
Control group	48	24.76± 4.11	22.10± 3.00#	1.12± 0.12	1.37± 0.28#

3 讨论

脑卒中具有起病急、致死率高和致残率高等特点,据报道,在脑卒中幸存者中,约有 80 %的患者会存在不同的功能障碍。其中肢体功能障碍不仅导致患者的运动质量下降,还给患者增加了骨折的风险,严重影响其生活质量[13]。近年来由于社会变革和人们生活方式的变化, 脑卒中的发病率人数有增加的趋势。当前对于脑卒中的治疗以康复训练、西药、中药治疗为主。神经可塑性和脑功能重组是脑卒中运动功能恢复的基础,因此在脑卒中后,患者进行及早的特定康复治疗,对于大脑可塑性的改变具有促进作用,进而可改善其预后[14]。等速肌力训练是抗阻训练,具有可重复性、安全性、客观性等特点,可增强肌肉力量,可同时测试主动肌和拮抗肌在任何一点的力矩值,避免患者在运动过程中发生不必要的损伤,也可缓解痉挛[15,16]。本研究显示:与治疗前相比,两组治疗后 NIHSS 评分较低,联合组较对照组低;两组治疗后的简化 Fugl-Meye 下肢评分高于治疗前,联合组高于对照组,以上结果表明:二者联合应用对于改善脑卒中患者下肢肌力具有促进作用, 且能提高患者的神经功能。该结果与 Du J 等人[17]的研究具有一致性。从机制上分析,低频重复经颅磁刺激是一种利用脉冲磁场无衰减的穿过颅骨作用于大脑皮质,影响神经组织的电活动及脑内组织代谢,使脑组织产生感应性电流,改变神经细胞膜电位,而产生相应理化反应的刺激技术[18]。其能诱发突触性能增强,重建的短暂网络系统,促进树突和轴突发芽形成新的突触,从而促进脑功能的重组恢复[19]。并且低频重复经颅磁刺激可降低健侧异常增高的皮层兴奋性,增强单纯运动训练的作用,从而促进患者运动功能恢复[20]。

脑卒中是临床中极为常见的脑血管疾病,脑部的血流动力学、血液粘稠度、血管形态可被认为是导致其产生的重要原因。同时脑卒中的发生是一个动态的病理变化过程,可随着缺血程度或出血程度的加重而改变。拮抗肌痉挛将会引发因脑卒中后运动神经元损伤所致的下肢肌力下降,因此合理的肌力训练可显著增加肌肉力量[21]。本研究显示两组治疗后的 120 ° /s 时膝关节的伸肌与屈肌峰力矩体重比都高于治疗前,联合组高于对照组。该结果与 Kim WS 等人[22]的研究具有一致性。从机制上分析,等速肌力训练可防止肌肉废用性萎缩,纠正异常运动模

式,有利于维持关节稳定性。并且等速肌力训练可增强肌力训练的安全性,避免患者在运动过程中发生不良反应。低频重复经颅磁刺激以产生脉冲磁场为途径，对大脑皮质进行连续、重复的刺激,进而起到调节作用,可促进神经的可塑性,改善肌张力,引起相关大脑部下肢功能得到重建[23-25]。

随着心脑血管等疾病发病率的不断攀升,脑卒中也逐年高发。当前报道显示:西药对于脑卒中患者的临床症状、神经功能缺损等具有积极作用,但是对患者的肢体与运动功能改善效果不佳[26]。本研究也显示两组治疗后的运动诱发电位潜伏期低于治疗前,波幅高于治疗前,联合组与对照组对比有差异。该结果与 El-Tamawy MS 等人[27]的研究具有一致性。从机制上分析,等速肌力训练可训练肌肉承受顺应性阻力，进而输出最大的力矩,因此可用于脑卒中患者肌力训练。而低频重复经颅磁刺激可以促进突触的增强和再建,影响大脑皮质的兴奋性,从而改善患者相应的运动诱发电位,从而促进神经功能的恢复。并且低频重复经颅磁刺激也可明显改善脑部的血液动力学,促进神经功能恢复，通过增加血管肌细胞内的环磷酸腺苷的含量,从而改善患者的临床神经功能[28-30]。本研究也存在一定不足,未分析低频重复经颅磁刺激对机体微观炎症因子表达的影响,纳入患者数量较少,且未进行随访分析,将在后续深入探究分析。

总之,等速肌力训练联合低频重复经颅磁刺激应用于脑卒中患者,可促进改善神经功能与运动诱发电位,从而提高患者的下肢肌力与运动能力。

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