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电针刺激联合局部振动治疗对脊髓损伤并发下肢痉挛患者康复效果及血清 BDNF、PDGF 的影响 *

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摘要 目的:探讨脊髓损伤(SCI)并发下肢痉挛患者经电针刺激联合局部振动治疗后的临床效果。**方法:**选取本院于2018年1月到2019年6月期间收治的SCI并发下肢痉挛患者90例,根据乱数表法将上述患者分为对照组(n=45)和研究组(n=45),对照组患者给予常规康复系统疗法治疗,研究组在对照组的基础上给予电针刺激联合局部振动治疗,比较两组患者临床疗效、相关量表评分、内收肌角、直腿抬高角以及血清BDNF、PDGF水平。**结果:**研究组治疗后的临床总有效率为91.11%(41/45),高于对照组的64.44%(29/45)($P<0.05$)。两组患者治疗后改良Barthel指数、血清BDNF、PDGF水平均升高,且研究组高于对照组($P<0.05$);改良Ashworth量表、临床痉挛指数评分降低,且研究组低于对照组($P<0.05$)。两组患者治疗后内收肌角、直腿抬高角均扩大,且研究组大于对照组($P<0.05$)。**结论:**电针刺激联合局部振动治疗SCI并发下肢痉挛患者,可有效促进患者康复,改善下肢痉挛,提高生活自理能力,同时还可有效改善血清BDNF、PDGF水平。

关键词:电针;局部振动治疗;脊髓损伤;下肢痉挛;脑源性神经营养因子;血小板衍生生长因子

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Effect of Electroacupuncture Combined with Local Vibration Therapy on Rehabilitation and Serum BDNF and PDGF in Patients with Spinal Cord Injury Complicated with Lower Extremity Spasm*

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ABSTRACT Objective: To explore the clinical effect of electro-acupuncture combined with local vibration therapy in patients with spinal cord injury (SCI) complicated with lower limb spasm. **Methods:** 90 patients with SCI who were admitted to our hospital from January 2018 to June 2019 were selected, they were divided into control group (n=45) and research group (n=45) according to random number table method. The patients in control group were given routine rehabilitation system therapy. The patients in research group were given electro-acupuncture stimulation combined with local vibration therapy on the basis of the control group. The clinical efficacy, related scale scores, adductor angle, straight leg elevation angle and serum levels of BDNF and PDGF were compared between the two groups. **Results:** The total effective rate of the research group after treatment was 91.11% (41/45), which was significantly higher than that of the control group 64.44% (29/45) ($P<0.05$). The modified Barthel, Serum levels of BDNF and PDGF index increased in both groups after treatment, and that in the research group was higher than that in the control group ($P<0.05$). The scores of modified Ashworth scale and clinical spasm index decreased, and those in the research group were lower than those in the control group ($P<0.05$). The adductor angle and straight leg elevation angle of both groups were enlarged after treatment, and those in the research group were larger than those in the control group ($P<0.05$). **Conclusion:** Electroacupuncture combined with local vibration in the treatment of SCI patients with lower extremity spasm, which can effectively promote the recovery of patients, improve lower extremity spasm, improve the ability of self-care, and also effectively improve the level of serum BDNF and PDGF.

Key words: Electro-acupuncture; Local vibration therapy; Spinal cord injury; Lower limb spasm; Brain-derived neurotrophic factor

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前言

脊髓损伤(Spinal cord injury, SCI)是由于各种不同致病因素引起脊髓结构和功能的损伤,为中枢神经系统的严重创伤之

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—^[1]。随着近年来现代化进程的加快,SCI的发病率呈逐年递增趋势,既往相关调查研究^[2]显示,约有16.87%的脊柱骨折患者可并发SCI。SCI临床主要表现为损伤面以下的运动、感觉和自主神经功能的异常改变,若未能及时予以治疗,可造成下肢痉挛,引起终身残疾,给患者生活质量造成严重影响^[3,4]。目前临床针对SCI的治疗主要给予早期康复治疗,主要目的在于促进患者康复、防止痉挛,并最大程度的保留及恢复患者运动功能^[5,6]。然而此种治疗方式虽可在一定程度上延缓SCI的病理改变,但仍远远无法满足临床。局部振动治疗是引起肌肉振荡以刺激神经肌肉系统的一种特殊的治疗方式^[7]。电针是针灸的一种,具有操作简便、安全可靠、作用持久等优点,可有效恢复SCI患者运动功能^[8]。本研究通过对我院收治的SCI并发下肢痉挛患者给予电针刺激联合局部振动治疗,取得了较好的疗效,现整理报道如下。

1 资料与方法

1.1 一般资料

选取本院于2018年1月到2019年6月期间收治的SCI并发下肢痉挛患者90例,纳入标准:(1)均符合美国脊柱损伤协会(American Spinal Injury Association, ASIA)制定的SCI并发下肢痉挛诊断及分级标准^[9],并经相关影像学确诊;(2)近1个月内未服用过肌肉松弛剂者;(3)既往未接受过针对肢体痉挛的其他中医治疗;(4)生命体征平稳,可参与各项治疗运动;(5)患者及其家属知情本研究且签署了同意书;(6)SCI符合国际标准(ASIA)评定等级的B~D级。排除标准:(1)合并严重心肺等重要脏器功能障碍者;(2)合并严重周围神经损伤、四肢骨折等;(3)合并严重皮肤病无法进行针灸治疗者;(4)合并有关节周围异位骨化等影响神经功能检查者;(5)妊娠及哺乳期妇女;(6)不愿合作,依从性较差者;(7)治疗过程中严重感染及因其他原因中途放弃治疗者。根据乱数表法将上述患者分为研究组(n=45)、对照组(n=45),其中对照组男23例,女22例,年龄28~62岁,平均(43.77±3.81)岁;病程3~28d,平均(10.86±2.35)d;ASIA分级:B级18例,C级17例,D级10例;损伤平面C₃₋₈26例,T₁₋₈19例;损伤部位:颈髓损伤14例,胸髓损伤19例,腰髓损伤12例。研究组男23例,女22例,年龄27~62岁,平均(42.93±3.56)岁;病程4~32d,平均(11.06±2.16)d;ASIA分级:B级19例,C级16例,D级10例;损伤平面C₃₋₈25例,T₁₋₈20例;损伤部位:胸髓损伤18例,颈髓损伤13例,腰髓损伤14例。两组一般资料对比无差异(P>0.05)。

1.2 治疗方法

对照组患者给予常规康复系统疗法,具体如下:(1)电刺激治疗,包括直肠电刺激、功能性电刺激、经皮神经电刺激等。(2)关节锻炼,早期对患者全部关节进行主动活动、被动活动,持续20~30 min,促进关节功能恢复。(3)全身性锻炼,主要包括翻身坐起训练,转移训练,轮椅使用训练,痉挛肌群的牵伸训练,持续牵张训练等。研究组在对照组的基础上联合电针刺激联合局部振动治疗,具体操作如下:选取EP-I型局部振动训练器(意大利EVM公司生产),振幅10 mm,振动输出频率60 Hz,取仰卧位,下肢置于悬吊带,振动器采用网架床悬吊装置将振动器固定,2次/d,每侧下肢训练20 min/次,5d/周,连续治疗8

周。电针刺激方法如下:在SCI节段上方和下方各取督脉一穴,如神庭、百会、灵台、悬枢等,上肢取曲池、外关、合谷,下肢取足三里、阳陵泉、昆仑、太冲及三阴交。采用汉医牌一次性无菌针灸针和华佗牌SDZ-II电针治疗仪进行治疗,步骤如下:常规消毒后,避开瘢痕部位,沿棘突方向进针,采用平补平泻进针法,得气后,施以提插捻转行针,强刺激2 min后,连接电针治疗仪,于肢体远端连接电针负极,近端连接电针正极,采用疏密波,频率为2/100 Hz,以患者耐受的电流强度为宜进行治疗。30 min/次,1次/d,6d/周。连续治疗8周。

1.3 观察指标

(1)记录两组治疗后的临床总有效率。疗效判定^[10]依据如下:显效:临床痉挛指数评分降低1级以上,改良Ashworth评分降低1级以上,改良的Barthel指数评分提高1级以上;有效:临床痉挛指数评分降低1级,改良Ashworth评分降低1级,改良的Barthel指数评分提高1级;无效:治疗前未见明显变化甚至恶化。总有效率=显效率+有效率。(2)于治疗前后采用改良Ashworth量表、改良Barthel指数、临床痉挛指数评价患者上下肢肌张力、日常生活自理能力、痉挛情况,其中改良Ashworth量表^[10]上下肢肌张力由轻~重评分0~5分,分数越高,肌张力情况则越严重。改良Barthel指数^[11]共10个项目,分数越高,日常生活自理能力越好。临床痉挛指数^[12]包括肌张力、腱反射、阵挛3大项,总分0~16分,分数越高,痉挛程度越严重。(3)于治疗前后测量患者内收肌角、直腿抬高角评定患者下肢关节活动度。其中内收肌角为患者膝部使下肢伸直,并尽可能达到最大角度,记录两大腿之间的角度。直腿抬高角为检查者一手置于膝关节上方另一手握住患者踝部,伸直膝关节,抬高至患者感到疼痛时停止,记录抬高角度。(4)于治疗前后抽取患者清晨空腹静脉血6 mL,3900 r/min离心13 min,离心半径14 cm,分离上清液,置于-30℃冰箱中待测。采用双抗体夹心法检测血清脑源性神经营养因子(Brain-derived neurotrophic factor, BDNF)、血小板衍生生长因子(Platelet-derived growth factor, PDGF)水平,严格遵守试剂盒(武汉博士德生物技术有限公司)说明书进行操作。

1.4 统计学方法

采用SPSS25.0进行统计分析,所有数据均符合正态分布,计量资料用($\bar{x} \pm s$)表示,采用t检验,计数资料以率(%)表示,采用 χ^2 检验,以 $\alpha=0.05$ 为检验标准。

2 结果

2.1 临床疗效比较

研究组治疗后的临床总有效率为91.11%(41/45),高于对照组的64.44%(29/45)(P<0.05);详见表1。

2.2 相关量表评分比较

两组患者治疗前改良Ashworth量表、改良Barthel指数、临床痉挛指数评分比较无差异(P>0.05);两组患者治疗后改良Barthel指数评分升高,且研究组高于对照组(P<0.05);改良Ashworth量表、临床痉挛指数评分降低,且研究组低于对照组(P<0.05);详见表2。

2.3 两组内收肌角、直腿抬高角比较

两组患者治疗前内收肌角、直腿抬高角比较无差异(P>0.

05);两组治疗后内收肌角、直腿抬高角均扩大,且研究组大于 对照组($P<0.05$);详见表 3。

表 1 临床疗效比较 [例(%)]
Table 1 Comparison of clinical effects [n(%)]

Groups	Markedly effective	Effective	Invalid	Total effective rate
Control group(n=45)	8(17.78)	21(46.67)	16(35.56)	29(64.44)
Research group(n=45)	17(37.78)	24(53.33)	4(8.89)	41(91.11)
χ^2				9.257
P				0.002

表 2 相关量表评分比较($\bar{x}\pm s$,分)
Table 2 Comparison of relevant scale score($\bar{x}\pm s$, scores)

Groups	Modified Ashworth scale score		Modified Barthel index score		Clinical spasm index score	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group (n=45)	3.92±0.48	2.67±0.32 ^a	45.26±8.51	61.81±9.48 ^a	13.28±1.26	8.24±1.29 ^a
Research group (n=45)	3.99±0.51	1.42±0.27 ^a	45.19±7.48	83.35±8.36 ^a	13.32±1.31	4.38±1.22 ^a
t	0.670	20.027	0.041	11.432	0.148	14.584
P	0.504	0.000	0.967	0.000	0.883	0.000

Note: Compared with before treatment, ^a $P<0.05$.

表 3 两组内收肌角、直腿抬高角比较($\bar{x}\pm s$,°)
Table 3 Comparison of adductor angle and straight leg elevation angle between two groups($\bar{x}\pm s$, °)

Groups	Adductor angle		Straight leg elevation angle	
	Before treatment	After treatment	Before treatment	After treatment
Control group(n=45)	16.98±3.14	31.37±5.19 ^a	43.91±5.44	51.76±5.39 ^a
Research group(n=45)	16.96±3.17	43.15±5.22 ^a	43.87±4.35	59.04±5.38 ^a
t	0.030	10.735	0.039	6.145
P	0.976	0.000	0.969	0.000

Note: Compared with before treatment, ^a $P<0.05$.

2.4 两组血清 BDNF、PDGF 水平比较 两组治疗后血清 BDNF、PDGF 水平均升高,且研究组高于对照组
两组治疗前血清 BDNF、PDGF 水平比较无差异($P>0.05$); 组($P<0.05$);详见表 4。

表 4 两组血清 BDNF、PDGF 水平比较($\bar{x}\pm s$,pg/mL)
Table 4 Comparison of levels of serum BDNF and PDGF between two groups($\bar{x}\pm s$, pg/mL)

Groups	BDNF		PDGF	
	Before treatment	After treatment	Before treatment	After treatment
Control group(n=45)	1.74±0.69	3.17±0.51 ^a	217.28±23.26	330.57±25.32 ^a
Research group(n=45)	1.71±0.58	4.29±0.46 ^a	216.33±24.37	408.13±24.26 ^a
t	0.223	10.939	0.189	14.837
P	0.824	0.000	0.850	0.000

Note: Compared with before treatment, ^a $P<0.05$.

3 讨论

下肢痉挛是 SCI 的常见并发症,据以往研究^[13]发现,12%~37%的 SCI 患者可出现下肢痉挛,发病率较高。下肢痉挛主要是由于上运动神经元损伤后,运动控制发生紊乱引起^[14]。痉挛

对患者的作用具有双重性,适当的低水平肢体痉挛可延缓患者肌萎缩,帮助患者站立,但若肢体痉挛不受控制,则可导致患者肢体疼痛、异位骨化、行走困难等^[15,16]。目前,临床针对 SCI 患者下肢痉挛的主要处理办法为早期康复训练,然而单一的早期康复训练并不能满足所有患者的需求,不利于改善患者预后^[17,18],

局部振动治疗最初用于体育运动员的辅助训练,近年来已逐渐应用于康复治疗中,取得了一定的治疗效果^[19,20]。但仍有不少学者认为,任何一种单一康复治疗方式均存在一定的不足,主张采用综合性康复治疗手段^[21,22]。电针作为针灸的一种,可将电脉冲的物理作用和针刺效应有效结合,可有效延缓周围神经损伤^[23,24]。

本次研究结果显示,研究组治疗后的临床总有效率、改良 Ashworth 量表、改良 Barthel 指数、临床痉挛指数评分改善情况、内收肌角、直腿抬高角等均优于对照组,可见电针刺激联合局部振动治疗对 SCI 患者下肢痉挛,可促进患者康复,提高治疗效果。分析其原因,局部振动治疗对肌肉进行直接振动刺激后,可抑制牵张反射的传入神经输入,从而对肌张力产生影响;同时还可诱导 Ia 类传入神经突触前抑制,抑制单突触反射兴奋。而电针刺激可平衡脏腑经络的气血阴阳、疏导督脉阳气,使得肢体得以濡养,从而达到缓解下肢痉挛的目的。具体机制表现为以下几点:电针刺激可直接作用于脊髓神经,兴奋上下行神经纤维,进而恢复或改善中枢对肌张力的控制。其次,电针刺激可通过调整脊髓抑制与兴奋的生理病理过程来激发处在“间生态”的脊髓组织恢复。另外,电针刺激还可激发脊髓的潜在功能,使得非神经元细胞代偿获得神经元细胞功能,进而缓解肢体痉挛。既往研究结果表明^[25,26],SCI 患者由于受血管破裂、儿茶酚胺神经递质积储等因素影响,可导致血管收缩和阻塞,进而引起神经功能障碍。BDNF 是在大脑内形成的蛋白质,具有促进受损神经再生和分化、改善神经元病理状态等作用^[27]。PDGF 能增加少突胶质细胞脂类蛋白和髓鞘基础蛋白、维持神经元活性,同时还可促进骨细胞增殖分化^[28]。本研究两组患者治疗后血清 BDNF、PDGF 水平平均升高,且研究组高于对照组,可见电针刺激联合局部振动治疗可有效减轻机体神经组织损伤,这可能是因为电针刺激足三里可促进乙酰胆碱释放,加强神经细胞功能;电针刺激百会可改善脑部血液循环,改善患肢神经功能;同时电针刺激治疗还可促使脊髓神经再生,促进新的轴突联系建立,促进患者康复^[29,30]。

综上所述,SCI 并发下肢痉挛患者经电针刺激联合局部振动治疗后,患者症状及血清 BDNF、PDGF 水平得到较大改善,生活自理能力显著提高。

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