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表面肌电图在腰痛患者 ODI 指数和 JOA 评分评估中的临床应用 *

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摘要 目的:探讨表面肌电图在腰痛患者腰椎 Oswestry 功能障碍指数(ODI)和日本骨科协会评估治疗分数(JOA)评估中的临床应用。**方法:**选择 2019 年 6 月至 2020 年 6 月我院接诊的 80 例腰痛患者进行研究,通过将患者按照腰部 VAS 评分的不同划为对照组(VAS 评分 ≤ 5 分)和观察组(5分 $<$ VAS 评分 <10 分),每组各 40 例,两组患者均接受接受常规治疗和肌电仪检测。比较治疗前后两组患者运动传导速度(MCV)、股神经的感觉传导速度(SCV)、动作电位的潜伏期、长肌力(IMS)、腰背肌后伸活动度(ROM)、ODI 指数和 JOA 评分的变化情况。**结果:**治疗后,观察组运动传导速度、股神经的感觉传导速度指标水平均低于对照组,动作电位的潜伏期长于对照组($P<0.05$);观察组长肌力、腰背肌后伸活动度指标水平均低于对照组($P<0.05$);观察组 Oswestry 功能障碍指数(ODI)高于对照组,日本骨科协会评估治疗分数(JOA)评分低于对照组($P<0.05$)。**结论:**腰痛患者中存在着明显的表面肌电图信号改变,且随着腰痛程度的加剧,改变程度越明显,有助于评估患者病情。

关键词:表面肌电图;腰痛;腰椎 Oswestry 功能障碍指数;日本骨科协会评估治疗分数;临床应用

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Clinical Application of Surface Electromyography in Evaluation of ODI Index and JOA Score in Patients with Low Back Pain*

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ABSTRACT Objective: To explore the clinical application of surface electromyography in the evaluation of the Oswestry dysfunction index (ODI) of the lumbar spine in patients with low back pain and the Japanese Orthopaedic Association Evaluation Treatment Score (JOA). **Methods:** 80 patients with low back pain who were admitted to our hospital from June 2019 to June 2020 were selected for the study. The patients were according to the difference of waist VAS score, the patients were divided into a control group (VAS score ≤ 5 points) and an observation group (5 points $<$ VAS score <10 points), 40 cases in each group, patients in both groups received conventional treatment and electromyography. Comparison of motor conduction velocity (MCV), sensory conduction velocity of femoral nerve (SCV), latency of action potential, long muscle strength (IMS), range of motion (ROM), ODI index and JOA before and after treatment Change in score. **Results:** After treatment, the observation group's motor conduction velocity and femoral nerve sensory conduction velocity index levels were lower than those of the control group, and the latency of action potentials was longer than that of the control group ($P<0.05$); the long muscle strength and back extension activity index levels of the observation group were lower than those of the control group ($P<0.05$); the Oswestry Dysfunction Index (ODI) of the observation group was higher than that of the control group, and the Japanese Orthopaedic Association's Evaluation Treatment Score (JOA) score was lower than that of the control group ($P<0.05$). **Conclusion:** There are obvious changes in surface electromyography signals in patients with low back pain, and as the degree of low back pain intensifies, the more obvious the changes are, which helps to evaluate the patient's condition.

Key words: Surface electromyography; Low back pain; Lumbar Oswestry dysfunction index; Japanese orthopaedic association Evaluation of treatment score; Clinical application

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前言

在临床治疗中发现导致患者出现腰部疼痛的原因常见的有二十多种,主要的是脊柱和腰部肌肉软组织所引起的病变^[1,2]。常见的脊柱的原因有脊柱的骨质增生、退行性变、黄韧带的钙化、腰椎管狭窄、腰椎间盘突出症、腰椎滑脱等原因^[3,4]。其中腰部肌肉软组织引起的病变以腰肌劳损为主,由于患者腰部肌肉过度紧张,腰部出现痉挛现象,血液循环会受到阻力,疼痛加剧,严重影响患者日常的身体健康和睡眠质量^[5,6]。目前临床上对于腰痛的评估主要采取 ODI 指数和 JOA 评分等,但此类量表评分缺乏客观性。表面肌电图具有直观便捷、安全无后遗症的特点,其主要是用于肌肉病变以及周围神经病变的诊断,对于运动神经元病、重症肌无力等疾病具有重要的诊断价值^[7,8]。因此,本研究旨在探讨表面肌电图在腰痛患者评估中的临床应用。

1 资料与方法

1.1 一般资料

选择我院 2019 年 6 月至 2020 年 6 月所接诊的 80 例腰痛患者,纳入标准:① 患者均符合腰痛的诊疗规范,并经 X 光片或 MRI 检查确诊;② 临床表现腰部活动受限,下肢出现放射性疼痛,腰部与脊柱两侧的肌肉僵硬且弹性下降;③ 患者签署知情同意书。排除标准:① 脊柱骨折史和脊柱炎;② 既往有与脊椎外科相关的手术史;③ 免疫功能异常及患有其他患有恶性肿瘤;④ 心理和精神类疾病;⑤ 重要内脏器官功能性障碍。将患者按照腰部 VAS 评分的不同划为对照组(VAS 评分 ≤ 5 分)和观察组(5 分 $<$ VAS 评分 <10 分),每组患者为 40 例,对照组与观察组患者的临床基本资料中性别、年龄、BMI 指数、SF-36 评分、病程均具有可比性($P>0.05$)。本研究已通过我院伦理委员会批准实施。

表 1 对照组与观察组患者的临床基本资料比较($\bar{x} \pm s, n(\%)$)

Table 1 Comparison of clinical basic data between control group and observation group($\bar{x} \pm s, n(\%)$)

Groups	Gender		Age (years)	BMI(kg/ m ²)	VAS(scores)	SF-36(scores)	Course of disease (month)
	Man	Woman					
Observation group(n=40)	22(55.00)	18(45.00)	43.09 $\pm$ 2.11	21.15 $\pm$ 2.02	5.15 $\pm$ 0.30	52.13 $\pm$ 6.20	12.05 $\pm$ 1.23
Control group (n=40)	19(47.50)	21(52.50)	43.15 $\pm$ 2.07	21.13 $\pm$ 2.06	4.60 $\pm$ 0.24	53.41 $\pm$ 5.03	12.09 $\pm$ 1.25
χ^2/t value	0.457		0.128	0.051	41.978	1.014	0.144
P value	0.499		0.898	0.959	0.000	0.314	0.886

1.2 治疗方法

两组均给予常规治疗措施,包括嘱咐平躺平板床休息、禁止做弯腰、提重物等活动,并接受腰椎牵引疗法,20 min/ 次,1 次/d,持续治疗 4 周。

1.3 观察指标

记录治疗前后下述指标的变化,开始检查时,先进行神经传导测定,然后采用 NEUROWERK 数字肌电诱发电位仪(德国 SIGMA 公司)测量患者腰部的肌电图情况,① 肌电图指标情况:观察并患者运动传导速度(MCV)、股神经的感觉传导速度(SCV)、动作电位的潜伏期;② IMS 和 ROM:两组患者采用 Ter-gumed 710 脊柱功能测试训练系统进行测试和记录等长肌力(IMS)和腰背肌后伸活动度(ROM)的指标水平,两组患者均测试 2 次,每次用时 3 s,取 2 次的平均值做为有效值;③ ODI 指数和 JOA 评分:ODI 指数由 10 个问题组成,只要由疼痛的强度、生活自理、提物、步行、坐位、站立、干扰睡眠、性生活、社会生活、旅游等 10 个方面构成,每个问题的分值范围为 0~5 分,总分为 50 分,ODI 指数=(实际得分/最高分) $\times$ 100%,ODI 指数越高表明患者的腰椎功能性障碍越严重;JOA 评分的分值范围为 0~29 分,主要包括临床体征、主观症状、日常生活 3 部分,所得分值越低代表患者的功能障碍越大。

1.4 统计学方法

以 spss21.0 软件包处理,正态分布计量资料用均数 $\pm$ 标准差($\bar{x} \pm s$)表示,组间比较使用独立样本 t 检验,组内比较使用配对样本 t 检验,计数资料以率表示, χ^2 检验,差异具有统计学意

义用 $P<0.05$ 表示。

2 结果

2.1 观察组与对照组患者运动传导速度、股神经的感觉传导速度的肌电图对比

治疗后,观察组运动传导速度、股神经的感觉传导速度指标水平均低于对照组,动作电位的潜伏期长于对照组($P<0.05$),见表 2。

2.2 观察组与对照组患者长肌力、腰背肌后伸活动度的指标对比

治疗后,观察组长肌力、腰背肌后伸活动度指标水平均低于对照组($P<0.05$),见表 3。

2.3 观察组与对照组患者 Oswestry 功能障碍指数(ODI)和日本骨科协会评估治疗分数(JOA)评分比较

治疗后,观察组 Oswestry 功能障碍指数(ODI)高于对照组,日本骨科协会评估治疗分数(JOA)评分低于对照组($P<0.05$),见表 4。

3 讨论

腰部是人体中的重要关节,主要的位置大约在人体后部,背部以下和臀部以上的部位,具体的腰部是由腰椎支撑而形成,腰椎由五块腰椎骨组成,相互关节形成腰椎脊柱,腰椎具有生理前凸,并可以前屈后伸,左右侧弯和旋转活动^[9,10]。由此可见腰部属于身体的 " 要 " 害部位,它维持着身体的平衡,保持

表 2 观察组与对照组患者运动传导速度、股神经的感觉传导速度的肌电图对比($\bar{x} \pm s$)Table 2 Electromyography comparison of motor conduction velocity and sensory conduction velocity of femoral nerve between observation group and control group ($\bar{x} \pm s$)

Groups	Motor conduction velocity(m/s)		Sensory conduction velocity of femoral nerve(m/s)		Latency of action potential(ms)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group(n=40)	39.26 $\pm$ 3.72 [#]	46.47 $\pm$ 2.45 ^{*#}	39.92 $\pm$ 5.58 [#]	49.02 $\pm$ 3.63 ^{*#}	6.56 $\pm$ 0.83 [#]	4.83 $\pm$ 0.69 ^{*#}
Control group(n=40)	46.18 $\pm$ 3.54	52.09 $\pm$ 3.43 [*]	48.07 $\pm$ 5.63	57.29 $\pm$ 3.80 [*]	5.52 $\pm$ 0.90	3.54 $\pm$ 0.51 [*]

Note: The observation group and the control group compared with before treatment, ^{*} $P < 0.05$; the observation group and the control group of patients with index level comparison, [#] $P < 0.05$.

表 3 观察组与对照组患者长肌力、腰背肌后伸活动度的指标对比($\bar{x} \pm s$)Table 3 Comparison of indexes of long muscle strength and lumbar dorsal muscle extension activity between the observation group and the control group ($\bar{x} \pm s$)

Groups	long muscle strength (N)		range of motion (cm)	
	Before treatment	After treatment	Before treatment	After treatment
Observation group(n=40)	435.46 $\pm$ 62.61 [#]	616.16 $\pm$ 111.20 ^{*#}	9.13 $\pm$ 2.10 [#]	14.27 $\pm$ 3.24 ^{*#}
Control group(n=40)	562.77 $\pm$ 94.30	723.28 $\pm$ 197.54 [*]	15.98 $\pm$ 3.14	22.61 $\pm$ 2.17 [*]

Note: The observation group and the control group compared with before treatment, ^{*} $P < 0.05$; the observation group and the control group of patients with index level comparison, [#] $P < 0.05$.

表 4 观察组与对照组患者 Oswestry 功能障碍指数(ODI)和日本骨科协会评估治疗分数(JOA)评分比较($\bar{x} \pm s$, 分)Table 4 Comparison of Oswestry Dysfunction Index (ODI) and Japanese Orthopedic Association (JOA) score between observation group and control group ($\bar{x} \pm s$, scores)

Groups	Oswestry Dysfunction Index (ODI)		Japanese Orthopedic Association (JOA)	
	Before treatment	After treatment	Before treatment	After treatment
Observation group(n=40)	51.84 $\pm$ 3.28 [#]	33.16 $\pm$ 2.34 ^{*#}	9.92 $\pm$ 1.15 [#]	15.24 $\pm$ 2.28 ^{*#}
Control group(n=40)	43.06 $\pm$ 4.30	22.20 $\pm$ 3.27 [*]	13.10 $\pm$ 2.13	22.85 $\pm$ 2.63 [*]

Note: The observation group and the control group compared with before treatment, ^{*} $P < 0.05$; the observation group and the control group of patients with index level comparison, [#] $P < 0.05$.

着身体的稳定^[11]。腰痛属于临床中的常见病之一,其发病率仅次于感冒,随着人们生活方式的不断改变,腰痛的发病率也有着逐年增长的趋势,其可对腰背部的正常生理功能产生诸多不良影响,并会造成肌肉骨骼系统紊乱^[12]。据国外相关研究的数据统计,成年人几乎 75% 都有过腰痛的经历,通过临床研究表明,引起腰痛的主要由 4 个方面的原因:1. 腰椎间盘突出与膨出: 腰椎间起保护作用的纤维环破裂,椎内的物质刺激、压迫神经。浅层断裂是膨出,深层断裂是突出^[13]。2. 腰肌劳损: 腰背部肌肉在长时间地绷紧、拉伸后,出现疲劳,形成损伤性炎症^[14]。3. 腰椎增生: 腰椎间盘因长期损伤而退化,椎体就会发生病理性增生,俗称骨刺^[15]。4. 腰椎管狭窄: 除先天因素外,椎间盘退化,也会引起椎管前后呈不同程度的狭窄,压迫神经^[16]。

目前对于腰痛的检测手段主要是通过患者自诉、评分量表以及影像学检查手段等,其中 DOI 指数和 JOA 评分是应用较多的两个评分量表,DOI 指数是由 10 个问题组成,主要包括疼痛的强度、提物、坐位、站立、步行、旅游、影响睡眠、性生活、社会生活、生活自理等 10 个方面评价患者腰椎的功能性障碍情况^[17,18]。JOA 评分主要对患者临床症状、病体特征、日常生活

中运动功能和感觉功能等方面对腰痛的程度进行评价,DOI 指数和 JOA 评分在临床用于腰间盘突出、腰肌劳损的疾病中的评定中已得到广泛的应用,但此类指标的评价带有一定的主观性,容易受到诸多因素的影响,导致评估结果不准确^[19,20]。而在影像学检查方式中,例如 X 线、CT 等,虽然评估结果较好,但又无法动态性的了解病理变化。因此,寻找一种准确、方便的评估手段应用于腰痛患者中显得极为重要^[21,22]。

表面肌电图是一种无创性的影像学检查手段,通过采集肌肉活动时产生的生物电,经过引导、放大、记录和显示所获得的电压变化而记录的一维时间序列信号图形,可动态的对椎旁肌生理病理状态予以定量检测。国外 20 世纪 50 年代开始应用于临床,我国大约在 80 年代开始在临床应用^[23,24]。以其量化、无创性、实时性、连续性和易操作性等显著优势,已广泛运用于肌肉状态的定量评估和分析^[25]。表面肌电图目前主要运用于躯体较大、浅表单根或多跟肌纤维的功能评估,主要包括肌力、肌耐力、肌张力、肌群协同收缩等,肌肉痉挛状态,吞咽障碍,步态分析等^[26,27]。与此同时在临床组织化学、分子生物学、基因检测和影像学占据重要地位的检查技术,适用于临床多种疾病和功能

障碍,如脑卒中、面瘫、各种慢性肌肉劳损、产后盆底肌障碍、排尿障碍、术前和术后评估等^[28,29]。近年来,也有研究开始探讨表面肌电图在腰背肌功能中的应用价值,有研究证实,在腰椎间盘突出症患者中,治疗后症状缓解的患者中位频率斜率(MFs)较治疗前降低,而健侧无明显变化,且健侧的表面肌电信号也没有显著改变,患侧呈升高的趋势,并认为表面肌电图可用于评价腰椎间盘突出患者的客观指标^[30,31]。并有研究指出,通过注射药物诱发疼痛后,表面肌电图信号发生了明显改变^[32,33]。

本研究通过观察显示,无论是在治疗前还是治疗后,观察组 MCV、SCV 指标水平和 JOA 评分均低于对照组,动作电位的潜伏期均长于对照组,且 IMS、ROM、ODI 指数均比对照组高,在经过治疗后,两组患者的上述指标水平也均得到了明显改变,显示出在腰痛患者中存在着肌电图信号改变,且腰痛程度更明显的患者各指标结果更差,而当经过治疗,患者功能障碍情况得到明显改善后,表面肌电图信号也同样出现了改变,通过分析是由于在疼痛的影响下,可对腰部肌肉的活动产生不同程度的限制,致使肌肉功能出现退化,当肌肉收缩能力降低的同时,又会直接影响到脊柱的稳定性,加剧疼痛,这一系列病理生理变化均可能导致表面肌电图出现异常改变,本研究也为今后评估腰痛患者病情程度方面提供了一定参考依据,尤其是在目前腰痛患者发病率逐年增加的情况下,表面肌电图也有着广泛的应用前景^[34,35]。近年来,虽然表面肌电图的检测方式及具体评价内容方面也在不断完善,但尚未在临床上形成较为规范的诊断标准,且本研究也存在着部分不足,例如未设置与健康人群的对比,以及分析其诊断的特异度灵敏性等,此后仍需进一步深入研究以验证本结论。

综上所述,腰痛患者中存在着明显的表面肌电图信号改变,且随着腰痛程度的加剧,改变程度越明显,有助于评估患者病情。

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