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Rehabilitation Medicine

·临床研究·

六字诀联合吸气肌训练治疗慢性阻塞性肺疾病临床研究

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摘要 **目的:**观察六字诀联合吸气肌训练对慢性阻塞性肺疾病(COPD)患者肺功能、运动耐力及生活质量的影响。**方法:**选择2020年3月—2021年6月在山东中医药大学附属医院康复科治疗的COPD患者60例,采用随机数字表法分为对照组、吸气肌训练组、六字诀联合吸气肌训练组(联合组),每组20例。对照组进行常规药物治疗及康复训练,其中康复训练30 min/次,1次/d,5 d/周,持续治疗8周;吸气肌训练组在对照组基础上增加吸气肌训练,20 min/次,1次/d,5 d/周,持续治疗8周;联合组在吸气肌训练组基础上增加健身气功"六字诀"训练,30 min/次,1次/d,5 d/周,持续治疗8周。在治疗前和治疗8周后采用第1秒用力呼气量占预计百分比(FEV_1%pred)和最大吸气压(MIP)评估患者肺功能;采用六分钟步行试验(6MWT)评估患者运动耐力;采用慢性阻塞性肺疾病评估测试(CAT)评估患者生活质量。**结果:**与治疗前比较,3组治疗后FEV_1%pred、MIP、6MWT均明显升高,CAT评分均明显降低,差异具有统计学意义($P<0.05$)。与对照组比较,吸气肌训练组、联合组治疗后FEV_1%pred、MIP、6MWT均明显更高,CAT评分均明显更低,差异具有统计学意义($P<0.05$)。与吸气肌训练组比较,联合组治疗后FEV_1%pred、MIP、6MWT均明显更高,CAT评分明显更低,差异具有统计学意义($P<0.05$)。**结论:**六字诀联合吸气肌训练可明显改善COPD患者的肺功能、运动耐力和生活质量,值得临床推广应用。

关键词 慢性阻塞性肺疾病;六字诀;吸气肌训练;肺功能;运动耐力;生活质量

慢性阻塞性肺疾病(chronic obstructive pulmonary disease,COPD)是一种常见的肺部疾病,其主要特征为进行性发展、持续性存在的气流受限[1]。流行病学显示,COPD是我国第3大慢性疾病[2],仅次于高血压和糖尿病,其患病人数高达9 900万人,是我国第4大致死性病因[3]。COPD往往与肺部接触有害气体或颗粒导致的气道、肺血管和肺实质的慢性炎症反应有关。COPD主要表现为呼吸急促、胸闷、慢性咳嗽和呼吸困难,甚至可能发展为肺心病[4]。目前,对于COPD的治疗尚无根治方法,药物只能暂时缓解患者的症状,无法阻止肺部结构的病理性退变。COPD患者除肺功能呈进行性下降趋势外,还存在运动耐力下降的问题,严重影响患者的生活质量[5]。因此,寻找有效的康复方案,改善COPD患者肺功能和运动功能,提高患者的生活质量,成为亟待解决的重要问题。

《慢性阻塞性肺病全球倡议(Global Initiative for Chronic Obstructive Lung Disease,GOLD)2017》将肺康复作为COPD患者的基本预防和控制措施[6]。常规肺康复方法包括有氧运动训练、抗阻训练、腹式

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呼吸训练、肺康复教育等,虽然有一定的疗效,但训练方式相对单一、缺乏趣味性、患者的依从性不高[7]。“六字诀”是在中医整体观念的指导下,通过“嘘、呵、呼、呬、吹、嘻”6种不同的发音配合肢体动作调整脏腑功能,从而达到治病目的的中国传统功法,对慢性疾病的预防和治疗具有重要意义[8]。“六字诀”练习动作简单易学,安全可控,可以提高患者的积极性和依从性,增强治疗的趣味性,弥补常规康复方法的不足。吸气肌训练(inspiratory muscle training,IMT)通过吸气肌压力负荷锻炼以膈肌为主的吸气肌群,可有效提高吸气肌力量和运动功能[9]。本研究采用六字诀联合吸气肌训练治疗COPD患者,取得良好疗效。现报告如下。

1　临床资料

1.1　病例选择标准

1.1.1　诊断标准　符合中华医学会呼吸病学分会慢性肺疾病学组制定的《慢性阻塞性肺疾病诊治指南(2013年修订版)》[10]有关COPD诊断标准。

1.1.2　纳入标准　① 生命体征稳定,处于稳定期者;② 意识清晰;③ 自愿参与本研究,并自愿签署知情同意书。

1.1.3　排除标准　① 合并哮喘、肺炎等其他肺部疾病;② 合并其他严重疾病者,如心血管、消化、血液疾病;③ 伴有人格障碍、言语障碍、意识障碍和精神疾病。

1.1.4　中止和脱落标准　① 因各种原因退出研究;② 研究中不配合、不服从管理;③ 研究中出现严重不良事件;④ 研究中病情加重。

1.2　一般资料

本研究参考效应指标为六分钟步行试验(6 minutes walking test,6MWT),取$\alpha=0.05$,$\beta=0.10$,效应量f=0.5,利用G*Power软件(3.1.9.3版本)中单因素方差分析进行样本量计算,得到样本量为每组18例,考虑到10%脱落率,每组需纳入20例,共计60例。本研究选择2020年3月—2021年6月就诊于山东中医药大学附属医院康复科的COPD患者60例,按照随机数字表法分为对照组、吸气肌训练组、六字诀联合吸气肌训练组(联合组),每组20例。3组性别、年龄、病程、吸烟史等一般资料比较,差异均无统计学意义($P>0.05$),具有可比性。见表1。本研究通过山东中医药大学附属医院医学伦理委员会批准[审批号:(2021)伦审第(025)号-KY]。

表1　3组一般资料比较

Table 1　Comparison of general data in three groups

组别	例数	性别		年龄/($\bar{x}\pm s$,岁)	病程/($\bar{x}\pm s$,年)	吸烟史	
		男	女			是	否
对照组	20	12	8	67.13±8.62	6.00±2.07	10	10
吸气肌训练组	20	14	6	64.87±7.20	5.73±1.22	12	8
联合组	20	11	9	66.20±7.82	5.20±2.82	11	9

2　方　法

2.1　治疗方法

2.1.1　对照组　给予常规药物治疗和康复治疗。常规药物治疗主要包括噻托溴铵、丙酸氟替卡松、布地奈德福莫特罗等。常规康复治疗包括缩唇呼吸训练、腹式呼吸训练、弹力带抗阻训练、四肢联动训练、股四头肌抗阻训练,30 min/次,1次/d,5 d/周,持续治疗8周。

2.1.2　吸气肌训练组　在对照组基础上进行吸气肌训练。利用吸气肌压力训练器(英国Power Breathe公司,型号:K5)进行吸气肌训练。患者取坐位,呼吸模式为腹式呼吸,待呼吸平稳后,利用K5评估系统在3 cm H_2O阈值压力下测得患者最大吸气压(maximum inspiration pressure,MIP)。利用K5训练系统在30% MIP下进行训练。在每周最后1次训练结束后,再次评估患者MIP,以此调整下一次训练阻力,20 min/次,1次/d,5 d/周,持续治疗8周。

2.1.3　联合组　在吸气肌训练组基础上练习健身气功“六字诀”。首先进行为期3 d“六字诀”的培训,包括观看国家体育总局版《健身气功·六字诀》视频;为患者讲解六字诀习练要领、注意事项等。由1名治疗师带领患者进行训练,训练时按照“起势→调息→嘘→呵→呼→呬→吹→嘻→收势”的顺序进行,每个字诀练习6遍后,调息1次,再开始下一字诀,30 min/次,1次/d,5 d/周,持续治疗8周。

2.2　观察指标

2.2.1　肺功能　利用肺功能评估设备[席勒(中国)医疗设备有限公司,型号:CS-200]评估患者肺通气能力[第1秒用力呼气量(forced breathing in the first second,FEV_1)占预计百分比(FEV_1%pred)];采用K5

评估系统评估患者MIP。

2.2.2 运动耐力 采用6MWT评估患者的运动耐力[11]。嘱咐患者以最快的速度在30 m安静长廊上来回走动6 min，步行距离越长，表明患者运动耐力越好。

2.2.3 生活质量 采用慢性阻塞性肺疾病评估测试（COPD assessment test，CAT）评估患者生活质量[11]。CAT包括咳嗽、咳痰、胸闷、活动能力、日常生活能力、外出能力、睡眠、精力8个项目，每项最高分5分，最低分0分，满分为40分，分值越高表示患者的健康状况受疾病影响越严重。结果可分为4个等级：0～10分为轻微影响；11～20分为中度影响；21～30分为严重影响；31～40分为极度影响。

2.3 统计学方法

采用SPSS 22.0统计软件进行数据分析。计量资料符合正态分布，数据以（$\bar{x}\pm s$）表示。组内比较采用配对t检验；组间比较采用单因素方差分析，组间两两比较采用LSD-t检验。$P<0.05$为差异具有统计学意义。

3 结 果

3.1 3组治疗前后肺功能比较

与治疗前比较，3组治疗后FEV_1%pred、MIP均明显提高，差异具有统计学意义（$P<0.05$）。与对照组比较，吸气肌训练组、联合组治疗后FEV_1%pred、MIP均明显更高，差异具有统计学意义（$P<0.05$）。与吸气肌训练组比较，联合组治疗后FEV_1%pred、MIP明显更高，差异具有统计学意义（$P<0.05$）。见表2。

表2 3组治疗前后肺功能比较（$\bar{x}\pm s$）

Table 2 Comparison of lung function in three groups before and after treatment（$\bar{x}\pm s$）

组别	例数	时间	FEV_1%pred/%	MIP/cm H_2O
对照组	20	治疗前	49.66±6.45	50.41±6.25
		治疗后	55.07±6.16[1)]	54.02±5.82[1)]
吸气肌训练组	20	治疗前	52.33±7.31	50.12±4.69
		治疗后	59.87±6.30[1)2)]	58.88±3.83[1)2)]
联合组	20	治疗前	51.27±6.08	51.65±4.33
		治疗后	67.13±5.93[1)2)3)]	65.93±5.57[1)2)3)]

注：与治疗前比较，1）$P<0.05$；与对照组比较，2）$P<0.05$；与吸气肌训练组比较，3）$P<0.05$。

Note: Compared with that before treatment, 1) $P<0.05$; compared with the control group, 2) $P<0.05$; compared with the inspiratory muscle training group, 3) $P<0.05$.

3.2 3组治疗前后6MWT、CAT评分比较

与治疗前比较，3组治疗后6MWT均明显提高，CAT评分均明显降低，差异具有统计学意义（$P<0.05$）。与对照组比较，吸气肌训练组、联合组治疗后6MWT均明显更高，CAT评分均明显更低，差异具有统计学意义（$P<0.05$）。与吸气肌训练组比较，联合组治疗后6MWT明显更高，CAT评分明显更低，差异具有统计学意义（$P<0.05$）。见表3。

表3 3组治疗前后6MWT、CAT评分比较（$\bar{x}\pm s$）

Table 4 Comparison of 6MWT, CAT score in three groups before and after treatment（$\bar{x}\pm s$）

组别	例数	时间	6MWT/m	CAT/分
对照组	20	治疗前	302.40±27.23	27.08±4.29
		治疗后	324.13±18.50[1)]	25.00±4.59[1)]
吸气肌训练组	20	治疗前	305.42±22.65	26.40±3.66
		治疗后	335.47±17.14[1)2)]	21.33±2.97[1)2)]
联合组	20	治疗前	309.67±28.43	25.60±2.92
		治疗后	367.28±17.51[1)2)3)]	18.67±1.84[1)2)3)]

注：与治疗前比较，1）$P<0.05$；与对照组比较，2）$P<0.05$；与吸气肌训练组比较，3）$P<0.05$。

Note: Compared with that before treatment, 1) $P<0.05$; compared with the control group, 2) $P<0.05$; compared with the inspiratory muscle training group, 3) $P<0.05$.

4 讨 论

4.1 六字诀联合吸气肌训练可提高COPD患者的肺功能

肺功能是诊断COPD的金指标，其中FEV_1%pred是评估COPD患者气道通气能力和阻塞程度的重要指标[10]，同时可以反映疾病的严重程度。随着FEV_1%pred降低，COPD患者存活率也随之降低[12]。本研究结果显示，与对照组、吸气肌训练组比较，联合组治疗后FEV_1%pred、MIP均明显更高，表明六字诀联合吸气肌训练可以改善COPD患者通气功能。可能与以下因素有关：① 吸气肌训练通过调节膈肌收缩，增大肺容积，增加潮气量；在增强膈肌肌力的同时，改善Ⅰ型纤维和Ⅱ型纤维比例[13]，提高膈肌做功效率，从而提高COPD患者肺通气能力。② COPD属于中医学“肺胀”范畴，病机为肺气胀满、敛降失常，病变部位早期在肺，随着疾病发展，逐渐累及脾、肾，后期累及心。按照中医藏象理论、五行学说，“嘘、呵、呼、呬、吹”分别对应人体“肝、心、脾、肺、肾”，“嘻”字诀对应三焦[14]。六字诀以鼻纳气、

以口吐气、以“音、形、意”引气,通过发音与相应脏腑形成共振,同时对腹腔、胸腔内产生不同的压力,激发脏腑经络的气血流通[15]。“呬”字散发肺中浊气,降逆化痰,调节肺的宣发肃降功能;“吹”字补益肾精,培本固元,强肾纳气;“呼”字升清降浊,健脾和胃;“呵”字下降心火,宁心静志[16]。六字诀呼气时类似缩唇呼吸,可有效防止气道塌陷和阻塞,降低气道阻力,有效减少肺组织中残余气体量,提高患者肺通气能力。这与邓丽金等[17]研究结果一致。③ 膈肌是呼吸运动的主要动力源,参与大约80%呼吸过程,COPD患者呼吸功能的减退与膈肌能力下降有关[18-19]。此外,COPD患者往往存在膈肌活动和中枢驱动的增加,呼吸肌为适应肺过度通气的变化,表现为神经激活率增加[20]。六字诀联合吸气肌训练可以降低膈肌神经激活率,减少膈肌肌肉疲劳程度;同时调整呼吸模式为逆腹式呼吸,增加膈肌上下移动幅度,加深吸气深度,有助于增强呼吸协同肌肌力和胸廓弹性,改善COPD患者肺功能。

4.2　六字诀联合吸气肌训练可提高COPD患者运动耐力和生活质量

本研究结果显示,与对照组、吸气肌训练组比较,联合组治疗后6MWT明显更高,CAT评分明显更低,表明六字诀结合吸气肌训练可以提高COPD患者运动耐力和生活质量。可能与以下因素有关:① COPD患者运动耐力下降,往往与骨骼肌氧化应激导致的骨骼肌功能障碍有关。COPD患者系统性炎症和持续性低氧状态,可诱导蛋白质异常分解,致使肌肉结构和功能的改变,使骨骼肌发生氧化应激反应[21]。吸气肌训练通过对膈肌的锻炼,有助于改善吸气肌“血液窃流”现象[22],增加四肢骨骼肌的血液供应,减缓骨骼肌疲劳的发生。② 六字诀属于低强度的有氧运动,每个字诀配合全身的肢体运动练习6遍,可产生神经调节效应,增加COPD患者四肢神经肌肉的募集率[23],同时还能降低白细胞介素(interleukin,IL)-17、基质金属蛋白酶-9(matrix metalloproteinase-9,MMP-9)等炎症因子水平,升高IL-10抗感染因子水平[24],增强机体免疫应答能力,提高患者运动耐力。③ COPD患者由于肺功能和运动能力的下降,往往伴随日常生活能力和睡眠质量下降。有研究显示,COPD患者焦虑发病率13%～46%,抑郁发病率10%～42%[25]。六字诀基于形神合一的整体观念,强调用意念引领呼吸和肢体运动,注重“调心、调息、调身”三调合一,解郁调神,有助于改善COPD患者抑郁、焦虑、低落等不良情绪,从而改善患者生活质量[26-27]。

5　小　结

六字诀联合吸气肌训练可以有效改善COPD患者肺功能、运动耐力和生活质量,值得临床推广。但本研究仍存在一定的局限性,如纳入样本量偏少、未对出院患者进行随访等。下一步将开展多中心大样本随机对照研究,加强对出院患者进行随访,为六字诀联合吸气肌训练治疗COPD提供更科学的依据。

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Effect of Liuzijue Combined with Inspiratory Muscle Training on Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT **Objective:** To explore the effect of Liuzijue combined with inspiratory muscle training on lung function, exercise endurance and quality of life of patients with chronic obstructive pulmonary disease (COPD). **Methods:** A total of 60 patients with COPD in the rehabilitation department of the Affiliated Hospital of Shandong University of Traditional Chinese Medicine from March 2020 to June 2021 were randomly divided into control group, inspiratory muscle training group and Liuzijue combined with inspiratory muscle training group (combined group), with 20 cases in each group. The control group received routine drug treatment and rehabilitation training, including rehabilitation training 30 minutes a time, once a day, five days a week, lasting for eight weeks. The inspiratory muscle training group received the inspiratory muscle training on the basis of the control group, 20 minutes a time, once a day, five days a week, lasting for eight weeks. On the basis of the inspiratory muscle training group, the combined group received "six character formula" training of fitness Qigong, 30 min a time, once a day, five days a week, lasting for eight weeks. Before treatment and after eight weeks of treatment , the percentage of forced breathing in the first second (FEV_1%pred) and the maximum inspiratory pressure (MIP) were used to evaluate the patient's lung function; 6 minutes walking test (6MWT) was used to evaluate the patient's exercise tolerance; COPD assessment test (CAT) was used to evaluate the quality of life of patients. **Results:** Compared with those before treatment, the FEV_1%pred, MIP and 6MWT of all three groups increased significantly after treatment, CAT score decreased significantly after treatment, and the differences were statistically significant (P<0.05). Compared with the control group, the FEV_1%pred, MIP and 6MWT of the inspiratory muscle training group and the combined group were significantly higher after treatment, and the CAT score was significantly lower, and the differences were statistically significant (P<0.05). Compared with the inspiratory muscle training group, the FEV_1%pred, MIP, and 6MWT of the combined group were significantly higher after treatment (P<0.05), and the CAT score was significantly lower, and the difference was statistically significant (P<0.05). **Conclusion:** Liuzijue combined with inspiratory muscle training can effectively improve the lung function, exercise endurance and quality of life of patients with COPD, which is recommended for clinical application.
KEY WORDS chronic obstructive pulmonary disease; Liuzijue; inspiratory muscle training; lung function; exercise endurance; quality of life
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Effect of Constraint-Induced Movement Therapy on Motor Function of Rats with Cerebral Ischemia-Reperfusion Injury Based on Magnetic Resonance Spectroscopy Imaging

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ABSTRACT **Objective:** Animal magnetic resonance spectroscopy (MRS) imaging was used to explore the regulatory effect of constraint-induced movement therapy (CIMT) on motor function of rats with cerebral ischemia-reperfusion injury. **Methods:** The modified Longa's method was used to prepare the left middle cerebral artery occlusion (MCAO) reperfusion injury rats model. After modeling, the rats were randomly divided into control group and CIMT group, with six rats in each group. The rats moved freely in the cage in the control group; CIMT intervention was performed in the CIMT group after modeling at the 7th day, in which the rat's unaffected side was immobilized, and the affected side was forced to move on the treadmill, once a day, 20 minutes a time, seven days a week, lasting for two weeks. Before and after CIMT intervention, the open field test was used to evaluate the motor function; the modified neurological severity score (mNSS) was used to evaluate the neurological deficits; 9.4 T small animal MRS imaging was used to detect the changes of glutamate and γ-aminobutyric acid levels in the M1 area of the bilateral motor cortex of rats. **Results:** (1) Motor function: compared with the control group, the total distance of spontaneous locomotor activity in the CIMT group significantly increased after intervention, and the difference was statistically significant (P<0.05). (2) mNSS score results: compared with the control group, the mNSS in the CIMT group significantly decreased after intervention, and the differences were statistically significant (P<0.05). (3) Comparison of glutamate and γ-aminobutyric acid levels in the M1 area of the motor cortex: compared with that before intervention, the ratio of glutamate/creatinine in the M1 area of the contralesional motor cortex significantly decreased in the control group, and the ratio of glutamate/creatinine in the M1 area of the affected side in the CIMT group after intervention significantly increased, the ratio of γ-aminobutyric acid/creatinine significantly decreased (P<0.05). Compared with the control group, the ratio of glutamate/creatinine in the M1 area of the affected motor cortex in the CIMT group significantly increased, and the ratio of γ-aminobutyric acid/creatinine significantly decreased (P<0.05). **Conclusion:** CIMT can improve motor dysfunction and neurological deficit of rats with cerebral ischemia-reperfusion injury, and its mechanism may be related to increase the level of excitatory neurotransmitter glutamate in M1 area of motor cortex and reduce the level of inhibitory neurotransmitter γ- aminobutyric acid.
KEY WORDS cerebral ischemia-reperfusion injury; constraint-induced movement therapy; magnetic resonance spectroscopy; motor function; glutamate; γ-aminobutyric acid
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