Original paper

Combined standard medication and acupuncture for COPD: a case series

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ABSTRACT

Background Traditional acupuncture has been used in patients with chronic obstructive pulmonary disease (COPD). However, only a few studies have been performed to determine the efficacy of this treatment.

Objective To observe changes in the symptoms of COPD during acupuncture treatment in patients with COPD stratified according to the severity of the disease.

Methods A prospective case series of 26 patients with dyspnoea on exertion due to COPD was followed from October 2004 to October 2008 in the Departments of Respiratory Internal Medicine, Gifu University of Medicine and Meiji University of Integrative Medicine, Japan. All participants received acupuncture treatments once a week for 10 weeks in addition to standard medication therapy. The main outcome measure was the modified Borg dyspnoea scale after the 6 min walk test (6MWT) and the secondary outcome measure was the BODE index.

Results All 26 patients showed significant improvement in the Borg dyspnoea scale after 10 weeks of acupuncture treatment (from 4.02 (2.85) to 1.96 (1.97), mean difference -2.06, 95% CI -3.03 to -1.09, p=0.0002, paired t test). Improvements in the BODE index, 6MWT and oxygen saturation during exercise, which indicates better reduced dyspnoea on exertion and prognosis, were also found.

Conclusion The results of this study suggest that acupuncture treatment has clinically useful effects, at least in the short term, in reducing dyspnoea on exercise in patients with COPD, particularly in those more severely affected.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is predicted to be the third most frequent cause of death worldwide by 2020.[1] It is characterised by airflow obstruction and reduced exercise capacity, which are associated with dyspnoea and fatigue.[2] Management of stable COPD includes pharmacotherapy for relief of symptoms, pulmonary rehabilitation programmes for health education and exercise to improve exercise tolerance and dyspnoea.

Adverse effects of medications have led to the use of alternative approaches to manage patients with chronic disease. Acupuncture has been reported to be one alternative method for managing breathlessness in oncology patients.[3 4]

A review of 16 randomised controlled trials involving 2937 participants concluded that acupuncture is a safe and potentially effective intervention for patients with asthma and COPD.[5]

We have previously demonstrated that respiratory function evaluated with Borg scale scores and the 6 min walking distance (6MWD) could be markedly improved with acupuncture in a prospective matched-pair trial that included patients treated with acupuncture and those receiving standard medication.[6] However, differences in the effect of acupuncture between subgroups classified according to disease severity are unclear. In addition, the manner in which acupuncture affects disease prognosis has not been clearly demonstrated.

Our objective was to observe changes in the symptoms of COPD during acupuncture treatment in patients with COPD stratified according to the severity of the disease.

METHODS

This study was a prospective single-intervention case series trial conducted from October 2004 to October 2008 at the Departments of Respiratory Medicine in two hospitals, Meiji University of Integrative Medicine and Gifu University, Japan. All participants met the following criteria: (1) diagnosed with COPD with dyspnoea; (2) clinically stable condition with no history of infections or exacerbation of respiratory symptoms, no changes in medication within the 3 months preceding the study and no clinical signs of oedema; (3) graded as stage I or higher using the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria;[7] (4) received pulmonary rehabilitation in the previous 6 months; (5) outpatients only; and (6) had not previously received acupuncture.

Patients presenting with evidence of cardiovascular disease, collagen disease, renal fail-

Table 1 Baseline subject characteristics

Characteristic	
Sex	**24/2 (M/F)**
Age, year	68.9 (6.8)
BMI, kg/m²	20.7 (3.5)
Brinkman index	903.8 (368.2)
GOLD criteria	
I	4
II	9
III	6
IV	7
Exercise capacity	
6MWD, m	371.2 (111.4)
Borg scale	4.0 (2.9)
Spo_2, % lowest	88.5 (7.3)
Pulmonary function	
VC, l	2.68 (0.78)
IC, l	1.66 (0.57)
ERV, l	1.03 (0.39)
FVC, l	2.49 (0.87)
FEV_1, l	1.19 (0.53)
$\%FEV_1$, %predicted	51.45 (22.67)
FEV_1/FVC, %	48.45 (14.22)

BMI, body mass index; ERV, expiratory reserve volume; FEV_1, forced expiratory volume in 1 s; $\%FEV_1$, predicted percentage forced expiratory volume in 1 s; FVC, forced vital capacity; GOLD, Global Initiative for Chronic Obstructive Lung Disease; IC, inspiratory capacity; 6MWD, 6 min walk distance; VC, vital capacity.

ure, thyroid dysfunction, hepatic function disorder, cancer and severe mental disorders were excluded from the case series. The Institutional Review Board of Meiji University of Integrative Medicine and Faculty of Medicine approved the study and each patient provided written informed consent.

Outcome measures

All outcome measures in the present study were assessed at baseline and after completion of 10 weeks of intervention. The primary outcome measure was severity of dyspnoea on exertion (DOE) assessed using the 6 min walk test (6MWT) following standard procedures.[8] To rate breathlessness before and immediately after the 6MWT, a modified 12-point Borg category ratio scale was used where 0 signified 'breathing very well, barely breathless' and 10 signified 'severely breathless'[8 9] (see table A1 in online supplement).

The secondary outcome measure was the BODE index, a multidimensional index that includes four factors that predict the risk of death: **B**ody mass index (BMI), degree of airflow **O**bstruction, functional **D**yspnoea and **E**xercise capacity as assessed by the 6MWT.[10]

Other outcome measures

The other outcome measures included 6MWD (distance covered during the 6MWT in metres) and oxygen saturation (Spo_2) during the 6MWT.[8] Spo_2 was monitored at 1 min intervals throughout the 6MWT using a saturation

pulse oxygen meter. Spo_2 values were based on the lowest value determined during 6 min. Pulmonary function was measured using a spirometer (vital capacity (VC), expiratory reserve volume (ERV), inspiratory capacity (IC)) and flow volume (forced vital capacity (FVC), forced expiratory volume in 1 s (FEV_1), $\%FEV_1$, $FEV_1\%$)) (Minato Autospiro AS-929, Minato Medical Science, Osaka, Japan).[11] Ventilatory muscle strength and endurance were determined as follows: the maximum inspiratory mouth pressure (MIP) from the residual volume and maximum expiratory mouth pressure (MEP) from the total lung capacity were measured using a standard mouthpiece and a Vitaropower device (KH115 Chest MI, Tokyo, Japan). The MIP and MEP measurements were repeated until three technically satisfactory consistent values were achieved.[12] Dyspnoea during activities of daily living was scored using the modified Medical Research Council (MRC) dyspnoea scale.[13]

Acupuncture

In addition to daily medication, all patients with COPD received acupuncture treatment once a week for 10 weeks. An acupuncturist who had been in practice for over 10 years in the area of pulmonary diseases administered the treatment. The acupuncture style was selected according to traditional Chinese medicine theory. Acupuncture points that were shown to be effective on dyspnoea of COPD in our earlier research were used:[6] *Zhongfu* (LU1) and *Taiyuan* (LU9), *Futu* (LI18), *Guanyuan* (CV4) and *Zhongwan* (CV12), *Zusanli* (ST36), *Taixi* (KI3), *Wangu* (GB12), and *Feishu* (BL13), *Pishu* (BL20) and *Shenshu* (BL23). These points were identical between subjects.

The sterilised stainless steel acupuncture needles (length 40 mm, diameter 0.16–0.20 mm, Seirin, Japan) were inserted at a depth ranging from 4 to 20 mm, depending on the thickness of the skin and subcutaneous fatty tissue. Since these meridian points (LU1, BL13, BL20) have potential risk of pneumothorax, the depth was limited to <5 mm. The needles were manually rotated clockwise and counterclockwise for 3–4 min at each point during the 50-min treatment period. The patients were in the supine position during the needling process to the points located on the front, and then turned to the prone position to needle the points on the back, except those who were not able to be prone because of severe dyspnoea who were treated in the lateral position.

No electrical stimulation was performed. Subjects were asked to report any perceived sensation (*de qi*) when the needles were inserted or manipulated.

Patients were told that the acupuncture treatment improves dyspnoea.

Statistical analysis

The sample size of this study was computed for detection of minimal clinically important differences of 2 units for the primary end point (changes in Borg scale at the end of the 6MWT) at a significance level of 0.05 and a power of 0.8, with an estimated SD of 2.6 according to our previous

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Table 2 Results of all the measured outcomes (n=26)

	Baseline	Post-treatment	Mean difference	95% CI	p Value
Exercise capacity					
Borg scale	4.02 (2.85)	1.96 (1.97)	−2.06	−3.03 to −1.09	0.0002
6MWD, m	371.15 (111.36)	419.96 (112.55)	48.81	26.72 to 70.89	0.0001
Spo_2, % lowest	88.46 (7.28)	91.42 (5.23)	2.96	1.80 to 4.12	0.0001
Pulmonary function					
VC, l	2.68 (0.78)	2.94 (0.83)	0.26	0.11 to 0.34	0.0004
IC, l	1.66 (0.57)	1.77 (0.59)	0.11	−0.05 to 0.28	0.1557
ERV, l	1.03 (0.39)	1.14 (0.49)	0.11	0.24 to −0.02	0.0896
FVC, l	2.49 (0.87)	2.75 (0.87)	0.26	0.13 to 0.39	0.0005
FEV_1, l	1.19 (0.53)	1.31 (0.53)	0.12	0.04 to 0.20	0.0050
%FEV, %	52.4 (22.6)	56.3 (22.4)	3.90	0.17 to 7.26	0.0406
Respiratory muscle strength					
MEP, cm H_2O (n=20)	61.31 (30.96)	75.81 (33.97)	14.50	5.49 to 23.51	0.0033
MIP, cm H_2O (n=20)	55.04 (31.11)	77.24 (40.11)	22.20	13.20 to 31.21	0.0001
ADL dyspnoea					
MRC unit	2.4 (1.0)	1.6 (0.8)	−0.85	−1.03 to −0.66	0.0001
Nutritional evaluation					
BMI, kg/m²	20.72 (3.51)	21.66 (3.28)	0.94	0.61 to 1.28	0.0001
Mortality evaluation					
BODE index	4.04 (2.88)	2.50 (2.27)	−1.54	−1.98 to −1.09	0.0001

Main outcome measure showed a remarkable improvement in the acupuncture after 10 weeks, and this favourable change was significantly greater than that in the baseline. Values are means (SD).

ADL, Activities of Daily Living; BMI, body mass index; ERV, expiratory reserve volume; FEV_1, forced expiratory volume in one second; %FEV_1, predicted percentage forced expiratory volume in 1 s; FVC, forced vital capacity; IC, inspiratory capacity; MEP, maximum expiratory mouth pressure; MIP, maximum inspiratory mouth pressure; MRC, medical research council; 6MWD, 6 min walk distance; VC, vital capacity.

report.[6][14] The required sample size was calculated to be 16 patients.

To investigate differences in the effects of acupuncture according to the severity of symptoms, patients were further subdivided into two groups according to GOLD classification (GOLD I/II or III/IV). All data are presented as means±SD and/or 95% CI. The difference between baseline and final values was compared using a paired t test. All analyses were performed using SPSS V.11.0 for Windows (SPSS, Chicago, Illinois, USA).

RESULTS

Of the 31 patients screened, five were excluded because they had lung cancer (n=2), collagen disease (n=1) or cardiovascular disease (n=2). Thus, 26 patients were enrolled into the study between 2004 and 2008. The flow of patients in the study is shown in figure A1 in the online appendix. Baseline patient characteristics are presented in table 1 and table A2 in the online appendix. Patients were receiving any of the following drugs: β_2 agonists, long-acting β_2 agonists and oxitropium bromide, ipratropium bromide, inhaled corticosteroids or oral corticosteroids.

Although three patients reported some minor transitory bruising and pain after acupuncture treatment, no major adverse reactions to the acupuncture procedure were reported.

Main outcome measure
Changes in the outcome variables after 10 sessions of acupuncture are shown in table 2. The mean Borg scale improved from 4.02 (2.85) to 1.96 (1.97), (mean difference −2.06; 95% CI −3.03 to −1.09; p=0.0002, paired t test).

Secondary outcome measure
The mean BODE index of the acupuncture treatments showed a significant improvement from 4.04 (2.88) to 2.50 (2.27) (mean difference −1.54; 95% CI −1.98 to −1.09; p=0.0001, paired t test) after 10 acupuncture sessions (table 2).

Other outcome measures
The 6MWD increased significantly after 10 acupuncture sessions from 371.15 (111.36) m to 419.96 (112.55) m (mean difference 48.81; 95% CI 26.72 to 70.89; p=0.0003, paired t test) (table 2).

Table 3 Results of GOLD I and II subgroup (n=13)

	Baseline	Post-treatment	Mean difference	95% CI	p Value
Exercise capacity					
Borg scale	2.50 (2.25)	1.08 (1.41)	−1.42	−2.86 to 0.02	0.052
6MWD, m	406.83 (78.66)	450.96 (90.20)	44.13	11.80 to 76.47	0.0116
Spo_2, % lowest	92.00 (4.12)	93.62 (3.01)	1.62	0.64 to 2.59	0.0035
Pulmonary function					
VC, l	2.94 (0.70)	3.14 (0.78)	0.20	0.02 to 0.39	0.0344
IC, l	1.87 (0.51)	1.91 (0.63)	0.04	−0.26 to 0.32	0.8156
ERV, l	1.06 (0.29)	1.23 (0.54)	0.17	−0.04 to 0.38	0.0969
FVC, l	2.83 (0.68)	2.99 (0.72)	0.16	−0.01 to 0.36	0.0624
FEV_1, l	1.58 (0.41)	1.64 (0.44)	0.06	−0.06 to 0.18	0.3117
$\%FEV_1$, %	70.72 (12.19)	72.15 (15.22)	1.43	−4.48 to 7.34	0.6075
Respiratory muscle strength					
MEP, cm H_2O (n=10)	73.59 (36.10)	85.26 (38.05)	11.67	−1.27 to 24.60	0.0711
MIP, cm H_2O (n=10)	68.92 (31.27)	86.13 (34.76)	17.21	6.75 to 27.67	0.0053
ADL dyspnoea					
MRC unit	1.77 (0.73)	1.15 (0.55)	−0.62	−0.92 to −0.31	0.0009
Nutritional evaluation					
BMI, kg/m²	22.15 (3.35)	22.17 (3.07)	0.02	−0.39 to 0.44	0.8969
Mortality evaluation					
BODE index	1.77 (1.09)	1.00 (1.08)	−0.77	−1.27 to −0.27	0.006

Values are means (SD).

ADL, Activities of Daily Living; BMI, body mass index; ERV, Expiratory Reserve Volume; FEV_1, forced expiratory volume in 1 s; $\%FEV_1$, predicted percentage forced expiratory volume in 1 s; FVC, forced vital capacity; GOLD, Global Initiative for Chronic Obstructive Lung Disease; IC, inspiratory capacity; MEP, maximum expiratory mouth pressure; MIP, maximum inspiratory mouth pressure; MRC, medical research council; 6MWD, 6 min walk distance; VC, vital capacity.

The lowest Spo_2 increased from 88.46 (7.28) to 91.42 (5.23) (mean difference 2.96; 95% CI 1.80 to 4.12; p<0.0001, paired t test) after 10 acupuncture sessions.

Marked improvement in respiratory function (VC, FVC and FEV_1) and muscle strength (MEP and MIP) was observed after 10 acupuncture sessions. The mean BMI of patients increased from 20.27 (3.51) kg/m² to 21.66 (3.28) kg/m² (mean difference 0.94 kg/m²; 95% CI 0.61 to 1.28; p=0.0001, paired t test) after 10 acupuncture sessions.

Changes in outcome measures of those classified as GOLD I /II

After 10 weeks a significant improvement was found in the BODE index and 6MWD (table 3). Although a statistically significant difference was found in the lowest value between baseline and after 10 weeks, the reduction in the Spo_2 during the 6MWT was much lower than in patients classified as GOLD III or IV (figure 1A). However, the improvement in the Borg scale in this subgroup did not reach statistical significance.

In terms of respiratory function, a significant improvement was seen only in VC, and in terms of muscle strength, a significant improvement was only seen in MIP. There was no significant difference between GOLD subgroups in BMI after the treatment period.

Changes in outcome measures of those classified as GOLD III/IV

Table 4 shows the effects of acupuncture among the subgroup classified as III or IV according to the GOLD classification. In this subgroup the Borg scale, BODE index and 6MWD showed significant improvement. The Spo_2 during the 6MWT showed a larger reduction than in those classified as GOLD I or II, with statistical significance in the lowest value between baseline and after 10 weeks (figure 1B). Similarly, a significant improvement was seen in IC, FVC and FEV_1. MEP and MIP also showed a significant improvement in this subgroup.

DISCUSSION

In this study we evaluated the effect of acupuncture on DOE in patients with COPD. To our knowledge, this is the first study of acupuncture treatments to use precise evaluations of dyspnoea, exercise capacity and the BODE index in patients with COPD, as well as further analysis among subgroups classified according to the GOLD criteria.

Although previous studies evaluated the efficacy of acupuncture on dyspnoea of patients with chronic pulmonary diseases, participants in those studies were not limited to those with COPD but included some other conditions such as bronchial asthma, interstitial pneumonia or cystic fibrosis.[15 16] It was therefore inconclusive from these studies whether acupuncture was capable of improving symptoms of COPD.

The difference in the Borg scale observed after intervention in the present study was more than 2 units, which is recognised as a minimal clinically important difference in the measurement in patients with COPD.[14] It is therefore conceivable that the improvement in the Borg scale in the patients in the present study achieved a clinically sufficient level. 6MWD and Spo_2 also showed marked improvements. These results suggest that exercise capacity and

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Table 4   Results of GOLD III and IV subgroup (n=13)

	Baseline	Post-treatment	Mean difference	95% CI	p Value
Exercise capacity					
Borg scale	5.54 (2.63)	2.85 (2.11)	−2.69	−4.11 to −1.27	0.0014
6MWD, m	335.48 (129.96)	388.95 (127.17)	53.47	18.67 to 88.28	0.0058
Spo_2, % lowest	84.92 (8.15)	89.23 (6.13)	4.31	2.33 to 6.29	0.0005
Pulmonary function					
VC, l	2.43 (0.79)	2.72 (0.86)	0.29	0.86 to 0.42	0.0061
IC, l	1.44 (0.56)	1.64 (0.53)	0.20	0.01 to 0.40	0.0428
ERV, l	1.01 (0.48)	1.01 (0.44)	0.04	−0.15 to 0.22	0.6741
FVC, l	2.15 (0.92)	2.50 (0.97)	0.35	0.14 to 0.57	0.0034
FEV_1, l	0.80 (0.27)	0.98 (0.39)	0.18	0.07 to 0.29	0.0036
$\%FEV_1$, %	32.18 (10.87)	38.18 (14.57)	6.00	1.58 to 10.42	0.0119
Respiratory muscle strength					
MEP, cm H_2O (n=10)	50.25 (21.72)	67.30 (29.17)	17.05	2.17 to 31.93	0.0291
MIP, cm H_2O (n=10)	42.54 (26.46)	69.24 (44.65)	26.70	10.93 to 42.48	0.0040
ADL dyspnoea					
MRC unit	3.08 (0.76)	2.00 (0.71)	−1.08	−1.25 to −0.91	0.0001
Nutritional evaluation					
BMI, kg/m²	19.29 (3.16)	20.33 (3.13)	1.04	0.47 to 1.61	0.0018
Mortality evaluation					
BODE index	6.31 (2.21)	4.00 (2.61)	−2.31	−2.76 to −1.85	0.0001

Values are means (SD).

ADL, Activities of Daily Living; BMI, body mass index; ERV, expiratory reserve volume; FEV_1, forced expiratory volume in 1 s; $\% FEV_1$, predicted percentage forced expiratory volume in 1 s; FVC, forced vital capacity; GOLD, Global Initiative for Chronic Obstructive Lung Disease; IC, inspiratory capacity; MEP, maximum expiratory mouth pressure; MIP, maximum inspiratory mouth pressure; MRC, medical research council; 6MWD, 6 min walk distance; VC, vital capacity.

the oxygenation of patients with COPD were improved after intervention with acupuncture treatment. According to the GOLD criteria, dyspnoea and exercise capacity play important roles in the management of COPD. Furthermore, the improvement in the BODE index suggests that intervention with acupuncture may have a beneficial influence on the prognosis of patients with COPD.

The results of the subgroup analysis indicated that the significant improvements in the Borg scale, 6MWD and Spo_2 during the 6MWT were apparent in the group classified as III/IV. It is noteworthy that acupuncture was capable of improving DOE in patients with COPD, even in the advanced stage. Although changes in the Borg scale in the group classified as I/II did not reach statistical significance, this may not mean that acupuncture did not have positive effects because baseline values were much lower in this subgroup and therefore the absolute reduction range was small. In addition, improvements in the 6MWD and Spo_2 in patients in group I/II were statistically significant.

Possible mechanism of effect of acupuncture on dyspnoea
There are several hypotheses[17] regarding the causes of dyspnoea associated with COPD including reduced respiratory function by dynamic hyperinflation, hypoxaemia, hypercapnia and/or a limitation in ribcage movement accompanied by fatigue and dysfunction in the accessory muscles caused by an increased workload.

Although mechanisms underlying the clinical effects of acupuncture remain unknown, there are some hypotheses regarding the effect of acupuncture on dyspnoea in patients with COPD.

First, peripheral airway obstruction progressively traps air during expiration, leading to hyperinflation. Hyperinflation reduces inspiratory capacity so that functional residual capacity increases, particularly during exercise, and this results in dyspnoea and a limitation of exercise capacity. It is now thought that hyperinflation develops early in the disease and is the main mechanism associated with exertional dyspnoea. Moffet reported that the mechanical effects of acupuncture are mediated via effects in the autonomic nervous system.[18] Bronchomotor tone is primarily controlled by the parasympathetic nervous system, but is also affected by the stimulation of β-adrenergic receptors in bronchial smooth muscle. Thus, either cholinergic inhibition or adrenergic stimulation may be responsible for the partial relief of experimentally-induced bronchospasm after acupuncture. We therefore speculate that improvements in FEV_1 and $\%FEV_1$ observed in the present trial may be related to autonomic functions activated by acupuncture treatment and consequently the IC showed an improvement. In addition, improvement in the respiratory function may contribute to the improvement in the DOE.

Second, increases in MEP and MIP were observed in patients with COPD at the end of the acupuncture treatment in this study, which suggests that acupuncture may result in a release of tension in the respiratory accessory muscles groups and consequently the diaphragm breathing was facilitated. Kawakita et al reported suppression of electromyogram findings in the muscle that was experimentally hyperactivated by repeated eccentric contraction during acupuncture needling on the muscle.[19] We
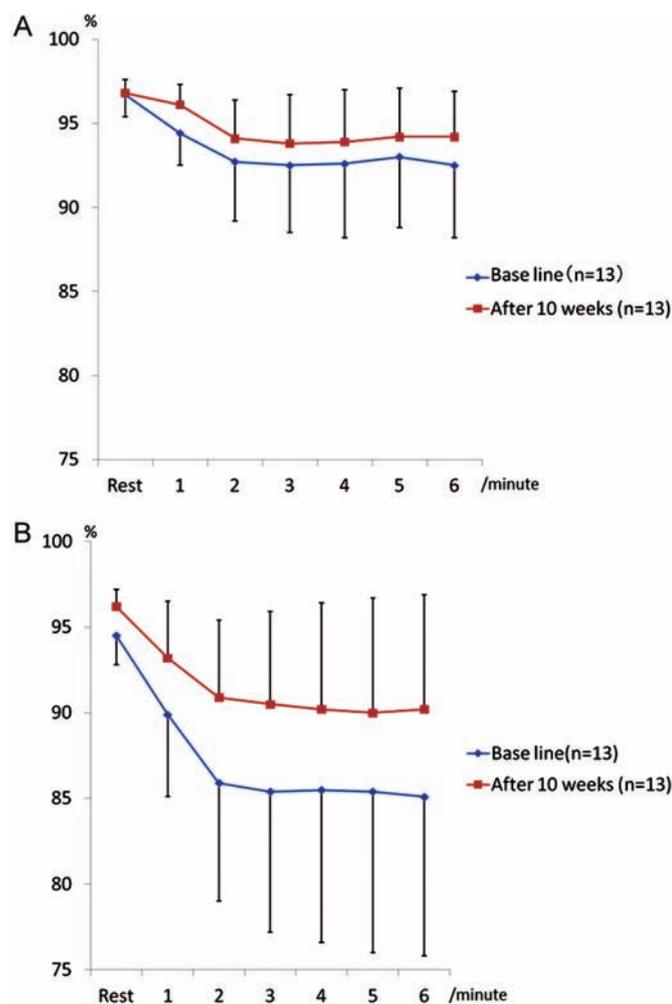
Figure 1 Oxygen saturation (Spo₂) values during the 6-min walk test. Spo₂ showed improvement at 10 weeks after acupuncture treatment. The reduction and the difference between subgroups in the time course was much smaller in the patients classified as GOLD I or II (A) than in those classified as GOLD III and IV (B).

speculate that a similar phenomenon was evoked in the respiratory accessory muscles by needling on the acupuncture points located on the rib cage, which may lead to the recovery of strength in these muscles. Relaxation in the quadrate muscle of the loins and/or abdominal rectus muscle by needling in the lower back and abdomen may contribute to the increase in the respiratory muscles and the diaphragm breathing.

Improvement in the functions of these muscles by acupuncture needling may also contribute to the relief of fatigue in these muscles accompanied by hyperinflation of the lung in patients with COPD which, in turn, may contribute to the amelioration of problems with respiratory function by increasing mobility in the rib cage.

Several investigations have reported an association between exercise tolerance and respiratory muscle strength.[20] In patients with COPD, respiratory accessory muscle groups are mobilised during ventilation.[21] It is thought that increased oxygen consumption caused by a rise in ventilation during physical activity can influence

these respiratory muscles, especially inspiratory muscles, and may cause muscular fatigue and tonicity in patients with COPD.

Needling on the acupuncture points which exist on the respiratory muscles causes relaxation of the muscles, which may support recovery of the function in the respiratory muscles and lead to improvement in tolerability to exercise. We also speculate that this mechanism led to the improvement of DOE in COPD patients which may have contributed to a better performance in the 6MWD.

Acupuncture and nutritional benefit

Nutritional disorder is a major problem in patients with COPD.[22] Nutritional state is an important determinant of symptoms, disability and prognosis in COPD, and being underweight can be problematic. Specific nutritional recommendations for patients with COPD are based on expert opinion and some small randomised clinical trials. Approximately 25% of patients with stage II (moderate COPD) to stage IV (very severe COPD) show a reduction in both BMI and fat-free mass. A reduction in BMI is an independent risk factor for mortality in patients with COPD. Also, improving the nutritional state of patients with COPD who are losing weight can lead to improved respiratory muscle strength.[23]

Our study clearly demonstrated that the BMI of patients with COPD was improved after 10 weeks of acupuncture. It is reported that acupuncture at ST36 and CV12 accelerates gastric emptying,[24] which may consequently facilitate food ingestion. We therefore suggest that improvement in gastrointestinal function as well as reduced dyspnoea during meal time may facilitate food intake and result in a better nutritional condition of the patient.

In addition, improvements were observed in %FEV₁, MRC and 6MWD. Celli et al[10] suggested that the BODE index—calculated from multiple factors including BMI, obstruction estimated with %FEV₁, dyspnoea evaluated with MRC criteria and exercise capacity evaluated with 6MWD—could be useful predictors of prognosis of COPD patients. It is therefore conceivable that acupuncture may affect the prognosis of patients with COPD as the treatment improved all factors included in the BODE index.

These results suggest that acupuncture may have a considerable influence on the prognosis of patients with COPD, especially those with advanced disease.

Limitations

There are several limitations to this study. First, most of the patients were already receiving standard medication for COPD because it was practically impossible to recruit those who were not already being treated. It should therefore be noted that changes in the outcome measures in the present trial were achieved by acupuncture and might also include additional or synergic effects of medication. Second, this study focused on the effect of acupuncture performed over a relatively short period without follow-up evaluation. It is therefore necessary to investigate the potential long-term

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Summary points
► A case series of 16 patients with chronic bronchitis
► Dyspnoea improved with acupuncture

effects of acupuncture on dyspnoea in patients with COPD in a randomised controlled clinical trial with longer term interventions and an appropriate follow-up period in the future.

CONCLUSIONS

We have demonstrated the clinical relevance of acupuncture treatment on DOE and BODE index after 10 sessions in patients with COPD. Furthermore, it became clear that acupuncture even had an effect in patients with severe COPD. It is unlikely that a placebo effect can account for all of the objective and subjective dyspnoea changes observed in this study. Nevertheless, these results must be confirmed in randomised trials with larger sample sizes and rigorous methods that reflect the principles and practice of acupuncture as it is commonly performed. Further research is required to define the possible role of acupuncture in the treatment of COPD.

Contributors MS and TS were responsible for all the acupuncture procedures and carried out various aspects of the experiments summarised in the paper. MS, ME, KN, YO and HF participated in the design and coordinated the performance of the study. ME and NI provided technical advice on the project. MS and NI drafted the manuscript.

Competing interests None.

Patient consent Obtained.

Ethics approval The Institutional Review Board of Meiji University of Integrative Medicine and Faculty of Medicine approved the study.

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