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Research Article

ACUPUNCTURE EFFECTS ON RESPIRATORY PARAMETERS IN ALS PATIENTS

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ABSTRACT

In amyotrophic lateral sclerosis (ALS), respiratory dysfunction is a leading cause of mortality. Acupuncture has been observed to alter respiratory physiology parameters. In this study, 18 ALS patients underwent five days of acupuncture treatment. Capnography and oximetry were monitored before and during treatment. Patients with higher K-ALSFRS-R scores exhibited greater changes in pulse rate; specifically, EtCO2 and respiratory rate decreased, while SpO2 increased. Post-acupuncture stimulation, statistically significant differences were observed in SpO2 and pulse rate, although not in EtCO2 and respiratory rate. Acupuncture may be particularly effective in early-stage ALS, with a greater impact on inspiration than expiration. Further research investigating acupuncture in ALS patients is warranted.

Keywords: ALS (Amyotrophic Lateral Sclerosis), Acupuncture, Respiratory symptoms, K-ALSFRS-R scores, neuromuscular atrophy.

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INTRODUCTION

This disease affects motor neurons in the spinal cord, brain stem, and cortical areas of the brain, leading to progressive neuromuscular atrophy [1,2]. Respiratory compromise necessitating mechanical ventilation often occurs, and within 2-3 years of diagnosis, around 84% of ALS patients succumb to respiratory complications [3]. Patients with respiratory symptoms typically have a survival rate of only two months on average. Respiratory muscle weakness, resulting from progressive motor neuron degeneration [4], leads to insufficient pressure and airflow generation during breathing, causing carbon dioxide retention, hypoxia, and respiratory failure. These symptoms worsen over time and often lead to fatal respiratory events [5], significantly impacting patients' prognosis and quality of life. Positive pressure ventilation methods such as non-invasive positive pressure ventilation (NIPPV) have been shown to improve the quality of life and extend the survival of ALS patients [6]. However, effective treatments for respiratory dysfunction in ALS remain elusive. Acupuncture, a traditional East Asian therapy, has shown promise in improving [6] dyspnea associated with conditions like chronic obstructive pulmonary disease (COPD). Animal studies have also demonstrated potential benefits of acupuncture in alleviating ALS symptoms [7,8]. This study focused on acupuncture, aiming to tone the lungs, as a potential treatment for ALS. The effects of Sa-am acupuncture on respiratory parameters such as end-tidal carbon dioxide (EtCO2), oxygen saturation (SpO2), pulse rate, and respiration rate in ALS patients were investigated.

METHODS

During this period, sixteen eligible ALS patients were selected to participate in the study. All participants provided written informed consent, which was obtained after approval from the institutional review board (IRB).

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Inclusion criteria for the study required patients to be diagnosed with ALS based on the criteria, to have provided consent, to cooperate with the study procedures, and to refrain from smoking, alcohol consumption, coffee intake, or green tea consumption prior to testing [9]. Additionally, patients who were menstruating were excluded from participation. Patients with respiratory care, spastic bulbar palsy, ischemic heart disease, thyroid disease, chronic renal failure, fever, seizure disorders, mental illness, or addiction to alcohol, nicotine, or caffeine were also excluded from the study. Any patients deemed ineligible for participation based on these criteria were excluded as well.

Measurements

Devices for measuring oximetry and capnography were utilized as convenient tools in this study. Pulse rate, respiratory rate, and end-tidal carbon dioxide were measured. ALS Functional Rating Scale-Revised (ALSFRS-R) was employed to assess patients' ability to perform daily living activities, with higher scores indicating better health. The experimental procedure involved: (1) subjects resting for 15 minutes before measurement, (2) measuring respiratory parameters for 15 minutes using Capnography and Oximetry, (3) acupuncture at specific acupoints using stainless steel, disposable, sterile needles, with electrical stimulation applied until an unpleasant sensation (but not pain) was felt, and (4) concurrent measurement of atmospheric oxygen saturation, respiratory rate, and heart rate. Each patient received acupuncture twice daily for five days. Point selection for acupuncture was based on Five-Element Acupuncture, focusing on points that tonify lung function. Treatments were administered by certified Korean medicine practitioners following WHO guidelines. Data analysis was conducted using SPSS version 20.0, correlating pulse rate, SpO2, and EtCO2 with K-ALSFRS-R using Pearson's correlation. Mean values of respiratory function parameters before and after acupuncture stimulation were compared over 15 minutes, with a significance level set at $p < 0.05$.

RESULTS

Analysis of correlation with K-ALSFRS-R

The study compared glucose levels, oxygen levels, respiratory rate, and pulse rate before and after acupuncture stimulation. Following acupuncture, K-ALSFRS-R scores were analyzed for correlation with end-tidal carbon dioxide (EtCO2), oxygen saturation (SpO2), respiratory rate (RR), and heart rate using Pearson's correlation analysis. The results revealed a negative correlation between K-ALSFRS-R scores and pulse rates after acupuncture stimulation.

After acupuncture stimulation, EtCO2 and respiratory rate did not change significantly by paired t-test. However, SpO2 increased from 96.42% to 96.58% after acupuncture stimulation. 83.49 beats per minute decreased to 81.08 after acupuncture stimulation.

Table-1: Baseline characteristics of ALS patients

Patients with ALS	***N* = 36**
Gender (male : female)	15:4
Age (in years)	57.06 (±8.53)[a]
onset age	53.39 (±10.29)[a]
(maximum 48) K-ALSFRS-R score	34.24 (±6.19)[a]
K-ALSFRS-R respiration subscores (total: 12)	10.71 (±4.24)[a]
The site of onset	
Bulbar	4
The upper limb	6
The lower limb	11

Table 2: A correlation between K-ALSFRS-R score and difference in EtCO2, SpO2, RR, and pulse rate

	$EtCO_2$	SpO_2	RR	Pulse
K-ALSFRS-R	1.104	1.046	−1.077	−1.236

Table 3: K-ALSFRS-R score and EtCO2, SpO2, RR, and pulse rate after acupuncture are correlated.

	$EtCO_2$	SpO_2	RR	Pulse
K-ALSFRS-R	−1.276**	1.173*	−1.254**	−1.420***

Table 4: Changes in EtCO2, SpO2, RR, and pulse rate after acupuncture

	Before		**After**		***t***	***P***
	Mean	**SD**	**Mean**	**SD**		

EtCO2	38.70	6.47	38.94	6.35	−0.383	0.702
SpO2	96.42	3.48	96.58	3.57	−3.097	0.002**
RR	21.64	4.31	21.47	4.02	1.359	0.180
Pulse rate	83.49	14.33	81.08	14.15	9.992	0.000***

DISCUSSION

This pilot study aimed to assess the impact of acupuncture treatment on respiratory parameters in ALS patients using capnography and oximetry [9,10]. The objective was to establish guidelines for managing respiratory problems in ALS patients, as respiratory failure is a common cause of paralysis and death in individuals with ALS [11], and effective treatment and control methods remain unknown.

ALS, classified as a Wei symptom in Chinese traditional medicine [12], often leads to paralysis and respiratory failure. Despite its wide use in clinical practice, acupuncture's efficacy in ALS remains underexplored [13]. This study aimed to evaluate the effects of acupuncture, focusing on lung tonification, on respiratory parameters in ALS patients. The treatment targeted lung dysfunction associated with ALS symptoms, such as coughing up sputum. Previous research suggests acupuncture may alleviate respiratory symptoms in ALS, yet with limited sample sizes and animal studies [14]. In this study, intensive acupuncture was administered at lung zones SP3, LU9, HT8, and LU10. Pulse rate and SpO2 significantly improved post-treatment, while EtCO2 and RR showed no significant changes [15]. Notably, lung tonification appeared to enhance inspiration more than expiration, possibly by regulating the autonomic nervous system. Despite modest improvements in respiratory parameters, acupuncture could help ALS patients maintain respiratory function and delay muscle weakness. However, further research is needed to validate these findings and develop effective acupuncture treatments for ALS patients, aiming to prevent respiratory complications and enhance quality of life

CONCLUSIONS

This study combined with acupuncture stimulation, notably influenced pulse rates and oxygen saturations among participants. Notably, the effectiveness of acupuncture treatment was more pronounced in patients with high K-ALSFRS-R scores compared to those with lower scores. However, the findings from this study call for further exploration and expansion to provide a comprehensive understanding of the potential benefits of acupuncture in ALS management.

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