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Short communication

Effect of handball training on cognitive ability in elderly with mild cognitive impairment

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HIGHLIGHTS

- We tested 60 Chinese elders with MCI.
- This is a randomized clinical trial.
- Handball training can improve cognitive ability in elderly with MCI.

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ABSTRACT

The aim was to examine the effect of handball training on cognitive ability in elderly with mild cognitive impairment. A total of 60 elderly were randomly divided into training group ($n = 30$) and control group ($n = 30$). The mini-mental state examination (MMSE) score and abilities of daily living scale (ADL) score before, after 3-month, and after 6-month intervention period was measured. The results showed that MMSE score was increased and ADL score was decreased in training group after 3-month and 6-month intervention ($P < 0.05$), while there were no significant changes in MMSE or ADL in control group (P£3/40.05). These preliminary results indicated that handball training can improve cognitive ability in elderly with MCI.

1. Introduction

Mild cognitive impairment (MCI) represents a transitional state between healthy aging and very mild Alzheimer disease (AD) [28]. Elderly individuals with MCI are at high risk for developing AD. There are about 10–15% of MCI patients develop AD each year [13,19], and normal elderly subjects convert to AD at a rate of only 1–2% per year [5]. At present, using the same medication that is used to treat AD is the most common method used to treat MCI intervention. However, researchers concluded that currently, no effective pharmacological treatments exist for MCI patients [1], especially with regard to long-term beneficial effects. A recent systematic review did not reportconvincing effects in delayed disease progression or conversion to dementia in MCI patients treated with cholinesterase inhibitors (I-ChEs), and the authors reported important risks associated with the I-ChE treatment [23]. A recent review recommends engagement of MCI persons in cognitive activities and participation in social activities, given that these might be beneficial and pose little risk [21].

Epidemiological data suggests that regular participation in physical activity, especially aerobic exercise, is associated with a lower risk of dementia [4,16,17,33]. According to these findings, epidemiological studies and randomized controlled trials examining the effects of exercise have proposed it is associated with various cognitive benefits [4,8,9,24,29,30], and several meta-analyses reported that physical activity or exercise is associated with improvements in attention, processing speed, and executive function in older adults with or without cognitive impairments [2,7,27]. RCT have been conducted to determine the effects of exercise or physical activity on cognitive functions in older adults with MCI. Several studies identified the effects of muticomponent exercise on cognitive function in older adults with MCI and found it is beneficial for improving logical memory and maintaining general cognitive function and reducing whole brain cortical atrophy in older adults with amnestic MCI [29,30]. A study further compared effects of multicomponent exercise and resistance training

Abbreviations: SD, Standard deviation; MMSE, Mini-mental state examination; ADL, Activity of daily living scale.

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on executive cognitive functions and functional mobility in older adults and the results confirmed that both physical training benefits executive function and suggest that different training types might lead to such benefits through different pathways, both types of training promoted functional mobility in older adulthood [12]. In addition to muticomponent exercise, Rovner demonstrated that a self-designed behavior activation could prevent cognitive decline in older African Americans [24], Cyarto proved that home-based physical activity may delay the progression of white matter changes on MRI in older adults with memory complaints and MCI through a single-blind randomized controlled trial conducted in 156 participants [8], and Erickson found that moderate-intensity aerobic exercise training was effective at reversing hippocampal volume loss in late adulthood, which is accompanied by improved memory function [10].

Based on the evidence of the relationship between exercise and cognitive function in MCI, the current study was designed to test whether a 6-month supervised handball training program could improve cognitive function among older adults with MCI. The reason for examining this program was because recently researches have confirmed that handball training program can enhance intelligence in children [6,15,20], but no findings about its effect on cognitive function among older adults with MCI has been reported. Handball combines the elements of fitness endurance, hand-eye coordination, agility and strategy in any given game through the use of handball for some actions such as cast, throw and so on. Previous reviews have suggested that multiple exercise interventions improve mobility among older adults [14,27].

2. Methods

2.1. Participants

This study was conducted from October 2011 to August 2012. A total of 60 aged patients with mild cognitive impairment (MCI) were selected according to the US mental disorders 4th edition of the Diagnostic and Statistical Manual (DSM-IV) [3] in mild neurocognitive damage standards and the Diagnosis standard of Shanghai Mental Health Center [26].

Inclusion standards: (1) ages ranged from 60 to 75 years old; (2) existing subjective or objective cognitive impairment; (3) mini-mental state examination (MMSE) Score ≤26 points, the level of Global Deterioration Scale (GDS) assessment is between 2 and 3; (4) activity of daily living scale (ADL) Score ≤18 points; (5) Hachinski ischemia index (HIS) ≤4 points; (6) course of cognitive impairment >3 months; (7) normal or corrected-to-normal hearing and vision.

Exclusion standards: (1) depression (self-rating depression scale standard <53); (2) history of drug use, such as memory-improving drugs; (3) body movement disorder.

All subjects were from a nursing home and they were randomly divided into training group ($n = 30$) and control group ($n = 30$). All of the 60 individuals enrolled in the study completed the six month follow-up and complete assessment after the intervention. All of the subjects were informed and agreed to participate in the study.

Participant characteristics at the beginning of the study are shown in Table 1. We confirmed that there were no significant differences in demographic characteristics, physical performance, or instrumental ADL and MMSE levels between the training and control groups.

2.2. Intervention methods

2.2.1. Training group

Handball training program was used in training group. This program contained following activities: (1) toss training: tossing a ball (or walnut instead) up with one hand and caught it with the other hand, and practiced it repeatedly; (2) hit training: hitting a ping pong ball with table tennis racket without dropping it down on the ground and counting the times f hitting (except dropping) by participants themselves. (3) Bounce training: forming groups of 2 or more, one participant patting a ball twice first and bouncing it to the other who should do the same thing; (4) pass training: all participants formed like a circle and the ball holder passed the ball to the named person; (5) grab training: scooping the table tennis balls into a bowl with a spoon, and the one who had the most balls in his/her bowls was the winner; (6) field going training: standing at a designated position and shoot a ball into specified basket by hitting it to the ground; (7) roll training: rotating two balls of different colors in one hand by fixing eyes on one ball only throughout the training; (8) pinch training: pinching beans into a narrow-mouth bottle with fingers and counting the number. The materials for the training were provided by the researchers.

Subjects in the training group were divided into two groups with 15 participants in one group. The two groups exercised respectively under the supervision of the well-trained nurses for 30 min/day, 5 days/week, for a total of 120 times over 6 months. Two physiotherapists involved in geriatric rehabilitation and three well-trained nurses conducted each intervention. Each supervised session began with “toss training” for 5 min to warm the participants up, followed

Table 1
Characteristics of the training and control groups.

	Mean (SD)		*t*/*z* value	*P* value
	Training group($n = 30$)	Control group($n = 30$)		
Age, years	66.73 (5.48)	65.27 (4.63)	0.894	0.375
Men, no. (%)	21(70.0)	19(63.3)	0.543	0.587
Educational level, no. (%)			0.551	0.582
Elementary school or lower	21(70.0)	19(63.3)		
Middle school	6(20.0)	7(23.3)		
High school	2(6.7)	3(10)		
College	1(3.3)	1(3.3)		
Diagnosis, no. (%)				
Hypertension	5 (16.7)	7 (23.3)	0.640	0.522
Heart disease	0 (0)	2 (6.7)	1.426	0.154
Diabetes mellitus	3 (10)	5 (16.7)	0.753	0.451
ADL score	15.33(1.69)	15.10(1.45)	0.493	0.624
MMSE score	24.33(1.65)	25.00(1.29)	−1.75	0.085

Abbreviations: SD: standard deviation, MMSE: mini-mental state examination, ADL: activity of daily living scale.
This is the comparision results in demographic characteristics, physical performance, and instrumental ADL and MMSE levels between the training and control groups at baseline.