

Original Article

A study on influence of scalp acupuncture on behaviors, cognitive function and activity of daily living in vascular dementia patients

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Abstract: Objective: It is aimed to explore the influence of scalp acupuncture (SA) on vascular dementia (VD) patients' behaviors, cognitive function (CF) and activity of daily living (ADL). Methods: 63 VD patients were selected from our hospital as objects of study and divided into experimental group (EG) (n=34) and control group (CG) (n=29) according to different treatment methods. CG was treated with conventional western medicine (CWM) and EG was treated with SA on the basis of treatment used for CG so as to compare the response rate (RR) and the mini-mental state examination (MMSE) and ADL scores before treatment and 1 month and 3 months after treatment and analyze the levels of tumor necrosis factor- α (TNF- α) and interleukin-1 β (IL-1 β) before and after treatment. Results: (1) The RR of EG was higher than that of CG ($P<0.05$). (2) The MMSE scores of two groups had no statistical difference before treatment ($P>0.05$), and the scores of EG were much higher than those of CG 1 month and 3 months after treatment ($P<0.05$). (3) The ADL scores of two groups had no statistical difference before treatment ($P>0.05$), and the scores of EG were much higher than those of CG 1 month and 3 months after treatment ($P<0.05$). (4) There was no statistical difference in levels of TNF- α and IL-1 β between two groups before treatment ($P>0.05$), and the levels of above factors in EG were lower than those in CG after treatment ($P<0.05$). Conclusion: SA had a good therapeutic effect on VD and could improve patients' cognitive ability (CA) and ADL and reduce the level of serum inflammatory factors (SIF), showing a definite effect.

Keywords: Scalp acupuncture, vascular dementia, behaviors, cognitive function, activity of daily living

Introduction

The incidence of cardiovascular and cerebrovascular diseases increases progressively year by year due to the change of life style and the adjustment of dietary structure in Chinese residents in recent years. Vascular dementia (VD) is a cerebrovascular disease of cerebral hypoperfusion caused by ischemic stroke or hemorrhagic stroke, which further leads to the cognitive impairment (CI) in memory, cognitive function (CF) and behaviors. Its main manifestation is the decline or disappearance of language, memory, emotion, personality and logical reasoning [1, 2]. According to statistics, the morbidity rate of VD is 1.1-3.0% in China, approxi-

mately accounting for 60% of all dementia patients due to the aggravating trend of aging society and the increasing incidence of cerebrovascular diseases. Now, it has become the second cause for dementia next to Alzheimer's disease and brought great economic burden to patients and society [3].

Global scholars have carried out intensive researches on the treatment of VD for the past few years, aiming to delay or stop the progression of dementia and improve the memory function and quality of life [4]. At present, a certain research progress has been made on the prevention and treatment of VD through western medicine and a better control efficiency has

been achieved on VD through appropriate intervention and medicine. The current common methods include hyperbaric oxygen therapy, drugs that improve cerebral circulation, cerebral protective drugs and drugs that enhance brain cell support [5, 6]. In spite of the definite effect of above methods, there is still no fundamental specific medicine. So global medical staffs strive to seek for a safe and effective method to treat VD. The study on VD has lasted for thousands of years in the field of traditional Chinese medicine (TCM), where it is attributed to "civil madness", "amnesia" and "dementia", etc. It is thought in TCM that the disease location is brain, with deficiency in origin and excess in superficiality. And the cognition on its pathology and pathogenesis lies in deficiency of kidney-essence and insufficiency of heart and spleen [7-9]. Scalp acupuncture (SA) is one of the common treatment methods in clinical practice. As shown in various researches, it has obvious therapeutic effect on acute cerebral infarction and cerebral hemorrhage, but there are few researches about its application to VD. It was found in this paper that SA had a good therapeutic effect on VD and could improve patients' cognitive ability (CA) and activity of daily living (ADL) and reduce the level of SIF, showing a definite effect. The details are shown below.

Material and methods

General material

63 VD patients were selected from our hospital as objects of study and divided into EG (n=34) and CG (n=29) according to different treatment methods. This study has been approved by the Ethics Committee of the First Affiliated Hospital of Guangxi University of Chinese Medicine. All study participants provided written informed consent before participating in the study.

Inclusion criteria: (1) All objects met the diagnostic criteria of VD, with cognitive impairment (CI), abnormal behaviors and other typical clinical symptoms; (2) their clinical history was complete; (3) this study was conducted with the permission of Hospital Ethics Committee; (4) patients' family members signed the informed consent form; (5) there were obvious signs and symptoms in imaging diagnosis; and (6) the treatment compliance was good.

Exclusion criteria: This study excluded (1) patients suffering from dementia due to other causes, like Alzheimer's disease; (2) those complicated with severe neurological impairment, such as aphasia and unconsciousness that affected the judgement of therapeutic effect; (3) those complicated with severe primary disease in heart, brain, liver and kidney; (4) those complicated with malignant tumors; (5) those complicated with diseases that disturbed the evaluation of CF, such as drug taking and intemperance; (6) those with poor compliance; and (7) those complicated with mental diseases.

Removal criteria: (1) Patients failed to continue the investigation due to poor compliance during treatment; (2) patients or their family members requested to quit the investigation; and (3) patients suffered from serious adverse events or complications during investigation and thus could not continue the treatment.

Methods

General treatment

The same general treatment was performed in both groups, including diet nursing, proper exercise, taking of Vitamin E and C and other ancillary drugs, and control of hypertension and hyperglycemia.

Based on the treatment of conventional western medicine (CWM), control group (CG) was treated with Piracetam tablets (manufacturer: Shenyang No.1 Pharmaceutical Co., Ltd. of Northeast Pharmaceutical Group; specification: 0.4 g/tablet; registered number of approval: SFDA approval number H21021775) three times a day at the dose of 1.6 g/time for 8 weeks, i.e. 2 courses of treatment.

Experimental group (EG) was treated with SA on the basis of treatment used for CG, with detailed procedures shown below. Patients were kept in a comfortable position to perform the routine disinfection of acupoints. The acupuncture needle (0.4 mm × 50 mm) (manufacturer: Taixing Tianhe Medical Instrument Co., Ltd.) was used for the acupuncture of Shencong Acupoint, Xuanli Acupoint, Baihui Acupoint, Naokong Acupoint, Fengchi Acupoint, Naohu Acupoint and Fengfu Acupoint by puncturing Xuanli Acupoint through Shencong Acupoint,

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Baihui Acupoint through Shenting Acupoint, Fengchi Acupoint through Naokong Acupoint and Fengfu Acupoint through Naohu Acupoint. The needle was inserted horizontally in the position about 1 cun away from subcutaneous layer. After patients had the feelings of numbness, distention and soreness, the acupuncture needle was twirled once every 10 minutes. The needle was retained for 30 minutes after acuesthesia. Patients were treated once a day for 60 days, i.e. 2 courses of treatment.

Observation targets and evaluation criteria

Response rate (RR): RR was evaluated 2 months after treatment, including marked effectiveness, effectiveness and ineffectiveness. The changes before and after treatment were judged based on scale scores. Marked effectiveness meant that mini-mental state examination (MMSE) and ADL scores increased by 20% or above after treatment; effectiveness meant that MMSE and ADL scores increased by 12%-20% after treatment; and ineffectiveness meant that MMSE and ADL scores increased by 12% or below after treatment. $RR = (\text{number of markedly effective cases} + \text{number of effective cases}) / \text{total number of cases} \times 100\%$.

Changes of CF before and after treatment

The CF of two groups was evaluated through MMSE before and after treatment, including executive ability, orientation to time and place, short memory, immediate memory, language competence, calculation ability and attention, etc. The highest scores were 30. CF was defined based on patients' educational level. It was normal when MMSE scores were ≥ 17 in illiterate patients; ≥ 20 in patients graduating from primary school; and ≥ 24 in those graduating from middle school or above. The lower the scores, the severer the CI [10].

Changes of ADL before and after treatment

ADL scale was used to evaluate the ADL of two groups before and after treatment. It was a common clinical tool to evaluate ADL, including 10 items in total with the total scores of 100. The higher scores indicate the better ADL. ADL was severely damaged if the scores were less than 40; and it was moderately damaged if the scores were 41-60 [11].

Changes of SIF level before and after treatment

The fasting venous blood was collected before and after treatment for centrifugation through centrifuge. Then, the serum was reserved for later use. Enzyme linked immunosorbent assay (ELISA) was used to detect the levels of TNF- α and IL-1 β before and after treatment. The kit was purchased from Sino Biological Inc. and used in strict accordance with instructions. Each index was detected 3 times and the mean value was the final value.

Statistical methods

SPSS22.0 was used for statistical analysis. The measurement data were represented by mean \pm standard deviation and the results were compared through independent-samples *t* test between groups and in group. The enumeration data were represented by [n (%)] and the results were compared through χ^2 test between groups and in group. The multi-point comparison was performed through ANOVA in group. $P < 0.05$ meant that the difference had statistical significance.

Results

Comparison of general material between two groups

There was no statistical difference in gender ratio, average age, educational level and marital status between two groups ($P > 0.05$) (**Table 1**).

Comparison of RR between two groups

According to evaluation, the RR was 97.06% (33/34) in EG and 79.31% (23/29) in CG, showing statistical difference ($P < 0.05$) (**Table 2** and **Figure 1**).

Comparison on CF scores of two groups before and after treatment

According to evaluation, there was no statistical difference in MMSE scores between two groups before treatment ($P > 0.05$); the scores of two groups increased obviously after treatment, showing statistical difference with those before treatment ($P < 0.05$); and the scores of EG were higher than those of CG 1 month and 3

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Table 1. Comparison of general material between two groups ($\bar{x}\pm sd$)/[n (%)]

Material		EG (n=34)	CG (n=29)	t/X ²	P
Gender	Male	20 (58.82)	16 (55.17)	0.085	0.77
	Female	14 (41.18)	13 (44.83)		
Average age (years old)		53.26±3.22	52.98±3.61	0.325	0.746
Educational level	Illiteracy	3 (8.82)	3 (10.34)	0.201	0.369
	Primary school	5 (14.71)	5 (17.24)		
	Middle school	9 (26.47)	7 (24.14)		
	Senior high school or above	17 (50.00)	14 (48.28)		
Marital status	Married	26 (76.47)	23 (79.31)	0.073	0.787
	Unmarried	8 (23.53)	6 (20.69)		

Table 2. Comparison of RR between two groups [n (%)]

Group	Number of cases	Markedly effective	Effective	Ineffective	RR
EG	34	30 (88.24)	3 (8.82)	1 (2.94)	33 (97.06)
CG	29	20 (68.97)	3 (10.34)	6 (20.69)	23 (79.31)
X ²	-	-	-	-	4.992
P	-	-	-	-	0.025

months after treatment ($P<0.05$) (**Table 3** and **Figure 2**).

Comparison on ADL scores of two groups before and after treatment

According to evaluation, there was no statistical difference in ADL scores between two groups before treatment ($P>0.05$); the scores of two groups increased obviously after treatment, showing statistical difference with those before treatment ($P<0.05$); and the scores of EG were higher than those of CG 1 month and 3 months after treatment ($P<0.05$) (**Table 4** and **Figure 3**).

Comparison on SIF level of two groups before and after treatment

According to evaluation, there was no statistical difference in levels of TNF- α and IL-1 β between two groups before treatment ($P>0.05$); the levels of above factors reduced obviously 3 months after treatment in two groups, showing statistical difference with those before treatment ($P<0.05$); the levels of TNF- α and IL-1 β in EG were much lower than those of CG 3 months after treatment ($P<0.05$) (**Table 5** and **Figure 4**).

Discussion

VD is a disease caused by cerebrovascular diseases and CI is its typical manifestation. It is characterized by sudden onset, fluctuant progression and complication of focal nervous system damage, etc. The clinical symptoms of VD patients include damaged executive function,

impaired abstract thinking ability, memory decline, and declined calculation ability, etc. Some patients may be complicated with depression, haziness of spirit-affect and other mental symptoms [12, 13]. As data shown, VD is currently the second cause for senile dementia next to Alzheimer's disease in European and American countries. A domestic investigation on the elderly aged over 60 years old showed that the incidence of VD was about 0.43-2.64% in China, accounting for 68.2% of all dementia cases. It has greatly reduced the ADL of Chinese residents and brought great economic burden to society [14, 15].

Based on clinical researches, VD is currently the only dementia that can be prevented. The reasonable prevention and treatment in early stage can effectively improve patients' prognosis and enhance their ADL. Modern medical researches indicated the following major risk factors of VD: (1) those related to atherosclerosis, such as hypertension, heart disease and hyperlipidemia, etc.; (2) those unrelated to atherosclerosis, such as psychological and genetic factors, etc.; and (3) personal and environmental factors, such as educational level and advanced age, etc. Some studies showed that the etiology and pathology of VD could be divid-

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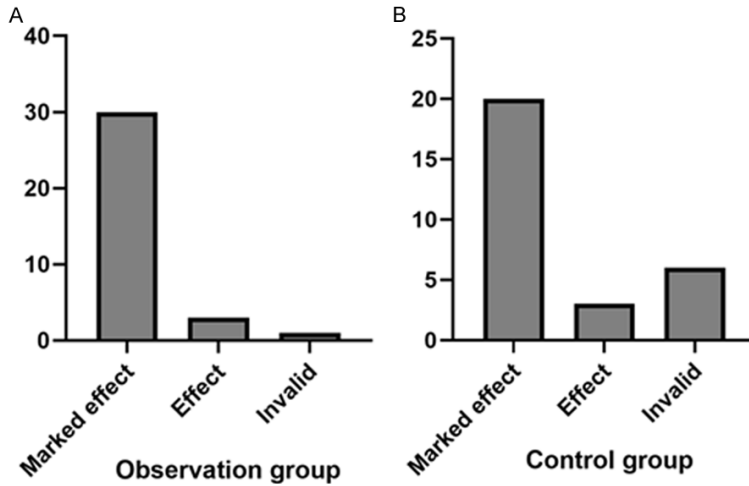


Figure 1. Comparison of RR between two groups. The RR of EG was 97.06% (A), including 30 cases of marked effectiveness, 3 cases of effectiveness and 1 case of ineffectiveness; and the RR of CG was 79.31% (B), including 20 cases of marked effectiveness, 3 cases of effectiveness and 6 cases of ineffectiveness. There was statistical difference in RR between two groups ($P < 0.05$).

Table 3. Comparison on CF scores of two groups before and after treatment ($\bar{X} \pm sd$)

Group	Number of cases	Before treatment	1 month after treatment	3 months after treatment
EG	34	19.06±2.35	24.26±2.68	27.29±2.01
CG	29	19.16±2.09	22.26±1.97	25.36±1.98
χ^2	-	0.177	3.324	3.825
P	-	0.86	0.001	<0.001

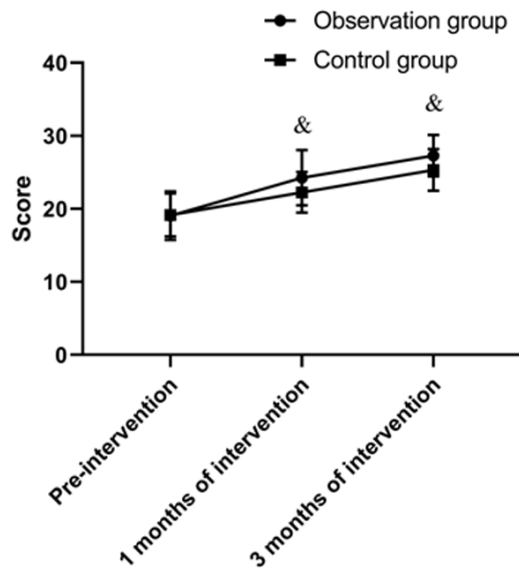


Figure 2. Comparison on CF scores of two groups before and after treatment. There was no statistical difference in MMSE scores between two groups before

treatment ($P > 0.05$). The scores of EG were higher than those of CG 1 month and 3 months after treatment ($P < 0.05$). & meant $P < 0.05$ when two groups were compared in the same index.

ed into the following aspects: (1) cerebral infarction in key positions, mainly referring to memory impairment and confusion caused by the ischemia disease in hippocampus, thalamus and other key positions related to higher cortical function; (2) lacunar infarction, mainly referring to fibrinoid degeneration on arterial wall caused by the obliteration of small perforating artery in cerebral hemisphere or deep part of brainstem; (3) nutritional disorder caused by decreased cerebral blood flow; (4) hypoxia-ischemic changes of nerve cells caused by leukoaraiosis; and (5) disrupted neural connections caused by the lesion of sub-cortical conducting fibers [16-18]. Based on above factors, prophylactic and symptomatic treatments are frequently used

in western medicine treatment (WMT) of VD. The former aims to reduce or delay the occurrence of disease by controlling the risk factors of VD, mainly including dietary intervention and exercise intervention. The latter aims to improve the clinical symptoms of patients through drugs based on the principle of evidence-based medicine. Some researches showed that the degradation of acetyl choline could be inhibited through cholinesterase inhibitors, which further improved VD patients' CF, memory, attention and active ability [19]. Some other researches indicated that cerebral metabolism activators could enhance the use ratio of glucose in brain cells and thus strengthen the cerebral metabolism and improve VD patients' learning ability and memory [20]. In spite of a certain effect achieved by WMT of VD, there are still some deficiencies, such as few methods and limited effects. So the application of TCM to this disease has become a research hotspot.

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Table 4. Comparison on ADL scores of two groups before and after treatment ($\bar{x}\pm sd$)

Group	Number of cases	Before treatment	1 month after treatment	3 months after treatment
EG	34	53.26±3.62	76.51±4.11	86.95±4.13
CG	29	53.69±3.16	70.51±3.21	80.16±3.26
χ^2	-	0.498	6.374	7.152
P	-	0.62	<0.001	<0.001

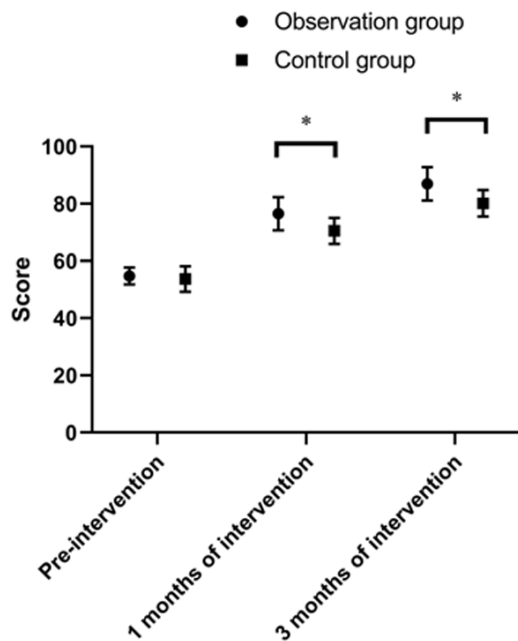


Figure 3. Comparison on ADL scores of two groups before and after treatment. There was no statistical difference in ADL scores between two groups before treatment ($P>0.05$). The scores of EG were higher than those of CG 1 month and 3 months after treatment ($P<0.05$). * meant $P<0.05$ when two groups were compared in the same index.

But this disease can be attributed to “dementia” and “civil madness” according to patients’ clinical manifestations. In *Lingshu Tiannian*, “centenarians’ five viscera are deficient without any spirit”. In *Zuo Zhuan*, “the unwise are so-called idiots”. It is thought in TCM that the disease location of VD is brain and its etiology and pathogenesis mainly lie in congenital defect or oldness and weakness and insufficient blood gas that lead to viscera function decline, insufficiency of marrow-sea, malnutrition of primordial spirit and apraxia of spiritual mechanism. This is similar to modern medical researches on etiology of VD [21]. Two groups were set in this study to research the influence of SA on VD

patients’ CF, behaviors and ADL. The results showed that the RR of EG additionally treated with SA was 97.06%, higher than that of CG merely treated with CWM. According to TCM, all yang meridians are ascending to the head which is the confluence of all yang meridians and the meridian qi gathers in the head to moisten and nourish brains. Meanwhile, head is the house of

mental activity, so the acupuncture of head acupoints can regulate the brain and even the body status [22]. Researches showed that SA could use the acupoints more concisely compared with the traditional scalp acupuncture and thus activate head meridians and meridian qi, dredge head meridians and regulate qi and blood of viscera [23]. The RR of EG was much higher than that of CG in this study, which indicated that the WMT combined with SA could enhance therapeutic effect.

Besides, this study also showed that the CF and ADL scores increased much more obviously after treatment in EG than in CG. SA was performed in this study through Shencong Acupoint, Xuanli Acupoint, Baihui Acupoint, Naokong Acupoint, Fengchi Acupoint and Naohu Acupoint. Thereinto, Baihui Acupoint is an acupoint on Du Channel which is the sea of yang channels and governs the channels of all meridians. It can regulate the meridian qi of all yang meridians. The acupuncture of Baihui Acupoint has the functions of inducing resuscitation and benefiting qi and raising yang. The acupuncture of Xuanli Acupoint through Shencong Acupoint can activate mental activities, i.e. the yang qi of gallbladder. The acupuncture of Fengchi Acupoint can dispel pathogenic wind for improving eyesight. Naohu Acupoint and Fengfu Acupoint are also acupoints on Du Channel, which can reinforce the intelligence and invigorate the brain through stimulation [24]. Modern medical researches have also verified that the acupuncture of head acupoints can stimulate the projection area of cerebral cortex, improve the brain blood circulation, strengthen the nerve conduction, excite the nerve center, activate the neuronal activity and thus improve VD patients’ CF and ADL [25]. Animal experiments also showed that acupuncture improved the learning ability and memory of VD rats. The reason may be that the acupuncture could improve

Table 5. Comparison on SIF level of two groups before and after treatment ($\bar{x} \pm sd$)

Group	Number of cases	TNF- α (ng/L)		IL-1 β (ng/L)	
		Before treatment	After treatment	Before treatment	After treatment
EG	34	46.36 \pm 5.26	11.65 \pm 3.26	53.26 \pm 6.35	15.22 \pm 3.15
CG	29	46.22 \pm 5.92	20.34 \pm 3.81	53.08 \pm 6.99	26.35 \pm 6.21
<i>t</i>	-	0.099	9.758	0.107	9.167
<i>P</i>	-	0.921	<0.001	0.915	<0.001

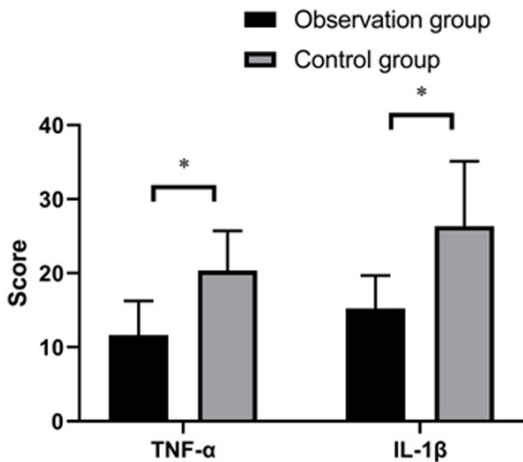


Figure 4. Comparison on SIF level of two groups before and after treatment. The levels of TNF- α and IL-1 β in EG were lower than those in CG 3 months after treatment ($P < 0.05$). * meant $P < 0.05$ when two groups were compared in the same index.

the local microcirculation and increase the number of neurons in hippocampus [26]. This is similar to this study.

In conclusion, SA has a good therapeutic effect on VD and can significantly improve CA and ADL of patients as well as reduce the level of SIF, which shows a definite effect and is of good application value. However, there are also some shortcomings: (1) the results obtained were not comprehensive and representative enough due to the small sample size in this study; (2) the effect of intervention on the long-term therapeutic effect of patients was unknown due to the lack of long-term follow-up. In view of the above deficiencies, it is planned to carry out the intervention with larger sample size and longer follow-up time in the next step, and focus on the development of prospective studies to obtain more representative and scientific conclusions, so as to provide more detailed and accurate clinical data supports for the treatment of VD.

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Disclosure of conflict of interest

None.

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