Acupuncture effect on the magnetic resonance imaging (MRI) test for mild cognitive impairment leukoaraiosis

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Accepted 1 June, 2012

Vascular cognitive impairment refers to the risk factors derived from blood vessels caused by a variety of levels and types of cognitive impairment, such as vascular mild cognitive impairment, vascular dementia and mixed dementia. Using acupuncture for mild cognitive impairment leukoaraiosis has impacts on the functional magnetic resonance. To know the neurotransmitter changes before and after acupuncture intervention in mild cognitive impairment with the functional magnetic resonance brain, laboratory for music and communication in infancy (LAMCI) cases (23), and 13 normal subjects (control group) cases were observed. Acupuncture treatment and the natural process group were observed for 3 months, respectively. Neuropsychological evaluation and magnetic resonance spectroscopy check were executed at the beginning and end of each day. Neuropsychological assessment includes mini-mental state examination (MMSE) and montreal cognitive assessment (MoCA), magnetic resonance imaging (MRI), spectroscopy N-acetylaspartate (NAA)/creatine (Cr), choline (Cho)/Cr, and myoinositol (MI)/Cr. The results showed that acupuncture can be used as an effective means of intervention for mild cognitive impairment leukoaraiosis, which can reduce activated brain regions in order to raise the efficiency of the task when stimulation is processed.

Key words: Acupuncture, leukoaraiosis, mild cognitive impairment, functional magnetic resonance, magnetic resonance spectroscopy.

INTRODUCTION

Vascular cognitive impairment refers to various types and degrees of cognitive impairment caused by risky factors of vessels, which include mild cognitive impairment, vascular dementia and mixed dementia. Early discovery, diagnosis, and intervention can prevent and delay its occurrence and development. It is of great value to economy and medicine where there is no effective treatment and lack of economic support.

Factors causing mild vascular cognitive impairment have different features, including leukoaraiosis, narrow cerebral arteriosclerosis, cerebral infarction, cerebral hemorrhage, hypertension, diabetes, etc. With magnetic resonance imaging (MRI) techniques, it is found that the occurrence of leukoaraiosis among the aged is up to 49.7%, and the cases are increasing with the age; and its rate among people is nearly 80 to 100%. Leukoaraiosis is not only a change of the pathologic image, but the worst is that the clinical behavior is mainly cognitive impairment. Therefore, the entry point for the research is the case with both cognitive impairment and the change of pathological image.

Acupuncture is a better and effective method for the treatment of dementia. Clinically, most focus is on the efficacy of acupuncture shown in a variety of neuro-psychological evaluations. There is no work on neuro-imaging of cognitive function to explore the mechanism of acupuncture and the efficacy of the objective standard. Functional magnetic resonance imaging (fMRI) is an important kind of medical data visualization technology. It can offer objective visual display of any change of the...
functional information of the human brain. MRI technique has become an advance means and objective standard for studying the mechanism and efficacy of acupuncture for the treatment of mild cognitive impairment.

Ogawa et al. (1990), in the American Bell Laboratory, for the first time used blood oxygen level dependent (BOLD), a contrast technology, to make fMRI. The brain fMRI can either observe multiple brain regions for the research of the relationship among those functional regions, or observe the dynamic activities of the brain regions, which have irreplaceable advantage in determining the position of the brain functional activity.

Acupuncture in China, as a part of the Chinese medicine, has a history of thousands of years. It has exacted effect on a variety of ailments, yet the treatment mechanic is still unclear. With fMRI, the effect on the improvement of brain function can be directly observed, which provides effective means for the study of acupuncture mechanism on points. In recent years, a series of related research based on some new methods (Jianxin et al., 2007; 2010; 2011) have proved that acupuncture can activate the functional reactions of different brain regions, to cause the change of fMRI signals, and to reflect the different responses of neural information processing in the cerebral cortex.

Mild cognitive impairment is the transition phrase between the normal aged and the dementia patients. Mostly, these cases are regarded as the early stage of Alzheimer disease (AD). Studies (Greicius et al., 2004) on patients' MGI in other states showed that MCI patients with hippocampal functional connection are reduced, the rear of cingulate gyrus and adjacent precuneus deactivation decreased or disappeared, and these abnormal changes can be used as sensitive and specific indicators of the diagnosis of AD.

Meaningless graphics memory and visual recognition memory of fMRI examination were made among MCI, dementia, and normal volunteers; then reaction time, correct rate and brain activation region were compared, which showed that MCI patients used longer reaction time, and correct rate was significantly reduced. The brain activation region showed that MCI and dementia patients had increased activation regions more than the normal group, mostly distributed in the right middle frontal gyrus, bilateral middle temporal gyrus, middle frontal gyrus and bilateral cingulate cortex of the front. In comparison, MCI group has more activation regions than the dementia group in right hippocampus and parahippocampal gyrus, right putamen, right fusiform gyrus, left inferior frontal gyrus, left supramarginal gyrus, and bilateral buckle back, which indicated that along with the development of the ailment, the compensatory functional activation region would gradually decrease. With fMRI examination of memory functions and the joint application of cognitive neuropsychology, we can clearly come to the conclusion that MCI patients have memory dysfunction. However, there is no report about the research on fMRI of very mild cognitive impairment (VMCI). Some drugs like Jiang-Zhi-Ning may affect the function, but there is lack of more evidences (Jianxin et al., 2012; 2011). Electric acupuncture on the points of Neiguan or manacupuncture bilateral Hegu points can greatly activate the bilateral cerebral hemispheres of the frontal lobe, temporal lobe, or even activate both sides of the hippocampus, suggesting that acupuncture treatment of cognitive impairment can improve patients' cognitive abilities (Lusting et al., 2003).

The essay reveals the study of mild cognitive impairment leukoaraisosis by means of functional MRI, with reference to practical clinical state and long time of acupuncture intervention, so as to find the clinical changes of these patients with the help of neuropsychological assessment. On these bases, observation on the changes of the MRI and the neurotransmitter in the brain of the cases with mild cognitive impairment was made, for the exploration of acupuncture intervention mechanism on mild cognitive impairment and the efficac standard of the subjects.

CLINICAL CASE INFORMATION

The subjects were collected from cases in the outpatient Department of Dongfang Hospital affiliated to Beijing University of Chinese Medicine. 23 cases were selected according to the diagnosis and standard, among them were 14 males and 9 females ranging from 60 to 76 years old. 13 cases in the control group were volunteers from Fangzhuang Community: 5 males and 8 females from 60 to 71 years. All the selected cases were evaluated by Hamilton depression rating scale (HAMD), excluding depression, traumatic brain injury, other nerve system diseases in history, nor digestive system diseases, liver, kidney, thyroid disease, anemia, malnutrition history, and right handedness.

Diagnostic standard

(1) The cases who claimed cognitive impairment or the complaint given by their close attendants should provide evidence or examples. Also, they should be proved by Mini-mental State Examination (MMSE) and Montreal cognitive assessment (MoCA), and clinical dementia rating (CDR) to have one or over two types of impairments.

(2) The patients or their close attendants should report that the patients had decreased cognitive ability, and the trouble had lasted over 6 months.

(3) Cases were proved by activities of daily living (ADL) and functional activity questionnaire (FAQ) as mild impairment of daily activities or social activities.

(4) In accordance with the DSM-IV-R (revised 4th edition of American Psychiatric Association's Diagnostic and Statistical Manual), dementia was excluded.

(5) The head computed tomography (CT) showed diffuse
patchy or fusion of low density lesions in white matter, MRI showed high signal in T2WI and fluid attenuation inversion recovery (FLAIR) sequences; T1WI showed equal signal or low signal, which is up to the demand of leukoaraiosis neuroimaging diagnosis, according to the standards of the Aharon-Pretz, leukoaraiosis class 5.

(6) The cases belong to kidney phlegm stasis syndrome: weakness in waist and knees, dizziness, tinnitus, forgetfulness, also with dark purple lips, light purple tongue, thready and astringent pulse or nausea, dizziness, physically heavy in body, chest tightness, greasy moss, slippery pulse or numbness, dark purple tongue, petechiae, bulged and twisted veins under the tongue and greasy moss, string.

Criteria selected cases

(1) Up to the diagnosis standard
(2) Aged from 50 to 80
(3) With clear consciousness, sufficient visual and hearing ability to accept neuropsychology test
(4) Scores of MMSE: illiterate >17 points; primary school education >20 points; middle school education and above>24 points; MoCA <26 points; ADL <26 points; FAQ<9 points; CDR 0 to 0.5 point; GDS I-1degrees.
(5) MRI 2 to 3 classes
(6) Traditional Chinese Medicine (TCM) dialectical analysis: kidney inefficiency, kidney phlegm and blood stasis syndrome.

Exclusion criteria

(1) Diagnosis of dementia;
(2) Cerebral hemorrhage, cerebral infarction, lacunar infarction, subarachnoid hemorrhage,Binswanger’s disease, multiple sclerosis, encephalitis, brain trauma, early aged gliatrophy, mental illness, hypoxemia, carbon monoxide (CO) poisoning, and cognitive impairment caused by low blood sugar;
(3) Depression (HAMD) score ≥ 17 points;
(4) Obvious focal neurological symptoms and signs, or other somatic diseases that seriously influence the psychological tests;
(5) Outside the age range;
(6) With severe original disease in liver, kidney, hematopoietic system, and the endocrine system;
(7) With in 1 month taking drugs that may influence the cognitive ability
(8) Not the type of kidney inefficiency, kidney phlegm and blood stasis syndrome in TCM
(9) Subjects who cannot follow the research procedures.

Exclusion standard

(1) Subjects below the criteria were selected by mistakes
(2) Standard subjects did not receive acupuncture
(3) Poor compliance of the subjects
(4) Subjects with serious accidents, complications or special biological changes
(5) Retreat by themselves

RESEARCH METHODS

Acupuncture application

The purpose of treatment was to tonify the brain and marrow, deplete phlegm and clear the channels. Selected points were Baihui (DU20), Sishencong, Zusanli (ST36), Fenglong (ST40), Sanyinjiao SP6), and Xuanzhong (G37).

Method used for the acupuncture was 1.5 cun pasteurized sterile stainless steel needle (made by Suzhou Huatuo Acupuncture Medical Instrument Ltd Company) manipulated by a practitioner. After conventional disinfection of the needle, the needle was inserted into the subjects’ supine, then it was quickly twisted 180 degree/min, and the needle was retained for 2 min. Electrical acupuncture instrument (LH202H type Han’s Point Nerve Stimulator made by Beijing Huawei Industrial Development Corporation) was used on Baihui, Sishencong, Zusanli, Fenglong, and Sanyinjiao for regular manipulation for 30 min each time.

The acupuncture time was three times a week, 12 weeks in all. LAMCI subjects were divided into acupuncture group (10 cases), normal group (13 cases) and regular group (13 cases).

Observation method and data evaluation

Before and after the treatment, the LAMCI acupuncture group was given a neuropsychology test, a functional magnetic resonance imaging and a spectroscopic magnetic resonance imaging. Neuropsychology test was MMSE and MoCA (Beijing Edition). MMSE included 7 cognitive areas: time orientation, place orientation, instant memory, attention and accounting ability, delayed memory, language, time and space. It was all together 13 questions and 1 point for each question. Wrong answer or no answer gets “0”, the total is 30 points, and the lowest is “0”. MoCA included 8 cognitive areas: visual space and application ability, naming object, memory, language, abstract memory, delayed recalling, and direction orientation. All together were 30 questions, and the full score is 30 points, the lowest is 0. The English original edition test result showed the normal value is >26 points. If the education is up to 12 years, 1 point is added; the highest is 30 points >26 which is normal. At present, there is no Chinese edition, analysis on the Beijing area regular model, and reliability and validity analysis.

Functional magnetic resonance imaging (fMRI) methods

Hearing music task showed the block design, that is, the baseline-task stimulating (off-on) 1-back form of subtract mode. All subjects were given one scan to complete a task. Auditory stimulation was given by female Mandarin recording made by Sound Edit PRO software. The sound was transmitted by magnetic resonance instrument with air duct earphones, intensity of 90 dB and frequency of 4400Hz. The experiment had rest and stimulus periods. Scanning started from rest period, and the order was rest-stim-rest-stim in cycles. Each period was 30 s, 5 cycles in all; and each cycle was 60 s, the total time was 300 s (P1), with baseline period used as comparison. Before the first rest period, there was 30 s female’s voice prompted to give the subjects instructions by telling them to listen to music in the stimulating period, and take a rest in the rest period with no stimulations. The reliability of the fMRI results was influenced by magnetic resonance instrument noise.
instrument noise and experimental design; data analysis followed the subtraction principle. The background noise of MRI scanning was persistent and relatively constant, such as the big or small sound and frequency. During the experiment, the subjects were required to listen to the scanning sound of MRI during the rest and stimulating periods so as to reduce the influence of noise on the result of the experiment. The rest and stimulating periods were compared, and the final result was the music test stimulating cerebral area after the subtraction of the stimulated cerebral areas during the two periods (Figure 1).

Scanning method

All fMRI scanning was completed in the Magnetic Resonance Room of Oriental Hospital of Beijing TCM University. The scanning instrument was from Philips Intera achievea 1.5T Nova, dual magnetic resonance scanner, and sense-head-8 coil. All subjects were forbidden to take any tobacco, wine, coffee and drugs 24 h before the test, and ensured a deep sleep. When they acquired stable peace, they were asked to close their eyes to illuminate all visual stimulation. Scanning steps are as follows:

(1) Scan conventional T2WI of FLAIR of T1WI axis T1WI vector like in order to make positioning.
(2) Anatomical structural scanning, T1WI-of TSE fat suppression mode; the main parameters for the sense = 1.7; the visual field (field of view, FOV) = 230 × 230 mm; acquisition matrix (Matrix) = 384 × 268; slice thickness = 5 mm; interval = 0; the number of layers = 26; factor = 5; TR/TI = 2216/350 ms; TE = 15 ms; the NSA = 1; SPIR fat suppression.
(3) Functional image acquisition: (single-shot of FFE-EPI) T2 * sequence, sense = NO; acquisition matrix = 96 × 96; TR/TE = 3000/50 ms; the NSA = 1; FOV; slice thickness, spacing and layers and more of T1WI-the TSE consistent anatomical structure; dynamic number = 90, about 2600 frames.
(4) Spectral data acquisition for the selection of single quality of spectral sequence STEAM series, conventional T2WI-of FLAIR T1WI axial and T1WI vector of image to selected regions of interest (volumes of interest, VOI) posterior cingulate (parieto occipital above the ditch, the rear of the corpus callosum); its size is 20 × 20 × 20 mm³; the machine with the software is to make shimming and suppression of water treatment for the selected VOI, before data collection. The main parameters were TR/TE = 2000/23 ms; acquisition time, 5 min. Again, data processing, resonance frequency (units of measurement in Hertz) of 100 million (ppm) indicated the location of the nuclear magnetic resonance spectroscopy, which was qualitative analysis. The area under the spectrum was the nuclear resonance concentration, that is, quantitative analysis. MR analysis software was used to analyze automatically the spectral signal, to measure the metabolite peak of the peak height (Figure 2), metabolites of the chemical frequency shift position as follows:

N-acetyl aspartate (N-acetyl aspartate and NAA), 2.0 ppm; creatine (creatinine, Cr), 3.0 ppm; choline (choline contain compounds, Cho), 3.2 ppm; and inositol (Myoinositol, MI) 3.5 ppm. NAA, Cho, Cr and MI, signal strength. Cr peak area were drawn under the peak as the standard, then its ratio in the area under each metabolite peak was calculated.

Image processing method

On the platform of computer MATLAB 5.3, start SPM software, and select fMRI module. First, make space match of functional image sequence, and standardize it to Montreal Neurological Institute (MNI) space. Use FWHM of 12 × 12 × 24 mm³ of three Gaussian functions for special smoothing of the standardized data. Smoothed data were statistically analyzed according to the generalized linear model. Scale factor was used to eliminate the effects of whole brain, using high-pass and low pass filter to eliminate noise and physiological noise. Later, unilateral t test was used to study the difference between rest and stimulating periods state under each item. The threshold is set to P < 0.001, 30 or more contiguous pixels activated brain regions to constitute a statistical parametric map which is the test activating cerebral area. Significant areas were integrated with the standard cerebral structural image, and based on MNI coordinate, the anatomical localization (Brodmann area BA) of each functional area was found. Thus the cerebral image of music hearing task of brain function changes was acquired.

Statistical analysis

Statistical Package for Social Sciences (SPSS) 17.0 statistical software package for data processing was used. First step, chi-square test of trial population characteristics (age, gender, and education level) was compared. Second step, independent sample t test was used for mean t test of subject group; the data were expressed as mean ± standard deviation. Third step involves using Spearman test for the scores of the subject’s MocA, MMSE, and making related analysis with NAA/Cr, Cho/Cr, MI/Cr value. Fourth step is hierarchical processing of matching factors of age, and comparing LAMCI subjects and normal subjects neurotransmitter change. P <0.05 for differences was statistically significant

RESULTS AND DISCUSSION

Demographic characteristics

Ages of LAWCI subjects are from 60 to 76; average, 69.5 ± 5.1 years old. Ages of normal subjects are from 60 to
71; average 66.5 ± 3.8 years old. The subjects of LAWCI and normal groups have no significant difference in age, gender, and education (P > 0.05) (Table 1).

Neuropsychological examination

MoCA scores of LAMCI subjects were 24 points; the lowest was 18 points, an average of 21.2 ± 2.1; MMSE score of 30 points; the lowest, 26 points, an average of 28.13 ± 1.18 points. Normal subjects’ MoCA scores were up to 30 points, the lowest, 26 min; an average of 28.2 ± 1.4; MMSE score was 30 points, the lowest, 27 points, with an average of 29.0 ± 1.08 points. MMSE and MoCA scores between the two groups have significant difference (P < 0.05) (Table 2).

Results of neurotransmitter

The results of measuring neurotransmitter of posterior cingulate showed that between the LAMCI subjects and the normal subjects, there is no significant difference in NAA / Cr in Cho / Cr, MI / Cr (P > 0.05) (Table 3).

Neuropsychological examination and correlation with the neurotransmitter

MMSE score and NAA/Cr Cho/Cr and MI/Cr showed no correlation (P > 0.05); score of MoCA had no correlation between NAA/Cr and MI/Cr and Cho/Cr (P < 0.05) (Table 4).

Age-matched subgroup neurotransmitter measurements

Using age match for the correction factors, 8 cases of LAMCI subjects and normal subjects were chosen and their LAMCI was re-compared. It was found in the posterior cingulate that both groups of NAA/Cr in Cho/Cr had no significant differences (P > 0.05). LAMCI test group with MI/Cr was significantly higher and there was significant difference between the two groups (P < 0.05) (Table 5).

Acupuncture and the natural LAMCI subjects’ neurotransmitter measurements

The subjects of LSMCI were divided into acupuncture and normal groups, for the comparison of the change of neurotransmitter. It was found that NAA/Cr, Cho/Cr, and MI/Cr had no significant difference (P > 0.05). The acupuncture group had 5 completed cases and lost 5 cases (Table 6).

Brain activation before acupuncture

LAMCI subjects were given the task of hearing music before the acupuncture treatment to stimulate the activation of brain regions (Table 7), superior temporal gyrus (BA22), middle temporal gyrus (BA21) and temporal polar region (BA38). The somatosensory cortex of the frontal lobe (BA1) and premotor cortex (BA6) brain activated areas presented red clusters of high signal distribution.
Table 1. Demographic features of LAMCI and normal subjects.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Case number (n)</th>
<th>Age</th>
<th>Gender</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAMCI</td>
<td>23</td>
<td>69.52 ± 5.06</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Normal</td>
<td>13</td>
<td>66.46 ± 3.78</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

E0: Illiterate; E1: Primary School; E2: Middle School; E3: Professional School; E4: College.

Table 2. Comparison of LAMCI with the neuropsychological score of normal subjects.

<table>
<thead>
<tr>
<th>Subject</th>
<th>MMSE</th>
<th>MoCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAMCI</td>
<td>28.13 ± 1.18*</td>
<td>21.17 ± 2.06*</td>
</tr>
<tr>
<td>Normal</td>
<td>29.0 ± 1.08</td>
<td>28.15 ± 1.40</td>
</tr>
</tbody>
</table>

*P<0.05.

Table 3. Comparison between LAMCI 1H-MRS of normal subjects.

<table>
<thead>
<tr>
<th>Subject</th>
<th>NAA/Cr</th>
<th>Cho/Cr</th>
<th>MI/Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAMCI</td>
<td>1.736 ± 0.337</td>
<td>0.891 ± 0.235</td>
<td>1.057 ± 0.289</td>
</tr>
<tr>
<td>Normal</td>
<td>1.705 ± 0.257</td>
<td>1.020 ± 0.166</td>
<td>1.122 ± 0.371</td>
</tr>
</tbody>
</table>

Table 4. Neuropsychological score and correlation with spearman (r value).

<table>
<thead>
<tr>
<th>Variable</th>
<th>NAA/Cr</th>
<th>Cho/Cr</th>
<th>MI/Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE</td>
<td>-0.152</td>
<td>-0.004</td>
<td>0.173</td>
</tr>
<tr>
<td>MoCA</td>
<td>-0.059</td>
<td>0.332*</td>
<td>0.21</td>
</tr>
</tbody>
</table>

* P<0.05

Brain activated areas after acupuncture

LAMCI subjects’ activated brain areas used for hearing music after acupuncture include brain areas (Table 8) temporal lobe, temporal gyrus (BA22); the frontal lobe of the amount of the orbital gyrus (BA11), frontal pole area (BA10), frontal lobe cover (BA45), premotor cortex (BA6). The brain activation area showed red clusters of high signal distribution.

From the aforementioned results, it can be seen that the LAMCI subjects’ activated brain areas for hearing music show red cluster high signal distribution involving different Brodmann areas of temporal lobe and special lobe. Before acupuncture, the subjects main activated areas were located in the multiple sites of temporal gyrus (BA22), middle temporal gyrus (BA21) and temporal pole (BA38). The prefrontal cortex had not been activated. After acupuncture, the main sites activated were the prefrontal cortex to the amount of orbital gyrus (BA11), frontal pole (BA10), frontal lobe cover (BA45), temporal lobe and temporal gyrus (BA22). After long course of acupuncture stimulation, the Brodmann area of temporal lobe was significantly fewer than the activated Brodmann area before acupuncture. However, an increase of the prefrontal cortex was activated in the Brodmann area.

Table 5. Comparison of LSMCI of normal subjects age-match versus IH-MRS of subgroup.

<table>
<thead>
<tr>
<th>Subject</th>
<th>NAA/Cr</th>
<th>Cho/Cr</th>
<th>MI/Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAMCI</td>
<td>1.762 ± 0.313</td>
<td>0.944 ± 0.157</td>
<td>1.193 ± 0.267*</td>
</tr>
<tr>
<td>Normal</td>
<td>1.746 ± 0.207</td>
<td>0.970 ± 0.092</td>
<td>0.936 ± 0.157</td>
</tr>
</tbody>
</table>

*P<0.05

Table 6. Comparison of IH-MRS of LAMRI acupuncture and natural subjects.

<table>
<thead>
<tr>
<th>Subject</th>
<th>NAA/Cr</th>
<th>Cho/Cr</th>
<th>MI/Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acupuncture</td>
<td>1.921 ± 0.196</td>
<td>1.037 ± 0.191</td>
<td>1.273 ± 0.377</td>
</tr>
<tr>
<td>Natural</td>
<td>1.560 ± 0.329</td>
<td>0.925 ± 0.045</td>
<td>1.020 ± 0.077</td>
</tr>
</tbody>
</table>

Conclusion

The leukoaraiosis mild cognitive impairment showed that cingulate part had neurotransmitter changes, and MI/Cr ratio increased, which may be one of the indicators of the diagnosis of the disease. Acupuncture can be an effective means of intervention of mild cognitive impairment caused by leukoaraiosis, for it can reduce the activated brain regions, improve the task of stimulus processing efficiency. But to achieve the changes affecting the neurotransmitters in the brain needs longer time of intervention, and the information of pharmacokinetics may contribute to further understanding (Jianxin et al., 2012). The authors will focus on further study.

ACKNOWLEDGEMENT

This work was supported by the National Department of
### Table 7. LAMCI subjects' brain activated area by hearing music task before acupuncture.

<table>
<thead>
<tr>
<th>Brain area</th>
<th>BA</th>
<th>T</th>
<th>Z</th>
<th>Voxel</th>
<th>MNI x</th>
<th>y</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 and A2</td>
<td>22</td>
<td>6.2163</td>
<td>5.6748</td>
<td>104</td>
<td>-63</td>
<td>-18</td>
<td>6</td>
</tr>
<tr>
<td>Temporal lobe</td>
<td>22</td>
<td>4.7384</td>
<td>4.4753</td>
<td>90</td>
<td>-69</td>
<td>-39</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>9.8509</td>
<td>&gt;&gt;10</td>
<td>88</td>
<td>-60</td>
<td>-21</td>
<td>0</td>
</tr>
<tr>
<td>BA22</td>
<td>22</td>
<td>8.1779</td>
<td>7.0889</td>
<td>73</td>
<td>63</td>
<td>-27</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>6.6230</td>
<td>5.9845</td>
<td>86</td>
<td>60</td>
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<td>6</td>
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<td></td>
<td>22</td>
<td>5.0397</td>
<td>4.7292</td>
<td>18</td>
<td>72</td>
<td>-21</td>
<td>9</td>
</tr>
<tr>
<td>A1 and A3</td>
<td>21</td>
<td>5.3027</td>
<td>4.9469</td>
<td>66</td>
<td>63</td>
<td>-33</td>
<td>-3</td>
</tr>
<tr>
<td>A1</td>
<td>21</td>
<td>4.9567</td>
<td>4.6597</td>
<td>93</td>
<td>69</td>
<td>-24</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>4.3038</td>
<td>4.1011</td>
<td>112</td>
<td>54</td>
<td>6</td>
<td>-24</td>
</tr>
<tr>
<td>BA21</td>
<td>21</td>
<td>4.223</td>
<td>4.0304</td>
<td>84</td>
<td>60</td>
<td>12</td>
<td>-24</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>9.1790</td>
<td>7.7263</td>
<td>83</td>
<td>63</td>
<td>-6</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>5.9721</td>
<td>5.4846</td>
<td>91</td>
<td>-57</td>
<td>0</td>
<td>-6</td>
</tr>
<tr>
<td>A1 and A4</td>
<td>38</td>
<td>4.4896</td>
<td>4.2622</td>
<td>58</td>
<td>60</td>
<td>15</td>
<td>-18</td>
</tr>
<tr>
<td>Temporal pole</td>
<td>38</td>
<td>4.3548</td>
<td>4.1454</td>
<td>87</td>
<td>54</td>
<td>21</td>
<td>-18</td>
</tr>
<tr>
<td>A5</td>
<td>6</td>
<td>5.2603</td>
<td>4.9121</td>
<td>58</td>
<td>66</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>A1 and A6</td>
<td>1</td>
<td>5.7418</td>
<td>5.3023</td>
<td>12</td>
<td>69</td>
<td>-18</td>
<td>36</td>
</tr>
</tbody>
</table>


### Table 8. LAMCI subjects' brain activated area by hearing music task after acupuncture.

<table>
<thead>
<tr>
<th>Brain area</th>
<th>BA</th>
<th>T</th>
<th>Z</th>
<th>Voxel</th>
<th>MNI x</th>
<th>y</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 and A2</td>
<td>22</td>
<td>5.5691</td>
<td>5.1637</td>
<td>74</td>
<td>69</td>
<td>-18</td>
<td>12</td>
</tr>
<tr>
<td>A2</td>
<td>22</td>
<td>5.8668</td>
<td>5.4016</td>
<td>113</td>
<td>63</td>
<td>-24</td>
<td>9</td>
</tr>
<tr>
<td>A1</td>
<td>11</td>
<td>5.9131</td>
<td>5.4385</td>
<td>56</td>
<td>-9</td>
<td>66</td>
<td>-9</td>
</tr>
<tr>
<td>A4</td>
<td>6</td>
<td>5.2707</td>
<td>4.9206</td>
<td>48</td>
<td>39</td>
<td>-6</td>
<td>66</td>
</tr>
<tr>
<td>A1 and A5</td>
<td>45</td>
<td>4.8688</td>
<td>4.5858</td>
<td>90</td>
<td>60</td>
<td>-30</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>5.8914</td>
<td>5.4210</td>
<td>67</td>
<td>-6</td>
<td>66</td>
<td>0</td>
</tr>
</tbody>
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Public Benefit Research Foundation (201007002) and Project of Wangjing Hospital affiliated to Chinese China Academy of Chinese Medical Sciences WJ2011-7.

REFERENCES


Jianxin Chen, Xueling Ma, Huilui Zhao, Ying Yang, Jing Han, Shuzhen Guo, Bing Liu, Jian Ni, Wei Wang (2011). Biological effects based


