Original Article

Analysis on correlation of white matter lesion and lacunar infarction with vascular cognitive impairment

Ting Yan1*, Jia-Rui Yu1*, Yun-Pei Zhang2, Tao Li2

1Department of Imaging, The Third Hospital of Ji Nan, Shandong, China; 2Department of Neurology, The Fourth Hospital of Ji Nan, Shandong, China. *Co-first authors.

Received May 6, 2015; Accepted July 28, 2015; Epub August 15, 2015; Published August 30, 2015

Abstract: Objective: To investigate the correlation of white matter lesion (WML) and lacunar infarction (LI) with vascular cognitive impairment. To investigate the correlation of cognitive changes of vascular dementia (VD) patients with lacunar infarction (LI) and white matter lesion (WML). Methods: The clinical data of 60 cases of VD patients were evaluated and analyzed by combining with imageological findings and cognitive function assessment. Results: Multiple LI and WML were negatively correlated with both mini-mental state examination (MMSE) scale scores (r = -0.401, P = 0.036) and clock drawing test (CDT) scale scores (r = -0.482, P = 0.028); the LI number in occipital lobe was negatively correlated with MMSE scores (r = 0.338, P = 0.048), the LI number in temporal lobe was negatively correlated with CDT scores (r = -0.235, P = 0.047), and the LI number in frontal lobe was negatively correlated with MoCA scores (r = -0.450, P = 0.039). Conclusion: All of LI location and number as well as WML are independent influencing factors of cognitive impairment of VD patients.

Keywords: White matter lesion, multiple lacunar infarction, vascular cognitive impairment

Introduction

Vascular dementia (VD), as a relatively severe cognitive impairment, usually occurs in older people. The prevalence rate of vascular dementia is 5% in those over 65. It has a morbidity second only to Alzheimer’s disease regarding the proportion in senile dementia [1]. The risk factors including cerebrovascular disease hypertension, hyperlipidemia arteriosclerosis [2]. The common causes include ischemic or hemorrhagic stroke and other ischemic white matter lesions leading to cerebral ischemia or hypoxia [3, 4]. Of them, the most common cause is ischemic stroke (also known as cerebral infarction), whose most common pathogenetic factor is believed to be atherosclerosis [5, 6]. Ischemic infarction occurring in cerebral small arteries will gradually heal with time and eventually form irregular lacunae, thus developing the condition called lacunar infarction (LI). At present, a large number of studies have confirmed the important correlation of LI and white matter lesion (WML) with VD [7, 8].

Both LI and WML can be imageologically observed directly by using brain magnetic resonance imaging (MRI) or other means, which leads some scholars to consider whether these two items play a predictive role for VD [9]; however, this idea remains inconclusive so far. It has been demonstrated that both the number and location of imageologically observed LIs exert an influence on patient’s cognitive function, especially when LIs are found in such sites as thalamus and putamen. Nevertheless [10], it remains controversial whether there is an established relationship between WML and cognitive changes [11]. Therefore, this study is designed to investigate the correlation of VD patients with multiple lacunar infarction and cerebral WML.

Materials and methods

Object

Sixty cases of VD patients admitted to Neurology Department of our hospital from January 2011 to January 2013 were diagnosed according to the symptoms, signs, imageological evidence and status of cognitive dysfunction, and their clinical data was then analyzed. These are 25 males and 35 females aged from 50 to 78
Correlation of WML and LI

<table>
<thead>
<tr>
<th>LI number</th>
<th>MMSE (points)</th>
<th>CDT (points)</th>
<th>MoCA (points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortex</td>
<td>0.93±0.89</td>
<td>24.33±3.54</td>
<td>3.41±0.47</td>
</tr>
<tr>
<td>Temporal lobe</td>
<td>1.00±0.33</td>
<td>24.55±3.33</td>
<td>3.43±0.41</td>
</tr>
<tr>
<td>Parietal lobe</td>
<td>2.00±1.14</td>
<td>24.57±3.68</td>
<td>3.49±0.51</td>
</tr>
<tr>
<td>Frontal lobe</td>
<td>2.25±1.43</td>
<td>22.89±2.45</td>
<td>3.21±0.91</td>
</tr>
<tr>
<td>Occipital lobe</td>
<td>0.83±0.24</td>
<td>23.56±3.98</td>
<td>3.36±0.31</td>
</tr>
<tr>
<td>Basal ganglia</td>
<td>0.97±0.34</td>
<td>25.51±2.89</td>
<td>3.26±0.31</td>
</tr>
</tbody>
</table>

Statistic methods
Software SPSS19.0 was used for the linear regression analysis.

Results

Correlation between WML and cognitive function
WML was negatively correlated with both MMSE scores ($r = -0.401$, $P = 0.036$) and CDT scores ($r = -0.482$, $P = 0.028$) while was not significantly correlated with MoCA ($r = -0.123$, $P = 0.682$).

Correlation between lacunar infarction and cognitive function
The LI number in occipital lobe was negatively correlated with MMSE scores ($P = 0.048$), the LI number in temporal lobe was negatively correlated with CDT scores ($P = 0.047$), and the LI number in frontal lobe was negatively correlated with MoCA scores ($P = 0.039$); no significant difference was reported in other correlations (Table 1).

Discussion
In the causes of VD patients, cerebral small vessel diseases are gaining an increasing proportion, and some studies even state that such diseases have become the primary cause of VD [13]. Despite of the extensive application of imageological evidence like MRI in studies regarding cerebral physical and mental activities, the subjective cognitive function of patients cannot be obtained from the imageological evidence yet [14, 15]. MMSE scores have been widely used in the therapies of neurology department owing to the advantages of
simple operation and high accuracy and sensitivity; however, the simple operation also leads to a rough rather than detailed evaluation of patient’s cognitive function [16]. When evaluating patient’s cognitive function, CDT scores mainly cover visual-spatial and planning functions as well as the executive function [17]. Inversely, MoCA scale is featured with high sensitivity and specificity and plays an important role in the diagnosis and assessment of vascular causes that lead to cognitive impairment. The results of this paper suggest that LI location and number are closely associated with cognitive function in VD patients, which is independent from cerebral WML [18]. LIs in frontal lobe will lead to reduced MoCA scores and mainly interfere with patient memory function. Based on the assessment of MoCA scores on delayed memory in the scope of episodic memory and by combining with anatomical theory, the medial temporal lobe, frontal lobe and nucleus anterior thalami are mainly responsible for human episodic memory function, where frontal lobe tends to code and manage information [19]. The findings are consistent with the anatomical structure. Occipital lobe is mainly responsible for processing physical visual information, and their effect on the correlation with cognitive function appears to be not significant. Temporal lobe not only exerts an important impact on memory function together with frontal lobe but also is responsible for processing auditory information and managing emotions. Consequently, the LI number in temporal lobe will affect CDT scores, suggesting a significant correlation between them [20].

The results of the study demonstrate that cerebral WML may result in patient’s cognitive impairment to varying degrees. All of LI location and number as well as WML are independent influencing factors of cognitive impairment of VD patients [21, 22]. However, given the small number of samples included in this study, more large-scale and long-term clinical studies are required to verify the conclusion.

Disclosure of conflict of interest

None.

Address correspondence to: Yun-Pei Zhang, Department of Imaging, Jin Nani First People’s Hospital, Shandong, China. Tel: +86 531 88985434; Fax: +86 531 88985434; E-mail: yunpeizhangdoc@yeah.net

References

Correlation of WML and LI

14122


