Chapter 1
The Early Diagnosis of Alzheimer’s Disease: From Behavioral to Genetic Study

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ABSTRACT

Alzheimer’s disease, a common form of dementia, is a type of neurodegenerative disease that affects more than 30% of the population older than 85. Clinically, it is characterized as memory loss and cognitive decline. Pathologically, its symptoms include cerebral atrophy, amyloid plaques and NFTs. Generally, the life expectancy is no more than nine years after the definite diagnosis, and life expectancy exceeds 14 years in only 3% of patients. Presently, there is no effective treatment to stop the process; the only measures we can take are to ease or improve symptoms temporarily. Therefore, it is necessary to diagnosis the disease in the early stage, such as through imaging detection via CT, MRI, PET and MSR, or prediction before the disease (genetic examination). However, literature data have supported the notion that Alzheimer’s disease patients show cognitive reserve abilities to some degree. In the future, research perspectives may focus on the cognitive training paradigms in compensatory and restorative strategies.

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INTRODUCTION

Alzheimer’s disease (AD), also known as just Alzheimer’s, is the sixth leading cause of death in the United States and is the fifth leading cause of death in Americans aged 65 or older (Association, 2011). Alzheimer’s disease, which is a chronic neurodegenerative disease, accounts for 60 to 70% of dementia cases. It often begins in people over 65 years of age and is an aging-related neurodegenerative disorder (Palop et al., 2003). According to Hebert, in next 40 years, the number of individuals with Alzheimer’s disease in the United States will increase dramatically (Hebert et al., 2013). There were approximately 4.5 million people with Alzheimer’s disease in 2000, and this number has since reached 5.1 million. This number is expected to reach 5.7 million by 2020, 7.7 million by 2030, 11.0 million by 2040, and 13.2 million by 2050 (Figure 1).

The exact causes that lead to Alzheimer’s disease are not yet known. However, many experts have now reached an agreement that, similar to other chronic diseases, Alzheimer’s disease likely develops as a result of multiple factors. Changes in the brain include the accumulation of the protein β amyloid outside of the neuron and the accumulation of the protein tau in the neuron (Hebert et al., 2013). In addition, approximately 70% of the risk is believed to be genetic, with many genes usually involved, such as apolipoprotein E- ε4 (APOE ε4). The APOE gene has three common forms, APOE ε2, APOE ε3 and APOE ε4; this gene provides a

Figure 1. Estimated number of people aged 65 and over with AD in the United States

<table>
<thead>
<tr>
<th>Years</th>
<th>Millions of people with AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4.5</td>
</tr>
<tr>
<td>2010</td>
<td>5.1</td>
</tr>
<tr>
<td>2020</td>
<td>5.7</td>
</tr>
<tr>
<td>2030</td>
<td>7.7</td>
</tr>
<tr>
<td>2040</td>
<td>11.0</td>
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<tr>
<td>2050</td>
<td>13.2</td>
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