

Risk Factors, Prevention and Intervention Strategy of Parkinson Disease

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Abstract:

Parkinson disease (PD) is a kind of popular neurodegenerative disease which mainly affects old people. It has already become one of the most popular nervous disease around the globe, second only to Alzheimer disease. And the topic of PD is attracting increasingly widespread social attention in recent years. Hence, this article aims to collect and conclude basic information about risk factors, prevention and intervention of PD by searching relative essays, as well as giving some strategy to fight against PD. First, this article states such risk factors that trigger PD and analyses the pathogenesis. Secondly, the ways to prevent PD and how to screen PD patients are introduced. Finally, the article writes about nowadays how do people interfere the PD, including two methods which are medicines and operation. Also, this part gives some disadvantages and limitation of each method. Finally, there is some vision of the future and suggestions about future researching direction of PD.

Keywords: Parkinson Disease; Risk factors; Prevention; Intervention.

1. Introduction

Parkinson Disease(PD) is one type of chronic neurodegenerative disease. It has an impact on the central nervous system, especially on the motor nervous system. According to lately research, New Estimate Suggests 25 Million People with Parkinson's by 2050 and almost a half (1050 thousand) of global PD patients in 2050 will concentrate in East Asia [1]. The age group with the highest rate of PD rate is the old ,especially around 60 years old. However, PD showed a rejuvenation developing trend in recent years, around 10% of PD patients contract the disease before 50 years old. PD directly causes to a wide range of symptoms, Including tremor, limb stiffness,

abnormal gait and so on. Evenworth, patients with serious PD have a high frequency (around 1/3 of PD patients) of dementia. PD can have negative effects on sleep, perception and emotion(such as depressive disorder and anxiety disorder)of PD patients as well. PD can be induced by various factors, consisting genetic factors, environmental factors, aging of the nervous system and so forth. The pathogenesis of PD have not been completely understood and discovered yet. Nowadays, popular methods to cure PD includes medicine such as Selegiline Combined with Amantadine Tablets [2]. Another way is let PD patients intensive physiotherapy such as Acupuncture Combined with Levodopa Therap [3].

However, there is not any recover method to completely treat PD yet, the PD medicines can only help control and reduce symptoms instead of curing PD. Therefore, further exploration of risk factors of curing PD as well as effective prevention and intervention measures constitutes the current focus of research. However, there is a lack of systematic review and analysis on these research aspects. Thus, this article intends to sort out relevant published literatures in recent years and systematically expound the risk factors, prevention and intervention strategies of PD, so as to provide more theoretical references for future diagnosis and treatment.

2. Risk Factors

There are various risk factors that causes and leads to PD. In order to fully understand how PD happens and find superable way to prevent it, scientists and scholars have made great efforts. Till now, they have found that there are 3 main factors of PD, genetic factors, environmental factors and aging of the nervous system. All of these 3 factors are proved having strong relationships with the triggering of PD.

2.1 Genetic Factors

Around 10% PD patients have family history of PD or other relative nervous system disease. According to research, PD is related to genetic mutation. Early-onset PD is influenced by at least 5 gene loci and has a stronger correlation with specific mutant genes, including the SNCA protein-coding gene, LRRK2, PINK1 (also known as PARK6), DJ-1 (PARK7), and Parkin (also known as PARK2). Among these, mutations in the Parkin, DJ-1, PINK1, and ATP13A2 genes are inherited in an autosomal recessive manner, while mutations in SNCA and leucine-rich repeat kinase 2 (LRRK2) are inherited in an autosomal dominant manner [4]. A research about DNA mutation of PD patients, evaluate α -Syn oligomers in cerebrospinal fluid (CSF) by combining α -Syn oligomers with DNA and detecting the electric current when the complex passes through nanopores. The results showed in the form of subpeak of current detected, Subpeak analysis showed that PD patients had a higher subpeak ratio than the healthy control group. The subpeak current distribution also revealed differences between the two cohorts, with the PD patient cohort having a higher mean subpeak current and a broader distribution, indicating a larger quantity of α -Syn oligomers with varying sizes [5]. Hence, PD was confirmed that it is related with genetic factors (DNA).

2.2 Environmental Factors

Multi-factor Effects: Some studies suggest that 90% of Parkinson's Disease (PD) cases are sporadic, which implies that PD cannot be entirely caused by genetics. This indicates that PD itself has a complex multi-factor etiology. The onset of the vast majority of cases depends on the complex interactions between genes, as well as between genes and environmental factors. Hence, environmental factors also play an key role in infecting PD.

2.2.1 Atmospheric Pollutant

A large number of epidemiological studies have shown that air pollutants have become an important risk factor for the development of cardiovascular diseases, respiratory diseases, and central nervous system diseases including PD [4]. The impact of air pollutants on the central nervous system (CNS) is increasingly severe. Air pollutants cause both long-term and short-term damage to the central nervous system, increasing the incidence of PD [6].

2.2.2 Organic Pesticides

Some kind of organic pesticides contain large amount of rotenone (C₂₃H₂₂O₆). This kind of chemical organic complex is an important etiology of sporadic Parkinson's disease which causes dopamineergic neuron damage [7]. This phenomenon is because rotenone leads to Damage and apoptosis of dopaminergic neurons which causes PD. However, the pathogenesis of Parkinson's disease (PD) induced by rotenone has not been fully clarified. Also, many other kinds of chemicals in pesticides and agriculture complex may leads to PD, such as paraquat.

2.2.3 Heavy Metal

Excessive exposure to heavy metals and their accumulations in brain produce Parkinson's disease like symptoms [8]. Heavy metals can release radiation which can trigger mutation in human DNA, leading to PD. For example, The massive increases in oxidative stress lead to protein aggregation by altering the function of the ubiquitin proteasome system. There is an association between PD and exposure to these heavy metals, either alone or in combination, and this association increases the prevalence of PD. Long-term exposure to heavy metals is linked to the activation of proinflammatory cytokines, which leads to neuroinflammation and subsequently results in neuronal loss. Similarly, heavy metals disrupt redox homeostasis, while simultaneously inducing the production of free radicals and reducing the level of antioxidants in the substantia nigra. These heavy metals include but not limited to iron, magnesium, copper and manganese [9].

2.3 Aging of Nervous System

Aging affects many cellular processes that predispose to neurodegeneration, and age-related changes in cellular function predispose to the pathogenesis of PD [10]. Most of PD patients concentrate in the old, especially those who are older than 60 years old. The average age of onset is 55. PD patients under 40 is super rare. The major factor of this phenomenon in age distribution of PD patients is the aging nervous system. First, hallmarks of brain aging such as mitochondrial dysfunction and oxidative stress, loss of protein homeostasis, and neuroinflammation are centrally implicated in PD development. Second, mutations that cause monogenic PD are present from conception, yet typically only cause disease following a period of aging [11].

2.4 Gender

The number of PD patients have large difference between males and females. Under standardized age, the possibility of PD patients among male is 267/100,000, which is more than 1.5 times than the possibility among females (163/100,000). Also, there is difference in PD condition progression between two genders. A growing body of evidence indicates that biological gender or sex is a crucial factor in the onset and phenotypic expression of PD. Studies have shown that men are twice as likely to develop PD as women; however, women have a higher mortality rate and experience faster disease progression. The clinical behaviour of PD differs because of gender as well. A research compared 102 male PD patients with 101 female patients in similar ages, by the methods of Mini-Mental State Examination (MMSE), Montreal Cognitive Assessment (MoCA), Hamilton Depression Scale (HAMD), Hamilton Anxiety Scale (HAM-A), Parkinson's disease sleep scale (PDSS), the third part of Unified Parkinson's Disease Rating Scale (UPDRS) and Hoehn-Yahr (H-Y), Staging to Evaluate Patients with PD discovering the difference between two groups. The result showed that the rates of emotional/apathy symptoms in female PD patients, including reduced interest, low mood, anxiety, and increased sweating, are significantly higher than those in men in the same group, while the rate of dysphagia is significantly lower. In contrast, men are more susceptible to the impact of disease duration [12].

3. Prevention

In order to discover PD patients from people earlier, avoiding them from having serious PD, scientists have already explore such methods including dogs and artificial intelligence (AI). Apart from scientific access, healthy

people can have several methods to prevent PD. Hence, this part is about prevention, including the lately achievements and exploration in curing PD, how scientists and doctors separate PD patients from healthy people, what can healthy people do or behaviour to prevent PD.

3.1 Methods

People can prevent PD from a wide range of aspects. First, it is vitally essential that people do regular screening, especially those who have family medical history of PD because incidental genetic risk factors [12]. Second, staying away from dangerous or poisoned chemical material such as rotenone and paraquat, avoiding taking in toxic molecules that triggers PD. Heavy metals and bad-quality air are also concerned. Third, Abstaining from unhealthy habits such as smoking, alcohols and so on. At present, the etiology of PD has not been fully clarified, but many unhealthy habits may increase the risk of developing the disease in individuals. Finally, people had better having a healthy lifestyle. For instance, healthy people are supposed to take regular daily routine, have enough sleep, do more exercise and have a balanced diet. Improving self-immunity plays a significant role in preventing PD [13].

3.2 Screening

Nowadays, scientists and doctors have already found various ways to pick out those who have already contract PD or have great potential possibility of contracting PD in the future. This greatly help earlier prevention of PD and control condition progression, avoiding PD deterioration and developing to the late stage. This part states some access to screen PD patients or individuals with high potential PD risk from people and characteristics of these access.

3.2.1 Dogs

In patients with early-stage Parkinson's disease, the sebaceous glands secrete excessively, resulting in abnormally oily skin. They hypothesize that it is the unique odor emitted by this excess sebum that provides dogs with a biological marker for identifying the disease [14]. Even though patients have contract other kinds of diseases, well-trained dogs can also find out PD patients accurately. Hence, dogs have already become a popular method to screen PD patients.

3.2.2 Artificial Intelligence (AI)

A pen equipped with magnetic ink, developed by American scientists, can be used to assist in detecting the early symptoms of PD. This device leverages neural networks to aid in data analysis, enabling it to identify differences in handwriting characteristics between PD patients and

healthy individuals, and it is expected to facilitate earlier diagnosis. This diagnostic pen may represent a low-cost, accurate, and easily scalable technology, holding promise for improving the diagnosis of PD in large populations and resource-scarce regions [15].

4. Intervention

Although there have not any measure to completely cure PD yet, there are some exploration and discovery to reduce the risk of PD, slow down the progression of PD and prevent the condition from worsening, including medicine and operation.

4.1 Medicine

A kind of medicine called Duopa have remarkable positive impact on curing PD, it's a form of carbidopa-levodopa delivered directly into the intestine in gel form rather than a pill. Doctors delivers Duopa directly to your intestine through a tube, by making a small hole in your abdomen to place the tube. A research found that Duopa can not only effectively improve the motor function of patients with Parkinson's Disease (PD), but also have a significant therapeutic effect on a variety of non-motor symptoms, including mood disorders, sleep problems, and cognitive decline. Ultimately, this translates into a substantial improvement in the patients' overall quality of life, especially [3]. It has a clear improving effect on common and significantly impactful non-motor symptoms such as depression, anxiety, and sleep disorders. There are also other kinds of medicines can achieve the aim of intervention on PD such as pramipexole combined with levodopa and benserazide hydrochloride tablets, which had outstanding therapeutic effects on Parkinson's disease patients, which can improve their condition, improve patients' cognitive and motor functions, as well as the metabolic level of frontal lobe nerve cells.

4.2 Operation

Currently, the most common operation treatment available for people living with PD are called deep brain stimulation (DBS). DBS operation implants electrodes within areas of the brain. The electrodes produce electrical impulses that affect brain activity to treat certain medical conditions. The electrical impulses also can affect cells and chemicals within the brain that cause medical conditions [16]. Some research proposed improvement suggestions such as using U-net Encoder - Bottleneck Layer - Decoder structure to achieve automatic localization of surgical targets [17]. However, there is no denying that treating PD by operation have such drawbacks. Firstly, the cost

of operation treatment is very expensive, sometimes even more than 500 thousand rmb for a completely treatment. Secondly, there are certain risks and complications, such as cerebral hemorrhage, infection and so forth. Hence whether PD patients take operation treatment should be carefully considered.

5. Conclusion

All in all, PD is a neurodegenerative disease that becoming increasingly popular around the globe. The number of PD patients is also predicted will showed a sharp surge in the near future. PD can be caused by several risk factors. With the deepening of research, the prevention and treatment paradigm of AD is undergoing a significant transformation from „treatment-oriented“ to „prevention-first“, screen patients or potential PD people as early as possible in order to control the disease development. Aiming to do this, 2 solutions are explored, medicines and operation. In the future, people hope that screening methods which can be more widely used and more accurate will be found. Although the road to completely conquering Alzheimer's disease remains long and arduous, the perseverance and continuous breakthroughs of the scientific community are gradually turning the dawn into the light of day, bringing true hope to millions of patients and their families.

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