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Analysis of treatment methods for Parkinson's disease

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Abstract. This research mainly introduces the symptoms and harms of Parkinson's disease, as well as the mainstream treatment methods in the past five years and potential treatments for Parkinson's disease (PD) in the future. First of all, it talks about a biological treatment of PD. Levodopa and dopamine, which is currently the main drug used to relieve PD motor symptoms. It helps patients reduce motor symptoms as much as possible by supplementing the lack of dopamine in the brain. Secondly, it talks about MAO-B inhibitors, like medicine rasagiline and selegiline. These drugs increase dopamine availability by inhibiting dopamine metabolism, thereby reducing the symptoms of PD while reducing potential drug side effects. In addition, this research introduces two potential treatments for PD that are under development: nanomedicine and deep brain stimulation (DBS). The application of nanomedicine in PD treatment such as how it can improve the lives of PD patients through innovative methods in drug delivery, early diagnosis and nerve repair and some potential problems of nanomedicine during PD treatment, and how deep brain stimulation, a surgical treatment, can significantly reduce the symptoms of PD by implanting electrodes and stimulating specific brain areas, thereby improving patients' quality of life.

Keywords: Parkinson's Disease, Drug Treatment, Application.

1. Introduction

Parkinson's disease (PD) affects balance and muscle control over the long term and is a degenerative movement disorder, and exhibit different symptoms, such as asymmetric onset and stiffness. Over time, these symptoms progressively get worse, and typically other secondary symptoms start to appear. As humans age, the likelihood of developing PD is expected to increase further [1]. With the increasing age and lifespan of the global population, age-related diseases such as PD are receiving increasing attention. PD is the neurological condition that is now causing the greatest amount of impairment worldwide. According to the report, there will be about 7 million cases of PD e in 2015 and 13 million cases in 2015 [2]. This portends the possibility of a " PD pandemic" in 2040. During observation, it was noted that while spending the movie with Link, he exhibited slight involuntary shaking of his hands and head. This phenomenon was not answered affirmatively when asked whether it was caused by feeling cold. Further observations showed that the jitters did not appear to be limited to specific situations, but became more pronounced during times of stress.

Since 1817, when British physician James Parkinson first defined the condition, PD has existed. PD is likely to have increasingly detrimental effects on the health and longevity of older adults without proper preventive measures and post-morbid drug treatment. Since there are many factors that lead to

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the result of getting sick, increasingly biological treatments appears. Considering Parkinson's disease affects several factors, current treatment options can only reduce symptoms and they cannot cure it. In addition, according to the report, vitamins can also be used as auxiliary treatments [3]. To sum up, PD is a complex neurological disease that has a significant impact on patients and society. This research will analysis and examine the aspects of PD treatments to help readers better understand the pharmacological approaches used for the treatment of Parkinson's disease in recent years.

2. Different treatment methods for PD

2.1. Levodopa and dopamine

PD belongs to a neurodegenerative condition marked by motor symptoms such tremors, rigidity in the muscles, and bradykinesia because dopamine-producing brain cells are gradually lost. There may also be non-motor symptoms that have an impact on every part of the patient's life. As shown in Figure 1, because a lack of dopamine is the main cause of PD, the mainstream treatment is levodopa [2]. Levodopa is a precursor to dopamine and one of the essential raw materials used in the brain to create dopamine. Dopamine is a neurotransmitter that primarily regulates motor actions and carries out regular neurotransmission. Dopamine levels fall with PD, though, leading to movement problems and other symptoms. Levodopa can enter the brain and penetrate the blood-brain barrier as a precursor to dopamine, where it is then transformed into the neurotransmitter dopamine. Dopamine levels may be increased or restored as a result, which may assist patients with PD experience fewer motor symptoms such muscular stiffness, tremors, and slowness of movement.

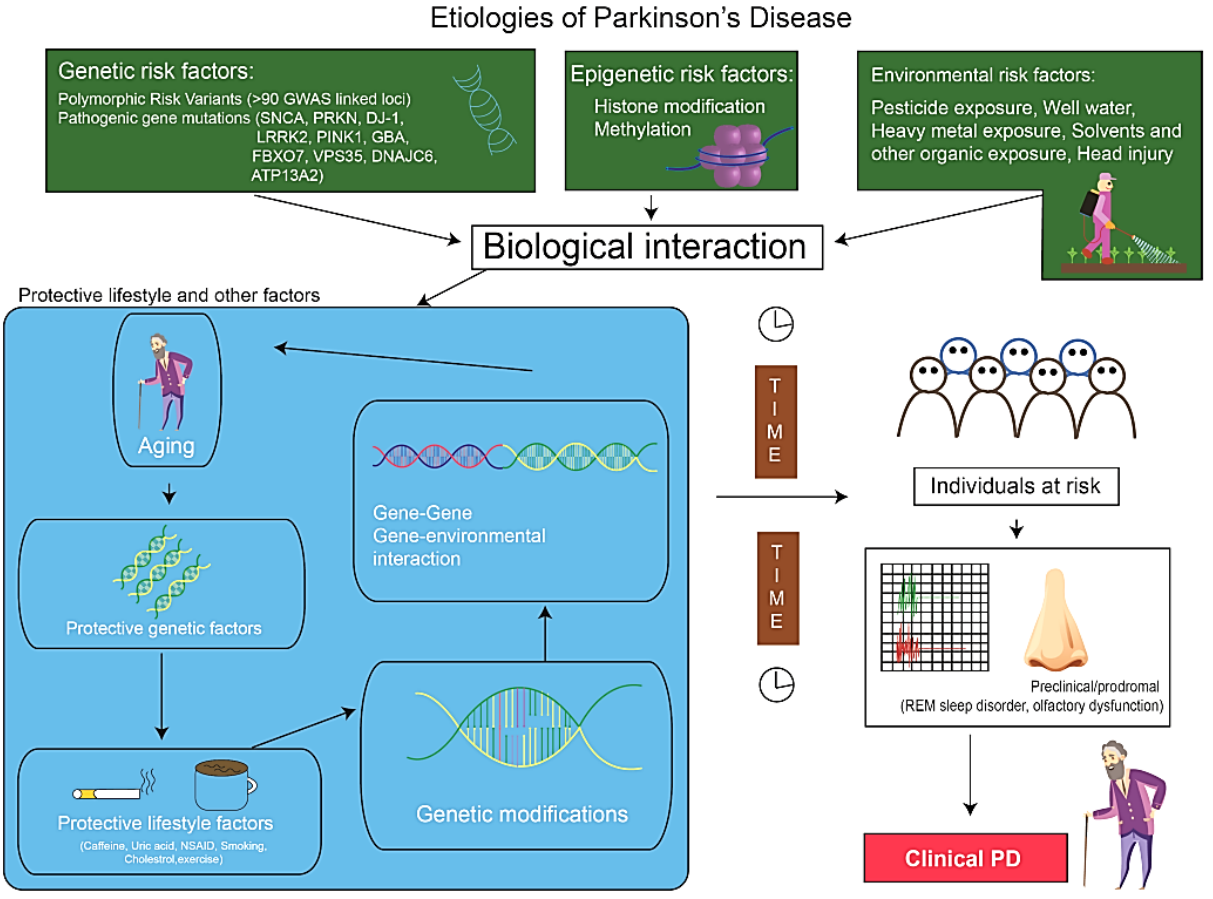

Figure 1. The Etiologies of PD [2].

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It is worth noting that treatments with levodopa and dopamine mainly target the motor symptoms of PD rather than its non-motor symptoms. On the basis of using levodopa and some drugs, patients can relieve symptoms of muscle stiffness, tremors, slowed movements and unstable postures. However, in recent years, fewer and fewer doctors and patients are using this method, because the use of levodopa is usually accompanied by side effects, such as nausea and vomiting, confusion and sleep disorders [2]. Impulse control disorders may even develop in young PD patients, leading them to develop gambling addictions, hyperactivity, compulsive shopping, compulsive eating, urges, and compulsive drug use [4]. When the above situations occur, it often takes more money and time to investigate their behavior. And as PD worsens, its drug resistance will also become stronger, so more different reagents are now being developed. Nevertheless, a nine-month experiment demonstrates that levodopa doses of 300 and 600 mg daily with placebo showed no signs of levodopa toxicity, whereas 16.5% of the patients in the 600 mg group exhibited dyskinesia. This investigation examined 150 in what is known as the "earlier vs. later L-dopa experiment." Furthermore, there was no statistically significant difference in the rate of progression between the early and delayed-start groups, proving that a disease-modifying effect for levodopa [2].

2.2. MAO-B

Another mainstream treatment for PD is MAO-B. The MAO-B inhibitors have made significant progress for PD treatment since the 1980s. MAO-B is a kind of enzyme can break down dopamine in the brain. Dopamine levels fall as a result of the death of dopamine-producing neurons in PD, which causes patients to develop bradycardia, stiff tics, and slow movements. However, MAO-B reduces the degradation of dopamine and increases dopamine by preventing the activity of MAO-B, thereby alleviating the above situation. And some studies suggest that these drugs may be potentially neuroprotective, meaning they may have the potential to disrupt disease progression. At present, the main MAO-B drugs include selegiline and rasagiline. For some therapies, a class of medications, such as coMT inhibitors and dopaminergic medications [5], must be added. Entacapone, opicapone, and andtolcapone are examples of COMT inhibitors. When you take levodopa or MAO-B drugs, a compound in your body called COMT renders some of the medication ineffective. Levodopa can be used more efficiently by the brain [5].

Selegiline works by inhibiting the MAO-B enzyme to increase the availability of dopamine in the brain to help reduce the motor symptoms of PD. For selegiline insomnia is the most frequent side effect, especially if the drug is taken in the afternoon or evening. Because of this, medication regulating. It is advised to take it either after lunch or in the morning. When used with levodopa, confusion and hallucinations may happen. Levodopa may also worsen hyper- or dyskinetic conditions [6]. Rasagiline, like selegiline, works by inhibiting the MAO-B enzyme to increase the availability of dopamine in the brain, thereby helping to reduce the motor symptoms of PD. According to [6] it is more effective than selegiline [6]. However, rasagiline interacts with some foods and medications, so only some patients can use it.

2.3. Nanomedicine

The third treatment of PD was nanomedicine which means the nanoscale particles used in medicine, particularly as therapeutic vehicles, has large potential in curing a lot of diseases due to their favorable properties such as shape, size and surface morphology. Nanomedicine refers to the precise delivery of drugs through the design of nanoparticles or nanocarriers. The capacity to bind a variety of biomolecules to nanoparticles (NPs) due to their malleability makes it possible to transport pharmacologically active substances, such as genes or medicines, effectively and safely. The blood-brain barrier, tumor vasculature, gastrointestinal fluids, lungs, liver, and delivery vehicles for nanoparticles with diameters of 1-100 nm are only a few of the critical physiological barriers that can be penetrated [7]. As a result, for PD patients, the development of nanomedicine means that drugs can be delivered directly to the brain areas that need treatment, such as the substantia nigra (Substantia Nigra), thereby reducing the dose of the drug and the risk of systemic side effects. In addition, some studies have shown that

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mitochondrial function may be damaged in PD. Mitochondrial dysfunction leads to reduced energy production, which affects the normal function of dopamine-producing neurons, thereby exacerbating the symptoms of PD. However, nanomedicine can overcome this phenomenon through gene therapy (by inhibiting mitochondrial damage or promoting mitochondrial biogenesis) [7]. However, nanomedicine technology is not yet mature, so the above are some experiments that have been done but are not fully mature. Therefore, nanomedicine has a bright future, so hope nanomedicine can bring more suitable treatment options through future research.

2.4. Deep brain stimulation

Deep brain stimulation (DBS) was proposed in the late 1990s [8]. DBS is a kind of surgical method treatment that reduces motor symptoms such as tremors, muscle stiffness, and slowness of movement of PD symptoms by using electrical stimulation methods. During this period, the doctor can complete the treatment by adjusting the size of the current. Although DBS is a very effective treatment method that can effectively relieve motor symptoms, the side effects are also obvious, including but not limited to long-term stimulation that can cause harm to the body, the need to replace the device battery when DBS energy consumption is high, and according to PD Depending on the patient's symptoms, doctors need to adjust the parameters. Additionally, decreased verbal fluency and a freeze of the gait may occur. [8, 9] These are all potential risks caused by DBS treatment. Levodopa and DBS treatments are often used together to enhance their beneficial effects [8]. They continued modelling and tests based on DBS, according to [9], with the cortex-thalamus-basal ganglia as the primary modelling target. It also suggested that it can optimize the therapeutic efficacy of DBS for each patient and concentrated on the investigation of closed-loop DBS because the conversion of modelling results from DBS to clinical disease-modifying treatment still confronts enormous hurdles [9, 10].

3. Conclusion

PD is a neurological situation which severely affects not only individuals but also their families. This research goes over some of the primary therapies for PD as well as its symptoms, risks, and hazards. The two primary treatments for PD, levodopa and dopamine replacement therapy, have significantly reduced motor symptoms, while they may still cause adverse effects. People with PD now have another therapy option thanks to MAO-B inhibitors like selegiline and rasagiline, which make more dopamine available while posing fewer adverse effects. To further improve the efficacy of the treatments, research on these medications is still underway. Nanomedicine's use in medicine gives those with PD fresh hope. Drug delivery to the brain can be accelerated via nanomedicine, minimizing adverse effects while maintaining dose, and more precisely identify and treat PD in its early stages. Finally, deep brain stimulation, a surgical procedure that has demonstrated encouraging benefits in some PD patients, offers additional choices for individuals who do not react well to pharmacological therapies by reducing symptoms by administering electrical stimulation to particular parts of the brain. There is certainly opportunity for development, however there are still some uncontrolled events. In conclusion, despite major advancements in medication development, PD is still a complicated condition that cannot be cured by a single treatment. For persons with PD, ongoing research and innovation in medications and therapies are essential. We intend to keep fostering advancement in the field of PD treatment in future research, improve patients' quality of life, and ultimately find a way to completely cure this disease.

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