



RESEARCH ARTICLE

Obesity may Increase the Prevalence of Parkinson's Disease while Parkinson's may Reduce Obesity Index in Patients

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Abstract

Objective: Currently Parkinson's disease is becoming more common among younger people of ages from 30-40 years. The incidence is higher among patients with higher BMI, some reports has it that Obesity is a risk factor for Parkinson's disease while some reported that there is no relationship between obesity and Parkinson's disease. Parkinson's disease patient at the time of diagnosis has a above normal BMI but this goes below normal as the disease progresses. Therefore, it is important to explore the relationship between Parkinson's disease and Obesity.

Methods: 349 outpatients and inpatients with Parkinson's disease were selected from the people's Hospital affiliated to Jiangsu University from 2014.01 to 2018.12, and 64 inpatients with non-cerebrovascular disease in the same period were selected as the control group. According to Hoehn-Yahr grade, Parkinson's patients were divided into early stage (1~2 grade), middle stage (2.5~3 grade) and late stage (4~5 grade). The height, weight, waist circumference, total cholesterol (TC), TG (TG), high density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were measured and recorded. The relationship between the severity of Parkinson's disease and blood lipid was evaluated.

Results: BMI in patients with early Parkinson's disease was higher than that in patients with other diseases, but there was no significant difference. Blood lipids in patients with early Parkinson's disease were higher than those in normal control group and in patients with advanced Parkinson's disease.

Conclusion: Obesity may increase the prevalence of Parkinson's disease, while Parkinson's may decrease the obesity index of patients with early Parkinson's disease.

Keywords

Obesity, Overweight, Metabolic syndrome, Neurodegenerative disease, Parkinson's disease, Parkinsonism

Introduction

Following Alzheimer's disease, Parkinson's disease (PD) is the second most common age-related neurodegenerative disorder. The motor-related symptoms include bradykinesia, rigidity, tremor and postural instability, while metabolic imbalances, psychiatric and cognitive disorders are typical of the non-motor symptoms [1]. Among the metabolic imbalances, several reports have correlated BMI and PD [2]. Despite evidences that report a rise in insulin resistance among PD patients, the mechanistic insights of this relationship are not fully understood a finish study emphasized on the association of over 80% of its study at high risk of PD due to history of Diabetes Mellitus (DM) while adjusting BMI [2-5]. Diets rich in fat have been reported to be a risk factor for PD while unsaturated fatty acids have been described to reduce PD risk obesity has been associated with inflammation affecting metabolism [6-9]. In the treatment

of obesity, chronic use of Phenetamine, a sympathomimetic agent that acts on the presynaptic vesicles in the lateral hypothalamus, stimulating β 2-adrenergic receptor hence increasing the level of Norepinephrine, dopamine and serotonin, was reported to cause PD. On the other hand, acute overdose presented classical PD symptoms such as restlessness, tremors, hyperreflexia, confusion, hallucination, and schizophrenia [10-13].

Dopamine deficiency causes a number of symptoms in which weight loss or gain, Gastroesophageal reflux (GERD) diseases are part of the presenting symptoms [7,14-22]. Uncontrolled weight gain causes maladaptation of the brain and the activation of inflammatory pathway affecting the hormonal milieu which together impacts negatively on the central nervous system (CNS). PD patients lacks enough dopamine, it is understandable they might react negatively to proper diet during the course of the disease [23,24].

The years of diagnosis of PD[YOD] has been reported to affect the normal metabolic balance of the patient, disease course tends to depreciate the metabolism, bringing about tremendous weight loss as the years goes by, this could be caused as a result of the medication used in the treatment of PD. However, there has been no much report that relates YOD with BMI, in this study we therefore examined prospectively whether the years of diagnosis of PD has a relationship with the BMI change and if obesity is a risk factor for PD.

Methods

In our study, 359 outpatients and inpatients with Parkinson's disease were selected from First People's Hospital affiliated to Jiangsu University from January 2014 to December 2018, and 74 inpatients with non-cerebrovascular disease in the same period were

selected as the control group. The inclusion criteria were: i) All patients met 2017 international MDS diagnostic criteria for PD; ii) Levodopa test was positive in all patients; iii) The onset time of all Parkinson's patients can be traced back. Exclusion criteria was: i) Parkinsonism; ii) Patients with severe cardiovascular and cerebral vascular diseases; iii) Patients with severe liver and kidney insufficiency; iv) History of extracranial injury. The enrollment criteria for the control group were: I) In-hospital neurology patients in the same period; ii) The age range was 55-75 years; iii) Parkinsonism: iv) Patients with cerebrovascular disease.

Detailed patients' history was collated, such as the age at onset of the disease presentation to determine whether it was early onset PD, and also to stage the condition based on Hoehn-Yahr gradings. Patients were divided as: Early stage (1~2 grade), Middle stage (2.5~3 grade), and Late stage (4~5 grade). The height, weight, waist circumference, Total cholesterol (TC), Triglyceride (TG), High density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were measured and recorded. The relationship between the severity of Parkinson's disease and blood lipid was evaluated. All the data were checked by two people, and the study passed the ethical review of ethics committee of the First People's Hospital affiliated to Jiangsu University (Table 1).

Patients' weights and heights were obtained using an electronic height weight BMI machine with ultrasonic body weighing scale following standard protocol (that is, fasting, bare feet, light clothing, erect posture and back facing the opposite side while on full inspiration). Waist circumference was taken using a standard meter scale. Blood samples were collected within 24 hours after the patient recorded data such as height and weight.

Table 1: General information on patients admitted to the group.

Variable	Category of variable distribution				
Onset phase					
Men	Control	≤ 24 m	25-72 m	73-120 m	> 120
No of cases	29	47	68	15	25
Mean years	66.11 ± 14.52	65.35 ± 8.39	69.18 ± 10.99	69.81 ± 9.09	73.17 ± 8.17
Women	Control	≤ 24 m	25-72 m	73-120 m	> 120
No of cases	45	52	57	10	10
Mean years	68.74 ± 9.73	67.48 ± 7.22	66.26 ± 12.20	77.37 ± 11.54	79.87 ± 10.66
Outset phase					
Men	Control	H-Y1-2	H-Y2-2.5	H-Y ≥ 3	
No of cases	29	93	38	12	
Mean years	66.11 ± 14.52	67.13 ± 9.45		78.98 ± 11.23	
Women	Control	H-Y1-2	H-Y2-2.5	H-Y ≥ 3	
No of cases	45	98	33	10	
Mean years	68.74 ± 9.73	67.88 ± 9.82		80.11 ± 9.89	

Table 2: Relationship between onset time of Parkinson's disease and body mass index (n).

Onset	≤ 24 m	25-72 m	73-120 m	> 120 m
Male	24.57 ± 3.78 (47)	24.83 ± 4.17 (68)	23.67 ± 3.57 (19)	21.67 ± 3.79* (25)
Female	24.92 ± 4.17 (52)	25.25 ± 4.78 (57)	24.37 ± 3.48* (10)	22.22 ± 3.56* (10)

Table 3: BMI relationship between Parkinson early patients and control patients (n).

	No PD	Onset of PD ≤ 24 m	Hoehn-Yahr 1-2
Male	22.76 ± 4.28 (29)	24.57 ± 3.78 (47)	25.12 ± 4.87* (93)
Female	23.08 ± 5.01 (45)	24.92 ± 4.17 (52)	25.77 ± 3.76* (98)

Table 4: The onset time of Parkinson's disease and lipid profile between males and females.

Onset control	≤ 24 m	24-72 m	72-120 m	> 120 m
Males				
TC	4.53 ± 0.46 (47)	3.89 ± 0.37 (68)	3.43 ± 0.27 (15)	3.42 ± 0.36* (25)
TG	1.82 ± 0.18(47)	1.38 ± 0.14* (68)	1.56 ± 0.11 (15)	1.40 ± 0.15 (25)
HDL-C	1.19 ± 0.12 (47)	1.11 ± 0.21 (68)	1.51 ± 0.17 (15)	1.10 ± 0.11 (25)
LDL-C	2.57 ± 0.27 (47)	2.31 ± 0.24 (68)	1.94 ± 0.34 (15)	1.95 ± 0.17* (25)
Females				
TC	4.61 ± 0.47 (52)	4.11 ± 0.43 (57)	4.51 ± 0.23 (10)	3.55 ± 0.34* (10)
TG	2.03 ± 0.22 (52)	1.43 ± 0.13* (57)	1.78 ± 0.45* (10)	1.02 ± 0.17* (10)
HDL-C	1.13 ± 0.11 (52)	1.20 ± 0.14 (57)	0.99 ± 0.14* (10)	0.77 ± 0.11 (10)
LDL-C	2.63 ± 0.31 (52)	2.42 ± 0.25 (57)	2.88 ± 0.13* (10)	2.12 ± 0.24* (10)

Statistical analysis

SPSS 16.0 statistical software was used to analyze all the indexes. Normal test and variance homogeneity test were carried out. The mean data were expressed by mean ± standard deviation ($x \pm s$). Two independent sample t tests were used for mean comparison, Spearman correlation analysis for univariate analysis, variance analysis for complete random design and multiple stepwise regression analysis for multivariate analysis, the difference was statistically significant ($P < 0.05$).

Results

All the patients collected were divided into less than or equal to 24 months group, 25-72 months group, 73 months-120 months group and greater than 120 months group according to the time difference between the recording time and the onset time. The results showed that there was no significant change in the body mass index (BMI) of the patients in the first few years of diagnosis of Parkinson's disease, but the body mass index (BMI) of the patients decreased after 120 months, especially in women. The details are as follows (Table 2).

We analyzed the body mass index of patients whose onset time was less than or equal to 24 months or whose severity of Parkinson's disease was $1 \leq 2$ in Hoehn-Yahr grade. The results showed that the body mass index of patients with Parkinson's disease in early stage and within 2 years was higher than that in patients with non-cerebrovascular disease and non-Parkinson's

disease, but there was no significant difference, but the body mass index of patients with Hoehn-Yahr grade $1 \leq 2$ was higher than that of the control group, and there was statistical difference (Table 3).

At the same time, we analyzed the blood lipids of patients with Parkinson's disease at different onset stages, the results showed that the total blood lipids, TG, Cholesterol and LDL decreased slightly after 72 months of onset especially in 120 months and the changes were similar both men and women but more significant in women (Table 4).

We analyzed the blood lipids of patients with Parkinson's disease at the early stage and in patients with non-cerebrovascular disease and non-Parkinson's disease whose onset time was less than or equal to 24 months. The results showed that the cholesterol level of the patients whose Hoehn-Yahr grades were 1-2 was only higher than that of the control group and there were no other abnormalities (Table 5 and Table 6).

Discussion

The rapid growth in China's economy caused an increase in Obesity a risk factors for PD [25], the prevalence was estimated as 18 per 100,000 people in a survey in Shanghai, China age adjusted rates give more restricted range of 72-258.8 per 100,000 people. Most of the reports recorded overall crude report ratio of between male and female of all ages 100 and 200 per 100,000 people [26]. However, the incidence was not mentioned in any of these reports.

Table 5: Parkinson's disease and control group (n).

	Control	Onset of PD ≤ 24	Hoehn-Yahr 1-2
Males			
TC	4.14 ± 0.7 (29)	4.53 ± 0.46 (47)	4.17 ± 0.39 (93)
TG	1.01 ± 0.13 (29)	1.82 ± 0.18 (47)	1.63 ± 0.27 (93)
HDL-C	1.37 ± 0.45 (29)	1.19 ± 0.12 (47)	1.13 ± 0.21 (93)
LDL-C	2.31 ± 0.7 (29)	2.57 ± 0.27 (47)	2.42 ± 0.25 (93)
Females			
TC	4.21 ± 0.79 (45)	4.61 ± 0.47 (52)	4.34 ± 0.43 (98)
TG	1.09 ± 0.15 (45)	2.03 ± 0.22 (52)	1.79 ± 0.28 (98)
HDL-C	1.29 ± 0.51 (45)	1.13 ± 0.11 (52)	1.11 ± 0.11 (98)
LDL-C	2.57 ± 0.73 (45)	2.63 ± 0.31 (52)	2.51 ± 0.26 (98)

Table 6: Pearson's correlation showing the relationship between BMI and YOD.

Height	Weight	BMI	YOD	HY	WESTER
1	0.463	0.157	-0.276	-0.010	0.016
0.463	1	0.899	-0.407	-0.393	-0.051
0.157	0.899	1	-0.569	-0.651	-0.184
-0.276	-0.407	-0.569	1	0.746	0.516
-0.01	-0.393	-0.651	0.746	1	0.160
0.016	-0.051	-0.184	0.516	0.160	1

Table 4 describes how the lipid profile kept declining as the years of diagnosis increase and Table 5 compared different lipid elements with controlled group at an early stage of the disease the blood lipid was higher than those patients with advanced Parkinson's disease.

From Table 2 and Table 3, We found that the body mass index of the patients with onset time within 24 months was higher than that of the control group, but there was no significant difference and the body mass index of the patients with Hoehn-Yahr 1- 2 was higher than that of the control group, suggesting that the body mass index of the early patients was higher than that of the control group. The reason for the patient's non-significant difference in the 24-month period might be because the number of patients was not that much. Walker RW HA, et al. reported an inverse relationship between the severity of PD and BMI [27], lack of association in all other studies might be because of the short duration of our report because our study recorded duration ranging from the past 5 years, shown in months on Table 1.

Table 4 and Table 5 showed the relationships of lipid profile as TC, TG, LDL, HDL, LDL-C, HDL-C with BMI as disease progresses in months, Blood lipids in patients with early Parkinson's disease were higher than those in normal control group and in patients with advanced Parkinson's disease. Ga Eun Nam1 SMK, et al. his studies reported a relationship between weight gain and deep brain stimulation (DBS) likewise a Korean study reported a relationship between metabolic syndrome (Mets)

and PD [28].

Table 6 Pearson's correlation analysis was performed on the parameters and the result is as shown as expected, BMI showed a great positive correlation with weight, which indicates that the two parameters are highly dependent on each other and as one increases the other increases as well. A similar trend is also observed with HY staging and years of diagnosis (YOD) with 0.746, followed by wester and YOD then weight and height. This also indicates that any of the parameter can be taken on a patient and it will suffice for the diagnosis, most of the other parameters showed a negative correlation which signifies that as one increases the other decreases. However, the correlation is not so high except for the YOD and BMI with -0.569, from this result it can be ascertained that there is 50% chance that years of diagnosis has effect on BMI.

Finally, there is a lot of controversy about the relationship between BMI and PD because overweight, normal weight, underweight can all be present depending on individual and how well managed the disease is [6].

Conclusion

In summary, the results of our study showed that: i) Obesity may increase the prevalence of Parkinson's disease. ii) The body mass index of patients with Parkinson's disease shows two-way changes in different periods, and the body mass index is higher, and cholesterol is higher in the early stage of Parkinson's disease. Attention should be paid to these metabolic diseases that not only disrupt the system but also affects the medication used decreasing the chances of proper PD management. Neurologist should work hand in hand with endocrinologist and nutritionist to follow up on PD patients for proper management and prognosis.

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