Analysis of Risk Factors Associated with Parkinson's Disease in Li Region in Hainan Area of China

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Abstract: Objective — To analyse the risk factors associated with Parkinson's patients of Li ethnic groups in Hainan area. Methods — A retrospective survey study was conducted to select 81 cases of Parkinson's disease patients of Li ethnicity (Parkinson's group) and 110 cases of healthy population of Li ethnicity (control group), respectively, to collect data and conduct statistical analysis. Results — (1) GLU, UA, TG, HDL, LDL, Cys-C, Scr, BUN, ApoA, ApoB in the Li Parkinson's disease group were not statistically significant ($P>0.05$) compared with the control group. TC, Hcy and ApoB were significantly higher in the Li Parkinson's disease group than in the control group, and the differences were statistically significant ($P<0.05$). (2) Through Binary logistic regression analysis, the results showed that hypertension, TC and Hcy may be risk factors for the development of PD in the Li population. Conclusion — A history of hypertension and elevated cholesterol and homocysteine levels are independent risk factors for Parkinson's disease in Li patients in Hainan area.

Keywords: Parkinson's disease, risk factors, blood glucose, cholesterol, apolipoprotein a, apolipoprotein b, creatinine

Parkinson's disease (PD) is a degenerative neurological disorder, the incidence of which is increasing with the aging of the population, and is a common movement disorder of the elderly, with clinical manifestations such as resting tremor, myotonia, bradykinesia and abnormal posture[1]. The pathogenesis of PD is not yet fully understood, but studies have found that genetic factors, environmental factors, oxidative stress, apoptosis and ageing may have a close relationship with the onset of PD[2]. Most patients are still diagnosed only after the onset of typical symptoms, when the best time for treatment has been missed. Early diagnosis and intervention are therefore important in assessing the prognosis of PD patients. The Li people are an early and unique minority group that has lived in Hainan for hundreds of years, surviving by fishing for a long time and having special customs and eating habits. The Li are also known as a long-lived people, and some studies have found that the Li population may have certain longevity genes. Therefore, this study investigates the correlation between the medical history and biochemical indicators of PD in the Li populations in Hainan and their risk factors.

1. Materials and methods

1.1 Study population

Eighty-one Li Parkinson's patients (PD group),43 males and 38 females, aged 47-87 years, hospitalized in the Department of Neurology of a tertiary care hospital in Sanya, Hainan Province, from January 2018 to January 2022, were selected for inclusion criteria: meeting the Parkinson's Disease Diagnostic Criteria of the British Parkinson Society [1]: (1) slow onset with at least 2 of the 3 symptoms of resting tremor, tonicity and motor bradykinesia. (2) Effective levodopa treatment. The Li population needs to have lived in Hainan for three generations and not intermarried with the outside world. Exclusion criteria: Parkinson's syndrome due to cerebrovascular disease, encephalitis, traumatic brain injury and other causes; malignant tumors, liver and kidney insufficiency, thyroid disease, hematological diseases.

Another 110 cases (control group), 63 males and 47 females, aged 49-91 years old, were selected from healthy Li people examined at the same time in the physical examination center of the hospital, and the age and sex of the PD and control groups were matched and comparable.

1.2 Research methodology

1.2.1 General medical history collection

Including: name, age, gender, and relevant medical history: (1) history of smoking: continuous or intermittent smoking of more than 100 cigarettes; (2) history of alcohol consumption: at least 1 drink per week and $\geqq$50g each time; (3) history of hypertension and diabetes: ever diagnosed with hypertension or diabetes in hospital; (4) family history of PD: whether family members are suffering from PD.

1.2.2 Measurement of serum biochemical indexes

5 ml of venous blood was collected by vacuum blood collection tube in the morning under fasting condition, and serum glucose (blood glucose, GLU), blood uric acid (blood uric acid, UA), total cholesterrol (TC), triglyeerides (TG), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), triglycerides (TG) and triglycerides (TG) were measured. (TG), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), cystatin C (Cys-C), serum creatinine (Cys-C), and blood uric acid (UA). serum creatinine (Scr), urea nitrogen (BUN), homocysteine (Hcy), apolipoprotein A (ApoA), apolipoprotein B (ApoB).

1.3 Statistical methods

SPSS 20.0 statistical software was used to analyse the data, and the measurement data were expressed as $\bar{x}\pm S$. The chi-square test was used to compare the count data between groups, the t-test or non-parametric rank sum test was used to compare the measurement data between groups, and the binary logistic regression analysis was used for multi-factor analysis. $p< 0.05$ was statistically significant.

2. Results

2.1 Comparison of the Li Parkinson's disease group with the control group

2.1.1 Comparison of general information

The age, gender, history of smoking, history of alcohol consumption, history of hypertension and history of diabetes mellitus of the Li Parkinson's disease group were compared with the control group by chi-square test respectively, and the results showed that the differences in history of smoking, history of alcohol consumption, history of hypertension and history of diabetes mellitus were statistically significant ($P< 0.05$). See Table 1.

2.1.2 Comparison of biochemical indexes

GLU, UA, TG, HDL, LDL, Cys-C, Scr, BUN, ApoA in the Li Parkinson's disease group compared with the control group, the differences were not statistically significant ($P> 0.05$). TC, Hcy, Apo B were significantly higher in the Li Parkinson's disease group than in the control group, and the difference were statistically significant ($P< 0.05$). See Table 1.

Table 1. Comparison of biochemical indicators between the Li Parkinson's disease group and the control group

Projects	Parkinson's Disease Group (n=81)	Control group (n=110)	t/c2	P
Age	65.71±10.61	62.71±11.19	-1.740	0.084
Gender (male/female)	43/38	63/47	1.846	0.156
Smoking history (no/yes)	74/7	88/22	9.476	0.029
Drinking history (no/yes)	74/7	83/27	13.782	0.005
History of hypertension (no/yes)	61/20	105/5	12.549	0.000
History of diabetes (no/yes)	73/8	110/0	5.378	0.001
Glu (mmol/l)	5.27±1.06	5.03±0.58	-1.828	0.069
UA (mmol/L)	285.73±83.23	258.91±89.22	-1.966	0.051
TG (mmol/L)	1.00±0.67	0.85±0.34	-1.732	0.085
TC (mmol/L)	4.59±1.04	4.00±0.82	-3.974	0.000
HDL (mmol/L)	1.47±0.35	1.47±0.49	-0.116	0.908
LDL (mmol/L)	2.82±2.0.86	2.64±0.79	-1.387	0.168
Cys-C (µmol/L)	0.99±0.26	0.98±0.26	-0.141	0.888
Scr (µmol/L)	72.67±17.94	69.87±18.80	-0.964	0.337
BUN (mmol/L)	4.66±1.69	4.25±1.24	-1.780	0.077
Hcy (µmol/L)	12.78±6.05	9.55±2.99	-4.260	0.000
Apo A (µmol/L)	1.20±0.32	1.15±0.39	-0.953	0.342
Apo B (µmol/L)	0.94±0.28	0.85±0.19	-2.520	0.013

2.2 Univariate analysis of risk factors

The indicators with statistically significant differences in the univariate analysis (history of smoking, history of alcohol consumption, history of hypertension, history of diabetes mellitus and TC, Hcy, Apo B) were used as independent variables and whether or not to switch PD was used as the dependent variable in a binary logistic regression analysis, which showed that hypertension, TC and Hcy may be risk factors for the development of PD in the Li population. See Table2.

Table 2. Logistic analysis of patients with Parkinson's disease among the Li ethnic group and controls

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Smoking history	-1.356	1.001	1.836	1	.175	.258	.036	1.832
History of alcohol consumption	-.867	.869	.994	1	.319	.420	.077	2.310
History of hypertension	1.704	.713	5.712	1	.017	5.495	1.359	22.221
History of diabetes	1.340	.905	2.193	1	.139	3.819	.648	22.492
TC	.562	.251	5.005	1	.025	1.754	1.072	2.868
Hcy	.212	.060	12.512	1	.000	1.236	1.099	1.390
ApoB	.116	1.061	.012	1	.913	1.124	.140	8.991

3. Discussion

The pathology of PD is characterised by massive deformation, necrosis, loss of nigrostriatal dopamine neurons and the formation of intracellular Lewy bodies[5]. The diagnosis of Parkinson's disease is low, the course of the disease is irreversible, the disability rate is high, and the drugs used in clinical treatment can only improve the symptoms but not cure the disease, causing a significant burden to families and society. Therefore, early diagnosis of PD and early intervention and treatment are particularly important for the prognosis of patients. This study analysed the risk factors associated with Parkinson's disease in the Li-Chinese population in Hainan, to raise awareness of PD and to find relevant serum markers and influencing factors that are important for improving clinical diagnosis and preventing disease progression.

García-Sanz Pz et al[6] found that elevated cholesterol impedes the clearance of mitochondria and the production of reactive oxygen species, causing the death of dopaminergic neurons, which may be associated with the development of Parkinson's disease. Wang Ket al [7] showed a correlation between cholesterol and Parkinson's disease in a study that analysed changes in total blood cholesterol during the development of Parkinson's disease, which is consistent with the results of the present study.

Li J et al[8] showed that high levels of HDL-C, Hcy and Cys C may be associated with the onset and progression of PD, and that high Hcy increases the susceptibility of dopaminergic neurons to neurotoxic damage and accelerates the onset and progression of PD. Decreased levels of Apo B and increased levels of HDL-C and Hcy are independent risk factors.

In summary, History of hypertension, cholesterol and Hcy are risk factors for Parkinson's disease in the Li ethnic group, This may be related to genetic variability. The unique living environment as well as dietary habits and customs of the Li ethnic minority may lead to differences in risk factors for the development of Parkinson's disease compared to the other ethnic group. Therefore, independent risk factors for Parkinson's disease may have different outcomes among different ethnic groups.

Acknowledgments

References

[1] Chen J, Zhang C, Wu Y, Zhang D. Association between Hypertension and the Risk of Parkinson's Disease: A Meta-Analysis of Analytical Studies. *Neuroepidemiology*. 2019;52(3-4):181-192.

[2] Dong MX, Feng X, Xu XM, et al. Integrated Analysis Reveals Altered Lipid and Glucose Metabolism and Identifies NOTCH2 as a Biomarker for Parkinson's Disease Related Depression. *front Mol Neurosci*. 2018;31(11):257.

[3]   Hughes A J, Daniel S E, Kilford L, et al. Accuracy of clinical diagnosis of idiopathic Parkinson's disease: a clinico-pathological study of 100 cases.[J]. *Journal of Neurology*, 1992.

[4]   Adler CH, Beach TG, Hentz JG, et al. Low clinical diagnostic accuracy of early vs advanced Parkinson disease: clinicopathologic study. *Neurology*. 2014;83(5):406-12.

[5]   Cassani E, Cereda E, Barichella M,et al.Cardiometabolic factors and disease duration in patients with Parkinson's disease. *Nutrition*. 2013;29(11-12):1331-5.

[6]   García-Sanz P, Orgaz L, Bueno-Gil G, et al. N370S-GBA1 mutation causes lysosomal cholesterol accumulation in Parkinson's disease. mov Disord. 2017;32(10):1409-1422.

[7]   Wang K, Luo Z, Li C, Huang X,et al. Blood Cholesterol Decreases as Parkinson's Disease Develops and Progresses. *j Parkinsons Dis*. 2021;11(3):1177-1186.

[8]   Li J, Gu C, Zhu M, Li D, et al. Correlations between blood lipid, serum cystatin C, and homocysteine levels in patients with Parkinson's disease. *Psychogeriatrics*. 2020;20(2):180-188.