SIRT1: The Value of Functional Outcome, Stroke-Related Dementia, Anxiety, and Depression in Patients with Acute Ischemic Stroke

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Background: The outcome of ischemic stroke depends on multiple factors and their function of each other. Studies have shown that Sirtuin1 (SIRT1) plays a chief role in the key procedure during ischemia/hypoxia by protecting against cellular stress and controlling the metabolic pathways. *Aims:* To explore the alterations in serum SIRT1 concentrations in acute ischemic stroke (AIS) patients and the relationship between SIRT1 and poststroke dementia, anxiety, and depression. *Methods:* One hundred and twenty four consecutive patients with clinically diagnosed AIS were recruited to participate in the study. Serum SIRT1 levels were measured using a commercially available ELISA equipment for SIRT1 (Cusabio, Wuhan, China). In 1 year after admission, the severity of stroke was assessed with the National Institutes of Health Stroke Scale score, and the functional outcome was measured by a modified Rankin scale, the Hamilton Anxiety Scale scores were evaluated to define patients with or without anxiety, and the Hamilton Depression Scale scores for depression. *Results:* We found the levels of serum SIRT1 was significantly higher (P = .036) in AIS patients (.62 ± .77 ng/mL) compared with healthy control subjects (.45 ± .69 ng/mL), but not significantly higher SIRT1 concentration (.58 ± .69 versus .64 ± .81 ng/mL, P = .298) than patients in the unfavorable functional outcome group. *Conclusions:* There is no potential diagnostic and prognostic role of SIRT1 in AIS-related dementia, anxiety, and depression. The role of SIRT1 in AIS among human race needs to be further investigated.

Key Words: SIRT1—biomarker—acute ischemic stroke—functional outcome

Introduction

Stroke is the second leading cause of death following ischemic heart disease globally, and the third leading cause of disability. There were 42.4 million people who suffered from stroke, which included ischemic stroke for 24.9 million and 3.0 million individuals died because of ischemic stroke in 2015,[1] and the number is increasing in recent years.[2] Moreover, the incidence of stroke remains high because of aging of the population.[3] Ischemic stroke is characterized by the discontinue of cerebral blood flow and lack of oxygen to the affected area.[4] During ischemia and reperfusion, multiple signaling pathways are activated by elevated levels of reactive oxygen, resulting in oxidative stress.[5]

The outcome of ischemic stroke depends on multiple factors and their function of each other. It is important to find a rapidly and measurable biomarkers to predict

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illness development, outcome, and mortality for optimized care and allocation of healthcare resources.[6]

In recent years, a series of evidence have demonstrated the role of Sirtuins, and Sirtuin1 (SIRT1) particularly, in neuroprotection from ischemia has emerged.[7] Many studies have suggested that SIRT1 has beneficial properties in diseases which include ischemia/reperfusion processes and neurodegeneration.[3]

SIRT1 is 1 of the 7 members (SIRT1-7) of the silent information regulator 2 family in mammals, which has function as a nicotinamide adenine dinucleotide (NAD+)-dependent histone deacetylase[8] and has become the best and widely studied protein from this family. Lysine deacetylation by sirtuins is combined to the cleavage of a key intermediate of cellular energy metabolism, NAD+, into nicotinamide and 1'-O-acetyl-ADP-ribose or 2'- and 3'-O-acetyl-ADP-ribose.[9] Thus, the activities of sirtuins are compulsorily dependent on cellular NAD+, and effectively influenced by cellular metabolic and redox states.[9] SIRT1 has been demonstrated to regulate the structure of chromatin, transcription, apoptosis, cell survival, DNA repair, inflammation, oxidative stress, metabolism, and so on by deacetylating numerous substrates.[10]

Studies have shown that SIRT1 plays a chief role in the key procedure during ischemia/hypoxia by protecting against cellular stress and controlling the metabolic pathways.[11]

Sirtuins are expressed within the whole body, in tissues such as the heart, liver, kidney, muscle, adipose, endothelium, the brain, and so on.[7] Especially, SIRT1 expresses at a high level in the brain compared to other peripheral tissues.[12]

The function of SIRT1 in peripheral organs has been known widely and can be consulted in other reviews,[13] but no direct evidence has been reported on the direct significance of SIRT1 in ischemic stroke.[3] Thus, the purpose of this study was to explore the potential diagnostic role of SIRT1, also the relationship between SIRT1 and post-stroke dementia, anxiety, and depression in patients with acute ischemic stroke (AIS) of China.

Methods and Materials

AIS Patients and Healthy Controls

One hundred and twenty four consecutive patients at least 50 years old with clinically diagnosed AIS were recruited at the Department of Neurology at the Affiliated Hospital. All the patients were admitted to the hospital within 3 days after the onset of stroke. The confirmed criteria for AIS were met by the World Health Organization criteria,[14] and the diagnosis had to be confirmed by computer tomography scanning or magnetic resonance imaging. And we enrolled 53 sex-matched and age-matched healthy people from our Physical Examination Centre in the same registration time. The exclusion criteria were used in all subjects: (1) history of stroke; (2) neurodegenerative disease, brain trauma or encephalon surgery, or other Central Nervous System (CNS) diseases; (3) coexistence of serious systemic disease (for example, chronic heart failure, tumor, or Chronic obstructive pulmonary disease. (COPD)) or infectious disease while enrollment. Our study was allowed by ethics committee of the First Affiliated Hospital of Chongqing Medical University and performed in accordance with ethical principles. All subjects provided written informed consent prior to inclusion in this study.

Clinical Data and Disease Assessment Scale

Serum samples of participations were gained by centrifugation blood specimens collected from median cubital vein at 6:00 am the next day after the patients were admitted to the hospital. The levels of high-sensitivity C-reactive protein (CRP), leucocytes, total cholesterol (TC), cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and glycated hemoglobin were measured soon using a Cobas Integra 400 plus automatic biochemical analyzer with matched reagent kits (Roche, Basel, Switzerland). The laboratory benchmarks were quantified per manufacture specifications. Serum SIRT1 levels were determined using an available ELISA equipments for SIRT1 (Cusabio, Wuhan, China). We assessed National Institutes of Health Stroke Scale scores in AIS patients while collecting the blood specimen and the modified Rankin scale (mRS) score, Mini-Mental State Examination scores, Hamilton Anxiety Scale scores, Hamilton Depression Scale scores were assessed in 1 year after admission with a structured follow-up interview by who is blinded to SIRT1 levels. We used National Institutes of Health Stroke Scale scores to evaluate the degrees of neurological deficit. While mRS score of 0-2 points is defined as favorable functional outcome. Mini-Mental State Examination scores were used to detect cognitive impairment in AIS patients, and 3 different cut-off points were used to determine dementia according to patient education level.[15] Patients were also defined as anxiety patients ($\geq$14) and possible depression patients ($\geq$7) according to the total Hamilton Anxiety score. Two observers assessed all the scores, and any objections were resolved by discussion.

Statistical Methods

In our study, absolute numbers and percentages (%) were used to display the categorical data, while the mean values and standard deviations were used to display continuous data. We used χ^2 tests for categorical data and nonparametric Mann-Whitney U tests for the continuous data to compare the demographics between the AIS patients and healthy control group. We also performed univariate linear regression analyses to assess the risk factors of serum SIRT1 of participants. Statistical analyses were performed using a software package (IBM SPSS version 21.0, Armonk, NY) which is commercially available.

Tests were 2-tailed, and the statistical significance was set at $P < .05$.

Results

The Participants' Clinical Characteristics

Table 1 showed the clinical features of healthy participations and AIS patients, between 2 groups, no differences were found in sex and age. Mean age was 70.44 ± 11.23 years in AIS patients, and 66.83 ± 9.80 years in the healthy controls. The numbers of males were 81 (65.3%) in the AIS patients and 27 (50.9%) in the healthy controls. We treated all the patients according to the orientations of the American Heart Association. The levels of serum SIRT1 were found significantly higher (P = .036) in AIS patients (.62 ± .77 ng/mL) than the control subjects (.45 ± .69 ng/mL).

Risk Factors of SIRT1

Tables 2 and 3 showed results of univariate linear regression analyses of serum SIRT1 in participants and AIS patients. Serum SIRT1 not significantly correlated with age, sex, TC, cholesterol, LDL, HDL, glycated hemoglobin, high-sensitivity CRP, leucocytes, smoking history, alcohol consumption, diabetes mellitus, hypertension, hypercholesterolemia (a disorder in patients with an elevation of plasma TC and LDL-C and a reduction in plasma HDL-C),[16] coronary heart disease (CHD), and atrial fibrillation.

Relationship with Disease Prognosis

AIS patients were categorized into favorable and unfavorable functional outcome groups according to the mRS scores. The patients in favorable functional group had a no significantly higher serum SIRT1 concentration (.58 ± .69 versus .64 ± .81 ng/mL, P = .298) than patients in the unfavorable functional outcome group (Table 4). There is no difference for Patients with anxiety or without anxiety in SIRT1 concentration (.64 ± .80 versus .64 ± .79 ng/mL, P = .284; Table 5). Patients with dementia had no significantly lower SIRT1 concentrations (.54 ± .56 versus .67 ± .91 ng/mL, P = .801) than patients without dementia (Table 6). As for stroke patients with and without possible depression after 1 year, it also showed no significant difference (.73 ± .94 versus .62 ± .75 ng/mL, P = .547) in Table 7.

Discussion

Ischemic stroke is a severe disorder of nervous system with high rates of mortality and morbidity in the whole world.[17] A series of pathophysiological processes initiated in cerebral ischemia, including oxidative stress, inflammation, apoptosis, and mitochondrial dysfunction.[18,19]

Table 1. *Clinical characteristics of Stroke patients and healthy controls*

Variable (SD/%)	Stroke patients (124)	Control (53)	*P* value	Variable (SD/%)	Stroke patients (124)	Control (53)	*P* value
Age (year)	70.44 ± 11.23	66.83 ± 9.80	.056	Leucocytes	7.72 ± 2.75	6.42 ± 2.34	.002
Gender, male	81 (65.3%)	27 (50.9%)	.072	Smoking history	56 (45.2%)	20 (37.7%)	.361
TC (mmol/L)	4.50 ± .98	4.12 ± .82	.009	Alcohol consumption	43 (34.7%)	7 (13.2%)	.004
Cholesterol (mmol/L)	1.67 ± 1.32	1.39 ± .63	.647	Hypertension	83 (66.9%)	29 (54.7%)	.122
LDL (mmol/L)	2.85 ± .85	2.59 ± .72	.070	Diabetes mellitus	35 (28.2%)	11 (20.8%)	.299
HDL (mmol/L)	1.23 ± .31	1.30 ± .42	.451	Hypercholesterolemia	38 (30.6%)	18 (34.0%)	.664
SIRT1	.62 ± .77	.45 ± .69	.036	CHD	19 (15.3%)	7 (13.2%)	.716
HbA1c %	6.95 ± 1.99	6.45 ± 1.38	.160	Atrial fibrillation	28 (22.6%)	0 (.0%)	.000
Hs-CRP (mg/L)	6.01 ± 6.95	3.26 ± 5.07	.000				

Abbreviations: CHD, coronary heart disease; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; Hs-CRP, high-sensitivity C-reactive protein; LDL, low-density lipoprotein; SD, standard deviation; SIRT1, Sirtuin1; TC, total cholesterol.

Table 2. *Univariate and multivariate linear regression analysis of correlation factors for serum Sirtuin1 concentration*

	Univariate	
Variable	*Beta value	*P* value
Age	−.003	.509
Gender, male	.074	.518
TC	.081	.181
Cholesterol	−.030	.553
LDL	.086	.222
HDL	.024	.887
HbA1c %	−.049	.252
Hs-CRP	.01	.246
Leucocytes	.011	.598
Smoking history	.128	.258
Alcohol consumption	.096	.440
Hypertension	−.089	.447
Diabetes mellitus	−.068	.594
Hypercholesterolemia	.15	.215
CHD	−.303	.055
Atrial fibrillation	−.162	.293

Abbreviations: CHD, coronary heart disease; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; Hs-CRP, high-sensitivity C-reactive protein; LDL, low-density lipoprotein; TC, total cholesterol.

*Beta value, adjusted regression coefficient.

Table 3. *Univariate and multivariate linear regression analysis of correlation factors for serum Sirtuin1 concentration in patient with Stroke*

	Univariate	
Variable	*Beta value	*P* value
Age	−.003	.599
Gender, male	.178	.220
TC	.104	.152
Cholesterol	−.047	.389
LDL	.133	.111
HDL	−.03	.898
Admission NIHSS	−.001	.898
HbA1c %	−.06	.215
Hs-CRP	.016	.130
Leucocytes	.014	.567
Smoking history	.238	.084
Alcohol consumption	.103	.480
Hypertension	−.172	.242
Diabetes mellitus	.039	.799
Hypercholesterolemia	.084	.577
CHD	−.322	.092
Atrial fibrillation	−.239	.146

Abbreviations: CHD, coronary heart disease; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; Hs-CRP, high-sensitivity C-reactive protein; LDL, low-density lipoprotein; TC, total cholesterol.

*Beta value, adjusted regression coefficient.

Table 4. *Clinical characteristics of Stroke patients with favorable and unfavorable functional outcome after 1 year*

Variable (SD/%)	Unfavorable outcome (42)	Favorable outcome (82)	*P* value	Variable (SD/%)	Unfavorable outcome (42)	Favorable outcome (82)	*P* value
Age (year)	77.14 ± 10.62	67.00 ± 9.95	.000	Leucocytes	8.32 ± 3.02	7.40 ± 2.57	.090
Gender, male	25 (59.5%)	56 (68.3%)	.332	Smoking history	22 (52.4%)	34 (41.5%)	.248
TC (mmol/L)	4.72 ± 1.15	4.39 ± .88	.232	Alcohol consumption	17 (40.5%)	26 (31.7%)	.332
Cholesterol (mmol/L)	1.68 ± 1.54	1.67 ± 1.20	.745	Hypertension	30 (71.4%)	53 (64.6%)	.447
LDL (mmol/L)	2.99 ± 1.02	2.78 ± .75	.373	Diabetes mellitus	13 (31.0%)	22 (26.8%)	.629
HDL (mmol/L)	1.28 ± .34	1.20 ± .29	.117	Hypercholesterolemia	10 (23.8%)	28 (34.1%)	.237
SIRT1	.58 ± .69	.64 ± .81	.298	CHD	11 (26.2%)	8 (9.8%)	.016
HbA1c %	7.08 ± 2.28	6.94 ± 1.94	.788	Atrial fibrillation	16 (38.1%)	12 (14.6%)	.003
Hs-CRP (mg/L)	9.44 ± 7.60	4.33 ± 5.98	.000	NIHSS score at the time of admission	11.71 ± 7.04	4.56 ± 4.23	.000
				NIHSS score after 1 year	6.19 ± 4.36	.98 ± 1.48	.000

Abbreviations: CHD, coronary heart disease; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; Hs-CRP, high-sensitivity C-reactive protein; LDL, low-density lipoprotein; NIHSS, National Institutes of Health Stroke Scale; SD, standard deviation; SIRT1, Sirtuin1; TC, total cholesterol.

Table 5. *Clinical characteristics of Stroke patients with and without anxiety after 1 year*

Variable (SD/%)	With anxiety (33)	Without anxiety (75)	*P* value	Variable (SD/%)	With anxiety (33)	Without anxiety (75)	*P* value
Age (year)	72.88 ± 12.30	66.88 ± 9.37	.014	Leucocytes	7.72 ± 2.77	7.57 ± 2.61	.951
Gender, male	21 (63.6%)	52 (69.3%)	.560	Smoking history	20 (60.6%)	30 (40.0%)	.048
TC (mmol/L)	4.74 ± 1.05	4.37 ± .90	.114	Alcohol consumption	16 (48.5%)	23 (30.7%)	.076
Cholesterol (mmol/L)	1.67 ± 1.62	1.71 ± 1.24	.604	Hypertension	25 (75.8%)	47 (62.7%)	.184
LDL (mmol/L)	3.06 ± .95	2.77 ± .75	.163	Diabetes mellitus	8 (24.2%)	22 (29.3%)	.586
HDL (mmol/L)	1.29 ± .32	1.18 ± .28	.063	Hypercholesterolemia	9 (27.3%)	26 (34.7%)	.449
SIRT1	.64 ± .80	.64 ± .79	.284	CHD	4 (12.1%)	8 (10.7%)	.825
HbA1c %	7.28 ± 2.82	6.95 ± 1.79	.241	Atrial fibrillation	7 (21.2%)	11 (14.7%)	.400
Hs-CRP (mg/L)	6.81 ± 7.36	4.54 ± 6.20	.082	NIHSS score at the time of admission	8.52 ± 6.40	4.51 ± 4.11	.002
				NIHSS score after 1 year	5.06 ± 4.47	.99 ± 1.52	.000

Abbreviations: CHD, coronary heart disease; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; Hs-CRP, high-sensitivity C-reactive protein; LDL, low-density lipoprotein; NIHSS, National Institutes of Health Stroke Scale; SD, standard deviation; SIRT1, Sirtuin1; TC, total cholesterol.

Table 6. *Clinical characteristics of Stroke patients with and without dementia after 1 year*

Variable (SD/%)	With dementia (32)	Without dementia (56)	*P* value	Variable (SD/%)	With dementia (32)	Without dementia (56)	*P* value
Age (year)	72.78 ± 11.69	65.48 ± 9.15	.004	Leucocytes	7.27 ± 2.92	7.26 ± 2.21	.574
Gender, male	17 (53.1%)	43 (76.8%)	.022	Smoking history	13 (40.6%)	26 (46.4%)	.598
TC (mmol/L)	4.38 ± 1.04	4.51 ± .87	.756	Alcohol consumption	9 (28.1%)	20 (35.7%)	.466
Cholesterol (mmol/L)	1.60 ± 1.01	1.69 ± 1.26	.836	Hypertension	23 (71.9%)	39 (69.6%)	.825
LDL (mmol/L)	2.74 ± .90	2.92 ± .75	.378	Diabetes mellitus	12 (37.5%)	12 (21.4%)	.103
HDL (mmol/L)	1.20 ± .36	1.20 ± .27	.791	Hypercholesterolemia	11 (34.4%)	21 (37.5%)	.769
SIRT1	.54 ± .56	.67 ± .91	.801	CHD	4 (12.5%)	5 (8.9%)	.595
HbA1c %	7.14 ± 2.31	6.87 ± 2.02	.392	Atrial fibrillation	7 (21.9%)	6 (10.7%)	0.156
Hs-CRP (mg/L)	5.84 ± 7.41	3.25 ± 4.60	.272	NIHSS score at the time of admission	5.31 ± 4.40	3.70 ± 3.59	.060
				NIHSS score after 1 year	2.09 ± 2.63	.98 ± 1.84	.019

Abbreviations: CHD, coronary heart disease; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; Hs-CRP, high-sensitivity C-reactive protein; LDL, low-density lipoprotein; NIHSS, National Institutes of Health Stroke Scale; SD, standard deviation; SIRT1, Sirtuin1; TC, total cholesterol.

Table 7. *Clinical characteristics of Stroke patients with and without possible depression after 1 year*

Variable (SD/%)	With possible depression (22)	Without possible depression (86)	*P* value	Variable (SD/%)	With possible depression (22)	Without possible depression (86)	*P* value
Age (year)	77.59 ± 9.40	66.44 ± 9.78	.000	Leucocytes	7.66 ± 2.99	7.61 ± 2.57	.797
Gender, male	11 (50.0%)	62 (72.1%)	.048	Smoking history	11 (50.0%)	39 (45.3%)	.696
TC (mmol/L)	4.79 ± 1.23	4.41 ± .87	.213	Alcohol consumption	10 (45.5%)	29 (33.7%)	.307
Cholesterol (mmol/L)	1.37 ± 1.09	1.78 ± 1.42	.164	Hypertension	16 (72.7%)	56 (65.1%)	.499
LDL (mmol/L)	3.18 ± 1.04	2.78 ± .74	.078	Diabetes mellitus	5 (22.7%)	25 (29.1%)	.553
HDL (mmol/L)	1.26 ± .30	1.20 ± .29	.322	Hypercholesterolemia	9 (40.9%)	26 (30.2%)	.340
SIRT1	.73 ± .94	.62 ± .75	.547	CHD	3 (13.6%)	9 (10.5%)	.673
HbA1c %	7.31 ± 2.81	6.98 ± 1.96	.856	Atrial fibrillation	6 (27.3%)	12 (14.0%)	.135
Hs-CRP (mg/L)	9.08 ± 8.16	4.27 ± 5.85	.012	NIHSS score at the time of admission	8.86 ± 5.63	4.93 ± 4.84	.001
				NIHSS score after 1 year	5.59 ± 4.43	1.37 ± 2.35	.000

Abbreviations: CHD, coronary heart disease; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; Hs-CRP, high-sensitivity C-reactive protein; LDL, low-density lipoprotein; NIHSS, National Institutes of Health Stroke Scale; SD, standard deviation; SIRT1, Sirtuin1; TC, total cholesterol.

In recent years, SIRT1 has become a target for drug development because of its various effects in procedures such as inflammation, cancer, cardiovascular disease, diabetes mellitus, and neurodegeneration.[20-22] The protective properties of SIRT1 have been described in heart ischemia-reperfusion and ischemic preconditioning.[23] In addition, several authors demonstrated its role in normal cognitive function and synaptic plasticity, differentiation of stem cells,[24] and neurodegenerative disorders.[25] Studies have shown that SIRT1 might play an important role in ischemic stroke,[3] but the protective effect of SIRT1 is still a matter of controversy[12] because not all studies find evidence of neuroprotection.[26]

Our study offers possibly important findings of the role of SIRT1 in AIS.

First, we determined the serum SIRT1 concentration in AIS patients and healthy participations, it was found that the levels of serum SIRT1 were higher in AIS patients than the healthy controls significantly. There were no differences observed in characteristics like mean age, sex composition, cholesterol level, LDL level, smoking, hypercholesterolemia, diabetes mellitus, and so on, indicating that the contrast was reasonable.

Second, linear regression analyses of univariate for serum SIRT1 concentration of healthy controls and AIS patients were performed, the result indicates that SIRT1 may be an independent risk factor for cerebral infarction, is not associated with blood pressure, blood glucose, smoking, CRP, cholesterol, and so on. The increase in serum SIRT1 might be attributable to stroke per se, this conclusion will be more convincing if the concentration of SIRT1 before stroke was measured. But unfortunately, since the patients have suffered from stroke before admitted to the hospital, the baseline level of SIRT1 was not measurable.

Unexpectedly, patients of the favorable functional group showed a no significantly higher SIRT1 concentration than patients in the unfavorable functional outcome group, which does not coincide with the neuroprotective effect of SIRT1.

We guess the possible reason as follow. SIRT1 is a member of the class III group of histone deacetylases, which has a function of NAD+-dependent,[27] the activities of sirtuins are compulsorily dependent on cellular NAD+.[9] It is clear that the activation of SIRT1 can lead to NAD+ consumption, which is decreasing the activity of PARP-1, leading to prevention of PARP-1-mediated cell death.[28] However, high levels of SIRT1 may consume too much or even deplete NAD+, which could increase the disorder,[26] the decrease of NAD+ may reduce SIRT1 activity in turn.[29] Thus, it is possible that this harmful effect of NAD + deficiency compromises the neuroprotective effect of SIRT1.[26] Another study also pointed out that SIRT1 may promote cell survival and be involved in adaptive stress responses under conditions where cells have enough NAD+; conversely, when NAD+ levels are limited,

stimulating SIRT1 activity may render cells vulnerable to death.[30]

Further studies are required in order to prove the relationship between SIRT1 and NAD+ in ischemic stroke.

Originally, calorie restriction (CR) was found to attenuate the reduction of SIRT1 after ischemia/reperfusion in rats,[31] the caloric restriction with optimal nutrition diet was found to decrease the blood level of triglycerides, LDL cholesterol, TC, and total lipid levels,[32] but in our study, the nutritional status did not influence serum SIRT1 concentration. First, there is no evidence indicate that CR is the single influence factor of the blood lipids. Genetic factors, exercise, smoking, etc., also have an influence on blood lipids. Second, as far as we know, no relevant researches showed that serum SIRT1 can be induced by CR in humans, but only animal models. More clinical trials are needed to explore the relationship between CR and SIRT1.

We also assess the value of SIRT1 in AIS-related anxiety, depression, and dementia by doing subgroup analyses. Results indicated there is no difference for patients with anxiety or without anxiety in SIRT1 concentration. Patients with dementia had no significantly lower SIRT1 concentrations than patients without dementia. As for Stroke patients with and without possible depression after 1 year, it also showed no significant difference. The results indicating that there is no potential diagnostic and prognostic role of SIRT1 in AIS-related dementia, anxiety, and depression.

Conclusion

SIRT1 may be an independent risk factor for cerebral infarction, is not associated with blood pressure, blood glucose, smoking, CRP, cholesterol, and so on. The high concentration of SIRT1 in cerebral infarction may be related to the destruction of the blood-brain barrier, and it is not related to prognosis, anxiety, depression, and dementia. The role of SIRT1 in AIS among humans still needs to be further investigated.

Authors' Contributions

Xue Liang and Yang Liu and You-Dong Wei conceived the study. The data analysis was performed by Xue Liang, Yang Liu, and Meixue Dong. The manuscript was revised by Xue Liang, Xiao-Min Xu, and Shiyu Jia. Xue Liang and Yang Liu contributed equally to the manuscript.

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