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Research Article

Awareness of Risk Factors for Cerebrovascular Diseases among Acute Ischemic Stroke Patients in Shenzhen, China

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Abstract

Background and Purpose: Unawareness of the risk factors is one of the most important issues need to be settled for the stroke prevention. We aimed to evaluate the awareness of risk factors for Cerebrovascular Diseases (CVDs) among acute ischemic stroke patients, and to investigate the characteristics of patients who were unaware of their risk factors in Shenzhen, China.

Methods: Registered data on awareness of CVDs risk factors of patients with confirmed Acute Ischemic Stroke (AIS) from June 2019 to December 2020 were analyzed in May 2021. The data were extracted from the database of Shenzhen Quality Control Center for Management of Cerebrovascular Diseases.

Results: Totally, there were 5147 AIS patients with complete data eligible for this study. AIS patients' awareness regarding existing hypertension, diabetes, dyslipidemia and Atrial Fibrillation (AF) was 76.1%, 76.2%, 24.2% and 53.4% respectively. Patients who were lack of awareness of the CVDs risk factors were more likely to be males, individuals with younger age and without medical insurance or CVDs history.

Conclusions: The overall awareness of the CVDs risk factors was suboptimal among AIS patients in Shenzhen, especially for the existing dyslipidemia. Age was an independent factor associated with the lack of awareness of the CVDs risk factors. The stroke screening program should be extending to younger people.

Introduction

Stroke is a leading cause of disability worldwide and the leading cause of death in China [1,2]. Although stroke mortality have decreased in the past decade, the number of stroke survivors as well as the overall global stroke burden are still increasing [3]. China is predicted to to have the highest estimated lifetime risk of stroke up to 39.3%, which would impose an enormous disease burden [4]. Moreover, the burden of stroke is aslo huge in younger people and the incidence of stroke is still increasing in young people [5]. Shenzhen is an economically developed city in South China with median age of 31.95, but with ischemic stroke incidence up to 102 cases per 100000 person-years [6,7].

Tracking and controlling of the modifiable stroke risk factors, such as hypertension, diabetes and dyslipidaemia, are critical in stroke prevention and management. However, the prevalence of hypertension, smoking, diabetes as well as other modifiable risk factors were still high in stroke survivors based on China Stroke Statistics 2019 [8]. The prevalence of those risk factors were even higher in Shenzhen compared with the average status of China [9]. Previous studies indicated the awareness of Cerebrovascular Diseases (CVDs) risk factors was lower in China than Western countries [10,11]. Therefore, we suppose that the unawareness of the risk factors is one of the most important issues need to be settled for the stroke management and prevention. But the awareness condition of CVDs risk factors is still unclear among stroke patients in Shenzhen, China. In this study, we aimed to assess the awareness of risk factors for CVDs among Acute Ischemic Stroke (AIS) patients in Shenzhen, China. In addition, investigation of the characteristics of patients who were not aware of their risk factors to improve stroke management and prevention strategies.

Methods

The Shenzhen Quality Control Center for Management of Cerebrovascular Diseases was established since 2014. By the end of 2020, there were overall 29 hospitals covers the whole city registered patients admission to hospitals with acute cerebrovascular diseases annually. All patients or their guardians were informed consent to participate in this medical quality control program. Meanwhile, the data was public for appli-

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cation and de-identified. We retrospectively collected the registered clinical information of patients with acute ischemic stroke from June 2019 to December 2020. All data were analyzed in May 2021. The eligibility of each stroke case was confirmed by brain Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) during hospitalization. The glucose and lipids metabolism were assessed by the fasting biochemical profiles on the second morning after admission.

Data Collection and Definition of Variables

The demographic characteristics, including age, gender, smoking status, medical insurance condition, Body Mass Index (BMI) as well as self-reported history of stroke, Myocardial Infarction (MI) and Transient Ischemic Attack (TIA), were extracted from the database. We evaluated the patients' awareness of hypertension, dyslipidemia, diabetes and Atrial Fibrillation (AF) by comparison their past medical history and clinical assessment during hospitalization. Individuals were assessed as unawareness of hypertension if their admission mean (measured three times) Systolic Blood Pressure (SBP) ≥140mmHg or mean Diastolic Blood Pressure (DBP) ≥90mmHg [12] but without self reported hypertension history or taking antihypertensive agents before admission. Diabetes were diagnosed as serum fasting blood glucose level higher than 7.0mmol/l, or postprandial blood glucose higher than 11.1mmol/L with diabetic related symptoms [13]. Patients met with the diagnostic criteria but did not reported diabetes history or taking hypoglycemic agents were assessed as unawareness of diabetes. Patients with serum Lower Density Lipids (LDL) level higher than 130 mg/dl (3.4mmol/l) [14] but without self reported dyslipidemia history or taking lipid lowering agents before admission were evaluated as unawareness of dyslipidemia. Unawareness of AF was defined as electrocardiograph confirmed paroxysma or persistent AF but lack of self reported AF history at admission.

Statistical Analysis

We presented continuous variables by Mean±Standard deviation or medians [Interquartile Range (IQR)] based on whether data was normally distributed. Categorical variables were presented by frequencies. Differences between aware and unaware groups were compared by means of the Kruskal-Wallis nonparametric test for non-normal distributed continuous variables, and t-tests for normal distributed continuous variables. Pearson's Chi squared test was used for the comparison of categorical variables. The association of variables associated with CVDs risk factors awareness was assessed in univariate logistic regression analyses and a full multivariable model, including predictors simultaneously. p values less than 0.05 were classed as significant in all analyses Statistical analysis was performed using SPSS software, version 22.0 (SPSS IBM Inc, Chicago, IL, USA).

Results

Awareness of Hypertension

Overall, we collected 5147 acute ischemic stroke patients in this retrospective study (Figure 1). There were 4369 (84.9%) patients diagnosed as hypertension, among which 3129 (71.6%) patients knew the existence of disease. The rate of taking antihypertensive medicines was about 61.6% among patients with awareness of their hypertension. Patients unaware of their hypertensive status were younger (61.80 vs 58.36, p<0.001) and male-dominated (69.7% vs 76.3%, p<0.001). Patients had medical insurance (p=0.001) and illness history of stroke (p<0.001) or MI (p=0.046) might have better awareness of hypertension. There were more smokers actually quit smoking (12.5% vs 7.8%, p<0.001) and less current smokers (24.3% vs 31.1%, p<0.001) among patients aware of hypertension. The LDL levels (2.93 vs 3.04mmol/l, p<0.001) and DBP (91 vs 93mmHg, p=0.001)

Table 1: Characteristics of AIS patients with or without awareness of their existing hypertension and diabetes.

	Hypertension			Diabetes		
	Awareness (n=3129)	Unawareness (n=1240)	*p* value	Awareness (n=1216)	Unawareness (n=380)	*p* value
Age (yrs)	61.80±12.91	58.36±13.18	<0.001	63.37±11.95	57.82±12.01	<0.001
Male (%)	69.7	76.3	<0.001	66.5	73.2	0.017
BMI (kg/m^2)	23.88±3.49	23.64±3.21	0.032	23.76±4.05	24.21±2.92	0.043
Medical insurance(%)	64.1	58.5	0.001	65.8	58.9	0.017
Smoking status			<0.001			0.010
Current (%)	24.3	31.1		22.8	29.7	
Ever (%)	12.5	7.8		13.0	9.5	
Never (%)	63.2	61.1		64.2	60.8	
Stroke (%)	21.0	9.9	<0.001	27.0	9.5	<0.001
MI (%)	2.2	1.3	0.046	3.7	1.3	0.180
TIA (%)	3.0	2.6	0.548	3.4	3.2	1.000
Admission SBP (mmHg)	156 [142- 171]	153 [144- 165]	0.071	153.39±23.15	157.36±24.06	0.004
Admission DBP (mmHg)	91 [82-101]	93 [85-101]	0.001	88 [79-96]	93 [85-103]	<0.001
Admission NIHSS	3.65±4.28	3.58±4.14	0.605	3.83±4.22	4.12±4.47	0.248
FBG (mmol/l)	5.82 [5.12- 7.15]	5.63 [5.02- 7.18]	<0.001	8.83±3.57	11.04±3.68	<0.001
HbA1C (%)	6.64±1.79	6.46±1.78	0.004	8.21±2.13	8.92±2.06	<0.001
LDL (mmol/l)	2.93±0.96	3.04±1.03	0.001	2.88±1.02	3.22±1.15	<0.001
HCY (mmol/l)	15.19±11.02	14.69±11.04	0.175	13.66±8.13	13.61±7.42	0.915
UA (umol/l)	353.0 [292.0- 423.0]	344.0 [289.4- 409.0]	0.019	342.86±101.09	339.71±99.28	0.594

BMI: Body Mass Index, MI: Myocardial Infarction, TIA: Transient Ischemic Attacks, SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, LDL: Low-Density Lipoprotein Cholesterol; HCY: Homocysteine; FBG: Fasting Blood Glucose; UA: Uric Acid; NIHSS: National Institutes of Health Stroke Scale
*p<0.05 was statistical significant.

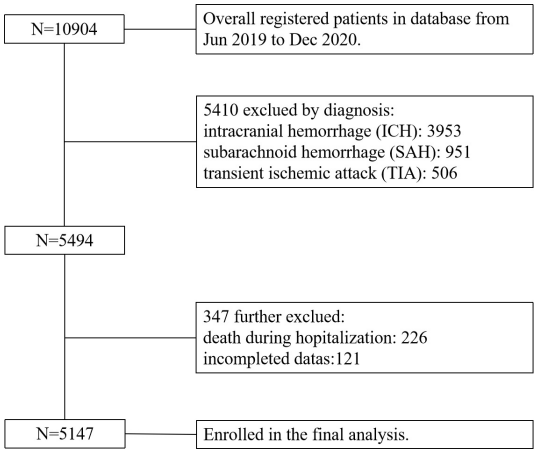

Figure 1: Patients selected flow chart. This flow chart shows the selection process by which the patients were submitted to final analysis.

were slightly higher in patients showed unawareness of hypertension, while the glucose (FBG, 5.82 vs 5.63mmol/l, p<0.001; HbA1C, 6.64% vs 6.46%, p=0.004) and uric acid (UA, 353 vs 344umol/l, p=0.019) levels were higher in patients known their blood pressure issues (details shown in Table 1).

Awareness of Diabetes

Overall, 1596 (31%) patients with acute ischemic stroke combined with diabetes in this study. The rate of diabetes awareness was about 76.2%. There were 865 (71.1%) patients with awareness of their diabetes regularly taken hypoglycemic agent. Individuals who were unaware of diabetes existence were more likely to be obese (BMI, 23.76 vs 24.21 kg/m^2, p=0.043) and younger (63.37 vs 57.82, p<0.001). Males and patients without medical insurance were more likely showed unawareness of diabetes (p=0.004). There were less current smokers and more ex-smokers among patients known their blood glucose issue (p=0.010). Patients with illness history of stroke might show better awareness of diabetes (p<0.001). Patients who were aware of diabetes showed better controlled blood pressure (both SBP and DBP), glucose and lipid level, than those who were lack of awareness (Table 1).

Awareness of Dyslipidemia

Table 2 presented the characteristics of patients with or without awareness of dyslipidemia or AF, respectively. 1333 patients (25.9%) were identified as dyslipidemia based on the serum level of LDL, among which only about 24.2% patients were aware of their blood lipids issues. The rate of taking lipid-lowering medicines was about 35.4% in patients with awareness of their dyslipidemia. Patients who were unaware of the dyslipidemia were more likely to be younger (63.62 vs 58.88, p<0.001) and lack of medical insurance (71.7% vs 60.3%, p<0.001). The awareness would be higher in patients with history of stroke or MI (p<0.001). The blood pressure (both SBP and DBP) and serum lipid LDL levels were higher in patients without awareness of dyslipidemia (2.93 vs 4.11 mmol/l, p<0.001).

Awareness of AF

In our analysis, there were 337 patients (6.5%) diagnosed as AF with the awareness rate up to 53.4%. There were 115 (63.9%) patients with awareness of AF regularly taken anticoagulants. Males and younger individuals (74.5 vs 66.0, p<0.001) were more prominent in patients who were unaware of AF. Patients with stroke history had higher awareness of AF (p=0.002). Patents with or without awareness of AF existence showed no significant difference in levels of serum glucose, lipids, UA as well as blood pressure (Table 2).

In addition, patients with younger age showed lower awareness of their risk factors, including hypertension, diabetes, dyslipidemia and AF (Figure 2). We did not identified significant difference in the severity of neurological dysfunction based on the NIHSS score among patients who were aware or unaware of their CVDs risk factors.

Table 2: Characteristics of AIS patients with or without awareness of their existing dyslipidemia and atrial fibrillation.

	Dyslipidemia			Atrial fibrillation		
	Awareness (n=322)	**Unawareness (n=1011)**	***p* value**	**Awareness (n=180)**	**Unawareness (n=157)**	***p* value**
Age (yrs)	63.62±13.43	58.88±13.44	<0.001	74.5 [65-81]	66 [52-76]	<0.001
Male (%)	65.2	67.4	0.497	51.7	65.6	0.011
BMI (kg/m^2)	24.06±3.09	24.02±3.11	0.878	23.29±3.17	22.88±3.08	0.235
Medical insurance(%)	71.7	60.3	<0.001	65.6	63.7	0.733
Smoking status			0.919			0.413
Current (%)	26.7	26.6		9.4	14.1	
Ever (%)	11.2	10.4		11.7	10.9	
Never (%)	62.1	63.0		78.9	75.0	
Stroke (%)	44.1	11.9	<0.001	27.8	14.0	0.002
MI (%)	6.2	1.5	<0.001	6.7	7.0	1.000
TIA (%)	4.7	2.8	0.104	3.9	2.5	0.553
Admission SBP (mmHg)	151.11±22.37	157.48±23.90	<0.001	146.71±21.94	145.62±25.44	0.676
Admission DBP (mmHg)	87 [78-98]	92 [82-102]	<0.001	86.67±15.03	87.10±16.25	0.804
Admission NIHSS	3.83±4.51	3.70±4.26	0.644	7.52±6.90	8.10±6.78	0.443
FBG (mmol/l)	6.93±3.24	7.26±3.21	0.110	6.58±2.15	6.43±2.07	0.523
HbA1C (%)	6.20 [5.60-7.40]	6.00 [5.60-7.40]	0.350	6.29±1.16	6.14±1.26	0.269
LDL (mmol/l)	2.93 [2.18-3.63]	4.11 [3.83-4.50]	<0.001	2.64±0.92	2.70±0.92	0.556
HCY (mmol/l)	15.80±12.58	14.70±11.20	0.138	14.36±7.02	14.16±9.92	0.829
UA (umol/l)	352.38±102.68	372.92±109.21	0.003	351.05±108.87	342.42±112.33	0.475

BMI: Body Mass Index, MI: Myocardial Infarction, TIA: Transient Ischemic Attacks, SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, LDL: Low-Density Lipoprotein Cholesterol; HCY: Homocysteine; FBG: Fasting Blood Glucose; UA: Uric Acid; NIHSS: National Institutes Of Health Stroke Scale
*P<0.05 Was Statistical Significant.

Table 3: Factors respectively associated with the awareness of hypertension, diabetes, dyslipidemia and atrial fibrillation.

	Hypertension		Diabetes		Dyslipidemia		Atrial fibrillation	
Covariates	**Univariate[1] OR (95% CI)**	**Multivariable[2] OR (95% CI)**	**Univariate[1] OR (95% CI)**	**Multivariable[2] OR (95% CI)**	**Univariate[1] OR (95% CI)**	**Multivariable[2] OR (95% CI)**	**Univariate[1] OR (95% CI)**	**Multivariable[2] OR (95% CI)**
Age (ref= age≥60)								
<45	0.43 (0.35-0.53)	0.50 (0.40-0.63)	0.25 (0.16-0.38)	0.28 (0.18-0.45)	0.43 (0.27-0.68)	0.48 (0.29-0.80)	0.17 (0.07-0.45)	0.21 (0.08-0.57)
45-59	0.73 (0.64-0.84)	0.81 (0.70-0.94)	0.48 (0.37-0.61)	0.53 (0.41-0.69)	0.60 (0.45-0.79)	0.59 (0.43-0.82)	0.37 (0.21-0.66)	0.39 (0.21-0.72)
Male sex	0.72 (0.62-0.83)	0.75 (0.63-0.89)	0.73 (0.56-0.94)	0.85 (0.63-1.15)	0.99 (0.70-1.18)	0.96 (0.68-1.36)	0.56 (0.36-0.87)	0.57 (0.34-0.94)
BMI (ref= BMI≤16)								
16.01-24.99	1.64 (0.71-3.81)	2.04 (0.86-4.85)	0.58 (0.07-4.84)	1.11 (0.12-10.14)	0.79 (0.51-4.08)	1.44 (0.24-8.53)	2.22 (0.20-24.74)	2.62 (0.20-34.78)
≥25	1.75 (0.75-4.01)	2.44 (1.02-5.84)	0.44 (0.05-3.72)	0.95 (0.10-8.74)	0.82 (0.16-4.27)	1.85 (0.31-11.06)	2.65 (0.23-30.31)	3.71 (0.27-50.94)
Medical insurance	1.26 (1.11-1.44)	1.30 (1.13-1.49)	1.34 (1.06-1.70)	1.45 (1.13-1.85)	1.67 (1.27-2.20)	2.03 (1.50-2.74)	1.09 (0.69-1.70)	1.28 (0.80-2.07)
Smoking status (ref=never smoke)								
Current	0.76 (0.65-0.88)	0.94 (0.79-1.10)	0.73 (0.56-0.94)	0.98 (0.73-1.32)	1.02 (0.76-1.34)	1.36 (0.95-1.95)	0.64 (0.32-1.26)	1.27 (0.58-2.79)
Ever	1.54 (1.22-1.96)	1.68 (1.31-2.15)	1.30 (0.88-1.92)	1.35 (0.89-2.04)	1.09 (0.72-1.64)	1.12 (0.70-1.79)	1.02 (0.51-2.02)	1.24 (0.59-2.63)
Comorbidity								
Stroke	2.42 (1.97-2.97)	2.24 (1.82-2.76)	3.53 (2.45-5.09)	3.07 (2.12-4.46)	5.86 (4.38-7.84)	5.92 (4.36-8.03)	2.36 (1.35-4.12)	2.38 (1.31-4.33)
MI	1.75 (1.01-3.02)	1.55 (0.89-2.71)	2.88 (1.14-7.31)	2.27 (0.88-5.86)	4.40 (2.22-8.70)	3.64 (1.72-7.73)	0.95 (0.41-2.21)	0.71 (0.27-1.82)
TIA	1.16 (0.77-1.74)	1.19 (0.79-1.80)	1.07 (0.56-2.06)	0.95 (0.48-1.87)	1.72 (0.90-3.25)	1.47 (0.70-3.06)	1.55 (0.44-5.39)	1.34 (0.35-5.11)

[1]Univariate column of the table is the isolated association of the specific factor with the awareness of hypertension, diabetes, dyslipidemia and atrial fibrillation, respectively.

[2]Multivariable column is the association of the specific factor with the awareness of those modifiable risk factors after adjustment for all other factors shown in the table.

Statistic values of P≤0.05 are indicated in bold.

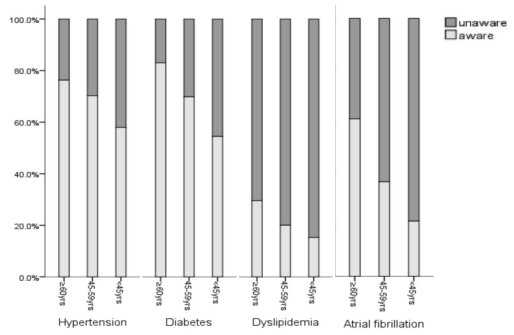

Figure 2: Awareness of hypertension, diabetes and atrial fibrillation among acute ischemic stroke patients in Shenzhen by age groups.

Factors that Influence Awareness of CVDs Risk Factors

Factors independently associated with the awareness, following adjustment for age, gender, BMI, medical insurance condition, smoking status and history of cerebrovascular diseases (using multiple models), are reported in Table 3. Patients with younger age were less likely to be aware, while patients with previous history of stroke were more likely to be aware of all the CVDs risk factors we analyzed. Medical insurance condition was independent related with the awareness of most CVDs risk factors, expect for AF.

Discussions

The overall prevalence of hypertension (84.9%) in our study was similar to the data from National Epidemiological Survey of Stroke (NESS) in China 2013 (84.2%), but much higher than the data from CNSR III (63.0%) [8]. As for the awareness, there were 71.6% patients known their blood pressure issues, which was slightly higher than overall Chinese people but still lower than individuals from western countries [10,15]. We indicated that males were more likely to ignore their preexisting hypertension, which was consistent with the characteristics of U.S. adults but not for eastern Chinese, even though the prevalence of hypertension might be higher in males based on previous studies [10,15-18]. In keeping with earlier findings, younger patients in our study showed higher risk of being unaware of their hypertension [19,20]. Meanwhile, patients without medical insurance were supposed to be unaware of the existence of hypertension, which mainly caused by the economic concerns. Former studies also demonstrated that lower income was associated with lower awareness of hypertension [20-22].

Positive past history of stroke or MI might increase the awareness of hypertension in our analysis, but the association of MI became insignificant after adjusting confounders, stayed the same with previous researches [23]. Besides, patients quitting smoke and obesity were more likely aware of their existing hypertension. Since measurement of blood pressure is a kind of easy and noninvasive procedure. Thus, the hypertension was easier to be detected than other CVDs risk factors as long as improving the personal motivation. Nevertheless, the blood pressure showed no clinical significant different in patients no matter they knew their own hypertensive issue or not. In addition, the blood serum glucose levels were even higher in patients with awareness of presence of hypertension. Hence, awareness

of the disease was the first but not the only step, patients also need to pay more attention to the blood pressure control.

The prevalence of diabetes in our AIS patients was about 31% slightly higher than the data from CNSR III [8]. While the awareness rate of diabetes was about 76.2%, which was lower than several other studies but still in line with the range of most previous researches [24-27]. Among patients who were unaware of their diabetic status, there were more younger individuals, males as well as individuals without medical insurance. In consistent with a recent study conducted in Dubai, females and individuals with health insurance and higher monthly income showed better knowledge of the diabetes [26]. Although female gender was associated with decreased awareness of diabetes in Malaysia [27]. Different from hypertensive patients, the blood glucose control was kind of well in patients known their diabetic issues, since their serum blood glucose levels were lower than those without awareness. Additionally, the mean blood pressure (both SBP and DBP), serum LDL level as well as BMI were also lower in patients presented with awareness of diabetes. This might kind of due to well knowledge of their healthy promoted good control of glucose as well as other metabolism issues, since hyperglycemia was one of the most critical issues in the metabolic syndrome [29,30].

Overall, 1333 patients (25.9%) were identified as dyslipidemia based on the serum level of LDL, which was much slightly lower than general Chinese people from NESS but much higher than acute ischemic stroke patients from CNSR III [8]. There were only 24.2% patients knew their dyslipidemic status, which was close to the previous data [31]. In keeping with other studies, more younger patients and patients without medical insurance were likely to be unaware of the existence of dyslipidemia [32,33]. Patients with stroke and MI history might have increased awareness of their lipid dysbolism, the same phenomenon were also found in previous research [34]. But the association between MI history and risk factors awareness became insignificant after adjusting other confounders. Patients controlled the lipids more effectively if they knew their lipids issues. The blood pressure levels were also slightly lower in patients who were aware of their dysilipidemia, although the mean blood pressure was still not ideal for the stroke prevention. Different from the awareness of other risk factors in our study, there was no significant gender difference between patients who were aware or unaware of their dyslipidemic problems. The gender difference was also negative in in northeast China as well as Switzerland, which might be due to the increased risk of dyslipidemia in menopause women [34,35].

The prevalence of AF in our study was aligned with the prevalence among AIS patients in CNSR III [8]. Up to 53.4% patients were aware of their abnormal heart rhythm.The awareness condition seemed to be better than elderly people in Ireland but still lag behind individuals in Estonia [15,36]. Older and females patients were more prominent in patients who were aware of the AF condition the same as elderly Irish population [36]. Patients with increased Charlson Comorbidity Index was associated with higher awareness of AF in ATRIA-CVRN study [37]. Similarly, among patients with well understanding of their abnormal heart rhythm, there were more patients combined with past history of stroke in the present study.

Additionally, older patients showed better awareness of their CVDs risk factors in our study, among which patients younger than 45 years old demonstrated lowest awareness of their hypertension, diabetes, dyslipidemia as well as AF. Actually, young patients throughout the world are found to be less aware of their existing stroke factors, even though the incidence rate of stroke in young people is still increasing at present [32,38,39]. Furthermore, based on our study, the treatment conditions of hypertension (61.6%), diabetes (71.1%), dyslipidemia (35.4%) and AF (63.9%) were also suboptimal, which would be another important issue need to be settled while improving the awareness of CVDs risk factors.

There are several limitations of our study. Firstly, there might be underestimated dyslipidemia condition, since we diagnose the dyslipidemia only based on serum LDL level. Actually, LDL is one of the most issues factors need to be well controlled for the secondary prevention of stroke, and the serum LDL level change align with serum cholesterol in most cases. Secondly, the blood pressure level as well as the blood glucose level might be transitory increased because of the stress reaction. Therefore, we measured three times a day and calculated mean value to assess the admission mean blood pressure. The blood glucose was assessed by the fasting biochemical profiles on the second morning after admission to minimize the effect of stress reaction caused by the acute ischemic stroke. Thirdly, this is a cross sectional study aimed to describe the status of CVDs risk factors awareness among AIS patients in Shenzhen. And some key factors is missing in our present study, such as education level that might also influence the awareness of CVDs risk factors, although this effect might be less in young population. The results of our study is not sufficient to identify the cause-and-effect conclusions, and we are conducting the prospective cohort to evaluate the potential contributing factors as well as the compliance of the treatment of each risk factor.

Conclusion

The overall awareness of the CVDs risk factors was suboptimal among AIS patients in Shenzhen, especially for the existing dyslipidemia. We indicated that males and younger patients and patients lacking of medical insurance, past illness history of stroke or MI were more likely to be unaware of their existing modifiable CVDs risk factors. The overall control of blood glucose and lipids as well as blood pressure were still need to be improved in patients with acute ischemic stroke, especially for those who knew less about their own health issues. More importantly, we should pay more attention to the improvement of the awareness of CVDs risk factors in people younger than 45 years old in Shenzhen, since the stroke screening program of China are mainly at the service of patients older than this age threshold.

Author Statements

Acknowledgments

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Authors' Contributions

Lijie Ren and Yang Wang conceived and designed the study. Zhihao Lei and Shiyu Hu performed the data collection. Tao Lan and Shiyu Hu performed the statistical analysis and paper writing. Lijie Ren and Yang Wang reviewed and edited the manuscript. All authors read and approved the manuscript.

Availability of Data and Materials

The datasets analysed during the current study available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

All methods were carried out in accordance with relevant guidelines and regulations. All patients or their guardians were informed consent to participate in this medical quality control program. The data was public for application and de-identified. All experimental protocols were approved by the ethics committee of Shenzhen Second People's Hospital.

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Competing Interests

No potential conflict of interest was reported by the authors.

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