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# Effect of ginkgo capsules combined with secondary preventive drugs on the endothelial injury and plaque properties of patients with hypertension complicated by carotid atherosclerosis

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## ABSTRACT

**Objective:** To study the effect of ginkgo capsules combined with secondary preventive drugs on the endothelial injury and plaque properties of patients with hypertension complicated by carotid atherosclerosis. **Methods:** A total of 178 patients with hypertension complicated by carotid atherosclerosis who were treated in Chengyue Community Health Service Center of Xisaishan District Huangshi City Hubei Province between February 2015 and January 2017 were collected and randomly divided into two groups. Control group were treated with conventional secondary preventive drugs, and observation group were treated with ginkgo capsules combined with secondary preventive drugs. The differences in serum endothelial injury indexes and lipid metabolism indexes as well as carotid artery ultrasound parameters were compared between the two groups before and after treatment. **Results:** Before treatment, endothelial injury indexes and lipid metabolism indexes as well as carotid artery ultrasound parameters were not significantly different between two groups. After treatment, serum ET, Ang II, TC, LDL-C and LpA contents as well as carotid artery ultrasound parameters DS and AS levels of observation group were lower than those of control group while serum NO and HDL-C contents as well as carotid artery ultrasound parameter MLD level were higher than those of control group. **Conclusion:** Ginkgo capsule combined with secondary preventive drugs can effectively reduce the endothelial injury and stabilize the plaques in patients with hypertension complicated by carotid atherosclerosis.

## 1. Introduction

Hypertension is the chronic cardiovascular disease with the highest incidence in our country, abnormal continuous blood pressure elevation can directly damage the vascular endothelium (especially the great vessels), and result in platelet accumulation in local injured area and atheromatous plaque formation, etc., and the plaque falling may directly result in myocardial infarction, cerebral infarction and

other severe complications[1,2]. Carotid artery is the area where the plaques earliest appear, hypertension combined with carotid plaque is the main cause of cardiovascular events, and early intervention measures should be taken to optimize the treatment outcome[3,4]. Blood pressure lowering, antiplatelet and other secondary preventive drugs have been popularized in the treatment of patients with hypertension combined with carotid plaque, but after the application of the basic treatment, there are still plaque stability decline as well as cardiovascular and cerebrovascular events in a higher proportion of patients. Traditional Chinese medicine treatment of hypertension and carotid plaque has a long history, ginkgo capsule is made of ginkgo flavone glycoside and total terpenes lactones extracted from high-quality ginkgo leaf, it has the functions of lowering blood pressure, regulating blood fat, optimizing blood vessels, and so on,

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and many scholars have currently recommended it as an adjuvant drug for adjuvant therapy of patients with hypertension combined with carotid atherosclerosis[5]. The effect of adjuvant ginkgo capsule therapy on the endothelial injury and plaque properties of patients with hypertension complicated by carotid atherosclerosis was specifically analyzed in this study.

## 2. Information and methods

### 2.1 Case information

A total of 178 patients with hypertension complicated by carotid atherosclerosis who were treated in Chengyue Community Health Service Center of Xisaishan District Huangshi City Hubei Province between February 2015 and January 2017 were selected as the research subjects and the patients themselves signed the informed consent. Random number table was used to divide the 178 patients into two groups, with 89 patients in each group. Control group included 49 men and 40 women that were 47-71 years old; observation group included 50 men and 39 women that were 45-76 years old. The difference in general information was not significant between the two groups ( $P>0.05$ ).

### 2.2 Inclusion and exclusion criteria

Inclusion criteria: (1) diagnosed with hypertension and carotid atherosclerosis; (2) receiving regular secondary preventive drug treatment for 6 months; (3) no dropping out during data collection. Exclusion criteria: (1) patients with allergy to ginkgo capsules; (2) patients combined with infectious diseases; (3) patients combined with severe liver, liver and kidney dysfunction.

### 2.3 Therapy

Control group received conventional oral antihypertensive drugs, and the target blood pressure was  $\leq 130/80$  mmHg. Observation group received ginkgo capsule combined with conventional secondary prevention drugs, specifically as follows: compound ginkgo capsule (Guangxi Ecan Pharmaceutical Co., Ltd., approved by B20020772), oral administration, 2 tablets/time, 2 times/d, for 3 months in a row. Conventional secondary preventive drugs were the same as those of the control group.

**Table 1.**

Comparison of serum endothelial injury index contents between two groups of patients before and after treatment.

Groups	n	ET		NO		Ang II	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group	89	412.83±59.74	275.71±30.86*	30.71±4.53	42.85±5.27*	632.81±75.37	472.73±52.88*
Observation group	89	411.62±54.86	168.35±20.49*	30.69±4.37	58.63±6.29*	630.64±72.98	268.52±30.79*
T		0.281	14.297	0.176	11.627	0.326	20.398
P		>0.05	<0.05	>0.05	<0.05	>0.05	<0.05

Note: comparison of indexes within group between before and after treatment, \* $P<0.05$ .

### 2.4 Observation indexes

Before and after treatment, 3.0 mL of fasting cubital venous blood was collected from the two groups of patients, anti-coagulated, then let stand at room temperature for stratification and centrifuged at low speed to separate serum which was stored in a cryogenic environment. RIA method was used to detect serum levels of endothelial injury indexes endothelin (ET), nitric oxide (NO) and angiotensin II (Ang II); automatic biochemical analyzer was used to detect serum levels of lipid metabolism indexes total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) and lipoprotein A (LpA). Carotid artery color Doppler imaging was used to detect the minimum lumen diameter (MLD), diameter stenosis (DS) and area stenosis (AS) of the diseased blood vessels.

### 2.5 Statistical processing

Statistical software in the study was SPSS 25.0 and measurement data between two groups was by t test. Statistic  $P<0.05$  indicated statistical significance in differences.

## 3. Results

### 3.1 Endothelial injury indexes

Comparison of serum endothelial injury indexes ET (pg/mL), NO ( $\mu\text{g/mL}$ ) and Ang II (pg/mL) contents between two groups of patients before and after treatment was as follows: before treatment, the differences in serum ET, NO and Ang II contents were not significant between the two groups ( $P>0.05$ ); after treatment, serum ET and Ang II contents of both groups of patients were lower than those before treatment while NO contents were higher than those before treatment ( $P<0.05$ ), and serum ET and Ang II contents of observation group were lower than those of control group while NO content was higher than that of control group ( $P<0.05$ ), shown in Table 1.

**Table 2.**

Comparison of serum lipid metabolism index contents between two groups of patients before and after treatment.

Groups	n	TC		LDL-C		HDL-C		LpA	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group	89	4.82±0.51	3.57±0.41*	2.98±0.35	2.17±0.24*	1.17±0.18	1.43±0.16*	0.29±0.04	0.21±0.03*
Observation group	89	4.79±0.53	2.98±0.35*	2.97±0.34	1.78±0.21*	1.19±0.17	1.78±0.25*	0.28±0.03	0.12±0.02*
T		0.182	8.928	0.251	6.372	0.174	6.948	0.114	5.388
P		>0.05	<0.05	>0.05	<0.05	>0.05	<0.05	>0.05	<0.05

Note: comparison of indexes within group between before and after treatment, \* $P<0.05$ .**Table 3.**

Comparison of ultrasound plaque property parameter levels between two groups of patients before and after treatment.

Groups	n	MLD		DS		AS	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group	89	2.54±0.29	3.11±0.34*	0.58±0.07	0.51±0.06*	0.76±0.08	0.62±0.07*
Observation group	89	2.53±0.28	4.09±0.45*	0.57±0.06	0.40±0.05*	0.75±0.09	0.51±0.06*
T		0.192	7.281	0.215	6.384	0.174	6.983
P		>0.05	<0.05	>0.05	<0.05	>0.05	<0.05

Note: comparison of indexes within group between before and after treatment, \* $P<0.05$ .

### 3.2 Lipid metabolism indexes

Comparison of serum lipid metabolism indexes TC (mmol/L), LDL-C (mmol/L), HDL-C (mmol/L) and LpA (g/L) contents between two groups of patients before and after treatment was as follows: before treatment, serum TC, LDL-C, HDL-C and LpA contents were not significantly different between the two groups ( $P>0.05$ ); compared with those before treatment, serum TC, LDL-C and LpA contents of both groups of patients decreased significantly while HDL-C contents increased significantly after treatment ( $P<0.05$ ), and compared with those of control group, serum TC, LDL-C and LpA contents of observation group decreased significantly while HDL-C content increased significantly after treatment ( $P<0.05$ ), shown in Table 2.

### 3.3 Ultrasound plaque property parameters

Comparison of ultrasound plaque property parameters MLD (mm), DS and AS levels of diseased-side blood vessels between two groups of patients before and after treatment was as follows: before treatment, the differences in MLD, DS and AS levels were not significant between the two groups ( $P>0.05$ ); after treatment, MLD levels of both groups of patients were higher than those before treatment while DS and AS levels were lower than those before treatment ( $P<0.05$ ), and MLD level of observation group was higher than that of control group while DS and AS levels were lower than those of control group ( $P<0.05$ ), shown in Table 3.

## 4. Discussion

Hypertension combined with carotid plaque is the main cause of clinical acute myocardial infarction, cerebral infarction and so on, routine blood pressure-lowering and antiplatelet therapy have limitations in optimizing the disease, inhibiting the occurrence of adverse events and so on, and other drugs are needed for adjuvant treatment in order to enhance the overall curative effect and optimize patients' outcome. Ginkgo capsule is made from ginkgo

leaf essence, it is rich in ginkgo flavone glycoside, total terpene lactones and flavonol that have multiple functions such as lowering blood pressure, antiplatelet, regulating blood lipid and softening blood vessels, and it is currently mostly used in the treatment of patients with hypertension, coronary heart disease, Alzheimer's and others[6-8]. In the study, ginkgo capsule was added for combination therapy on the basis of secondary prevention medication, and the effect of the therapy on endothelial damage and plaque properties was explored to lay practice basis for the subsequent treatment of similar patients.

Previous studies have confirmed that almost all patients with primary hypertension have vascular endothelial injury, and a sharp rise in blood pressure can damage endothelial cells, reduce their NO release and reduce the NO bioavailability[9,10]. ET is the most powerful vasoconstrictive substance, and there is the increase of reactive ET secretion in patients with hypertension, which further leads to vasoconstriction dysfunction and endothelial dysfunction[11,12]. Ang II has strong vasoconstrictive function, participates in the development of hypertension, and is one of the important factors that lead to vascular endothelial injury[13,14]. In the study, analysis of the changes in serum levels of these endothelial injury indexes before and after treatment showed that compared with those before treatment, serum vasoconstrictive substances ET and Ang II contents of both groups of patients decreased while vasodilatory substance NO contents increased after treatment, indicating that both treatments can optimize the endothelial function; further analysis of the differences in these indexes after treatment between the two groups of patients showed that compared with those of control group, serum ET and Ang II contents of observation group were lower while NO content was higher after treatment, confirming that adjuvant ginkgo capsule therapy can effectively relieve the endothelial damage and optimize the vasomotor function in patients with hypertension complicated by carotid atherosclerosis.

Vascular endothelial injury is the initiating factor of plaque formation, and lipid metabolism disturbance is the most important driving factor for the enlargement of plaque volume and the decline of plaque stability. TC content represents the overall lipid metabolism status of the body, and the high TC indicates that the body's lipid transport and degradation ability decrease[15,16]. LDL-C

is the main carrier of endogenous cholesterol in human body, and its content is positively proportional to the incidence of coronary heart disease[17]. LpA is mainly formed in the liver, and its continuous high level is an important cause of angina and myocardial infarction. HDL-C is an anti-atherosclerotic lipoprotein, which promotes the elimination of cholesterol in peripheral tissues and is a protective factor for coronary heart disease[18,19]. In the study, analysis of the changes in serum levels of these lipid metabolism indexes before and after treatment showed that compared with before treatment, serum TC, LDL-C and LpA contents of both groups of patients were lower while HDL-C contents were higher after treatment, showing that both therapies can optimize the lipid metabolism process; further compared with those of control group, serum TC, LDL-C and LpA contents of observation group were lower while HDL-C content was higher after treatment, confirming that ginkgo capsule combined with secondary preventive drugs can more effectively promote lipid metabolism and restrain plaque progression.

Carotid ultrasound is the gold standard to determine the nature of plaques. MLD can directly reflect the influence of plaques on carotid blood flow, and the lower the MLD levels, the more serious the plaques[20]. Both DS and AS reflect the degree of carotid artery stenosis caused by plaques, and the higher the proportion, the larger the plaque volume and the lower the plaque stability[21]. In the study, analysis of the changes in these ultrasound parameters before and after treatment showed that compared with those before treatment, ultrasonic parameter MLD levels of both groups increased while DS and AS levels decreased after treatment; further compared with those of control group, MLD level of observation group was higher while DS and AS levels were lower after treatment, confirming that ginkgo capsule combined with secondary preventive drugs can more effectively reduce the plaque severity.

Therefore, it can be concluded that ginkgo capsule combined with secondary preventive drugs can effectively protect vascular endothelium, reduce endothelial injury, improve lipid metabolism and reduce plaque severity in patients with hypertension combined with carotid atherosclerosis, and it is worthy of popularization and application in clinical practice in the future.

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