



## REVIEW IN TRADITIONAL CHINESE MEDICINE FOR STROKE THERAPY

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### ABSTRACT

Stroke is the important cause of disability or death in the world, which limited therapeutics approaches are effective currently. Many researchers are trying their best to find developing new therapies for stroke. China's long-range experience for the treatment of stroke using traditional Chinese medicines (TCMs) indicates that TCM prescriptions are not only effective, but have no or few side effects. Nowadays, TCM get wide acceptance by people because many multiple ingredients were proved reliable for the therapeutic effects. We briefly describe the mechanisms of stroke in this review, and then summarize the research that single prescription and combination prescription have performed in recent years. We hope to promote further developing of TCM in stroke therapy.

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## INTRODUCTION

Stroke carries a long-range prognosis for disability and death. There are few valid treatments that reduce disability and death after stroke, and it is the second leading cause of mortality after cancer in the world, with a life risk of about 10%.<sup>1</sup> Stroke is called as "apoplexy" and an "attack on the viscera and bowels" in TCM. And it was first recorded in 《Treatise on Febrile Diseases》 which was written by Zhang Zhong Jing in the Han Dynasty. Stroke survivors always go through various degrees of physical disabilities, including dysarthria, urinary incontinence, limb deficit(weakness or paralysis in any limb), swallowing deficit and consciousness disorder. In general, stroke associated with hypertensive, hyperlipemia, ischemic heart disease became the largest burden of disease.<sup>2</sup> Nowadays, in many countries, TCM has become more and more popular, and it plays an important treatment and prevention role in health care. TCM diagnoses and treats the diseases based on the concepts of Yin-Yang, the five-elements theories and long-range practical experience, TCM is characterized by its unique theoretical system and entails complex ingredients that are effective by their synergistic effects. TCMs have been recorded in ancient medicine systems as therapies for stroke-related ailments. Pharmacological studies have proved that some TCMs have anti-oxidant, anti-inflammatory, vasodilatory, anti-plate, anti-glutamate, and protective effects against ischemia and reperfusion injury.<sup>3</sup> TCMs have been successfully used for a long time to cure all kinds of ailments, which have attracted increasing attention of industry and academia in China.

A system of medical theory and practice that is obviously different from Western Medicine have been developed and used in China for thousands of years. The theory and practice of this unique form of medicine are an integral part of Chinese culture where it is accordingly simply referred to as Chinese Medicine (Zhong Yi in Chinese), as opposed to Western Medicine (Xi Yi). The main principles of Chinese Medicine were first published in the book Huang Di Nei Jing about 2500 years ago.<sup>4</sup> Although some basic ideas may date back to the origin of Chinese civilization about 5000 years ago. Most prescriptions consist of a combination of several drugs. In fact, combination therapy is a fundamental principle of Chinese medicine. The combination of multiple medicines in complex formulations (and the presence of multiple active compounds even in single herbs) is thought to maximize therapeutic efficacy by facilitating mutual reinforcement of the drugs and mutual restraint or mutual detoxification a drug's potential adverse effects at the same time as targeting one or mutual assistance.<sup>5</sup> Some medicines may be mutual inhibition in their therapeutic effect when they are combined, while others may become full poisonous or cause serious adverse effects in combination, which must be avoided.

### Mechanisms of stroke

#### View from TCM

View from traditional Chinese Medicine, stroke caused by a Qi deficiency, blood stasis, and phlegm. Because of the Qi deficiency, the blood stasis and phlegm obstruct the Internal structure of blood vessel then intertwist each other, causing the blood stasis with phlegm to insert the vessel in the brain, and giving rise to infarction. The abnormal blood causes inter-

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vessel high blood pressure and forcing the blood stasis with phlegm out of the blood vessel may break the vessel, leading to hemorrhage. In TCM theory, if blood stasis is accompanied by phlegm, it can lead to more clearly damaged lesion in the brain. This is the mechanism that explains why stroke patients often come along with advanced neuronal damage, including aphasia, and the two pathological phenomenon of infarction and hemorrhage can be simultaneously caused.

**View from Western Medicine**

View from Western Medicine, the mechanisms of stroke have been regarded as many complex processes, including decay of energy, acidosis, loss of cell ion homeostasis, increased intracellular calcium levels, excitotoxicity, free radical mediated toxicity, cytokine-mediated cytotoxicity, disruption of the blood-brain barrier (BBB), activation of glial cells, and infiltration of leukocytes. During a few minutes of cerebral ischemia, blood flow severe decrease result in the core of brain tissue injured and subsequently undergoes necrotic cell death.<sup>6</sup> This necrotic core is surrounded by a zone of less severely affected tissue which is turned functionally inactive by ischemia but remains metabolically active. Necrosis is morphologically characterized by the swell of initial cellular and organelle, subsequent disruption of nuclear, organelle, and plasma membranes, and disintegration of nuclear structure and cytoplasmic organelles with extrusion of cell contents into the extra cellular space. The region bordering the infarct core, called as the ischemic penumbra, comprises as much as half of the total lesion volume during the initial stages of ischemia, and represents the region in which there is an opportunity for salvage via post-stroke therapy.<sup>7</sup>

**Single prescription**

**Achyranthes bidentate**

*Achyranthes bidentate* Blume (*A. bidentata*) is a commonly described Chinese medicinal herb. And has a series of pharmacological traits.<sup>8</sup> The watery extract of *Achyranthes bidentata* Blume has been shown to promote peripheral nerve regeneration in rabbits with the crush injury to the common peroneal nerve.<sup>9</sup> From the watery extract of *Achyranthes bidentate* Blume, we isolated *Achyranthes bidentate* polypeptides (ABPP). The role of ABPPk in protection against ischemia-induced neuronal damage might be mediated by mitochondrial dependent pathways, including modulation of apoptosis-related gene expression, regulation of mitochondrial dysfunction through restoring mitochondrial membrane potential, reducing the release of mitochondrial apoptogenic factors, and inhibiting intracellular ROS production. The neuroprotective effect of ABPPk may suggest the possible use of this agent in the treatment and prevention of cerebral ischemic stroke, which attenuated the glutamate induced apoptosis in primary hippocampal neurons, and supported recovery from experimental cerebral ischemia in vivo.<sup>10</sup> And promoted peripheral nerve regeneration in rodents with sciatic nerve crush through stimulating release of growth factors.<sup>11-12</sup>

**Acorus Tatarinowii Schott**

*Acorus tatarinowii* Schott (ATS) is a widely known TCM and is officially documented in the Chinese Pharmacopoeia with the name ‘Shi Chang Pu’. it is used for some diseases treatment, such as epilepsy, dementia, amnesia and insomnia. The extracts of ATS is  $\beta$ -asarones,  $\beta$ -asarones also is chief

component. And it is a fat-soluble substance with a small molecular weight, and it is easy to pass through the blood brain barrier.<sup>13</sup>  $\beta$ -asarone has important pharmacological effects on central nervous system. It can work on multi-target genes in rat brain. The expression of c-fos in rat brain with epilepsy can be dramatically increased, and attenuate neuronal apoptosis induced by  $\beta$ -amyloid in rat hippocampus and in PC12 cells.<sup>14</sup> From these study we can get a conclusion that  $\beta$ -asarones shows diverse neuronprotective effects.

Medicinal name	Scientific name	Pinyin/Chinese name
Aloe		Luhui 芦荟
Bombyx batryticatus		Jiangcan 僵蚕
Bulbus Fritillariae thunbergii		Zhebeimu 浙贝母
Caulis Bambusae in taeniam	Aloe vera	Zhuru 竹茹
	Bombyx mori	Shouwuteng 首乌藤
Caulis Polygoni multiflori	Fritillaria thunbergii	Lingyangjiao 羚羊角
Cornu Saigae tataricae	Bambusa tuldoidea	Hehuanhua 合欢花
Flos Albiziae	Polygonum multiflorum	Honghua 红花
Flos Carthami	Saiga tatarica	Yejuhua 野菊花
Flos Chrysanthemi indicii	Albizia julibrissin	Yangjinhua 洋金花
Flos Daturae	Carthamus tinctorius	Luobuma 罗布麻
Folium Apocyni veneti	Chrysanthemum indicum	Lianqiao 连翘
Fructus Forsythiae	Datura metel	Jili 蒺藜
Fructus Tribuli	Apocynum apocyni veneti	Jingucuo 筋骨草
Herba Ajugae	Forsythia suspensa	Xixin 细辛
Herba Asari	Tribulus terrestris	Jixuecao 积雪草
Herba Centellae	AJuga decumbens	Mahuang 麻黄
Herba Ephedrae	Asarum heterotropoides	Muzei 木贼
Herba Equisethiemaleis	Centella asiatica	Dengyexixin 灯叶细辛
Herba Erigeron	Ephedra sinica.	
Herba Leonuri	Equisetum hiemale	
Herba Menthae	Erigeron breviscapus	
Lasiosphaera seu Calvatia	Leonurus heterophyllus	Yimucuo 益母草
Lumbricus	Mentha haplocalyx	Bohe 薄荷
Periostracum cicadae	Lasiosphaera fenzlii	Mabo 马勃
Poria	Pheretima asiatica	Dilong 地龙
Radix Acanthopanaxis senticosi	Cryptotympana pustulata	Chantui 蝉蜕
Radix Achyranthis bidentatae	Poria cocos	Fuling 茯苓
Radix Angelicae pubescentis	Acanthopanax senticosus	Ciwujia 刺五加
Radix Bupleuri chinensis	Achyranthes bidentata	Niuxi 牛膝
Radix Gentianae macrophyllae	Angelica pubesens	Duhuo 独活
Radix Ledebouriellae	Bupleurum chinense	Chaihui 柴胡
Radix Paeoniae rubra	Gentiana macrophylla	Fangfeng 防风
Radix Polygalae	Ledebouriella divaricata	Chishao 赤芍
Radix Puerariae	Paeonia lactiflora	Yuanzhi 远志
Radix Rehmanniae	Polygala tenuifolia	Gegen 葛根
Radix Salviae miltiorrhizae	Pureraria lobata	Dihuang 地黄
Radix Scutellariae	Rehmannia glutinosa	Danshen 丹参
Radix Stephaniae tetrandrae	Salvia miltiorrhiza	Huangqin 黄芩
Ramulus Mori	Scutellaria baicalensis	Fangji 防己
Ramulus Uncariae cum uncis	Stephania tetrandra	Sangzhi 桑枝
Rhizoma Acori tatarinowii	Morus alba	Gouteng 钩藤
Rhizoma Arisaematis	Uncaria rhynchophylla	Shichangpu 石菖蒲
Rhizoma Cimicifugae foetidae	Acorus tatarinowii	Tiannanxing 天南星
Rhizoma Gastrodiae	Arisaema erubescens	Shengma 升麻
Rhizoma Ligustici	Cimicifuga goetida	Tianma 天麻
Rhizoma Notopterygii	Gastrodia elata	Chuanxiong 川芎
Rhizoma Paridis	Ligusticum chuanxiong	Qianghuo 羌活
Rhizoma Pinelliae	Notopterygium incisum	Chonglou 重楼
Rhizoma Sparganii	Paris polyphylla var. Yunnanensis	Banxia 半夏
Rhizoma Typhonii	Pinellia ternata	Sanling 三棱
Romulus Loranthis	Sparganium stoloniferum	Baifuzi 白附子
Scolopendra	Typhonium giganteum	Sangjisheng 桑寄生
Scorpio	Loranthus parasiticus	Wugong 蜈蚣
Semen Persicae	Scolopendra subspinipes	Quanxie 全蝎
Semen Plalycladi	Buthus martensi	Taoren 桃仁
Semen Xanthi sibiricum	Prunus Persica	Baiziren 柏子仁
Semen Ziziphi spinosae	Platycladus orientalis	Cangerzi 苍耳子
	Xanthium sibiricum	Suanzaoren 酸枣仁
	Ziziphus jujuba var. spinosa	

It is extracted from ATS, so ATS treatment for stroke has play an important role.

### **Safflower**

Safflower, namely *Carthamus tinctorius* L., is a member of the family Compositae, a kind of thistle like plants, and geologically distributes in all provinces in China. The flower of the plant, also called honghua (HH) in China, is used for producing herbal medicines, food colorants and a natural red dye for over 2500 years. As a therapeutical plant, HH is known to be effective for the treatment of inflammation, hyperlipemia, arteriosclerosis, gynecological diseases, and osteoporosis according to ancient traditional herbal literatures. The HH is also regarded as an effective biological response modifier for augmenting host homeostasis of body circulation, such as promoting blood coagulation, invigorating blood circulation, normalizing menstruation, and eliminating blood stasis. Variety of recent literatures have provided evidences that Safflower or its constituents possess neuroprotective action and anticerebral thromboembolism.<sup>15</sup> It as well as other traditional Chinese medicine makes up prescriptions for treatment of stroke.

### **Traditional Chinese medicines used in stroke therapy**

In Chinses medicine theory, compatibility of traditional Chinese medicine is more common. there are many traditional Chinese medicines that were recorded for treat stroke therapy.

### **Combination prescription**

#### **Wen Dan Decoction**

Wen Dan Decoction (WDD) documented as early as 652 AD (TangDynasty), is one of famous TCM prescriptions for recovery of patients from many illness. The WDD prescription includes Banxia (*Pinellia ternata*), Shengjiang (Ginger), Zhuru(Bamboo shavings), Zhishi (Unripe bitter orange), Chenpi(Tangerine peel) and Gancao (Licorice root). All the six herbsare were recorded in the Chinese Pharmacopeia. Papers about clinical studies of WDD have often been published in Chinese journals which are not widely read and not highly understood. Hereby, Jia Hua Xu provided the existing clinical evidence of WDD for ischemic stroke and hemorrhagic stroke.<sup>16</sup> Wen Dan Decoction treatment could improve neurological functional deficit score of stroke due to either ischemia, hemorrhage or both. The single prescription Wen Dan Decoction shows potential efficacy for both ischemic stroke and hemorrhagics stroke, validating the important character of dual modulation by TCM. The dual action is targeting on restoring inner homeostasis.<sup>17</sup> The role of WDD relies on the modulation of Qi Energy. On the one hand, WDD could stimulate Qi Energy to accelerate blood circulation and improve removing the stasis associated with ischemic stroke. On the other hand, the WDD induced Qi Energy might maintain the blood within the cerebral arteries and so stop bleeding and stable the atherosclerotic plaquesin hemorrhagic stroke.<sup>18</sup> So WDD has long been considered as Qi-tonifying TCM for restoring homeostasis with new therapeutic potentials in cerebrovascular accidents. Which means WDD is efficient for stroke.

#### **Dengzhanxixin injection**

A traditional Chinese medicinal plant, *Erigeron breviscapus*, has a long history of medicinal use in Chinese medicine. Its numerous preparations have been extensively used in clinic to

treat ischemic cardio cerebral vascular diseases for a long time. Among them, Dengzhanxixin jecton has been officially listed in the Chinese pharmacopoeia (The Pharmacopoeia Commission of PRC, 2005). It is one of the most widely used drugs for clinical treatment of cerebral ischemic China. Chinese pharmacopoeia defines that Dengzhanxixin injection mainly consists of scutellarin (Scu) and caffeic acid ester fraction(Caf). Scuisa is polyphenolic flavonoid compound. Experimental data proved that it can regulate nitric oxide(NO) production,<sup>19</sup> inhibit hydrogen peroxide induced cytotoxicity and rescue rat neuronal damage induced by ischemia/reperfusion.<sup>20</sup> the present study demonstrates that Scu and Caf are the active ingredients of Dengzhanxixin injection. A study suggested that Scu and Caf may be of value in the neuroprotection through astrocytes.

#### **Xue-Fu-Zhu-Yu decoction**

Xue-Fu-Zhu-Yu decoction (XFZYD) is a famous TCM formula for treating cardiovascular diseases (CVDs) with a history of several centuries.<sup>21</sup>The formulation of XFZYD consists of eleven plants material. The therapeutic effects of this XFZYD were validated, especially atherosclerosis and hyperlipidemia.<sup>22</sup> Recently, Gao also reported that this decoction can induce endothelial progenitor cell angiogenesis and hasten tube formation, especially in capillary vessels. Jie-Jen Lee reported for the first time that oral treatment with XFZYD suppressed thromboembolic stroke, and it also potentiated rt-PA mediated neuroprotection in rats. In the past, many different animal stroke models were described in the literature such as photochemically induced MCAO, surgical occlusion, and vessel occlusion by electrical cauterization or the thread occlusion model which only simulated the aspect of vessel occlusion Krueger of thrombolytic agents. In the present study, the thromboembolic stroke model mimics human strokes more closely than do other models of cerebral ischemia.<sup>23</sup> Furthermore, animal thromboembolic strokes induced by blood clots facilitate the investigation of the effects of thrombolytic therapy, which is currently the only available stroke treatment in humans. Cerebral ischemia restricted to the distribution of the thromboembolic occlusion gives rise to focal metabolic disturbances that result in infarction, neuronal necrosis, and brainedema.<sup>24</sup> Thromboembolic occlusion reperfusion injury induces HIF-1, iNOS, TNF, and active caspase-3 expressions, which may represent the response of neurons suffering from ischemic insult.

#### **Buchang Nao xin tong capsules**

The Buchang Naoxintong capsule (BNC) is one of the TCM prescriptions (BuYangHuanWuTang) in China. Every BNC consists of sixteen TCMs: *Astragalus membranaceus*, *Salvia miltiorrhiza*, *chuan xiong hort*, *Radix paeoniae rubra*, *Szechwan lovage rhizome*, *Semen persicae*, *Carthamus tinctorius* L, *frankincense*, *myrrh*, *Spatholobus suberectus* Dunn, *Achyranthes bidentate*, *cassia twig*, *Morus alba* L., *Pheretima hupeiensis*, *Buthus martensii*, and *Whitmania pigra* Whitman. Amygdalin and paeoniflorin are the two most abundant BNC constituents, Amygdalin produced an anti-cerebral ischemia effect, likely by interacting with the glucocorticoid receptor (NR3C1) and serpin peptidase inhibitor, clade C (antithrombin). Amygdalin and paeoniflorin were identified as KACs of BNCs based on their high abundance in the product, appropriate drug like properties,

and importance to the bioactivity of the mixture of BNC constituents. Finally, the MCAO model was used to show that amygdalin and paeoniflorin significantly decreased the infarction volume and improved neurological scores in ischemic rats.<sup>25</sup>

#### **Danhong injection**

Danhong injection (DHI) has been widely prescribed to patients with acute ischemic stroke (AIS). Extracted from Radix Salviae miltiorrhizae (Danshen) and Flos Carthami tinctorii (Honghua), is a Chinese medicinal product approved by the China Food and Drug Administration (CFDA). Previous studies demonstrated the neuroprotective efficacy of DHI in rat models with cerebral ischemic reperfusion injury.<sup>26</sup> Bing Li etc designed adequate randomization, double blinding, placebo control, and complete outcome data may lead to various biases, so there is a robust evidence to prove its efficacy. There is a study the first rigorously designed RCT to evaluate the efficacy and safety of DHI for AIS.<sup>27</sup>

#### **Gualou Guizhi decoction**

Gualou Guizhi decoction (GLGZD), a well-known traditional Chinese formula, was first recorded in 'Essentials from the Golden Cabinet', which was written during the Eastern Han Dynasty, in ~210 A.D. According to the theory of Traditional Chinese Medicine, GLGZD is formulated of six herbs, which collectively exert therapeutic and modulatory effects. The formula has been used to treat muscular spasticity following stroke, epilepsy or spinal cord injury in China. In the present study, the neuroprotective effect of GLGZD was evaluated in vivo using an MCAO rat model. The results showed that GLGZD significantly decreased the focal infarct volume, neurological deficit score and level of apoptosis compared with the model rats. These findings were consistent with those of a previous report.<sup>28</sup> The neuroprotective effect of GLGZD may involve a number of different mechanisms, including reduced inflammatory cytokine levels, an anti-oxidation effect and the modulation of Glu levels and  $\alpha$ -amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptor (AMPA) expression.<sup>29</sup>

#### **Nao-Xue-Shu Oral Liquid**

Nao-Xue-Shu oral liquid formulation improved aphasia in mixed stroke patients and thus might be a potentially effective drug for treating stroke aphasia. Nao-Xue -Shu oral liquid may raise Qi and remove blood stasis, clear pathogenic "heat" and "cool" blood (make the abnormal activity of the blood quiet stop bleeding), and eliminate phlegm. The Nao-Xue-Shu oral liquid formulation contains five herbs that can help increase Qi, remove blood stasis and phlegm, and assist the body to excrete the pathogenic metabolites of blood stasis and phlegm. In fact, Nao-Xue-Shu oral liquid contains two famous prescriptions of TCM; one is Bu-Yang-Huan-Wu decoction, which originated in the Qing Dynasty (about 185 years ago) and has been used frequently to treat stroke in China and Asia.<sup>30</sup> Clinical pharmacological studies have confirmed that Nao-Xue-Shu oral liquid accelerates the absorption of hematoma in the brain of rats, reduces edema around the hematoma accelerating fibrinolysis and inhibiting thrombosis, cerebral blood flow, and improves brain blood and oxygen supply, so improving blood circulation and promoting the absorption of hematoma.

#### **XingNaoJing prescription**

Xingnaojing (XNJ), a well known prescription in traditional Chinese medicine, has been used for treatment of stroke in China. And has approval from the Chinese National Drug Administration.<sup>31</sup> XNJ consists of four Chinese herbs: Moschus, a dry substance secreted by a gland in the subumbilical sac of the male musk deer, Radix Curcumae, the dried roots of Curcuma aromatica Salisb and C. zedoaria (Berg) Rosc, family Zingiberaceae, Fructus Gardeniae, the fruit of Gardenia jasminoides Ellis var. radicans (Thunb.) Makino, family Rubiaceae, and crystals from the evaporated exudate of the trunk of Dryobalanops aromatica Gaertn. f, family Dipterocarpaceae. Clinical trials have reported that XNJ can reduce brain injury and enhance functional recovery after stroke.<sup>32</sup> Pharmacological studies have demonstrated that XNJ has neuroprotective effects in cell and animal models of stroke.<sup>33</sup> XNJ contained some small molecules including muscone, borneol and Camphor.<sup>34</sup> Unlike large molecule agents, such as therapeutic antibodies or neurotrophic factors lack of transport across blood brain barrier.<sup>35</sup> Here comes an innate advantage for XNJ to become therapeutic agents for brain diseases.

#### **Nao-Shuan-Tong**

Nao-Shuan-Tong NST contains a combination of plant extracts, and several of these, including Pollen Typhae.<sup>36</sup> Radix Paeoniae Rubra and Rhizome Gastrodiae were previously reported to exert potent anti-oxidant and anti-inflammatory activities. Moreover, Pollen Typhae was also reported to have anti-thrombotic effects and Rhizome Gastrodiae was reported to reduce ischemia induced elevation of glutamate levels.<sup>37</sup> It is plausible to suggest that these properties could contribute to the neuroprotective effects of NST against injury produced by cerebral ischemia.

#### **Bu-yang Huan-wu decoction**

Bu-yang Huan-wu decoction (BHD) is a famous traditional Chinese medicine formula that has been used clinically in Asia to treat stroke induced disability for centuries. Bu-yang Huan-wu decoction (BHD), has been used to improve neurological functional recovery. From stroke induced disability in China for more than 300 years. Recent studies have reported that it has neuroprotective effects and mechanisms that are effective against cerebral ischaemia reperfusion (CI/R) injury.<sup>38</sup> The formula has also been shown to have a potential growth-promoting effect on the regeneration of peripheral nerves. BHD is composed of Astragalus membranaceus Bunge (Family Leguminosae), Angelica sinensis (Oliv.) Diels (Family Apiaceae), Paeonia lactiflora Pall. (Family Paeoniaceae), Ligusticum chuanxiong S. H. Qiu, Y. Q. Zeng, K. Y. Pan, Y. C. Tang & J. M. Xu (Family Apiaceae), Prunus persica (L.) Batsch (Family Rosaceae), Carthamus tinctorius L. (Family Asteraceae) and Pheretima aspergillum (E. Perrier) (Family Megascolecidae). Treatment with BHD dramatically reduced inflammation and oxidative stress, BHD has been demonstrated to stimulate neuronal proliferation in ischemic rats. But the underlying mechanisms remained unclear. Hsei-Wei Wang find that BHD also significantly increases the expression of protective factors in the damage area, BHD reduced the expression level of genes involved in wounding, apoptosis and acute inflammation.<sup>39</sup>

**Summary and Perspective**

Traditional Chinese medicine is the most widely practiced form of herbalism worldwide. It is based on a sophisticated system of medical theory and practice that is distinctly different from orthodox Western scientific medicine. Most traditional therapeutic prescriptions consist of a combination of several drugs. The combination of multiple drugs is thought to maximize therapeutic efficacy by facilitating synergistic actions and ameliorating or preventing potential adverse effects while at the same time aiming at multiple targets. Nowadays, an increasing number of patients and medical practitioners in the industrialized world use traditional Chinese medicines as a supplement to or substitute for prescription drugs.<sup>40</sup> traditional Chinese medicines are often considered to be a gentle and safe alternative to synthetically manufactured drugs. With the development of science and technology, more than half of the medically important pharmaceutical drugs are either natural products or derivatives of natural products<sup>48</sup> (Newman DJ *et al.*2002). At the same time, most of the world's people living in developing countries regard traditional Chinese medicine as the primary source for health care.

Many prescriptions of traditional Chinese medicine (TCM) have been used in clinical for centuries to treat disability induced by stroke. Some researchers utilize omics and systems biology techniques to elucidate the detailed molecular mechanisms underlying the effectiveness and promote the modernization of TCMs.<sup>42</sup> Traditional Chinese medicine in disease treatment and health care, is playing an increasingly important role, we through summarizing mechanism of Chinese medicine for stroke, providing clues in the treatment of brain death using traditional Chinese medicine for further research.

**Author contributions**

YW Z and SY H contributed in collecting related articles. RC and LY contributed to write the manuscript. LD and XY F contributed to critical reading of the manuscript. All the authors have read the final manuscript and approved submission.

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