

<http://ansinet.com/itj>

ITJ

ISSN 1812-5638

# INFORMATION TECHNOLOGY JOURNAL

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Basic Treatment Principles for Ischemic Cerebrovascular Disease with Chinese Herbal Medicine: An Application of Text Mining

<sup>1</sup>Rongfen Dong, <sup>2</sup>Shanshan Shen, <sup>1</sup>Baojie Dong, <sup>1</sup>Li Zhou, <sup>1</sup>He Yang, <sup>3</sup>Guang Zheng, <sup>4</sup>Hongtao Guo,  
<sup>2</sup>Cheng Lu, <sup>1</sup>Jinrong Zhang, <sup>1</sup>Zhaoli Cui, <sup>1</sup>Longsheng Zhang, <sup>2</sup>Aiping Lu,  
<sup>2</sup>Miao Jiang and <sup>1</sup>Yaoxian Wang

<sup>1</sup>Dongzhimen Hospital Affiliated to Beijing University of Chinese Medicine,  
100007, Beijing, China

<sup>2</sup>Institute of Basic Research in Clinical Medicine, China Academy of Chinese Medical Sciences,  
100700, Beijing, China

<sup>3</sup>School of Information Science-Engineering, Lanzhou University, 730000, Lanzhou, China

<sup>4</sup>Henan Province Traditional Chinese Medicine Hospital, 450002, Zhengzhou, China

---

**Abstract:** Cerebrovascular diseases which is called wind stroke in Chinese medicine, happened commonly and frequently in either the community or healthcare setting. Poststroke motor dysfunction and shortage of effective or curative treatments bring an enormous emotional and financial burden. Ischemic cerebrovascular (ICVD) disease is one of the three principal diseases causing people to death in which seconded only to heart disease and cancer. The pathophysiological role of platelets and coagulation is largely unclear. The currently approved drugs of treating or preventing ICVD have significant limitations. Chinese Herbal Medicine (CHM) has been an integral part of Traditional Chinese Medicine for thousands of years. Some chinese herbs were proved to have potential benefits on neural regeneration in cerebral ischemic injury. Many herbal formulations have been developed and used in the treatment of ICVD and were proved to be effective and safe. In this study, a novel text mining method was development to explore the treatment principles more intuitively. Networks of TCM patterns and CHMs which are most frequently used in ICVD treatment are built-up and analyzed, two major principles are explored: Promoting blood circulation to remove blood stasis with strengthening healthy qi. These findings might guide the clinicians in treatment of ischemic cerebrovascular.

**Key words:** Ischemic cerebrovascular disease, Chinese herbal medicine, pattern, traditional chinese medicine, text mining

---

### INTRODUCTION

Cerebrovascular diseases (CVD) include hemorrhagic disorder and ischemic cerebral disorder, which is called wind stroke in Chinese medicine, happened commonly and frequently in either the community or healthcare setting. It is recognized as one of the leading causes of death and severe neurological disability worldwide. The death number of CVD patients was estimated at 5.6 million in the world (Chen, 2010) and it will be much more in future since it is witnessing the aging of a society in which the population over the age of 60 years will account for approximately 31% (about 400 million calculated on the current populationbase) of the whole population by the year of 2050 (Gao *et al.*, 2013). These epidemiological data have painted a less than optimistic outlook in prevention and treatment of thisdisease in the world, especially in

those countries with a rapidly aging society such as China. Poststroke motor dysfunction and shortage of effective or curative treatments bring an enormous emotional and financial burden on patients, their families and society. Here, we will pay more attentions to Ischemic Cerebrovascular Disease(ICVD) ,beause it accounts for 80-85% of all cerebrovascular cases in our country (Wang and Zeng, 2011) and is one of the three principal diseases causing people to death in which seconded only to heart disease and cancer. Meanwhile, it is also the main reason of disabled people (Li, 2006).

Although, most strokes are caused by thrombotic or embolic vessel occlusions, the pathophysiological role of platelets and coagulation is largely unclear. The currently approved drugs of treating or preventing ischemic stroke have significant limitations: Either they show only moderate efficacy (platelet inhibitors), or they

significantly increase the risk for hemorrhages (thrombolytics, anticoagulants) (Kraft *et al.*, 2012).

Traditional Chinese Medicine (TCM) has for many centuries been used and it has accumulated a rich experiences in etiology, pathogenesis, treatment and prevention of cerebrovascular diseases (Peng and Sun, 2004; Liu *et al.*, 2004; Peng and Jiang, 2004; Xue and Cuo, 2004). Some Chinese herbs in the study were proved to have potential benefits on neural regeneration in cerebral ischemic injury (Si *et al.*, 2011; Xu *et al.*, 2011). These properties had prompted their compound prescription use in the management of ICVD. Many herbal formulations have been developed and used in the treatment of ICVD and were proved to be effective and safe (Wang *et al.*, 2011).

However, due to the complexity of TCM theory, the treatment principles of ICVD are complicated and mysterious. In order to explore the treatment principles more intuitively, a novel text mining method was development based on a comprehensive collection of 62,903 records of literatures (Zheng *et al.*, 2011). The study would provide an accessible way for understanding the treatment principles for ICVD with CHMs.

## MATERIALS AND METHODS

**Data collection:** The dataset were downloaded from SinoMed (<http://sinomed.cintcm.ac.cn/index.jsp>) with the query term of “Ischemic cerebrovascular disease” on September 20, 2013. This dataset contains 62,903 records of literatures on clinical practices or theoretical research on ICVD. In this dataset, each record/paper is tagged with a unique ID. These records contain the title, keywords and abstract of published papers (Zheng *et al.*, 2011).

### Data filtering:

- **TCM patter:** Pattern (also called as Syndrome, or Zheng) differentiation is regarded as the key role in the clinical practise of TCM traditional Chinese medicine (Jiang *et al.*, 2012). Usually, pattern identification is the basis of the prescription of herb formulae, CHMs, or other TCM therapies. Thus it is natural and intuitive to filter out the pattern and then try to find the association rules between pattern and CHMs. The top TCM patterns in ICVD are: the qi deficiency and blood stasis pattern (Qi xu xue yu) and the blood stasis pattern (Xue yu)
- **Chinese herbal medicine:** Based on the keyword list of CHMs (both legal names and other popular names are included for calculation), we filtered the CHMs in the plain text format and then converted all

popular names into legal names. All the CHMs were tagged with their unique paper ID. Based on the unique paper ID, we could construct the pairs of co-existed CHMs as they do coexisted in literature. For example, in one paper, CHMs of Huangqi (*Radix Astragaliseu Hedysari*), Renshen (*Radix Ginseng*) and Shengdihuang (*Radix Rehmanniae Recens*) are mentioned. Then, the pairs of co-existed CHMs of “Huangqi-Renshen”, “Huangqi-Shengdihuang” and “Renshen-Shengdihuang” are constructed

## RESULTS

In this study, focused on ICVD, we explored the principles of pattern differentiation and CHMs prescription and the association between the two aspects under the framework of TCM theory from 62,903 literatures. The network construction is based on the analysis of networks of pattern and CHM correlated with ICVD in literature. The connections among these networks are built-up under the professional knowledge of TCM.

**Major TCM patterns in ICVD:** Pattern identification is regarded as the first step during TCM clinical practice procedure. After the pattern is approved, the treatment principle can be determined. For example, when the pattern of blood stasis is approved, then the treatment principle of active blood and resolve stasis is determined. In our results, 168 TCM patterns are detected to be related with ICVD and the top 10 TCM patterns in ICVD are presented in Fig. 1. Remarkably, the top patterns focus on qi deficiency and blood stasis in ICVD.

**Most frequently prescribed CHMs in ICVD treatment:** Altogether 275 CHMs are mined from the literature in treatment of ICVD. As herbal formulae are composed by the CHMs, the list of most frequently used CHMs can certainly provide the information of TCM treatment principles more effectively due to the stability and uniqueness of each CHMs rather than formulae which can be renamed easily after slight regulation. The top 10 frequently prescribed CHMs are shown in Fig. 2. It is demonstrated that most CHMs prescribed in ICVD management are those with functions of promoting blood circulation to remove blood stasis, only 2 CHMs stand for tonification, which can help strengthen the principal curative action of activating blood circulation.

**Networks of the pattern and CHMs in ICVD:** The networks of patterns and CHMs in ICVD treatment can be

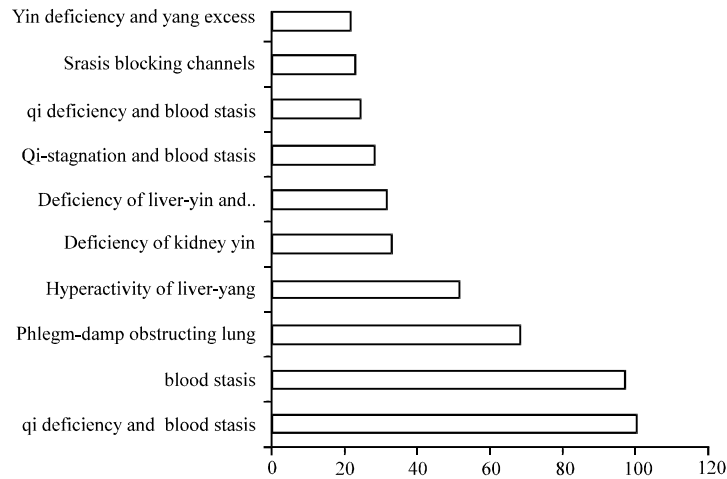


Fig. 1: Top 10 TCM patterns in ICVD

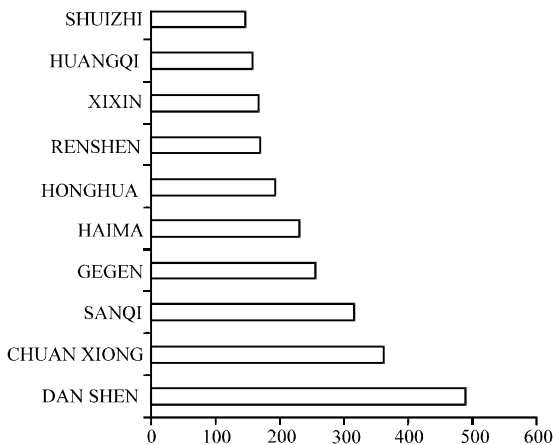


Fig. 2: Top 10 frequently prescribed CHMs in treatment of ICVD

constructed based on the co-existence frequency among patterns or CHMs, respectively. By checking these two networks, the correlation between TCM patterns and CHMs can be analyzed and explored. In order to achieve better visualization, the CHM network is simplified to preserve 13 CHMs which are the most frequently used in combination in treating ICVD. The networks of pattern and CHMs with their correlation on ICVD are demonstrated in Fig. 3. The major correlation between TCM patterns identification and CHMs are demonstrated with arrows.

### CONCLUSION AND DISCUSSION

Based on the analysis described in previous section, it is naturally come to the point that TCM

treatment principles of a disease can be reasonably mined out and presented from dataset downloaded from SinoMed. Compared with the textbook, most of the knowledge is covered by the simple and succinct networks demonstrated in Fig. 3. The knowledge can be summarized with following points:

- TCM networks of patterns and CHMs can be constructed and analyzed:** In this study, through mass calculation on dataset of ICVD, the main aspect of TCM networks were built-up. The main TCM organs (different from modern medical concept) involved in ICVD development are liver,spleen and kidney. The pathogenesis related with ICVD includes qi deficiency and blood stasis, hyperactivity of liver yang and deficiency of yin in liver and kidney. To follow the matter of course, CHMs most frequently prescribed in ICVD treatment can be grouped in two major classes, one group is responsible for promoting blood circulation to remove blood stasis, the other is responsible for help the principle action and reinforcing the healthy qi. These major principles might guide the clinicians in treatment of ICVD
- Internal connections among networks:** Through directed text mining, the internal connections among TCM networks were also found. These internal connections can be grouped into two major hierarchical clusters. Each cluster is associated with one major kind of patterns. The major treatment principles of TCM treatment of ICVD can be explored by text mining method and summarized in a succinct figure

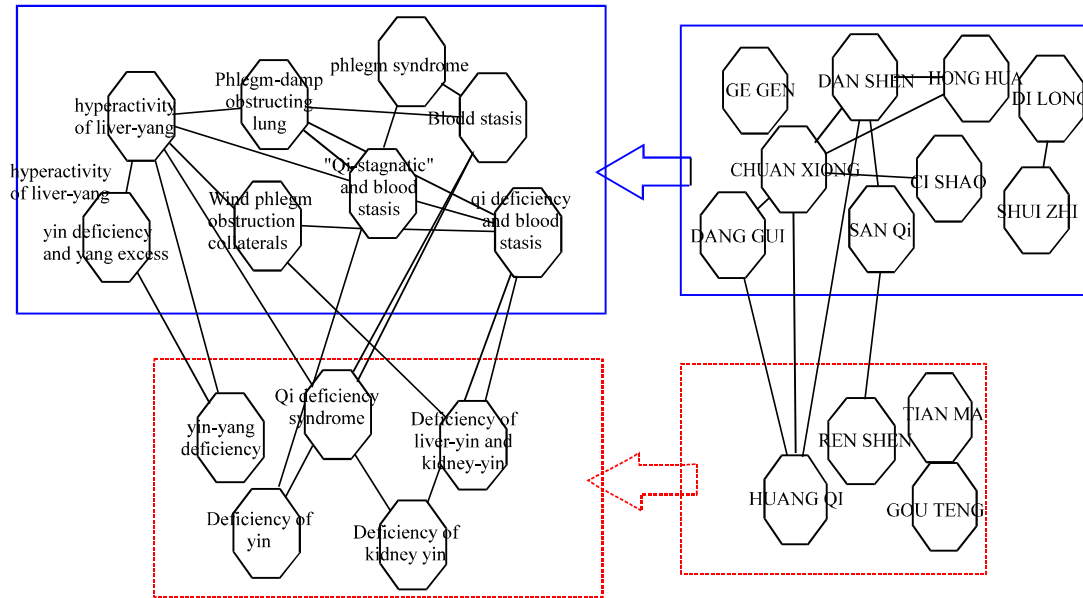


Fig. 3: Networks of TCM patterns and CHMs in treatment of ICVD. Network of patters is shown in the left part, network of CHMs in right part. Bigger shape represents higher frequencies. The lines between the shapes represent the co-existent correlations between the two patterns/CHMs. Arrows represent the correlation between TCM patterns and CHMs

- TCM Network might be useful in both TCM clinical practices and scientific researches:** The network demonstrated in Fig. 3 can be taken as a high level of abstraction on the treatment of ICVD out of dataset contains 62,903 records. From the view point of clinicians, it can be taken as a kind of reference. From the view point of basic researchers, this result might be useful to illuminate some further studies in ICVD

**ACKNOWLEDGMENTS**

This study was partially supported by Beijing Municipal Science and Technology Commission Project (No: Z12110000312006) Traditional Chinese Medicine National Professional Project 2012 (No. 201207012).

**REFERENCES**

Chen, Z.Q., 2010. The research progress of ischemic cerebrovascular disease. *Asia-Pacific Traditional Med.*, 6: 159-162.  
 Gao, J.J., Y. Inagaki, X. Li, N. Kokudo and W. Tang, 2013. Research progress on natural products from traditional Chinese medicine in treatment of Alzheimer's disease. *Drug Discov. Ther.*, 7: 46-57.

Jiang, M., C. Zhang, G. Zheng, H. Guo and L. Li *et al.*, 2012. Traditional Chinese medicine zheng in the era of evidence-based medicine: A literature analysis. *Evidence-Based Complement Alternat. Med.* 10.1155/2012/409568  
 Kraft, P., S.F. De-Meyer and C. Kleinschnitz, 2012. Next-generation antithrombotics in ischemic stroke: Preclinical perspective on bleeding-free antithrombosis. *J. Cereb. Blood Flow Metab.*, 32: 1831-1840.  
 Li, J.H., 2006. The current situation and progress about therapy of ischemic cerebrovascular disease. *Med. Recapitulate*, 12: 638-639.  
 Liu, Y.H., X.P. Zhang and G. Feng, 2004. Protecting effect of Complex Hirudo on immunity injury of cytokine in rats with focal cerebral ische. *Chinese J. Clin. Rehabil.*, 8: 3079-3081.  
 Peng, K. and H.H. Jiang, 2004. Effect of Wu long dan on contents of twenty kinds of amino acids in the brain tissue of model rats with multi-infarct dementia. *Chinese J. Clin. Rehabil.*, 8: 5470-5472.  
 Peng, K. and Z. Sun, 2004. Effects of Bu yang huan Wu tang on the contents of adenosine triphosphate, adenosine dihosphate and monoamine neurotransmitters in brain tissue of stroke sequela models of rats with deficiency of Qi and blood stasis. *Chinese J. Clin. Rehabil.*, 8: 1908-1911.

- Si, Y.C., J.P. Zhang, C.E. Xie, L.J. Zhang and X.N. Jiang, 2011. Effects of *Panax notoginseng* saponins on proliferation and differentiation of rat hippocampal neural stem cells. *Am. J. Chin. Med.*, 39: 999-1013.
- Wang, H.H. and H. Zeng, 2011. Diagnosis and treatment of ischemic cerebrovascular disease. *Chinese J. Clin.*, 39: 407-410.
- Wang, H.W., K.T. Liou, Y.H. Wang, C.K. Lu and Y.L. Lin *et al.*, 2011. Deciphering the neuroprotective mechanisms of Bu-Yang Huan-Wu decoction by an integrative neurofunctional and genomic approach in ischemic stroke mice. *J. Ethnopharmacol.*, 138: 22-33.
- Xu, J.X., M. Yang, K.J. Deng and H. Zhou, 2011. Antioxidant activities of *Dracocephalum tanguticum* maxim extract and its up-regulation on the expression of neurotrophic factors in a rat model of permanent focal cerebral ischemia. *Am. J. Chin. Med.*, 39: 65-91.
- Xue, H. and Z.K. Cuo, 2004. Effects of combined traditional Chinese medicines on brain tissue structure: Water content and enzyme activity in rats with ischemic cerebral infarction at supra-early period. *Chinese J. Clin. Rehabil.*, 8: 4530-4531.
- Zheng, G., M. Jiang, X.J. He, J. Zhao and H.G. Guo *et al.*, 2011. Discrete derivative: A data slicing algorithm for exploration of sharing biological networks between rheumatoid arthritis and coronary heart disease. *BioData Min.* 10.1186/1756-0381-4-18.