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# A new way to analyze the traditional Chinese medicine syndrome: heat toxin syndrome in cerebral infarction

Zhichen Zhang [a], Shaozhen Ji [b], Xuejie Yu [b], Xianglan Jin [b], Liping Zhang [b], Rongjuan Guo [a], Hong Zheng [a], Mingqi Wang [b], Yunling Zhang [a],*

[a] Dongfang Hospital, Beijing University of Chinese Medicine, Beijing, China
[b] Beijing University of Chinese Medicine, Beijing, China

**Abstract** *Objective:* To establish a diagnostic system for heat toxin syndrome of acute cerebral infarction. Based on this toxin syndrome diagnostic system, the general principles of heat toxin development will be uncovered, and the critical turning point at which the heat toxin syndrome occurs will also be explored.
*Methods:* In this study, a total of 271 hypertension patients with cerebral infarction within 72 h were recruited from the Affiliated Dongfang Hospital of the Beijing University of Chinese Medicine, the Affiliated Dongzhimen Hospital of Beijing University of Chinese Medicine, the Affiliated Renmin Hospital of Peking University, the Second Affiliated Hospital of Tianjin University of Traditional Chinese Medicine, the Affiliated Hospital of Shandong University of Traditional Chinese Medicine, the Affiliated Hospital of Changchun University of Traditional Chinese Medicine, the Affiliated Hospital of Hebei University of Traditional Chinese Medicine and China Meitan General Hospital from August, 2008, to December, 2009. The patients' Chinese medical information was recorded on days 1, 3, 5, 7, and 14 during their hospitalizations. The medical records were recorded according to traditional Chinese medicine (TCM) theory and included the serum marker levels at the beginning and at the end of the trial. The time line was also analyzed.
*Results:* The level of Hs-CRP, PAG, NSE, OX-LDL, and MMP-9 were abnormal and, were higher in CI patients compared to hypertension patients. In the study of the heat toxin diagnosis system, according to the entropy clustering results, 30 combinations of the medical information can be sorted into the traditional syndromes, but 13 combinations cannot be sorted. To obtain more precise symptoms related to the heat toxins, a logistic regression equation was set up with the

variables from the unsorted medical information; the dependent variables were fever and BP fluctuation. Weighted variables were obtained. MLP analysis demonstrated that the diagnosis model was stable and precise. The accuracy reached 83.82%. The ROC test showed that seven points of the diagnosis system was the best cutting point, with a sensitivity of 0.857 and a specificity of 0.955. Progressing stroke was related to heat toxin syndrome. When the turning point appeared, the combination of symptoms, such as coma, aphasia, gummy eyes, and halitosis, predicted the deterioration or recovery of CI. The heat toxin syndrome existed in every subtype of CI; however, the observed heat toxin levels were highest in PACI and lowest in LACI. Meanwhile, blood and sputum stasis syndromes transformed into heat toxicity were one source of heat toxin syndrome.

*Conclusion*: Heat toxin syndrome, as well as qi/blood/sputum stasis, co-existed in the CI patients, and the transformation frequently appeared during the process. Three to five days after the onset of CI was the turning point, at which time several combinations of medical indicators make it possible to predict the development of CI.

## Introduction

Acute cerebral infarction, also known as ischemic stroke or stroke in traditional Chinese medicine, is the sudden loss of blood circulation in the brain, causing a corresponding sudden loss of neurological function. Stroke is a huge threat to human health, which can cause permanent nerve damage. Stroke can also cause disability or death immediate diagnosis and treatment.

Hypertension is an independent risk factor for acute cerebral infarction. Hypertension marks the start of chronic damage to the cerebrovascular wall, and laboratory markers of the syndrome that manifest during an acute cerebral infarction are observed latent at this stage.

There are no effective prevention and treatment methods for ischemic stroke at present. Although administering thrombolytics is an effective method in acute cerebral infarction patients, that efficacy is limited to a narrow window of 3 h after the first stroke symptoms. Due to this limitation, most patients miss the treatment period, and it is estimated that the proportion of stroke patients who benefit from thrombolysis is less than 5%. Therefore, early warning of ischemic stroke symptoms is essential. Stroke is a major challenge for both traditional Chinese and Western medicine. Western medicine places emphasis on urgent needs in clinical research and the exact meaning of biochemical markers to evaluate the condition of the patient, for the early detection and the early treatment of stroke. Traditional Chinese medicine, in contrast, emphasizes understanding the syndrome and therapies are based on the dynamic state of a disease. Defining the type of syndrome before and after stroke is an essential prerequisite for the prescription of Chinese medicine and for providing a fundamental theory.

In both traditional Chinese and Western medicine, the analysis and diagnosis of the disease reflect an understanding of its root causes. Many modern diseases are complex, and multiple factors must be considered. In the Chinese medicine theory, external and internal pathogenic processes, give rise to pathological factors, such as wind, fire, phlegm and blood stasis. Single or complex syndrome differentiation and treatment through traditional Chinese medicine has achieved certain effects, but further improvement of the curative effect is difficult, and the efficacy achieved in clinical trials cannot be repeated. The academician Yongyan Wang, who had previous clinical experience, while reviewing the disease process, put forth the Chinese medicine theory of the "poison damaged brain"[1] in stroke patients, which obtained better curative effects in clinical practice.

Internal poison damage in the collaterals is the result of a dynamic relationship between the etiology of the disease and the pathogenesis of the disease and is also an important reason for the disease occurrence. Poison damage involves the interaction of a variety of pathogenic factors and the pathogenic transformation of multiple components. To examine internal poison damage in the collaterals, under the guidance of the whole theory, modern life science technology has become the best way to detect its causes. A large quantity of data has been collected through randomized clinical trials and analyzed by "system integration" using the modern computer and information science theory in conjunction with experimental trials to analyze and recognize different presentations of this dynamic process. Thus, such techniques as data mining and the decision tree method have assisted in the diagnosis of TCM syndrome types.[2–4] These approaches help to confirm the specific state of internal poison damage in the collaterals accurately and to execute the planned clinical treatment and will also become the crossover point between the traditional Chinese medicine and Western medicine and between traditional and modern research.

The turning point is the change of run trend or run rate in the process of disease development. In the mathematical field, this term refers to the connection point of the convex curve and the concave curve. When a point on the function of the image that makes the second derivative of the function zero, and the third derivative is not zero, this point is the turning point of the function. In everyday life, the term "turning point" is used to illustrate the decline or fall of certain circumstances after they have risen for a given length of time. Introducing mathematical theory to the study of traditional Chinese medicine theory allows a