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Design Method of Stroke Research Based On Complex Network

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Abstract: In order to understand cerebral vascular disease better in stroke, we collect the reasons of prevention and control so as to find the methods. Complex network is a new tool to find the inner factors of a real system that it can be used to cerebral vascular disease to improve the prevention and control. The custom methods provide active role for prevention and control of cerebral vascular disease, which can work together with complex network to get better. The design method of stroke based on complex network will provide the novel window for Cerebral vascular disease.

Keywords: Stroke; Cerebral vascular disease; Complex networks; Blood perfusion.

INTRODUCTION

Stroke is a catastrophic disease of mankind. It is characterized by high morbidity, high mortality, high disability rate, high recurrence rate and high economic burden. It is one of the three major causes of human death. Data from the Third National Survey of Death Causes and the China Stroke Congress show that stroke has become the first cause of death in China [1, 2]. Among the deaths caused by various causes, the proportion of stroke deaths in China is four to five times higher than that in developed countries in Europe and the United States, and at least half of the surviving patients have varying degrees of disability, and about three-fourths of the survivors are incapacitated, of which about forty percent are severely disabled.

Stroke is an acute cerebrovascular disease, which is caused by sudden rupture of blood vessels in the brain or by blockage of blood vessels that prevents blood from flowing into the brain and causes brain tissue damage, including ischemic and hemorrhagic strokes [3].

Ischemic stroke is the most common type of stroke, accounting for sixty percent to eighty percent of all the stroke types. Chronic neurological deficits such as limb paralysis caused by ischemic stroke require long-term, large amount of medical care and daily life care, bringing great burden to society and families. Therefore, the diagnosis, treatment and prevention of stroke are of great importance to human health [4].

Different types of stroke have different treatment modalities. Because of the lack of effective treatment, prevention is considered to be the best measure. Hypertension is an important controllable risk factor leading to stroke. Therefore, antihypertensive therapy is particularly important to prevent the onset and recurrence of stroke. Education on risk factors and precursory symptoms of stroke should be strengthened in order to prevent and treat stroke [2].

Prevention and control of cerebrovascular disease is a difficult problem in the field of chronic disease prevention and control. Early intervention of risk factors can effectively reduce its morbidity and mortality. With the research and development of science and technology in the field of medicine, especially in the field of emergency medical treatment, although the number of survivors after ischemic stroke is increasing, the means of prevention and treatment are also increasing, but due to strict. Because of lattice time window restriction and lack of effective methods of stroke for evaluation and prediction, which was restricted within 3 hours after onset, clinical treatment such as thrombolysis can only benefit a very small number of patients with ischemic stroke after ischemic stroke. The number of patients with chronic neurological impairment is increasing, and the vast majority of patients are facing neurological impairment. So far, there is no effective prevention and cure method for stroke prediction. Therefore, the effective prevention and treatment of ischemic stroke is one of the important medical tasks and research topics facing our country [5, 6].

METHODS

To solve this problem, we uses the advantages of network evaluation and prediction to establish a complex network model of blood flow perfusion in ischemic stroke, and studies the evaluation and prediction methods of blood flow perfusion through the

changes of network dynamics attributes, and then establishes an effective evaluation and prevention measures for ischemic stroke. It provides a new means for the diagnosis and treatment of ischemic stroke.

Hemodynamics is a branch of biomechanics. Its main task is to apply the theory and method of fluid mechanics to study the causes, conditions, States and various influencing factors of blood flow along blood vessels in order to clarify the law of blood flow, physiological significance and the relationship between blood flow and disease [7].

Complex network is a research tool. It abstracts the real system into a network by extracting the actual meaning, and then studies the physical meaning of the real system through the dynamic characteristics of the network. Complex networks use models to study the relationship between network nodes, so that people can make clear the correlation or internal relationship between the nodes in the real system, and then further explore the evolution, mechanism and application [4].

Based on hemodynamics and complex networks, combing with computed tomography, magnetic resonance imaging, ultrasound and digital subtraction imaging and so on, computer modeling methods provide a reliable data base for the establishment of personalized 3D models based on precise anatomical structures. The development of computational fluid dynamics, finite element analysis, fluid-solid coupling technology and high-performance computer hardware provides a powerful theoretical basis for hemodynamic analysis [4, 7].

Brain network is a research hot for human disease from structural and functional. With hemodynamics, we can also set up blood brain network to make research on it so as to find the mysterious of human brain.

RESULTS AND DISCUSSION

In the study of cerebrovascular diseases, the detection of cerebrovascular reactivity is a common method to identify impaired automatic regulation of cerebrovascular function [5]. Vascular examination is the most basic means of stroke detection and treatment. Because of its low cost and non-invasive operation, blood flow detection has become the most direct choice and examination means of vascular diagnosis and treatment [6], brain tissue. The changes of blood perfusion indices can directly reflect the degree of cerebral ischemia and the normal and abnormal state of brain tissue [7]. The changes of blood flow are quantitative indicators of different types of brain failure, and can indirectly reflect the degree of vascular wall lesions [8, 9]. Therefore, the evaluation and prediction of cerebral blood flow perfusion provide a direct basis for the diagnosis and prevention of stroke [10, 11]. In the study of ischemic stroke, abnormal cerebral hemodynamics is closely related to the risk of stroke, and has been considered as an important pathogenesis of ischemic cerebrovascular disease [7].

The index of blood perfusion reflects the pulsatile blood flow, which reflects the ability of blood perfusion. The larger the pulsatile blood flow, the greater the pulsating component and the greater the blood perfusion index. Therefore, measuring the site (skin, nails, bones, etc.) and the patient's own blood perfusion (arterial blood flow) will affect the value of blood perfusion index. Because sympathetic nerves affect heart rate and arterial blood pressure (affecting arterial blood flow), the human body's neuroregulatory system or mental state also indirectly affects the value of blood perfusion index. Therefore, the index of blood perfusion is different under different anesthetic conditions [12, 13].

As the most commonly used detection method for stroke, there are few tools to mine the minor changes and potential relationships contained in the blood perfusion data, but complex networks can use their own advantages to find more functions and meanings, giving it more clinical significance. Combining the research thinking of complex network and the functional characteristics of hemodynamics in ischemic stroke, a reliable complex network model is established by grasping the structural and hemodynamic changes of cerebral blood flow system, and the advantages of complex network evaluation and prediction are applied to the study of ischemic stroke. It provides a new way of thinking for prediction and prevention [4, 7, 12, 13].

Through the perfusion network, not only can the decrease of cerebral blood flow perfusion and collateral circulation in the lesion area caused by ischemic stroke be quantitatively calculated, but also the degree of stroke damage and the relationship between blood supply improvement can be evaluated, and the vascular compensatory capacity can be predicted. In addition, the security and robustness of blood perfusion, including the stability of various pathways and the connectivity of regions, can be studied by evaluating and predicting the effectiveness of blood flow networks and the buffering and compensating capabilities of individual sites or vessels [14, 15].

Blood flow perfusion assessment is helpful for the selection of treatment options, clinical prognosis and risk stratification of ischemic stroke; on the basis of the assessment, changes in network indicators can predict risk factors, the risk of vascular access decompensation, the health of individual nodes or vessels, and so on, and then proceed. Early diagnosis

and monitoring can even delay or prevent recurrence of stroke [16, 17].

CONCLUSION

In this paper, we put forward a design method for stroke research with hemodynamics and complex networks, which provides a new way to make research for stroke prevention and control. This design will establish a new method and strategy for the effective evaluation and active prediction of stroke. It will play a guiding role in the diagnosis, injury and risk assessment, treatment and prevention of stroke. It is of great theoretical and clinical significance to provide a reference for the evaluation, prediction and prevention of neurological function after ischemic stroke, as well as for the evaluation, diagnosis, treatment and monitoring of stroke by clinical staff.

Of course, any research needs to be combined with practice, especially clinical practice to be more meaningful and convincing, but this method not only provides theoretical support for stroke research, but also can be applied to clinical practice, through practice to verify the theoretical method, and improve the theoretical method of research.

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