Discussion on the Construction of Stroke Treatment Network under the Background of Big Data

ZhengGong Shao1 *
1 Wuhan University of Science and Technology, Wuhan, China
*Corresponding author e-mail: 2016075380@qq.com

Abstract. Stroke, also known as cerebrovascular disease, is one of the diseases with high morbidity, mortality, disability rate and recurrence rate in China. According to the epidemiological survey data released by the Chinese association of stroke, there are 14.94 million stroke patients in China, with a prevalence of 11.14.8 per 100,000 and a incidence of 246.8 per 100,000.Cerebrovascular diseases kill 1.54 million people every year, with a mortality rate of 114.8 per 100,000.It is very important for stroke patients to receive thrombolytic recanalization within "golden hour". The purpose of this paper is to analyze how the current network model of regional heart and brain therapy is implemented and how to integrate scattered stroke data locally into a complete national data network. Stroke centers can use information analysis technology to identify potential stroke patients and provide timely treatment for stroke patients. This is also a new direction of stroke treatment that this paper aims to explore.

Keywords: Stroke Treatment, Big Data, First Aid Network Construction

1. Introduction

With the development of industrialization, urbanization, aging population, ecological environment and lifestyle changes, chronic non-communicable diseases (hereinafter referred to as chronic diseases) have become the main cause of death and disease burden of residents. Cardiovascular and cerebrovascular diseases, cancer, chronic respiratory diseases, diabetes and other chronic diseases account for more than 70% of the total disease burden, and have become an important factor restricting the improvement of healthy life expectancy.[1]

Most of the researches on stroke prevention and treatment in China focus on the investigation of the current situation of stroke.In China, chronic stroke is the leading cause of death among Chinese residents, and its number has been rising steadily, becoming a major economic and health problem in China. According to the latest data, China has 290 million patients with cardiovascular and cerebrovascular diseases, and 3.5 million people die of cardiovascular and cerebrovascular diseases every year. The cost of diagnosis and treatment of cardiovascular and cerebrovascular diseases is as high as 300 billion yuan, far more than western countries in Europe and the United States; Deaths from cardiovascular disease will increase to 20 million by 2030.The current development of stroke in China is shown in picture 1.

For the prevention and treatment of stroke in China, the foreign research and understanding are insufficient. European and American scholars even know little about the
phenomenon of promoting stroke prevention and treatment through big data in China. In the severe form of stroke prevention and treatment, China brain defense committee established a set of unique stroke treatment network mode with the stroke emergency map of China as the breakthrough point. It is of great practical value to study the current data of stroke prevention and control in China.

![Incidence of stroke in China From 2005 To 2016. (unit: 10000)](image)

Figure 1. Incidence of stroke in China From 2005 To 2016. (unit: 10000)

2. The methods and procedures of applying data in the stroke treatment network in dispersed areas

2.1. How the stroke network works

Regional management in the stroke treatment network includes hierarchical management of stroke center, standardized electronic medical record management, and emergency database management of stroke, and a closed-loop management system of the whole process is constructed.

2.1.1. Regional management is the key to the normal operation of stroke treatment network.

There are hundreds of stroke emergency centers in China, and the conditions in each center are complex and varied. To manage such miscellaneous data needs to be refined. First, the national database of stroke centers in China was classified according to the classification of stroke centers. There are three types of stroke centers in China: demonstration stroke centers, advanced stroke centers and stroke prevention centers. The three correspond to the first-aid scope of the province, city and county. Emergency patients can choose the corresponding treatment area according to their own region. Stroke centers at all levels then divided their patient records by disease type. These patient databases will eventually be uploaded to the data center of the China brain defense commission to facilitate the central government's analysis and evaluation of stroke prevention and control in various regions. The current status of stroke centers in China is shown in table 1.

| Unit level | Demonstration advanced stroke center | Advanced stroke centre | Advanced stroke center construction unit | Demonstration stroke center | Stroke prevention center |
|------------|-------------------------------------|------------------------|-----------------------------------------|----------------------------|-------------------------|
| 2018       | 25                                  | 243                    | 144                                     | 157                        | 36                      |
| 2019       | 30                                  | 265                    | 171                                     | 181                        | 51                      |
2.1.2. Expand the collection of health information about potential patients through social media such as WeChat. In-hospital patient information is sufficient to meet the needs of stroke treatment, but to achieve stroke prevention, more health information of potential population needs to be collected. Chinese social media, represented by the WeChat public account, quickly spreads the information needed by the audience through one-to-many forms.[2] Currently, this model is the best way to expand communication with potential patients. The public id of the stroke center can help the public identify stroke symptoms early. At the same time, the public account is used to quickly search the golden emergency circle and select the nationally certified stroke center (hospital). According to the information of the patients in the public account, optimize the hospital path to reduce the delay of illness to call for help. In view of the fact that most of the potential stroke patients are middle-aged and elderly, the publicity mode and operation process of public accounts need to be more simple and easy to understand, so as to facilitate the learning and use of potential patients.

2.1.3. The establishment of the green channel of hospital one-link service can help the treatment of stroke better, and its normal operation needs a set of efficient green channel information management system. The golden time for stroke treatment is short and the preparation time is long, so it is necessary for stroke centers to speed up the efficiency of admission treatment for stroke patients. After stroke patients are sent to the hospital for emergency treatment, one-stop green channel services are integrated including registration, initial diagnosis, triage, examination, image examination, drug collection, payment, treatment and consultation. The stroke center information management system can integrate many processes and links in the patient treatment into the information system, which greatly improves the working efficiency of the stroke center.

2.2. With the help of big data, stroke treatment network workflow shows up

If the stroke treatment network engineering is divided into modules, then we can get four ways of stroke treatment.

2.2.1. From the perspective of structural analysis, the operation of the stroke treatment network is divided into four steps: regional management, patient information acquisition, pre-hospital first aid and green channel treatment. The sequence of regional management, patient information acquisition, pre-hospital first aid and green channel treatment is arranged according to the sequence of big data playing a role in the stroke treatment network. From the perspective of big data, we can well observe how information analysis technology plays a role in modern medical treatment [3], but the disadvantages of this process are also obvious: it is too simple and ignores many details of the work. Without these details, the network of stroke care cannot be put into practice. Its operation process is shown in picture 2.

Figure 2. Stroke treatment network workflow

2.2.2. If we look at stroke care from the patient's point of view, we'll come up with a completely different set of flow patterns. The patterns that are used in stroke centers are what we might call the "post-hospital model," which is less sensitive to the patient's experience. The process of patient visit is called "pre-hospital mode"[4], which can better reflect how stroke patients find the best way to see a doctor through big data. According to brain committee official proof, stroke center in hope to provide patients with "taking patients as the center, the use of information technology, the advanced Internet + provide pre-hospital - the courts integration seamless, efficient and orderly stroke first aid medical services standardization, and on this basis to explore the classification treatment and regional coordination and preserving treatment network model". The biggest effect of this technology is to guide patients to the right green channel in time. Currently, there are three ways for patients to visit designated stroke centers. The first way is for patients to seek the designated
stroke center through the national emergency stroke map and come to the hospital for treatment by themselves. The second is for emergency patients to call 120 through the smart emergency APP. The emergency center determines the emergency type of patients through the emergency information center of the stroke center and finally the call 120 is transferred to the designated emergency channel. The third condition is the green channel emergency treatment referred between affiliated hospitals of the stroke center hospital. The operation of "pre-hospital mode" needs a set of well-functioning management platform to ensure the seamless connection of online work for stroke treatment.

The biggest difference between "pre-hospital mode" and "post-hospital mode" treatment network is that the pre-hospital treatment network can make better use of patients' data. The "prehospital model" can provide more patient advice and ideas, which can help stroke centers better identify gaps in stroke care. Of course, each has its own function, and the value of the other cannot be denied.

3. Current problems faced by the national brain defense commission in the construction of China's stroke treatment information management system

3.1. The stroke emergency map in China, the key to the informationized stroke emergency engineering, failed to achieve the desired effect.

The China brain defense commission expects to use the Chinese stroke emergency map to bridge the gap between the middle line and the offline line of stroke emergency, so as to achieve better results in the construction of stroke centers. However, there is an obvious problem with the actual stroke emergency map in China. As an APP driven by the government, its use and review logic is not based on users but on facilitating the work of the brain defense commission. According to its red letter on strengthening the construction of national stroke emergency map, "map management units in various regions should regularly promote quality control management, training and education, and data reporting, so as to promote the orderly and efficient operation of stroke emergency map". This indicates that the brain defense committee assigned the construction of emergency stroke maps in China to local stroke centers [5], but the brain defense committee does not need to provide any explanation for the submission of these data. Its application process is shown in picture 4.

![Figure 3. Application process of stroke emergency map in China](image)

3.2. The application and approval of information in stroke centers are slow, and the information base of patients cannot be updated timely.

At present, China has realized the prevention and treatment of stroke centers and superior units all online office. However, due to the fact that stroke treatment involves the operation of hospital administrators, the use of APP exclusive to the stroke team, the reporting of patients' cases, the operation of 120 administrators and other operations in different environments [6], the complexity of the practice is much higher than the traditional offline communication.

3.3. There is no communication between the emergency information system and the hospital's neurosurgical record system.

The stroke center information system has two important data sources: one is the 120
emergency care system that feeds into the stroke center. The other is information on the neurosurgical department responsible for care. The emergency care system is responsible not only for information processing in the stroke center, but also for information reporting in the chest pain center and ICU. Therefore, the authority of data management in the 120 emergency care system in the hospital is higher than that in the stroke center, and there is no need to report to the stroke center. At the same time, the stroke center only passively waited for the data feedback from the 120 emergency care system, and there was no corresponding action to communicate with the 120 emergency care center.

4. Conclusion
At present, stroke treatment is undergoing a profound historical transformation under the role of big data. The establishment of a national stroke treatment network has greatly facilitated the treatment and prevention of stroke centers. At the same time, the current is also the exploration stage of the construction of stroke treatment network. The problems of bureaucracy and formalism have always existed in the construction of stroke centers in China, but it is undeniable that the brain prevention committee plays a key role in promoting the systematization and dataization of stroke centers \[7\]. With the increasing number of cerebrovascular patients in China, stroke treatment in China will face more crises and challenges in the future. How to make better use of big data to promote stroke treatment will be a problem that stroke treatment workers in China must face.

References
[1] Researchers from University of Guelph Report Details of New Studies and Findings in the Area of Bioinformatics, A Scoping Review of 'big Data', 'informatics', and Tbioinformatics' In the Animal Health and Veterinary Medical Literature, [J]. Computers, Networks & Communications, 2020.
[2] Jones Mike, Collier George, Reinkensmeyer David J, DeRuyter Frank, Dzivak John, Zondervan Daniel, Morris John, Big Data Analytics and Sensor-Enhanced Activity Management to Improve Effectiveness and Efficiency of Outpatient Medical Rehabilitation, [J]. International journal of environmental research and public health, 2020, 17(3).
[3] Das Anthony Vipin, Kammari Priyanka, Vadapalli Ranganath, Big data and the eyeSmart electronic medical record system - An 8-year experience from a three-tier eye care network in India, [J]. Indian journal of ophthalmology, 2020, 68(3).
[4] X. Borrat, L.A. Celi, C. Ferrando, Big data techniques for the secondary use of clinical data in the generation of medical knowledge. The MIMIC solution, [J]. Revista Española de Anestesiología y Reanimación (English Edition), 2019, 66(10).
[5] Chung-Y Hsu, Shinn-Zong Lin, Increased risk of strokes in patients with chronic low back pain (CLBP): A nationwide population-based cohort study, [J]. Clinical Neurology and Neurosurgery, 2020, 192. (in Chinese)
[6] Kyung-Jong Yoo, Hyun-Chel Joo, Axillary artery cannulation reduces early embolic stroke and mortality after open arch repair with circulatory arrest, [J]. The Journal of Thoracic and Cardiovascular Surgery, 2020, 159(3).
[7] Mayank Goyal, Johanna Ospel, Challenges to stroke care 5 years after endovascular therapy became the standard, [J]. The Lancet Neurology, 2020, 19(3).