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Research Article

Awakening Effect of Transcranial Magnetic Stimulation with Multimodal Magnetic Resonance Imaging under Three-Dimensional Reconstruction Algorithm Combined with Wake-Up Nursing on Patients with Massive Cerebral Infarction

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This study was aimed to provide arousal treatment for disturbance of consciousness in patients with massive cerebral infarction, using multimodal magnetic resonance imaging (MRI)-assisted transcranial magnetic stimulation (TMS) under three-dimensional reconstruction algorithm combined with wake-up nursing. The application effect was also evaluated. 80 patients with massive cerebral infarction were selected as the research objects. These patients were divided into the control group (routine nursing and TMS) and the experimental group (routine nursing, multisensory stimulation wake-up nursing, and TMS) according to the even- and odd-numbered admission orders. There were 40 cases in each group, and the treatment effects of the two groups were compared and analyzed. The peak signal-to-noise ratio (PSNR) (800 dB) of the bilateral filtering algorithm was higher than that of the wavelet threshold denoising (321 dB) and the nonlocal mean filtering algorithm (455 dB). The segmentation accuracy of the improved region growing method/fuzzy spatial clustering algorithm (96.21% and 97.22%) was higher than that of the unimproved ones (82.11% and 79.99%). The Glasgow Coma Scale (GCS), Coma Recovery Scale-Revised (CRS-R), and Dysfunction Scale (DFS) scores of the experimental group were significantly higher than those of the control group 1 week and 2 weeks after treatment ($P < 0.05$). The awakening rate of patients in the experimental group (95%) was also significantly higher than that in the control group (72.5%), and the time needed for waking up was (2.28 ± 2.92) hours, lower than that in the control group (4.34 ± 3.49) hours ($P < 0.05$). The three-dimensional reconstruction algorithm could effectively improve the display effect of MRI images and assist in the examination of diseases. Multisensory stimulation wake-up nursing combined with TMS could promote patients to wake up more quickly and help the recovery of brain function of patients in the treatment of massive cerebral infarction and disturbance of consciousness.

1. Introduction

Disturbance of consciousness is one of the common main symptoms of patients with massive cerebral infarction, and it is closely related to the cerebral edema and neurotransmitter reduction and easily induces a series of complications [1–3]. Studies have revealed that the longer the disturbance of consciousness, the poorer the patients' recovery, and the higher the disability and mortality [4]. Therefore, promoting the recovery of patients' consciousness has received the attention of global clinical research studies. Clinical studies have found that stimulation of peripheral signals plays an important role in the reorganization and compensation of damaged brain functions [5]. Multisensory stimulation wake-up nursing is to stimulate the senses such as hearing, vision, motion, touch, and smell, so as to promote the excitability of nerve cells and accelerate the recovery of consciousness [6–8]. Research studies have proved that wake-up nursing is worthy of recognition in promoting the self-repair of neurological function and the recovery of consciousness state in patients with disturbance of consciousness [9, 10]. Multisensory stimulation wake-up nursing indirectly suggests the feasibility of transcranial magnetic stimulation (TMS) in the application of consciousness awakening in severe disturbances of consciousness [11]. TMS is a painless and noninvasive cranial therapy technique because it stimulates the neural excitatory or inhibitory functions of the cerebral cortex through magnetic signals [12]. TMS has been widely used for nonpharmacological treatment of neurological disorders [13] and psychiatric disorders [14]. However, there are few studies about TMS combined with wake-up nursing in the treatment of massive cerebral infarction, and further research is needed.

Due to the lack of specific manifestations in the early stage, the diagnosis of massive cerebral infarction is difficult, and the clinical efficacy is not significant. Therefore, the examination method has attracted attention [15]. Magnetic resonance imaging (MRI) examination has a good effect on massive cerebral infarction, but different MRI sequences have different effects on brain image display. For example, the cerebral cortex is shown by T1-weighted imaging (T1WI) and T2-weighted imaging (T2WI) mainly with high signals, while the equal signal is mainly displayed by diffusion-weighted imaging (DWI) and susceptibility-weighted imaging (SWI); the characteristics of each sequence are different [16]. Therefore, a multisequence MRI examination, multimodal MRI technology, has been proposed; this technology has been widely used in the diagnosis of various clinical diseases. However, the complexity of brain structure and individual differences lead to complex and difficult segmentation of MRI brain images of interest. Currently, the segmentation and three-dimensional reconstruction of MRI brain images are the hot topics in medicine and image processing. Three-dimensional reconstruction technology has been widely applied in diseases of the brain, pelvis, etc. Studies have also shown that three-dimensional reconstruction technology can assist the treatment of patients and improve the treatment effect and functional recovery of patients [17, 18]. The removal of noises and skull and tissue segmentation can affect the three-dimensional reconstruction of the image. The bilateral filtering algorithm has a good application effect in the denoising of medical images. Lee et al. [19] utilized the bilateral filtering algorithm for denoising in the skin surface three-dimensional reconstruction algorithm. The results showed that this method could reconstruct skin surfaces accurately. Marching cubes is also of great significance in three-dimensional image reconstruction, but the traditional marching cubes technology has poor smoothness of three-dimensional images. To improve the reconstruction effect, the improved regularized marching cube (RMC) method was adopted for three-dimensional reconstruction of images.

To sum up, it was to promote the development of neurocritical nursing and provide more effective treatment methods. The disturbance of consciousness in patients with massive cerebral infarction was treated with multimodal MRI-assisted TMS combined with wake-up nursing under the three-dimensional reconstruction algorithm. Its treatment effect was then evaluated, to provide a more effective research basis for the formulation of treatment plans for patients with clinical disturbance of consciousness.

2. Research Methods

2.1. Research Objects. Eighty patients with massive cerebral infarction, who were admitted to the hospital from October 2020 to March 2022, were selected as research objects. There were 48 male patients and 32 female patients, aged 25–60 years, with an average age of 51.36 ± 9.06 years. Their body mass index (BMI) was 22–26 kg/m^2, with an average BMI of (23.73 ± 0.99) kg/m^2. The course of disease was 1–7 hours, and the average course of disease was 4.23 ± 2.11 hours. 52 cases were infarcted in anterior circulation and 28 cases in posterior circulation. According to the even and odd numbers of the admission orders, the patients were divided into control group and experimental group. The patients in the control group were given routine nursing and TMS, while those in experimental group was treated with a combined treatment of routine nursing, multisensory stimulation wake-up nursing, as well as TMS. 40 cases were in each group, and the patients in both groups were diagnosed with multimodal MRI under RMC three-dimensional reconstruction algorithm. After that, the treatment effects of the two groups were compared and analyzed. This study was approved by the ethics committee of the hospital.

Inclusion criteria were as follows: their age ≥18 years old, and the gender was not limited; Glasgow Coma Scale (GCS) score ≤14 points; the patients were diagnosed with massive cerebral infarction through computerized tomography or MRI of the head; the informed consent of patients' families was obtained.

Exclusion criteria were as follows: there were implanted metal objects in the body; the patients were complicated with refractory epilepsy or uncontrolled epilepsy; those patients had unstable vital signs, such as deep coma, mydriasis, and shock; those patients withdrew from the research due to various reasons.

2.2. Three-Dimensional Reconstruction Algorithm. The first was image denoising. To improve the quality of MRI brain images, bilateral filtering [20] was adopted for denoising. Bilateral filtering was on the basis of Gaussian filtering and optimized the spatial proximity weight of center point. The specific expression was as follows:

$$g(i,j) = \frac{\int_{(k,l)\in S(i,j)} f(k,l)\, w(i,j,k,l)}{\int_{(k,l)\in S(i,j)} w(i,j,k,l)}, \tag{1}$$

where $g(i,j)$ represented the output point, $S(i,j)$ represented the range centered on (i,j), $f(k,l)$ was the input point, and $w(i,j,k,l)$ was the value obtained by two Gaussian function calculations.

$$w = wG \cdot wR, \tag{2}$$

$$wG = \varepsilon \cdot - \left| (i-k)^2 + (j-l)^2 \right| \cdot \frac{1}{2\omega_G^2}, \tag{3}$$

$$wR = \varepsilon \cdot \dashv f(i,j) - f(k,l)|^2 \cdot \frac{1}{2\omega_R^2}. \tag{4}$$

In equations (2), (3), and (4), wG was the spatial proximity Gaussian function, while wR was the pixel similarity Gaussian function. ε represented the constant and ω was the Gaussian coefficient. To make the calculation easier, $w(i,j,k,l)$ was set to be q, and then the following equation was obtained:

$$g(i,j) = \frac{(f_1 \cdot q_1 + f_2 \cdot q_2 + \cdots + f_e \cdot q_e)}{(q_1 + q_2 + \cdots + q_e)} \tag{5}$$

$(q_1 + q_2 + \cdots + q_e) = Q$, from which the following equation was worked out:

$$g(i,j) = f_1 q_1 \cdot \frac{1}{Q} + f_2 q_2 \cdot \frac{1}{Q} + \cdots + f_e q_e \cdot \frac{1}{Q}. \tag{6}$$

The obvious expressions of the convolution operation between the image matrix and the kernel were observed from the above. $q_e \cdot (1/Q)$ stood for the weight of the e-th. The weighted sum was made by the convolution operator, and the output value was finally obtained.

The second was to remove skull in the image.

When the MRI skull was segmented, the more commonly used algorithm was the region growing algorithm, but this method was limited by the unclear border between the skull and brain tissues [21]. Therefore, a method combining automatic thresholding and boundary tracking was put forward. The specific steps were as follows:

The first step: the automatic threshold was adopted to obtain the MRI binary image, and then the pixel point $S(i,j)$ was obtained. The pixel point that satisfied equations (7), (8), and (9) was set as the starting point D.

$$S(i,j) = 0, \tag{7}$$

$$S(i-1,j) + S(i,j-1) + S(i+1,j) + S(i,j+1) < 4, \tag{8}$$

$$S(i-1,j) + S(i,j-1) + S(i+1,j) + S(i,j+1) > 0. \tag{9}$$

The second step: 8 neighborhood points of the coordinates of point D were found in a clockwise direction to satisfy equations (7), (8), and (9), and the satisfied point was set as the new point D. The second step was repeated. Otherwise, it was observed whether there was a D point in each neighborhood point; if it existed, it meant that the boundary search was successful; if not, the third step was carried out.

The third step: the stack was observed. If it was not empty, the top element of the stack was set as D and the first step was repeated. Otherwise, the boundary search failed, which indicated that there was no boundary point.

The fourth step: the algorithm terminated when two boundary points were found.

The third was tissue segmentation.

An improved fuzzy spatial clustering algorithm [22] was used to extract brain tissue in the image. It was supposed that the set of pixel grayscales in the image was expressed as

$$P = (p_1, p_2, \ldots, p_m). \tag{10}$$

Then, the expression of the fuzzy spatial clustering objective function could be expressed as

$$Az(U,V) = \int_{i=1}^{c} \int_{j=1}^{m} \delta_{ij}^{z} (x_i - v_i)^2. \tag{11}$$

where z represented the weighted index, and $1 < z < \infty$. v_i represented the pixel grayscale value of the i-th clustering center, and c represented the number of clustering centers. stood for the similarity measurement method between the data point and the clustering center, and (U,V) was the pixel point. The peak F was obtained by the automatic peak detection method and designated as clustering center. In the same way, the number of peaks was c. Thus,

$$2 \le c \le m, \tag{12}$$

$$\delta_{ij} = \frac{1}{\int_{k=1}^{c} \left\{ (x_j - v_i)/(x_j - v_k) \right\}^{2/(z-1)}}. \tag{13}$$

The membership function could be obtained with equation (13). Then, the spatial cost function K_{ij} was imported to suppress noise, and the expression of K_{ij} was as follows:

$$K_{ij} = \int_{k=\mathrm{NB}(x_j)} \delta_{ik}. \tag{14}$$

$\mathrm{NB}(x_j)$ represented the window centered on x_j. When the pixel grayscale values were the same, the value of K_{ij} was greater, so there was a new membership function of

$$\delta_{ij} = \frac{\delta_{ij}^{o} K_{ij}^{b}}{\int_{k=1}^{c} \delta_{ij}^{o} K_{ij}^{b}}. \tag{15}$$

o and b mainly controlled the importance of two functions. The membership function needed to satisfy equation (16), and the clustering center was updated through equation (17).

$$\int_{k=1}^{c} \delta_{ij} = 1, \begin{cases} 1 \le j \le m, \\ \delta_{ij} \in [0,1], \end{cases} \tag{16}$$

$$v_{ij} = \int_{k=1}^{m} \frac{(\delta_{ij})^z \cdot x_k}{(\delta_{kj})^z}. \tag{17}$$

After that, the membership function matrix obtained by equation (13) was substituted into equation (11) to obtain a new objective function. When it satisfied $|A_z - A_{z-1}| \le 3$, the iteration was terminated; otherwise, it was started over from the third step.

The denoised images, skull-removed images, and brain tissue segmentation images obtained by the above algorithms were reconstructed three-dimensionally using the RMC algorithm. The three-dimensional reconstruction method of RMC algorithm could be divided into three parts of surface judgment, merging of seed iso-surface, and iso-surface triangulation. The algorithm application steps were as follows. On the marching cube (MC) algorithm, the direction of the iso-surface was judged to get a surface lookup table, which would pave the way for the next step of iso-surface merging. The seed iso-surfaces were set, the normal was calculated, and the iso-surfaces were merged according to the conditions. The approximation plane was set, and all the vertices of the iso-surface boundary were projected to form a triangular mesh. So far, the three-dimensional reconstruction was completed.

For the evaluation indexes, the peak signal-to-noise ratio (PSNR) was used to evaluate the denoising effect, the segmentation accuracy was to evaluate the segmentation effect, and the three-dimensional reconstruction effect was evaluated by the subjective observation. The specific calculation is shown as follows:

$$\mathrm{PSNR} = 10\log_{10}\left[\frac{225^2}{\sum_{i=1}^{Q}\sum_{j=1}^{E}\left(Y_{ij} - X_{ij}\right)^2/QE}\right]. \quad (18)$$

In the equation above, Y_{ij} and X_{ij} stood for the grayscale values of the reconstructed image and the original image, respectively. Q and E represented the row and column of the image, respectively. The higher the PSNR, the better the denoising effect.

$$\mathrm{Acc} = \frac{1}{P}\cdot\sum_{j\in C}\left(\frac{R_i}{T_i}\right). \quad (19)$$

P was the number of samples in the test set, C was the set of pixels in the test set, R was the number of correct pixels in the predicted image, and T was the number of pixels of positive samples in the labeled image.

2.3. Examination Method. The examination was performed with 3.0 T MRI scanner and the head coils. The scanning range was from the cranial top to the lower border of the foramen magnum. The patients were instructed to take the supine position, and routine MRI plain scanning (T1WI and T2WI), DWI, and SWI were performed. The specific scanning parameters are shown in Table 1. All the examination images were uploaded to the postimage management system and were processed through three-dimensional reconstruction technology.

2.4. Treatment Methods. The control group received routine nursing and TMS. The routine nursing care included drug treatment as ordered by the doctor immediately after admission, nasogastric feeding to maintain water and electrolyte balance, indwelling catheterization, urethral orifice care, maintaining airway patency, and oral care. The nurse should also help the patients turn over, pat the back, suck phlegm, prevent from pressuring wounds, and place limbs in the good position. Traditional rehabilitation treatments such as acupuncture and physiotherapy were also included. Magnetic stimulation therapy adopted repetitive TMS. The research objects lay flat naturally and were connected to the magnetic stimulation device. For the parameter setting, the stimulation intensity was set to 80% of the motion threshold at rest, and the frequency was 20 Hz; after the stimulation for 1 s, the interval lasted for 6 s. 1200-pulse treatment was given for 7 minutes, once a day and 6 times a week. The stimulation sites were selected from the dorsolateral prefrontal cortex.

In addition to the routine nursing and TMS therapy in the control group, the patients in the experimental group were given multisensory stimulation wake-up nursing as well. The auditory stimulation consisted of the verbal wake-up method and music wake-up method. For the verbal wake-up method, a visit of the patient's relatives and friends (spouse, parents, children, etc.) was scheduled once a day. These relatives and friends were instructed to call the patients' name in the ear and talk to the patients with their favorite, most concerned, or other important things before the onset of the disease, which lasted for 30 minutes. For the music wake-up method, the music that the patients usually liked or were familiar with were repeatedly played at a moderate volume, as the music were understood and carefully selected by the patients' families. This method was carried out for 30 minutes each time, 4 times a day. The visual stimulation adopted the colorful lighting method. With adjustable colorful flashlight, the pupils of the patients were stimulated. It lasted for 30 s for each pupil alternately, 5 times a day. The tactile stimulation included massage stimulation and thermal stimulation. For the limb massage method, the cheeks, ears, arms, and legs of patients were gently touched, and the joints of the upper and lower limbs were massaged. The massage should be gentle, and the duration of each time was about 15–20 minutes, once in the morning and once in the evening. For the thermal stimulation method, two rubber gloves were taken, as one was filled with cold water and the other was filled with hot water. They were placed on the palm or sole of the patients. Each of the hot and cold stimulation lasted for 2 minutes, and the cold and hot stimulations were alternated for 5 times for each operation, once performed in the morning and once in the evening. The olfactory stimulation was the aromatherapy. 0.64 g vanilla essential oil was mixed with 100 mL distilled water, and 10 drops were dropped on a gauze. The gauze was placed about 10 cm away from the head of patients, and the stimulation lasted for 10 s each time, once a day. Taste stimulation was the stimulation of taste buds on the tongue. In the condition that the patients' oral secretions would not cause aspiration to the patients, a cotton swab dipped in saline or lime juice was used to stimulate the front part of the tongue, 5 stimulations each time, 2 times a day. Kinesthetic stimulation was about the limb movement sense. The charge nurse or rehabilitation physician conducted passive movements regularly such as extension, flexion, and external rotation of each joint of the limbs for the patients. The movements were gentle, and the vital signs of patients

Table 1: Scanning parameters of each sequence.

	T1WI	T2WI	DWI	SWI
Time of repetition (ms)	250	4000	5700	25
Time of echo (ms)	2.3	89	90	18
Layer thickness (mm)	4.5	4.5	4.5	2.0
Field of view (mm^2)	220 × 220	220 × 220	220 × 220	220 × 220
b value			10,1000	

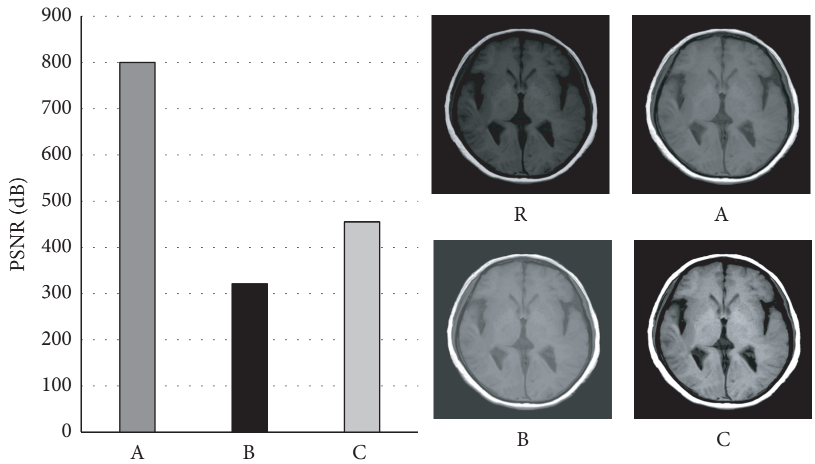

Figure 1: Comparison of PSNR and images. R, A, B, and C indicated the original image, bilateral filtering algorithm, wavelet threshold denoising, and nonlocal mean filtering algorithm, respectively.

were also monitored during the movements. The amount of exercise could be gradually increased if the condition permitted, 15–30 minutes each time, twice a day in the morning and evening, respectively.

2.5. Observation Indexes. The GCS [23], Coma Recovery Scale-Revised (CRS-R) [24], and Dysfunction Scale (DFS) [25] were used as the evaluation indexes, which were collected at the same time period (at admission, 1 week after treatment, and 2 weeks after treatment) of patients in each group. The awakening rate and time needed for waking up of the two groups of objects were also observed.

2.6. Statistical Methods. SPSS 20.0 was used for analysis. The enumeration data were expressed as case (%), and the chi-square test or rank sum test was adopted for the comparison between groups. The measurement data were expressed as ($x(\_) \pm s$), and the t-test was for the comparison between groups and within the group before and after treatment. $P < 0.05$ was considered to be statistically significant.

3. Results

3.1. Comparison of Image Processing Effects. As shown in Figure 1, the PSNR of bilateral filtering algorithm, the wavelet threshold denoising [26], and the nonlocal mean filtering algorithm [27] were compared. The results showed that the PSNR (800 dB) of the bilateral filtering algorithm was higher than that of the wavelet threshold denoising (321 dB) and the nonlocal mean filtering algorithm (455 dB).

The segmentation accuracy was utilized to evaluate the skull segmentation results of the region growing algorithm before and after the improvement. It was concluded that the accuracy of the improved region growing method (96.21%) was higher than that of the unimproved region growing algorithm (82.11%), which could be observed from Figure 2. Besides, the segmentation effect on the brain tissue of the fuzzy spatial clustering algorithm was also evaluated before and after its improvement. The results in Figure 3 suggested that the segmentation accuracy of the improved fuzzy spatial clustering algorithm (97.22%) was higher than that of the unimproved algorithm (79.99%).

The three-dimensional reconstruction of the brain MRI image was performed on the grounds of the above three kinds of data, and Figure 4 displays the three-dimensional reconstruction images in different directions. The tissue structure of the brain could be clearly observed from the three-dimensional MRI images from the following two directions, suggesting that the three-dimensional reconstructed images had a certain usability.

3.2. Comparison of General Data. Figure 5 presents the distribution of gender, age, BMI, course of disease, and infarction location of patients of the two groups. It could be found that the gender distribution, average age, average BMI, average course of disease, and infarction location of patients in the experimental group were not significantly

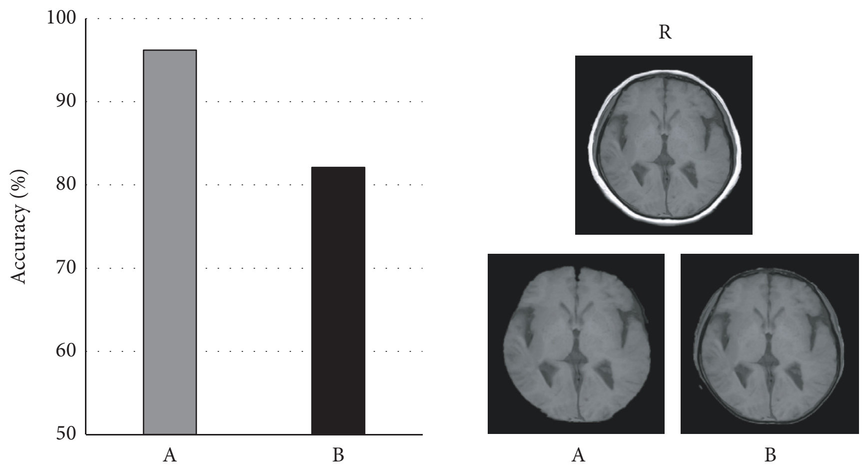

Figure 2: Comparison of skull segmentation effects. R: original image; A: improved region growing algorithm; B: region growing algorithm.

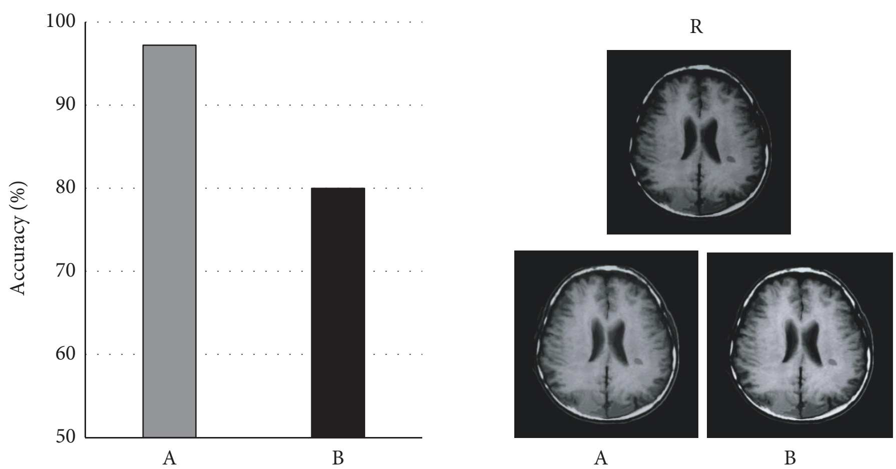

Figure 3: Comparison of brain tissue segmentation effects. R: original image; A: improved fuzzy spatial clustering algorithm; B: fuzzy spatial clustering algorithm.

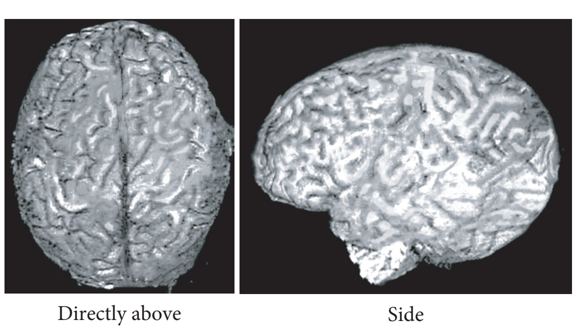

Figure 4: Display of the three-dimensional reconstruction effect.

different from those in the control group ($P > 0.05$). This suggested that there was certain feasibility of the research.

3.3. Comparison of Scores before and after Treatment. Figure 6 shows the GCS, CRS-R, and DFS scores of the two groups of patients at admission, 1 week after treatment, and 2 weeks after treatment. The GCS score of the experimental group was (5.97 ± 3.23), (9.32 ± 4.11), and (12.07 ± 3.18) at admission, 1 week after treatment, and 2 weeks after treatment, respectively. The GCS score of the control group was (5.69 ± 3.31), (7.22 ± 3.47), and (9.87 ± 3.98), respectively. At admission, 1 week after treatment, and 2 weeks after treatment, CRS-R score of the experimental group was (5.12 ± 2.03), (7.45 ± 2.76), and (9.76 ± 1.12), respectively, while that of the control group was (5.01 ± 2.12), (5.79 ± 2.62), and (7.91 ± 1.18), respectively. As for DFS score, that was (4.98 ± 3.41), (6.11 ± 4.21), and (7.06 ± 4.39) at admission, 1 week after treatment, and 2 weeks after treatment, respectively, in the experimental group. Then it was (5.00 ± 3.22), (5.47 ± 3.02), and (5.99 ± 4.41), respectively, in the control group. The GCS, CRS-R, and DFS scores of both groups after 1 week and 2 weeks of treatment were higher than those at admission. However, the scores of the experimental group after 1 week and 2 weeks of treatment were significantly higher than those of the control group ($P < 0.05$).

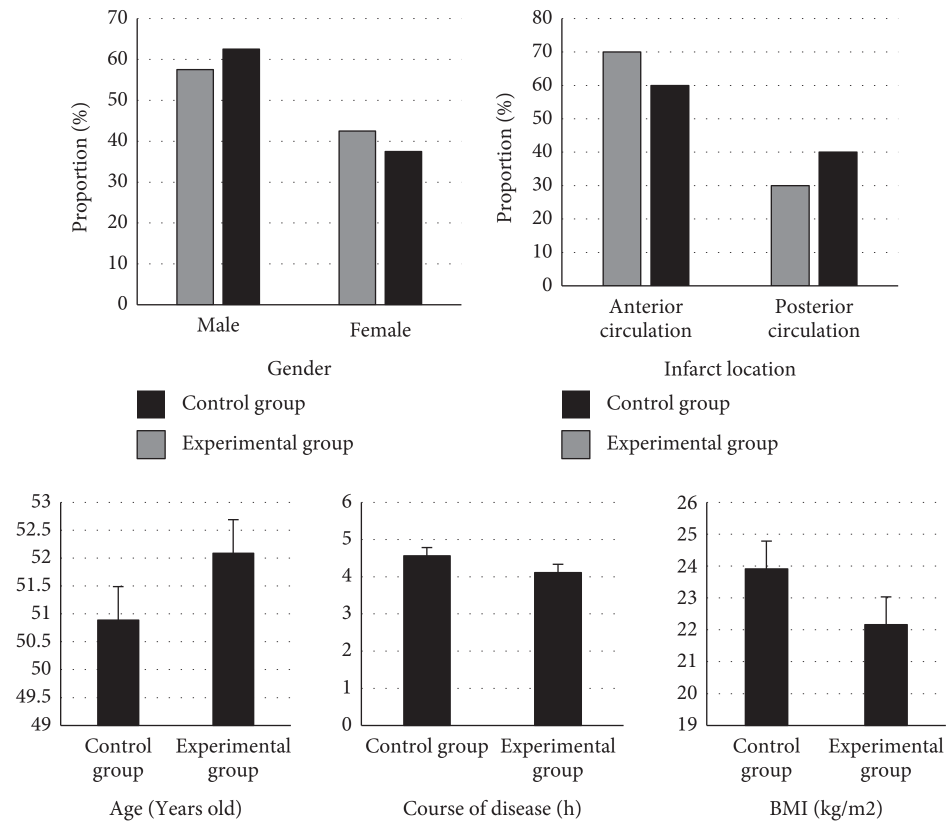

Figure 5: Comparison of general data of patients in two groups.

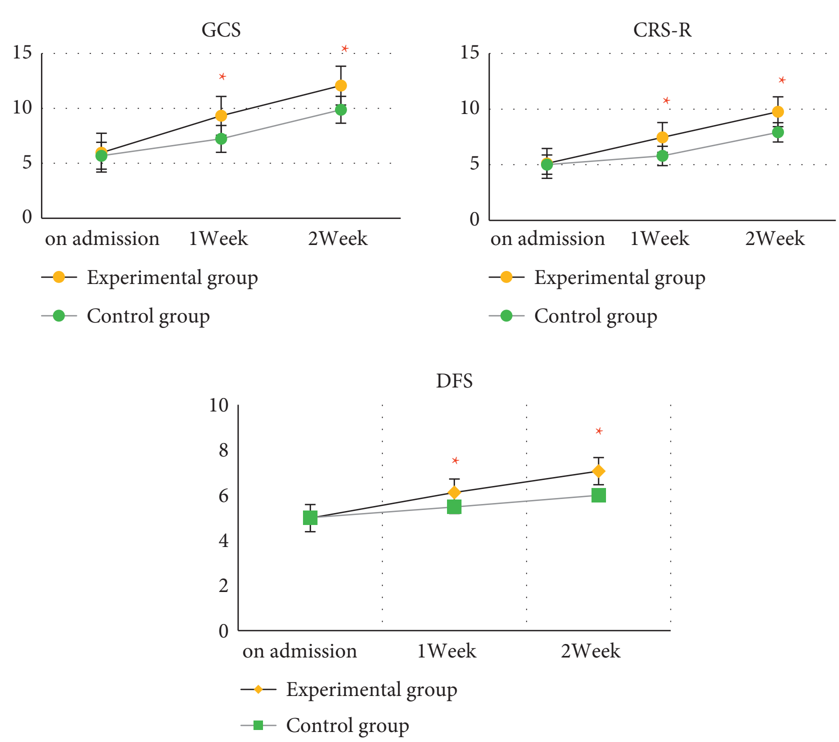

Figure 6: Comparison of GCS, CRS-R, and DFS scores. *Compared with control group, $P < 0.05$.

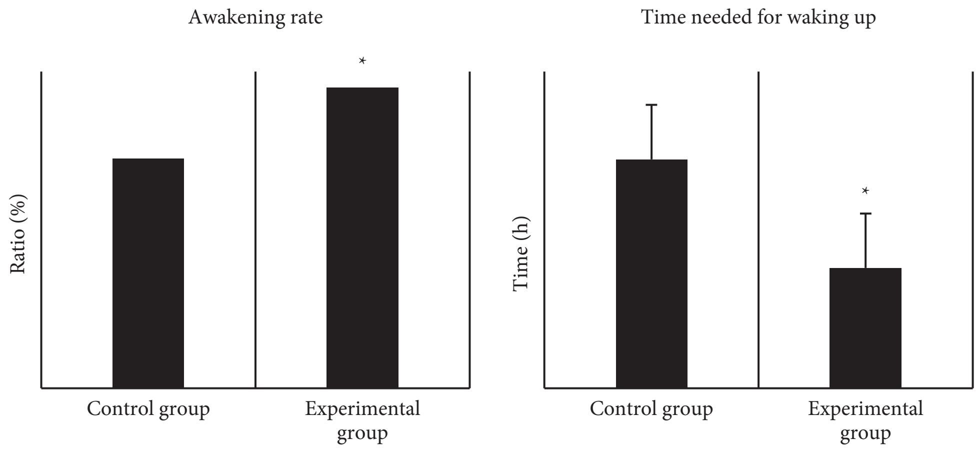

Figure 7: Comparison of the awakening status of the two groups of patients. *Compared with control group, $P < 0.05$.

3.4. Comparison of Awakening Situations. Among the 40 cases in the control group, 29 patients (72.5%) waked up after treatment, and the average time needed for waking up was (4.34 ± 3.49) hours. Among the 40 cases in the experimental group, 38 cases (95%) waked up with an average time needed of (2.28 ± 2.92) hours. The awakening rate of patients in the experimental group was significantly higher than that in the control group, and the time needed for waking up was shorter than that of the control group ($P < 0.05$). The details are presented in Figure 7.

4. Discussion

The multisensory stimulation wake-up nursing was combined with TMS to treat patients with massive cerebral infarction concomitant with disturbance of consciousness, providing a new and effective treatment method for the treatment and prognosis. The results showed that the GCS, CRS-R, and DFS scores of the two groups 1 week and 2 weeks after treatment were higher than those at admission. But the GCS, CRS-R, and DFS scores of the experimental group 1 week and 2 weeks after treatment were significantly higher than those of the control group ($P < 0.05$). Such results suggested that multisensory stimulation wake-up nursing combined with TMS was more beneficial to the recovery of brain function in patients with massive cerebral infarction and disturbance of consciousness. It has also been suggested that repeated TMS can stimulate neuronal activity in the cerebral cortex, thereby promoting the recovery of brain function and awakening the consciousness of patients [28, 29]. The multisensory stimulation wake-up nursing also helps the recovery of the human central nervous system and enhances the activity of neurons in the upper cerebral cortex, thereby enhancing the connection between the cortex and the subcortical tissue and promoting the awakening of patients [30, 31]. Hong et al. [32] proposed that repeated TMS therapy could improve the neurological function of patients with massive cerebral infarction concomitant with impaired consciousness. The results here also showed that the awakening rate of the patients in the experimental group was significantly higher than that in the control group, while the time needed to wake up was shorter than that in the control group ($P < 0.05$). It meant that multisensory stimulation wake-up nursing combined with TMS was more helpful than single TMS treatment for the awakening of consciousness of patients. This supported the above results, which were also consistent with those of Zhong et al. [33].

To make the findings more accurate, the three-dimensional reconstruction-based multimodal MRI images for guided treatment of patients. Ichikawa et al. [34] proposed in their study that the three-dimensional reconstruction algorithm under bilateral filtering algorithm provided the better edge-preserving noise reduction for low-dose computed tomography images. Therefore, in this work, the three-dimensional reconstruction algorithm improved by bilateral filtering algorithm was applied in reconstructing the MRI images of the brain, to assist the treatment of patients. It was shown from the results that the PSNR of the bilateral filtering algorithm (800 dB) was greatly higher than that of the wavelet threshold denoising (321 dB) and the nonlocal mean filtering algorithm (455 dB). This was consistent with the findings of Li [35]. The segmentation accuracy of the improved region growing method/the improved fuzzy spatial clustering algorithm (96.21% and 97.22%) was higher than that of the unimproved ones (82.11% and 79.99%). It was suggested that the combination of automatic threshold and boundary tracking could optimize the region growing algorithm, and the automatic peak detection method could improve the segmentation effect of the fuzzy spatial clustering algorithm. Khodaverdi et al. [35] came up with an automatic threshold and boundary tracking algorithm that could distinguish the target from the background, which was more conducive to image segmentation. Chen and Maharatna [36] proposed that the peak automatic detection method could improve the retrieval efficiency of the clustering centers in the fuzzy spatial clustering algorithm. Therefore, after the optimization of the above algorithms, the reconstruction effect of three-dimensional MRI images became better.

5. Conclusion

In summary, the three-dimensional reconstruction algorithm could effectively improve the display effect of MRI images and played an auxiliary role in the examination of diseases. Multisensory stimulation wake-up nursing combined with TMS could promote faster awakening in patients with massive cerebral infarction and contributed to the recovery of brain function. However, the sample size selected was relatively small, the scope was relatively limited, and the representativeness was not strong enough. The research scope needed to be further expanded. Multisensory stimulation wake-up nursing had a good auxiliary effect on the treatment of TMS and had a great application prospect worth exploring in clinical practice.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

Authors' Contributions

Bocan Chen and Li Li contributed equally to this work.

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