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Multidisciplinary team collaboration impact on NGF, BDNF, serum IGF-1, and life quality in patients with hemiplegia after stroke

Jing He[1], Lanlan Chen[1], Fan Tang[2], Rui Huang[3], Jingting Liao[1], Hua Tian[4*]

[1] Neurological Department, The Third Hospital of Mianyang·Sichuan Mental Health Center, Mianyang, 621000, China
[2] Neurosurgery Department, The Third Hospital of Mianyang·Sichuan Mental Health Center, Mianyang, 621000, China
[3] Neurological Department, Sichuan Provincial People's Hospital, Chengdu, 610000, China
[4] Nursing Department, The Third Hospital of Mianyang·Sichuan Mental Health Center, Mianyang, 621000, China

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ABSTRACT

This study aimed to study the impact of multidisciplinary team collaboration on NGF, BDNF, serum IGF-1, and life quality in patients with hemiplegia after stroke. For this purpose, 200 post-stroke hemiplegic patients admitted from March 2022 to February 2023 were selected and randomly divided into a control group (100) and an observation group (100). The control group was given routine nursing care, while the observation group was given a multidisciplinary team collaboration model. The neurotroph in [nerve growth factor (NGF), brain-derived neurotrophic factor (BDNF), insulin-like growth factor-1 (IGF-1)] and nutritional status [hemoglobin (HGB), serum albumin (ALB), transferrin (TRF)] of patients were compared before and after the intervention on the second day of admission and on the 30th day of intervention. The FUGL Meyer (FM) motor function assessment scale, NIHSS National Institutes of Health Stroke Scale, and the Specialized Quality of Life Scale (SS-QIL) for stroke patients were used to assess limb motor function, balance function, degree of neurological impairment, and life quality. Results showed that before intervention, there was no statistically significant difference in the levels of NGF, BDNF, IGF-1, HGB, ALB, TRF, limb motor function, balance function, neurological deficits, and quality of life scores between the two ($P>0.05$); After intervention, the levels of NGF, BDNF, IGF-1, HGB, ALB, and TRF in the observation group were significantly higher ($P<0.05$); The FM and SS-QOL of patients in the observation group were significantly higher ($P<0.05$); The NIHSS score of patients in the observation group was significantly lower ($P<0.05$). In conclusion, multidisciplinary team cooperation can significantly improve the level of neurotrophin, reduce the degree of nerve defect, and promote the recovery of limb function, balance function and life quality for stroke patients with hemiplegia.

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Introduction

Stroke is a brain dysfunction disease caused by cerebrovascular diseases with high mortality and disability rates classified as ischemic and hemorrhagic (1). According to the "China Stroke Prevention and Treatment Report 2020" (2), it is the main death cause. A survey of the epidemiological characteristics of complications in surviving stroke shows that there are approximately 70-80% of motor dysfunction, 30-42% of language dysfunction, and 27-64% of swallowing dysfunction (3). Therefore, improving neural function to promote their return to society and family is an important rehabilitation goal. Traditional rehabilitation nursing is mainly led by the responsible nurse, passing on the knowledge of the attending physician about patients' rehabilitation, while the occurrence, development and outcome of diseases are not simply diseases that ultimately materialize. With the evolution and implementation of the integrated health service system in the world, multidisciplinary treatment (MDT) collaboration has emerged at a historic moment. MDT collaboration refers to the professional analysis conducted by specialized medical staff in different fields regarding the condition, providing specialized opinions, and implementing standardized and personalized treatment plans for it (4). The MDT collaboration model originated in the late 20th century in the UK and was eventually imitated by France, Belgium, and Australia (5). In 2018, China's Health Commission issued the "Multidisciplinary Diagnosis and Treatment Pilot Work Plan for Cancer (2018-2020)" (6), marking China's entry into the development stage of the MDT diagnosis and treatment model. At present, the MDT collaboration model is being applied in clinical practice to diseases with comprehensive nursing needs such as chronic diseases, tumors, and hospice care. MDT not only has clear requirements for team member division and structure but also covers long-term health support both inside and outside the hospital (7). It has been shown (8) that the MDT collaborative model can significantly improve the prognosis of 93 patients with lung cancer undergoing radical surgery during a 5-year follow-up. Stewart et al. (9) showed that multidisciplinary fields can effectively promote the rehabilitation of nervous system disease in motor neurology. Based on this, this study investigates the impact of multidisciplinary team collaboration on NGF, BDNF, serum IGF-1, and life quality in patients with hemiplegia after stroke, providing data and theoretical titles for clinical-related fields.

* Corresponding author. Email: tianhua19761218@163.com

Materials and Methods

General information

200 post-stroke hemiplegic patients admitted from March 2022 to February 2023 were evenly and randomly divided into a control group (C) and an observation group (O). Patients and their families were aware of the purpose of this survey and signed informed consent forms. This survey was approved by the hospital ethics committee. There was no statistically significant difference in general information ($P>0.05$).

Inclusion and exclusion standards

Inclusion

(A) Conforming to the relevant diagnostic criteria of the Chinese Guidelines for the Diagnosis and Treatment of Acute Ischemic Stroke (10) through CT or MRI imaging examination; (B) First onset; (C) Having unilateral limb dysfunction after onset; (D) After 24 hours of mild or moderate onset, there was no progression of the condition, while in severe cases, the vital signs remained stable and neurological function did not worsen; (E) Swallowing function is normal.

Exclusion before research

(A) Mental dysfunction; (B) Previously accompanied by motor dysfunction; (C) Participated in similar research within 3 months; (D) Concomitant intracranial tumors or epilepsy; (E) Concomitant coagulation disorders; (F) Limb movement dysfunction caused by rheumatic immune disease or diabetes peripheral neuropathy; (G) Complicated with organic lesions.

Exclusion during research

(A) The condition worsened during the research process; (B) Voluntary withdrawal from the research midway; (C) Transferred to another hospital for treatment midway through.

Methods

Group C was given a routine rehabilitation mode, and nursing staff conducted health education and rehabilitation training through the distribution of manuals. In terms of rehabilitation, the attending physician shall assess whether the rehabilitation technician is required to intervene.

Group O (I) A stroke MDT writing collaboration group was established, with the head nurse and neurology director serving as the group leader, mainly responsible for group activity content, normative standards, and precautions; The team members included specialist nurses in neurology, rehabilitation specialists, psychological consultants and dietitian. The nurses in the neurology department were mainly responsible for assisting other team members to complete the treatment measures in the scheme. The rehabilitation specialists were mainly responsible for the functional rehabilitation training of patients' hemiplegic limbs. The psychological consultants were mainly responsible for psychological counseling and guidance in the rehabilitation process; The dietitian was mainly responsible for nutrition risk screening and nutrition support during rehabilitation. All team members would receive a 2-week training under the leadership of the team leader and would be assessed after the training. If the score of all team members was ≥ 95, it would be considered qualified. If the score was not qualified, the training would continue until the entire team was assessed as qualified; (II) Specialist nurse in the neurology department: Health education was carried out after completing relevant medical orders. Through communication with patients, nurses can inform patients of disease-related knowledge, precautions, common complications and self-care points through video in WeChat official account. This official account can be used during hospitalization and after discharge of patients, including the nursing side, patient side and consulting side. At the nursing end, one nurse demonstrated and one nurse recorded the video and uploaded it to the official account; The patient end included all the examination results reports of the patient in our hospital; The consultation end was the communication interface between patients and nursing staff. Patients can ask relevant questions during this stage, and nursing staff can answer questions online. (III) Rehabilitation therapist: a. Upper limb: ① The elbow joint of the upper limb was abducted and extended, a sitting position was taken, an elastic bandage was used to fix it at the bedside, and the other end was fixed on the affected hand. The patient was guided to abduct the elbow and shoulder joints, and use physical force during breathing to extend the affected upper limb outward. When inhaling, the upper limb slowly returns to its original position and moves back and forth. ② Checkers or chess were prepared before starting the training by flexing finger joints. The patient was guided through side pinching, finger pinching, and metacarpophalangeal joint flexion. ③ Finger joint grasping: A ball that fits the size of the patient's palm was prepared, and the patient was guided in fine hand movements such as side pinching, finger pinching, column grasping, and ball grasping. b. Lower limb: ① With lower limb hip abduction and flexion, the patient's standing position was taken, wrapping an elastic band around the operator's hand, and fixing the other end to the patient's affected leg. The patient was guided to perform hip abduction exercises, and use hip force when exhaling. The affected leg was guided to extend outward, and slowly return to its original position when inhaling, repeating the cycle. ② Hip flexion exercise: The patient was taken in a supine position, straightening the knee joint, using an elastic band to fix one end to the ankle joint of the affected leg, and wrapping the other end around the fixed position. Hip flexion training was performed in an extended knee state. ③ Inward hip joint rotation: The patient was taken in a supine position, bending the hip and knee of the patient's affected leg, and wrapping an elastic band around the affected knee joint. The operator stretched the elastic band to instruct the patient to rotate the hip joint inward. The operator's elastic band applied force to form a reaction force with the patient, forming a confrontation. ④ Outward hip joint rotation: The patient was taken in a supine position and guided to bend the knee and hip, placing the elastic band above the affected knee joint. The operator pulled on the elastic band to instruct the patient to rotate the hip joint outward. The operator applied pressure to the elastic band relative to the patient's direction of motion. ⑤ Knee extension training: The patient was taken in a supine position, wrapping one end of the elastic band around the ankle joint of the affected leg, bending the hip and knee joints, and fixing the other end to the operator's left and right. The nursing staff instructed the patient to extend the knee, and the elastic band should be in the opposite direction

of the patient's movement. The patient's seat position was taken and guided to naturally lower limb droop, flexing the knee joint. The elastic band was secured on one side to the ankle joint of the impaired leg, and on the other side to the chair, with the knee extended forward. ⑥ Knee bending training: The patient was taken in a supine position, whose knee joint of the affected leg was placed by the bed, wrapping an elastic band around the ankle joint of the affected leg, and fixing the other end to the operator's hand. The patient was guided to bend the knee, and the elastic band formed resistance in the opposite direction of the patient's movement. ⑦ Ankle dorsiflexion training: The patient's sitting position was taken, one end of the elastic band was fixed, and the other end was wrapped around the patient's forefoot. The knee joint was straightened, and the patient's ankle joint was instructed to resist the resistance of the elastic band and force the dorsiflexion, gradually reducing it. During the exercise process, patients needed to exhale with force and inhale when returning. ⑧ Ankle plantar flexor muscle group training: In a supine position, one end of the elastic band was fixed, and the other end was wrapped around the patient's front foot. The knee joint was straightened, and the ankle joint was subjected to plantar flexion against resistance band pressure, that is, the patient used the affected foot to step back on the elastic band and gradually relax. Each exercise mentioned above was practiced in 2 groups daily, with each group practicing 10 times. After each group completes the training, they rested for 1 minute, and the intervention period was 4 weeks; (IV) Psychological counselor: Psychological counselors can use the Hamilton Anxiety Scale (HAMA) (11) to assess the patient's current anxiety state. For patients with anxiety, language can be used to guide them to express their anxiety, understand their physiological and psychological needs, encourage them to express their inner thoughts, and guide patients in relaxation training; (V) Nutrition support: The dietitian can evaluate the current nutritional status of the patient according to the NRS2002 Nutrition Risk Screening Scale (12), which includes three parts: recent weight change, food intake, and disease severity. In combination with the corresponding scores of each part, the nutritionist can specify a nutrition support plan that meets the individual differences of the patient, and the dietitian would evaluate it once a week.

Observation indicators and evaluation criteria

General information

Using a self-designed general information survey questionnaire, the patient's gender, age, course of disease, stroke type, hemiplegic side, comorbid underlying disease, and time from onset to admission were statistically analyzed.

Neurotrophin

The nursing staff took 5ml of peripheral venous blood and sent it to the laboratory, maintained the rate of 1500r/min for 5min centrifugation, and took the supernatant for enzyme-linked immunosorbent assay.

Nutritional status

The nursing staff took 5ml of the patient's peripheral venous blood in the morning and sent it to the laboratory. The full-automatic biochemical analyzer was used for colorimetric detection.

Sports function

The rehabilitation physician used the FUGL Meyer (FM) (13) motor function assessment scale to evaluate the patient's motor function, which included upper limbs (0-33 points) and lower limbs (0-66 points).

Degree of neurological impairment

The attending physician of the neurology department used the (NIHSS) (14) National Institutes of Health Stroke Scale to assess the degree of neurological impairment of patients. The scale contains 11 separate items, and the total score of the scale was 0-42 points.

Life quality

Nursing staff evaluated the life quality using the Specialized Stroke Quality of Life Scale (SS-QOL) (15), which includes 12 dimensions and a total of 49 items. Each item was evaluated using the Likert1-5 5-level scoring method.

Quality control

The multidisciplinary team mainly invited one neurologist attending physician, one rehabilitation physician, one dietitian, one psychological consultant, and one responsible nurse each, and all the staff under the leadership of the researcher received a two-week training, which mainly focused on the knowledge of hemiplegia rehabilitation after stroke. After the training, the team was assessed. All team members were deemed qualified if their assessment scores were ≥ 90. If one person was unqualified, all the staff continued training until all the staff passed the assessment.

Information collection

To ensure authenticity, the data collection personnel were not nursing staff involved in the study. During the observation process, one patient was excluded due to worsening of the condition midway. 120 questionnaires were distributed, and 119 valid questionnaires were collected, with a recovery rate of 99.17%.

Statistical analysis

SPSS 27.0 was selected for data processing and analysis. Kolmogorov–Smirnov test verified whether the data conform to the normal distribution, and the measurement data was expressed by the mean ± standard deviation ($\bar{x}\pm s$). Independent t-tests were performed between groups, and paired t-tests were performed within groups; The measurement data was expressed by [n (%)]. $\chi 2$ test was performed. $P<0.05$ indicated a statistically significant difference.

Results

General information comparison

There was no statistically significant difference in the general information comparison ($P>0.05$) (Table 1).

Neurotrophin levels comparison

Before intervention, there was no statistically significant difference in the levels of NGF, BDNF, and IGF-1 ($P>0.05$); After intervention, the levels of NGF, BDNF, and IGF-1 in the observation group were significantly higher ($P<0.05$) (Table 2, Figures 1-3).

Table 1. General information comparison [(%)]/ ($\bar{x}\pm s$).

Group	n	Gender		Age range	Average age	Stroke type	
		M	F			Ischemic	Hemorrhagic
O	99	55	44	43-67	51.34±5.21	71	28
C	100	57	43	42-65	50.94±6.06	73	27
x2/t		0.042		-	0.499	0.041	
P		0.837		-	0.618	0.840	

Group	n	Hemiplegic side		Underlying disease			Time from onset to admission (h)	Average time (h)
		L	R	Hypertension	Hyperlipidemia	Diabetes		
O	99	52	47	37	29	33	3-15	10.34±3.05
C	100	55	45	35	30	35	3-16	11.01±2.94
x2/t		0.123		0.126			-	1.578
P		0.726		0.939			-	0.116

Table 2. Neurotrophin levels comparison ($\bar{x}\pm s$).

Group	n	NGF (pg/mL)		*t*	*P*
		Before intervention	After intervention		
O	99	283.96±33.76	461.95±63.88	23.816	<0.001
C	100	279.98±33.03	414.63±57.63	21.425	<0.001
t		-0.840	-5.488		
P		0.402	<0.001		

Group	n	BDNF (pg/mL)		*t*	*P*
		Before intervention	After intervention		
O	99	382.38±51.19	568.56±63.45	23.252	<0.001
C	100	383.32±45.36	547.54±54.40	20.947	<0.001
t		0.137	-2.509		
P		0.891	0.013		

Group	n	IGF-1 (pg/mL)		*t*	*P*
		Before intervention	After intervention		
O	99	380.55±54.15	579.53±74.77	20.770	<0.001
C	100	383.50±49.90	514.31±57.00	16.752	<0.001
t		0.399	-6.924		
P		0.690	<0.001		

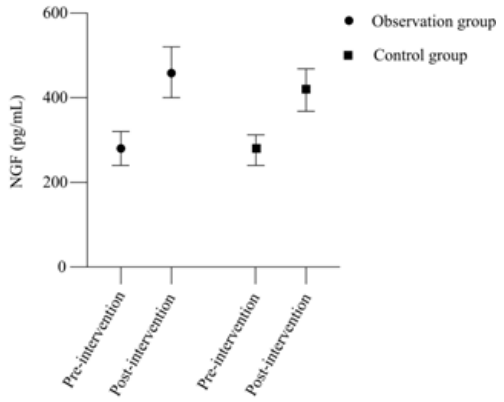

Figure 1. NGF levels before and after intervention in both groups.

Nutritional status comparison

Before intervention, there was no statistically significant difference in the levels of HGB, ALB, and TRF in nutritional status (P>0.05); After intervention, the levels of HGB, ALB, and TRF in the observation group were significantly higher (P<0.05) (Table 3, Figures 4-6).

Motor function comparison before and after intervention

Before intervention, there was no statistically significant difference in the upper and lower limb scores on the FM scale (P>0.05); After intervention, the upper and lower limb scores on the FM scale in the observation group were significantly higher (P<0.05) (Table 4).

Neurological impairment and life quality comparison before and after intervention

Before intervention, there was a statistically significant difference in the scores of the NIHSS and SS-QOL scales (P>0.05); After intervention, the NIHSS scale score of the

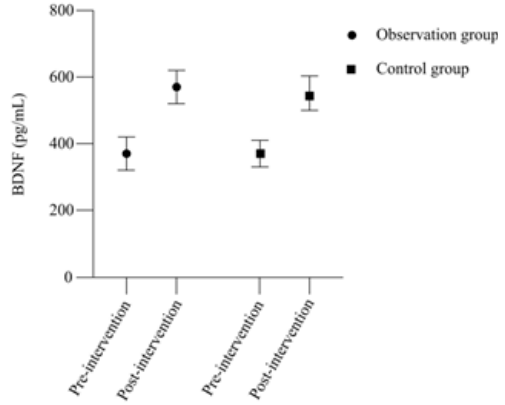

Figure 2. BDNF levels before and after intervention in both groups.

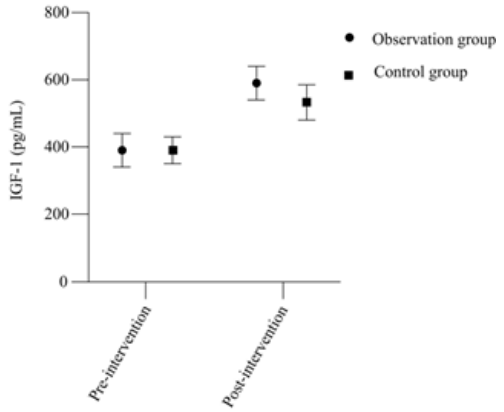

Figure 3. IGF-1 levels before and after the intervention in both groups.

observation group was significantly lower, while the SS-QOL scale score was significantly higher (P<0.05) (Table 5).

Discussion

Stroke is mainly caused by heat stroke and damage to the cortical medullary tract, leading to ischemic and hypoxic necrosis of brain tissue in the ischemic center. However, there are still weak collateral circulation and neurons distributed in the ischemic penumbra around it. Therefore, rehabilitation care after the condition stabilizes mainly aims to promote cortical functional reorganization and neuronal remodeling, and increase blood supply and neural repair ability (16). The core of the MDT collaboration model mainly lies in the formation of teams of professionals from multiple disciplines and providing patients with the best treatment plan in their respective fields

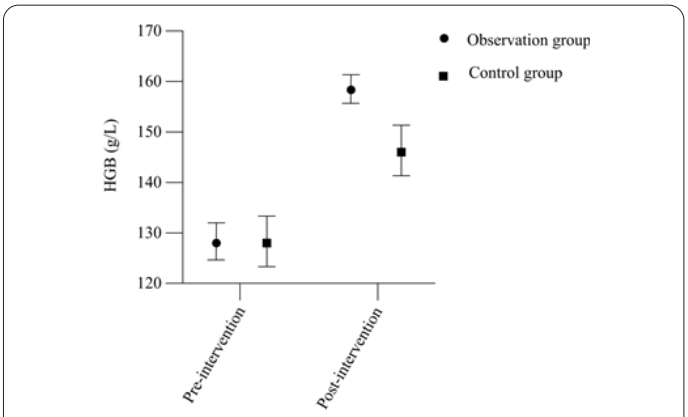

Figure 4. HGB levels before and after the intervention in both groups.

Table 3. Nutritional status comparison ($\bar{x}\pm s$).

Group	n	HGB (g/L)		t	P
		Before intervention	After intervention		
O	99	128.19±5.09	158.27±2.53	52.594	<0.001
C	100	128.49±6.38	145.31±5.57	18.614	<0.001
t		0.367	-21.080		
P		0.714	<0.001		
Group	**n**	**ALB (g/L)**		**t**	**P**
		Before intervention	**After intervention**		
O	99	30.08±4.25	37.71±4.01	13.603	<0.001
C	100	30.46±5.03	35.65±2.88	8.762	<0.001
t		0.585	-4.181		
P		0.559	<0.001		
Group	**n**	**TRF (g/L)**		**t**	**P**
		Before intervention	**After intervention**		
O	99	1.76±0.60	3.18±0.45	18.541	<0.001
C	100	1.83±0.91	2.54±0.36	7.822	<0.001
t		0.656	7.230		
P		0.513	<0.001		

Table 4. Motor function comparison before and after intervention.

Group	n	Upper limb		t	P
		Before intervention	After intervention		
O	99	25.38±2.16	30.34±2.99	14.704	<0.001
C	100	25.07±1.82	28.12±1.32	13.198	<0.001
t		-1.110	-2.287		
P		0.269	0.023		
Group	**n**	**Lower limbs**		**t**	**P**
		Before intervention	**After intervention**		
O	99	43.48±4.36	48.34±4.06	8.089	<0.001
C	100	43.78±6.02	46.04±3.23	3.359	0.001
t		0.396	-4.433		
P		0.693	<0.001		

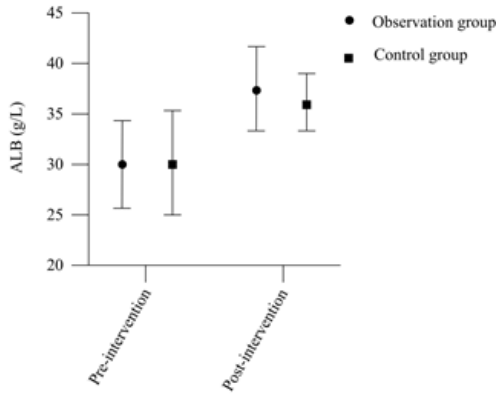

Figure 5. ALB levels before and after intervention in both groups.

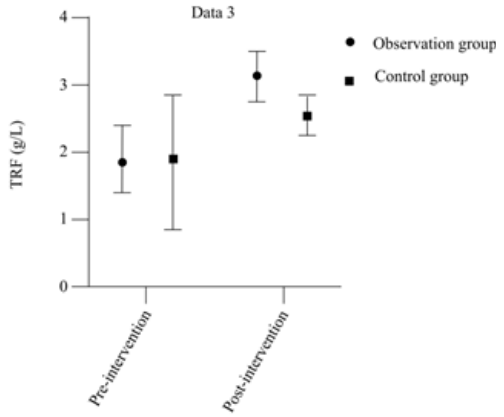

Figure 6. TRF levels before and after intervention in both groups.

through consultation for a certain disease (17). After receiving multidisciplinary assistance, patients can regain their confidence and self-esteem, maintain high compliance and motivation, and improve their self-efficacy and nursing ability in disease recovery, thereby reducing the incidence of disability and death in patients (18). Compared with conventional rehabilitation nursing models, it avoids nursing blindness and arbitrariness and improves the quality of nursing services.

Results showed that the levels of neurotrophin NGF, BDNF, and IGF-1 in the observation group were significantly higher (P<0.05); MDT cooperation mode can improve the repair of neurotrophin in patients. BDNF has the ability to resist free radical damage to nerve cells, and increase the self-repair and antioxidant capacity of nerve cells; IGF-1 has the synergistic effect of BDNF in promoting the recovery of central nervous system function and neural cell duplication, regulating the growth, differentiation, and maturation of central nervous cells, and repairing damaged tissues while maintaining brain tissue. In addition to the non-nervous system, NGF also has the function of regulating the immune system, promoting the repair of damaged tissues and wound healing (19). The three interact and jointly participate in the protection of the nervous system. The multidisciplinary integration of the attending physician, specialist nurse, rehabilitation physician, psychological consultant, and dietitian of the neurology department in the MDT cooperation mode starts with the neuron repair drug treatment, rehabilitation training, and psychological and nutritional support that affects hemiplegia, establishes a decision-making or discussion platform. Therefore, patients can obtain professional, continuous, and standardized whole-process care. The rehabilitation training program of the rehabilitators in the MDT team cooperation is a non-invasive, non-invasive, safe and reliable Neuromodulation therapy, which stimulates the trained nerve cells in the cycle of training. It enhances NGF, BDNF, and IGF-1 levels, increases the number of medial branches of the lesion, and provides sufficient nutrients for the repair of neural function (20).

The occurrence of malnutrition after hemiplegia after stroke is mainly due to the following factors: (I) Stress in the body after stroke leads to systemic metabolic hardening, which increases the high metabolic response of large tissue boundaries and energy demand; (II) Long term bed rest after stroke and hemiplegia leads to a decrease in intestinal peristalsis, leading to a decrease in nutrient intake and increased consumption of autologous fat; (III) The negative psychology after being separated from society and work after stroke hemiplegia enhances central control of the brain, leading to gastrointestinal dysfunction, excessive consumption of nutrients, and multiple factors leading to malnutrition (21). The dietitian in the MDT collaboration mode uses the NRS2002 Nutrition Risk Screening Form to determine the current nutritional status of patients. For patients with non-nutritional risks, nutritional support is provided to maintain nutritional status. For patients with nutritional risks, nutritional programs are comprehensively specified according to nutritional status, gastrointestinal tolerance and individual differences. Nutrition management is refined and quantified to meet the nutritional support of patients in the rehabilitation process. The results are consistent with a previously reported article (22).

Table 5. Neurological impairment and life quality comparison before and after intervention.

Group	n	NIHSS		*t*	*P*
		Before intervention	After intervention		
O	99	34.95±4.19	30.03±2.28	-10.486	<0.001
C	100	36.00±4.02	33.68±1.40	-5.321	<0.001
t		1.806	13.611		
P		0.072	<0.001		
Group	**n**	**SS-QOL**		***t***	***P***
		Before intervention	**After intervention**		
O	99	164.37±21.43	182.91±17.55	5.355	<0.001
C	100	163.91±22.54	175.82±20.37	4.306	<0.001
t		-1.864	-2.544		
P		0.064	0.012		

Results showed that the motor function, neurological function, and life quality of the observation group were significantly improved ($P<0.05$); Note: MDT collaborative mode can effectively improve motor function, neurological function, and life quality recovery. The reasons are analyzed as follows: (I) The technicians of the rehabilitation department provide resistance training for the functional rehabilitation of upper and lower limbs, increase the blood supply of the brain, and promote the functional recovery of the brain tissue around the focus. Resistance training is aimed at key joints. The resistance movement using elastic bands to form resistance can generate corresponding "load stimulation" to the body, recruit a "motor unit", and improve muscle strength and joint mobility. Training is repeated to improve limb motor function (23); (II) The MDT cooperation mode comprehensively proposes rehabilitation content in various disciplines and fields, and finally formulates the start time, frequency, intensity, and course of rehabilitation. After long-term, continuous, dynamic changes and multiple factors, resistance exercise can regulate the central nerve of the patient's upper spinal cord, increase act in and myosin fibers, and improve the repair of the patient's damaged nerves. This is consistent with Langhorne P (24).

To sum up, the multi-scientific team collaboration model has transformed the original patient-centered model from a doctor-centered model to a patient-centered model for medical and nursing teams. The simple rehabilitation model has been integrated into a joint participation model of medical, patient, and technician teams, providing multi-disciplinary rehabilitation plans for stroke patients with hemiplegia regarding limb and neurological function recovery and rehabilitation, ultimately achieving the promotion of patient's life quality, deserving widespread clinical promotion.

References

1. Demarin V. Pathophysiology and Classification of Cerebrovascular Disorders. EJIFCC 2004; 15(3): 44-46.
2. Wang Longde (Report on Stroke Prevention and Treatment in China Writing Group). Brief report on stroke prevention and treatment in China, 2020. Chin J Cerebrovasc Dis 2022; 19(2): 136-144.
3. Liu GZ, Hu R, Peng DT; Geriatric Neurology Group, Geriatric Branch of Chinese Medical Association; Writing Group of Chinese expert consensus on diagnosis of cardiogenic stroke. Chinese expert consensus on the diagnosis of cardiogenic stroke (2019). Chin Med J (Engl) 2021; 134(5): 505-507. https://doi.org/10.1097/CM9.0000000000001217
4. Cox JS, Searle AJ, Hinton EC, Giri D, Shield JPH. Perceptions of non-successful families attending a weight-management clinic. Arch Dis Child 2021; 106(4): 377-382. https://doi.org/10.1136/archdischild-2020-319558
5. Yip BHK, Lee EKP, Sit RWS, Wong C, Li X, Wong ELY, Wong MCS, Chung RYN, Chung VCH, Kung K, Wong SYS. Nurse-led hypertension management was well accepted and non-inferior to physician consultation in a Chinese population: a randomized controlled trial. Sci Rep 2018; 8(1): 10302. https://doi.org/10.1038/s41598-018-28721-2
6. Hongyang W, Shengli Y. Editorial for the special issue on new technology of tumor diagnosis and treatment. Eng 2021; 7(10): 1343-1344. http://doi.org/10.1016/j.eng.2021.08.002
7. Lunt N, Fung KW. Scoping the literature on patient travel abroad for cancer screening, diagnosis and treatment. Int J Health Plann Manage 2022; 37(1): 66-77. https://doi.org/10.1002/hpm.3315
8. Zhu S, Chen J, Ni Y, Zhang H, Liu Z, Shen P, Sun G, Liang J, Zhang X, Wang Z, Wei Q, Li X, Chen N, Li Z, Wang X, Shen Y, Yao J, Huang R, Liu J, Cai D, Zeng H. Dynamic multidisciplinary team discussions can improve the prognosis of metastatic castration-resistant prostate cancer patients. Prostate. 2021 Aug;81(11):721-727. doi: 10.1002/pros.24167.
9. Stewart EL, Anderson SA, Williams VB. Sports neurology as a multidisciplinary field. Handb Clin Neurol 2018; 158: 11-18. https://doi.org/10.1016/B978-0-444-63954-7.00002-1
10. Chinese Society of Neurology; Chinese Stroke Society. Chinese guidelines for diagnosis and treatment of acute ischemic stroke 2018. Chin J Neurol 2018; 51(9): 666-682. http://dx.doi.org/10.3760/cma.j.issn.1006-7876.2018.09.004
11. Gao XJ, Sun JJ, Xiang M. Positive psychological intervention for anxiety, depression and coping in subjects addicted to online games. World J Clin Cases 2021; 9(14): 3287-3293. https://doi.org/10.12998/wjcc.v9.i14.3287
12. Hui CR, Wu XH, Huang DL, Fu XB, Zhang C, Zhou K, Zhu GY, Liu D, Cai JT, Tan MH. The role of the PNI and NLR in nutritional risk screening and assessment of gastric cancer patients. J Nutr Oncol 2022; 7(4): 192-198.
13. Huang D, Yang R, Liang J, Zhang X, Li Y, Zhao K, Cheng Y, Miao R. Effects of different pension models on cognitive function and prognosis improvement in elderly patients with acute cerebral infarction. Hainan Med J 2022; 33(3): 288-291.
14. Rajashekar D, Wilms M, MacDonald ME, Schimert S, Hill MD, Demchuk A, Goyal M, Dukelow SP, Forkert ND. Lesion-symptom mapping with NIHSS sub-scores in ischemic stroke patients. Stroke Vasc Neurol 2022; 7(2): 124-131. https://doi.org/10.1136/svn-2021-001091
15. Zhang X, Wang D, Wang H, Cai X, Shi H, Fang Q. Predictors of Good Outcomes in Stroke Thrombolysis Guided by Tissue-Window. Neurologist 2020; 26(1): 1-5. https://doi.org/10.1097/NRL.0000000000000300
16. Guzik A, Bushnell C. Stroke Epidemiology and Risk Factor Management. Continuum (Minneap Minn) 2017; 23(1): 15-39. https://doi.org/10.1212/CON.0000000000000416
17. Rosen MA, DiazGranados D, Dietz AS, Benishek LE, Thompson D, Pronovost PJ, Weaver SJ. Teamwork in healthcare: Key discoveries enabling safer, high-quality care. Am Psychol 2018; 73(4): 433-450. https://doi.org/10.1037/amp0000298
18. Deering S, Johnston LC, Colacchio K. Multidisciplinary teamwork and communication training. Semin Perinatol 2011; 35(2): 89-96. https://doi.org/10.1053/j.semperi.2011.01.009
19. Wei YY, Koh CL, Hsu MJ, Lo SK, Chen CH, Lin JH. Effects of Transcranial Direct Current Stimulation Combined with Neuromuscular Electrical Stimulation on Upper Extremity Motor Function in Patients with Stroke. Am J Phys Med Rehabil 2022; 101(2): 145-151. https://doi.org/10.1097/PHM.0000000000001759
20. Middleton S. An outcomes approach to stroke care: the importance of teamwork and evidence-based nursing care. Int J Stroke 2012; 7(3): 224-226. https://doi.org/10.1111/j.1747-4949.2012.00774.x
21. Yuan K, Zhu S, Wang H, Chen J, Zhang X, Xu P, Xie Y, Zhu X, Zhu W, Sun W, Xu G, Liu X. Association between malnutrition and long-term mortality in older adults with ischemic stroke. Clin Nutr 2021; 40(5): 2535-2542. https://doi.org/10.1016/j.clnu.2021.04.018
22. Cui C, He C, Sun Q, Xu Z, Li Q, Yue S, Liu J, Wang L, Wang H. Association between visceral adiposity index and incident stroke: Data from the China Health and Retirement Longitudinal Study. Nutr Metab Cardiovasc Dis 2022; 32(5): 1202-1209. https://doi.org/10.1016/j.numecd.2022.01.031

23. Le Danseur M. Stroke Rehabilitation. Crit Care Nurs Clin North Am 2020; 32(1): 97-108. https://doi.org/10.1016/j.cnc.2019.11.004

24. Langhorne P, Bernhardt J, Kwakkel G. Stroke rehabilitation. Lancet 2011; 377(9778): 1693-1702. https://doi.org/10.1016/S0140-6736(11)60325-5