Am J Transl Res 2021;13(4):3811-3818
www.ajtr.org /ISSN:1943-8141/AJTR0119495

Original Article

Effects of early rehabilitation nursing on neurological functions and quality of life of patients with ischemic stroke hemiplegia

Luanjiao Hu, Guangwei Liu

Department of Neurology, The First Affiliated Hospital of Chongqing Medical University, Chongqing 400016, China

Received August 3, 2020; Accepted December 22, 2020; Epub April 15, 2021; Published April 30, 2021

Abstract: Objective: This study aimed at exploring the effects of early rehabilitation nursing (ERN) on the neurological functions, the incidence of lower extremity deep venous thrombosis (LEDVT) and the quality of life (QOL) of patients with ischemic stroke hemiplegia (ISH). Methods: Admitted to our hospital from January 2018 to February 2019, 123 patients with ISH were enrolled, among which 70 cases received routine nursing (a control group) and 53 cases received ERN (a study group). The patients in the two groups were compared with respect to the scores of the European Stroke Scale (ESS), the Barthel Index (BI) and the Fugl-Meyer Assessment (FMA), the incidences of complications and LEDVT, QOL and nursing satisfaction. Results: After intervention, the ESS, BI and FMA scores rose in both groups, but they were remarkably higher in the study group ($P < 0.05$). Compared with those in the control group, patients in the study group had remarkably lower incidences of complications and LEDVT ($P < 0.05$), remarkably better indicators of QOL ($P < 0.05$), and higher nursing satisfaction ($P < 0.05$). Conclusion: For patients with ISH, ERN can improve neurological functions, reduce the incidence of LEDVT, and improve their QOL, so this safe and effective nursing method is worthy of clinical application.

Keywords: Early rehabilitation nursing, ischemic stroke hemiplegia, neurological functions, incidence of lower extremity deep venous thrombosis, quality of life

Introduction

Stroke is classified into ischemic stroke (IS) and hemorrhagic stroke, among which the former is the more common type and patients with it account for 60-80% of stroke patients [1]. IS, also considered as cerebral infarction, occurs more commonly among the elderly, and has a high incidence, mortality rate, disability rate and recurrence rate [2, 3]. Because of the disturbance of blood circulation, local brain tissues are necrotic after ischemia and hypoxia, and limbs suffer from different degrees of antagonistic muscle spasm [4]. Clinically, IS is manifested as a series of clinical syndromes such as unilateral or bilateral paralysis and numbness of upper and lower limbs, neurological defects, balance disturbance, facial distortion or expressive language disorders [5]. IS complicated with hemiplegia (ischemic stroke hemiplegia; ISH) is the most common complication, usually characterized by dyskinesia, balance disturbance, language disorders and dysphagia [6, 7]. Due to sudden changes in physiological functions, ISH is easily complicated with negative psychology, and then patients with ISH lose confidence in life, resist treatment, and subsequently develop the psychology of anxiety, depression and suicide [8]. According to modern medicine, the central nervous system of the brain has strong plasticity, and rehabilitation exercises can promote the recovery of hemiplegic limbs, especially during the first 1-3 months of the exercises, so the untimely treatment of ISH greatly reduces the patients' quality of daily life and abilities of activities [9].

Early rehabilitation nursing (ERN) is very important for ISH patients. On the basis of mastering the plasticity of cranial nerves tissues, through scientific and standardized rehabilitation exercises, active and effective ERN can restore and reconnect damaged neurons, and make them

plasticized, thus strengthening the functional rehabilitation of nerve tissues and improving the prognosis of patients [10]. As reported by a previous study, after their vital signs are stabilized, patients with ISH are suggested to receive ERN to improve physiological functions, reverse negative psychology, and promote the recovery of neurological functions [11]. Therefore, in this study, the effects of ERN on patients with ISH were discussed. Specific reports are as follows.

Materials and methods

General information

Admitted to The First Affiliated Hospital of Chongqing Medical University from January 2018 to February 2019, 123 patients with ISH were enrolled, among which 70 cases received routine nursing (the control group) and 53 cases received ERN (the study group). The patients consisted of 59 males and 64 females with an average age of 55.72 ± 18.38 years. There were 35 cases of grade I, 63 cases of grade II, and 25 cases of grade III muscle tension in total. Inclusion criteria: (1) All included patients were diagnosed with ISH by clinical manifestations and imaging examinations. (2) The included patients were aged over 50, and their vital signs were stable and their estimated survival time was over one month. Exclusion criteria: (1) Those who were complicated with severe systemic or local infection and severe hepatic, renal, cardiac and pulmonary insufficiencies. (2) Those who suffered from coagulation disorders and psychological or mental diseases. (3) Those who were complicated with diseases related to the neuromuscular junction of the motor system. Before enrollment, the patients or their authorized persons signed the consent form. This study was approved by the ethics committee of our hospital.

Nursing methods

Within two weeks after the onset of ISH, the patients in the control group received routine nursing from the aspects of diet and life. The nursing staff strengthened psychological guidance and health education on the patients, and explained and implemented active and passive postoperative rehabilitation exercises when their symptoms were effectively relieved. Within 24 hours after the onset of the disease, the patients in the study group received the training of ERN, and were intervened when their vital signs were initially stable. (1) Psychological nursing: The generally sudden attacks of stroke and the factors such as prognosis and economic pressure easily lead to desperateness, stress, anxiety and other different degrees of negative psychology and emotions, which affect the therapeutic effects of ERN. Medical staff accurately assessed the patients' postoperative conditions, strengthened their understanding of stroke and hemiplegia, and perfected the research on their personal characteristics and psychological states, so as to strengthen psychological support. For instance, the patients' attention could be diverted via music, language environment, bedside education and family care. The medical staff also regularly communicated and interacted with the patients and their families, understood their true feelings, and carefully answered their questions about various diseases, so that their early negative emotions could be eliminated. After hemiplegia, effective early rehabilitation training could enhance the courage and self-confidence of the patients in treatment and rehabilitation. Besides, the most comfortable and quiet wards could be created and nursing operation could be scientifically arranged, so as to minimize the negative effects of external environment on the patients. (2) Limb function training: After the individualized plans of ERN were formulated, the nursing staff formulated scientific and feasible nursing plans and training targets according to the patients' daily life. During the recovery period, the patients were guided to conduct isometric, standing, and walking training. They were also guided to adjust their sitting and prone positions, in order to keep the correct physiological position of the lumbar spine. During the rehabilitation training, it was suggested that the patients should be placed in a position on the unaffected side and develop the habit of turning over once every 2 hours. The nursing staff also assisted the patients to change positions intermittently. Active and passive exercises were implemented after the affected limb was fully extended. As for the hemiplegic limbs, the time of the isometric training was appropriately prolonged to avoid strephenopodia, ankylosis and foot drop. The focus of the guidance was to improve the muscle strength of the hemiplegic limbs. The nursing staff informed the

patients and their families of the importance of passive massage, explained the detailed knowledge and precautions of massage action, and kept the effective local blood circulation of the affected limbs through the passive massage, thereby avoiding joint stiffness and muscular atrophy and helping the patients restore the functions of the affected limbs faster. Additionally, the correct use of toilets was explained. (3) Diet guidance: The patients were instructed to eat more food with high proteins and cellulose, and strengthen the supply of appropriate vitamins and calcium.

Outcome measures

(1) The European Stroke Scale (ESS) was used for scoring the patients' neurological functions, with a total score of 100 points; the ESS scores are directly proportional to the neurological functions [12]. (2) Activities of daily living: Before and after discharge, the scores of the modified Barthel Index (BI) were assessed by the primary nurses; higher BI scores indicate better self-care ability [13]. (3) The Fugl-Meyer Assessment (FMA) was used to assess the motor function of limbs, and the FMA scores are directly proportional to the motor function [14]. (4) Incidence of complications: After intervention, the incidence of complications (pulmonary infection, joint stiffness, muscular atrophy, bedsore) was compared between the two groups. (5) The incidence of lower extremity deep venous thrombosis (LEDVT) was counted and compared between the two groups. (6) The World Health Organization Quality of Life: Brief Version (WHOQOL-BREF) was used to assess the patients' quality of life (QOL), which consisted of social, environmental, physiological and psychological fields. Higher QOL scores indicate better QOL [15]. (7) Nursing satisfaction: The self-made satisfaction questionnaires of our hospital were applied to assessment from the items of hospital environment, doctor-patient communication, medical ethics, technical levels and medical expenses. Nursing satisfaction = (very satisfied + satisfied cases)/total number of cases ×100%.

Statistical processing

SPSS 20.0 was applied to data processing. Measurement data with normal distribution or approximate normal distribution were expressed as mean ± standard deviation, and compared by the two independent samples t-test. Measurement data with non-normal distribution were expressed as M (QR), and compared by the Mann-Whitney U test. The χ^2 test was used for analyzing counting data. $P < 0.05$ was considered as statistically significant difference.

Results

Comparison of general information

There were no significant differences between the study and control groups in gender, age, course of disease and other aspects ($P > 0.05$) (**Table 1**).

Comparison of ESS scores

Before intervention, there were no statistically significant differences in the ESS scores between the control group (50.93 ± 6.79) and the study group (51.31 ± 6.83) ($P > 0.05$). After intervention, the ESS scores in both groups rose, but those in the study group (84.34 ± 11.31) were remarkably higher than those in the control group (69.93 ± 8.19) ($P < 0.05$) (**Table 2**).

Comparison of BI scores

Before intervention, there were no statistically significant differences in the BI scores between the control group (61.03 ± 7.97) and the study group (61.22 ± 7.93) ($P > 0.05$). After intervention, the BI scores in both groups rose, but those in the study group (83.23 ± 11.13) were remarkably higher than those in the control group (70.36 ± 9.38) ($P < 0.05$) (**Table 3**).

Comparison of FMA scores

Before intervention, there were no statistically significant differences in the FMA scores between the control group (43.23 ± 5.34) and the study group (43.62 ± 5.42) ($P > 0.05$). After intervention, the FMA scores in both groups rose, but those in the study group (71.42 ± 6.92) were remarkably higher than those in the control group (62.42 ± 6.73) ($P < 0.05$) (**Table 4**).

Comparison of incidence of complications

The incidence of complications in the study group was 3.77% (2/53), which was remarkably

Table 1. Comparison of general information

Groups	Control group (n=70)	Study group (n=53)	t/X^2	P
Gender (Cases)			0.080	0.777
Male	33 (47.14)	26 (49.06)		
Female	37 (52.86)	27 (50.94)		
Age (Years)	55.56 ± 18.32	55.78 ± 18.39	0.066	0.948
Course of stroke (Days)	18.72 ± 3.63	18.38 ± 3.52	0.521	0.603
Educational backgrounds (Cases)			1.034	0.596
Primary school	17 (24.29)	14 (26.42)		
Junior and senior high schools	42 (60.00)	33 (62.26)		
University and above	11 (15.71)	6 (11.32)		
Hemiplegic sites (Cases)			0.080	0.777
Left	34 (48.57)	25 (47.17)		
Right	36 (51.43)	28 (52.83)		
Muscle tension (Cases)			0.398	0.820
Grade I	21 (30.00)	14 (26.42)		
Grade II	35 (50.00)	28 (52.83)		
Grade III	14 (20.00)	11 (20.75)		
Complications (Cases)			3.480	0.176
Hypertension	38 (54.29)	34 (64.15)		
Diabetes	18 (25.71)	13 (24.53)		
Heart disease	14 (20.00)	6 (11.32)		
Stroke sites (Cases)			1.454	0.835
Basal ganglia	33 (47.14)	26 (49.06)		
Thalamus	13 (18.57)	11 (20.75)		
Temporal lobe	8 (11.43)	7 (13.21)		
Frontal lobe	10 (14.29)	5 (9.43)		
Pons	6 (8.57)	4 (7.55)		

Table 2. Comparison of ESS scores (Points)

Groups	Control group (n=70)	Study group (n=53)	t	P
Before intervention	50.93 ± 6.79	51.31 ± 6.83	0.307	0.760
After intervention	69.93 ± 8.19	84.34 ± 11.31	8.197	< 0.001
t	14.940	18.200		
P	< 0.001	< 0.001		

Table 3. Comparison of BI scores (Points)

Groups	Control group (n=70)	Study group (n=53)	t	P
Before intervention	61.03 ± 7.97	61.22 ± 7.93	0.131	0.896
After intervention	70.36 ± 9.38	83.23 ± 11.13	6.951	< 0.001
t	6.342	11.730		
P	< 0.001	< 0.001		

lower than 14.29% (10/70) in the control group (P < 0.05) (**Table 5**).

Comparison of incidence of LEDVT

The incidence of LEDVT was 1.89% (1/53) in the study group and 18.57% (13/70) in the control group. The incidence of LEDVT was remarkably lower in the study group (P < 0.05) (**Table 6**).

Comparison of QOL

The scores of each indicator in the WHOQOL-BREF and the total QOL scores were remarkably better in the study group than those in the control group. The QOL scores were 58.39 ± 10.28 in the study group and 44.23 ± 8.93 in the control group (P < 0.05) (**Table 7**).

Table 4. Comparison of FMA scores (Points)

Groups	Control group (n=70)	Study group (n=53)	t	P
Before intervention	43.23 ± 5.34	43.62 ± 5.42	0.399	0.691
After intervention	62.42 ± 6.73	71.42 ± 6.92	7.256	< 0.001
t	18.690	24.990		
P	< 0.001	< 0.001		

Table 5. Comparison of incidence of complications [n (%)]

Groups	Control group (n=70)	Study group (n=53)	X^2	P
Pulmonary infection	3 (4.29)	1 (1.89)	-	-
Joint stiffness	4 (5.71)	0	-	-
Muscular atrophy	1 (1.43)	0	-	-
Bedsore	2 (2.86)	1 (1.89)	-	-
Incidence of complications	10 (14.29)	2 (3.77)	6.105	0.014

Table 6. Comparison of incidence of LEDVT

Groups	Control group (n=70)	Study group (n=53)	X^2	P
incidence of LEDVT	13 (18.57)	1 (1.89)	15.381	0.05

Table 7. Comparison of QOL (Points)

Groups	Control group (n=70)	Study group (n=53)	t	P
Physiological field	10.37 ± 2.34	14.23 ± 2.79	8.336	< 0.001
Psychological field	11.15 ± 2.73	14.12 ± 2.68	6.022	< 0.001
Social field	11.09 ± 2.69	13.92 ± 3.02	5.479	< 0.001
Environmental field	11.62 ± 2.10	13.99 ± 3.04	5.111	< 0.001
Total scores	44.23 ± 8.93	58.39 ± 10.28	8.157	< 0.001

Table 8. Comparison of nursing satisfaction [n (%)]

Groups	Control group (n=70)	Study group (n=53)	X^2	P
Very satisfied	37 (52.86)	42 (79.25)	-	-
Satisfied	24 (34.29)	10 (18.87)	-	-
Dissatisfied	9 (12.86)	1 (1.89)	-	-
Nursing satisfaction	61 (87.14)	52 (98.11)	8.721	0.003

Comparison of nursing satisfaction

The nursing satisfaction of the patients was 98.11% (52/53) in the study group and 87.14% (61/70) in the control group. The nursing satisfaction was remarkably higher in the study group ($P < 0.05$) (**Table 8**).

Discussion

Surgery and drugs are mostly used to treat stroke. After the onset of IS, patients with the disease may suffer from dyskinesia and expressive language disorders, and most patients who have undergone surgery still experience the dysfunction of consciousness, language and movement, which seriously affects their daily life [16]. Hemiplegia is a common complication of IS. ISH may be greatly related to the fact that the ischemia or hypoxia of the central nervous system after the onset softens brain tissues and then causes damage to the cerebral nervous system. Additionally, the long-term bedridden induced by hemiplegia may result in the reduced ability of muscle protein synthesis and even different degrees of bone loss, which is considered to affect the prognosis of patients [17, 18]. According to related research, nervous compensation promotes the regeneration of neurons and the recovery of limb functions, thus reducing negative emotions [19]. Early rehabilitation training can avoid muscular atrophy and joint stiffness that are caused by the hemiplegia-induced long-term bedridden, so it is a scientific and reasonable nursing model [20]. Therefore, in this study, patients with ISH were included, and given routine nursing and ERN for comparison, in order to observe their prognoses after interventions.

The recovery of neurological functions is crucial to patients with hemiplegia that is caused by cranial nerve injury. Therefore, we counted the ESS scores of the patients after intervention, and found that the scores were higher in the study group compared with the control group. As reported by previous studies, hemiplegic

patients can conduct early rehabilitation training based on the plasticity of the central nervous system, which promotes the formation of new synapses and stimulate the repair and regeneration of cells. The rehabilitation nursing of limb movement, physiology and language can contribute to the recovery of brain functions. The repeated activities of affected limbs can stimulate cerebral cortex, promote the recovery of reflex function, and shorten the recovery time of consciousness, language and motor functions. Additionally, the combination with nervous compensation can repair and regenerate some damaged tissues, cells and neurons, alleviate the hypoxia and ischemia that is caused by the long-term damage to the microcirculation of the central nervous system, and promote the recovery of cell functions, eventually completing the functional reconstruction of non-damaged areas [21, 22]. These findings suggest that on the basis of the regeneration ability and high plasticity of central nervous system tissues, rehabilitation training in the early stage of ISH contributes to the recovery of neurological functions. Furthermore, it is of positive significance for promoting the recovery of nervous system functions in stroke patients to strengthen health education, conduct ERN based on the patients' characteristics, and relieve their pessimistic and negative psychology, as well as improve their confidence in rehabilitation and training cooperation [23]. The activity of daily living of hemiplegic patients is affected by the damage severity of their neurological and motor functions and by their later recovery. In our study, the BI scores were better and the FMA scores were remarkably higher in the study group, compared with those in the control group. ERN is performed on patients after their postoperative physical conditions are basically stabilized, to evaluate various aspects of them and formulate individualized exercise rehabilitation programs, which are instructed and implemented by rehabilitation therapists; the therapists should keep on observing ECG monitors to ensure the safety of rehabilitation training, which amount should be gradually increased within the patients' tolerance range [24]. Accordingly, the implementation of scientific exercise plans is helpful in restoring the motor capacity of patients with ISH.

After intervention, the incidence of complications in the study group was lower than that in the control group, which reveals that ERN prevents the occurrence of avoidable complications. Clinical attention is highly paid to the incidence of LEDVT in patients with ISH, and the occurrence of thrombosis largely determines the prognosis of the patients. In this study, the incidence of LEDVT was lower in the study group compared with the control group. The implementation of each rehabilitation plan, which is formulated based on early rehabilitation training, can accelerate the blood flow velocity of heart, restore myocardial blood supply in time, and dilute blood. Moreover, these effects promote blood circulation, balance endothelium-derived contracting and relaxing factors, and improve cardiac and body functions rapidly, as well as effectively avoid the occurrence of venous thrombosis [25]. This is quite consistent with the conclusions of this study. Finally, in our study, the QOL and the nursing satisfaction in the study group were better than those in the control group. This suggests that postoperative ERN is markedly effective for patients with ISH, and that it can promote the improvement of the two indicators, so it is worthy of clinical promotion.

In summary, for patients with ISH, safe and effective ERN can improve neurological functions, reduce the incidence of LEDVT, and improve QOL. In this research, we focused on the way of ERN to restore and improve the neurological functions of the patients, and on the preventive measures for LEDVT. Studies have shown that from the aspects of proprioception and cognitive methods, the rehabilitation of patients with ISH has improved after ERN [26]. Our experiments have further validated relevant views. However, there are still shortcomings in this study. For example, the activity of daily living was investigated only from the aspects of neurological and motor functions. Besides, we did not carry out analyses from psychological and other factors, and explain the improvement of QOL from the aspect of implementing rehabilitation methods. These will be the focuses and directions of subsequent studies, in order to provide better prognostic nursing for patients with ISH.

Disclosure of conflict of interest

None.

Address correspondence to: Guangwei Liu, Department of Neurology, The First Affiliated Hospital

of Chongqing Medical University, No. 1 Youyi Road, Yuzhong District, Chongqing 400016, China. Tel: +86-18523438683; E-mail: LiuGW18523438683@163.com

References

[1] Athiyarath R, George B, Mathews V, Srivastava A and Edison ES. Association of growth differentiation factor 15 (GDF15) polymorphisms with serum GDF15 and ferritin levels in beta-thalassemia. Ann Hematol 2014; 93: 2093-2095.

[2] Alawieh A, Chatterjee A, Feng W, Porto G, Vargas J, Kellogg R, Turk AS, Turner RD, Imran Chaudry M and Spiotta AM. Thrombectomy for acute ischemic stroke in the elderly: a 'real world' experience. J Neurointerv Surg 2018; 10: 1209-1217.

[3] Roy-O'Reilly M and McCullough LD. Age and sex are critical factors in ischemic stroke pathology. Endocrinology 2018; 159: 3120-3131.

[4] Vaagenes P. Effects of therapeutic hypothermia on activity of some enzymes in cerebrospinal fluid of patients with anoxic-ischemic brain injury. Clin Chem 1986; 32: 1336-1340.

[5] Wegener V, Stabler A, Jansson V, Birkenmaier C and Wegener B. Lumbar burner and stinger syndrome in an elderly athlete. Korean J Pain 2018; 31: 54-57.

[6] Qi L, Han Z, Zhou Y, Chen W, Chu L, Lu J, Xu W, Wang H, Wang Z and Ling J. Dynamic scalp acupuncture combined with PNF therapy for upper limb motor impairment in ischemic stroke spastic hemiplegia. Zhongguo Zhen Jiu 2018; 38: 234-238.

[7] Wei P, Xu Y, Zhang Z, Zhang S and Lv Z. Treatment for upper esophageal sphincter dysfunction in a patient with poststroke dysphagia: a case report. Medicine (Baltimore) 2019; 98: e14988.

[8] Rohde D, Gaynor E, Large M, Conway O, Bennett K, Williams DJ, Callaly E, Dolan E and Hickey A. Stroke survivor cognitive decline and psychological wellbeing of family caregivers five years post-stroke: a cross-sectional analysis. Top Stroke Rehabil 2019; 26: 180-186.

[9] Santello M and Lang CE. Are movement disorders and sensorimotor injuries pathologic synergies? When normal multi-joint movement synergies become pathologic. Front Hum Neurosci 2014; 8: 1050.

[10] Liu G, Dang C, Chen X, Xing S, Dani K, Xie C, Peng K, Zhang J, Li J, Zhang J, Chen L, Pei Z and Zeng J. Structural remodeling of white matter in the contralesional hemisphere is correlated with early motor recovery in patients with subcortical infarction. Restor Neurol Neurosci 2015; 33: 309-319.

[11] Nair R, Radhakrishnan K, Chatterjee A, Gorthi SP and Prabhu VA. Sleep apnea-predictor of functional outcome in acute ischemic stroke. J Stroke Cerebrovasc Dis 2019; 28: 807-814.

[12] Sadasivam K, Patial K, Vijayan VK and Ravi K. Anti-oxidant treatment in obstructive sleep apnoea syndrome. Indian J Chest Dis Allied Sci 2011; 53: 153-162.

[13] Musa KI and Keegan TJ. The change of Barthel Index scores from the time of discharge until 3-month post-discharge among acute stroke patients in malaysia: a random intercept model. PLoS One 2018; 13: e0208594.

[14] Cha HK, Ji SG, Kim MK and Chang JS. Effect of transcranial direct current stimulation of function in patients with stroke. J Phys Ther Sci 2014; 26: 363-365.

[15] Pedersen SG, Heiberg GA, Nielsen JF, Friborg O, Stabel HH, Anke A and Arntzen C. Validity, reliability and norwegian adaptation of the stroke-specific quality of life (SS-QOL) scale. SAGE Open Med 2018; 6: 205031211775-2031.

[16] Chen YT, Li S, Magat E, Zhou P and Li S. Motor overflow and spasticity in chronic stroke share a common pathophysiological process: analysis of within-limb and between-limb EMG-EMG coherence. Front Neurol 2018; 9: 795.

[17] Raju TN, Nelson KB, Ferriero D and Lynch JK; NICHD-NINDS Perinatal Stroke Workshop Participants. Ischemic perinatal stroke: summary of a workshop sponsored by the National Institute of Child Health and Human Development and the National Institute of Neurological Disorders and Stroke. Pediatrics 2007; 120: 609-616.

[18] Lee HJ, Kang TW and Kim BR. Effects of diaphragm and deep abdominal muscle exercise on walking and balance ability in patients with hemiplegia due to stroke. J Exerc Rehabil 2018; 14: 648-653.

[19] Chester DS, Lynam DR, Milich R, Powell DK, Andersen AH and DeWall CN. How do negative emotions impair self-control? A neural model of negative urgency. Neuroimage 2016; 132: 43-50.

[20] Schneider SA, Paisan-Ruiz C, Garcia-Gorostiaga I, Quinn NP, Weber YG, Lerche H, Hardy J and Bhatia KP. GLUT1 gene mutations cause sporadic paroxysmal exercise-induced dyskinesias. Mov Disord 2009; 24: 1684-1688.

[21] Zhu GX, Hu YS, Wu Y, Zhu YL, Han X, Sun LM, Fan WK, Jiang CY, Xie Z and Hong Z. [Effects of standardized three-stage rehabilitation on recovery of neurological function in stroke patients with hemiplegia]. Zhonghua Yi Xue Za Zhi 2004; 84: 1955-1958.

[22] Namdari S, Alosh H, Baldwin K, Mehta S and Keenan MA. Shoulder tenotomies to improve

passive motion and relieve pain in patients with spastic hemiplegia after upper motor neuron injury. J Shoulder Elbow Surg 2011; 20: 802-806.
[23] Itzhaki M and Koton S. Knowledge, perceptions and thoughts of stroke among Arab-Muslim Israelis. Eur J Cardiovasc Nurs 2014; 13: 78-85.
[24] Theofanidis D, Savopoulos C and Hatzitolios A. Global specialized stroke care delivery models. J Vasc Nurs 2016; 34: 2-11.
[25] Farag E, Dilger J, Brooks P and Tetzlaff JE. Epidural analgesia improves early rehabilitation after total knee replacement. J Clin Anesth 2005; 17: 281-285.
[26] Morreale M, Marchione P, Pili A, Lauta A, Castiglia SF, Spallone A, Pierelli F and Giacomini P. Early versus delayed rehabilitation treatment in hemiplegic patients with ischemic stroke: proprioceptive or cognitive approach? Eur J Phys Rehabil Med 2016; 52: 81-89.