

The effect of a prevention procedure modified by evidence-based nursing on the incidence of lower extremity deep venous thrombosis after stroke

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Abstract

Objective: To investigate the effect of deep venous thrombosis (DVT) prevention procedure on the incidence of lower extremity DVT after stroke.

Methods: The patients with stroke admitted in the Department of Neurology of The Fifth Affiliated Hospital of Sun Yat-sen University in 2015 were enrolled as the control group, and those admitted in 2016 were enrolled as the intervention group. The patients in the control group received routine preventive measures of lower extremity DVT. Based on the evidence-based medicine, doctors and nurses discussed and formulated a new procedure of lower extremity DVT prevention for patients with stroke. Based on the new procedure, the patients in the intervention group were assessed for the risk of DVT, and only the stroke patients with high risk of DVT received individualized preventive measures.

Results: The incidence of lower extremity DVT was significantly reduced in patients with stroke in 2016 comparing with that in 2015.

Conclusions: The new DVT prevention procedure based on evidence-based nursing can effectively prevent lower extremity DVT in patients with stroke.

Introduction

Deep venous thrombosis (DVT) and its sequel pulmonary embolism (PE) are important causes of illness and death after stroke [1]. In addition, about one-third of patients with symptomatic DVT develop the post-thrombotic syndrome, which is often disabling and is associated with substantial costs to patients and to society [2]. Patients who are immobile, with significant weakness of the limbs and with a prior history of DVT are at greatest risk of DVT development [3].

Although there are several options for thromboprophylaxis, many of these patients received no or inadequate thromboprophylaxis during their hospital stay [4]. In fact, because of inadequate thromboprophylaxis, pulmonary embolism is considered the principal cause of preventable death in hospitalized patients [5]. Therefore, the risk of DVT should be assessed in all patients with stroke on admission to hospital, and appropriate thromboprophylaxis should be prescribed. The aims of our study were to formulate a DVT prevention protocol for patients with stroke and investigate its efficacy.

Methods

Ethics statement

This research was approved by the ethics committee of The Fifth Affiliated Hospital of Sun Yat-sen University.

Patients

The study included all the patients who were diagnosed as having ischemic stroke for the first time and admitted in the Department of

Neurology of The Fifth Affiliated Hospital of Sun Yat-Sen University from January 2015 to December 2016.

Diagnosis of ischemic stroke

The diagnosis of ischemic stroke was based on the history of symptoms and their acute presentation, clinical examination and cerebral diffusion-weighted magnetic resonance imaging (DWI).

Data collection and assessment

The data on demographic characteristics, NIHSS scores, patterns of infarction distribution, risk factors of DVT, and occurrence of DVT were collected from medical documentation. The data of the patients with ischemic stroke admitted from January 2015 to December 2015 (phase 1) were retrospectively collected. During phase 1, only the patients with muscle strength of grade 0-3 were taken into account for DVT prevention. The measures for DVT prevention included

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intermittent pneumatic compression, passive activity, and avoidance of injections on the paralysed limbs. The causes of DVT among these patients were analyzed. A DVT prevention protocol for stroke patients was formulated by the doctors and nurses in the Department of Neurology, based on guidelines and literatures. The protocol was introduced from January 2016 to December 2016 (phase 2). The effect of the protocol on reducing DVT was assessed.

The DVT prevention protocol for stroke patients

From January 2016, the following protocol was implemented for the patients with ischemic stroke: 1) a Doppler ultrasound scan for four limbs was performed to detect preexistent DVT; 2) the doctors assessed the risk of DVT with Autar Scale, and gave medical orders of DVT prevention for the patients at moderate-high risk; 3) the nurses set up a nursing record for DVT detection. The contents of the nursing record included color, sensation, temperature, pulse strength, and circumference of the limbs, as well as Homans sign and Neuhof sign. If DVT was suspected, the doctors would be informed immediately and prescribed D-dimer test and Doppler ultrasound scan; 4) the nurses assessed the patients' muscle strength everyday and setting up individualized intervention: grade 0-2, passive activity lasting 30 minutes on the bed, twice a day; grade 3-5, active and passive activity; grade 0-3, intermittent pneumatic compression devices were applied for 15 minutes, twice a day; grade 4-5, patients were taught to do ankle pump; 5) venous protection: injections in the paralysed limbs, repeated injections, and injections with stimulating drugs should be avoided. Besides, drugs should be injected through the upper limbs instead of the lower limbs; 6) if necessary, the patients at high risk of DVT would receive anti-coagulation therapy; 7) when DVT was suspected, relative scales would be used to assess the probability of DVT; 8) when DVT was highly suspected, anti-coagulation therapy could be given before definite diagnosis was made, as long as there was no contraindication of anti-coagulation; 9) index of coagulation and signs of bleeding should be monitored during anti-coagulation therapy; 10) if necessary, patients would receive thrombolysis or thrombectomy; 11) dietary guide: low fat, low vitamin K, and high fiber diet was recommended. Large amount of water intake was helpful to reduce blood viscosity; 12) dealt with constipation; 13) the doctors and nurses made dynamic assessment and discussion together during ward-round; 14) informing the nurses and doctors on the next shift about the DVT risk of all the stroke patients; 15) supervision of the DVT prevention measures by nursing group leaders and head nurse.

Statistical analysis

Statistical analysis was performed by SPSS version 19.0. P values of 0.05 were considered statistically significant. All quantitative data in this study are presented as mean ± standard deviation (SD) or median ± range. Quantitative data were processed using the t test. Qualitative data were analyzed with the chi-square test.

Results

There were 348 and 419 patients with ischemic stroke admitted to our department in phase 1 and phase 2, respectively. The demographic characteristics, NIHSS scores, patterns of infarction distribution, and risk factors of DVT of these patients were summarized in Table 1. There was no significant difference in demographic characteristics, NIHSS scores, patterns of infarction distribution, and risk factors of DVT between the 2 groups. There were 6 cases of DVT in phase 1, and 1 case of DVT in phase 2. The details of the DVT cases were summarized in Table 2. The incidence of DVT in phase 2 was significantly lower than that in phase 1 (p=0.025, Table 1).

Table 1. Comparison of ischemic stroke patients in phase 1 and phase 2.

	Phase 1	Phase 2	p
Age (years)	61.2 ± 13.38	58.4 ± 13.67	0.649
Male (%)	64.7	66.8	0.541
Smoking (%)	41.66	46.77	0.166
Thrombocytosis (%)	15.51	21.24	0.500
BMI	25.2 ± 2.11	26.0 ± 2.06	0.403
Lying in bed more than 3 days (%)	27.58	29.83	0.522
Deep vein catheterization (%)	5.17	5.72	0.753
Hyperhomocysteinaemia (%)	36.20	41.76	0.120
Anticardiolipin antibody seropositivity (%)	2.81	2.91	0.890
Hypercoagulable states (%)	22.98	25.77	0.400
Severe systemic infection (%)	9.19	10.73	0.547
NIHSS	6.1 ± 4.5	5.7 ± 3.8	0.674
Infarction distribution (%)			
Anterior circulation	81.4	83.7	0.813
Posterior circulation	16.9	15.0	0.704
Anterior and posterior circulation	1.7	1.3	0.575
Incidence of DVT (%)	1.72	0.24	0.025

Discussion

Ischemic stroke is a main cause of neurologic morbidity and mortality worldwide. Patients with ischemic stroke are at high risk of DVT due to various neurologic impairment and systemic factors. The consequences of DVT for the patient can be severe, including PE and even death. Thus, DVT prevention is very important for patients with ischemic stroke. However, many patients received no or inadequate thromboprophylaxis during admission. The aims of our study were to formulate an effective fall prevention protocol for the inpatient ischemic stroke patients.

It has been demonstrated that ischemic stroke patients with severe paralysis were more prone to DVT [6]. Therefore, we focused DVT prevention on patients with muscle strength of grade 0-3. From the cases of DVT in phase 1, we found only 2 patients were with severe paralysis. On one hand, it suggested that the DVT prevention methods we used in the past could effectively reduce the incidence of DVT in ischemic stroke patients with severe paralysis. On the other hand, it suggested that focusing on such patients was not enough. Many other factors could increase the incidence of DVT, including infection, anticardiolipin syndrome, deep vein catheterization. So, the patients with ischemic stroke should receive comprehensive assessment for risks of DVT. Autar Scale is used to evaluate the risk of DVT, and the Autar Scale score is positively correlated to the incidence of DVT. In this research, we used Autar Scale to recognize the risk factors of DVT and identify the patients at moderate-high risk of DVT. Individualized management was applied to the patients according to the DVT prevention protocol. Meanwhile, we emphasized dynamic assessment so that the plan could be adjusted in time when the patients' situation improved or deteriorated. Since the DVT prevention protocol for stroke patients was introduced, the incidence of DVT in patients with ischemic stroke was significantly decreased.

The limitation of our study was that a second Doppler ultrasound scan was performed only when the patient with symptoms of DVT, so it was likely that the patients with asymptomatic DVT would be missed. Besides, limited to the amount of the cases of DVT, we were not able to perform association analysis to find out the risk factors of DVT among stroke patients during hospitalization.

In conclusion, assessing DVT risk upon the ischemic stroke patient's admission plays an important part in the efforts for preventing DVT during hospitalization. The comprehensive DVT prevention

Table 2. Cases of DVT among ischemic stroke patients.

		Age	Gender	Muscle strength of paralysed limbs	NIHSS	Infarction distribution	Risk factors of DVT
2015	Case 1	46	Male	1	9	Anterior circulation	Immobility, lying in bed more than 3 days
	Case 2	66	Male	4	4	Anterior circulation	Increased D-dimer
	Case 3	57	Male	4	6	Anterior circulation	Thrombocytosis, smoking
	Case 4	76	Female	3	7	Posterior circulation	Immobility caused by gouty arthritis
	Case 5	72	Female	4	5	Anterior circulation	Hyperhomocysteinaemia
	Case 6	68	Male	4	3	Anterior circulation	Severe pulmonary infection
2016	Case 1	62	Male	4	4	Anterior circulation	Memantine

protocol for ischemic stroke patients was effective in reducing the incidence of DVT.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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