

## ORIGINAL ARTICLES

### Lower extremity deep vein thrombosis among the Thai patients with stroke

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#### Abstract

**Background and Purpose:** Deep vein thrombosis (DVT) is common in Western countries, but prevalence and determinants for DVT among stroke patients in Thailand are unknown. This study aims to identify the prevalence of and determinants for DVT among stroke patients who were referred for rehabilitation. **Materials and Methods:** Prospective study of all stroke patients admitted at the Prasat Neurological Institute and Pramongkutklao Hospital from February to December 1997. The diagnosis of DVT was based on real time ultrasound. **Results:** Seven out of 111 patients (6.3%, 95% CI 2.6-12.6) had DVT of which 6 had DVT on paralyzed legs and one had DVT in both legs. Swelling either above or below the knee was associated with DVT ( $p=0.025$ ). Leg swelling was independently associated with DVT (adjusted OR=4.4, 95% CI 1.1-17.7,  $p=0.037$ ) when controlled for leg weakness, bed rest for more than one week, type of cerebral lesion, age, gender, history of diabetes mellitus or hypertension. **Conclusions:** DVT was found in 6.3% of Thai stroke patients who were referred for rehabilitation. Leg swelling was significantly associated with DVT. Careful observation for leg swelling is thus recommended for its early diagnosis and treatment.

**Key words:** Deep vein thrombosis, leg swelling, prevalence, stroke, Thailand

## INTRODUCTION

Lower extremity deep vein thrombosis (DVT) is very common among patients in Western countries with significant mortality. It is estimated that there are approximately 2 million DVT cases per year in US, with 600,000 patients developing pulmonary embolism (PE) and 60,000 mortality.<sup>1</sup> The overall risk of DVT among stroke patients is said to be about 23-75%, with the risk of PE in 10-20% and mortality in 10%.<sup>2</sup>

There has not been many previous reports on DVT in Thailand. A study among the autopsy cases in Siriraj Hospital, Bangkok from 1960-1970 showed a DVT prevalence rate 0.2%, and PE prevalence rate of 0.4%.<sup>3</sup> Chamnijarakij et al in 1975 reported a DVT prevalence rate of 1.7% among the post abdominal hysterectomy patients and 3.8% among the post major pelvic surgery patients. No case of PE was reported.<sup>4</sup> Pornpibulaya et al in 1984 reported a DVT prevalence rate of 12.1% among post major elective surgery patients with no case of PE.<sup>5</sup> In 1984 at Ramathibodi Hospital, a major teaching

hospital in Bangkok, there was 0.05% of DVT cases and 0.005% of PE cases among the in-patients. Of the DVT patients, 5.5% had stroke.<sup>6</sup> No previous prospective study on post stroke DVT has been done in Thailand.

It was found in Western countries that most DVT occurred during the first week after a stroke<sup>7-10</sup> and it could also occur during the rehabilitation phase.<sup>11-14</sup> This study done at Prasat Neurological Institute and Pramongkutklao Hospital, Bangkok aimed to determine the prevalence of DVT among Thai stroke patients undergoing rehabilitation and the factors related to its occurrence.

Diagnosis of DVT by clinical examination is not reliable nor is it specific.<sup>15-18</sup> It is said that most DVT patients have no clinical symptoms.<sup>19</sup> Further investigations are necessary to detect the asymptomatic cases and confirm the diagnosis of those with symptoms. Venography is the gold standard investigation. However, it is invasive, expensive, time consuming and may be allergenic.<sup>20-22</sup> Other investigations are: impedance plethysmography, fibrinogen leg scanning, and radionuclide venograms, but they

are all time consuming and inconvenient. Ultrasound on the other hand, is non-invasive, has no untoward side-effect and is convenient. It can be done as a bedside procedure in 10-15 minutes. The sensitivity and specificity of real time ultrasound is said to be 91-95% and 99-100%<sup>23,24</sup> respectively with a sensitivity of 99% above the knee and 90% below the knee.<sup>25</sup> Thus, real time ultrasound was used in this study.

## MATERIALS AND METHODS

*Inclusion criteria:* All patients with stroke undergoing rehabilitation from February to December 1997 at Prasat Neurological Institute and Pramongkutklao Hospital were screened for the study. The patients were excluded from the study if they were comatose or in intensive care unit, were on the anticoagulant drugs, had congestive heart failure, had no leg weakness, or had DVT before referral for rehabilitation

*Muscle power:* The muscle power of the lower extremities were graded from zero to five according to the MRC grading system.

*Limb swelling:* The thigh and leg circumference was measured at a point 15 cm above and below the mid-patella of the knee. If the circumference of the weak lower extremity is more than one centimeter larger than the unaffected side, it was considered as swollen.

*Ultrasound:* The diagnosis of DVT was based on real time ultrasound. The B-scan ultrasound machine used were: ALOKA SSD-650 with spectral doppler or ALOKA SSD-2000 with color doppler, using high frequency (7.5 MHz.) small part probe. The ultrasound examination was performed as follow. With the patient in supine position, relaxed with slight abduction of both hips, the probe was placed on the groin and popliteal region to identify the femoral and popliteal veins alongside the arteries. The diagnosis of venous thrombosis was based on compression technique. When under pressure, a normal vein would completely collapse, but a thrombosed vein would not. Acute DVT was anechoic or hypoechoic in contrast to chronic DVT which was hyperechoic. The doppler mode was used in some cases to examine the iliac vein. The spectral doppler showed blood flow at a selected foci graphically. The color doppler showed the flow in an area covering the whole lumen. A doppler signal was also used to demonstrate partially occluded lumen and collateral flow. When there was no signal,

augmentation procedures such as squeezing the calf to enhance antegrade flow was done to confirm a complete DVT.

*Statistical Analysis:* Univariate and multivariate analysis (Logistic regression) were used with SPSS (Statistical Package for Social Science) program for Windows 6.0 and EGRET (Epidemiological Graphics, Estimation, and Testing package). A confidence interval (1- $\alpha$ ) of 95% and a multiplicative model were used as a calculation method.

## RESULTS

From February to December 1997, 111 patients fulfilled the inclusion criteria and were studied. The mean age of the patients was 64 years (range, 39-89). There were 61 males (55%) and 50 females (45%). Eighty one patients (73%) had cerebral infarct and thirty patients (27%) had cerebral hemorrhage. The time from the onset of stroke to the ultrasound examination was 5-242 days. Ninety-eight cases (88%) were confined to bed for more than a week.

Ultrasound examination showed that 7 out of 111 patients (6.3%) had DVT. Six patients had DVT in the weak lower limb, one patient had DVT in both lower limbs. Of the 7 patients with DVT, three had swelling both above and below the knee. Two had swelling above the knee, one had swelling below the knee, one had no leg swelling. The time from the onset of stroke to the diagnosis of DVT was 12, 17, 28, 30, 51, 54 and 74 days respectively for the 7 patients. Five patients had muscle power of grade zero, one had grade two, and another patient had grade three. Table 1 is the summary of the clinical characteristics of patients with and without DVT.

By using the multiple regression (logistic regression model), only leg swelling was statistically correlated to the occurrence of DVT ( $p= 0.037$ ). It corresponded to an analysis of Chi square for linear trend. Patients with weak leg who had swelling either below or above the knee had 4 folds higher risk of having DVT than in patients who had no leg swelling. If the swelling occurred in both below and above the knee, the risk increased to 12 folds. The relationship of the leg swelling and DVT is as listed in Table 2 & 3.

## DISCUSSION

In this 11-months prospective cross sectional study, we found seven patients (6.3%) with DVT among stroke patients referred for

**TABLE 1: Clinical characteristics of patients with and without DVT**

	<b>With DVT (n = 7)</b>	<b>No DVT (n = 104)</b>
Age (Years)	54 – 74	39 – 89
Male	4 (57.1%)	57 (54.8%)
Type of Lesion		
– Cerebral infarction	4 (57.1%)	77 (74.0%)
– Cerebral hemorrhage	3 (42.9%)	27 (26.0%)
Hypertension	5 (71.4%)	58 (55.8%)
Diabetes mellitus	3 (42.9%)	35 (33.7%)
Smoking	0 (0%)	37 (35.6%)
Bed rest > 1 week	6 (85.7%)	92 (88.5%)
Bed rest < 1 week	1 (14.3%)	12 (11.5%)
Atrial fibrillation	0 (0%)	3 (2.9%)
Swelling of Lower Extremity		
– Above Knee	2 (28.6%)	26 (25%)
– Below Knee	1 (14.3%)	13 (12.5%)
– Above and Below Knee	3 (42.9%)	13 (12.5%)
No Swelling	1 (14.3%)	52 (50%)
Leg Pain	0 (0%)	4 (3.8%)
Leg warmth	2 (28.6%)	3 (2.9%)
Leg tenderness	0 (0%)	2 (1.9%)
Homan's sign (+ ve)	0 (0%)	2 (1.9%)
Leg hyperpigmentation	1 (14.3%)	6 (5.8%)
Muscle Power		
– Grade 0	5 (71.4%)	42 (40.4%)
– Grade 1	0 (0%)	18 (17.3%)
– Grade 2	1 (14.3%)	24 (23.1%)
– Grade 3	1 (14.3%)	16 (15.4%)
– Grade 4	0 (0%)	4 (3.8%)
– Grade 5 (Normal)	0 (0%)	0 (0%)

**TABLE 2: Relationship between leg swelling and DVT**

<b>Swelling</b>	<b>Ultrasound for DVT</b>			<b>ODDS Ratio</b>
	<b>+ ve</b>	<b>–ve</b>	<b>Total</b>	
No swelling	1	52	53	1.00
Below the knee	1	13	14	4.00
Above the knee	2	26	28	4.00
Both below and above	3	13	16	12.00
Total	7	104	111	

Chi square for linear trend = 4.991, P = 0.025

**TABLE 3: Logistic regression analysis for DVT among stroke patients**

Variables	ODDS Ratio	95% CI	P-Value
Leg swelling	4.4	1.1-17.7	0.037
Leg weakness	1.0	0.5-2.2	0.968
Bed rest > 1 week	1.2	0.1-17.1	0.877
Cerebral infarction	3.6	0.5-25.8	0.199

Note: Controlled for age (continuous variable), gender, history of diabetes mellitus, hypertension

rehabilitation. Sioson et al reported from Cleveland a prevalence rate for DVT in stroke patients prior to rehabilitation of 33%.<sup>13</sup> Impedence plethysmography (IPG) was used to diagnose the DVT in the study. The average interval between the stroke and the IPG was 45.3 days. Pambianco et al<sup>14</sup> from Pittsburgh reported a corresponding prevalence rate of 21% and Desmukh et al<sup>12</sup> reported a rate of 18%. Thus, the post-stroke DVT prevalence among our patients appears to be lower than that of the Caucasian population. This is consistent with the commonly held view that DVT and pulmonary embolism is less common among Asians.<sup>6,26-28</sup> As for post-stroke DVT study among Asians, Tso<sup>29</sup> reported from Hong Kong an incidence of post-stroke DVT of 17% using 125I-fibrinogen scan. The design of the study was similar to that of Warlow et al in Aberdeen, Scotland, where the incidence of post-stroke DVT was 53%.<sup>30</sup> Tso concluded that the study confirmed the low incidence of venous thromboembolism among Chinese.<sup>29</sup> However, there were also evidences to indicate that venous thromboembolism among Asians is not rare. Dhillon et al<sup>31</sup> from Kuala Lumpur showed that 62.5% of 88 consecutive patients undergoing surgery for fractures of the proximal femur or total hip/knee replacement had venogram evidence of DVT, a rate similar to the Western population. Chau et al<sup>32</sup> in an autopsy study reported a marked rise from 0.58% (1975-79) to 2.08% (1985-89) in the incidence of significant pulmonary thromboembolism in Hong Kong. Our study showed that DVT is not uncommon among Thai stroke patients. Physicians should be on the alert for its early diagnosis and treatment. Further studies should be done among Asians to determine its true incidence and the appropriate prophylactic measures.

Clinical diagnosis of DVT is said to be unreliable.<sup>7-10</sup> None of our patients with DVT had the classical symptoms and signs of pain,

tenderness, warmth, swelling and positive Horman's sign. However, when carefully measured, six out of seven (86%) of our patients with DVT had leg swelling whereas it was seen in only 52/104 (50%) of those without DVT. Leg swelling was the only variable that could be used statistically to predict the occurrence of DVT. Patients with leg swelling above or below the knee had a four times greater risk of developing DVT. For those where the swelling occurred in both above and below the knee, the risk was 12 times. There were other studies which have also found the usefulness of leg swelling as a clinical indicator of DVT.<sup>15,17,33</sup> Landefeld et al<sup>17</sup> found that 46% of patients with swelling above and below the knee developed DVT. Cope et al<sup>15</sup> reported an association of swelling in a weak leg with DVT.

In six of the seven of our patients, the DVT occurred in the weak leg. In the other patient, the DVT occurred in both legs. In five out of the seven patients, the muscle power of the leg that developed DVT was grade zero. There was thus a trend in the association between weak leg and DVT, although it was not statistically significant. Other studies have also showed the association between poor muscle power and DVT.<sup>7-9,13,15,30</sup> The risk of developing DVT in a weak leg was estimated to be four to nine times greater that of the normal leg.<sup>16</sup>

Advancing age has also been found to be a factor in the development of DVT.<sup>8,16</sup> However, age was not a significant factor for predicting DVT in our patients. The mean age of our patients with DVT was 64 years whereas it was 63 years for those without DVT. Other associations which were reported in the literature but not found to be significant in this study were hypertension<sup>12</sup>, atrial fibrillation<sup>34</sup> and varicose vein.<sup>30</sup> These could be due to the small number of patients in our study.

The duration from the onset of stroke to the diagnosis of DVT among our seven patients was

12, 17, 28, 30, 51, 54, and 74 days. However, the exact time that DVT developed in these patients were uncertain as the DVT were clinically occult. With the use of anticoagulants, the leg swelling of our patients reduced slightly or not at all. This might be due to fibrosis causing permanent endothelial and valve damage and chronic venous insufficiency.

In conclusion, DVT was found in 6.3% of all Thai stroke patients before starting rehabilitation. The prevalence of DVT in Thai stroke patients may be lower than that of the Western countries. Six out of seven (86%) of the DVT patients had leg swelling. The risk of DVT was even greater if swelling occurred in both above and below the knee. Careful observation with measurement for leg circumference for early detection of DVT is recommended.

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