

## The Success of Stroke Fast Track at Bangkok Hospital Medical Center: 5 Years' Experience



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**OBJECTIVE:** To study the outcomes of intravenous recombinant tissue plasminogen activator (rt-PA) therapy in acute ischemic stroke patients at Bangkok Hospital Medical Center (BMC).

**MATERIALS AND METHODS:** A retrospective review was performed on acute ischemic stroke patients who arrived at the hospital within three hours of symptom onset and entered the stroke pathway, from 2008 to 2012. The success of the stroke fast track was determined using the National Institute of Health Stroke Scale (NIHSS), Barthel Index (BI), and modified Rankin Scale (mRS) scores.

**RESULTS:** All 1,548 patients were enrolled in the stroke pathway at BMC from 2008 to 2012. There were 182 acute ischemic stroke patients who arrived at the hospital within 3 hours from the onset of symptoms, and 25 of them were eligible for intravenous rt-PA therapy. The patients who received rt-PA therapy demonstrated a significant reduction in NIHSS and mRS scores, as well as a significant increase in BI scores on the discharge day ( $p < 0.01$ ).

**CONCLUSION:** Our data suggests favorable clinical outcomes in acute ischemic stroke patients who received rt-PA therapy, as well as the success of the stroke pathway administration system at BMC.

**T**ime is critical for the brain, especially within the first few hours of stroke symptom onset, because nervous tissue is rapidly lost after the occlusion of cerebral arteries. According to the Ministry of Public Health and the World Health Organization, stroke ranks first amongst causes of death in women, and second in men. Stroke is also associated with high disability rates.<sup>1</sup> Acute stroke patients must be promptly evaluated because some of them may be candidates for thrombolytic treatment with intravenous recombinant tissue plasminogen activator (rt-PA) or alteplase, if they present to the hospital within three hours after symptom onset. This FDA-approved treatment has been shown to reduce long-term disability in ischemic stroke patients.<sup>2-4</sup>

There are currently several clinical practice guidelines for acute ischemic stroke patients; however, the rate of rt-PA utilization remains low, and many hospitals do not have enough capacity to administer this medication, due to their limitations in personnel, radiology and laboratory departments, as well as intensive care and inpatient units. The Brain Center of the BMC developed a Clinical Pathway for Acute Stroke Patients, so that our patients receive international standards of care. This pathway classifies stroke patients who arrive within the three-hour window, and makes sure that they receive rt-PA therapy if deemed eligible. The pathway also ensures that the patients receive international standard treatment within the first week from the multi-disciplinary team in our stroke

unit. This can both reduce the death and disability rates and improve patients' quality of life.<sup>5</sup>

## Materials and Methods

A retrospective review was performed on medical records of patients with the diagnosis of acute ischemic stroke having arrived at the hospital within the 3 hours window and having entered the stroke pathway program. The patients had to be at least 18 years old, with documented National Institute of Health Stroke Scale (NIHSS), Barthel Index (BI), and modified Rankin Scale (mRS) scores at day 0 and day 7. The stroke checklists of these patients according to the Clinical Care Program Certification (CCPC) in ischemic stroke by the Joint Commission International (JCI) are determined as: time of onset, time of arrival, time to first doctor, time to neurologist, time to CT brain, time to CT reading, time to laboratory report (blood sugar, INR, and platelet counts), and time to the bolus dose of rt-PA.<sup>6</sup>

*Statistical Analysis: SPSS (Statistical Package for Social Science) version 18.0*

Demographic data including gender, age, risk factors, the number of patients, the time for intravenous rt-PA administration were analyzed using descriptive statistics, such as frequency, percentage, mean and standard deviation. The comparison of intravenous rt-PA outcomes between

the admission day 0 and day 7 with NIHSS, BI, and mRS scores was performed using paired sample t-test analysis.

## Results

All 1,548 patients were enrolled in the stroke pathway at BMC, Bangkok, Thailand, from 2008 to 2012. Of these, 1,249 were acute ischemic stroke patients, and 182 of them presented to the hospital within 3 hours after symptom onset. Twenty-five of 182 patients were eligible for intravenous rt-PA therapy and their NIHSS, mRS, and BI were determined on admission day 0 and day 7. The data of these patients are characterized as follows:

- Table 1 demonstrates the demographic information of all 1,548 patients who were enrolled into the stroke pathway. 1,249 patients (80.7%) had ischemic stroke. The majority of acute ischemic stroke patients were men (61.4%). The median age was 67 years (range: 24 years to 94 years). Significant risk factors include hypertension, which presented in 74.7% of the patients followed by diabetes mellitus in 32.0%, and dyslipidemia in 24.4%. There were 182 acute stroke (11.8%) patients who arrived at the hospital within the three-hour window, and only 25 (2%) of the Acute Ischemic Stroke patients received intravenous rt-PA administration.

Table 1: Characteristics of patients enrolled in the Stroke Pathway (n = 1,548).

Parameters	Year				
	2008	2009	2010	2011	2012
n (%)	262 (17)	291 (19)	327 (21)	360 (23)	308 (20)
Type of stroke					
Ischemic stroke	240 (19)	244 (20)	255 (20)	284 (23)	226 (18)
Hemorrhagic stroke	22 (8)	47 (16)	72 (24)	76 (25)	82 (27)
Gender					
Male	149 (16)	182 (19)	185 (19)	239 (25)	196 (21)
Female	113 (19)	109 (18)	142 (24)	121 (20)	112 (19)
Age					
Median (range)	69 (33-100)	67 (24-94)	67 (27-99)	65 (21-96)	65 (24-93)
Risk factor					
Hypertension	190 (16)	216 (19)	247 (21)	270 (24)	233 (20)
Diabetes mellitus	94 (19)	82 (17)	102 (21)	118 (23)	100 (10)
Ischemic heart disease	47 (24)	34 (17)	55 (28)	39 (19)	24 (12)
Atrial fibrillation	35 (16)	50 (24)	37 (18)	56 (26)	33 (16)
Smoking	41 (16)	50 (19)	53 (20)	74 (28)	45 (17)
Valvular heart disease	7 (28)	7 (28)	3 (11)	6 (21)	5 (18)
Hypercholesterolemia	0	0	0	223 (59)	155 (41)
Alcohol	0	0	0	59 (64)	33 (36)
Genetic disease	0	0	0	27 (63)	16 (37)
No risk factor	33 (22)	36 (24)	44 (30)	15 (10)	20 (14)
Onset time within 3 hours	39 (21)	36 (20)	38 (21)	38 (21)	31 (17)
IV rt-PA administration	6 (24)	2 (8)	4 (16)	6 (24)	7 (28)

- Table 2 demonstrates the key timing of each process for intravenous rt-PA administration according to JCI standards. Compared with the target time, the **'door to stroke team'** and the **'door to lab results'** were longer than the standard in the first year of the stroke pathway administration system, but decreased continuously as the stroke team realized and solved organizational problems. The **'door to needle'** time was more than the target in 2011 and 2012, due to delayed decision-making by patients'

families, but overall the patients who entered the stroke pathway received intravenous rt-PA therapy within a three-hour window.

- Table 3 demonstrates the outcomes of acute ischemic stroke patients who received rt-PA treatments. The NIHSS and mRS scores reduced significantly; whereas the BI score has significantly increased, suggesting improved outcomes in stroke patients at day 7.

Table 2: Indicators of intravenous rt-PA administration for patients enrolled to Stroke Fast Track.

Indicators	Year									
	2008 (n=6)		2009 (n=2)		2010 (n=4)		2011 (n=6)		2012 (n=7)	
	n* (%)	Mean±SD	n* (%)	Mean±SD	n* (%)	Mean±SD	n* (%)	Mean±SD	n* (%)	Mean±SD
Door to first doctor (Target 10 Minutes)	5 (83.3)	5.5±4.8	2 (100)	2.5±3.5	4 (100)	0.3±0.5	6 (100)	1.8±4.0	7 (100)	0
Door to Stroke team (Target 15 Minutes)	3 (50.0)	24.8±33.0	2 (100)	8.0±4.2	4 (100)	7.0±1.6	5 (83.3)	8.5±10.6	7 (100)	3.6±5.6
Door to CT read (Target 45 Minutes)	6 (100)	29.5± 8.9	1 (50.0)	33.0±19.8	4 (100)	18.8±8.5	4 (66.7)	39.0±21.6	7 (100)	30.9±10.0
Door to lab result (Target 45 Minutes)	4 (66.7)	49.5±36.8	2 (100)	42.5±3.5	4 (100)	19.8±7.6	5 (83.3)	29.2±14.4	4 (57.1)	55.3±48.5
Door to needle (Target 60 Minutes)	5 (83.3)	56.2±28.8	2 (100)	51.0±4.2	3 (75.0)	52.5±19.8	4 (66.7)	64.7±31.2	3 (42.9)	87.6±50.6

n\* = Achieve Target cases

Table 3: Clinical outcome measurement using Paired t-test.

Clinical Outcomes Measures**	Year					t	p value
	2008 (n=6)	2009 (n=2)	2010 (n=4)	2011 (n=6)	2012 (n=7)		
NIHSS (mean)							
- Day 0	6	7	13	7	15	4.68	0.0001*
- Day 7	2	3	6	4	14		
Modified Rankin Scale (mean)							
- Day 0	3	3	4	4	4	4.51	0.0002*
- Day 7	1	2	2	3	4		
Barthel Index (mean)							
- Day 0	70	50	40	50	30	-3.46	0.0025*
- Day 7	90	75	50	60	60		

\*p value ≤ 0.01

\*\*NIHSS was measured to initial stroke severity; Mild stroke (NIHSS ≤ 7), Moderate stroke (NIHSS 8-20) and Severe stroke (NIHSS >20).

-Modified Rankin Scale (mRS) used scale for measuring the degree of disability or dependence in daily activities; 0 - No symptoms,

1 - No significant disability, 2 - Slight disability, 3 - Moderate disability, 4 - Moderately severe disability, 5 - Severe disability and 6 - Dead

-Barthel Index (BI) used to measure performance in activities of daily living (ADL); Very severe disability (0-20), Severe disability (25-45),

Moderate disability (50-70), Mild disability (75-95) and Physically independent (100).

## Discussion

According to our study, the most common vascular risk factors are hypertension, diabetes mellitus and dyslipidemia respectively. In addition, a lot of our stroke patients were active smokers. These are modifiable risk factors, and lifestyle changes can help improve the risk of stroke in this group of patients.<sup>7</sup>

Our study found that only 11.8% of acute stroke patients arrived at the hospital within the 3 hours window, and only 2.0% of acute ischemic stroke patients received rt-PA therapy. Although the rt-PA utilization rate at BMC appears low, this is comparable to the Thai Stroke Registry; a multi-center study in governmental hospitals of Thailand during 2008-2010, revealed that only 3.8% of the acute ischemic stroke patients receive rt-PA.<sup>8</sup> In addition, a study in JCAHO-accredited Hospital in Michigan also shows a low rt-PA utilization rate of 3.8%.<sup>9</sup> The reasons for not using rt-PA in our institution are as follows: rapid improvement of stroke symptoms in 68 patients (43.3%), intracerebral hemorrhage on CT

brain in 29 patients (18.4%), unclear onset time in 15 patients (9.5%) and family refused rt-PA in 10 patients (6.3%) respectively.

The low rate of rt-PA utilization is a major problem worldwide despite its clear benefits, as demonstrated in the study by The National Institute of Neurological Disorders and Stroke (NINDS) and the Zurich Thrombolytic Registry, which show that acute ischemic stroke patients have better clinical outcomes and quality of life at 3 months follow up.<sup>10,11</sup> This is probably due to one of the risks of rt-PA, namely intracranial hemorrhage which can be seen in 6.4% of subjects.<sup>10</sup> However, according to Saver, most patients who developed intracranial hemorrhage were destined anyway for poor clinical outcomes.<sup>12</sup>

## Conclusion

This study suggests favorable clinical outcomes in acute ischemic stroke patients who received rt-PA treatments and who arrived at hospital within 3 hours from the onset of symptoms.

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