

Effect Of Door-To-Needle Time And Infarct Type On Nihss Improvement In Ischaemic Stroke Patients

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ABSTRACT

Introduction : Door-to-needle (DTN) time and the infarct type (i.e. lacunar vs territorial infarct) are two of critical factors that determine ischaemic stroke outcome. This study aim to observe the effect of DTN time and infarction type to the stroke outcome measured by NIHSS improvement.

Methods : This study is an analytic observational study using prospective cohort approach on acute ischemic stroke patients who got thrombolytic therapy at Dr. Kariadi Hospital from January 2018 to May 2018. The difference of the baseline and discharge NIHSS score were examined. The DTN time was documented as 40, 45, 50, 55, and 60 minute. The infarct type was documented as lacunar or territorial infarct. The data tested using Two-Way ANOVA, and post hoc study.

Results : The total of 30 patients had DTN time as follow: 4 (13.3%) were 60 minute, 3 (10%) were 55 minute, 7 (23.3%) were 50 minute, 10 (33.33%) were 45 minute, and 6 (20%) were 40 minute. The Two-Way ANOVA found a significant result in DTN time ($p = 0.024$), the

infarction type ($p = 0.023$), and the interaction of both factors ($p = 0.029$) related to the NIHSS improvement. The post hoc study found the difference of NIHSS improvement occurred between the group 40 minute versus 55 minute ($p = 0.023$) and 60 minute ($p = 0.001$).

Conclusions : The faster DTN time will give the better NIHSS improvement, and if the case is a territorial infarct, then it will give a greater NIHSS improvement than in a lacunar type infarct.

Keywords : thrombolytic, door to needle time, lacunar, territorial, ischemic stroke

Introduction

Stroke is still the major cause of death and disability all over the world. About 80% of all stroke case is an ischaemic stroke. The use of recombinant-Tissue Plasminogen Activator (r-TPA) given to eligible acute stroke patients both via intravenous or intra-arterial within 3 hours of onset is considered to improve clinical outcome of stroke patients. AHA's 2018 guideline in early stroke management recommends to achieve door-to-needle (DTN) time in less than 60 minutes.^(1,2) However there is a recent trend to further shorten the achieved DTN time that may improve the outcome of stroke patients.^(3,4)

The type of infarct can be classified into lacunar and territorial infarct. Lacunar stroke occurs from occlusion of small penetrating artery.⁽⁵⁾ Territorial infarct occurs from occlusion of large cerebral artery, and the infarct area follows the vasculature pattern of cerebral arteries.⁽⁶⁾ It has been known that better outcome is associated with less infarct volume, but there is little study to observe its association with DTN time.⁽⁷⁾

The National Institutes of Health Stroke Scale (NIHSS) is a systematic assessment tool that provides a quantitative measure of stroke-related neurologic deficit. The NIHSS was originally designed as a research tool to measure baseline data on patients in acute stroke clinical trials.

Now, the scale is also widely used as a clinical assessment tool to evaluate acuity of stroke patients, determine appropriate treatment, and predict patient outcome. The NIHSS is a 15-item neurologic examination stroke scale used to evaluate the effect of acute cerebral infarction on the levels of consciousness, language, neglect, visual-field loss, extraocular movement, motor strength, ataxia, dysarthria, and sensory loss. Ratings for each item are scored with 3 to 5 grades with 0 as normal, and there is an allowance for untestable items. The single patient assessment requires less than 10 minutes to complete.^(8,9)

In this study, we try to identify the relationship between DTN time and infarct type with clinical outcome, assessed using NIHSS score, of acute ischemic stroke patients.

Materials and Methods

This study is an analytic observational study using prospective cohort approach on acute ischemic stroke patients who got thrombolytic therapy at Dr. Kariadi Hospital from January 2018 to May 2018. The inclusion criterias were (1) patient with newly acute ischaemic stroke who was eligible to receive thrombolytic therapy, (2) patient got thrombolytic therapy, (3) patient aged 45-75 year old, (4) patient was willing to participate in this study. The exclusion criterias were (1) patient had haemorrhagic transformation due to thrombolytic therapy, (2) patient died prior to discharge, (3) patient got comorbid that could affect NIHSS score at discharge, such as sepsis.

Immediately after the patient's admission, stroke code was alarmed, then attending neurologist examined the history, signs, and symptoms. Baseline NIHSS score was also obtained. The patient then underwent CT-scan to confirm an acute ischaemic stroke. If eligible, the patient got thrombolytic therapy. The informed consent of the study was obtained after thrombolytic therapy was ongoing, so it didn't delay the DTN time. After the procedure, the patient then

treated in Stroke unit and discharged to general ward if necessary. The patient then followed up until being discharged from hospital. The final NIHSS was obtained prior to hospital discharge.

The difference of the baseline and discharge NIHSS score were examined and regarded as an NIHSS improvement. The DTN time was documented as 40, 45, 50, 55, and 60 minute. The infarct type was documented as lacunar or territorial infarct. The data tested using Two-Way ANOVA, and post hoc study. SPSS version 21.00 was used. Statistically significant was established as $p < 0.05$.

Results

Thirty patients were met all of the inclusion and exclusion criterias. Twenty three (76.7%) were male participants, and 7 (23.3%) were female participants. There were 3 patient who didn't show improved NIHSS score from baseline data, they had score of 1, 4, and 8. From these 3 patient, 2 patients had 60 minute DTN time, while the other had 45 minute DTN time. The greatest improvement observed in this study was a patient with baseline NIHSS score of 17 and improved to be 5 at discharge. This patient had DTN time of 40 minute. The demographic data are presented in Table 1.

Tabel I. Demographic data of all subjects

No	Variables	n (%)	mean	±	SD	n (%)
1	Age		57.83	±	9.534	
2	Sex					
	Male					23 (76.7%)
	Female					7 (23.3%)
3	NIHSS					
	Baseline		8.13	±	4.470	
	Discharge		4.50	±	2.570	
	Difference (Improvement)		3.63	±	2.659	
4	DTN time					
	40 min	6 (20.0%)				
	45 min	10 (33.3%)				
	50 min	7 (23.3%)				

55 min	3	(10.0%)
60 min	4	(13.3)
Infarct type		
Lacunar	12	(40.0%)
Territorial	18	(60.0%)
Infarct location		
Dominant	17	(56.7%)
Non-dominant	13	(43.3%)

NIHSS = National Institutes of Health Stroke Scale; DTN = Door-to-Needle.

The Two-Way ANOVA found a significant result in DTN time ($p = 0.024$), the infarction type ($p = 0.023$), and the interaction of both factors ($p = 0.029$) related to the NIHSS improvement. The post hoc study found the difference of NIHSS improvement occurred between the group 40 minute versus 55 minute ($p = 0.023$) and 60 minute ($p = 0.001$).

Table 2. Bivariate analysis of factors contributing to NIHSS improvement

No	Factors	NIHSS improvement			p value	post hoc				
		mean	±	SD		40	45	50	55	60
1	DTN time				0.024*					
	40 min	5.00	±	0.729						
	45 min	3.88	±	0.543		0.079				
	50 min	3.45	±	0.704		0.189	0.998			
	55 min	2.50	±	1.030		0.023*	0.608	0.515		
	60 min	0.67	±	0.971		0.001*	0.106	0.088	0.934	
2	Infarct Type				0.023*					
	Lacunar	2.20	±	0.599						
	Territorial	3.99	±	0.417						
4	DTN time x Infarct Type				0.029*					
	40 min ; Lacunar	2.00	±	1.190						
	40 min ; Territorial	8.00	±	0.841						
	45 min ; Lacunar	2.50	±	0.687						
	45 min ; Territorial	5.25	±	0.841						
	50 min ; Lacunar	2.50	±	1.190						
	50 min ; Territorial	4.40	±	0.752						
	55 min ; Lacunar	4.00	±	1.683						
	55 min ; Territorial	1.00	±	1.190						
	60 min ; Lacunar	1.016x10 ⁻¹³	±	1.683						
	60 min ; Territorial	1.33	±	0.971						

*significant p value

NIHSS = National Institutes of Health Stroke Scale; DTN = Door-to-Needle.

Discussion

In this study, we present 30 patients who got rTPA therapy. In our center we succeed to achieve between 40 to 60 minutes of DTN time. By reducing DTN time, we have seen an improving NIHSS score improvement, which is consistent with the existing literature.

One of the recent studies found the shorter DTN time associated with significantly reduced length of stay (LOS) (from 13.5 ±21.3 to 6.0 ±6.5 days), complications (from 16.7% to 9.8%) and mortality (from 7.8% to 3.9%). While the outcome, assessed using modified Rankin Scale (mRS), increased from before 41.2% to 47.1% at discharge, and from 51.1% to 73.3% at 90 days.⁽¹⁰⁾

Observational cohorts suggest that faster treatment is associated with better in-hospital and 3-month outcomes, and that rTPA efficacy in real life and in randomized controlled trials is similar.⁽¹¹⁻¹⁴⁾

Report of thrombolytic therapy on territorial infarct showed there was a benefit of thrombolytic administration in favorable outcome (better modified Rankin Scale score) and mortality.⁽¹⁵⁾ Our study found that greater NIHSS improvement achieved by territorial infarct population, which is known for more severe stroke type due to larger area of infarct.

Our study had some limitation. In our study, we counted NIHSS improvement at discharged. This data, however, do not concern about the variance in LOS, yet, our study still could demonstrate the association between DTN time and the NIHSS improvement at discharged. Another limitation was the size of the subject enrolled in this study. This limitation is caused by the low rate of seeking medical attention after the onset of stroke in our country which may take a great loss in the count of eligible rTPA candidate.⁽¹⁶⁾

We believe there is still room for improvement to shorten DTN time to achieve a better outcome. Best results were obtained in Helsinki, where in the final year a median DNT of 20 minutes was achieved by “doing as much as possible before the patient has arrived while doing as little as possible after the patient has arrived at the hospital”.⁽¹⁷⁾

Conclusions

This study show the importance of DTN time in thrombolytic therapy, more over, its relationship with the infarct type. The faster DTN time will give the better NIHSS improvement, and if the case is a territorial infarct, then it will give a greater NIHSS improvement than in a lacunar infarct. Further study to confirm its finding with larger sample size is mandatory. Using CT perfusion instead of NIHSS as indicator evaluating the outcome would be interesting.

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Figure Legends