Original Article

Is the NIHSS Associated with Outcomes of Acute Ischemic Stroke in Thai Patients who Received rt-PA Treatment?: A Study from Northeastern Thailand

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Stroke is a leading cause of high morbidity and mortality. The National Institute of Health Stroke Scale (NIHSS) has been shown to be related with poor stroke outcomes. However, the NIHSS cutoff points are varied and never been studied in Thai patients. This study was a descriptive retrospective study and conducted in eight hospitals in the northeastern Thailand. The study period was between May 1st, 2008 and April 30th, 2012. The inclusion criteria were 1) adult patients diagnosed as acute ischemic stroke who received rt-PA treatment and 2) had pre-rt-PA and/or post-rt-PA NIHSS score. The NIHSS score at baseline and post-rt-PA treatment at hospital discharge were studied on the stroke outcomes. There were 685 patients who met the study criteria. The baseline NIHSS of 16 to 25 was associated with poor stroke outcomes with odds ratio of 2.17 (95% CI 1.42, 7.14). In conclusion, the NIHSS score of 16 to 25 associated with poor outcomes in Thai patients with acute ischemic stroke who received the rt-PA treatment.

Keywords: Predictors, Stroke, NIHSS

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Acute ischemic stroke is a common disease leading to morbidity and mortality. A recombinant tissue plasminogen activator (rt-PA) is an effective treatment for acute ischemic stroke. Several previous studies showed that the National Institute of Health Stroke Scale (NIHSS) is a factor that can predict morbidity and mortality of acute ischemic stroke patients[1-4]. The pre-rt-PA NIHSS is associated with clinical stroke outcomes at seven days and three months[2]. Additionally, the baseline NIHSS lower than 6 is a predictor of good prognosis, while the baseline NIHSS over 16 is related to death or disability after treatment.

The NIHSS can be calculated by 15 clinical elements; score between 0 and 42; 42 indicated the most impaired stroke patients[1-4]. Even though the NIHSS can be used to predict stroke outcome, there is limited data on the cutoff point of NIHSS to predict acute ischemic stroke outcomes particularly in Thai patients who received the rt-PA treatment.

Materials and Methods

The present study was a retrospective analytical study. The inclusion criteria were 1) adult patients diagnosed as acute ischemic stroke who received rt-PA treatment and 2) had pre-rt-PA and/or post-rt-PA NIHSS score. This study was conducted in eight hospitals in northeast Thailand including Srinagarind Hospital, Khon Kaen Regional Hospital, Chumpae Hospital, Ubon Ratchathani Hospital, Nakhon Phanom Hospital, Chaiyaphum Hospital, Kalasin Hospital, and Nakhon Ratchasima Hospital. The study period was between May 1st, 2008 and April 30th, 2012.

All eligible patients were evaluated the clinical outcomes before hospital discharge. The clinical outcomes were categorized as stable, improved, and worse by comparing pre- and post-rt-PA NIHSS score. The post-rt-PA NIHSS score was also determined before hospital discharge. The NIHSS score was divided into four groups; 0 to 6, 7 to 15, 16 to 25, and 25 to 42[2]. If the post-rt-PA NIHSS group was lower than the pre-rt-PA NIHSS group, the patients were categorized as improved. If the post-rt-PA NIHSS group was similar to the pre-rt-PA NIHSS group, the patients were categorized as stable. And, if the post-rt-PA NIHSS group was higher than the pre-rt-PA NIHSS group, the patients were categorized as worse.

Descriptive statistics were used to execute baseline characteristics. The pre- and post-rt-PA NIHSS group were compared and showed as concordance and disconcordance in percentage. The odds ratios (95% confidence interval; CI) of pre-rt-PA NIHSS group were calculated for worse clinical outcomes.

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Table 1. Showed pre- and post-rt-PA NIHSS score in acute ischemic stroke patients who received rt-PA treatment

NIHSS score/treatment	Pre-rt-PA		Post-rt-PA	
	Numbers	NIHSS (range)	Numbers	NIHSS (range)
NIHSS 0 to 6	133	5 (1 to 6)	339	2 (0 to 6)
NIHSS 7 to 15	395	11 (7 to 15)	215	11 (7 to 15)
NIHSS 16 to 25	219	18 (16 to 25)	80	18 (16 to 25)
NIHSS 26 to 42	10	29 (26 to 35)	8	28 (26 to 42)
Total	757	12 (1 to 35)	691	6 (0 to 42)

NIHSS = the NIH Stroke Scale, rt-PA = recombinant tissue plasminogen activators

Table 2. Showed correlation between pre- and post-rt-PA NIHSS score in acute ischemic stroke patients who received rt-PA treatment

NIHSS score	NIHSS 0 to 6*	NIHSS 7 to 15*	NIHSS 16 to 25*	NIHSS 26 to 42*	Death*	Total*
NIHSS 0 to 6	118 (93.65)	3 (2.38)	4 (3.17)	0 (0.00)	1 (0.79)	126
NIHSS 7 to 15	182 (50.70)	141 (39.28)	15 (4.18)	3 (0.84)	18 (5.01)	359
NIHSS 16 to 25	34 (17.71)	66 (34.38)	58 (30.21)	5 (2.60)	29 (15.10)	192
NIHSS 26 to 42	2 (25.00)	3 (37.50)	2 (25.00)	0 (0.00)	1 (12.50)	8
Total	336 (49.05)	213 (31.09)	79 (11.53)	8 (1.17)	49 (7.15)	685

NIHSS = the NIH Stroke Scale, rt-PA = recombinant tissue plasminogen activators
* Indicated post rt-PA treatment

Results

During the study period, there were 777 patients who met the study criteria. Of those, 757 patients had NIHSS score prior to rt-PA treatment, 691 patients had NIHSS score after rt-PA treatment, and 685 patients had both pre- and post-rt-PA treatment (Table 1). The majority of patients had pre-rt-PA NIHSS score between 7 to 15 (395 patients) and post-rt-PA NIHSS score between 0 to 6 (339 patients).

After rt-PA treatment, those patients with pre-rt-PA NIHSS score of over 6 had lower NIHSS score (Table 2). For example, the pre-rt-PA NIHSS 16 to 25 group had lower NIHSS score for 52.09%. The overall mortality rate was 7.15%. The pre-rt-PA NIHSS 16 to 25 group had highest mortality rate at 15.10%. Almost half of patients (46.27%) had clinical improvement after rt-PA treatment, while 11.53% of patients had worse outcomes (Table 3). Compared with the pre-rt-PA NIHSS of 0 to 6, only the pre-rt-PA NIHSS of 16 to 25 had worse outcome significantly with odds ratio of 2.17 (95% CI 1.42, 7.14) as shown in Table 4 (*p*-value 0.01).

Table 3. Showed clinical outcomes at hospital discharge by comparing the pre- and post-rt-PA NIHSS score in acute ischemic stroke patients who received the rt-PA treatment

Treatment outcomes	Frequency (percentage)
Stable	289 (42.18)
Improved	317 (46.27)
Worsen	79 (11.53)
Total	685

NIHSS = the NIH Stroke Scale, rt-PA = recombinant tissue plasminogen activators

Discussion

The previous study found that the NIHSS was associated with the 30-day mortality in a linear fashion. The NIHSS of 22 to 42 had the highest mortality at 53.5%, while the NIHSS of 0 to 7 had the lowest mortality at 4.2%[1]. The present study did not find the linear correlation between the NIHSS and mortality (Table 2). The NIHSS group of 16 to 25 had higher mortality rate than the NIHSS group of 26 to 42 (15.10% vs. 12.50%). The overall mortality in the present study was also lower than the previous study (7.15% vs. 13.6%). These differences may be explained from different study populations and treatments. The previous study had much larger sample size than the present study (33,770 vs. 685 patients). The baseline NIHSS in the present study was higher than the previous study (mostly between 7 to 15 vs. median of 5). Additionally, rt-PA was not mentioned in the previous study, while the present study enrolled only acute ischemic stroke patients who received an rt-PA treatment.

Another study, conducted in acute ischemic stroke patients who received the rt-PA treatment in Japan registry, also found that the NIHSS time score is a significant predictor for stroke outcomes[5]. The present study did not evaluate the NIHSS time score but the authors found that the baseline NIHSS of 16 to 25 was significantly associated with worse stroke outcome (Table 4). A recent study found that NIHSS

Table 4. Showed correlation between the pre- and post-rt-PA NIHSS score and clinical outcomes at hospital discharge in acute ischemic stroke patients who received the rt-PA treatment

Pre-rt-PA NIHSS score	Stable/improved, n	Worse, n	Odds ratio	95% CI
0 to 6	118	8	1.00	-
7 to 15	323	36	1.64	0.74 to 3.63
16 to 25	158	34	2.17	1.42 to 7.14
26 to 42	7	1	2.11	0.20 to 19.2

NIHSS = the NIH Stroke Scale, rt-PA = recombinant tissue plasminogen activators

may not be suitable for infratentorial acute ischemic stroke with the rt-PA treatment[6]. The NIHSS cut point for poor outcome was 10 and 6 for supra- and infratentorial ischemic stroke. While, the cutoff of 9 may be appropriate for M2 stroke who required endovascular therapy[7]. Therefore, the NIHSS cut points for poor outcomes may be varied; mostly depend on type of stroke and rt-PA treatment.

There are some limitations in the present study. First, the results of NIHSS odds ratio on worse outcomes were not adjusted by other clinical factors. Second, the poor outcomes were defined at the hospital discharge; not after rt-PA treatment for three months. Third, the NIHSS group of 26 to 42 had very small sample size (n = 8).

In conclusion, the NIHSS score of 16 to 25 associated with poor outcomes in Thai patients with acute ischemic stroke who received rt-PA treatment.

What is already known on this topic?

The NIHSS is associated with acute ischemic stroke outcome. There is no ideal cutoff point of the NIHSS for Thai stroke patients.

What this study adds?

The NIHSS of 16 to 25 is associated with poor outcomes in Thai patients with acute ischemic stroke who received the rt-PA treatment.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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ค่า NIHSS สัมพันธ์กับผลการรักษาผู้ป่วยโรคหลอดเลือดสมองชนิดขาดเลือดชาวไทยที่ได้รับยาละลายลิ่มเลือดหรือไม่ การศึกษาจากภาคตะวันออกเฉียงเหนือของประเทศไทย

มัญชุมาส มัญจาวงษ์, นิศา วรสูต, นรงฤทธิ์ เกษมทรัพย์, สมศักดิ์ เทียมเก่า, กิตติศักดิ์ สวรรยาวิสุทธิ์, กรรณิการ์ คงบุญเกียรติ

โรคหลอดเลือดสมองชนิดขาดเลือดเป็นโรคที่ทำให้เกิดภาวะทุพลภาพและการเสียชีวิตค่า NIHSS เป็นค่าที่สัมพันธ์กับผลการรักษาที่ไม่ดีในผู้ป่วยโรคหลอดเลือดสมองชนิดขาดเลือด อย่างไรก็ตามค่า NIHSS ที่เหมาะสมในการบ่งถึงผลการรักษาที่ไม่ดีมีหลากหลายและยังไม่มีการศึกษาในชาวไทย การศึกษานี้ทำการศึกษาแบบย้อนหลังและชนิดพรรณนาโดยทำการศึกษาในโรงพยาบาลจำนวน 8 โรงพยาบาลในภาคตะวันออกเฉียงเหนือของไทยระหว่างวันที่ 1 พฤษภาคม พ.ศ. 2551 ถึงวันที่ 30 เมษายน พ.ศ. 2555 โดยมีเกณฑ์คัดเข้าการศึกษาคือ 1) ผู้ป่วยผู้ใหญ่ที่ได้รับการวินิจฉัยว่าเป็นโรคหลอดเลือดสมองชนิดขาดเลือดและได้รับการรักษาด้วยยา rt-PA และ 2) มีค่า NIHSS ก่อนและหรือหลังการรักษาด้วยยา rt-PA ค่าคะแนน NIHSS ก่อนและหลังรักษาด้วยยา rt-PA ก่อนที่ผู้ป่วยจะออกจากโรงพยาบาลจะถูกนำมาศึกษากับผลการรักษาโรคหลอดเลือดสมองชนิดขาดเลือด มีผู้ป่วยจำนวน 685 รายที่เข้าเกณฑ์การศึกษาค่าคะแนน NIHSS ที่ 16 ถึง 25 สัมพันธ์กับผลการรักษาโรคหลอดเลือดสมองชนิดขาดเลือดที่ไม่ดีโดยมีค่า odds ratio เท่ากับ 2.17 (95% CI 1.42, 7.14) โดยสรุปค่า NIHSS ที่ 16 ถึง 25 สัมพันธ์กับผลการรักษาโรคหลอดเลือดสมองชนิดขาดเลือดที่ไม่ดีในผู้ป่วยชาวไทยที่ได้รับการรักษาด้วยยาละลายลิ่มเลือด