CLINICAL AND PARACLINICAL CHARACTERISTICS AND TREATMENT OUTCOMES OF PATIENTS WITH MINOR STROKE ADMITTED WITHIN THE FIRST 4.5 HOURS

Mai Duy Ton[1,2,3], Ha Tran Hung[1] and Nguyen Tien Dung[1,2,3,✉]

[1]Hanoi Medical University

[2]Bach Mai Hospital

[3]VNU - University of Medicine and Pharmacy

The optimal therapeutic approach for patients with minor stroke presenting within 4.5 hours of symptom onset remains a subject of ongoing debate, particularly regarding the efficacy and safety of intravenous thrombolysis with alteplase compared to single (SAPT) or dual antiplatelet therapy (DAPT). We conducted a single-center, observational cohort study involving patients with acute minor stroke (NIHSS ≤ 5) who were admitted within 4.5 hours to the Stroke Center of Bach Mai Hospital. Patients were stratified into three treatment groups: intravenous alteplase, DAPT, and SAPT. The primary outcome was a favorable functional incidence at 90 days, defined as a modified Rankin Scale (mRS) score of 0–1. The results show that among 186 patients (34 alteplase, 119 DAPT, 33 SAPT), the proportions achieving mRS 0–1 at day 90 were 90.4% (79.4%, 96.7%, and 78.8%, respectively). The alteplase group demonstrated a higher baseline NIHSS score (median 4 [IQR: 3.75 – 5]) than the DAPT and SAPT groups (both with a median of 2; p < 0.001). Early neurological deterioration (END) occurred in 38.2% of the alteplase group, 18.2% of the SAPT group, and 0.8% of the DAPT group. END was an associated factor with unfavorable outcomes (mRS 2–6), with an adjusted odds ratio of 2.14 (95% CI: 1.25 – 3.68; p < 0.01). In this single-center observational study, 90.4% of patients with minor stroke achieved favorable functional outcomes at 90th day. The rates of favorable outcomes in the DAPT, alteplase, and SAPT groups were 96.7%, 79.4%, and 78.8%, respectively. Patients treated with alteplase had higher baseline NIHSS scores and a greater frequency of early neurological deterioration, which was associated with poor functional outcomes at 90 days.

Keywords: Minor stroke, thrombolysis, dual antiplatelet, single antiplatelet, first 4.5 hours.

I. INTRODUCTION

The term “minor stroke” was initially employed by many researcher in the 2010s to denote “mild ischemic stroke”. This classification is primarily based on clinical presentation-particularly the National Institutes of Health Stroke Scale score-rather than infarct size as assessed by computed tomography or magnetic resonance imaging of the brain.[1] Studies often choose the NIHSS score threshold of ≤ 5 to define as minor stroke.[2-5] Patients who suffered a minor stroke may exhibit mild neurological deficits, which might render their symptoms appearance as less severe which led to delay in seeking medical assistance. These individuals are at an higher risk of recurrent stroke or deteriorating neurologically, perhaps resulting in long-term damage.[6,7]

Neurological deficits in patients with minor

Corresponding author: Nguyen Tien Dung
Hanoi Medical University
Email: nguyentiendungtm29@gmail.com
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stroke are commonly classified as either disabling or non-disabling. These categories are associated with different clinical consequences, with disabling deficits generally leading to more significant long-term impact. However, even mild (non-disabling) symptoms may hinder a patient's ability to resume daily activities or return to their previous occupation.[8,9] Therefore, a more active treatment strategy is needed, especially reperfusion therapy (including thrombolysis and mechanical thrombectomy) or DAPT or SAPT. In patients with minor stroke (NIHSS 0–5), substantial evidence gaps remain regarding the comparative benefits of reperfusion therapy versus dual or single antiplatelet therapy.

To date, the scientific evidence for reperfusion therapy for patients with minor stroke is still unclear.[2,3,10] For patients with minor stroke presenting with disabling neurological deficits, intravenous thrombolysis is recommended within the first 4.5 hours of symptom onset. In contrast, for those without disabling deficits, current evidence remains insufficient to support a clear recommendation for thrombolytic therapy within this time window.[2,7] Based on expertise consensus, the European Stroke Organisation recommends intravenous thrombolysis for patients with acute non-disabling ischemic stroke if a large vessel occlusion is present. For patients with minor ischemic stroke due to LVO and presenting with disabling neurological deficits, current evidence remains insufficient to support the routine use of mechanical thrombectomy. Nevertheless, expert opinion and ESO recommendations suggest that mechanical thrombectomy may be considered in selected cases. In patients with minor stroke due to LVO and non-disabling symptoms, there is currently a lack of sufficient evidence to recommend thrombectomy. In contemporary clinical practice, several physicians opt to postpone thrombectomy and monitor clinical progression, only stepping in when neurological decline becomes apparent. Antiplatelet treatment complies with the current AHA and ESO recommendations. People with an NIHSS score of three or below are recommended to get dual antiplatelet therapy, which consists of clopidogrel and aspirin. Before switching to monotherapy with antiplatelet drugs, the treatment must begin within 24 hours after the beginning of symptoms and last for 21 days, up to 90 days. After receiving dual antiplatelet therapy with ticagrelor and aspirin for up to 30 days, patients with an NIHSS score of 5 or below are advised to switch to single antiplatelet therapy. Consequently, the objective of this investigation was to examine two distinct outcome measures: The primary goal of this investigation was to assess the frequency of favorable functional outcomes (defined as a modified Rankin Scale score of 0–1 at day 90) in patients with minor stroke who were treated with alteplase, DAPT, or SAPT. The identification of factors associated with treatment outcomes, as well as the rates of hemorrhagic transformation and early neurological deterioration, were secondary objectives.

II. MATERIALS AND METHODS

1. Subjects

Patient selection criteria

- Patients were diagnosed with acute ischemic stroke based on the criteria established by the American Heart Association/American Stroke Association.[3]

- NIHSS score on admission ranged from 0 to 5.

- Admitted within 4.5 hours of symptom onset or last known - normal health .

Exclusion criteria

- Patients with incomplete or insufficient medical records for data analysis

- Patients diagnosed with intracerebral hemorrhage, subarachnoid hemorrhage, or traumatic brain injury.

- Patients with a pre-stroke modified Rankin Scale score ≥ 2.

2. Methods

Research methods: Observational, retrospective, longitudinal study design.

Sample selection and sample size: Patient data used in this study were partially derived from the source dataset of a research project approved by the Ethics Committee of Hanoi Medical University and Bach Mai Hospital, following Decision No. 4837/BM-HDDD. (Figure 1).

Study location: Stroke Center - Bach Mai Hospital, Hanoi, Vietnam.

Research variables

Primary outcomes: Favorable outcome criteria are defined as a modified Rankin Scale score of 0-1.

The mRS score is calculated according to the instructions[11]:

- 0: No symptoms.

- 1: No disability. Able to perform all daily activities despite mild symptoms.

- 2: Mild disability. Able to care for self without assistance, but unable to perform all previous activities.

- 3: Moderate disability. Needs assistance but can walk without assistance.

- 4: Moderately severe disability. Unable to move the body without assistance or unable to walk without assistance.

- 5: Severe disability. Needs regular nursing care, confined to bed.

- 6: Death.

Secondary outcomes:

- Rate of hemorrhagic transformation according to ECASS III classification[12]:

+ Hemorrhage infarction type 1: Small hyperdense petechiae.

+ Hemorrhage infarction type 2: More confluent hyperdensity throughout the infarct zone, without mass effect.

+ Parenchymal hematoma type 1: Homogeneous hyperdensity occupying < 30% of the infarct zone; some mass effect.

+ Parenchymal hematoma type 2: Homogeneous hyperdensity occupying > 30% of the infarct zone; significant mass effect. Or, any homogenous hyperdensity located beyond the borders of the infarct zone.

- Rate of early neurological deterioration (END): END is a patient condition in which the NIHSS increased by 2 points compared to admission within the first 72 hours of the disease.

- Some factors related to treatment outcome.

Data collection and analysis methods:

Research Indicators:

- Input variables used for prognostic assessment include:

+ Clinical characteristics: age, gender, blood pressure, NIHSS score, time window from onset to admission.

+ Risk factors: hypertension, atrial fibrillation/flutter, diabetes, hypercholesterolemia, smoking, obesity, history of coronary artery disease, history of ischemic stroke or transient ischemic attack.

+ Blood test: platelets, INR, fibrinogen, aPTTs, cholesterol, HDLC, LDLC, and blood glucose at admission.

+ Cerebral vascular imaging: corresponding intracranial stenosis/occlusion, corresponding extracranial carotid stenosis/occlusion.

+ TOAST classification[13]:

- Large-artery atherosclerosis (LAA).
- Cardioembolic stroke (CE).
- Small-vessel disease (SVD).
- Stroke of other determined causes.
- Stroke of undetermined cause.

+ Treatment strategy: alteplase thrombolytic dose (0.6 mg/kg and 0.9 mg/kg), dual or single antiplatelet.

- Outcome variable: final clinical outcome scored by the mRS scale at 90 days after onset.

Analysis methods

All patients with acute ischemic stroke admitted to our center are managed in a dedicated stroke unit, where they undergo comprehensive clinical evaluation, including NIHSS scoring at admission and reassessment every six hours or upon detection of clinical changes. Stroke assessment is conducted according to AHA guidelines. It includes neuroimaging (MRI or CT) to evaluate brain parenchymal lesions, intracranial vascular imaging (MRA or CTA), carotid ultrasonography, transthoracic echocardiography, electrocardiography, and blood tests for classification of ischemic stroke subtypes based on the TOAST criteria. Antiplatelet therapy is administered following AHA and ESO guidelines: dual antiplatelet therapy with aspirin and clopidogrel is indicated for patients with NIHSS scores ≤ 3 within the first 24 hours, continued for 21 days (up to 90 days), before transitioning to single antiplatelet therapy, DAPT with ticagrelor and aspirin may be used for up to 30 days in patients with NIHSS ≤ 5, followed by a switch to SAPT.[6,7] Patients with minor stroke admitted within 4.5 hours of symptom onset are assessed for intravenous thrombolysis based on the presence of disabling neurological deficits, by AHA and ESO recommendations. Optimal medical management with SAPT or DAPT is provided without such deficits.[2,6,7]

We conducted a retrospective chart review to identify patients with minor ischemic stroke who were admitted to the Stroke Center of Bach Mai Hospital within 4.5 hours of last known well. Based on documented treatment strategies in the medical records, patients were categorized into three groups: those treated with intravenous Alteplase, those receiving dual antiplatelet therapy, and those receiving single antiplatelet therapy. We subsequently compared the proportion of patients achieving a favorable outcome on day 90, the rates of hemorrhagic transformation and early neurological deterioration, as well as various clinical, laboratory, imaging, and treatment-related characteristics among the three groups.

Quantitative variables were expressed as median and interquartile range (IQR) or mean and standard deviation. Qualitative variables were expressed as frequency and percentage. Clinical variables, imaging, treatment methods, and etiology of cerebral hemorrhage were compared between the two groups based on the clinical outcome of death or non-death using the T-test for quantitative variables, or the Mann-Whitney U test for qualitative variables. Univariate and multivariate regression analyses were conducted to calculate the odds ratio (OR) for the association between prognostic factors and outcome variables. A p-value < 0.05 represents a statistically significant difference with a 95% confidence interval (CI). Data were entered and processed using SPSS software (IBM, Chicago, USA).

3. Research ethics

This study was conducted using data extracted from a research project approved by the Ethics Committee of Bach Mai Hospital (Decision No. 4837/BM-HDDD) on November 11, 2023.

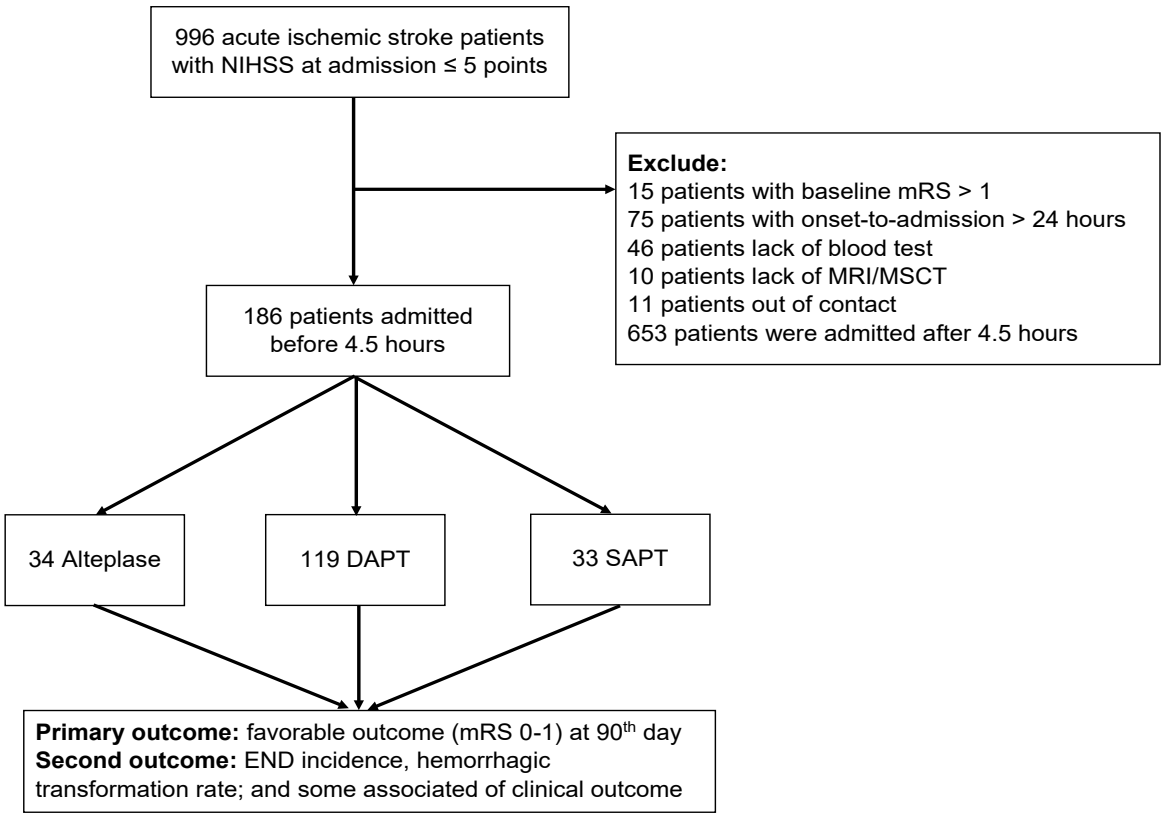

Figure 1. Study flowchart of patient selection and grouping

SAPT: single antiplatelet therapy; DAPT: dual antiplatelet therapy; NIHSS: National Institutes of Health Stroke Scale; mRS: Modified Rankin Score; END: early neurological deterioration; MRI: magnetic resonance imaging; MSCT: Multi-slice computed tomography

This is a retrospective observational study. All treatment decisions were made before data collection, based on routine clinical practice. The diagram illustrates patient inclusion and classification based on documented records, without randomization or intervention by the study investigators.

III. RESULTS

A total of 186 patients diagnosed with minor stroke were included in the study. All were admitted within 4.5 hours of symptom onset or the last known normal health. The study population was categorized into three treatment groups: intravenous alteplase (n = 34; 18.28%), dual antiplatelet therapy (DAPT; n = 119; 63.98%), and single antiplatelet therapy (SAPT; n = 33; 17.74%).

Table 1. Patient characteristics by treatment group (Alteplase, DAPT, and SAPT)

	Alteplase (n = 34)	DAPT (n = 119)	SAPT (n = 33)	p	note
Patient Characteristics					
Age (IQR)	65.59 ± 9.01	63.45 ± 11.41	65.89 ± 13.23	0.422	α
Male, n (%)	23 (67.6)	79 (66.4)	24 (72.7)	0.79	£
Initial SBP, mmHg, mean ± SD	152.06 ± 18.67	154.34 ± 25.02	152.94 ± 27.98	0.876	α, ¥
Initial DBP, mmHg, mean ± SD	89.09 ± 11.62	86.97 ± 13.09	89.58 ± 12.87	0.477	α, ¥
NIHSS, IQR	4 (3.75 - 5)	2 (1 - 3)	2 (2 - 3.5)	*< 0.001*	α
END, n (%)	13 (38.2)	1 (0.8)	6 (18.2)	*< 0.001*	
Admission within the first 3-hour window, n (%)	21 (61.8)	62 (52.1)	14 (42.4)	0.29	£
Admission within the first 3 - 4.5-hour window, n (%)	10 (29.4)	57 (47.9)	19 (57.6)	0.058	£
Risk of stroke					
Hypertension, n (%)	25 (73.5)	85 (71.4)	21 (63.6)	0.623	£
Atrial Fibrillation/ Flutter	2 (5.9)	0	0	NA	£
Diabetes, n (%)	8 (23.5)	23 (19.3)	3 (9.1)	0.275	£
High blood cholesterol, n (%)	3 (8.8)	8 (6.7)	3 (9.1)	0.776	£
Smoking, n (%)	11 (32.4)	25 (21.0)	8 (24.2)	0.388	£
Overweight/Obese, n %	5 (14.7)	23 (19.3)	7 (21.2)	0.771	£
Previous Ischemic stroke/TIA, n (%)	3 (8.8)	17 (14.3)	9 (27.3)	0.093	£
Blood test					
Platelets, mean ± SD	257.38 ± 68.75	269.31 ± 67.43	263.67 ± 62.4	0.639	α, ¥
INR, mean ± SD	0.98 ± 0.08	1.02 ± 0.72	0.97 ± 0.08	0.862	α, ¥
Fibrinogen, mean ± SD	3.35 ± 0.71	3.36 ± 0.71	3.26 ± 0.68	0.801	α, ¥

	Alteplase (n = 34)	DAPT (n = 119)	SAPT (n = 33)	p	note
Blood test					
aPTTs, mean ± SD	29.84 ± 4.52	29.14 ± 3.51	28.94 ± 4.2	0.577	α, ¥
Cholesterol total, mean ± SD	4.88 ± 1.21	4.94 ± 1.15	4.71 ± 0.99	0.588	α, ¥
HDL-C, mean ± SD	1.12 ± 0.29	1.16 ± 0.62	1.28 ± 0.54	0.475	α, ¥
LDL-C, mean ± SD	2.71 ± 0.95	2.72 ± 0.96	2.53 ± 1.08	0.564	α, ¥
Glucose on admission, mean ± SD	7.67 ± 3.17	7.46 ± 2.83	7.3 ± 3.89	0.884	α, ¥
Atrial Fibrillation/ Flutter on admission, n (%)	2 (5.9)	0	0	NA	
TOAST Classification					
Large artery atherosclerosis, n (%)	5 (14.7)	20 (16.8)	6 (18.2)	0.928	£
Cardioembolism, n (%)	2 (5.9)	0	0	NA	
Small artery occlusion, n (%)	17 (50.0)	80 (67.2)	14 (42.4)	0.16	£
Stroke of other determined cause, n (%)	1 (2.9)	0	0	NA	
Stroke of undetermined cause, n (%)	9 (26.5)	19 (16.0)	13 (39.4)	0.106	£
Treatment					
Alteplase, n (%)		NA	NA		
0.6 mg/kg, n (%)	18 (52.9)	NA	NA		
0.9 mg/kg, n (%)	16 (47.1)	NA	NA		
Door-to-needle time, Minutes (mean ± SD)	36.29±12.82	NA	NA		
Hemorrhage transformation, n (%)	1 (2.9)	1 (0.8)	0		

	Alteplase (n = 34)	DAPT (n = 119)	SAPT (n = 33)	p	note
Treatment					
Intracranial atery stenosis, n (%)	2 (5.8)	14 (11.7)	1 (3.0)	0.234	β €
Large vessel occlusion, n (%)	5 (14.7)	9 (7.6)	5 (15.2)	0.281	β €
Number of days in hospital, Day, IQR	3 (2 - 3.25)	3 (2 - 4)	3 (2 - 4)	0.761	β €

α - normally distributed continuous data, β - nonnormally distributed continuous data
¥ - t-test ; € - Kruskal-Wallis test ; £ - chi-square test

The alteplase group had a higher median NIHSS score at admission (4 [IQR: 3.75 – 5]) compared to the DAPT group (2 [IQR: 1 – 3]) and the SAPT group (2 [IQR: 2 – 3.5]). The incidence of early neurological deterioration (END) was highest in the alteplase group (38.2%), followed by the SAPT group (18.2%) and the DAPT group (0.8%). The proportion of patients achieving a favorable functional outcome (mRS 0–1 at day 90) was highest in the DAPT group (96.6%), compared to 79.4% in the alteplase group and 78.8% in the SAPT group.

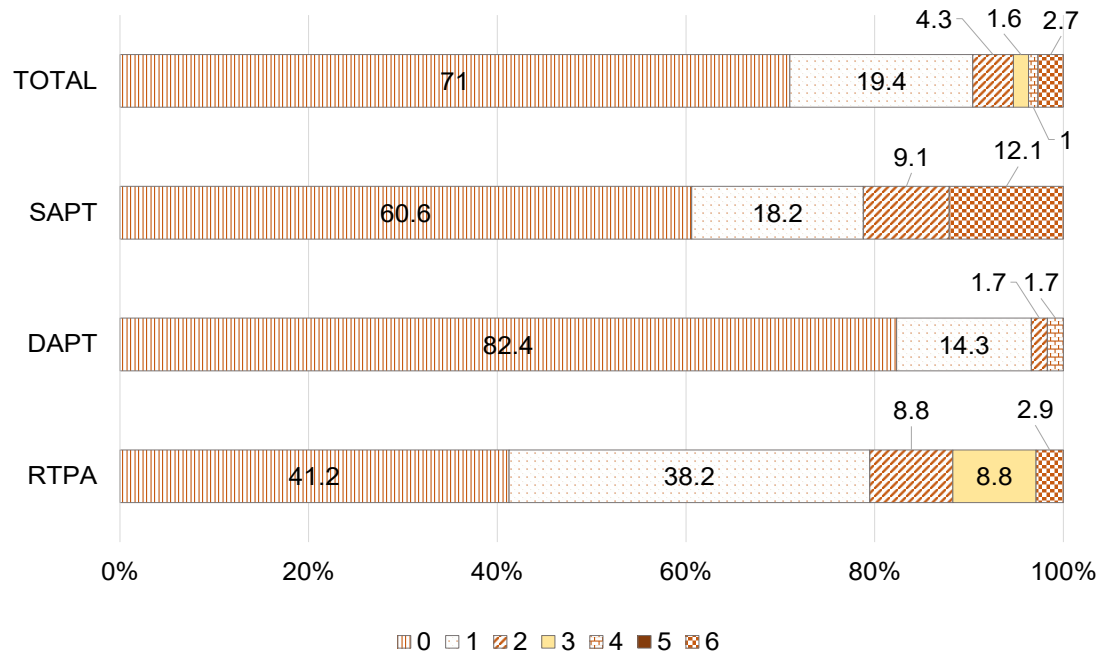

Chart 1. Distribution of modified Rankin scale scores at day 90
mRS: Modified Rankin Score; SAPT: single antiplatelet therapy; DAPT: dual antiplatelet therapy

At day 90, the proportion of patients achieving a favorable functional outcome (mRS 0–1) was 96.7% in the DAPT group, 79.4% in the alteplase group, and 78.8% in the SAPT group. The overall favorable outcome rate for the study population was 90.4%.

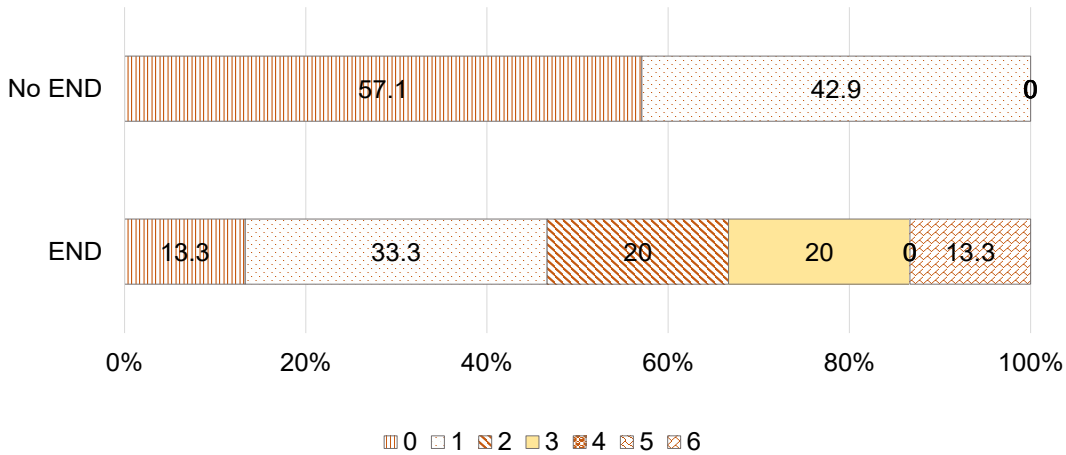

Chart 2. Distribution of modified Rankin scale scores at day 90 in the alteplase group stratified by early neurological deterioration

END: early neurological deterioration; mRS: Modified Rankin Score

In the alteplase group, all patients without early neurological deterioration achieved favorable functional outcomes at day 90, compared to 46.6% of those who experienced END. Additionally, the mortality rate among patients with END was 13.3%, whereas no death was recorded in patients without END.

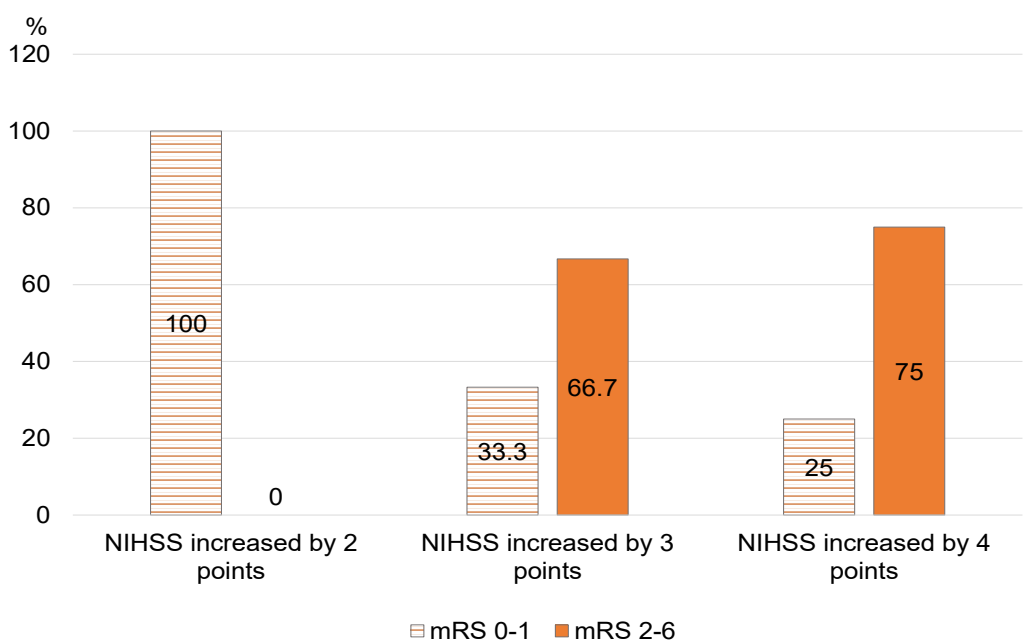

Chart 3. Baseline NIHSS scores and day-90 mRS outcomes in the alteplase group

NIHSS: National Institutes of Health Stroke Scale; mRS: Modified Rankin Score

Among patients with END in the alteplase group, higher degrees of NIHSS scores increase were associated with lower rates of favorable outcomes. A favorable outcome was achieved in 100% of patients with a 2-point rise in NIHSS, compared to 33.3% with a 3-point increase and 25% with an increase of 4 points or more.

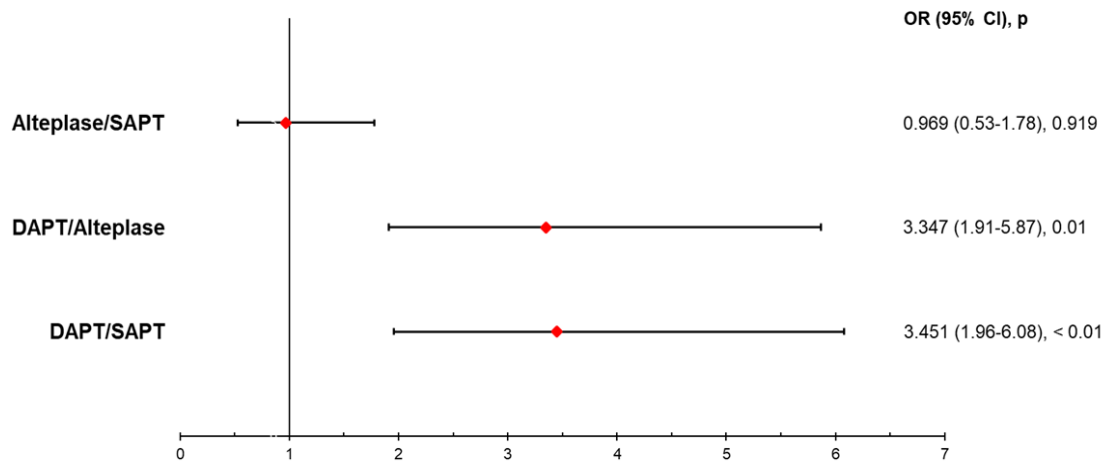

Chart 4. Comparative likelihood of achieving mRS 0–1 at day 90 among treatment subgroups

SAPT: single antiplatelet therapy; DAPT: dual antiplatelet therapy; mRS: Modified Rankin Score; OR: odd ratio

The DAPT group was more likely to achieve favorable outcomes than the Alteplase group with OR = 3.347 (95% CI: 1.91 - 5.87) and the SAPT group with OR = 3.451 (95% CI: 1.96 - 6.08). The likelihood of achieving favorable outcomes in the Alteplase and SAPT groups was not statistically different.

IV. DISCUSSION

The standard of care for patients with acute ischemic stroke is reperfusion therapy, which includes intravenous thrombolysis and/or mechanical thrombectomy, as recommended by the American Heart Association, the European Stroke Organisation, and the Vietnamese Ministry of Health.[2,3] Nevertheless, the potential benefits and hazards of reperfusion therapy must be meticulously assessed in patients with minor strokes before decisions are made. The primary basis for the current guidelines for this subgroup is secondary analyses from large randomized controlled trials, as per the American Heart Association and the European Stroke Organisation. By assessing the efficacy of reperfusion therapy-specifically intravenous thrombolysis, dual antiplatelet therapy, and single antiplatelet therapy-in patients with minor stroke, this study provides supplementary evidence to the existing literature.

The primary finding of this investigation was that the alteplase group achieved a 79.4% rate of patients attaining satisfactory neurological recovery, which was defined as a modified Rankin Scale score of 0–1 at 90 days. The DAPT group had a 96.6% rate, while the SAPT group had a 78.8% rate. This discovery is consistent with prior literature. Wen-Jun Tu et al. reported that 80.8% of patients treated with intravenous alteplase and 79.6% of those receiving standard medical therapy attained a favorable functional outcome at 90 days in a comparable patient population study.[14]

A multicenter prospective cohort study was conducted by Chunmiao Duan et al. to assess the treatment outcomes of 1401 patients with minor stroke and large vessel occlusion who received intravenous alteplase, dual antiplatelet therapy, or aspirin. In the alteplase group, the proportion of patients who achieved a favorable functional outcome at 90 days was 86.8%. In the DAPT group it was 82.9%, and in the aspirin group it was 77.2%, according to the study. The authors also observed that patients who received thrombolysis had a substantially higher likelihood of a favorable neurological recovery than those who received aspirin. Conversely, there was no statistically significant difference between the thrombolysis and DAPT groups.[15] Luo et al. (2024) also analyzed patients with minor stroke and large vessel occlusion and reported findings that were consistent with those of Chunmiao Duan et al. The control group had a lower proportion of patients (70.6%) than the alteplase group (74.6%) who achieved a modified Rankin Scale score of 0–1 at 90 days, with no statistically significant difference.[16] Hui-Sheng Chen et al. investigated patients with minor stroke presenting with non-disabling neurological deficits and reported similar findings. The proportion of patients achieving a modified Rankin Scale score of 0–1 at 90 days was 91.4% in the alteplase group and 93.8% in the DAPT group.[9] The clinical outcomes of the Alteplase group were less favorable than those of the DAPT group in our study, a result that contradicts numerous previously published studies. This discrepancy may be partially accounted for by the substantially higher baseline NIHSS scores observed in the Alteplase group (median 4 [IQR 3.75–5]) compared to the DAPT group (median 2 [IQR 1 – 3]; $p < 0.001$).

Among 996 minor stroke patients, 186 were hospitalized within the first 4.5 hours of symptoms onset, and 34 received intravenous thrombolysis treatment. With a 90-day death rate of 2.9% (1/34) and a hemorrhagic transformation rate of 2.9% (1/34) in this cohort, the results show that thrombolysis was safe. Compared to other studies, we obtained similar results. In a retrospective analysis of 26236 patients with minor ischemic stroke conducted by Wen-Jun Tu et al., including 13208 patients in the intravenous thrombolysis group and 13208 in the control group, the 90-day mortality rate was 2.1% in the intravenous thrombolysis group compared to 2.5% in the group receiving standard medical therapy. The incidence of symptomatic intracerebral hemorrhage was 1.8% and 1.5%, respectively.[14] Chunmiao Duan et al.'s study: Alteplase for minor stroke patients with large vessel occlusion: corresponding 90-day mortality rates were Alteplase 0%; DAPT 0.55%; Aspirin 2.34%.[15] Luo 2024 studied the same population as Chunmiao Duan et al. and found that the 90-day mortality rates were 0.2% and 0.2% in the Alteplase and aspirin groups, respectively, and the sICH rates were 2.1% and 2.0%.[16] Hui-Sheng Chen et al.'s study of patients with minor stroke with non-disabling neurological deficits using thrombolysis or DAPT showed 90-day mortality rates of 0.9% and 0.5%, respectively; hemorrhagic transformation rates of 5.4% and 1.6%; sICH 0.9% and 0.3%; END rates of 9.1% and 4.6%, respectively.[9] Pooja Khatri et al.'s study similar to Hui-Sheng Chen et al.'s, which used aspirin or Alteplase, found that the 90-day mortality rate was 0.6% and 0%, respectively. The rate of hemorrhage transformation was 7.1% and 3.3%, and the rates of sICH were 3.2% and 0%, respectively.[8] Mostafa Hossam El Din Moawad et al. performed a meta-analysis of 93057 minor strokes treated with Alteplase, including

21 studies, only one randomized controlled trial found that the Alteplase group, compared with the control group had a higher chance of achieving mRS 0-1 at day 90 with OR 1.67 (95% CI: 1.46 - 1.91).[17]

Early neurological deterioration is an associated factor of poor neurological outcomes.[18] In the Alteplase group, we had 13 (38.2%) patients with END, and the rate of mRS 0-1 on day 90 was 46.2%, much lower than the non-END group with a rate of 100%. Our study confirmed that early neurological deterioration was an associated factor of poor neurological outcome (mRS 2-6 at 90th day) with OR 2.14 (95% CI: 1.25 - 3.68), $p < 0.01$.

Limitations of the Study: First, due to the retrospective and observational nature of our study. Clinical characteristics, laboratory parameters, imaging findings, and treatment strategies were not uniformly standardized across all patients. Additionally, there was an imbalance in the sample sizes of the three treatment groups, which might led to bias and compromised the validity of the observed results. Second, our findings cannot be applied to the larger Vietnamese stroke population due to the single-center design and very small sample size. Nonetheless, these preliminary results may provide a basis for generating hypotheses to inform future prospective, multicenter interventional studies aimed at optimizing treatment strategies for patients with minor ischemic stroke. This population constitutes a substantial proportion of all stroke cases. Third, baseline characteristics differed across treatment groups. In comparison to the DAPT group [2 (IQR: 1 – 3)] and the SAPT group [2 (IQR: 2 – 3.5)], patients in the Alteplase group had a higher median NIHSS score [4 (IQR: 3.75 – 5)] upon admission, indicating more severe neurological impairments. Large vessel occlusion was also more common in the Alteplase group than in the DAPT group and was comparable to the SAPT group. The Alteplase group showed a lower percentage of good outcomes and a greater frequency of early neurological impairment, which may be partially explained by these baseline abnormalities. The discrepancy between our results and those published in earlier research may potentially be explained by these disparities. Fourth, our study identified END as a variable associated with unfavorable functional outcomes at day 90. However, this association was established through univariate analysis. Given the small subgroup sample sizes, performing a multivariable logistic regression analysis would have been underpowered and may not yield statistically robust estimates.

V. CONCLUSION

In this single-center observational study, 90.4% of patients with minor stroke achieved favorable functional outcomes at 90 days. The proportions of favorable outcomes in the dual antiplatelet therapy, alteplase, and single antiplatelet therapy groups were 96.7%, 79.4%, and 78.8%, respectively. Patients treated with alteplase had higher baseline NIHSS scores and a greater frequency of early neurological deterioration. Early neurological deterioration was independently associated with poor functional outcomes at 90 days. Further large-scale, multicenter randomized controlled trials are needed to directly compare the efficacy and safety of these three treatment strategies in the Vietnamese population.

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