

Abstract

Background: Malignant middle cerebral artery occlusion was high mortality rate in previous study and had longer hospital stay than non-middle cerebral artery occlusion.

Object: To study mortality rate, characteristics, other morbidity cause and modified ranking score (mRS) at 30 days after patients had malignant middle cerebral artery occlusion in stroke unit, Rajavithi Hospital.

Method: Retrospective cross sectional study of all acute ischemic stroke patients admitted in stroke unit, Rajavithi hospital from 1 July 2019 to 31 December 2021. Reviewing the medical record database of acute ischemic stroke patients who had middle cerebral artery occlusion. The diagnosis of middle cerebral artery occlusion was made by cerebrovascular specialist. The patients who had malignant middle cerebral artery more than 48 hours after onset of symptom and who were less than 18 years old would be excluded.

Result: From all 1100 ischemic stroke patients, 158 patients with malignant middle cerebral artery occlusion were included in this study. 20 patients were death within 30 days. Mortality rate is 12.7%. Risks for poor prognosis outcome are statistic significantly for patients who died within 30 days were NIHSS score (16.5 vs 13.48, P 0.04), onset time (359 min vs 671.9 min, P 0.002), congestive heart failure (45% vs 15.2%, P 0.04), midline shift (50% vs 8.7%, P < 0.01) and hemorrhagic transformation (65% vs 26.4%, P < 0.01). The patients who died within 30 days average of hospital stay were 9.9 days. Survive patients had higher hospital stay (22.2 days vs 9.9 days, P < 0.01)

Mortality Rate within 30 Days of the Patients Present with Malignant Middle Cerebral Occlusion in Stroke Unit, Rajavithi Hospital

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Conclusion: Malignant middle cerebral artery occlusion patients in stroke unit, Rajavithi Hospital had higher mortality rate at 30 days, higher mRS score at 30 days and longer hospital stay than those of general ischemic stroke patients.

Keywords: Acute ischemic stroke, Mortality, large artery occlusion, Middle cerebral artery occlusion,

Introduction

Ischemic stroke is a major healthcare problem that represents the third leading cause of death in Thailand. The overall incidence is around 206 per 100,000 population per year and is likely to rise in the future.¹ The disease accounts for 10% of deaths and 50-60 percent of the patient are left permanently disabled. In the case of large artery ischemic stroke, which is found in approximately 3-15% of all ischemic stroke patients¹⁻⁶, it was found to be associated with higher rates of death and disability, with a 17-80%¹⁻⁶ higher rate of death among hospitalized patients.

Patients with large artery ischemic stroke tend to develop cerebral edema after the brain is deprived of blood supply. It was found that the death rate was much higher, about 80%.^{2,5,6} As a result of increased intracranial pressure, patients experience cerebral displacement or cerebral hemorrhage in the area of the brain that is deprived of blood supply. The duration of palliative care is 2-5 days^{2-4,7} and it is often performed in an intensive care unit because there are complications that can cause reduced consciousness, a coma, or an inability to breathe adequately. Those patients often have to be treated by craniectomy to help reduce intracranial pressure.^{2,4-6,9,10} and in a study in Hong

Kong, patients with large artery ischemic stroke had a 30-day mortality rate significantly higher than those with ischemic stroke, at 31.1% and 4.6%,¹¹ respectively.

However, if large artery ischemic stroke patients who are at risk of developing more complications can be identified in the early stages through physical examination history, level of consciousness, stroke assessment scale score, neurological diagnostic imaging report, and blood pressure and blood sugar level, the death rate will be decreased accordingly.^{2,3-6,10}

However, mortality rate of malignant middle cerebral artery occlusion in Rajavithi Hospital has not been study. The researcher thus recognized the importance of finding large arterial ischemic stroke due to malignant middle cerebral artery occlusion patients who are at risk of death.

Objectives

The main objective is to determine the mortality rates within the 30 days after hospital admission of large artery ischemic stroke due to malignant middle cerebral artery occlusion patients in the stroke unit of Rajavithi Hospital.

The secondary objective is to study the factors associated with the death of large artery ischemic stroke due to malignant middle cerebral artery occlusion patients.

Materials and Methods

A retrospective cross-sectional study used collected data from large arterial ischemic stroke due to malignant middle cerebral artery occlusion patients admitted to the stroke unit of Rajavithi Hospital between 1 July 2019 - 31 December 2021.

Inclusion criteria

- Age 18 and above
- Computed tomography of the brain revealed more than 50% of the middle cerebral artery (MCA) occlusion patients.
- A patient diagnosed with large artery ischemic stroke due to malignant middle cerebral artery occlusion based on a CT brain scan who is hospitalized within 48 hours after showing symptoms of large artery ischemic stroke.

Exclusion criteria

- Patients whose medical record is incomplete or missing.
- Patients who were diagnosed with large artery ischemic stroke due to malignant middle cerebral artery occlusion based on a CT brain scan who is hospitalized more than 48 hours after showing symptoms of large artery ischemic stroke.
- Patients who were with large artery ischemic stroke was referred for the continuation of treatment according to the patient right before the duration of 30 days.

Withdrawal criteria

None

Sample size calculation

Sample size calculating for descriptive to estimate single proportion (categorical data)

$$n = \frac{Z_{\alpha/2}^2 p(1-p)}{d^2}$$

α = Pr. of type I error = 0.05 (2-sided)

$Z_{0.025} = 1.96$

P = Estimated proportion of large artery ischemic stroke patients who died within 30 days was 31.1 from study of Anderson COT¹¹

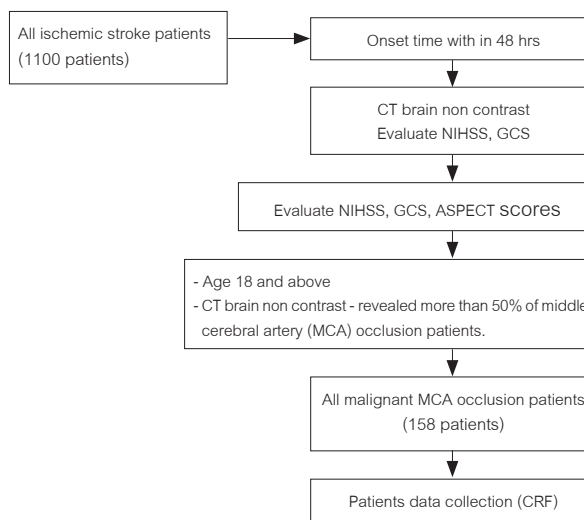
d = Margin of error in estimating π = 20% of estimated proportion ($d = 0.20 \times 0.311 = 0.062$)

$$n = \frac{1.96^2 \times 0.311 \times (1-0.311)}{0.062^2}$$

$n = 215 + \text{missing data } 10\% = 237$

Total patients estimate for this study is 237.

The researcher collected data from large artery ischemic stroke patients admitted to the stroke unit of Rajavithi Hospital between 1 July 2019 - 31 December 2021, approximately 158 patients.

Flowchart of the study**Statistical analyses**

Descriptive data were shown as mean and standard deviation (SD). Categorical data were presented in frequency and percent. SPSS version 22.0 was used for statistical analysis. Chi-square test was used to compare risk factors and outcomes between mRS below 6 group and mRS 6 group. Independent T-test was used to compare. Statistical significance was defined as p-value < 0.05.

Result

The new stroke unit of Rajavithi Hospital was founded in July 2019. To date, a total of 158 large artery ischemic stroke due to malignant middle cerebral artery occlusion patients have been reported, accounting for 14.4%.

The 30-day mortality rate of these patients resulted in a total of 20 cases, accounting for 12.7%. The researcher sees a relatively high mortality rate and wants to search for the factors associated with the death of this group of patients.

The study found that the average age of all patients is 67 years old and 49.4% of patients are women. When comparing large artery ischemic stroke patients who died within 30 days of being in the hospital and those who do not die, the mean age of the deceased is 70.4 years old VS 63.7 years old P 0.10, female 55% vs 48.6% P 0.59. NIHSS score 16.5 vs 13.5 P 0.04, GSC score 12.4 vs 13.3 P 0.28, ASPECT 5.6 vs 5 P 0.29, onset time 359 mins vs 671.9 mins P 0.02. (Table 1)

Other conditions that may be associated with large artery ischemic stroke and 30-day mortality rate include: diabetes mellitus 25% vs 24.6% P 0.58, hypertension 50% vs 56.5% P 0.58, dyslipidemia 15% vs 18.8% P 1.00, previous stroke 50% vs 39.1% P 0.36, congestive heart failure 45% vs 15.2% P 0.04, AF 50% vs 36.2% P 0.33, smoking 20% vs 28.9% p 0.40 (Table 1)

Other laboratory findings show no significant difference : HbA1C 6.9% vs 6.6% P 0.77, blood sugar at ER 160.8 VS 145.2 P 0.36, LDL 125.7 vs 121.6 P 0.70, WBC count at day1 8912 vs 9561.7 P 0.36. (Table 1)

In terms of radiology test result, there was no significant difference among patients who died within 30 days and those who do not die. It is found that M1-segment middle cerebral artery (MCA) occlusion is 85% vs 72.4% P 0.23, MCA occlusion is more than 50% of MCA territory is 15% vs 27.6% P 0.16, hyperdense MCA sign 80% vs 61.6% P 0.11, hyperdense ICA sign 40% vs 23.9% P 0.13 (Table 1)

When comparing the treatment of patients who died within 30 days and those who do not die., rtPA 35% vs 30.4% p 0.68, thrombectomy 15% vs 5.79% p 0.15. No statistically significant of treatment of patients in 2 groups but we found the patients who was died within 30 days were had thrombectomy more than other group. (Table 1)

The predictors prognosis for previous study were age above 70 years, lower GSC at day 1 below 10⁸, in this study risks for poor prognosis outcome are not statistic significantly but found higher ratio in patients who died within 30 days were age more than 80 years (40% vs 19.6%), GCS at day 1 < 10 (20% vs 13%), ICA occlusion (35% vs 26.8%), arrhythmia (55% vs 44.2%) and DBP ≥ 110 at ER (35% vs 15.9%) (Table 2)

Large artery ischemic stroke patients who were treated at Rajavithi Hospital received 31% rtPA and 7% thrombectomy (Table 3)

Complications seen in the patients who died within 30 days and survived patients are midline shift 50% vs 8.7% P < 0.01, hemorrhagic transformation 65% vs 26.5% P 0.001, craniectomy 25% vs 8% P 0.34, tracheostomy 5% vs 10.9% P 0.70 (Table 4)

The duration from the stroke onset to worsening is 27.8 hrs vs 37.5 hrs P 0.24. We found the patients who had midline shift and hemorrhagic transformation in patients who died within 30 days more than survived patients groups were statistic significantly.

In this study the risks for poor prognosis outcome are statistic significantly for patients who died within 30 days were NIHSS score, onset time, congestive heart failure, midline shift and hemorrhagic transformation. (Table 4)

It was found that the patients who died within 9.9 days after being hospitalized and survived patients had an average hospital stay of 22.2 days, which is longer than those of general ischemic stroke patients. The patients who died within

30 days have a 100% rate of bedridden from the beginning of hospitalization, while the survived counterparts have a 42% rate of bedridden, $p < 0.01$ (Table 5)

Table 1 Demographic profile and patients characteristic of malignant middle cerebral artery occlusion

	mRS < 6 in 30 (n= 138)	mRS = 6 in 30 (n = 20)	P value
Demographics			
Age (mean years)	63.7	70.4	0.10
Female	67 (48.6%)	11 (55%)	0.59
NIHSS	13.5	16.5	0.04
GSC	13.3	12.4	0.28
ASPECT	5	5.6	0.29
Onset (mins)	671.9	359	0.02
Comorbidity			
Diabetes mellitus	34 (24.6%)	5 (25%)	0.58
Hypertension	78 (56.5%)	10 (50%)	0.58
Dyslipidemia	26 (18.8%)	3 (15%)	1.00
Previous stroke	54 (39.1%)	10 (50%)	0.36
Congestive heart failure	21 (15.2%)	9 (45%)	0.04
Atrial fibrillation	50 (36.2%)	10 (50%)	0.33
Smoking	40 (28.9%)	4 (20%)	0.40
Laboratory			
HbA1C	6.6	6.9	0.77
Blood sugar at ER	145.2	160.8	0.36
LDL	121.7	125.7	0.70
WBC count at day 1	9561.7	8912	0.36
Imaging			
cMCA	100 (72.4%)	17(85%)	0.23
pMCA	38 (27.6%)	3 (15%)	0.16
Hyperden MCA	85 (61.6%)	16 (80%)	0.11
Hyperdense ICA	33 (23.9%)	8 (40%)	0.13

cMCA - total occlusion of MCA territories.

pMCA - partial occlusion and occlusion more than 50% of MCA territories.

Table 2 Risks for poor prognosis outcome after malignant middle cerebral artery occlusion

	mRS < 6 in 30 (n = 138)	mRS = 6 in 30 (n = 20)	P value
Demographics			
Age (years)			
<80	111 (80.4%)	12 (60%)	0.48
≥ 80	27 (19.6%)	8 (40%)	
GCS at day 1			
< 10	18 (13%)	4 (20%)	0.49
≥ 10	120 (87%)	16 (80%)	
ASPECT			
< 6	86 (62.3%)	13 (65%)	0.82
≥ 6	52 (37.7%)	17 (35%)	
ICA			
Yes	37 (26.8%)	7 (35%)	0.45
No	101 (73.2%)	13 (65%)	
Treatment			
rtPA or thrombectomy	46 (33.3%)	8 (40%)	0.56
None	92 (66.7%)	12 (60%)	
Arrhythmia			
Yes	61 (44.2%)	11 (55%)	0.50
No	77 (55.8%)	9 (45%)	
DBP (mmHg)			
< 110	116 (84.1%)	17 (65%)	0.61
≥ 110	22 (15.9%)	3 (35%)	

Table 3 Treatment after malignant middle cerebral artery occlusion

	mRS < 6 in 30 (n = 138)	mRS = 6 in 30 (n = 20)	P value
Treatment			
rtPA	42 (30.4%)	7 (35%)	0.68
Thrombectomy	8 (5.7%)	3 (15%)	0.15
None	92 (66.7%)	12 (60%)	0.56

Table 4 Complication after malignant middle cerebral artery occlusion

	mRS < 6 in 30 (n = 138)	mRS = 6 in 30 (n = 20)	P value
Complication			
Midline shift	12 (8.7%)	10 (50%)	<0.01
Hemorrhagic transformation	37 (26.5%)	13 (65%)	<0.01
Time to deterioration (hrs)	37.54	27.79	0.24

Table 5 Outcome after malignant middle cerebral artery occlusion

	mRS < 6 in 30 (n = 138)	mRS = 6 in 30 (n = 20)	P value
Outcome			
Length of stay (days)	22.2	9.85	<0.01
Tracheostomy	15 (10.9%)	1 (5%)	0.70
Bed ridden	59 (42.7%)	20 (100%)	<0.01
Craniectomy	11 (7.97%)	5 (25%)	0.34

Values are presented as number(percent) and mean±SD

* Significant at P-value <0.05 with Chi-square test and Independent T-test.

Discussion

The malignant middle cerebral artery occlusion patients had 14.4% in stroke unit, Rajavithi Hospital. Which similar to the previous study, the rate of large artery ischemic stroke patients was 3-15%.²⁻⁶ The 30-day mortality rate of these patients resulted in a total of 20 cases, accounting for 12.7%. It is lowest to a previous study in Hong Kong, which showed the 30-day mortality rate at 31.1%.¹¹

We found the risks for poor prognosis outcome are statistic significantly for patients who died within 30 days were NIHSS score, onset time, congestive heart failure, midline shift and hemorrhagic transformation. It shows that the NIHSS score of the patients who died within 30 days is higher and significantl statistically. Shorter onset time to the hospital than those who do not die after suffering from an ischemic stroke. It is probably because this patients may have more severe neurological symptoms. The NIHSS score can be used as a tool to assess neurological symptoms in ischemic stroke patients. The other comorbid conditions seen significantly in patients who died within 30 days after being hospitalized is congestive heart failure. These informations would help for recognized the importance of finding large arterial ischemic stroke due to malignant middle cerebral artery occlusion

patients who are at risk of death and help planning for early management in high risk groups.

Other risks for poor prognosis outcome are not statistic significantly but found higher ratio in patients who died within 30 days were age more than 80 years, GCS at day 1 < 10, ICA occlusion, arrhythmia, and DBP ≥ 110 at ER. The limitation of our study was small sample size.

Large artery ischemic stroke due to malignant middle cerebral artery occlusion patients at Rajavithi Hospital received rtPA 31% and thrombectomy 7%, which was lower than 10% and lower than western countries due to clinical efficacy, cost-effectiveness, universal access to thrombectomy remains challenge in asia.¹¹ Average hospital stay of 22.2 days, which is longer than those of general ischemic stroke patients. The patients who died within 30 days have a 100% rate of bedridden from the beginning of hospitalization.

Conclusion

The severity of stroke at onset was related to mortality and morbidity of ischemic stroke patients. The risks for poor prognosis outcome are statistic significantly for patients who died within 30 days were NIHSS score, onset time, congestive heart failure, midline shift and hemorrhagic transformation.

Malignant middle cerebral artery occlusion patients in stroke unit, Rajavthi Hospital had higher mortality rate at 30 days, higher mRS score at 30 days and longer hospital stay than those of general ischemic stroke patients.

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