

## Short Term Outcome Of Patients With Middle Cerebral Artery Territory Stroke

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### ABSTRACT:

**Background:** Subtotal or complete middle cerebral artery (MCA) territory infarctions, with or without additional ischemia of the anterior or posterior cerebral artery (ACA, PCA), constitute up to 10% of patients with supratentorial infarcts. The major cause of immediate mortality in MCA stroke is the neurological insult. Aspiration pneumonia and pulmonary embolism are the common secondary complications leading to mortality.

### Objectives:

1.To assess the outcome of patients with Middle Cerebral Artery stroke at the end of one month.

2.To assess the risk factors associated with increased mortality at the end of one month.

**Methodology:** A total of 112 patients in the department of General medicine diagnosed as MCA territory stroke who fulfilled the inclusion criteria were selected after obtaining consent. The risk factors were assessed, initial NIHSS and initial ASPECTS score was also assessed. The patients were clinically evaluated and followed up for development of aspiration pneumonia and hyponatremia. They were also followed up at day 30 with modified rankin scale. The relation of risk factors, clinical parameters, initial NIHSS 2 and initial ASPECTS score were compared with patient outcome and modified rankin scale.

**Results:** Out of the 112 patients with MCA stem or major branch occlusion, 82 patients (73.2%) survived till day 30. 20 patients (17.9%) succumbed to their illness before day 7. 25 patients (22.3%) were unable to perform previous activities and 9 patients (8%) were bedridden. 37 out of 112 patients (33.03%) showed neurological improvement, 37 patients (33.03%) showed deterioration of neurological status and 38 patients (33.9%) remained static. Clinical course was complicated by aspiration pneumonia in 39 patients (34.8%) and hyponatremia in 39 patients (34.8%). Systemic hypertension (in 61 patients, 54.5%), diabetes (in 46 patients, 41.1%) and alcoholism (in 45 patients, 40.2%) were the commonest risk factors. All the patients with initial NIHSS score 15 or less survived while only 93.2 % of subjects with initial NIHSS score >15 survived. Majority of patients with higher initial CT ASPECTS score  $\geq 3$  (80 patients; 83.3 %) survived, while majority of patients (11 patients; 84.7%) with initial CT ASPECTS score <3 have not.

**Conclusion:** One month survival in MCA stem or major branch occlusion was 73.2% which was lesser when compared to the overall survival in ischemic stroke. Majority of patients (84.7%) with initial ASPECTS score <3 have expired. All the patients with initial NIHSS score 15 or less have survived.

**Keywords:** Middle Cerebral Artery, ASPECTS score, NIHSS score

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### I. Introduction

Middle cerebral artery stroke describes the sudden onset of focal neurological deficit resulting from brain infarction or ischemia in the territory supplied by middle cerebral artery. Subtotal or complete middle cerebral artery (MCA) territory infarctions, with or without additional ischemia of the anterior or posterior cerebral artery (ACA, PCA), constitute up to 10% of patients with supratentorial infarcts.

Large space-occupying middle-cerebral-artery or hemispheric ischemic brain infarcts are associated with the development of massive brain oedema, which may lead to herniation and early death. This condition, which has been described as malignant middle-cerebral artery infarction, usually involve infarction of at least two thirds of the MCA<sup>1</sup>.

The major cause of immediate mortality in MCA stroke is the neurological insult. Aspiration pneumonia and pulmonary embolism are the common secondary complications leading to mortality. The National Institutes of Health Stroke Score is widely used to predict the outcomes of stroke patients. It includes items to assess level of consciousness, gaze, visual fields, facial palsy, motor strength, ataxia, sensation, language, dysarthria, and extinction/inattention. ASPECTS was widely used in clinical practice to determine the severity of ischemic injury

on brain tomography for deciding the treatment of choice and was reported to predict the neurological outcome; in particular, stroke patients with high ASPECTS have a more favourable prognosis.

## **II. Materials and Methods**

**Type of study:** This is a Prospective observational study which was approved by the institutional review board and received the ethics committee approval from the institutional ethics committee.

**Study population:** Patients with ischemic stroke in MCA territory presenting within 24hrs of symptom onset, admitted in Govt. Medical College, Kottayam, who have fulfilled the inclusion criteria.

**Inclusion criteria:** Patients with Ischemic stroke in MCA territory presenting within 24hrs of symptom onset.

### **Exclusion criteria:**

- Previous episodes of stroke
- Acute lacunar infarcts in MCA territory

**Methodology:** A total of 112 patients in the department of General medicine diagnosed as MCA territory stroke who presented within 24hrs of symptom onset were selected after obtaining consent. All patients included in the study had a detailed history including the risk factors like diabetes, hypertension, heart diseases, history of smoking, alcoholism and clinical evaluation. Treatment included antiplatelets and anti-oedema measures. Clinical evaluation of the patient including pulse rate, blood pressure and auscultation of the chest was done. Total WBC count, differential count, serum electrolytes were also done. NIHSS (National Institute of Health Stroke Scale) was calculated at the time of admission, and followed up at the end of 1st week. NIHSS score ranged from 0 to 42, and it was further stratified as follows: 0= no stroke 1-4=minor stroke 5-15=moderate stroke 15-20=moderate to severe stroke 21-42= severe stroke. Early CT changes of MCA stroke at the time of admission was noted and Alberta Stroke Program Early CT Score was calculated from the CT image at the time of admission. ASPECTS score will be graded as <3, 3-7 and more than 7. Repeat CT was done in patients with fall in GCS. Outcomes were measured as survival, death within one week and death after one week. Modified rankin scale was calculated during the follow-up of cases in the OPD. Those who were lost to follow up were contacted using telephone. The outcome and mRS at the end 1 month were compared with the initial NIHSS and initial CT ASPECTS score and with the patient risk factors including diabetes, hypertension, dyslipidaemia, history of heart disease, smoking history, use of alcohol and the side of weakness and with other clinical parameters including pulse rate, blood pressure, presence of AF, aspiration pneumonia, hyponatremia, UTI and with the presence of haemorrhagic transformation on CT.

**Sample size:** From the study conducted by Eric Juttler, the survival rate of Middle cerebral artery stroke was 47%. Sample size is calculated based on the formula  $n=4pq/d^2$   $N=4 \times 47 \times 53 / 9.4 \times 9.4 = 112$

**Data collection procedure:** Data was entered in Microsoft excel and analysed using IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. IBM Corp.

## **III. Confidentiality:**

Strict confidentiality was ensured by keeping the patients anonymous with study numbers and the information gathered will only be used for scientific publication.

## **IV. Ethical Issues:**

The proposal of the study was presented in front of the Institutional Review Board and the approval for the study was obtained from the Institutional Ethics Committee and informed consent was taken from all patients enrolled in the study.

## **V. Analysis of Data:**

Data was entered in Microsoft excel and analysed using IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. IBM Corp. Categorical variables were expressed as frequency (percentage) and association of various outcome scores with various factors were tested using Pearson Chi-square test. For all these statistical interpretations,  $p < 0.05$  was considered the threshold for statistical significance.

VI. Results:

**Table 6.1 Distribution Based on Population Characteristics**

Variable	Levels	N (%)
Age group	18- 39	5 (4.5)
	40-59	44 (39.3)
	60-79	62 (55.4)
	> 80	1 (0.9)
Gender	Male	60 (53.6)
	Female	52 (46.4)
Side of weakness	Left	48 (42.9)
	Right	64 (57.1)
Hypertension	Yes	61 (54.5)
	No	51 (45.5)
Diabetes mellitus	Yes	46 (41.1)
	No	66 (58.9)
Dyslipidemia	Yes	28 (25.0)
	No	84 (75.0)
Heart disease	Yes	32 (28.6)
	No	80 (71.4)
Smoking	Yes	39 (34.8)
	No	73 (65.2)
Alcoholism	Yes	45 (40.2)
	No	67 (59.8)
Pulse rate	<60	12 (10.7)
	60-100	85 (75.9)
	>100	15 (13.4)
Atrial fibrillation	Yes	22 (19.6)
	No	90 (80.4)
Systolic BP	< 140	11 (9.8)
	140-159	41 (36.6)
	≥ 160	60 (53.6)
Diastolic BP	<90	19 (17.0)
	91-99	48 (42.9)
	≥ 100	45 (40.2)
NIHSS D1	1 - 4	1 (0.9)
	5 - 15	31 (27.7)
	16 - 20	44 (39.3)
	21 - 42	36 (32.1)
ASPECTS score	8 - 10	55 (49.1)
	3 - 7	44 (39.3)
	< 3	13 (11.6)

**Table 6.2: Frequencies of outcome scores**

Scores	Levels	Frequency N (%)
Outcome	Survival	82 (73.2)
	Death in < 1 week	20 (17.9)
	Death in > 1 week	10 (8.9)
mRS	Able to perform all usual activities	10 (8.9)
	Unable to perform previous activities	25 (22.3)
	Able to walk without assistance	23 (20.5)
	Unable to walk without assistance	15 (13.4)
	Bedridden	9 (8.0)
	Death	30 (26.8)
NIHSS after day 30	1 - 4	10 (8.9)
	5 - 15	44 (39.3)
	16 - 20	18 (16.1)
	21 - 42	10 (8.9)
	Death	30 (26.8)

**Table 6.3 Association of side of weakness, Diabetes status, hypertension, dyslipidaemia and history of heart disease with NIHSS score on day one**

Variable	Levels	NIHSS day 1				$\chi^2$	P value
		1 - 4 N (%)	5 - 15 N (%)	16 - 20 N (%)	21 - 42 N (%)		
Side of weakness	Left	1 (2.1)	15 (31.2)	18 (37.5)	14 (29.2)	2.02	0.57
	Right	0 (0.0)	16 (25.0)	26 (40.6)	22 (34.4)		
Hypertension	Yes	0 (0.0)	14 (23.0)	24 (39.3)	23 (37.7)	3.57	0.312
	No	1 (2.0)	17 (33.3)	20 (39.2)	13 (25.5)		
Diabetes Mellitus	Yes	0 (0.0)	8 (17.4)	17 (37.0)	21 (45.7)	8.22	0.042*
	No	1 (1.5)	23 (34.8)	27 (40.9)	15 (22.7)		
Dyslipidaemia	Yes	0 (0.0)	6 (21.4)	10 (35.7)	12 (42.9)	2.31	0.51
	No	1 (1.2)	25 (29.8)	34 (40.5)	24 (28.6)		
Heart disease	Yes	1 (3.1)	7 (21.9)	12 (37.5)	12 (37.5)	3.49	0.32
	No	0 (0.0)	24 (30.0)	32 (40.0)	24 (30.0)		

*P value <0.05 is considered statistically significant  
Pearson Chi-square test*

**Inference**

There is a statistically significant association between diabetes mellitus and NIHSS score at day one. Majority of patients with diabetes had a higher score at day 1, whereas majority of those without diabetes had a score in the range 16-20. There is no association for side of weakness, hypertension, dyslipidaemia and history of heart disease with NIHSS on day 1.

**Table 6.4 Association of NIHSS score at day one and ASPECTS score with outcome**

Scores	Levels	Outcome			$\chi^2$	P value
		Survival N (%)	Death in < 1 week N (%)	Death in > 1 week N (%)		
NIHSS day 1	1 - 4	1 (100.0)	0 (0.0)	0 (0.0)	63.33	<0.001*
	5 - 15	31 (100.0)	0 (0.0)	0 (0.0)		
	16 - 20	41 (93.2)	2 (4.5)	1 (2.3)		
	21 - 42	9 (25.0)	18 (50.0)	9 (25.0)		
ASPECT	8 - 10	45 (81.8)	8 (14.5)	2 (3.6)	27.98	<0.001*
	3 - 7	35 (79.6)	6 (13.6)	3 (6.8)		
	<3	2 (15.4)	6 (46.2)	5 (38.5)		

*P value <0.05 is considered statistically significant  
Pearson Chi-square test*

**Inference**

There is a statistically significant association for NIHSS score on day one and ASPECTS score with the final outcome. All the patients with NIHSS score 15 or less have survived while only 93.2 % of subjects with NIHSS score survived. Majority of patients with higher ASPECTS score ( $\geq 3$ ) have survived, while majority of patients with score  $<3$  have not.

**Table 6.5 Association of Aspiration pneumonia, Hyponatremia, Urinary tract infection and Haemorrhagic transformation with outcome**

Variable	Levels	Outcome			$\chi^2$	P value
		Survival N (%)	Death in < 1 week N (%)	Death in > 1 week N (%)		
Aspiration pneumonia	Yes	19 (48.7)	14 (35.9)	6 (15.4)	18.60	<0.001*
	No	63 (86.3)	6 (8.2)	4 (5.5)		
Hyponatremia	Yes	30 (76.9)	7 (17.9)	2 (5.1)	1.08	0.58
	No	52 (71.2)	13 (17.8)	8 (11.0)		
Urinary tract infection	Yes	12 (80.0)	1 (6.7)	2 (13.3)	1.7	0.427
	No	70 (72.2)	19 (19.6)	8 (8.2)		
Haemorrhagic transformation	Yes	17 (56.7)	10 (33.3)	3 (10.0)	7.08	0.029*
	No	65 (79.3)	10 (12.2)	7 (8.5)		

\*P value <0.05 is considered statistically significant  
Pearson Chi-square test

**Inference**

There is a statistically significant association for aspiration pneumonia and haemorrhagic transformation with the final outcome. Among the patients who did survive majority had not developed aspiration pneumonia, whereas majority patients who died (< 1week or > 1 week) had developed aspiration pneumonia. Among the patients who survived majority had developed haemorrhagic transformation.

**Table 6.6 Association of NIHSS score at day one and ASPECTS score with Mrs**

Scores	Levels	mRS						$\chi^2$	P value
		Able to perform all usual activities N(%)	Unable to perform previous activities N(%)	Able to walk without assistance N(%)	Unable to walk without assistance N(%)	Bedridden N(%)	Death N(%)		
NIHSS day 1	1 – 4	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	111.7	<0.001*
	5 -15	9 (29.0)	11 (35.5)	11 (35.5)	0 (0.0)	0 (0.0)	0 (0.0)		
	16 – 20	0 (0.0)	14 (31.8)	12 (27.3)	9 (20.5)	6 (13.6)	3 (6.8)		
	21 - 42	0 (0.0)	0 (0.0)	0 (0.0)	6 (16.7)	3 (8.3)	27 (75.0)		
ASPECT	8 - 10	6 (10.9)	15 (27.3)	11 (20.0)	9 (16.4)	4 (7.3)	10 (18.2)	27.0	0.003*
	3 - 7	4 (9.1)	9 (20.5)	11 (25.0)	6 (13.6)	5 (11.4)	9 (20.5)		
	<3	0 (0.0)	1 (7.7)	1 (7.7)	0 (0.0)	0 (0.0)	11 (84.6)		

P value <0.05 is considered statistically significant  
Pearson Chi-square test

**Inference**

There is a statistically significant association for NIHSS score on day one and ASPECTS score with the mRS. Majority of patients with NIHSS score equal to or less than 15 had better outcomes in the mRS. Majority of patients with NIHSS score between 16 and 20 were unable to perform previous activities and majority of patients with NIHSS score more than 20 had death as their outcome. Majority of patients with higher ASPECTS

score (8-10) had outcomes like unable to perform previous activities and those with score between 3-7 were mostly able to walk without assistance. However, majority of patients with score less than 3 had death as their outcome.

## **VII. Discussion:**

In the present study, out of the 112 patients with MCA stem or major branch occlusion, 60 patients (53.5%) were males and 52 patients (46.5%) were females. 62 patients (55.4%) were of the age group 60-79 years. In the present study systemic hypertension (in 61 patients, 54.5%), diabetes (in 46 patients, 41.1%) and alcoholism (in 45 patients, 40.2%) were the commonest risk factors. Other risk factors were dyslipidaemia in 28 patients (25%), heart disease in 32 patients (28.6%), smoking in 39 patients (34.8%). Atrial fibrillation was present in 22(19.6%) patients. In the study by Saadat Kamran et al, the commonest risk factors were hypertension (52.1%), diabetes (31.5%)<sup>2</sup>. This was found to be similar to the present study. In the present study, 31 patients (27.7%) had an initial NIHSS of 5-15, 44 patients (39.3%) had an initial NIHSS of 16-20 and 36 patients (32.1%) had an initial NIHSS score of 21- 42. Majority (55 patients;49.1%) had an initial CT ASPECTS score of 8-10 and only 13 patients (11.6%) had an initial score <3.

In the current study, 82 patients (73.2%) survived till day 30. 20 patients (17.9%) succumbed to their illness before day 7. In the study by Stephen E Roberts and others the overall mortality following stroke was 11.6% at seven days, 21.4% at 30 days<sup>3</sup>. This was comparable to the present study. In the study by Xue -dong Liu and others, the survival rates following stroke even at the end of one-year period was 91.9%. The survival rate was lesser in our study, as only MCA territory strokes were included in our study. Causes of death were aspiration pneumonia and neurological deterioration in the present study. 37 out of 112 patients (33.03%) showed neurological improvement, 37 patients (33.03%) showed deterioration of neurological status and 38 patients (33.9%) remained static. Clinical course was complicated by aspiration pneumonia in 39 patients (34.8%) and hyponatremia in 39 patients (34.8%). In the study by feng et al the clinical course was complicated by aspiration pneumonia in 12.5%<sup>4</sup>, which was much lesser as compared to the current study probably because of better care and lesser stroke severity of the patients. 25 patients (22.3%) were unable to perform previous activities and 9 patients (8%) were bedridden. According to moulin et al, 28% patients were bedridden and 15% were unable to perform previous activities<sup>5</sup>. This disparity may be because of better post discharge care in our setting.

In the present study, there was no association for gender, age group, smoking habit and alcoholism or presence of hypertension, dyslipidaemia and history of heart disease with NIHSS at presentation or with the initial CT ASPECTS score or survival. However, there was significant association between diabetes mellitus and NIHSS score at day 1. Majority of patients with diabetes had a higher score at day 1, whereas majority of those without diabetes had a score in the range 16-20. 21 patients (45.7%) with diabetes had a score of 21-42, it was much lower in those without diabetes. In the present study, there is also statistically significant relation between diabetes status and mRS score, with a greater number of patients with outcome as death (14.1%), followed by unable to walk without assistance. While among the patients with no diabetes the outcome was mostly able to walk without assistance followed by unable to perform previous activities. In the study by Lau LH and others, diabetes was associated with poor neurological outcome, which was measured using modified rankin scale. According to the study by Ryota tanaka, presence of diabetes was associated with mortality of 7.1% at end of 30days, whereas nondiabetics was associated with no mortality. The greater mortality in the current study may be because, only MCA strokes were taken into account.

In the present study, there was significant association for NIHSS score on day one and ASPECTS score with the final outcome and modified rankin scale. All the patients with NIHSS score 15 or less have survived while only 93.2 % of subjects with NIHSS >15 score survived. According to study by C O Dawodu and others, patients with NIHSS score of 20 and above had mortality of 56.5%, NIHSS score between 15-19, mortality was 30%, With NIHSS score between 6-14, mortality was 24.9%. With NIHSS score of 5 or less there were no deaths. In the current study, majority of patients with higher ASPECTS score  $\geq 3$ (80 patients;83.3 %) have survived, while majority of patients (11 patients; 84.7%) with score <3 have not. Among the patients who did survive majority had not developed aspiration pneumonia, whereas majority patients who died (< 1 week or > 1 week) had developed aspiration pneumonia. Majority of patients who developed aspiration pneumonia had death as their final outcome. Similarly, majority of patients who developed haemorrhagic transformation had death as their final outcome.

## **VIII. Conclusion:**

One month survival in MCA stem or major branch occlusion was 73.2% which was lesser when compared to the overall survival in ischemic stroke. Most common risk factors in the study were hypertension (54.5%) and diabetes (41.1%). Majority of patients (84.7%) with initial ASPECTS score<3 have survived. All the patients with initial NIHSS score 15 or less have survived. Aspiration pneumonia was associated with greater mortality (51.3%).

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