Stroke Scores, their Clinico-Radiological Correlations in Acute Middle Cerebral Artery Infarct: A Study from Resource Limited Setting of Eastern India

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Abstract

Background: Stroke is 2nd leading cause of death worldwide and two third of these deaths Occur in people living in developing countries. Neuroimaging is the cornerstone of the diagnosis of stroke. The aim of the study was to predict the prognostic value of 4 scores in acute anterior circulation stroke those who have high grade stenosis in CT Angiogram.

Materials and Methods: It was a prospective clinical study in a tertiary referral corporate hospital of eastern India from January 2017 to December 2017. We Selected Anterior Circulation Stroke Patients Having High Grade Stenosis (60% - 100%) as our case cohort. High grade stenosis was confirmed by CT angiogram. Total 38 Patients were included. Aspects Score, clot burden score (CBS), collateral Score (CS) was calculated after doing NCCT Brain and CT angiogram. All Scores Were dichotomized to a high and low Score to predict the outcome in each Group. Ethical clearance was obtained from ethical society of SCB Medical College. Statistical analysis was done by spas software version 24.

Results: From the patient cohort incidence in male was higher than females. All the three scores were used to evaluate the patients. Post discharge follow up revealed significant improvement in patients having high scores in CBS, CT, ASPECTS and low scores in NIHSS. The collateral score was statistically significant in determining the prognosis of patients.

Conclusion: Plain CT scan is not enough to predict and prognosticate the outcome of ischemic stroke patients. CTA, CT perfusion scan must be done in all ischemic stroke patients to measure infarct core and salvageable penumbra which can be thrombolysed within window period. Collateral score can give better prediction about stroke outcome than other scores.

Keywords: *Stroke; CTA; Collateral Score; Clot Burden Score*

Introduction

Stroke is 2nd leading cause of death worldwide and two third of these deaths occur in people living in developing countries. Global burden of disease (GBD) study 2010 estimates that incidence of stroke is 68.6%, prevalence 52.2%, stroke death 70.9%, disability is 77.7% [1]. Someone has stroke every 45 seconds and every 3.1 minutes someone dies out of stroke [2]. According to the estimates from the GBD study in 2001, over 85 per cent of the global burden of stroke was borne by low- and middle-income countries (LMICs) [3]. Given the lack of reliable reporting mechanisms and disease or death registration systems in LMICs, the epidemiological findings from the GBD study for most of the LMICs are likely to be underestimated. India has been experiencing significant demographic, economic and epidemiological transition leading to increase in life expectancy and increase in numbers of old people during the past two decades [4]. Reliable morbidity and mortality estimates for stroke in India are very limited [5]. An eastern India based systemic review showed that the crude stroke prevalence in different parts of India ranged from 44.29 to 559/100,000 persons during the past two decades. The cumulative incidence of stroke in India ranged from 105 to 152/100,000 persons per year during the past two decades in different parts of the country. These estimates on stroke incidence and prevalence are found to be higher than those of high income countries (HIC) [6]. In a global systematic

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review on stroke epidemiology, the age-adjusted stroke incidence rate in HICs was reported to be 94/100,000 person-years during the 2000-2008For each decade after age 55, the risk of stroke doubles. 72% of all strokes occur in people over the age of 65 [6].

Aim of the Study

The aim of the study was to predict the prognostic value of 4 scores in acute anterior circulation stroke those who have high grade stenosis in CT Angiogram.

Scores

A 10-point score is normal, implying absence of thrombus [7]
• Subtract 2 each for thrombus in CTA in supraclinoid ICA and each proximal and distal halves of the MCA trunk. • Subtract 1 point for thrombus found in the infraclinoid ICA and A1 segment and for each affected M2 branch. A: Normal 10 point score B Occlusion of infra- and supraclinoid ICAs with a CBS of 7 C Distal M1 and 2 M2 branch occlusions produce a CBS of 6 D Occlusion of the terminal ICA, proximal M1, and A1, with a resultant CBS of 5

Table 1: *Clot burden score (CBS) [7].*

Collateral score (CS) [7]

The collateral grading system was scored on a scale of 0-3. A score of zero indicated absent collateral supply to the occluded MCA territory. A score of 1 indicated collateral supply filling ≤ 50% but > 0% of the occluded MCA territory. A score of 2 was given for collateral supply filling > 50% but < 100% of the occluded MCA territory. A score of 3 was given for 100% collateral supply of the occluded MCA territory.

Collateral score	
Two main routes underlie collateral perfusion of the brain parenchyma	
Extra cranial source	**Intracranial source**
Facial artery	Primary pathways
Maxillary Artery	Circle of Willis
Middle Meningeal Artery	Secondary pathway
Occipital Arteries	Comprises leptomeningeal anastomoses that link distal sections of the major cerebral arteries MCA with ACA, PCA.
ophthalmic artery,	

Table 2: *Collateral score (CS).*

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Alberta stroke program early CT score (ASPECT) [8]

- 10Point quantitative topographic CT scan score to assess early ischemic changes of the MCA region Assessed at 2 standardized regions.

- Ganglionic Level where the thalamus, basal ganglia and caudate are visible.

- Supraganglionic level which includes the corona radiata and centrum semiovale.

Normal ASPECT score is [10]: Deduct 1 point for each area involved. A score of 6 or less Correlates with poor functional outcome and hemorrhage.

*Limitation: Only scores the MCA.

National institutes of health stroke scale (NIHSS Score) [9]

The NIHSS is composed of 11 items, each of which scores a specific ability between a 0 and 4. For each item, a score of 0 typically indicates normal function in that specific ability, while a higher score is indicative of some level of impairment. The individual scores from each item are summed in order to calculate a patient's total NIHSS score. The maximum possible score is 42, with the minimum score being a 0.

Score [10]	Stroke severity
0	No stroke symptoms
1 - 4	Minor stroke
5 - 15	Moderate stroke
16 - 20	Moderate to severe stroke
21 - 42	Severe stroke

Table 3: *NIHSS scores.*

Materials and Methods

It was a prospective clinical study in a tertiary referral corporate hospital of eastern India from January 2017 to December 2017. We selected anterior circulation stroke patients having high grade stenosis (60%-100%) as our case cohort. High grade stenosis was confirmed by CT angiogram. Total 38 patients were selected after doing CT angiogram within first 24 hour of stroke onset. Other co-morbidities like type 2 diabetes mellitus (T2DM), hypertension (HTN) were not included as dependent variable. All were managed conservatively with antiedema Measures, antihypertensives, other supportive care according to protocol. NIHSS score was calculated in all patients at admission.

Aspects Score, clot Burden Score, collateral score was calculated after doing NCCT brain and CT angiogram by an experienced radiologist who was blind about patient's clinical status. All Scores were dichotomized to a high and low score to predict the outcome in each group:

- CBS-High (6-10), Low (0-5)

- ASPECTS-High (6-10), Low (0-5)

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- CS-High (2-3), Low (0-1)

- NIHSS-High (20-42), low (0-19)

Final outcome of stroke in the form of modified rankin scale (MRS): Good outcome (MRS 0-3) and poor outcome (MRS 4-6).

All patients were followed up and modified rankin scale was measured at 90 days.

Inclusion criteria

- Acute anterior circulation stroke cases were selected after CT and CTA done.

- Only high grade stenosis cases (> 65% occlusion) of anterior circulation were selected.

Exclusion criteria

- Posterior circulation strokes.

- Cardio embolic stroke and stroke due to other causes like vasculitis, SCD.

- Previous stroke (restroke).

Data were collected in a Performa and statistical analysis was done using SPSS Software Version-24. Logistic regression was done to predict the outcome of patients with respect to different variables. Chi-square and fishers test was used for qualitative analysis. (Association).

Results

- In the total cohort of 38 patients 15% were less than 45 yrs of age where as 85% were more than 45 yrs.

- 34% were female and 66% were male. Male to female ratio was 1.9:1

- Involvement of artery: 65% of all the cases were having middle cerebral artery involvement. It was followed by internal carotid artery and anterior cerebral artery.

Score	High/ low scores	Good outcome (MRS 0-3)	Bad outcome (MRS 0-3)
CBS	High scores (n = 17)	12 (57%)	9 (43%)
	Low scores (n = 21)	5 (30%)	12 (70%)
CS	High scores (n = 25)	24 (96%)	1 (4%)
	Low scores (n = 13)	4 (30%)	9 (70%)
ASPECTS	High scores (n = 15)	11 (73%)	4 (27%)
	Low scores (n = 23)	5 (21%)	18 (79%)
NIHSS	Low scores (n = 12)	13 (50%)	13 (50%)
	High scores (n = 26)	3 (25%)	9 (75%)

Table 4: *Outcomes according to scores.*

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From this analysis its apparent that among all the scores taken into study, each affects the stroke outcome but collateral score is statistically most significant ($p < 0.05$) in our study.

Discussions

Stroke is one of the commonest neurological diseases in eastern India. In our study the incidence of stroke is quite high in older age groups. The disease is more prevalent in female sex than male. In a study from this region Bhattacharya., *et al.* has delineated similar epidemiological observation [11]. Involvement of MCA was commonest in our study. This coincides with the fact that MCA is commonest artery to be involved in stroke [1,12].

CTA-derived assessment of clot extent (CBS) is an independent predictor of clinical and radiologic outcomes in acute MCA territory stroke. Patients with smaller clot extent are more likely to have smaller baseline infarcts and lower baseline NIHSS scores, achieve a good clinical outcome, and have smaller final infarct size. High score means less obstruction. Its directly related to better recovery in mRs. Other studies also coincide in this fact [7]. According to that study CBS and CS are useful additional markers predicting clinical and radiologic outcomes. Our study also confirms this statement.

Patients with acute ischemic stroke (AIS) secondary to large vessel occlusion can be treated by several endovascular arterial recanalization methods using DSA as imaging guidance. Evaluation of AIS patients with head CT after recanalization therapy sometimes demonstrates abnormal high density within the brain parenchyma, much higher than the density of haemorrhage that conforms to a normal anatomic structure and is without mass effect. This has been termed contrast staining [13]. Many stroke centres rely predominantly on clinical data such as baseline NIHSS score and time of symptom onset when deciding whether to perform thrombolysis in patients presenting with stroke like symptoms within accepted treatment time windows. Imaging data are often limited to an NCCT. In stroke centres and recent trials, increasingly advanced CT- and MR Imaging-based strategies are being considered to stratify patient risk better [14]. The CBS is designed to be weighted to vessel location, assigning higher points to the terminal ICA and proximal MCA locations. As we belong to a resource limited part of eastern India the patients included are not treated by thrombolytic. We treated the patients with conventional therapy and observed them in follow up. Statistically the collateral score was found to be significant than the other scores. In several other studies the importance of CBS and CT have been proved as isolated scores [7].

Conclusion

Plain CT scan is not enough to predict and prognosticate the outcome of ischemic stroke patients. CTA, CT perfusion scan must be done in all ischemic stroke patients to measure infarct core and salvagable penumbra which can be thrombolysis within window period. Collateral score can give better prediction about stroke outcome than other scores. In resource limited areas CT can be used for triage and those having less score can be treated by thrombolysis which will prevent unnecessary intervention.

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