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Outcome of Acute Ischemic Stroke: Clinical Study Carried at Tertiary Care Hospital

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Abstract

About 80% of all first ever lifetime strokes are ischemic, 10% are due to primary intracerebral haemorrhage, about 5% are due to subarachanoid haemorrhage and in the remainder there is an uncertainty. After coronary heart disease and all cancers, stroke is the common cause of death in the world causing about 4 million deaths, three quarter of them in developing countries. Personal history regarding dietary habits, smoking, alcohol consumption and tobacco chewing were noted. NIH Stroke Scale was assessed in all patients to assess the neurological disability and its prognosis. Detailed neurological examination was done based on proforma. Among 71 patients 61 patients are alive with significant improvement and 10 patients are expired. Among 10 patients who died, 6 patients are in the age group of more than 60 years and 4 patients are in the age group of 40-60 years. Maximum mortality was seen in the age group of more than 60 years. And no deaths are seen in the age group of less than 40 years.

Keywords: Stroke; Intracerebral Haemorrhage; Subarachanoid Haemorrhage.

Introduction

Stroke is defined as rapidly developing clinical symptoms and or signs of focal, at times global loss of brain functions with symptoms lasting for more than 24 hours or leading to death with no apparent cause other than that of vascular origin (WHO) [1]. There is a wide range of severity, from recovery in few days, though persistent disability, to death.

About 80% of all first ever lifetime strokes are ischemic, 10% are due to primary intracerebral hemorrhage, about 5% are due to subarachanoid hemorhrage and in the remainder there is an uncertainty [2].

After coronary heart disease and all cancers, stroke is the common cause of death in the world causing about 4 million deaths, three quarter of them in developing countries [3].

Like in all developing countries, stroke is fast emerging as a major public health problem in India. The age standardized average annual incidence rate to world standard population of first ever in a lifetime stroke is 145.30 (95% CI, 120.39 to 174.74) per 100000 persons per year.

- Incidence of first ever stroke varies from 13 per lakh per year to 27 per lakh per year
- Prevalence of stroke is around 84 per lakh
- Stroke mortality in India is estimated to be about 73 per lakh population

Emergency imaging of the brain is recommended before initiating any specific therapy to treat acute ischemic stroke. In most instances, NECT will provide the necessary information to make decisions about emergency management. Either NECT or MRI is recommended before intravenous rtPA administration to exclude ICH (absolute contraindication) and to determine whether CT hypodensity or MRI hyperintensity of ischemia is present. In intravenous fibrinolysis candidates, the brain imaging study should be interpreted within 45 minutes of patient arrival in the ED by a physician with expertise in reading CT and MRI studies of the brain parenchyma [4].

Noninvasive imaging of the cervical vessels should be performed routinely as part of the evaluation of patients with suspected TIAs. Noninvasive imaging by means of CTA or MRA of the intracranial vasculature is recommended to exclude the presence of proximal intracranial stenosis and/or occlusionand should be obtained when knowledge of intracranial stenoocclusive disease will alter management. Reliable diagnosis of the presence and degree of intracranial stenosis requires the performance of catheter angiography to confirm abnormalities detected with noninvasive testing [5].

Patients with transient ischemic neurological symptoms should undergo neuroimaging evaluation within 24 hours of symptom onset or as soon as possible in patients with delayed presentations. MRI, including DWI, is the preferred brain diagnostic imaging modality. If MRI is not available, head CT should be Performed.

Cardiac monitoring is recommended to screen for atrial fibrillation and other potentially serious cardiac arrhythmias that would necessitate emergency cardiac interventions. Cardiac monitoring should be performed for at least the first 24 hours.

Patients who have elevated blood pressure and are otherwise eligible for treatment with intravenous rtPA should have their blood pressure carefully lowered so that their systolic blood pressure is <185 mm Hg and their diastolic blood pressure is <110 mm Hg before fibrinolytic therapy is initiated. If medications are given to lower blood pressure, the clinician should be sure that the blood pressure is stabilized at the lower level before beginning treatment with intravenous rtPA and maintained below 180/105 mm Hg for at least the first 24 hours after intravenous rtPA treatment [6].

Airway support and ventilatory assistance are recommended for the treatment of patients with acute stroke who have decreased consciousness or who have bulbar dysfunction that causes compromise of the airway. Supplemental oxygen should be provided to maintain oxygen saturation >94%.

Sources of hyperthermia (temperature >38°C) shouldbe identified and treated, and antipyretic medications should be administered to lower temperature in hyperthermic patients with stroke.

In patients with markedly elevated blood pressure who do not receive fibrinolysis, a reasonable goal is to lower blood pressure by 15% during the first 24 hours after onset of stroke. The level of blood pressure that would mandate such treatment is not known, but consensus exists that medications should be withheld unless the systolic blood pressure is >220 mm Hg or the diastolic blood pressure is >120 mm Hg [7].

Hypovolemia should be corrected with intravenous normal saline, and cardiac arrhythmias that might be reducing cardiac output should be corrected.

Hypoglycemia (blood glucose <60 mg/dL) should be treated in patients with acute ischemic stroke. The goal is to achieve normoglycemia. Evidence indicates that persistent in-hospital hyperglycemia during the first 24 hours after stroke is associated with worse outcomes than normoglycemia, and thus, it is reasonable to treat hyperglycemia to achieve blood glucose levels in a range of 140 to 180 mg/dL and to closely monitor to prevent hypoglycemia in patients with acute ischemic stroke [8].

Evidence from one clinical trial indicates that initiation of antihypertensive therapy within 24 hours of stroke is relatively safe. Restarting antihypertensive medications is reasonable after the first 24 hours for patients who have preexisting hypertension and are neurologically stable unless a specific contraindication to restarting treatment is known.

Intravenous rtPA (0.9 mg/kg, maximum dose 90 mg) is recommended for administration to eligible patients who can be treated in the time period of 3 to 4.5 hours after stroke onset. The eligibility criteria for treatment in this time period are similar to those for people treated at earlier time periods within 3 hours, with the following additional exclusion criteria: patients >80 years old, those taking oral anticoagulants regardless of INR, those with a baseline NIHSS score >25, those with imaging evidence of ischemic injury involving more than one third of the MCA territory, or those with a history of both stroke and diabetes mellitus. The intravenous administration of streptokinase for treatment of stroke is not recommended.

Oral administration of aspirin (initial dose is 325 mg) within 24 to 48 hours after stroke onset is recommended for treatment of most patients. The usefulness of clopidogrel for the treatment of acute ischemic stroke is not well established. Aspirin is not recommended as a substitute for other acute interventions for treatment of stroke, including intravenous rtPA The administration of aspirin (or other antiplatelet agents) as an adjunctive therapy within 24 hours of intravenous fibrinolysis is not recommended [2].

Among patients already taking statins at the time of onset of ischemic stroke, continuation of statin therapy during the acute period is reasonable At present, no pharmacological agents with putative neuroprotective actions have demonstrated efficacy in improving outcomes after ischemic stroke, and therefore, other neuroprotective agents are not recommended.

The usefulness of emergent or urgent CEA (carotid endarterectomy) when clinical indicators or brain imaging suggests a small infarct core with large territory at risk (eg, penumbra), compromised by inadequate flow from a critical carotid stenosis or occlusion, or in the case of acute neurological deficit after CEA, in which acute thrombosis of the surgical site is suspected, is not well established [8].

In patients with unstable neurological status (either stroke-in-evolution or crescendo TIA), the efficacy of emergent or urgent CEA is not well established.

Patients with major infarctions are at high risk for complicating brain edema and increased ICP. Measures to lessen the risk of edema and close monitoring of the patient for signs of neurological worsening during the first days after stroke are recommended. Because of lack of evidence of efficacy and the potential to increase the risk of infectious complications, corticosteroids (in conventional or large doses) are not recommended for treatment of cerebral edema and increased ICP complicating ischemic stroke.

Methodology

Clinical history was taken from either patient or his/her attender. While taking history importance was given regarding presence or absence of vomiting, headache and convulsions, past history of hypertension, diabetes, coronary artery disease, rheumatic heart disease, transient ischemic attack, collagen diseases, meningitis, tuberculosis, endocrine disorders and congenital disorders were taken. Personal history regarding dietary habits, smoking, alcohol consumption and tobacco chewing were noted. NIH Stroke Scale was assessed in all patients to assess the neurological disability and its prognosis. Detailed neurological examination was done based on proforma.

All other systems like cardiovascular system, respiratory system, gastrointestinal system were examined in detail. Detailed investigations Complete blood count, ESR, Fasting Blood sugar, Serum electrolytes, Lipid profile, Chest X-Ray, Electrocardiography, Transthoracic echocardiography, HIV serology, Prothrombin time, INR, CRP level, CT Brain/MRI Brain was done in all patients. ANA Profile, Homocystiene level, antiphospholipid antibody, were done when clinically required.

Patients were be followed up for a period of three months and all patients were reassessed by using NIH stroke scale to know the clinical improvement or deterioration and venous blood sample was taken to estimate CRP level at the end of three months followup and compared with admission value of CRP and NIH stroke scale.

Inclusion Criteria

- The study population who presented to the hospital within 24 hours of stroke symptom onset.
- Confirmed cerebral infarct with either a CT scan or MRI.
- Age more than 18 years.
- First ischemic stroke

Exclusion Criteria

- Patients aged less than 18 years.
- Patients with hemorrhagic stroke.
- Patients with TIA (Transient ischemic attack).
- Patients with active infections.
- Patients with hypoglycaemia, migraine, electrolyte disturbances.
- Recurrent stroke or second stroke.
- Patients with prior history of inflammatory diseases like Rheumatoid arthritis and SLE.
- Those patients on steroids and immunomodulators.
- Patients with cortical venous thrombosis.
- Pregnant patients.

Results

Table 1: Distribution based on mortality

Mortality	Number	Percentage
Death	10	14.1
Alive	61	85.9
Total	71	100

Table 1 shows mortality of study group, among 71 patients 61 patients are alive with significant improvement and 10 patients are expired.

Table 2: Distribution of deaths by age:

Age categories	Alive	Percentage	Died	Percentage	Total
<40 years	8	100.0	0	0.0	8
40-60 years	28	87.5	4	12.5	32
>60 years	25	80.6	6	19.4	31
Total	61	85.9	10	14.1	71

Table 2 shows distribution of death according to age, among 10 patients who died, 6 patients are in the age group of more than 60 years and 4 patients are in the age group of 40-60 years. Maximum mortality was seen in the age group of more than 60 years. And no deaths are seen in the age griop of less than 40 years.

Table 3: Distribution of death by Gender

Sex	Alive	Percentage	Died	Percentage	Total
Female	27	84.4	5	15.6	32
Male	34	87.2	5	12.8	39
Total	61	85.9	10	14.1	71

Table 3 shows distribution of death by sex aong 10 patients who expired 5 are males and 5 are femals. Among 32 female patients 27 are alive and 5 are died constituting 15.6% and among 39 males 34 are alive and 5 are died constituting 12.8%, so mortality was more among females.

Table 4: Distribution of deaths by hypertension status

Hypertension status	Alive	Percentage	Died	Percentage	Total
No	38	92.7	3	7.3	41
Yes	23	76.7	7	23.3	30
Total	61	85.9	10	14.1	71

p value=0.06.

Table 4 shows distribution of mortality of patients who are known case of hypertension. Among 30 known patients with hypertension with acute ischemic stroke 7 patients have expired constituting 23.3% of total mortality and 23 patients are survived.

Table 5: Distribution of mortality by DM status:

DM status	Alive	Percentage	Died	Percentage	Total
No	49	86.0	8	14.0	57
Yes	12	85.7	2	14.3	14
Total	61	85.9	10	14.1	71

p value=0.98

Table 5 shows mortality of patients with acute ischemic stroke who are known cases of diabetes mellitus among 71 paitients 14 patients are with diabetes mellitus and among 14 patients with diabetes 2 patents expired and among 57 non diabetic 8 patients have expired.

Table 6: Distribution based on biochemical parameters:

Sl no	Parameter	Mean (SD)	Range
1	Random blood sugar	151.6 (37.9)	96-274
2	Cholesterol	197.1 (58.2)	89-326
3	HDL	41.9 (29.0)	26-276
4	TG	145.4 (51.5)	29-276

Table 6 shows the biochemical parameters of study population. The mean serum RBS was 151.6±37.9, the mean total cholesterol was 197.1±58.2 which was significantly raised, the mean HDL was 41.9±29.0 and mean TG was 145.4±51.5.

Discussion

In present study ischemic stroke in less than 40 years of age constitute 11.3% of all strokes and highest incidence was seen in the age group of 40-60 years, that is 45.1% and followed by age more than 60 years constituting 43.6%.

In contrast to the above study, in the present study we noticed an increased incidence of stroke in both male and females after the age of 60 years with a slight predominance in males. Incidence of stroke in males was 54.9% and that of females was 45.1%. and the overall mortality was slightly more in females (15.6%) compared to males (12.8%).

In the present study, CRP level was elevated in 50 out of 71 patients but we did not studied difference of incidence in cortical and sub-cortical infarct.

In the present study we observed that 28.2% of the patients with acute ischemic stroke had a past and present history of smoking, and 29.6% of patients had a history of alcohol use.

In the present study patients who presented with first episode of acute ischemic stroke (n=71), we observed 30 patients were hypertensive and constituting 42.3% which is a major risk factor and among which 7 patients expired constituted 23.3% of mortality.

In the present study, compared to hypertension, diabetes constituted only 20% of the study population with 14.3% of mortality and we did not notice any difference of incidence of stroke in young and old patients with diabetes.

In the present study, CRP was measured only after the CT image confirmation of infarction which was done after 24 hours of symptoms. So CRP level was estimated only after CT confirmation and within 72 hours of symptom onset.

In the present study CRP level of > 6 mg/dl was taken as positive and CRP level < 6mg/dl as negative. And we observed that CRP was elevated in 50 patients out of 71 patients at the time of admission which was statistically significant. And we classified Severity of stroke by using NIHSS, Patients were categorized as mild stroke (NIHSS 0–7), moderate (NIHSS 8–14), or severe stroke (NIHSS >14). Severity of stroke assessed by NIHSS revealed a mean score of 12.6±6.7 with 11 patients (15.5%) stratified as severe, 50 patients (70.4%) as moderate, and 10 patients (14.1%) as mild and there was a strong positive correlation between disease severity assessed by NIHSS and Serum CRP level, correlated positively with NIHSS (r = 0.41, p =0.003) . Serum CRP level was 25.3± 6 mg/L in patients with severe ischemic stroke compared to 6.7±3.5 mg/L in patients with mild and moderate presentation. (p = 0.003).

When we followed the patients for a period of three months and patients disability was reassessed by using NIHSS and CRP level, the association between the two was compared. Severity of stroke assessed by NIHSS revealed a mean score of 4 ±3.1, with 7 patients (9.9%) stratified as severe, 18 patients (25.4%) as moderate, and 46 patients (64.8%) as mild, and there was a strong positive correlation between disability severity assessed by NIHSS and Serum CRP level at the end of three months, correlated possitively with NIHSS (r = 0.62, p <0.001).

From the above observation, we concluded that CRP is a very useful marker to assess the severity of the disease and for prognosis of the disability in patients with acute ischemic stroke.

In the present study we did notice the significant rise in TC, Triglycerides and decrease in HDL in relation to ischemic stroke.

In present study the prediction of myocardial infarction and stroke could not be done since it needs longer follow-up.

Cerebral ischemia and infarction are usually caused by sudden occlusion of an artery supplying the brain or less often by low flow distal to an artery occluded or highly stenosed artery.

1. *Atherothromboembolism*

Atheroma is the most common arterial disorder and then complicated by thrombosis or embolism, is the most frequent cause of cerebral ischemia or infarction.

2. *Distribution of atheroma*

Atheroma mainly affects large and medium sized arteries at places of arterial branching, tortuosity and confluence. These are the sites of hemodynamic shear, stress and thus endothelial trauma, blood stagnation and the accumulation of platelets and of turbulence, all of which cause thrombosis [9].

3. *Natural history of atheroma*

Atheroma starts in childhood. Intimal fatty streaks appear first. In a general gradual process stretching over many years, circulating monocyte derived macrophages adhere to and invade the arterial wall, there is an inflammatory response with cytokine production and T-lymphocyte activation, intra and later extracellular cholesterol and other lipids are deposited, particularly in macrophages, which are then describes as foam cells, smooth muscle cells proliferate and fibrosis occurs and so fibrolipid plaques are formed [10].

Necrosis and calcifications complicate advanced lesions. the plaques are complicated by platelet adhesion, activation and aggregation, which initiate blood coagulation and subsequent thrombosis.

It is likely that atheromatous plaque become active or unstable from time to time, as a result of fissuring and cracking of the thin parts of the fibrous cap, which covers the rather rigid lesion, of ulceration perhaps, or sometimes of hemorrhage within the plaque, rather than the more commonly found haemorrhage entering via back in the endothelial surface [11]. Any of these events exposes the highly thrombogenic necrotic core of the plaque to the blood and so causes thrombus to form and perhaps to embolize.

4. *Cholesterol embolization syndrome*

This rare disorder seems to be due to the rupture of atheromatous plaques in elderly people with widespread disease, either spontaneous but perhaps more often as a complication of instrumentation or surgery of large atheromatous arteries such as aorta and possibly therapeutic due to thrombolysis [12].

5. *Intracranial small vessel disease*

The small penetrating arteries of the brain (less than 500 micro meter in diameter) are not supplied by a good collateral circulation i.e, the lenticulo-striate branches of the middle cerebral artery, the thalamoperforating branches of the proximal posterior cerebral artery and the perforating

arteries to the brainstem. Therefore the occlusion is likely to cause infartion, in small restricted areas of the brain. Such lacunar infarts comprise about one quarter of the first ischemic strokes. Hypertension is common in patients with lacunar infarctions [13].

6. Rare arterial disorders causing ischemic stroke

- Trauma – penetrating and non-penetrating
- Fibromuscular dysplasia, congenital anomalies, moya moya syndrome.
- Inflammatory vascular disease like giant cell arteritis, SLE, antiphospholipid antibody syndrome, etc.,
- Progressive systemic sclerosis
- Buerger's disease
- Irradiation.

7. Embolism from the heart

In developed countries about 20% of ischemic stroke and TIA are probably due to embolism from the heart, most common being non-rheumatic atrial fibrillation. Emboli vary in their composition from mostly fibrin to mostly platelet to calcium, or infected vegetation. The emboli also vary in size so they may impact in a medium sized artery to cause a substantial infarct or in a smaller artery to cause rarely a restricted defect. Some emboli may be completely asymptomatic [14].

8. Rheumatic valvular disease

Mitral far more often than aortic, is well recognised as an embolic sourse either because of thrombus in the left atrium or valvular debris [15].

9. Coronary artery disease

Left ventricular mural thrombus diagnosed echocardiographically occurred within days of an acute myocardial infarction, those with anterior are at a higher risk than those with inferior infarcts; large infarcts and a dyskinetic valve segment are also risk factors. These thrombi may embolize, particularly if protruding or mobile and/or associated with a 5 fold excess risk of stroke in first few days and weeks after myocardial infarction [16].

10. Mitral leaflet prolapse (MLP)

Common echocardiographic and clinical finding in asymptomatic people particularly if they are tall and thin and is sometimes familial**.** It can becomplicated by mitral regurgitation, atrial fibrillation, infective endocarditis and left atrial thrombus and so embolism to the brain [17].

11. Paradoxical embolism

From the venous system is the well accepted mechanism of ischemic stroke, based on a number of convincing cases described at post-mortem. The risk of recurrent stroke is very uncertain but probably not particularly high [18].

Conclusion

- Fatal stroke is the highest among hypertension group.
- Mortality is slightly more in females than males.
- Mortality is the highest among moderate stroke group in NIH stroke scale.

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