



# Comprehensive Stroke Care : An Overview

NK Mishra\*, H Patel\*\*, SM Hastak\*\*\*

## Abstract

Stroke is a global epidemic and an important cause of morbidity and mortality. It ranks next to cardiovascular disease and cancer as a cause of death. "India is likely to suffer huge social and economic burden in the rehabilitation of stroke patients owing to increased life expectancy"<sup>1</sup> and urbanization. Though, there are national programs in malaria eradication and tuberculosis control, there is hardly any governmental support in stroke management and rehabilitation. We propose to formulate stroke-prevention strategies specific to our national needs and covering all the age groups. Allocation of resources towards the stroke management and research is needed. Emphasis on stroke awareness in community should be stressed and should be inclusive of means of primordial and primary prevention apart from management of stroke and its recurrence. Recent international experience in stroke management has suggested the need of specialized stroke units (comprehensive stroke care under one roof). We wish to establish the need of creating awareness regarding the urgency of specialized care in acute stroke. We also wish to motivate our national health institutions to offer affordable, evidence based management of stroke and offer opportunities in stroke training and research. ©

Stroke is a global epidemic and an important cause of morbidity and mortality. It ranks next to cardiovascular and Cancer as a cause of death. Prof. PM Dalal<sup>1-3</sup> has warned that "*India will face an enormous socio-economic burden to meet the cost of rehabilitation of stroke victims owing to increased life expectancy*". Statistical evidence suggests that 1880 stroke victims die every day which is 22 times of death due to malaria and 1.4 times of that due to tuberculosis.<sup>4</sup> Though, there are national programs in malaria eradication and tuberculosis control, there is hardly any governmental support in stroke management and rehabilitation. National Health Policy should aim both at primordial and primary prevention, community awareness, stroke management and research promotion. Here we review the **comprehensive stroke management and request the national institutions towards offering quality health care and promote research in stroke.**

## Community awareness

The author's community based awareness evaluation study utilizing a structured questionnaire has suggested the lack in awareness about stroke in population visiting the stroke clinic (*unpublished*). The questionnaire was administered randomly to 25 stroke victims with "good consciousness" and the individual response was

recorded through an interview with the author. It was noted that only one patient could realize that his symptoms were of stroke and he should seek emergent medical attention. He was previously sensitized about stroke owing to occurrence of stroke in family. For others, it was the doctor who diagnosed the symptoms being of stroke. None of the respondents had any knowledge of "clot bursting" (thrombolysis) therapy for acute stroke management. About 80% patients said that primary organ involved in stroke is "heart". Only one respondent noted stroke to be the most dreadful disease while the others opined heart attack (n=16) and cancer (n=7) as the most fearful. Surprisingly, one respondent, who was himself suffering from stroke noted that heart attack is the most fearful disease! Never had their doctor discussed about the likelihood of stroke as a possible complication of diabetes or hypertension. This example illustrates that in our superstition driven society, community awareness is lacking. The respondents demonstrated full faith in medical fraternity as a primary source of information and therefore we resolve to work for the cause in stroke awareness, education and research.

## "In stroke there is hope; and prevention is the key"

Stroke which was previously considered a "curse (stroke) of god" and associated with "hopelessness" has entered into the era of "In stroke there is hope; and prevention is the key", thanks to the recent advances in stroke management. Conclusion of NINDS rt-PA Stroke Study<sup>5</sup> in June 1996 and time bound (within 3 hours) administration (US-FDA approved) of this novel therapy

\*Senior Research Officer (WHO-ICASS Stroke Study), \*\*Observer, \*\*\*Neurologist, Stroke Unit and Department of Neuroscience; Lilavati Hospital and Research Center, Bandra, Mumbai 400 050.

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has revolutionized the stroke management worldwide. **“TIME IS BRAIN”**<sup>6</sup>

STROKE IS AN EMERGENCY AND “TIME IS BRAIN”<sup>5</sup>. Early detection and prompt treatment can prevent morbidity as well as mortality. Present need is of integration of hospital administration system with the medical and paramedical staff trained specifically in stroke. The hospital system should offer emergent stroke health services with due flexibility based on previously set evidence based guidelines meant for stroke management.

Relatives fail to recognize the symptoms of stroke and exhibit reluctance to seek emergent medical care. Other factors causing delay in early stroke detection are lack of transport system, improper or delayed diagnosis and rating stroke as not an emergency. Valuable time may be saved by educating the community through awareness programs and training the team of Neurologist, Radiologist, Intensivist, Neurosurgeon, Junior doctors and Nursing staff through accredited stroke management course by recognized bodies and the institution itself. Emergency Medical personnel should be trained to identify early signs of stroke, practice triage and co-ordinate with radiologist and stroke team.

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#### “Time is Brain”

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“Time is Brain” because *“Human nervous tissue is rapidly and irretrievably lost as stroke progresses and therapeutic intervention should be emergently pursued.”*<sup>6</sup>

- **Average volume** of ischaemic stroke (in untreated patients) is 26 mL.
- **Average duration** of stroke evolution : 10 hour.(range 6-18 hour).
- **Number of neurons** in Brain are 100 billion (range 75-200). Following a ischaemic stroke and without treatment 4 million neurons, 12 million brain cells, 15 billion synapses die per minute.
- In **one hour post stroke**, brain loses 8 years of its complete life time.

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Adapted from Jeffrey L Saver presentation (April 14<sup>th</sup> 2005) in 57<sup>TH</sup> Annual meeting of American Academy of Neurology , Miami Beach, Florida.<sup>6</sup>

**Stroke Units : Stroke unit is a part of hospital that exclusively takes care of stroke patients.** Intensive care of stroke was attempted in 1970s with no significantly favorable outcome.<sup>7</sup> Later it was suggested that care of patients with acute stroke in a stroke unit improves clinical outcome when compared to treatment in general medical ward.<sup>8-10</sup>

Hospital system should be made flexible to expedite the MRI of brain. Diffusion weighted imaging (MR-DWI) offers a novel method to visualize brain areas of impaired metabolism thus offering means to detect acute phase of stroke<sup>11,12</sup> and thereby helping in early detection and therapeutic intervention. Because the MR-DWI picks up hyperacute stroke as bright signals in acute stroke it is the investigation of choice. In the absence of MRI and

strong clinical suspicion of stroke, CT Scan should be used to rule out hemorrhagic stroke in the patient for planning further treatment. It also helps differentiate spontaneous intracerebral hemorrhage and subarachnoid hemorrhage from ischaemic infarction.<sup>13</sup>

A working evidence based stroke protocol should be developed and stroke team should be adequately trained. Early physiological assessment of the patient should also include blood chemistry, hematology and cardiological functions.

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#### Seven D s in the stroke chain of survival and recovery<sup>14</sup>

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1. **Detection** of onset of sign and symptoms of stroke.
2. **Dispatch** through activation of the stroke help line and emergency services.
3. **Delivery** of the patient to the hospital while providing prehospital assessment care and prior notification to the hospital
4. **Door** - ED Triage
5. **Data** - ED evaluation including the neuro-radiological scanning
6. **Decision** about potential therapy
7. **Drug** therapy

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Adapted from Hazinski MF(1996)<sup>14</sup>: Demystifying recognition and management of stroke ; current emergency cardiac care .

Symptoms of stroke sometimes mimicks like hypoglycaemia and hypertension should be the first differential in emergency department soon on admission. Immediate euglycaemia should be attempted to be restored using intravenous dextrose solution .

#### STROKE MANAGEMENT<sup>13</sup>

Three areas require adequate attention while managing a case of acute stroke : (1) **general therapy** to maintain the physiology of patient , (2) **specific therapy** focussing on reperfusion and neuroprotection and finally (3) **complication prevention** like subarachnoid hemorrhage, cerebral or cerebellar swelling, post stroke infection, etc.

The early **general evaluation** should include history taking, physical examination, measurement of oxygen saturation by pulse oxymetry, measurement of blood sugar level, serum electrolytes and kidney functions; complete blood count; electrocardiography and X-ray chest. Firm clinical diagnosis should be made by testing for aphasia, homonymous hemianopia, hemiparesis or hemisensory loss and other signs suggesting focal neurological deficit.

**General therapy** comprises of respiratory and cardiac care, fluid and metabolic management, control of Blood Pressure, prophylactic measures against DVT, aspiration pneumonia and decubitus ulcer. This offers optimal physiological basis as a framework upon which specific therapeutic treatment strategy can be utilized. Neurological status should be assessed regularly using NIH Stroke Scale and vital function should be monitored.

Approximately 2-4 liters of Oxygen per minute administered per-nasally helps attain adequate oxygenation of the penumbra. Vertebro basilar and hemispheric infarction and also in the cases of other pathological respiratory pattern, an early intubation might be considered. Post stroke cardiac arrhythmias are known to occur. Cardiac enzyme elevation and ST-T changes are also known with stroke. Assessments of cardiac functions in stroke include optimal cardiac output, maintenance of high normal BP and a normal heart rate. Cerebral blood flow autoregulation depends passively on Mean Arterial Pressure and therefore drop in Blood Pressure should be prevented to maintain optimum cerebral perfusion. As a result, blood pressure of 180/100-105 of mercury should be maintained in previously hypertensive patient.<sup>15</sup>

In other cases, mild hypertension is desirable (160-180/90-100 mm of mercury). Blood pressure of level 220/120 mm of mercury may be set as a target to demand therapeutic intervention but still the fall in blood pressure should be gradual.<sup>15,16</sup>

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#### Investigations for patients in acute ischaemic stroke

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- MRI- (DWI scan first) and MRA
  - 2-D Echo of heart
  - ECG and X-ray Chest
  - Complete blood counts
  - Platelet count, Prothrombin time, Partial thromboplastin time.
  - Electrolytes, Blood glucose, Blood urine nitrogen, creatinine
  - Pulse oximetry
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Blood sugar level above 10mmol/l should be managed with insulin titration. High blood sugar level is detrimental in stroke.<sup>17</sup>

Experimental models of stroke have demonstrated increase in the size of infarct due to fever and therefore management fever is important. Temperature above 37.5 C should be treated with antipyretics like paracetamol.<sup>18</sup> Importantly, the primary cause of fever should be detected and treated appropriately. Fluid and electrolyte should be monitored.

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#### Clinical situations warranting emergent blood pressure reductions

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- Acute myocardial infarction
  - Unstable angina pectoris
  - Hypertensive encephalopathy
  - Subarachnoid hemorrhage
  - Acute renal failure
  - Acute cardiogenic pulmonary edema
  - Acute aortic dissection
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**Specific Therapy** includes thrombolysis with recombinant-tissue plasminogen activator (rt-PA) 0.9mg/kg administered within 3 hours of acute ischaemic stroke.<sup>5</sup> The decision to thrombolyse should be based on evidence based guidelines, clinical

judgement and with the informed consent of close relatives. Till date there are no recommendations to treat patients with neuroprotective agents. Neuroprotective agents leading to positive outcome in rodent model of stroke cannot be extrapolated upon human beings. Prolonged administration of neuroprotective agents especially glutamate antagonist, GABA agonist, calcium channel blockers which are CNS suppressant might reduce plasticity induced functional recovery during the course of rehabilitation.<sup>19</sup>

Aspirin may be administered 100-300 mg as a preventive measure in patients with positive symptoms even without CT scan but the diagnosis must be confirmed with radioimaging. The SALT Group<sup>20</sup> has suggested low dose (75mg/day) of aspirin significantly reduces the risk of stroke or death in patients with cerebrovascular ischaemic events thereby preventing the adverse effects of high dose.

**Preventive measures should be taken towards averting complications** like pneumonia, decubitus ulcer, deep vein thrombosis, etc. Nasogastric tube significantly (not completely) reduces the risk of post stroke pneumonia by preventing the aspiration. Acidification of urine and appropriate antibiotic should be used in case of urinary tract infection though prophylactic therapy is not recommended.

Physical therapy, Support Stockings and low molecular weight Heparin should be used to prevent Deep Vein Thrombosis and Pulmonary Embolism. It should be noted that LMW Heparin is indicated for DVT and pulmonary embolism prophylaxis and not for stroke prevention or its recurrence.<sup>21</sup> Decubitus ulcer can be prevented by frequent change of position on bed and use of appropriate beds meant for the purpose. There are no recommendations for prophylactic use of anticonvulsants in stroke. Ischaemic Brain edema occurs in initial two should be managed with mannitol. There is no role of Corticosteroids or concentrated dextrose solution and hence are not recommended.<sup>20</sup>

Mortality in MCA infarcts is usually due to complications of stroke like pneumonia or pulmonary embolism or in a small proportion by coning secondary to malignant cerebral edema. Prognosis of large MCA infarct or hemispheric infarct is poor.<sup>22,23</sup> A prospective study observed 80% death due to the condition. Decompressive surgery for MCA infarction allows extracranial expansion of the edematous brain tissue to avoid ventricular compression and horizontal as well as vertical tissue shifts. Data offered following a prospective study of the role of decompression surgery in malignant MCA Syndrome suggested decrease in mortality rate and better modified Rankin score.<sup>22,23</sup> **Neurosurgical decompression** surgery may be life saving at times.

**Rehabilitation** should be active and readily available and should be based upon status of patient and degree

of disability. Whereas in unconscious patient it focuses upon prevention of contractures, in conscious patient it helps improve the functional outcome.

Use dependent plasticity in human brain leads to functional recovery and can be utilized through physiotherapy or biofeedback mechanisms. Active physiotherapy also protects against DVT and Pulmonary Embolism. Thus Speech therapy and physiotherapy help in early recovery of functional status. The fastest recovery occurs in early 3 months of stroke and this should be the period of maximum rehabilitation effort, though it should be continued till desired results are attained.<sup>24</sup> A randomised, controlled, single-blind clinical trial comparing the intervention program to usual care suggested gain in endurance, balance and mobility beyond those attributable to spontaneous recovery and usual care thus highlighting the need of rehabilitative efforts.<sup>25</sup>

After stroke, recurrence is another major problem.<sup>21,26</sup> Oral anticoagulation treatment is a preferred choice for inferred cardioembolism in the setting of atrial fibrillation. Varying rates of hemorrhage with oral anticoagulants continue to favor antiplatelet therapy in other settings of inferred etiology.

Because emergent use of an anticoagulant in ischaemic stroke is associated with significantly increased risk of hemorrhagic transformation, it is suggested that most patients with acute stroke should not be treated with unfractionated heparin or other rapidly acting anticoagulants after stroke. Prevention of deep vein thrombosis and pulmonary embolism among bedridden patients is the only established indication for early anticoagulation after acute ischaemic stroke. Chen ZM *et al* have recommended that "early aspirin is of benefit for a wide range of patients, and its prompt use should be routinely considered for all patients with suspected acute ischaemic stroke, mainly to reduce the

#### Eligibility criteria for iv rt-PA thrombolysis treatment of acute ischaemic stroke

##### Inclusion criteria

- Onset of symptom to drug administration time is below 3 hours
- Patient has significant neurological deficit.
- No hemorrhage on CT Scan.

##### Exclusion criteria

- Stroke or severe head trauma in last three months
- Major surgery in last 14 days
- Systolic BP above 185 mm of Hg or Diastolic BP above 110 mm of Hg.
- If patient is rapidly improving or has minor symptoms
- Symptoms suggest Sub Arachnoid Hemorrhage
- Hematuria, malena, hemoptysis with in last 21 days.
- Seizure at the onset of stroke
- Elevated PTT for patients on heparin
- Prothrombin Time > 15 sec.
- Platelet count < 100,000/ mm<sup>2</sup>
- Glucose < 50 or > 400 mg/Dl.

risk of early recurrence".<sup>27</sup>

#### Management of intracerebral hemorrhage

##### Blood Pressure

- mean arterial pressure < 130 mm Hg in those with a history of hypertension
- avoid mean arterial pressure > 110 mm Hg if patient is postoperative
- prevent fall of systolic BP < 90 mm Hg

##### Intracranial Pressure

- NO STEROID are indicated
- Intracranial Therapy is defined more than 20 mm of Hg for > 5 min
- Maintain cerebral perfusion pressure > 70 mm of Hg
- Osmotherapy - mannitol 20% 0.25 - 0.5 g/kg every 4 hour keeping serum osmolality goal of less than or equal to 310 mOsm per decileter
- Hyperventilation - pCO<sub>2</sub> 30-35
- Muscle relaxants
- Non depolarizing neuromuscular blockade
- Maintain euvolemia

##### Temperature

- Treat temperatures > 38.5 C

##### Medical Therapy

- Factor rVII<sup>28,29</sup> given within four hours after intracerebral hemorrhage

##### Surgery

- For cerebellar hemorrhage > 3 cm who are deteriorating or have brain stem compression and hydrocephalus from ventricular compression
- Consider if hemorrhage > 10 cm, Glasgow Coma Scale > 4, young patient with moderate or large hemorrhage with clinical deterioration.

Adapted from Broderick JP *et al*. Stroke 1999;30:905-915.

Patients should be given comprehensive guidelines and choice of methodologies available for preventing the recurrence.

**Stroke care has future** owing to the research worldwide in studying the salvageable cerebral tissue utilizing the perfusion diffusion imaging and delineation of ischaemic penumbra, augmentation of thrombolysis using sonography<sup>30</sup> therapeutic use of stem cells<sup>31</sup> etc.

Hence, India must rise to the occasion. Specialized stroke management should be offered through Public Health System with active participation of government and Non government Organization. Special efforts should be taken for creating stroke awareness at community level. Community should have stroke support groups to create awareness and help in rehabilitation of the patients. Other means of information must be set up like online support groups and community seminars. Cost of the therapy should not act as a deterrent to national government as the DALYs, which the prompt therapy would cut short, would have many fold advantage for the nation which takes pride for its Human Resource. Further, stroke clinicians and scientists must actively participate into research in order to gain data and information specific to our demography

## Therapeutic guidelines for stroke

Mechanism of stroke	Acute management	Primary prevention of stroke	Secondary prevention of stroke
Cardioembolic	Consider		
1. High risk	<ul style="list-style-type: none"> <li>● rt-PA*</li> <li>● Heparin</li> </ul>	Anticoagulation (INR 2-3)	<ul style="list-style-type: none"> <li>● Anticoagulant INR 2-3</li> <li>● Anticoagulant + Aspirin (If prosthetic aortic valve + atrial fibrillation or prosthetic mitral valve.)</li> </ul>
2. Medium risk	Consider <ul style="list-style-type: none"> <li>● rt-PA*</li> <li>● Aspirin</li> </ul>	Antiplatelets	<ul style="list-style-type: none"> <li>● Antiplatelets</li> </ul>
Extracranial large caliber artery disease	Consider <ul style="list-style-type: none"> <li>● rt-PA*</li> <li>● aspirin</li> </ul>	If 70% stenosis, <ul style="list-style-type: none"> <li>● carotid endarterectomy or carotid angioplasty</li> <li>● Aspirin and risk modification</li> </ul> If < 70% stenosis <ul style="list-style-type: none"> <li>● aspirin</li> <li>● risk modification</li> </ul>	<ul style="list-style-type: none"> <li>● Aspirin</li> <li>● Risk modifications</li> <li>● Carotid endarterectomy or carotid angioplasty (70-99% stenosis)</li> </ul>
Intracranial arterial disease	Consider <ul style="list-style-type: none"> <li>● rt-PA*</li> <li>● Aspirin</li> </ul>	Aspirin	1. Aspirin 2. If recurrence occurs on aspirin then anticoagulation with PT INR 2-3 3. ? Stenting
Small artery disease (lacunar)	Aspirin	Antiplatelet and risk modification	Antiplatelet and risk modification
Hypercoagulable state	?Heparin, ?Aspirin	?Antiplatelets	?Antiplatelets

### High risk cardio-embolic

- Mechanical prosthetic valve
- Mitral stenosis
- Left atrial and left atrial appendage thrombus
- Sick sinus syndrome
- Recent MI (in last four weeks)
- Left ventricle thrombus
- Dilated cardio myopathy
- Akinetic interventricular septum
- Atrial myxoma
- Infective endocarditis

### Medium risk cardio-embolic

- Mitral annular calcification
- Left atrial turbulence
- Atrial septal aneurysm
- Patent foramen ovale
- Lone atrial fibrillation
- Bioprosthetic cardiac valve
- NBTE
- CCF with ejection fraction > 25%
- LV segmental wall hypokinesia AMI more than 4 weeks

[\*If patient presents within the window period<sup>5</sup> of 3 hours intravenous administration and if later by 3-6 hours intraarterial rt-PA administration (European guidelines consider window period of only 3 hours for the iv rt-PA therapy and therefore clinical judgement is desired on case by case basis); ? no evidence available at present; NBTE = Non Bacterial Thrombo Embolism]

and should seek international help and collaborations for the same.

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### **Announcement**

#### ***An Appeal to Physicians***

National Liver Foundation is a voluntary non-profit organization working towards help, information and support to patients suffering from liver diseases and to their families. As you are already aware, Wilson's disease (WD) is a genetic disease, and being progressive in nature can be fatal if treatment is not instituted early. As more than one individual from the same family could be affected, it causes a financial drain to the family. NLF would like to work towards ensuring that no child with Wilson's disease goes untreated because of financial reasons.

We have received a donation of 50,000 Artamine tablets which we would like to distribute to the most needy children with Wilson's disease.

Kindly direct your WD patients at the below mentioned address, so that NLF can provide whatever help required.

Contact : National Liver Foundation 303, Doctor House, Opp. Jaslok Hospital, Peddar Road, Mumbai-400026.

Tel: 23535591/23516591.

### **Announcement**

**The First Biennial Conference of Indian Rheumatology Association Assam chapter IRACON, ASSAM 2006 and Second East Zone Rheumatology Meet will be held at Assam Medical College, Dibrugarh, Assam on 10th, 11th, and 12th March 2006.**

For details please contact : **Dr. Sanjeeb Kakati**, Organising secretary IRACON ASSAM 2006.

E-Mail - drsanjeeb\_kakati@yahoo.co.in; Fax - 03732321230 Ph- 09435030173

Postal address : **Dr. Sanjeeb Kakati**, Associate Professor of Medicine, Assam Medical College, Dibrugarh, Assam, India. Pin-786002.