A PRACTICAL APPROACH TO ACUTE STROKE

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Stroke is characterized by an abrupt onset of neurological deficit lasting more than 24 hours attributed to an acute focal injury of the central nervous system (CNS) by a vascular cause. Worldwide, stroke accounts for 5.7 million deaths each year and is the second leading cause of death and the ranks first in causing serious disability. In most parts of the world about 70% of strokes are due to ischemia, of which 25% are cardio embolic, 27% are hemorrhagic and 3% are of unknown cause. With newer treatment modalities available; a passive attitude towards stroke is no longer justifiable. Stroke is an emergency and early thrombolysis within the window period can potentially save a patient’s life and resolve neurological deficits.

A brief review of the pathophysiology, practical approach and management of a patient with acute ischemic stroke is described below. The emphasis is on management of a suspected stroke patient in the Emergency department and identifying those who will benefit from thrombolytic therapy. Conservative management of stroke will be dealt with in the next issue.

PATHOPHYSIOLOGY OF STROKE

Proper management of the patient with ischemic stroke and use of treatment options is made more effective if one is clear about the pathophysiology behind the condition. Ischemic stroke results from interruption of blood supply to a certain arterial territory of the brain due to a block in the artery supplying it. An atherosclerotic plaque with associated thrombus in a large artery is the commonest cause for interruption of blood supply. The thrombus may break off and travel to a distant arterial branch resulting in an embolic stroke. The result is a dynamic and complex process of ischemic damage to the region of brain supplied by the vessel.

Table 1: Perfusion – dynamics

<table>
<thead>
<tr>
<th>In the cell</th>
<th>Blood Flow ml/100g/min</th>
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<tbody>
<tr>
<td>Normal</td>
<td>50–60</td>
</tr>
<tr>
<td>Protein synthesis stops</td>
<td>35</td>
</tr>
<tr>
<td>Synaptic transmission stops</td>
<td>20</td>
</tr>
<tr>
<td>Irreversible cell death</td>
<td>10</td>
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</tbody>
</table>

Table 1 shows the perfusion dynamics of the brain and changes that occur with decrease in perfusion. A reduction in perfusion below normal leads to physiological changes which are reversible if the perfusion is brought back to normal. Below the level of 10-20 ml/100gm/min, however, irreversible neuronal damage occurs.

Fig.1: Schematic diagram showing ischemic core and penumbra
In the event of ischemic stroke, there are two major zones in the ischemic cerebrovascular bed based on the cerebral perfusion:

1. **Ischemic core** – This is the area of severe ischemia (blood flow below 10% to 25% of normal) that is irreversibly damaged due to neuronal cell death.

2. **The ischemic penumbra** – is a region surrounding the rim of the ischemic core that is functionally impaired yet still has viable tissue.

The penumbra is the most relevant clinically and is the target of therapy because restoration of blood supply to this region can result in restriction of the extent of the infarct and edema with subsequent clinical recovery and reversal of neurological deficits. On the other hand, this region can progress to an infarct if blood supply is not restored in time, leading on to an increase in size of the infarct, increase in oedema and mass effect, which are potentially life threatening.

**TIME IS BRAIN**

“Time is brain” and time lost in treatment is brain lost. The time taken for the penumbra region to become an infarct is about 4-6 hours and it is estimated that about 30,000 neurons die per second during this period.

The emphasis in ischemic stroke management should therefore be on restoring blood supply to the penumbra region by recanalisation of the blocked artery as soon as possible. However not all patients benefit from therapy aimed at recanalisation and reperfusion. The “window period” during which thrombolysis is therapeutically effective is 4.5 hours after the time of onset of symptoms. Beyond 4.5 hours, there is no significant benefit and risks outweigh any potential benefits.

**TREATMENT OPTIONS AVAILABLE**

The treatment options available can be divided into two types – definitive and conservative management.

1. **Definitive management:**

   The only definitive management of stroke is reperfusion therapy (open up the blocked artery to restore blood flow). This can be achieved by any one of the following options

   a. **Intra-venous thrombolysis** using rTPA (recombinant Tissue Plasminogen activator)

   b. **Intra-Arterial Thrombolysis** using Urokinase or rtPA. (See box 1,2).

   c. **Mechanical thrombectomy** - removing the clot from the artery through the endovascular route using devices like the MERCI Retriever, Penumbra or Solitaire.

2. **Conservative management:**

   This is aimed at clinical stabilisation, prevention of complications due to the stroke and secondary preventive measures.

   In cases where there is severe brain swelling, a hemicraniectomy may be required as a life saving measure (Fig.2).

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**Fig.2:** CT images of the brain showing

(C) right Middle Cerebral artery territory infarct with mass effect

(D) Same patient after a right fronto-temporo-parietal decompressive craniectomy
ACUTE MANAGEMENT IN
THE EMERGENCY ROOM (ER)

Acute management of the patient in the ER is crucial for prognosis and recovery. ‘Time is brain’ and therefore the emphasis of management in the ER should be assessment and initiation of treatment as quickly and efficiently as possible. The following are some of the important aspects of acute management.

**Triage:** A stroke patient should be treated as an EMERGENCY, as one would treat a myocardial infarction. The attending nurse must be aware of this and the physician must be alerted immediately. **This is a key area as time lost in the ER can lead to poor prognosis.**

**The five important questions** to be answered in the ER are:

1. **Is there a stroke?**
   Stroke must be suspected in any patient who presents with a neurological deficit of sudden onset. A quick history and examination (Box 3) must now be performed to determine if the patient has had a stroke and to exclude stroke mimics. Stroke-like conditions or ‘stroke mimics’ (Box 4) have been found in 13% of patients diagnosed with stroke. The commonest causes of misdiagnosis were unwitnessed or unrecognised seizures (39%), confusional states and syncope (24%).

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**Box 1: Intravenous thrombolysis**

**Recombinant** tissue plasminogen activator (r TPA) is the most commonly used thrombolytic agent.

**Inclusion criteria**
- Diagnosis of ischemic stroke causing measurable neurological deficit
- Onset of symptoms less than 4.5 hours before beginning treatment
- Age more than or equal to 18 years

**Exclusion criteria**
- Significant stroke / head trauma within the last three months
- Previous intracranial hemorrhage / Symptoms suggestive of subarachnoid hemorrhage
- Intracranial neoplasm
- Active internal bleeding / Acute bleeding diathesis
- Anticoagulant use with an INR >1.7
- Heparin within 48 hours with elevated aPTT
- Current stroke already involving >33 % MCA

**Relative exclusion criteria**
- Major surgery or trauma in the previous 14 days
- Gastrointestinal or urinary tract bleeding in the previous 21 days
- Pregnancy / Recent MI (<3 Months) Complicated by pericarditis
- Consider Intra-arterial / Mechanical devices if available, in these situations

**Box 2: Intra-arterial thrombolysis**

- The advantage of intra-arterial thrombolysis is that the action of the drug is limited locally. This means that a lower dose of the drug can be used and the systemic effects of the drug can be avoided.
- Can be used in patients who have contraindications for IV thrombolysis (i.e. patient on oral anticoagulants)

However this is invasive (endovascular procedure) and requires a high level of expertise and infrastructure and is expensive.
PRACTICE GUIDELINES – Approach to acute ischemic stroke

2. Where is the stroke?
Does the stroke involve the anterior or posterior circulation?

Anterior circulation stroke:
Usually present with arm and leg weakness on one side, speech difficulty (aphasia) and facial weakness. Remember ‘FAST’ (F, A and S components. See Box 5.

Posterior circulation stroke:
Vertigo, swallowing difficulty, nystagmus, cerebellar dysfunction (imbalance while walking, dysarthria) are some of the common features.

3. What is the immediate treatment to be given?

a. Assess and stabilize airway, breathing and circulation: Noisy breathing is suggestive of compromised airway. The chin-lift manoeuvre and semi-prone positioning of the patient with poor sensorium helps in preventing airway compromise due to the tongue falling back. Endotracheal intubation may be necessary if these measures fail.

b. Blood pressure: It is important to remember - NEVER BRING DOWN THE BP FAST.
In a patient with an acute stroke with no myocardial co-morbid condition, in whom thrombolysis is not being considered, it is necessary to reduce BP only if it exceeds 220/120 mmHg on the first day. Even if it exceeds this value, it will have to be gradually brought down. Rapid and drastic reduction of blood pressure does more harm than good.

c. Oxygenation: Supplemental oxygen must be given using the least invasive method possible – through nasal cannula, mask or venturi mask.

d. Blood glucose: Measure a bedside blood glucose using a glucometer and manage hypoglycemia or hyperglycemia appropriately.

e. Intravenous fluids: Hypovolemia is detrimental as it can exacerbate cerebral hypoperfusion. Normal saline or Ringer’s Lactate solution is recommended. Hypotonic fluids like 5% dextrose must be avoided as they reduce blood osmolality and increase cerebral oedema.

4. How severe is the stroke?
The severity of the stroke can be assessed using standard scales like the National Institutes of Health Stroke Scale (NIHSS). Greater the score, greater is the severity of the stroke. The NIHSS scale is easily available online.

5. Is the patient a candidate for definitive treatment?
If the patient has presented within 4.5 hours of onset of symptoms, is over 18 years of age and has contra-indications, he or she is a candidate for thrombolysis. If thrombolysis is readily available in the institution, the patient must undergo radiological investigation (CT or MRI of the brain). If thrombolysis is not available, the patient must be referred to the nearest center that can provide thrombolysis (with a letter clearly stating that you are referring for possible thrombolysis.

Box 3: Important History
1. Time of onset of symptoms – most important
2. Contraindications for thrombolysis:
Recent surgery or trauma, bleeding disorder, anti-coagulant use, recent intracranial hemorrhage
3. Co-morbid conditions – hypertension, cardiac or renal dysfunction, diabetes

Quick Examination
1. ABC (airway, breathing, circulation) – assess and stabilize any abnormality
2. Vital signs: Pulse, BP, temperature, random blood sugars
3. Neurological examination

Box 4: Stroke mimics (“MEDICS”)
(M) Migraine, Multiple sclerosis, Mass lesion
(E) Epilepsy (postictal state), Electrolyte imbalance
(D) Dissection- aortic dissection, cervical discs prolapse,
(I) Intoxication (drug, alcohol), Infection
(C) cerebral Contusion, Conversion reaction
(S) brain Secondaries, Subdural hematomas
**KEY POINTS IN EMERGENCY ROOM MANAGEMENT**

1. Acute stroke patient gets is an EMERGENCY and gets TOP PRIORITY. (Like a cardiac arrest).

2. Never reduce the blood pressure drastically in a patient with acute stroke. Reduce only if BP > 220/120 mmHg.

3. If patient is within the window period of 4.5 hours for thrombolysis alert the acute stroke treatment team in your hospital. If your hospital does not providing thrombolysis, refer the patient to the nearest stroke centre.

4. If referring for thrombolysis, refer IMMEDIATELY. Do not waste time in imaging, antiplatelet drugs etc.

**Box 5: FAST**

(F) Facial weakness – noted when the patient is told to smile

(A) Arm weakness - when the person raises both arms

(S) Speech problems - Difficulty in articulation or understanding speech

(T) Time – Note the exact time of onset of the symptoms and if within the window period rush the patient to hospital.

“FAST” is used in education of the public for recognizing the symptoms of stroke.

**Important History**

1. Time of onset of symptoms – most important

2. Contraindications for thrombolysis:
   - Recent surgery or trauma,
   - Bleeding disorder, anti-coagulant use,
   - Recent intracranial hemorrhage

3. Co-morbid conditions – hypertension, cardiac or renal dysfunction, diabetes

**Quick Examination**

1. ABC (airway, breathing, circulation)

2. Vital signs: Pulse, BP, temperature, random blood sugars

3. Neurological examination