Cerebrovascular Accidents

A suspected stroke of any subtype (TIA, ischemic stroke, or hemorrhagic stroke), requires an emergency consult.

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CEREBROVASCULAR ACCIDENTS

Definition
Transient Ischemic Attack (TIA) and stroke are caused by pathophysiologic processes involving loss of blood flow to the brain potentially causing transient or permanent neurologic dysfunction.
Stroke is the third leading cause of death and a leading cause of morbidity and long-term disability.

The majority of strokes are classified as ischemic stroke (incidence of 68% to 85%); hemorrhagic stroke has an incidence of 15% to 32%.

Stroke subtypes
Note that stroke subtypes cannot be reliably determined without the use of diagnostic imaging.
Ischemic Stroke

- **Transient Ischemic Attacks**
  A brief episode (often less than one hour, but may last up to 24 hours) of neurological dysfunction caused by focal brain, spinal cord or retinal ischemia, with clinical symptoms and without imaging evidence of acute infarction.

TIAs and minor strokes are the mildest form of ischemic stroke and cannot be differentiated by symptom duration alone. There is a risk of permanent tissue injury even when the neurological symptoms last less than one hour, and there is an increased risk of recurrent stroke after TIA.

TIAs can be a warning sign that a large stroke is imminent and in some cases, urgent work up is required.

- **Embolic or thrombotic stroke**
  An episode of symptomatic neurological dysfunction caused by focal brain, retinal or spinal cord ischemia with evidence of acute infarction on imaging (MR, CT, retinal photomicrographs), and regardless of symptomatic duration.

This type of stroke involves fragments that break from a thrombus formed outside the brain or in the heart, aorta or common carotid artery (embolic), or from within the brain (thrombotic). Sources of emboli include fat, air, tumor, bacterial clumps and foreign bodies.

Hemorrhagic Stroke

- **Intracerebral Hemorrhage (ICH)**
- **Subarachnoid Hemorrhage (SAH)**
  An episode of symptomatic neurological dysfunction caused by focal brain, retinal or spinal cord hemorrhage with evidence of acute hemorrhage on imaging (MR, CT, retinal photomicrographs), regardless of symptomatic duration.

Causes

**TIA and Ischemic Stroke**

TIAs and ischemic stroke have the same causes and risk factors.

Both are considered emergencies and require urgent evaluation.

TIAs and ischemic stroke are caused by cerebral hypoperfusion and hypoxia resulting (most commonly) from thrombosis, embolism, or systemic hypoperfusion.

Risk Factors

**TIA and Ischemic Stroke**

- Age (> 65 years)
- Atrial fibrillation
- History of TIA
- Smoking
- Hypertension
- Hyperlipidemia
- Diabetes mellitus
- Previous myocardial infarction, ventricular aneurysm, coronary artery disease, congestive heart failure, valvular heart disease (mitral stenosis and mitral prolapse)
- Carotid stenosis, Peripheral vascular disease
- Recreational drug use (cocaine, amphetamines)
- Alcohol consumption (more than 2 drinks/day or ≥ 14 drinks/week in men, ≥ 9 drinks/week in women)
- Obesity
- Neck injury within the last year
(whiplash, trauma to neck)

- Stressful environment
- Sedentary lifestyle
- Reduced access to Social Determinants of Health

**Causes**

**Hemorrhagic stroke**

Rupture of a vessel in the intracerebral or subarachnoid space (accounts for 5% to 10% of strokes).

**Risk Factors**

**Hemorrhagic stroke**

- Hypertension
- Trauma
- Bleeding disorders, medications (warfarin, ASA, clopidogrel)
- Amyloid angiopathy
- Arteriovenous malformations
- Recreational drug use (cocaine, amphetamines)
- Alcohol abuse
- Brain cancer/ tumours
- Reduced access to Social Determinants of Health

**History**

Symptom onset and progression varies depending on the subtype of stroke: TIA, ischemic (embolic or thrombotic), or hemorrhagic (ICH - intracerebral or SAH - subarachnoid).

A thorough history is valuable for a differential diagnosis. In the event the client is unresponsive, interviewing those who know them well will be helpful to obtain as much information as possible.

- Slurred speech
- Drop attacks – sudden fall without loss of consciousness
- Previous TIA which may have variable occurrence from several times a day to once or twice a year, and often present with similar neurologic symptoms
- Neurologic symptoms which have a sudden onset and last less than 24 hours is associated with TIA
- Ischemic (embolic) stroke is associated with neurologic symptoms which begin suddenly with maximal focal dysfunction at onset.
- Ischemic (thrombotic) stroke is associated with neurologic symptoms (may report headache for several days leading up to the onset of symptoms) which often fluctuate, varying between normal and abnormal or progressing in a stepwise or transient fashion with some periods of improvement
- ICH is associated with neurologic symptoms (vomiting, seizures, headache which develops after symptom onset, reduced consciousness) which do not improve in the early period and increase gradually over minutes or a few hours
- SAH is associated with neurologic symptoms which begin instantaneously, and have an associated severe headache, nausea, vomiting, seizure, or stiff neck
- Physical activity such as shoveling, sexual activity at the onset or just before the stroke (may be suggestive of hemorrhagic stroke: less common with thrombotic ischemic strokes)
- Trauma prior to stroke (may be suggestive of hemorrhagic stroke, or ischemic stroke due to occlusion or dissection)
• Reports of sneezing prior to onset of stroke symptoms (may be suggestive of embolic ischemic stroke)
• Reports of getting up during the night to urinate prior to stroke (may be suggestive of ischemic stroke due to embolism)
• Fever prior to onset of stroke symptoms (may be suggestive of embolic stroke due to endocarditis. Fever associated with neural deterioration may also result from: meningitis, subdural empyema, aspiration pneumonia and urinary tract infection)\(^3,4\)
• Consciousness may be reduced or altered (suggestive of ischemic or hemorrhagic stroke)

**Physical Findings** \(^2,3\)

Presence and severity of physical findings will be impacted by the subtype of stroke.

• Physical exam may be normal if acute symptoms have subsided
• Heart rate may be normal, tachycardic or irregular (irregular pulse is suggestive of cardiac origin such as atrial fibrillation)
• Hypoventilation may be present due to increased intracranial pressure or muscular airway obstruction
• Blood pressure may be normal, hypotensive or hypertensive (most often hypertensive due to either chronic hypertension or compensatory responses to maintain brain perfusion)
• Focal sensory and/or motor symptoms (may be unilateral, bilateral) are suggestive of TIA, ischemic stroke and ICH. Less common with SAH.
• Reflexes on affected side may be reduced or hyperactive (for up to 24 hours after TIA)
• Headache
• Vomiting
• Seizures
• Client may appear well or may be moderate-to-acute distress
• Client may be alert, may have reduced alertness, be unconscious
• Confusion may be present
• Bladder and bowel incontinence or retention may be present
• Heart murmurs, arterial bruits or thrills may be present, peripheral pulses may be diminished or absent (suggestive of ischemic stroke)

**Differential Diagnosis** \(^3\)

Seizures, conversion disorder, migraines, hypoglycemia and drug/alcohol intoxication are the most common mimics of stroke.

• Seizure disorder
• Complicated migraine
• Substance intoxication: (ETOH)
• Medication toxicity (lithium, phenytoin)
• Hypertensive encephalopathy
• Bell’s palsy
• Hypoglycemia
• Subdural hematoma
• Head injury
• Tumour
• Psychiatric and/or conversion disorder
• Meningitis
• Cerebral venous thrombosis
• Brain abscess
• Epidural hematoma
• Viral encephalitis
• Syncope

**Complications** \(^5,6\)

• Aspiration
• Inadequate ventilation
• Seizures
• Heart failure
• Cardiac arrest
• Gastrointestinal bleeding
• Disturbances in communication
• Acute urinary retention or urinary incontinence
• Bowel incontinence
• Deep vein thrombosis
• Pressure injury
• Orthopedic complications and contractures
• Depression
• Pain
• Impairment in activities of daily living
• Caregiver strain
• Death

Diagnostic Tests\(^1,4,7\)
Screening tools for stroke severity:
• Glasgow Coma Scale
• ABCD\(^2\) for suspected TIA:
  › A=Age,
  › B=Blood pressure,
  › C=Clinical features,
  › D=Duration of symptoms,
  › D=and Diabetes score
• Los Angeles Motor Scale (LAMS) for suspected stroke
• ECG should be completed. Look for atrial fibrillation.
  ECG should NOT delay transport.
• Chest X Ray should be completed when the client has evidence of acute heart disease or pulmonary disease. Chest X Ray can be deferred until after a decision regarding acute treatment.
  Chest X Ray should NOT delay transport.

Laboratory investigations:
Drawing blood work should not delay transport.
If it will not delay transport, prioritize obtaining:
• Capillary Blood Glucose (CBG)
• Blood alcohol level (if alcohol consumption is reasonably suspected)
If it will not delay transport, consider the following additional tests:
• CBC
• Electrolytes
• International normalized ratio (INR)
• Partial thromboplastin time (aPTT)
• Troponin
• Creatinine, eGFR

The following laboratory studies may be appropriate in selected clients:
• Urea Nitrogen
• Toxicology screen
• β HCG (urine or serum) If female of childbearing age

If infection is suspected (if client has fever):
• Blood cultures
• Urinalysis
• Blood type and cross match

Management

Goals of Treatment
• Stabilize and transport
• Protect airway, ensure adequate ventilation and oxygenation and circulation
• Maintain strict blood glucose control
• Modify risk factors
• Prevent future recurrence of TIA or stroke
• Consideration for, or documentation of,
advanced care planning and goals of care

**Appropriate Consultation**
A suspected stroke of any subtype (TIA, acute ischemic stroke, or hemorrhagic stroke), requires an emergency consult.

**Client Centered Learning**
Assess readiness to learn, consider providing teaching points in the non-acute setting

- Provide education regarding stroke recognition and importance of early intervention.
- Discuss primary and secondary prevention strategies
- Client education around optimizing healthy lifestyle choices

**Non-pharmacologic Interventions**

- Ensure adequate airway, suction prn
- NPO: Nothing by mouth until swallowing function is evaluated
- Insert indwelling urinary catheter if level of consciousness impaired. Indwelling urinary catheters should be avoided due to risk of infection; and used only if indicated.
- Symptomatic treatment of pyrexia.
- Unless c-spine precautions are indicated, maintain head of bed in the position most comfortable for the client, but no lower than 30 degrees; especially in the following clients:
  - Clients at risk for elevated intracranial pressure (intracerebral hemorrhage, cerebral edema >24 hours from stroke onset in patients with large ischemic infarction)
  - Clients at risk for aspiration (those with dysphagia and/or diminished consciousness)
  - Clients at risk for cardiopulmonary decompensation or oxygen desaturation (those with chronic cardiac and pulmonary disease)

**Adjuvant Therapy**
- Patients who are hypoxic should receive supplemental oxygen to maintain SpO2 > 94%. Supplemental oxygen should not routinely be given to non-hypoxic patients with acute ischemic stroke.
- Insert saline lock. Consult for fluid management.
- Do not overload with volume, especially if cerebral hemorrhage is suspected
- Maintain strict blood glucose control
- Perform oral care (at least once prior to transport or discharge)

**Pharmacologic Therapy**
- For blood pressure management, consult
- Maintain optimal blood sugar levels
- If hyperglycemic, consult
- If hypoglycemic (<4mmol), refer to Hypoglycemia guideline (Chapter 10 Hematology, Metabolism and Endocrinology).
- If new onset seizures at the time of an acute stroke, occurring either immediately before or within 24 hours of stroke onset; obtain CBG and consult immediately.

**Monitoring and Follow-up**
- Monitor vital signs including neuro vitals q1h and prn as clinically indicated
- Strict fluid intake and output
- A suspected stroke of any subtype (TIA, acute ischemic stroke, or hemorrhagic stroke), requires an emergency consult.
• Prepare for emergency transportation
• Monitor for decompensation of pre-existing medical problems
• Follow up with client: discuss and support secondary prevention strategies and optimizing healthy lifestyle

**Referral**
A suspected stroke of any subtype (TIA, acute ischemic stroke, or hemorrhagic stroke), requires an emergency consult and referral

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**Diagnostic tests: Scoring Tools**

**Glasgow Coma Scale**

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>RESPONSE</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best Eye Opening</td>
<td>Spontaneous</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>To Speech</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>To Pain</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>1</td>
</tr>
<tr>
<td>Best Verbal Response</td>
<td>Oriented: person, place &amp; time</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Confused</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Inappropriate words</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Incomprehensible sounds</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>1</td>
</tr>
<tr>
<td>Best Motor Response</td>
<td>Follows commands</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Localizes</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Withdrawal from pain</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Abnormal flexion (decerebrate)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Abnormal extension (decorticate)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>1</td>
</tr>
</tbody>
</table>

**Brain injury Assessment tool**

- **Mild**: 13 or more
- **Moderate**: 9 – 12
- **Severe**: 8 or less

| Score needs to be recorded for each response and as a total |
**ABCD²**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Descriptor</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>&lt;60 years</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>≥60 years</td>
<td>1</td>
</tr>
<tr>
<td>BP</td>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Raised</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Either Systolic ≥ 140 mmHg or Diastolic ≥ 90 mmHg or both</td>
<td></td>
</tr>
<tr>
<td>Clinical Features</td>
<td>no unilateral weakness and no speech disturbance</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>no unilateral weakness and with speech disturbance present</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>unilateral weakness present and with/without speech impairment</td>
<td>2</td>
</tr>
<tr>
<td>Duration of TIA</td>
<td>&lt;10 minutes</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>10–59 minutes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>≥60 minutes</td>
<td>2</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Nil</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Diabetes present</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL POINTS:**

**RISK:**
- Low 1 - 3
- Mod 4 - 5
- High 6-7

The ABCD2 score is a clinical prediction tool used for patients following a transient ischemic attack. The tool is used to determine the risk for stroke in the days following a TIA and can assist in plan of care (e.g.: admission, transport, etc.)

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**The Los Angeles Motor Scale (LAMS)**

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial droop</td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>0</td>
</tr>
<tr>
<td>Present</td>
<td>1</td>
</tr>
<tr>
<td>Arm Drift</td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>0</td>
</tr>
<tr>
<td>Drifts down</td>
<td>1</td>
</tr>
<tr>
<td>Falls rapidly</td>
<td>2</td>
</tr>
<tr>
<td>Grip Strength</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td>Weak grip</td>
<td>1</td>
</tr>
<tr>
<td>No grip</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total (0-5)**

LAMS is a motor stroke deficit scale.

**A score ≥4** is associated with severe stroke.
REFERENCES


