All about Stroke
What is stroke or “brain attack”?
A stroke or “brain attack” is the result of a sudden interruption of blood supply due to blockage of a blood vessel that goes to the brain or a rupture of a blood vessel inside the brain. The patient’s signs and symptoms depend on the location and extent of the injured area of the brain.

What are the types of stroke?

Ischaemic Stroke / Infarct
- Is due to blockage of a blood vessel supplying an area of the brain.
- The blockage may be of a small blood vessel or a large blood vessel.
- The blockage may occur because of thrombus formation in the blood vessel or embolism (blockage by a blood clot that escapes from another place and travels to the brain artery. Such sources include a blood vessel in the neck or the heart).

Hemorrhagic Stroke / Hemorrhage
- Is due to bursting or rupture of a blood vessel in the brain. This is less common than ischaemic stroke.
- The bleeding may be intraparenchymal (bleed within the brain) or subarachnoid (bleeding into the space around the brain).
- The most common cause of bleeding is hypertension (high blood pressure).
- Rarely, it may be due to an arteriovenous malformation (AVM, abnormal connection of blood vessel) or aneurysm (a balloon-like bulge in an artery).
What is TIA (Transient Ischemic Attack)?
- Also called “mini-stroke” or pre-warning stroke.
- Patients show signs and symptoms of stroke that lasts only for a few minutes to hours.

**Mechanism of TIA**

<table>
<thead>
<tr>
<th>Normal</th>
<th>Blockage</th>
<th>Blockage Cleared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood flows easily</td>
<td>Plaque fragment and / or blood clot</td>
<td>The plaque or blood clot dissolves</td>
</tr>
<tr>
<td>through clear artery</td>
<td>blocks artery, reducing blood flow</td>
<td>or breaks up quickly, restoring</td>
</tr>
<tr>
<td></td>
<td>to brain</td>
<td>blood flow to brain.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The brain cells recover, and no</td>
</tr>
<tr>
<td></td>
<td></td>
<td>permanent brain damage occurs</td>
</tr>
</tbody>
</table>
What are the risk factors that can be modified?

1. **Smoking**
   Smoking increases the risk of stroke by 1.5 to 2.5 times for you and your family. This risk is significantly reduced when you stop smoking. Your risk of stroke will be equivalent to that of a non-smoker after five years of stopping.

2. **Hypertension**
   Uncontrolled hypertension increases the risk of stroke by four times. High blood pressure should be treated if it is repeatedly above 140/90 mmHg. If you have diabetes, your blood pressure should be below 130/80mmHg.

3. **Diabetes mellitus**
   Uncontrolled diabetes over a long period of time can cause damage to your blood vessels and nerves. The risk of stroke is 1.5 times more in diabetic patients.

4. **Increased cholesterol**
   Increased cholesterol levels can cause the narrowing of blood vessels in your body. This can lead to blockage of the blood flow to your vital organs including the brain, thus increasing the risk of stroke.

5. **Irregular heart beat**
   Patients with irregular heart beat have 60% to 80% risk of having a stroke.
6. Previous stroke or TIA
Having stroke increases the risk of another stroke within the year by 10% to 12%. Thereafter, the risk gradually decreases.

7. Excessive alcohol consumption
An average of more than one alcohol drink a day for women (30 ml of hard liquor, 330 ml of beer or 120 ml of red wine) or two drinks a day for men raise blood pressure and can lead to stroke.

8. Obesity
Obesity is the accumulation of excess body fat. It is associated with various stroke risk factors such as diabetes, high blood pressure and high cholesterol levels.

9. Sedentary lifestyle
Stroke risk is higher with sedentary lifestyle. Exercise at least three to five times a week, 30-60 minutes each time. Regular exercise helps to reduce obesity and also aids in the prevention and management of high blood pressure, diabetes and high cholesterol.

10. Substance abuse
Intravenous drug abuse enhances blood vessel disorders and oral drug abuse like amphetamines increases sympathetic response causing increased blood pressure.
What are the risk factors that cannot be modified?

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Hereditary</th>
</tr>
</thead>
<tbody>
<tr>
<td>The chance of stroke increases with age.</td>
<td>Male gender has higher risk of stroke compared to female but becomes equal after menopause.</td>
<td>Those who have family history of stroke at a young age has a higher risk.</td>
</tr>
</tbody>
</table>

What are the signs and symptoms of stroke?

You may be having a stroke when you have sudden onset of:

- Weakness of facial, arm, leg muscles on one side
- Numbness of face, arm leg on one side
- Slurred speech or difficulty expressing oneself
- Inability to comprehend
- Unsteady gait or loss of coordination
- Blurred or double vision
- Difficulty swallowing
- Severe headache with nausea and vomiting

Seek urgent medical attention if these symptoms develop. These symptoms may also be caused by other illnesses that would also need treatment.

F
Face
Does one side of the face droop?

A
Arm
Does one arm drift downwards?

S
Speech
Does the speech sound slurred or strange?

T
Time
Call 995 and go to a hospital immediately.
What to do if you have a stroke?
Call 995 for ambulance immediately.

Complications of stroke
Patients with a major stroke may suffer from many complications:

Infections
Because of swallowing impairment or drowsiness, food or saliva may accidentally enter the lungs and cause an infection (pneumonia). Urinary tract infection may occur if good hygiene is not maintained in the genital area.

Bed sores
Constant pressure over certain body parts may cause the skin at that area to break down, resulting in bed sores.

Dehydration, malnutrition
This occurs when there is inadequate intake of food or water due to swallowing impairment or drowsiness.

Constipation
This occurs when there is inadequate intake of fluids or fibre, or when the patient does not open the bowels regularly.

Incontinence
Stroke patients may be unable to control their bladder or bowel movements. More likely to occur in patients who are drowsy or have suffered a major stroke.

Contractures
This occurs when limbs become fixed in a certain position due to irreversible contraction and fibrosis of muscles.

Heart attack
Stroke and heart attack have similar risk factors. The factors that cause blockage of arteries in the brain may also cause blockage of arteries in the heart, causing heart attack.

Another stroke
Despite taking medications and modifying risk factors, the risk of having another stroke cannot be totally removed.
What are the diagnostic procedures available for stroke?

Depending on the kind of stroke and its location, the doctor may order any of the following diagnostic procedures:

**Brain Scan**

- **CT Scan (computerized tomography)**
  To detect hemorrhagic stroke, large ischemic stroke.

- **MRI / MRA (Magnetic Resonance Imaging / magnetic resonance)**
  To detect very small stroke especially in the brainstem that may not be seen well in the CT scan while the MRA can show non-invasively the blood vessels in the brain.

**Blood tests**

To check for risk factors like diabetes, increased cholesterol, clotting problem etc.

**Electrocardiogram (ECG) / 2D echocardiogram (ultrasound of the heart)**

To check for underlying heart conditions.

**Carotid and Vertebral Ultrasound**

To assess the major blood vessels of the neck that supply the brain.

**Computed Tomography Angiography (CTA) Carotid**

Is a non invasive procedure to confirm narrowing or severity of occlusion of the blood vessel that may be the cause of the stroke.

**Four Vessel Angiogram**

A small tube is inserted in the groin and moved to the level of the brain after which dye is injected. It provides more information if necessary, on the location and severity of blood vessel abnormality that maybe responsible for the stroke.
How is stroke treated?
You may receive the following treatments:

**Clot dissolving medication - Recombinant Tissue Plasminogen Activator (rTPA)**
This is given to patients who have fulfilled the inclusion criteria for intravenous thrombolysis. It is a fibrinolytic medication used to dissolve blood clot.

**Blood thinner (anti-platelet like aspirin or anti-coagulant like warfarin)**
This is used for patients with ischemic stroke as it significantly decreases the risk of a second stroke.

**Cholesterol lowering medication (“statins”)**
This significantly decreases the risk of a stroke.

**Blood pressure lowering medication**
This medication is avoided during the first 24 hours from the stroke onset. After 24 hours, it may be given depending on the patients’ clinical condition and blood pressure readings during hospital stay.

**Surgery**
Surgery will only be done according to the neurosurgeon’s assessment of the patient’s condition. There are several options of surgical interventions. These are:

- **Carotid Endarterectomy (CEA)**
  For severe narrowing of the blood vessels in the neck

- **Hemicraniectomy**
  For patients with large infarct only. Depending on patient’s condition and the neurosurgeon’s assessment, the neurosurgeon may take off the skull at the affected area

- **External Ventricular Drainage (EVD) / Ventricular Peritoneal (VP) shunting**
  To decrease excessive amount of fluid in the brain

- **Clipping of Aneurysm / Coiling**
  To clip or insert coils into the outpouching of the blood vessel in the brain to prevent further rupture
**What happens when you are hospitalised for stroke?**

You may be in the hospital for two weeks or more depending on your recovery.

<table>
<thead>
<tr>
<th>Day</th>
<th>Treatment and Monitoring</th>
<th>Activity</th>
<th>Nutrition</th>
</tr>
</thead>
</table>
| 1-3 | - You will be admitted to either Acute Stroke Unit (ASU) or General Ward for close monitoring and treatment  
    - Your consciousness level, heart beat and blood pressure will be monitored  
    - You will be fasted from midnight to take your blood sugar and cholesterol levels in the morning  
    - You will be started on medical management according to your stroke type  
    - Investigation will be done according to your stroke type | - You may be referred to allied health professionals (Speech Therapist / Physiotherapist / Occupational Therapist / Dietitian / Diabetic Nurse / Smoking Cessation Counsellor / Medical Social Worker) when necessary | - Depending on the swallowing test or the speech therapist assessment, you will start feeding either orally or by nasogastric tube (NGT) |
| 4-6 | - Doctors will advise you if further test and other medical management are required  
    - You will be referred to Rehabilitation Medicine if necessary | - Continue rehabilitation by PT/OT/ST  
    - Care giver training if required | - Continue oral feeding.  
    - If you are on NGT, you will be reassessed by ST for your safety of oral feeding |

**Discharge from Hospital**

If you are stable for discharge, in the Acute Hospital setting, you will be:
- discharged home with / without a caregiver, or
- transferred to community hospital for further rehabilitation or
- referred to Day Rehab Center or
- follow up at CGH out-patient Rehab or
- admitted to a Nursing Home

You will continue to take your medications, do your exercises, modify your lifestyle and follow-up with doctors for the control of your risk factors
What to expect after discharge from hospital?

1. Take your medications
   Medications improve quality of life, prevent a second stroke and improve survival. Take your medications as prescribed.

   The pharmacist will explain your medication to you. It is important to know the names of your medications, what they are used for, how often and at what times to take them.

   Keep a list of your medications and bring them when you visit any doctor. Inform your doctor if you are taking any supplements, vitamins and over the counter medications.

   Talk to your doctor or pharmacist if you have any doubt or problem regarding your medications. Never stop taking your medications without first discussing with your doctor.

   Medications prescribed by your doctor may be used to:
   a) Prevent stroke
   b) Control blood pressure
   c) Control diabetes
   d) Lower cholesterol

2. Dietary modifications
   Avoid food high in cholesterol, saturated fats, trans fats, salt, sugar and alcohol. Bake, boil or steam your food. Avoid frying. Consume more fibres, fresh fruits and vegetables.

3. Exercise regularly

4. Quit smoking
   If you smoke after stroke, your chance of having a second stroke is higher. You can quit smoking by gathering support from family and friends or joining a smoking cessation clinic. You may contact the following:

   CGH Smoking Cessation Counselling
   For an appointment, please call
   CGH Appointment Centre
   Tel: 6850 3333

   Health Information Centre (Level 3)
   Health Promotion Board (HPB)
   3 Second Hospital Avenues
   Singapore 168937
   Tel: 6435 3954
   Fax: 6536 1277
   Website: http://www.hpb.gov.sg

5. Limit alcohol intake
This is a list of medications that you may be on:

<table>
<thead>
<tr>
<th>Class of Medication</th>
<th>Name of Medication</th>
<th>What the Medication Does</th>
<th>Reason for Medication</th>
<th>Common Side Effects</th>
<th>Precautions and Advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiplatelet Agents</td>
<td>Aspirin, Clopidogrel, Dipyridamole</td>
<td>Prevent platelets in the blood from sticking together.</td>
<td>Reduce likelihood of clot formation.</td>
<td>-</td>
<td>Best to take with food. Look for increase in bleeding or bruising.</td>
</tr>
<tr>
<td>Anticoagulants</td>
<td>Warfarin/Coumadin,</td>
<td>Decreases the clotting ability of the blood.</td>
<td>Prevent harmful clots from forming in the blood vessels. May prevent the clots from becoming larger and causing more serious problems.</td>
<td>-</td>
<td>Patients on this medication needs to be monitored closely with regular blood testing.</td>
</tr>
<tr>
<td></td>
<td>Dabigatran, Rivaroxaban</td>
<td></td>
<td></td>
<td></td>
<td>These medications do not need blood testing.</td>
</tr>
<tr>
<td>Statins Cholesterol lowering drugs</td>
<td>Atorvastatin, Lovastatin, Pravastatin, Rosuvastatin, Simvastatin</td>
<td>Lower cholesterol in your body. Keep the plaques in your arteries stable.</td>
<td>Used to lower LDL (“bad” cholesterol) and lower triglyceride levels.</td>
<td>-</td>
<td>Patients on these medications must be monitored to check effectiveness and how well the liver is tolerating the medication.</td>
</tr>
<tr>
<td>Angiotensin-Converting Enzyme (ACE) Inhibitors</td>
<td>Captopril, Enalapril, Lisinopril, Perindopril, Ramipril</td>
<td>Expand blood vessels and decrease resistance to blood flow. Help the heart to work more efficiently.</td>
<td>Treat high blood pressure and heart failure and prevent stroke.</td>
<td>Dry cough, dizziness and changes in taste.</td>
<td>Do not take additional potassium supplements. Avoid use of salt substitute.</td>
</tr>
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<td>Class of Medication</td>
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</tr>
<tr>
<td>Angiotensin II receptor Blockers (or Inhibitors) (Also known as ARBs)</td>
<td>Candesartan, Losartan, Telmisartan, valsartan</td>
<td>Expand blood vessels and decrease resistance to blood flow. Help the heart to work more efficiently.</td>
<td>Treat high blood pressure. Prevent stroke and heart failure.</td>
<td>Dizziness and changes in taste.</td>
<td>Do not take additional potassium supplements. Avoid use of salt substitute.</td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>Atenolol, Bisoprolol, Carvedilol, Metoprolol, Propranolol, Sotalol</td>
<td>Decrease workload and oxygen demand of the heart. Lower blood pressure and make the heart beat more slowly.</td>
<td>Treat high blood pressure, abnormal heart rhythms and chest pain.</td>
<td>Tiredness, dizziness, cold hands and feet, slow heart beat, and breathlessness.</td>
<td>This side effect of tiredness wear off over time. Inform your doctor if you have asthma, fainting or near fainting spells.</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td>Amlodipine, Diltiazem, Nifedipine</td>
<td>Relax the blood vessels.</td>
<td>Used to treat high blood pressure, chest pain and some abnormal heart rhythms.</td>
<td>Headache, flushing, dizziness, palpitation, swelling of feet.</td>
<td>-</td>
</tr>
</tbody>
</table>
Frequently asked questions

Q What are the chances of recovery?

A The rate of recovery after a stroke differs for each person but most of the recovery is usually observed in the first three to six months.

In general:
- 30 % of stroke patients will have very good or full recovery
- 30 % of the patients will have partial recovery.
- 30 % of the patients will have poor recovery.
- 10 – 20 % of stroke patients do not survive, especially those with large stroke.

Q What are the chances of a recurrence of stroke?

A For patients who had a stroke, the risk of another stroke within the year is 10 to 12%. Thereafter, the risk gradually decreases.

Q Is there a stroke support group for stroke patients and carers?

A The Singapore National Stroke Association is the national stroke support group. It organises talks and activities for the public as well as stroke patients and their families.

Tel: 6358 4138
Email: sporensa@singnet.com.sg
Website: www.snsa.org.sg

Q Is there any service which we could consult if we have other questions?

A Changi General Hospital has an Ask-a-CGH Nurse service as an additional avenue for you to ask health-related questions. The service is provided by our team of experienced nurses, in consultation with our medical specialists and paramedical staff. This service is not intended to substitute medical advice or consultation.

To use this service, go to our website at http://www.cgh.com.sg and click on “Ask-a-CGH Nurse” to submit your question. You will hear from us within three working days.
### When can I start driving again?

<table>
<thead>
<tr>
<th>Stroke</th>
<th>Group 1 (Class 1, 2 &amp; 3 licences)</th>
<th>Group 2 (Class 4, 5 &amp; Vocational Licences)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patients without any residual disability may resume driving after 1 month.</td>
<td>Able to return to driving if all following conditions are met:</td>
</tr>
<tr>
<td></td>
<td>Patients with disabilities such as residual weakness, significant visual field defects, perceptual or mental impairment, in coordination, etc, severe enough to interfere with control of the vehicle should not drive.</td>
<td>• &gt;1 year post stroke</td>
</tr>
<tr>
<td></td>
<td>Patients with mild residual disabilities that may not interfere with control of the vehicle may undergo Driving Assessment and Rehabilitation Programme (DARP) &gt;1 month after stroke. They may be allowed to drive if they pass DARP, after final review by a doctor.</td>
<td>• Stroke is not due to high-risk underlying condition which is left untreated (e.g. high grade carotid stenosis, untreated aneurysm)</td>
</tr>
<tr>
<td>Transient ischemic Attack (TIA)</td>
<td><strong>Single TIA:</strong> Allowed to return to driving once free of TIA for 1 month</td>
<td>• Fully recovered</td>
</tr>
<tr>
<td></td>
<td><strong>Multiple TIA:</strong> Allowed to return to driving once free of TIA for 6 months</td>
<td>• Passed DARP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Compliant with treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Final clearance given by a doctor</td>
</tr>
</tbody>
</table>
2 Simei Street 3 Singapore 529889
Tel: 6788 8833 Fax: 6788 0933
Reg No 198904226R

For appointments and enquiries, please call the CGH Appointment Centre at
Tel: (65) 6850 3333

**CGH Appointment Centre operating hours:**
8.30 am to 8.00 pm (Monday to Friday)
8.30 am to 12.30 pm (Saturday & Sunday)
Closed on Public Holidays

For more information, please visit [http://www.cgh.com.sg](http://www.cgh.com.sg)

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