Understanding Cerebrovascular Diseases and Neurointervention
The chances of a stroke, otherwise known as cerebrovascular disease, is quite high among the Indian population. In fact it is as high as 800 per 100,000 people and the actual incidence is increasing considerably. Stroke is rated as the second highest cause of death and disability, after cancer, in non-communicable diseases.

Cerebrovascular disease affects the blood vessels of the brain, and is also known as a stroke. It is a generic term which includes brain haemorrhage and ischemic stroke. Both forms of stroke are treatable if detected in time, otherwise they can lead to paralysis or even death.

What is the incidence of stroke? The chances of a stroke, otherwise known as cerebrovascular disease, is quite high among the Indian population. In fact it is as high as 800 per 100,000 people and the actual incidence is increasing considerably. Stroke is rated as the second highest cause of death and disability, after cancer, in non-communicable diseases.

What are the risk factors for stroke? Risk factors which might lead to stroke are hypertension (poorly controlled blood pressure), diabetes (poorly controlled blood sugar), deranged lipid levels, excess of homocysteine in the blood, and polycystic kidney diseases, among many others.

Is stroke preventable or treatable? Certainly! With proper awareness about the disease, we can immediately start implementing lifestyle changes, along with prescription of medicines, to reduce the risk of stroke significantly. It is also crucial to identify a stroke in the first couple of hours for the best treatment.

How to recognize a stroke? There are many simple signs which allow a doctor, or even an onlooker, to recognize a stroke. Some of them are:

- Slurring of speech or sudden onset of confusion
- Sudden onset of blurry vision or even blindness
- Weakness on one side of the body or inability to balance
- Facial asymmetry: ask the person to smile, the curve of their lips will be irregular

How is a stroke treated? If you suspect that someone is experiencing a stroke, then you should immediately rush them to a stroke centre, where they will undergo imaging studies (CT and or MR) and will be treated by a stroke specialist. Further treatment might require clot-busting drugs or angioplasty of the brain vessels in a Cath Lab. Other treatments include:

- In case of an arteriovenous malformation, it will be embolized (filled) with an embolic material
- In case of an aneurysm disease (stenosis), a carotid artery angioplasty will be offered

All the above procedures are done in a Neurovascular Cath Lab and are called Neurointervention procedures.

What is Neurointervention or Endovascular Neurosurgery? Neurointervention is the newest sub-specialization of Neuroscience that deals with stroke procedures in Neurovascular Cath Labs. It involves tackling the diseases in the vascular system of the brain, from inside the brain arteries, with the help of smaller catheters, wires and various other specialized miniature devices.

What are the different types of Endovascular Neurosurgery procedures? Neurointervention procedures range from diagnostic tests (cerebral angiography) to the embolization of various malformations of the arteries and veins in the brain. They are as follows:

- Diagnostic Cerebral Angiogram (DSA)
- Aneurysm Coil Embolization
- Arteriovenous Malformation (AVM) Embolization
- Arteriovenous Fistula (AVF) Embolization
- Carotid and Intracranial Angioplasty
- Acute Stroke Procedures (opening brain arteries in stroke patients)

In some cases, vascular tumours are embolized before surgery to reduce blood loss.
Diagnostic Cerebral Angiography (DSA) is a procedure done to investigate various abnormalities of the blood vessels in the brain.

DSA is performed by placing a catheter in the selected blood vessel and then administrating contrast, while a rapid set of X-rays are obtained, much like time-lapse photography. It is the most accurate method to identify and define aneurysms, arteriovenous malformations, carotid stenosis and many other diseases of the blood vessels supplying the central nervous system.

To provide maximum comfort to the patient, conscious sedation and local anaesthesia is given before the catheters are placed. Most patients undergoing diagnostic angiography need to stay in the hospital for 3 to 6 hours after the procedure. To ensure complete peace of mind, patients are always seen by a physician prior to discharge. After the angiography, patients must avoid heavy lifting or exercise for the next 10 days and swimming for 5 days.

What is Diagnostic Cerebral Angiography (DSA)?

A brain aneurysm is the bulging and weakening of an area in the wall of an artery in the brain, resulting in an abnormal widening or ballooning. The aneurysm is thus at risk of bursting if the blood flow isn’t blocked (brain haemorrhage). Although most cases are likely the result of a genetic alteration, infection or trauma, atherosclerosis can also cause aneurysms.

Even though many patients show no symptoms, or simply experience mild headaches, 40% patients may have warning signs such as a localized headache, cranial nerve paralysis, nausea or vomiting. When the arteries rupture, the patients may experience severe headaches, photophobia, neck stiffness or even loss of consciousness, resulting in an intracranial haemorrhage called the subarachnoid haemorrhage.

What is Aneurysm?

In endovascular coiling, a very thin metal wire is inserted inside the brain aneurysm, through a miniature catheter, by a highly experienced surgeon. This microcatheter is navigated through the web of brain arteries under image guidance in a cath lab. Once the catheter reaches the desired location, a series of handmade coils are placed inside the aneurysm and detached from outside the body. These small coils form a coil mass which block the blood flow to the aneurysm and subsequently lead to the healing of the artery.

What is Coil Embolization of an Aneurysm?

What is Arteriovenous Malformation (AVM)?

An Arteriovenous Malformation (AVM) is an abnormal collection of blood vessels occurring within the brain itself.

AVM, there is a sort of short circuit which causes the blood to travel rapidly from the arteries directly into the veins. This can lead to pressure build-up and cause bleeding from the AVM or the veins, which do not have enough support in their walls. Patients can be asymptomatic or may suffer from headaches, seizures or deterioration of neurologic functions. If haemorrhage occurs, patients may experience severe headaches, stroke-like symptoms or even loss of consciousness.

The treatment of AVMs may include surgical excision, radiation treatment or embolization. In most cases, embolization is used to block the blood supply to the AVMs, making the treatment safe. In 70% of the cases, embolization may fully treat a lesion. In some cases, patients might have to undergo a surgical resection or radiation therapy to complete the treatment.

What is Carotid Angioplasty and Stenting?

In recent years, the use of Angioplasty and Stenting for the treatment of cerebrovascular diseases has grown immensely. Patients with more than 70% symptomatic carotid stenosis are the ones who greatly benefit from this intervention procedure. Patients may also have a history of a previous stroke or Transient Ischemic Attacks (TIAs). This procedure is performed under monitored anaesthetic care with the patient sedated or under general anaesthesia, depending on their medical condition, making it a highly personalized treatment.
Spinal AVM / AVF is a disorder of the arteries in the vertebral column, in which there is an abnormal cluster of arteries and veins leading to weakness of the lower limbs. This is usually caused by the 'steal phenomenon' where, instead of reaching the neural tissues, the oxygenated blood drains directly into the venous system, thus leading to the deficiency of oxygen and weakness. These spinal lesions are treated by embolization of tiny abnormal arteries in the spine.

### What is Spinal AVM / AVF and how is it treated?

- Headache
- Seizure
- Hydrocephalus
- Cranial nerve deficit (deviation of mouth/tongue, deviation/closure of eye(s))

It is recommended that individuals suffering from AVF seek treatment, which can be accomplished by endovascular means. Embolization of the AVF can be performed under general anaesthesia. Treated patients may be required to spend 2 to 3 days in the hospital, while patients who have had intracranial haemorrhage as a presenting symptom, may be required to spend two weeks or more in the hospital for complete recovery.

### What is Venous Sinus Occlusive Disease?

Venous sinus occlusive disease is an uncommonly occurring vascular abnormality. It may be associated with a variety of hypercoagulable states such as paraneoplastic syndromes, birth control pills, and genetic variations in which clotting factors are abnormal. This affects normal circulation in the brain and can lead to oedema, stroke or even haemorrhage. If patients have a serious neurologic deficit, an interventional procedure to remove the clot may be necessary.

### What is Stroke Therapy?

The incidences of serious stroke-related, long-term disabilities are rising every year. The current emphasis is on recognizing strokes as early as possible, and all attempts are made to open the clogged arteries to prevent the loss of brain neurons. The earlier the endovascular treatment is performed, the better the outcome.

This is done by using a clot-removing device, which traps and removes a clot from the artery of the brain in a cath lab. The functional outcomes of this procedure are significantly better as compared to traditional treatments of stroke.

### What is Carotid Cavernous Fistula?

Carotid Cavernous Fistula (CCF) is caused by an abnormal communication between the arterial and venous systems within the cavernous sinus in the skull. Patients with CCF may also have predisposing causes, but radiological features can help in the diagnosis of CCF and in determining the right intervention. Patients with any associated visual impairment or ocular conditions, such as glaucoma, need to be identified and treated as soon as possible. Depending on the patient’s symptoms, timely intervention is crucial to prevent morbidity or mortality. Some of the conventional treatments of CCF include carotid ligation and embolization.

### What is Arteriovenous Fistula?

Arteriovenous Fistulas (AVF) are abnormal connections of the arteries to the veins, in which patients may suffer the following symptoms:

- Headache
- Pulsatile tinnitus (noise in the ears)
- Seizure
- Brain haemorrhage
- Hydrocephalus
- Neurologic decline or stroke-like symptoms
- Cranial nerve deficit (deviation of mouth/tongue, deviation/closure of eye(s))

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### When is Tumour Embolization required?

There are several groups of patients in whom bleeding from a tumour needs to be controlled. This may include pre-operative treatment of the neck masses (paragangliomas and juvenile angiofibromas) or skull base lesions (meningiomas) to decrease the time and risk of surgery. Patients with epistaxis, i.e. persistent severe nose bleeding, may also benefit from tumour embolization.

### A diet lacking in calcium, excessive alcohol consumption (particularly in men), menopause, chronic steroid therapy and smoking can cause osteoporosis. It is estimated that 1 in 3 women, and 1 in 8 men, over the age of 50, suffer from osteoporosis worldwide.

Vertebroplasty and Kyphoplasty are minimally invasive methods of treating patients with compression fractures of the spine caused by osteoporosis.

In most cases Vertebroplasty is performed as a day procedure, with conscious sedation, including intravenous medication for complete relaxation and pain control.

Patients are closely observed in the hospital and usually sent home the same day, for convenience. It is an excellent procedure for augmentation and stabilization of vertebral fracture and pain relief. More than 90% of the patients get permanent pain relief and they no longer require any analgesics or braces.

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