



Healthy

Newsletter

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Life

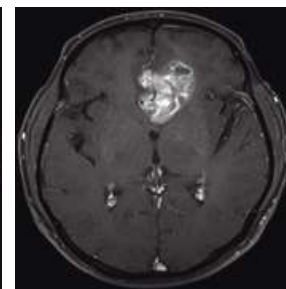
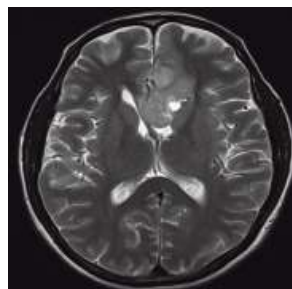
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Department of Neurosciences

Dr Vinod Rambal
 MS, MCh (Neurosurgery)
 Full-time Consultant Neurosurgeon



T2 Axial MR Brain and Postcontrast MR Brain showing glioblastoma multiforme

BRAIN TUMORS

The annual incidence of brain tumors is 22 per 1,00,000 persons. Incidence of tumor varies with age. There is a small peak at 2 years, a decline for the rest of the first decade and slow increase from 2 per million at age 20 to 6 per million at age 40. About half of them are primary and rest are metastatic in origin.

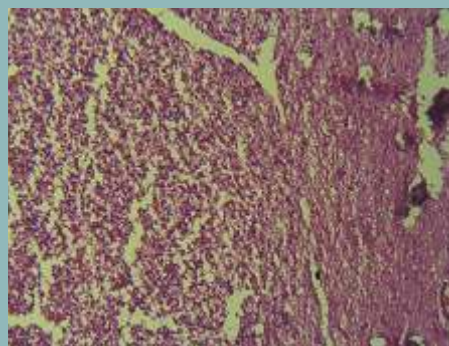
There are two main groups of tumors, which are quite diverse in their origin, behaviour and outcome.

In **benign** category, the biggest challenge is to remove the tumor completely and to safeguard the adjacent normal brain. These tumors arise outside brain parenchyma or neighbouring skull base and insinuate into the normal brain. These are slow growing and keep pushing or displacing normal brain. Usual presentation is that of general symptoms of headache, raised intracranial pressure features, convulsions in supratentorial tumors or obstructive hydrocephalus in infratentorial tumors.

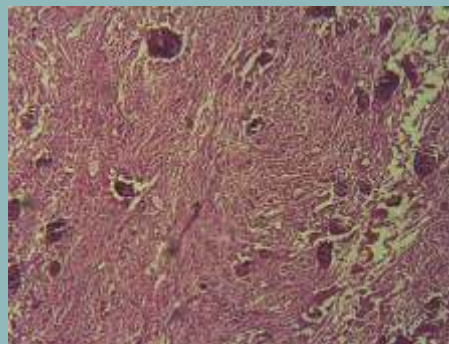
Malignant tumors usually arise from the supporting glial cells of neural tissue. These tumors being intrinsic in nature manifest by way of either 'area-located' symptoms or general

symptoms like headache, convulsions or vomiting. These tumors need to be removed. Surgery provides the confirmation, helps in alleviation of the symptoms and facilitates future planning and treatment. Depending on the grade of the tumor, further adjuvant therapy can be offered. The options are radiotherapy, chemotherapy, immunotherapy, biological response modifiers and inhibitors of angiogenesis. Lower grades, where one achieves a gross total removal, have a good outcome in terms of survival and quality of life. Lower grades have a 5-year survival of around 80%. High-grade tumors especially grade IV, survival is less than a year with best possible treatment, surgery plus adjuvant.

Malignant tumors from lung, breast, prostate, colorectal, kidney and melanoma commonly spread to the brain. It usually occurs at grey-white junction, however, it can grow at anywhere in the brain. About 15% may present as an occult primary. Treatment recommended is surgery in solitary metastasis, followed by whole brain radiation or Stereotactic Radiosurgery.



A 62 year old male with Oligodendroglioma



A 60 year old female with Meningioma(H & E, 100X)

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INJURIES WITH NEUROLOGICAL AFTER-EFFECTS

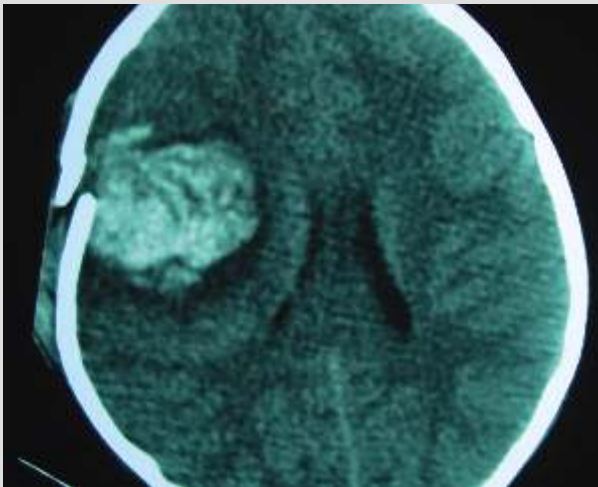
Dr Vinod Rambal
MS, MCh (Neurosurgery)
Full-time Consultant Neurosurgeon

HEAD INJURY

It usually involves younger age group, in their fruitful years of life. High-speed motor vehicular accidents are common; other causes are home and occupational accidents, accidental falls and assaults. It includes both, injuries to brain and parts of the head, such as scalp and skull. Specific problems after head injury can include - skull fracture, laceration to the scalp, traumatic subdural and extradural haematoma, traumatic subarachnoid haemorrhage and cerebral contusion.

In closed head injury cases, prompt cardiorespiratory stabilisation and clinical neurological examination is a must. Once that is achieved, patient is intubated, sedated and mechanically ventilated to restore blood pressure, oxygenation and ventilation. CT scan of the brain allows us to decide further management. In cases of extra or subdural haematomas, quick surgical evacuation is helpful. Diffuse injuries and contusions need to be aggressively handled. One needs to manage intracranial pressure surges. Uncontrolled raised pressure increases the morbidity and mortality.

Monitoring intracranial pressure is most rewarding. Various medical options are available apart from surgical intervention. Ventilation, maintaining



CT scan showing head injury

normocapnia, 3% saline infusion helps to combat raised intracranial pressure. Glasgow coma scale (GSC) helps in predicting the outcome. The GSC score of 14-15 is mild injury; moderate, when the score is 9-13 and severe injury, score is 8 or less. Hypotension and hypoxia greatly increase the morbidity and mortality. In case there are other organ involvement, screening those suspected areas is a must. Haemoglobin should be maintained in the normal range. Surgery encompasses a wide range of procedures, which will be dictated by clinical picture and CT scan findings and response to the conservative medicines. The basic issue of raised intracranial pressure needs to be ameliorated. It is the global ischaemia secondary to raised intracranial pressure due to diffuse cytotoxic and vasogenic oedema, which induces further damage and determines the ultimate outcome. Severe head injury patients have associated injuries, the incidence being long bone fractures-32%, Maxillary / mandibular fractures-22%, major chest injury-23%, abdominal visceral injury-7% and spinal injury in about 2% of patients.

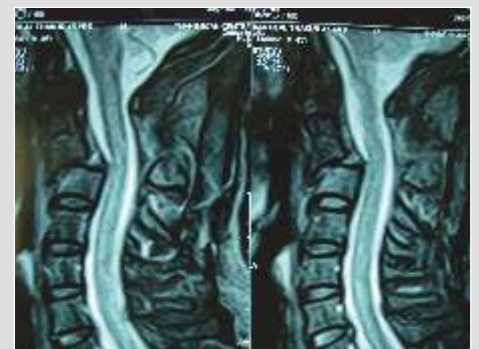
CERVICAL SPINE INJURY

Cervical spine being the most mobile portion of the spine is vulnerable and is a common site of injury. Major causes are motor vehicular accidents, accidental falls and sports associated injuries. The cause varies with age and sex; males being 3 to 4 times more common than females. The most frequent age group to suffer a spinal cord injury is 15-30 years. Spinal cord injury is unfortunately very common and occurs in 40-60% of patients.

Injuries can be bony, ligamentous or combination of both. External immobilisation is a must, at site / pre-hospital, much before any definitive treatment is planned. The spinal injuries may be in isolation or in association with head injuries. Identifying the other areas involved needs imaging (such as MRI, X-rays and ultrasound) and examining the other organ injuries entails risk to the existing spinal cord injury. Any body movement may enhance or worsen the existing spinal cord damage, especially when vertebral column is broken.



X-ray showing cervical vertebrae fracture



CT scan showing cervical spine injury

The broken vertebral column needs to be stabilised initially from outside and subsequently from within. Depending on the area involved, there may be cardiovascular or autonomic disturbances associated which will merit special attention and treatment. The associated bladder and bowel care needs to be instituted.



EPILEPSY



Dr Gautam Tripathy
MD, DM (Neurology)
Full Time Consultant Neurologist

Epilepsy is defined as a disorder of brain characterized by an ongoing liability for recurrent epileptic seizures. **Seizure** (from the latin word 'sacire' meaning "to take possession of") is a paroxysmal event due to abnormal, excessive, hypersynchronous discharge from an aggregate of central nervous system neurons. However, the manifestation of such activity may differ from person to person and manifest itself present in varied forms. Two or more unprovoked seizures are known as epilepsy.

- Incidence is about 80 new cases in every 1,00,000 persons per year
- Prevalence is about 4-10 cases per 1000 persons
- Overall prevalence of epilepsy in India is 5.33 per 1000 persons
- It occurs in all parts of the world and in all strata of population
- About 40% of cases of epilepsy occur below 16 years of age and 20% occur above 65 years of age
- Cumulative incidence of epilepsy - the risk of an individual having a seizure in their lifetime is about 4%

What is the cause?

Cause of epilepsy may vary in different age groups.

In newborn, they can be due to birth-asphyxia, inborn errors of metabolism and deficiency states like hypocalcemia and pyridoxine deficiency.

In children, they can be due to CNS infections and more commonly seen in a syndrome known as 'febrile convulsions'. This condition is usually benign.

In adolescents and early adulthood, a common cause of epilepsy is 'Juvenile Myoclonic Epilepsy' (JME) where generalized tonic-clonic seizures are associated with myoclonic jerks and at times absence seizures. These seizures belong to a group known as 'Idiopathic Generalized Epilepsy'. In India, infections such as neurocysticercosis occur commonly due to ingestion of tapeworm, *Taenia solium*, and tubercular abscess.

In adults and elderly, epilepsy can be due to stroke

and brain tumors. At times, metabolic disturbance in body may induce seizure.

Classification and Diagnosis

The International League against Epilepsy (ILAE) has outlined a broad and comprehensive classification. Broadly, epilepsy can be classified as **partial-onset** involving focal brain areas and involving unilateral body parts and **generalized** due to diffuse brain involvement. Diagnosis of epilepsy requires a detailed history and ruling out non-epileptic attacks like syncope, Transient Ischemic Attacks (TIA) and psychogenic non-epileptic attacks. EEG helps in localizing epilepsies though a normal EEG does not rule out seizures. Neuroimaging helps to find out structural brain lesions, cyst, brain tumors etc.

Treatment

The approach to drug treatment for epilepsy broadly depends on:

1. Seizure type
2. Stages Newly diagnosed, Chronic epilepsy, Epilepsy in remission
3. Epilepsy syndrome
4. Special patient groups

Initial Antiepileptic Drug in Drug-naïve Cases

1. Generalized Tonic-clonic Seizures
 - Valproate
 - Phenytoin, Lamotrigine and Carbamazepine are alternative drugs
 - Phenobarbital
2. Partial-onset Epilepsy
 - Carbamazepine is drug of choice
 - Valproate, Phenytoin, Oxcarbamazepine and Lamotrigine are alternatives
3. Myoclonic Epilepsy
 - Valproate
 - Lamotrigine or Clonazepam may be used as alternatives
4. Absence Epilepsy
 - Valproate or Ethosuximide

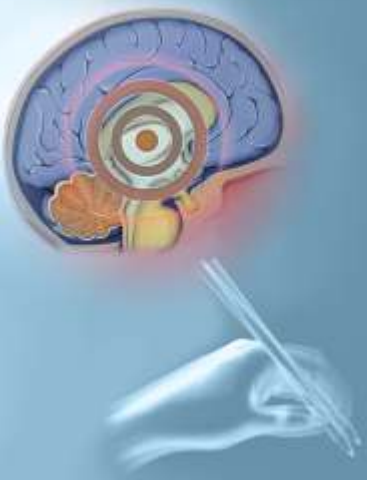
Choice of Anti-epileptic Therapy in Chronic Active Epilepsy

There is a choice from newer anti-epileptic drugs like Levitracetam, Zonisamide, Topiramate, Clobazam, Oxcarbamazepine, Gabapentin etc.

- Drug choice may change with specific patient groups like elderly, pregnant women etc
- Adverse effect profiles differ and should be taken into account and may vary with individual patient
- Monotherapy will be useful in about 70-80% of cases and should be chosen whenever possible
- Combination anti-epileptic drugs may be needed in about 20-30% cases, more in cases which have remained uncontrolled in spite of initial Monotherapy
- Discontinuation of anti-epileptic drugs should be gradual and the decision is made by a specialist on case-to-case basis
- Ketogenic diet is an alternative therapy for children who have difficult-to-control epilepsy. This diet is a high fat, adequate protein, very low carbohydrate diet which is carefully and individually calculated for each child



Surgery in epilepsy may be required in refractory epilepsy with a structural brain lesion such as Neuronal Migrational Disorder, Mesial Temporal Lobe Sclerosis (MTLE), Ganglioneuroma, Brain Tumors etc.



PARKINSON'S DISEASE

Dr Gautam Tripathy
MD, DM (Neurology)
Full Time Consultant Neurologist

*“Involuntary tremulous motion, with lessened muscular power, in parts not in action and even when supported,
with propensity to bend the trunk forward and to pass from walking to running pace;
the senses and intellects being uninjured.”*

James Parkinson's original description of this disorder immediately suggests one of the most distinctive conditions of neurology.

Clinically, patient with the Parkinson's disease has at least two out of three cardinal features of tremor, rigidity and bradykinesia. Postural instability may appear late. In case it appears early, other diagnosis closely related to Parkinson's disease known as 'Parkinson's Plus syndrome' should be considered. Patients with Parkinson's disease have a good clinical response to Levodopa.

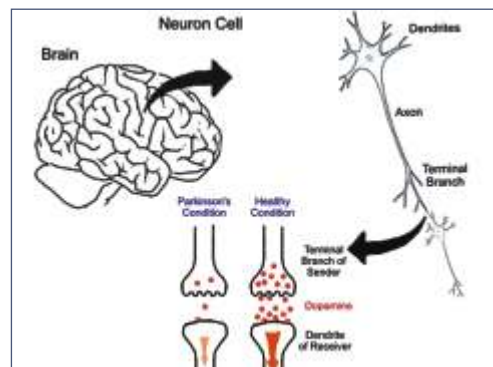
Prevalence rates are about 10-400 cases per 1,00,000 people. There is no significant difference between male and female. The Parsi community of Mumbai has a prevalence of Parkinson's disease of 328.3 per 1,00,000. India, as a whole, has a low prevalence.

The usual age of onset is after 50 years with the frequency rising steeply with age. Onset before 40 years is unusual and before 20 years is exceptional. The cause of Parkinson's disease is the destruction of pigmented dopaminergic neurons of the substantia nigra and some other brain regions. The mechanism appears to involve defective mitochondrial respiration and oxidative

stress. This in turn may be due to environmental factors, toxin exposure, genetic factors or an interaction between these factors. Environmental toxins implicated include MPTP (Methyl-phenyl-tetrahydropyridine). Several lines of evidence point to hereditary factors in Parkinson's disease and PARK gene mutation has been implicated in them.

Treatment options include MAO-B inhibitors like Selegiline and Rasagiline can be used as initial monotherapy and as adjunct therapy to levodopa. Selegiline was the subject of a major neuroprotective trial in Parkinson's disease. Early symptomatic therapy can be chosen from an array of drugs though Levodopa remains the mainstay of therapy. Dopa-agonists like Ropirinole, Pramipexole, and Amantadine may also be used. COMT inhibitor Entacapone prolongs the half-life of Levodopa.

Anticholinergics are useful in tremors. Patients on long-term Levodopa therapy may develop treatment-related complications like Dyskinesia and 'off-on' phenomenon. Treatment option in



such cases includes addition of Dopamine agonist and COMT Inhibitors. Surgery in Parkinson's disease is used for fluctuating symptoms and severe Dyskinesia. Functional surgery using Deep Brain Stimulation (DBS) device interrupts output from sub-thalamic nucleus and globus pallidus pars interna. At present, the procedure is used only for patients whose symptoms cannot be adequately controlled with medications or those who have medications associated with severe side effects like dyskinesia.

LUMBAR DISC PROLAPSE – CHRONIC PAIN IN THE BACK

Dr Vinod Rambal
MS, MCh (Neurosurgery)
Full-time Consultant Neurosurgeon

It is estimated that 50% of working adults will experience back pain in any given year. Neurosurgeons have extensive training in the management of disorders of the brain and peripheral nervous system. The syndromes produced due to lumbar disc herniation include radiculopathy, neurogenic claudication and *cauda equine syndrome*.

Majority of patients will settle on conservative treatment. Those who do not settle with conservative treatment will need surgical

intervention. Surgery helps them to get back to normal life quickly. Frequent relapses result in the cascade of events and ultimately result in canal stenosis. Currently surgical options are 'keyhole microsurgical procedures'. The 'conventional laminectomy' has no role in disc pathology. Laminectomy means removing posterior bony elements, resulting in spinal instability. With microsurgical procedures, the individual is pain-free, active and back to work in a fortnight. Posture-correction and muscle strengthening is required to stay fit.



Lumbar disc prolapse

DIAGNOSTIC NEURORADIOLOGY- An OVERVIEW



Dr Anand Gupta
DNB (Radiology), DMRD
Consultant Radiologist and Specialist in MRI / CT



Latest MR at Dr L H Hiranandani Hospital

Neuroimaging includes use of various techniques to directly or indirectly image the structure and function of the brain and spinal cord / nerves.

IMAGING MODALITIES AND THEIR SIGNIFICANCE

Diagnostic Imaging procedure of the nervous system includes Myelography, Computed Tomography (CT) and Magnetic Resonance Imaging (MRI).

Advanced diagnostic modalities include dynamic CT angiography and MR angiography, Perfusion CT and MRI, and Functional Magnetic Resonance Imaging (fMRI).

CT scanner uses a series of x-rays taken from many different directions, which are interpolated. It is an extremely fast technique and is a first line investigation in head injury and strokes.

Recent development of multi-slice scanners has enabled multi-planar imaging with extremely robust **CT Angiography** comparable to diagnostic accuracy of **Digital Subtraction Angiography (DSA)** which is an invasive study.

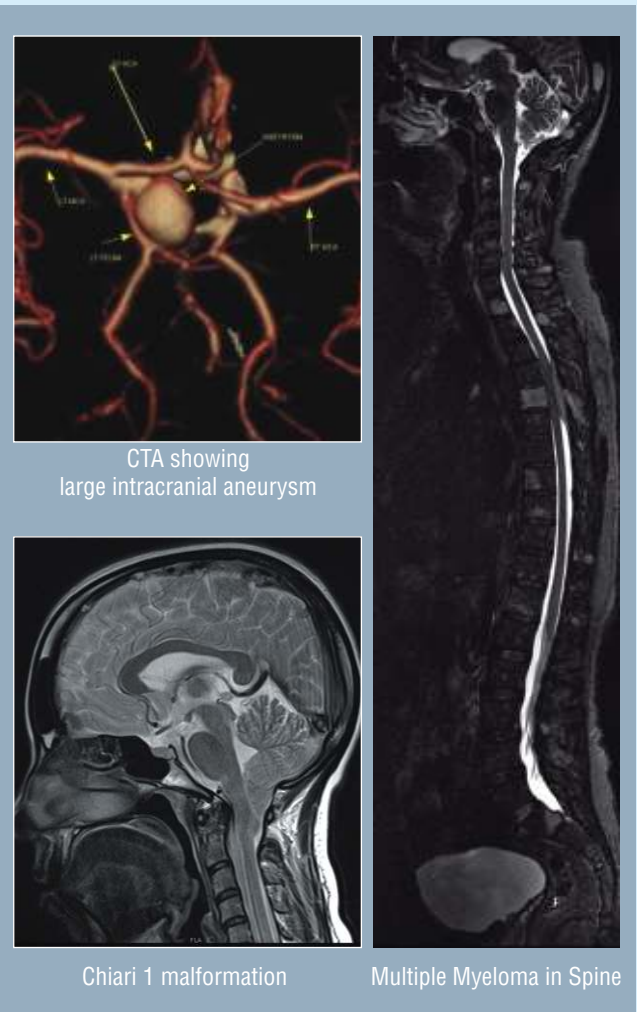
Magnetic Resonance Imaging (MRI) uses a powerful magnetic field to align the nuclear magnetization of (usually) hydrogen atoms in water in the body. MRI provides much greater contrast between the different soft tissues of the body than CT, making it especially useful in acute stroke,

tumor, demyelination, epilepsy, metabolic disease, congenital anomaly and neurodegenerative disease.

MRI Diffusion-Weighted Imaging (DWI) is a novel technique, which is sensitive to increase in restriction to water diffusion, as a result of Cytotoxic Edema. Following an ischemic stroke, DWI is highly sensitive to the changes occurring in the lesion. Coupled with imaging of cerebral perfusion, researchers can highlight regions of 'perfusion / diffusion mismatch' that may indicate regions capable of salvage by reperfusion therapy.

Diffusion Tensor Imaging (DTI) enables researchers to make brain maps of fiber directions to examine the connectivity of different regions in the brain (using Tractography) or to examine areas of neural degeneration and Demyelination in diseases like Multiple Sclerosis.

Magnetic Resonance Spectroscopy (MRS) is used to measure the levels of different metabolites in body tissues. This signature is used to diagnose certain metabolic disorders, differentiate between different space-occupying lesions and provide information on tumor metabolism.



CTA showing large intracranial aneurysm

Chiari 1 malformation

Multiple Myeloma in Spine

Magnetic Resonance Angiography

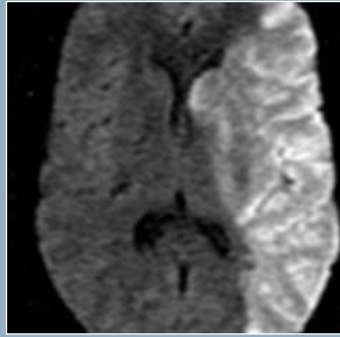
(MRA) can be performed non-invasively and provide excellent images of the vascular tree to evaluate them for Stenosis or Aneurysms. MRA is often used to evaluate the arteries of the neck and brain with variety of techniques including use of a paramagnetic contrast agent (Gadolinium) which provides DSA-like images.

Magnetic Resonance Gated Intracranial Cerebrospinal Fluid (CSF) flow study

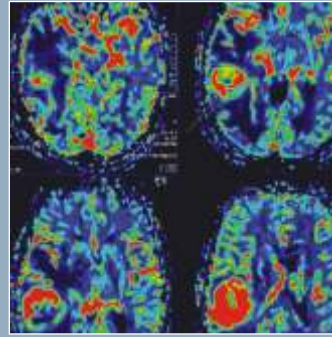
is a method for analyzing CSF circulatory system dynamics in patients with CSF obstructive lesions such as normal pressure hydrocephalus. It also allows visualization of both arterial and venous pulsatile blood flow in vessels without use of contrast agents.

Functional Magnetic Resonance Imaging (fMRI)

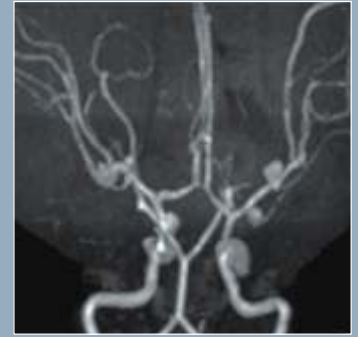
relies on the paramagnetic properties of oxygenated and deoxygenated hemoglobin to see images of changing blood flow in the brain associated with neural activity. This allows images to be generated that reflect which brain structures are activated (and how) during performance of different tasks.



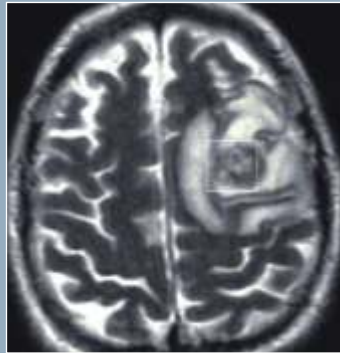
Middle cerebral artery territory acute infarct



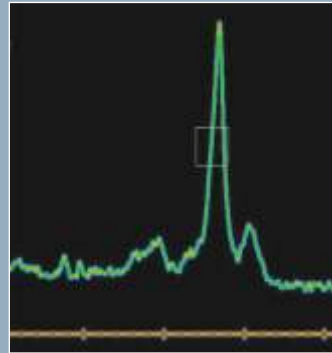
Tumor Perfusion



Time of Flight (TOF) Angiogram showing Multiple Intracranial Aneurysms



Large lipid / lactate peak in Tuberculoma



MRV showing right transverse and sigmoid sinus thrombosis

Endorphins



A man went to the doctor. The doctor came in and said, "Well, I have got some good news and some bad news. The bad news is that you have an inoperable brain tumor. The good news is our hospital has just been certified to do brain transplants and there has been an accident right out front and a young couple was killed and you can have which ever brain you like. The man's brain is Rs. 100,000.00 and the woman's brain is Rs. 30,000.00." The patient could not help but ask, "Why such a large difference between the male and the female brain?" The doctor replied, "The female brain is used."



Contact Us



Hiranandani Hospital
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Dr L H Hiranandani Hospital

Hillside Avenue, Hiranandani Gardens, Powai,
Mumbai - 400 076.

Tel: 2576 3300 / 3333 • Fax: 2576 3344 / 3311

Hiranandani Hospital

Hamilton 'B', Hiranandani Estate,
Off. Ghodbunder Road, Patlipada, Thane (W) - 400 607.
E-mail: info@hiranandanihospital.org

Board (Powai)	: 2576 3300, 2576 3333, 2576 3999
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Hiranandani Hospital, Thane	: 2545 8666, 2530 8666, 2530 8670, 2530 8668

E-mail: wecare@hiranandanihospital.org • homecare@hiranandanihospital.org
pathologyuser@hiranandanihospital.org

Editorial Team

- Dr Sujit Chatterjee
- Dr Suvin Shetty
- Mr Manish Joshi
- Ms Debashree Sanyal