THE COLLEGE OF SURGEONS OF HONG KONG

Specialty Board in Neurosurgery

THE ROYAL COLLEGE OF SURGEONS OF EDINBURGH

Joint Specialty Fellowship Examination in Neurosurgery

SYLLABUS

Note: this syllabus is to be updated regularly but the Specialty Examination Board reserves the right to ask questions related to topics that are not quoted but are relevant to the practice of Neurosurgery.

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Principles of Neurosurgery
(ONE-PAGE SUMMARY)

Note: this syllabus is to be updated regularly and the Specialty Examination Board reserves the right to ask questions related to topics that are not quoted but are relevant to the practice of Neurosurgery.

NEURO-PHYSIOLOGY
- To understand the functional organisation and integration of the central nervous system
- Clinical applications of neuro-physiology

PATHOPHYSIOLOGY OF INTRACRANIAL & SPINAL DISORDERS
- Cerebral blood flow and metabolism
- Cerebral autoregulation
- Blood brain barrier and edema
- Intracranial pressure dynamics
- Cerebral and spinal ischemia
- Neuroprotection
- CSF hydrodynamics

TRAUMA
- Pathophysiology of traumatic brain and spinal injury
- Interpretation of multi-modality cerebral monitoring, including: cerebral perfusion and oxygenation
- Definition and initial management of spinal injury and spinal shock
- Management of spinal instability
- Principles of spinal fusion

VASCULAR
- Etiology, pathophysiology and management of primary intracerebral hemorrhage, aneurysmal SAH, vascular malformations and steno-occlusive cerebrovascular disease, incl. dural venous sinus thrombosis

NEURO-ONCOLOGY
- Epidemiology, natural history, pathology, clinical presentation and treatment benign and malignant intracranial spinal, peripheral nerve neoplasia

FUNCTIONAL
- Classification, etiology, investigation and management of: epilepsy, pain, movement disorders, cranial neurovascular compression syndromes and spasticity

HYDROCEPHALUS
- Etiology and pathophysiology
- Normal pressure hydrocephalus
- Shunt design and function

PEDIATRIC
- Hindbrain herniation, syringomyelia, syringobulbia and associated spinal arachnoiditis
- Pediatric tumors and cysts
- Hydrocephalus
- Congenital spinal disorders
- Craniofacial disorders

SPINAL
- Principles of surgery for degenerative and rheumatoid spinal disorders
- Biomechanical principles of spinal instrumentation

CNS INFECTIONS
- Ventriculitis, brain abscess, subdural empyema and spinal epidural abscess
- Viral and fungal infections
- Human prion disease

NEURO-INFLAMMATORY DISEASE
- Diagnosis, assessment & initial management of patients with neuro-inflammatory disease

NEURO-RADIOLOGY
- X-ray physics, risks & regulations
- Principles of computed tomography
- Principles of magnetic resonance imaging
- Angiographic interpretation
- Spinal myelography
- Nuclear medicine based imaging
- Ultrasound & Doppler imaging

RADIATION THERAPY
- Radiobiology and the principles of radiosurgery, fractionated radiotherapy and stereotactic radiotherapy, including the generation and delivery of ionizing radiation

NEURO-PATHOLOGY
To understand the neuropathology of infection, inflammation, ischemia, neoplasia and trauma affecting the nervous system

NEURO-ANESTHESIA
- Principles of neuro-anesthesia
- Patient positioning
- Commonly used neuro-anesthetic drugs for sedation, pain control and muscle relaxation. Modes of action and adverse effects

Operative Neurosurgery and Surgical Anatomy
(ONE-PAGE SUMMARY)

Note: this syllabus is to be updated regularly and the Specialty Examination Board reserves the right to ask questions related to topics that are not quoted but are relevant to the practice of Neurosurgery.

ANATOMY

- Skull (vault and base)
- Brain, brainstem, spinal cord and vasculature
- Spine
- Autonomic nervous system
- Peripheral nervous system

TRAUMA

- Surgical management of commonly encountered neuro-trauma conditions
- Intraoperative decision making for untoward events
- Repair of CSF fistulae
- Complication management

VASCULAR

- Approaches to anterior circulation aneurysms
- Principles of aneurysm clipping and AVM excision
- Carotid endarterectomy
- Principles of endovascular therapy
- Surgical principles of spinal vascular disorder management
- Complication management

NEURO-ONCOLOGY

- Principles and approaches for intra- and extra-axial tumor excision
- Intraoperative neurophysiological monitoring
- Cortical and white matter tract anatomy
- Principles of resection of peripheral nerve sheath tumors
- Complication management

SKULL BASE

- Approaches to common skull-base and pituitary tumors
- Neuroendoscopy
- Intraoperative neurophysiological monitoring
- Principles of facial nerve palsy management
- Repair of CSF fistulas
- Cranial nerve anatomy
- Skull base anatomy
- Complication management

FUNCTIONAL

- Neurovascular decompression of the trigeminal and facial nerves
- Approaches to the mesial temporal region
- Deep brain stimulation for movement disorders
- Carpal tunnel release
- Pain pathway anatomy
- Complication management

HYDROCEPHALUS

- VP / VA / LP shunts
- Endoscopic third ventriculostomy
- Burr hole placement for ventricular catheter insertion
- Complication management

PEDIATRIC

- Posterior fossa decompression
- Dorsal root rhizotomy
- Principles of cranial vault reconstruction for craniosysnostosis
- Principles of spinal dysraphism
- Complication management

SPINAL DISORDERS

- Anterior and posterior approaches of spinal lesions
- Anterior cervical discectomy and fusion
- Cervical laminoplasty
- Lumbar microdiscectomy
- Principles of cervical and lumbar instrumentation
- Laminectomy
- Intraoperative neurophysiological monitoring
- Complication management

CNS INFECTION

- Surgical management primary or iatrogenic CNS infections incl. brain abscess, ventriculitis, subdural empyema, spinal infections
- Complication management

PERIOPERATIVE MANAGEMENT

- Prophylactic antibiotics
- DVT prophylaxis
- Seizure prophylaxis
- Postoperative fever
- Postoperative delirium

INFORMED CONSENT & MEDICOLEGAL ASPECTS

- Principles of autonomy, beneficence, non-maleficence and equality.
- Bolam & Montgomery tests

Medical Management of Neurosurgical Conditions
(ONE-PAGE SUMMARY)

Note: this syllabus is to be updated regularly and the Specialty Examination Board reserves the right to ask questions related to topics that are not quoted but are relevant to the practice of Neurosurgery.

TRAUMA

- Neurocritical care in traumatic brain injury and spinal injury
- Management of intracranial hypertension, cerebral autoregulation, flow-metabolic coupling
- Multimodality monitoring of intracranial pathophysiology
- Blood brain barrier & cerebral edema
- Fluid management, electrolyte disturbances (incl. CSW, cranial DI), nutrition & coagulopathy management

VASCULAR

- Neuro-critical care in hemorrhagic stroke (primary or secondary to intracranial vascular lesions) and steno-occlusive cerebrovascular disease
- Cerebral blood flow, metabolism, delayed cerebral ischemia, vasospasm, hyperperfusion breakthrough,
- Cerebral autoregulation
- Cerebral ischemia and neuroprotection

FUNCTIONAL

- Medical management of epilepsy, including status epilepticus
- Medical management of movement disorders
- Pain pathophysiology & medical management
- Medical management of spasticity
- Investigations and management of neurogenic bladder

CNS INFECTION

- Prevention and management of primary or iatrogenic CNS infections

IMPAIRED CONSCIOUSNESS & NON-TRAUMATIC COMA

- Etiology, differential diagnosis, investigation and initial management of impaired consciousness & coma

NEUROLOGICAL CONDITIONS

- Etiology, differential diagnosis, investigation and initial management of patients presenting with disorders of memory and cognition
- Etiology, differential diagnosis, investigation and initial management of headache

PHARMACOLOGY

- Mechanisms of actions, pharmacodynamics, adverse effects & interactions of commonly prescribed medication in neurosurgery

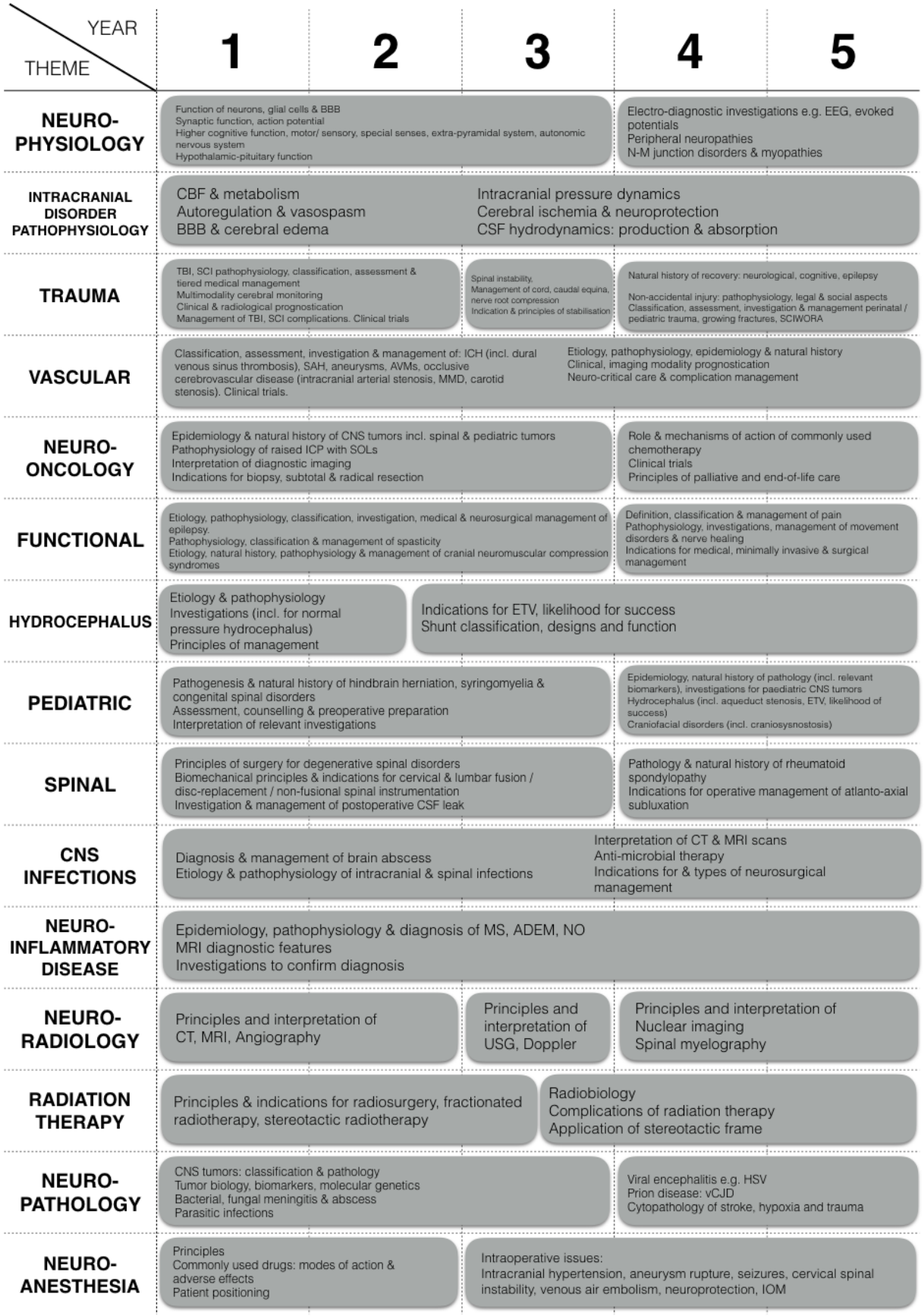
NEURO-REHABILITATION

- Principles of neurological rehabilitation and prognostication including strategies to optimise the recovery of cognition, communication, continence (neurogenic bladder), gait, self-care, psychological stability, social adjustment and employment

MEDICAL ETHICS

- Ethical issues that commonly arise in the management of patients with neurological disorders, including mental incapacity & the mental health ordinance, diagnosis of brain death

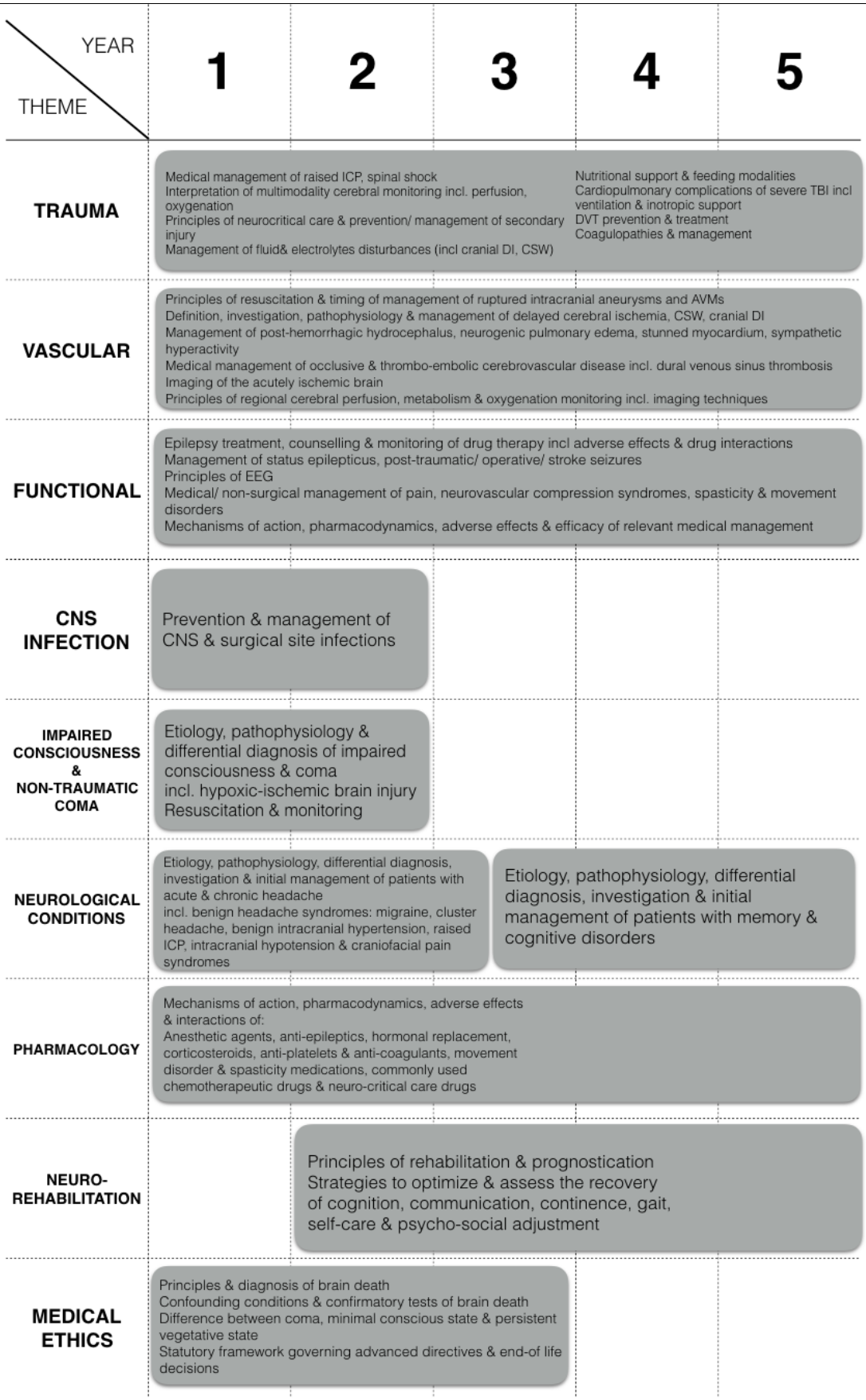
Principles of Neurosurgery
EXPECTED KNOWLEDGE ACQUISITION MILESTONES



Operative Neurosurgery and Surgical Anatomy
EXPECTED KNOWLEDGE ACQUISITION MILESTONES

THEME \ YEAR	1	2	3	4	5
ANATOMY	Skull, brain, spinal, peripheral nerve & autonomic nervous system anatomy				
TRAUMA	Craniotomy for supratentorial traumatic hematomas, burr hole drainage of CSDHs, EVD placement, ICP monitoring techniques Planning & siting of craniotomies Achieving hemostasis in the coagulopathic patient & bleeding from the dural venous sinuses		Surgical management of spinal instability Spinal intraoperative neurophysiological monitoring		
VASCULAR	Assessment, counselling & preoperative preparation for primary ICH, intracranial aneurysm, AVM, occlusive cerebrovascular disease management Interpretation of CT, MR & catheter angiography Microsurgical anatomy of the cerebral, carotid & vertebral circulation Indications, surgical approach selection for the surgical management of ICH, aneurysms, AVMs and occlusive cerebrovascular disease Complication management e.g. intraoperative rupture Principles of endovascular therapy				
NEURO-ONCOLOGY	Indications & surgical approach selection for superficial, hemispheric, paramedian, interhemispheric & midline intrinsic tumors, intraventricular/ pineal region tumors & extra-axial tumors e.g. meningiomas Applied surgical anatomy Principles of image-guided surgery Principles of awake craniotomy and intraoperative neurophysiological monitoring Principles of intracranial hemostasis Principles of suction, electro-coagulation & ultrasonic aspiration				
SKULL-BASE	Indications, selection & intraoperative management (incl. safe positioning & craniotomy siting, CSF drainage, exposure, retraction) of tumors arising from these regions.		Pterional, subfrontal, anterior interhemispheric, fronto-orbital, temporo-zygomatic, trans-sphenoidal, retrosigmoid, telo-velar approaches Complication management e.g. CSF leaK, surgical site infection, facial nerve palsy		
FUNCTIONAL	Assessment, counselling & preoperative preparation for epilepsy surgery & neurovascular compression syndromes Interpretation of CT, MRI & SPECT scans Microsurgical anatomy of the mesial temporal lobe & CP angle Indications & surgical approach selection e.g. craniotomy for mesial temporal sclerosis, MVD Disconnection procedures Complication management Principles of ECoG, cranial nerve. brainstem intraoperative neurophysiological monitoring				
HYDROCEPHALUS	Indications and surgical selection for EVD, VP, VA, LP shunts & ETV Applied surgical anatomy Selection of appropriate shunts Shunt revision Intraoperative testing of shunt function Complication management				
PEDIATRIC		Hindbrain herniation: selection of surgical approaches incl. posterior fossa decompression Applied surgical anatomy of the cranio-cervical junction and interpretation of MRI Indications and principles of dorsal root rhizotomy for spasticity Indications & principles of cranial vault reconstruction for craniosynostosis Principles of surgical management of spinal dysraphism Complication management			
SPINAL DISORDERS	Interpretation of CT, MRI scans Indications & surgical approach selection for spinal tumors, cervical myeloradiculopathy, lumbar radiculopathy Use of fluoroscopy to confirm spinal level		Biomechanical principles of cervical & lumbar surgery. Indications for instrumentation Complication management Intraoperative neurophysiological monitoring		
CNS INFECTION	Surgical management of primary or iatrogenic infections, incl. brain abscess, ventriculitis, subdural empyema Complication management				
PERI-OPERATIVE MANAGEMENT	Prophylactic antibiotics, DVT, seizure prophylaxis, postoperative fever & delirium management				
INFORMED CONSENT & MEDICOLEGAL ASPECTS	Principles of autonomy, beneficence, non-maleficence & equality Bolam & Montgomery tests				

Medical Management of Neurosurgical Conditions
EXPECTED KNOWLEDGE ACQUISITION MILESTONES



Principles of Neurosurgery

(OBJECTIVES & KNOWLEDGE REQUIREMENTS)

NEURO-RADIOLOGY	
OBJECTIVE	• To understand the principles of neuroradiological imaging of the structure and function of the nervous system
KNOWLEDGE	• X-ray generation, physics, risks and regulations • Interpretation of plain radiographs of the skull and spine • Principles of computed tomography of the brain, skull and spine • Interpretation of CT scans with particular reference to acute spinal disorders, cranial trauma, hydrocephalus, intracranial tumors and spontaneous intracranial hemorrhage • Principles of basic magnetic resonance imaging • Interpretation of MRI scans with particular reference to acute spinal disorders, cranial trauma, hydrocephalus and intracranial tumors • Principles of advance magnetic resonance imaging including fMRI, DWI and spectroscopy • Interpretation of angiographic images: CTA, MRA and DSA • Nuclear-based imaging: indications and interpretation • Ultrasound generation, physics and application, including Doppler

NEURO-PATHOLOGY	
OBJECTIVE	• To understand the neuropathology of infection, inflammation, ischemia, neoplasia and trauma affecting the nervous system
KNOWLEDGE	• Acute and chronic inflammatory processes in the CNS including demyelination • Bacterial, fungal and parasitic meningitis, encephalitis and abscess formation • Viral encephalitis • Slow viruses, CJD and vCJD • HIV associated infections, tumors and leucoencephalopathies • Cytopathology of neurons and glial in response to ischemia, hypoxia and trauma • Diffuse axonal injury • Macroscopic brain and spinal cord injury including effects of brain shift, herniation and raised ICP • Classification, epidemiology and pathology of CNS tumors • Tumor biology, cell kinetics, tumor markers, immunocytochemistry and molecular genetics

FUNCTIONAL & CLINICAL NEURO-PHYSIOLOGY	
OBJECTIVE	• To understand the functional organisation and integration of the central nervous system • To understand the clinical applications of neuro-physiology

KNOWLEDGE	• Structure and function of neurons and glial cells
	• Synaptic function, action potentials and axonal conduction
	• Higher cerebral functions, including memory
	• Control of motor function: ascending and descending pathways, basal ganglia and cerebellar function
	• The special senses, including:
	  • Significance of abnormalities of the pupils, fundi, external ocular movements and the visual field
	  • Significance of abnormalities of hearing and of the vestibular system
	• Functions of the autonomic nervous system
	• Hypothalamic-pituitary function
	• Neural control of the bladder, bowels and sexual function
	• Principles of electroencephalography
	• Principles of somatosensory, motor and brainstem evoked potential monitoring
	• Peripheral neuropathies (hereditary, genetic or acquired) and entrapment neuropathies including: structure and function of peripheral nerves, use of nerve conduction studies
	• Disorders of the neuromuscular junction and myopathies (hereditary, genetic or acquired) including: structure and function of smooth and striated muscle, use of electromyography

PRINCIPLES OF NEURO-ANESTHESIA	
OBJECTIVE	• To understand the principles of neuro-anesthesia from a neurosurgeon's perspective

KNOWLEDGE	• Key aims of neuro-anesthesia and how they are achieved:
	  • Rapid induction
	  • Rapid recovery for neurological assessment
	  • Control of intracranial pressure
	  • Neuroprotection
	  • Uninterrupted intraoperative neurophysiologic monitoring
	• Commonly used neuro-anesthetic drugs for sedation, pain control and muscle relaxation. Their modes of action and adverse effects.
	• Intra-operative anesthetic issues concerning:
	  • Intracranial hypertension
	  • Intracranial aneurysm rupture
	  • Cerebral revascularization
	  • Awake craniotomy and intraoperative monitoring
	  • Seizures
	  • Cervical spinal injury
	  • Venous air embolism
	  • Patient positioning

PATHOPHYSIOLOGY OF INTRACRANIAL DISORDERS	
OBJECTIVE	• To understand the pathophysiology of intracranial disorders
KNOWLEDGE	• Cerebral blood flow and metabolism • Cerebral autoregulation and vasospasm • Blood brain barrier and cerebral edema • Intracranial pressure dynamics • Cerebral ischemia and neuroprotection • CSF hydrodynamics - production and absorption

TRAUMA	**Traumatic Brain Injury**
OBJECTIVE	• To achieve competence in the medical management of neurosurgical patients with traumatic brain injury
KNOWLEDGE	• Pathophysiology of head injury, brain edema and chronic subdural hematomas • Neurological assessment of the head-injured patient including: assessment and categorisation of impaired consciousness • Medical management of raised intracranial pressure • Interpretation of multi-modality cerebral monitoring, including: cerebral perfusion and oxygenation • Principles of intensive care of head injured patients, including: the prevention and management of secondary brain injury • Management of fluid & electrolytes disturbances, in particular sodium balance • Natural history of recovery from head injury including neurological, cognitive, behavioural disability, posttraumatic epilepsy, hydrocephalus and pituitary dysfunction • Clinical and radiological prognostication of traumatic brain injury patients • Nutritional support and feeding modalities • Cardiopulmonary complications of severe traumatic brain injury • Deep vein thrombosis prevention & treatment • Coagulopathies & their management • Pathophysiology, legal and social aspects of non-accidental injury in children • Management of perinatal trauma, growing fractures and penetrating injuries in children

TRAUMA	**Spinal Injury**
OBJECTIVE	• To achieve competence in the all aspects of the management of spinal injury patients
KNOWLEDGE	• Pathophysiology of spinal cord injury and compression • Classification of spinal fracture-dislocations • Definition and biomechanics of spinal instability • The assessment of patients presenting with spinal cord, cauda equina and spinal root compression • Interpretation of plain radiology, CT and MRI scans • Definition and initial management of spinal injury and spinal hock • Management of spinal instability • Principles of spinal fusion • The detection and initial management of post-operative complications including compressing hematomas, CSF fistula and spinal sepsis • Classification, assessment, investigation and management of pediatric spinal injuries, including SCIWORA • Indications for halo traction and external stabilisation • Indications for and principles of open reduction and stabilisation • Use of external mobilisation including cervical collars and spinal boards • Application of halo traction • Application of a halo-body jacket

VASCULAR	**Primary Intracerebral Hematomas**
OBJECTIVE	• To achieve competence in the management of space-occupying spontaneous intracerebral hematomas
KNOWLEDGE	• Etiology of supra and infratentorial intracerebral hemorrhage • Pathophysiology of spontaneous intracerebral hemorrhage • Assessment of patients with intracerebral hematomas and raised intracranial pressure • Interpretation of CT and MRI scans including clot signal changes with time • Indications for CT angiography, MRA or digital subtraction angiography

VASCULAR	Intracranial Aneurysms and Subarachnoid Hemorrhage
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of ruptured and unruptured intracranial aneurysms • To achieve competence in the general management of SAH
KNOWLEDGE	• Etiology, epidemiology and natural history of unruptured and ruptured intracranial aneurysms • Etiology of SAH • Pathophysiology of SAH • WFNS grading of SAH • Principles of resuscitation and timing of interventions. • Indications for CT scanning, diagnostic lumbar puncture, CT angiography and digital subtraction angiography • Principles of management of post-hemorrhagic hydrocephalus • Indications and principles of endovascular and surgical intervention • Prevention and management of delayed cerebral ischemia, vasospasm and hydrocephalus • Management of unruptured intracranial aneurysms and familial intracranial aneurysms

VASCULAR	Intracranial Vascular Malformations
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of intracranial vascular malformations
KNOWLEDGE	• Pathogenesis, etiology, epidemiology and natural history of intracranial vascular malformations including AVMs, AV fistulae, cavernomas and venous malformations • Pathophysiology and general management of intracranial hemorrhage • Principles of managing AVMs: non-operative, operative and multi-modality treatment, including endovascular therapy and radiosurgery • Principles of managing cavernomas and Vein of Galen Malformations

VASCULAR	Occlusive Cerebrovascular Disease
OBJECTIVE	• To achieve competence in the surgical management of occlusive cerebrovascular disease
KNOWLEDGE	• The epidemiology, natural history and pathophysiology of extra- and intracranial atherosclerotic occlusive disease, Moya Moya disease, arterial dissection and dural venous sinus thrombosis • The epidemiology, natural history and pathophysiology of non-atherosclerotic occlusive diseases, including Moya Moya disease, arterial dissection and dural venous sinus thrombosis • Optimal medical management of occlusive and thrombo-embolic cerebrovascular disease • Imaging of the acutely ischemic brain using CT and MRI • Principles of non-invasive and invasive imaging of the extra and intracranial vasculature using CT, MRI and catheter angiography • Principles of regional cerebral blood flow and metabolism measurement and imaging using CT and MRI perfusion techniques; SPECT and PET scanning

NEURO-ONCOLOGY	
OBJECTIVE	• To achieve competence in the multi-disciplinary management of patients with intracranial, spinal and peripheral nerve neoplasia

KNOWLEDGE	• Classification and pathology of benign and malignant intracranial neoplasia
	• Epidemiology, natural history, pathology (including relevant molecular & genetic biomarkers), clinical presentation and treatment of:
	  • Meningiomas
	  • Intrinsic primary tumors, including high and low-grade gliomas
	  • Pituitary-parasellar tumors & craniopharyngioma
	  • Intraventricular tumors
	  • Primary CNS lymphomas
	  • Brain metastases
	  • Epidermoid & dermoid
	  • Skull base tumors, including:
	  • Schwannomas,
	  • Chordomas,
	  • Paragangliomas,
	  • Adenoid cystic carcinomas,
	  • Nasopharyngeal carcinomas
	  • Phakomatoses
	  • Spinal tumors: intradural-extramedullary & intramedullary
	  • Peripheral nerve sheath tumors
	• Pathophysiology of raised intracranial pressure associated with space occupying tumors
	• Diagnostic imaging of intracranial tumors including the interpretation of CT and MRI scans and the role of MRS
	• Investigation of the hypothalamic pituitary axis in patients with hypopituitarism and hypersecretion syndromes
	• Management of pituitary apoplexy
	• Indications for biopsy, subtotal and radical surgery
	• Role of adjuvant chemotherapy
	• Principles of clinical trials and their application to neuro-oncology
	• Principles of palliative & end-of-life care

RADIATION THERAPY	**Radiosurgery and Radiotherapy**
OBJECTIVE	• To achieve competence in the neurosurgical aspects of the multidisciplinary management of patients undergoing radiosurgery or radiotherapy
KNOWLEDGE	• Radiobiology and the principles of radiosurgery, fractionated radiotherapy and stereotactic radiotherapy, including the generation and delivery of ionizing radiation • The indications for their use as adjunctive and/or primary treatment modalities • Assessment of the suitability of these techniques for the treatment of metastatic and intrinsic tumors based on clinical presentation and imaging appearance • Application of stereotactic frames for radiation treatment • Frame-based versus frameless immobilization techniques

FUNCTIONAL	Epilepsy
OBJECTIVE	• To understand the surgical management of patients with idiopathic and lesional epilepsy
KNOWLEDGE	• The etiology and pathophysiology of idiopathic and lesional epilepsy • The classification of seizures and epilepsy • The assessment, counseling and pre-operative preparation of patients with epilepsy • Diagnosis of frontal, temporal, parietal lobe epilepsies and childhood/ adolescent epilepsy syndromes • Starting epilepsy treatment and monitoring drug therapy, including adverse effects and interactions with antiepileptic drugs • The effects of epilepsy on pregnancy, memory and its social consequences • Indications for surgical management, including palliative surgical treatment • Surgical aspects of the multi-disciplinary assessment of epilepsy patients • Interpretation of CT, MRI and SPECT scans, including the role of co-registration imaging • Role of EEG in the diagnosis of epilepsy • Principles of Principles of ictal, interictal, intra- & extra-operative EEG • Principles of video-EEG monitoring • Assessing surgical treatment outcomes

FUNCTIONAL	Pain
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of patients with chronic pain syndromes
KNOWLEDGE	• Definition and subtypes of pain • Applied surgical anatomy and the physiology of the pain pathway • The etiology and pathophysiology of chronic pain syndromes • The general medical management of pain, including the WHO analgesic ladder • Indications for medical, minimally-invasive and surgical management • Complications of surgery and their management • Surgical aspects of the multi-disciplinary assessment of chronic pain patients • Spinal cord stimulation • Lesioning therapy, e.g. DREZ • Open cordotomy • Deep brain stimulation, incl. stereotactic frame placement

FUNCTIONAL	Cranial Neurovascular Compression Syndromes
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of patients with cranial neurovascular compression syndromes
KNOWLEDGE	• Etiology, epidemiology, natural history and pathophysiology of neurovascular compression syndromes • Differential diagnosis and management of related cranio-facial pain syndromes • Medical management of cranio-facial pain and hemifacial spasm • The assessment, counseling and pre-operative preparation of patients with neurovascular compression syndromes • Interpretation of posterior fossa CT an MR and scans including MR sequences demonstrating neurovascular compression

FUNCTIONAL	Spasticity
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of patients with spasticity
KNOWLEDGE	• Definition and pathophysiology of spasticity • The general medical management of spasticity • Indications for medical and surgical management • Applied surgical anatomy • Complications of surgery and their management • Surgical aspects of the multi-disciplinary assessment of patients with spasticity • Pre-operative counseling and preparation • Intrathecal drug delivery

FUNCTIONAL	Movement Disorders
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of patients with movement disorders
KNOWLEDGE	• The etiology and pathophysiology of movement disorders, including Parkinson's disease, Essential Tremor, Tourette's Syndrome (and other tic disorders and dystonias • Classification of tremors and dystonias, including related genetics • The general medical management of movement disorders • Indications for medical and surgical management • Applied surgical anatomy • Complications of surgery and their management • Surgical aspects of the multi-disciplinary assessment of patients with movement disorders • Interpretation of MRI scans • Pre-operative counseling and preparation • Lesioning therapy • Deep brain stimulation, incl. stereotactic frame placement

FUNCTIONAL	Cranial & Peripheral Nerve Injury
OBJECTIVE	• To achieve competence in the surgical management cranial and peripheral nerve injury
KNOWLEDGE	• Assessment and counseling of patients with cranial and peripheral nerve injury • Physiology of peripheral nerve healing • Principles of surgical management in nerve repair, including multi-disciplinary management of patients with facial nerve palsy

SPINAL	Degenerative & Rheumatoid Spinal Disease
OBJECTIVE	• To achieve competence in the management of the degenerative spine • To achieve competence in the management of rheumatoid atlanto-axial subluxation and related disorders
KNOWLEDGE	• Principles of surgery for degenerative spinal disorders • Biomechanical principles of and indications for cervical and lumbar disc replacement and fusion • Biomechanical principles of and indications for non-fusion spinal stabilisation • Indications for, techniques and complications of vertebroplasty and kyphoplasty • The pathology and natural history of rheumatoid spondylopathy • Indications for operative management of atlanto-axial subluxation • Investigation and treatment of postoperative spinal CSF leak

PEDIATRIC	Hindbrain Herniation, Syringomyelia and Syringobulbia
OBJECTIVE	• To achieve competence in the management of hindbrain herniation, syringomyelia and syringobulbia
KNOWLEDGE	• The pathogenesis and natural history of hindbrain herniation, syringomyelia, syringobulbia and associated spinal arachnoiditis • The assessment, counseling and pre-operative preparation of patients with hind brain anomalies • Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms and 3D spinal reconstruction • Indications for foramen magnum / posterior fossa decompression • Principles of peri-operative care

PEDIATRIC	Neuro-oncology
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of children with tumors of the brain and spinal cord

KNOWLEDGE	• Epidemiology, natural history and pathology (including relevant molecular & genetic biomarkers) of tumors of the central nervous system in children including:
	  • Medulloblastoma
	  • Pilocytic astrocytoma
	  • High grade gliomas
	  • Brainstem tumors
	  • Intramedullary spinal cord tumors
	  • Craniopharyngiomas and other parasellar tumors
	  • Colloid cysts
	  • Arachnoid cysts
	  • Phakomatoses
	• Imaging of pediatric CNS tumors
	• Radiological and biochemical staging of tumors
	• Indications for surgery, radiotherapy, primary and adjuvant chemotherapy
	• Goals of surgery
	• Long-term effects of treatment on cognition, hypothalamic-pituitary function and quality of life

PEDIATRIC	Hydrocephalus
OBJECTIVE	• To achieve competence in all aspects of the management of pediatric patients with hydrocephalus.
KNOWLEDGE	• Pathophysiology and investigation of abnormal CSF dynamics in hydrocephalus and BIH • Indications for endoscopic third ventriculostomy (and the likelihood for success), shunt insertion and subtemporal decompression • Principles of shunt design and function • Antenatal diagnosis of hydrocephalus and its prognosis • Medical and ophthalmological treatment options for BIH

PEDIATRIC	Congenital Spinal Disorders
OBJECTIVE	• To achieve competence in all aspects of the management (operative and non-operative) of children with congenital spinal disorders

KNOWLEDGE	• Embryogenesis of craniospinal dysraphism
	• Pathophysiology of CSF circulation associated with hindbrain hernia, syringobulbia and syringomyelia
	• Epidemiology, natural history and clinical features of congenital spinal disorders including:
	  • Dysraphism
	  • Tethered cord syndrome
	  • Diastematomyelia
	  • Chiari malformations
	  • Klippel-Feil syndrome
	  • Achondroplasia
	  • Downs syndrome etc
	• Imaging of the neonatal and growing pediatric spine of children with congenital disorders
	• Antenatal diagnosis of dysraphism and its implications, including surgical treatment planning and parental counseling
	• Assessment and clinical management of children presenting with open or closed dysraphic spines and other congenital spinal abnormalities.

PEDIATRIC	Craniofacial Disorders
OBJECTIVE	• To achieve competence in all aspects of the management of children with craniosysnostosis

KNOWLEDGE	• Genetic understanding of craniofacial conditions
	• Epidemiology, natural history and clinical features of simple and syndromic craniosynostosis including cosmetic, cognitive and ophthalmological complications, including:
	  • Crouzon syndrome
	  • Apert syndrome
	  • Pfeiffer syndrome etc
	• Imaging of simple and syndromic craniosynostosis
	• Indication for and timing of surgical interventions
	• Understanding of causes and management of positional plagiocephaly
	• Epidemiology, natural history, and clinical features of common skull vault conditions including eosinophilic granuloma, fibrous dysplasia etc

HYDROCEPHALUS	
OBJECTIVE	• To achieve competence in all aspects of the management of adult patients with hydrocephalus.
KNOWLEDGE	• Etiology and pathophysiology of hydrocephalus • Investigations for hydrocephalus, including lumbar infusion tests • Normal pressure hydrocephalus • Spinal arachnoiditis • Management principles of hydrocephalus • Indications for endoscopic third ventriculostomy (and the likelihood for success), shunt insertion and subtemporal decompression • Principles of shunt design and function

CNS INFECTIONS	
OBJECTIVE	• To achieve competence in the management of patients with CNS infections including ventriculitis, cerebral abscess, subdural empyema and spinal epidural abscess

KNOWLEDGE	• The assessment, counseling and pre-operative preparation of patients with intracranial sepsis
	• Diagnosis and management of brain abscesses
	• Interpretation of CT and MRI scans
	• Management of anti-microbial therapy
	• The etiology- pathophysiology and management of intracranial and spinal infections:
	  • Pneumococcal and meningococcal meningitis
	  • Tubercular meningitis
	  • Aseptic meningitis
	  • Encephalitis
	  • Herpes Simplex Virus encephalitis
	  • Cryptococcal meningitis
	  • Toxoplasmosis
	  • HIV encephalopathy
	  • Human prion disease
	  • Discitis, vertebral osteomyelitis, epidural abscess
	• Indications for burr hole drainage, ventricular drainage and craniotomy in the management of intracranial sepsis
	• Indications for drainage of spinal epidural abscess by laminectomy and multiple laminotomies
	• Indications for combined otorhinological procedures

NEURO-INFLAMMATORY DISEASE	
OBJECTIVE	• To achieve competence in the assessment of patients with neuro-inflammatory disease from the neurosurgeon's perspective

KNOWLEDGE	• Basic epidemiology, pathophysiology and diagnosis of:
	  • Multiple sclerosis
	  • Acute disseminated encephalomyelitis
	  • Neuromyelitis optica
	  • Transverse myelitis
	  • Neurological manifestations of lupus and antiphospholipid syndrome
	  • Autoimmune encephalopathies
	• MRI diagnostic features
	• Selection of appropriate investigations to confirm the diagnosis

Operative Neurosurgery and Surgical Anatomy

(OBJECTIVES & KNOWLEDGE REQUIREMENTS)

SKULL-BASE	**Anterior and Middle Fossa Skull Base Tumors**
OBJECTIVE	• To achieve competence in the surgical management of patients with anterior and middle fossa tumors
KNOWLEDGE	• Indications for selected approaches in relation to pathology and surgical goals • Applied microsurgical anatomy of the anterior and middle cranial fossae • Principles of intra-operative management of patients undergoing resection of anterior and middle fossa tumors including olfactory groove, planum sphenoidale, parasellar, sphenoid wing, falcine, clinoidal, suprasellar, cavernous sinus and tentorial meningiomas, parasellar region tumors. • Standard pterional and subfrontal approaches including: pterional resection and basal drilling, subfrontal approach to the optic nerve, chiasm and internal carotid arteries, Sylvian fissure splitting and exposure of the MCA bifurcation, CSF drainage by chiasmatic cisternal release, intra-operative ventricular puncture and lamina terminalis fenestration • Bi-Frontal/Frontal and parietal parafalcine approaches • Microsurgical resection of superficial skull base meningiomas • Anterior interhemispheric, fronto-orbital, zygomatic and temporo-zygomatic approaches • Complications of surgery and their management

SKULL BASE	**Cerebellopontine Angle Tumors**
OBJECTIVE	• To achieve competence in the management of patients with cerebellopontine angle tumors
KNOWLEDGE	• The assessment, counseling and pre-operative preparation of patients with CP angle tumors • Interpretation of CT and MR scans • Relative indications for surgery, radiosurgery and conservative management • Principles of intra-operative management of patients undergoing resection of CP angle tumors including vestibular schwannomas and meningiomas (petroclival, lateral petrosal) • Principles and application of cranial nerve and brainstem monitoring • Applied microsurgical anatomy of the CP angle, brainstem and lower cranial nerves • Relative indications for retrosigmoid, middle fossa, and translabyrinthine approaches with respect to hearing preservation, tumor size and position • Retrosigmoid approach • Subarachnoid dissection and exposure of the tumor and lower cranial nerves • Subtotal microsurgical resection of vestibular schwannomas • Complications of surgery and their management

TRANS-SPHENOIDAL SURGERY	
OBJECTIVE	• To achieve competence in trans-sphenoidal approaches to the pituitary fossa and resection of pituitary adenomas
KNOWLEDGE	• Pathophysiology of the hypothalamic-pituitary axis • Indications for surgery • Selection of surgical approaches: sublabial, transnasal and endoscopic • Applied surgical anatomy of the skull base • Microsurgical trans-sphenoidal approach • Trans-sphenoidal resection of non-functional macroadenomas & functional adenomas • Complications of surgery and their management: including classification and management of CSF leak • Principles of peri-operative care

NEURO-ONCOLOGY	**Midline and Posterior Fossa Tumors**
OBJECTIVE	• To achieve competence in the surgical management of superficial, hemispheric and midline intrinsic posterior fossa tumors and metastases
KNOWLEDGE	• Indications for surgery • Selection of surgical approaches • Applied surgical anatomy • Principles of peri-operative care • Competence in midline, paramedian and retrosigmoid posterior fossa craniotomies including: safe patient positioning in the prone and semi-prone positions, exposure of the lateral and sigmoid sinuses, exposure and decompression of the foramen magnum, use of cisternal CSF drainage, safe use of fixed retractors, exposure and resection of superficial, lateral and mid-line intrinsic cerebellar tumors and metastases • Complications of surgery and their management

NEURO-ONCOLOGY	**Intraventricular and Pineal Region Tumors**
OBJECTIVE	• To achieve competence in the management of patients with intraventricular and pineal region tumors
KNOWLEDGE	• Surgical and non-surgical management options for low grade intrinsic tumors • Surgical anatomy relevant to approaches to the lateral and third ventricles and the pineal region • Choice of operative approaches based on tumor location and imaging • Transcallosal and transcortical approaches to ventricular tumors • Microsurgical resection of lateral intraventricular tumor • Microsurgical resection of third ventricular tumor/colloid cyst • Transfrontal endoscopic biopsy and third ventriculostomy • Supracerebellar infratentorial and occipital transtentorial approaches to the pineal region

NEURO-ONCOLOGY	Image-guided Surgery of Intracranial Tumors
OBJECTIVE	• To achieve competence in image-guided surgery applied to the management of patients with intracranial tumors
KNOWLEDGE	• Indications for biopsy of intracranial tumors • Risks of biopsy • Principles of image-guided surgery • Image-guided frameless and/or frame-based stereotactic biopsy including: Setting up a computer workstation and importing and interrogating image data. Positioning the patient and applying a cranial fixator. Obtaining and confirming accurate patient registration. Positioning and performing a suitable burr hole

NEURO-ONCOLOGY	Supratentorial Intrinsic Tumors
OBJECTIVE	• To achieve competence in the operative management of supra-tentorial intrinsic tumors
KNOWLEDGE	• Indications for surgery • Applied surgical anatomy • Principles of peri-operative care • Craniotomy for superficial, lobar supratentorial intrinsic tumor. In particular: safe patient positioning, planning and siting of craniotomy with and without image-guidance intra-operative management of raised ICP • Use of suction, electro-coagulation and ultrasonic aspiration • Intracranial hemostasis • Intraoperative neurophysiological monitoring, including awake craniotomy brain mapping • Complications of surgery

NEURO-ONCOLOGY	Convexity and Parasagittal Meningiomas
OBJECTIVE	• To achieve competence in the operative management of a convexity meningiomas
KNOWLEDGE	• Indications for surgery • Applied surgical anatomy • Principles of peri-operative care • Resection of a convexity meningioma, in particular: safe patient positioning, planning and siting of craniotomy with and without image-guidance. • Intra-operative management of raised ICP • Appropriate exposure of the tumor • Use of suction, electro-coagulation and ultrasonic aspiration • Use of internal tumor decompression dissection in the subarachnoid plane • Intracranial hemostasis • Use of duroplasty and cranioplasty • Complications of surgery and their management, including dural venous sinus tear

RADIOSURGERY	**Radiosurgery and Stereotactic Radiotherapy**
OBJECTIVE	• To achieve competence in the neurosurgical aspects of the multidisciplinary management of patients undergoing radiosurgery and stereotactic radiotherapy
KNOWLEDGE	• The indications for their use as adjunctive and/or primary treatment modalities • Assessment of the suitability of these techniques for the treatment of metastatic and intrinsic tumors based on clinical presentation and imaging appearance • Application of stereotactic frames for radiosurgical treatment

SPINAL / NEURO-ONCOLOGY	**Intradural Extramedullary Tumors**
OBJECTIVE	• To achieve competence in the management of patients with intradural extramedullary tumors including schwannomas, neurofibromas and meningiomas
KNOWLEDGE	• Interpretation of spinal MRI scans • Indications for surgery • Selection of surgical approaches • Applied surgical anatomy • Principles of peri-operative care • Microsurgical excision of posterior and postero-lateral intradural extramedullary tumors • Microsurgical excision of anterior intradural extramedullary tumors • Intraoperative neurophysiological monitoring • Complications of surgery and their management

SPINAL / NEURO-ONCOLOGY	Intramedullary Spinal Cord Tumors
OBJECTIVE	• To achieve competence in the management of patients with intramedullary spinal cord tumors
KNOWLEDGE	• Assessment, counseling and pre-operative preparation of patients with intramedullary spinal cord tumors • Interpretation of spinal MRI scans • Indications for biopsy, subtotal and radical excision • Role of adjuvant treatment • Applied surgical anatomy of spine and spinal cord • Selection of surgical approaches • Principles of intra-operative management of patients undergoing resection of intramedullary tumors • Microsurgical biopsy of intramedullary spinal cord tumor • Subtotal microsurgical resection of intramedullary tumor • Intraoperative neurophysiological monitoring • Complications of surgery and their management, including troubleshooting strategies when monitoring red-flag features are observed

SPINAL	Cervical Myeloradiculopathy
OBJECTIVE	• To achieve competence in the management of cervical radiculopathy
KNOWLEDGE	• Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms • Indications for operative management of cervical radiculopathies • Applied surgical anatomy of the cervical spinal column, spinal cord, nerve roots and vertebral arteries • Selection of surgical approaches • Principles of peri-operative care • Use of fluoroscopy or plain radiographs to confirm spinal level • Single and multi-level anterior cervical discectomy with and without fusion • Standard anterolateral approach to the cervical spine • Radical and subtotal excision of the cervical disc, PLL, central and unco-vertebral osteophytes • Protection and full decompression of the spinal cord and spinal nerve roots • Interbody fusion using autologous bone with or without interbody cages • Posterior cervical microforaminotomy and microdiscectomy • Posterior cervical decompression (laminotomy, hemilaminectomy, laminoplasty) • Intraoperative neurophysiological monitoring • Complications of surgery and their management, including C5 radiculopathy, troubleshooting strategies when monitoring red-flag features are observed

SPINAL	**Lumbar radiculopathies**
OBJECTIVE	• To achieve competence in the surgical management of lumbar compressive radiculopathies by lumbar microdiscectomies and associated microsurgical decompressions
KNOWLEDGE	• Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms • Indications for operative management of lumbar radiculopathies • Applied surgical anatomy of the lumbar spine with particular reference to degenerative neural compression and morphological variations in vertebral anatomy • Selection of minimally-invasive approaches • Principles of peri-operative care • Primary lumbar microdiscectomy • Primary posterior decompression (laminotomy, hemilaminectomy etc): including Identification of spinal level by pre-and intra-operative fluoroscopy. Achieving safe access to the spinal canal by micro-surgical fenestration. Achieving full decompression of the spinal canal, lateral recess and foramen by appropriate bone and soft tissue resection. Protection and safe retraction of neural tissues • Lumbar microdiscectomy • Microsurgical lateral recess decompression • Posterior decompression (laminotomy, hemilaminectomy, etc) • Revision lumbar microsurgical discectomy with and without decompression • Microsurgical lumbar discectomy for central disc protrusion with cauda equina compression • Intraoperative neurophysiological monitoring • Complications of surgery and their management, including troubleshooting strategies when monitoring red-flag features are observed

VASCULAR	Intracranial Aneurysms
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of ruptured and unruptured intracranial aneurysms
KNOWLEDGE	• The assessment, counseling and pre-operative preparation of patients with ruptured and unruptured aneurysms • Interpretation of CT, MR and catheter angiography • Angiographic and microsurgical anatomy of the cerebral circulation • Indications for surgical management of intracranial aneurysms by clipping, trapping, microsurgical reconstruction, microvascular bypass and endovascular therapy • Standard pterional and subfrontal approaches • Clipping of anterior circulation aneurysm • Principles of endovascular therapy • Complications of surgery and their management, including handling of intraoperative aneurysm rupture

VASCULAR	Intracranial Vascular Malformations
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of intracranial vascular malformations
KNOWLEDGE	• The assessment, counseling and pre-operative preparation of patients with vascular malformations • Interpretation of CT, MR and catheter angiography • Angiographic and microsurgical anatomy of the cerebral circulation • Indications for embolisation and radiosurgery • Indications for surgical management of malformations • Craniotomy and exposure of supratentorial AVM • Microsurgical resection of superficial gyral or sulcal AVM • Complications of surgery and their management, including hyperperfusion syndrome

VASCULAR	Occlusive Cerebrovascular Disease
OBJECTIVE	• To achieve competence in the surgical management of occlusive cerebrovascular disease, including Moya Moya disease
KNOWLEDGE	• The assessment, counseling and pre-operative preparation of patients undergoing surgery for occlusive cerebrovascular disease *with* ruptured and unruptured aneurysms • Interpretation of CT, MR and catheter angiography • Indications for carotid endarterectomy • Indications for endovascular intervention including intra-arterial thrombolysis; carotid angioplasty and stenting; intracranial angioplasty • Principles of cerebral revascularization by indirect synangiosis, low-flow EC-IC anastomosis and high flow EC-IC bypass grafting • Intraoperative neurophysiological monitoring • Complications and their management

VASCULAR	Primary Intracerebral Hematoma
OBJECTIVE	• To achieve competence in the operative management of space-occupying spontaneous intracerebral hematomas
KNOWLEDGE	• Indications for surgical evacuation • Management strategies to reduce the risk of intra-operative re-bleeding in presence of suspected aneurysm or AVM including partial hematoma evacuation, pre-or post-operative embolisation and definitive surgical treatment • Craniotomy for supratentorial hematoma including • Planning and siting of craniotomies • Use of ventricular drainage • Intracerebral hemostasis in the coagulopathic patient • Complications and their management

FUNCTIONAL	Epilepsy
OBJECTIVE	• To understand the surgical management of patients with idiopathic and lesional epilepsy
KNOWLEDGE	• The assessment, counseling and pre-operative preparation of patients with epilepsy • Indications for surgical management • Surgical aspects of the multi-disciplinary assessment of epilepsy patients • Interpretation of CT, MRI and SPECT scans • Microsurgical anatomy of the mesial temporal lobe • Invasive EEG recording: grid and depth electrode placement • Image-guided resection of cortical lesions • Craniotomy for mesial temporal lobe sclerosis • Disconnection procedures including corpus callosotomy, multiple subpial transections and functional hemispherectomy • Vagal nerve stimulation • Complications and their management

PERIPHERAL NERVE DISORDERS	Carpal Tunnel Compression
OBJECTIVE	• To achieve competence in carpal tunnel decompression
KNOWLEDGE	• Assessment and counseling of patients with carpal tunnel syndrome • Presentation, differential diagnosis and management of carpal tunnel syndrome • Interpretation of nerve conduction studies • Indications for surgery • Applied surgical anatomy • Carpal tunnel decompression • Complications and their management

FUNCTIONAL	Neurovascular Compression Syndromes
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of patients with neurovascular compression syndromes
KNOWLEDGE	• The assessment, counseling and pre-operative preparation of patients with trigeminal neuralgia • Interpretation of posterior fossa CT an MR and scans including MR sequences demonstrating neurovascular compression • Application and interpretation of intraoperative monitoring techniques • Indications for the surgical management of trigeminal, glossopharyngeal neuralgia and hemifacial spasm • Surface anatomy of the trigeminal nerve and microsurgical anatomy of the CP angle • Percutaneous trigeminal rhizotomy • Trigeminal and facial microvascular decompression • Complications of surgery and their management

FUNCTIONAL	Spasticity
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of patients with spasticity
KNOWLEDGE	• Indications for medical, minimally-invasive and surgical management • Applied surgical anatomy • Complications of surgery and their management • Surgical aspects of the multi-disciplinary assessment of patients with spasticity • Pre-operative counseling and preparation • Intrathecal drug delivery • Deep brain stimulation • Complications and their management

PERIPHERAL NERVE DISORDERS	Peripheral Nerve Sheath Tumors
OBJECTIVE	• To achieve competence in the resection of major and minor peripheral nerve tumors
KNOWLEDGE	• Assessment and counseling of patients with peripheral nerve sheath tumors • Pathology of peripheral nerve sheath tumors • Indications for complete and subtotal resection of tumors • Applied surgical anatomy of the major peripheral nerves • Microsurgical excision of peripheral nerve sheath tumor • Complications and their management

PEDIATRIC	Hindbrain Herniation
OBJECTIVE	• To achieve competence in the management of hindbrain herniation
KNOWLEDGE	• Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms and 3D spinal reconstruction • Indications for foramen magnum decompression • Applied surgical anatomy of the craniocervical junction • Selection of surgical approaches including: posterior fossa decompression • Principles of peri-operative care • Complications of surgery and their management

PEDIATRIC	Neuro-oncology
OBJECTIVE	• To achieve competence in the surgical aspects of the multi-disciplinary management of children with tumors of the brain and spinal cord
KNOWLEDGE	• Emergency operative management of a deteriorating child with an intracranial hemorrhage and/or hydrocephalus secondary to tumor • Use of CT, MRI, electromagnetic and ultrasound guided localization of tumors of the brain and spine • Stereotactic, image-guided and endoscopic biopsy of intracranial tumors • Craniotomy for supratentorial tumors • Approaches to the suprasellar region: pterional, orbitozygomatic and subfrontal • Approaches to the third ventricle: transcortical-transventricular, transcallosal • Approaches to the pineal region: endoscopic, supracerebellar, suboccipital transtentorial • Midline posterior fossa craniotomy for tumor • Retrosigmoid approach for CP angle tumors • Laminoplasty approach to spine cord tumors • Complications of surgery

PEDIATRIC	Congenital Spinal Disorders
OBJECTIVE	• To achieve competence in all aspects of the management (operative and non-operative) of children with congenital spinal disorders
KNOWLEDGE	• Assessment and clinical management of children presenting with open or closed dysraphic spines and other congenital spinal abnormalities • Closure of myelomeningocoele • Syringostomy and shunting of syringomyelia • Untethering of thickened filum • Excision of simple dermal sinus tract • Untethering and resection of bony spur in diastematomyelia • Untethering of spinal cord lipomas and lipomyelomeningocoeles

PEDIATRIC	Craniofacial Disorders
OBJECTIVE	• To achieve competence in all aspects of the surgical management of children with craniosysnostosis
KNOWLEDGE	• Management of ophthalmic and airway emergencies in syndromic craniosynostosis • Neurosurgical contribution to the multi-disciplinary management of children with craniofacial abnormalities • Cranioplasty using autologous, titanium or acrylic implants • Surgical management of non-syndromic single suture synostosis (in the context of a multidisciplinary team)

PEDIATRIC	Spasticity
OBJECTIVE	• To understand the principles of surgical management of spasticity and movement disorders in children
KNOWLEDGE	• The indications for, prognosis and complications of intrathecal baclofen therapy, dorsal rhizotomy and deep brain stimulation in the management of spasticity and dystonia • Baclofen pump insertion, assessment of function and revision • Laminotomy for selective dorsal rhizotomy

HYDROCEPHALUS	
OBJECTIVE	• The management of hydrocephalus complicating intracranial hemorrhage, head injury and intracranial space occupying lesions; insertion and tapping of CSF reservoirs; insertion and maintenance of lumbar and ventricular drains
KNOWLEDGE	• The assessment, counseling and pre-operative preparation of patients with hydrocephalus • Interpretation of pressure studies and CSF infusion studies • Interpretation of CT and MRI scans and identification of shunt malfunction • Applied surgical anatomy of the ventricular system • Indications for external ventricular drainage, VP & VA shunting, lumbar CSF drainage and shunting, ventriculo-cisternostomy • Insertion of ventricular drain/access device • Insertion of VP shunt • Revision of VP shunt • Insertion of VA shunt • Endoscopic third ventriculo-cisternostomy • Lumbo-peritoneal shunt • Use of 3D image-guidance or ultrasound for difficult ventricular • Lumbar subarachnoid drainage • External ventricular drainage • Intra-operative testing of shunt function • Selection of appropriate shunts • Complications of surgery and their management including ventriculostomy-associated infection, occlusion and perioperative ventricular hemorrhage

CNS INFECTIONS	
OBJECTIVE	• To achieve competence in the management of patients with CNS infections including ventriculitis, cerebral abscess, subdural empyema and spinal epidural abscess
KNOWLEDGE	• Applied surgical anatomy • Burr hole drainage of intracerebral abscess • Ventricular drainage • Craniotomy for subdural empyema, including frontal and parietal parafalcine approaches • Craniotomy and resection of frontal, temporal and cerebellar abscess • Anterior and middle fossa duroplasty • Drainage of spinal epidural abscess by laminectomy and/or multiple laminotomies • Principles of peri-operative care • Surgical complications

CRANIAL TRAUMA	
OBJECTIVE	• To achieve competence in the operative management of head-injured patients
KNOWLEDGE	• Applied surgical anatomy • Principles of peri-operative care Indications for surgery and appropriate surgical approaches • Craniotomy for supratentorial traumatic hematoma, in particular • Planning and siting of craniotomies for evacuation of extradural and subdural hematomas • Handling the "tight" brain • Performance of single and multiple frontal and parietal burr hole evacuation of CSDHs • Insertion of frontal ventricular, subdural and intraparenchymal ICP monitors using a standard frontal burr hole • Achieving hematostasis in the coagulopathic patient • Achieving hematostasis from the skull base and venous sinuses • Elevation of compound depressed skull fracture with dural repair • Delayed cranioplasty for acquired skull vault defects

ANATOMY OF THE SKULL	
OBJECTIVE	• To understand the anatomy of the skull
KNOWLEDGE	• Structure, blood supply, innervation, surface and three-dimensional relationships of the: scalp, skull, meninges, orbit, cranial fossae, cranial foraminae, cranial nerves

ANATOMY OF THE BRAIN	
OBJECTIVE	• To understand the structural anatomy of the brain
KNOWLEDGE	• Cortical topography • Projection and association tracts • Organisation of the basal ganglia • Structure, organisation and connections of the cerebellum, pons and brainstem • Cranial nerves and their relationships • Visual and auditory pathways • Ventricular system and choroid plexus • Subarachnoid space and cisterns • Circle of Willis and principle regional and segmental blood supply • Venous drainage and dural sinuses

ANATOMY OF THE SPINE	
OBJECTIVE	• To understand the anatomy of the spine
KNOWLEDGE	• Structure, blood supply, innervation, surface and three-dimensional relationships of the: vertebral column, spinal cord: ascending and descending tracts, spinal nerve roots, cauda equina

ANATOMY OF THE AUTONOMIC AND PERIPHERAL NERVOUS SYSTEM	
OBJECTIVE	• To understand the anatomy of the autonomic and peripheral nervous system
KNOWLEDGE	• Sympathetic and parasympathetic pathways • Visceral and pelvic innervation: control of sphincter function • Brachial plexus • Lumbosacral plexus • Course, distribution and innervation of the major peripheral nerves

Medical Management of Neurosurgical Conditions

(OBJECTIVES & KNOWLEDGE REQUIREMENTS)

TRAUMA	**Neurocritical care in Traumatic Brain Injury**
OBJECTIVE	To achieve competence in the medical management of neurosurgical patients with traumatic brain injury
KNOWLEDGE	• Pathophysiology of head injury and brain edema • Structure and function of the blood brain barrier • Neurological assessment of the head-injured patient including: assessment and categorisation • Medical management of raised intracranial pressure • Interpretation of multi-modality cerebral monitoring, including: cerebral perfusion and oxygenation • Principles of intensive care of head injured patients, including: the prevention and management of secondary brain injury • Management of fluid & electrolytes disturbances, in particular sodium balance • Natural history of recovery from head injury including neurological, cognitive and behavioural disability and post-traumatic epilepsy • Clinical and radiological prognostication of traumatic brain injury patients • Nutritional support and feeding modalities • Cardiopulmonary complications of severe traumatic brain injury • Deep vein thrombosis prevention & treatment • Coagulopathies & their management

TRAUMA	**ACUTE SPINAL DISORDERS**
OBJECTIVE	To achieve competence in the peri-operative management of patients presenting with spinal trauma
KNOWLEDGE	• The assessment and peri-operative management of patients presenting with spinal cord, cauda equina and spinal root compression • The management of spinal shock • Difference between spinal and neurogenic shock • The ward management of patients with spinal instability • The detection and initial management of post-operative complications including compressing haematomas, CSF fistula and spinal sepsis

VASCULAR	Neuro-critical Care in Hemorrhagic Stroke
OBJECTIVE	To achieve competence in the medical management of subarachnoid haemorrhage (SAH), intracerebral hemorrhage (ICH) and intraventricular hemorrhage (IVH)
KNOWLEDGE	• Etiology and pathophysiology of aneurysmal SAH, ICH and other vascular lesions, including arteriovenous malformations (AVMs)/ fistulae (AVFs) • Pathophysiology delayed cerebral ischemia • Clinical and radiological grading of aneurysmal SAH, ICH, and IVH • Principles of resuscitation and timing of intervention • Indications for CT scanning, diagnostic lumbar puncture, CT angiography and digital subtraction angiography • Principles of management of post-haemorrhagic hydrocephalus • Medical management ICH and ruptured AVM patients before and after intervention

VASCULAR	Medical Management of Steno-occlusive Cerebrovascular Disease
OBJECTIVE	To achieve competence in the medical management of Steno-occlusive cerebrovascular disease

KNOWLEDGE	• The epidemiology, natural history and pathophysiology of:
	  • Extra- and intracranial atherosclerotic (and non-atherosclerotic) steno-occlusive disease
	  • Venous thrombosis
	• Optimal medical management of steno-occlusive and thrombo-embolic cerebrovascular disease
	• Imaging of the acutely ischaemic brain using CT and MRI
	• Principles of non-invasive and invasive imaging of the extra and intracranial vasculature using CT, MRI and catheter angiography
	• Principles of regional cerebral perfusion, metabolism and oxygenation measurement.
	• Imaging using CT, MRI perfusion and radionucleotide techniques; incl, SPECT, PET, Tc-99m HMPAO
	• Indications for surgical management

VASCULAR	Medical Management of Aneurysmal Subarachnoid Hemorrhage
OBJECTIVE	• To achieve competence in the medical management of aneurysmal SAH
KNOWLEDGE	• Diagnosis, prevention and management of delayed cerebral ischemia, cerebral vasospasm, cerebral salt wasting and cranial DI • Management of post-SAH hydrocephalus, neurogenic pulmonary, stunned myocardium and sympathetic hyperactivity • Relative indications for endovascular and surgical interventions

IMPAIRED CONSCIOUSNESS AND NON-TRAUMATIC COMA	
OBJECTIVE	Etiology, pathophysiology and differential diagnosis of altered consciousness and coma due to: meningitis, encephalitis, intracranial haemorrhage, acutely raised ICP, hydrocephalus, hypoxemia and ischemia, cardiogenic shock, hypoglycaemia, epilepsy, metabolic encephalopathies, drugs and toxins
KNOWLEDGE	• Causes for coma • Neurological assessment and initial resuscitation of patients in coma or with impaired consciousness • Indications for intubation and ventilation • Establishing a neurological differential diagnosis • Planning and interpreting scans and other investigations, including EEG in the diagnosis of coma • Neurological complications of critical illness • Hypoxic-ischemic brain injury

FUNCTIONAL	Epilepsy
OBJECTIVE	To understand the medical management of patients with epilepsy
KNOWLEDGE	• Indications for medical and surgical management • Starting epilepsy treatment and monitoring drug therapy, including adverse effects and interactions with antiepileptic drugs • Management of status epilepticus (convulsive and non-convulsive), including post-operative/stroke/ traumatic seizures • Multi-disciplinary assessment of patients • Principles of ictal, interictal, intra- & extra-operative EEG • Principles of video-EEG monitoring

FUNCTIONAL	Pain Pathophysiology & Medical Management
OBJECTIVE	To understand the physiology and medical management of neurosurgical patients presenting with pain
KNOWLEDGE	• Indications and principles of medical management e.g. WHO analgesic pain ladder • Physiology of pain • Multi-disciplinary assessment of chronic pain patients *Neurovascular compression syndromes* • Etiology, epidemiology and natural history of trigeminal neuralgia, and glossopharyngeal neuralgia • Differential diagnosis and management of related cranio-facial pain syndromes

FUNCTIONAL	Spasticity
OBJECTIVE	To achieve competence in the surgical aspects of the multi-disciplinary management of patients with spasticity
KNOWLEDGE	• Indications for medical, minimally-invasive and surgical management • Multi-disciplinary assessment of patients with spasticity • Pre-operative counselling and preparation • Pharmacological intervention: mechanisms of action, adverse effects & efficacy), including intrathecal baclofen

FUNCTIONAL	Medical Management of Movement Disorders
OBJECTIVE	To achieve competence in the multi-disciplinary medical management of patients with movement disorders
KNOWLEDGE	• Etiology and pathophysiology of movement disorders: Parkinson's disease, dystonic syndromes, choreiform syndromes • Multi-disciplinary assessment of patients • Pre-operative counselling and preparation • Pharmacological intervention: mechanisms of action, adverse effects & efficacy) • Indications for surgical management • Drug-induced movement disorders

GENERAL MICROBIOLOGICAL PRINCIPLES	
OBJECTIVE	To achieve competence in the general management of CNS infections including ventriculitis, cerebral abscess, subdural empyema and spinal epidural abscess
KNOWLEDGE	• The pathophysiology of intracranial and spinal sepsis • Principles of anti-microbial therapy (prophylactic and therapeutic) • Indications for operative intervention • Clinical assessment of patients with CNS infections • Interpretation of CT and MRI scans

PHARMACOLOGY	
OBJECTIVE	To understand the principles of neuropharmacology

KNOWLEDGE	• Cell membrane receptor and ion channel function
	• Neuropeptides and neurotransmitters
	• Principles of pharmacological neuroprotection
	• The pharmacology (i.e. mechanisms of action, pharmacodynamics, adverse effects & interactions) of:
	  • Anaesthetic agents muscle relaxants, barbiturates, sedatives, analgesics
	  • Anti-epileptics
	  • Hormone replacement & corticosteroids
	  • Anti-platelet and anti-coagulant medications
	  • Movement disorder & spasticity medications
	  • Commonly used antidepressant & antipsychotic medication
	  • Commonly encountered chemotherapeutic drugs
	  • Commonly used neuro-critical care medications

MEDICAL ETHICS	
OBJECTIVE	To understand the ethical issues that commonly arise in the management of patients with neurological disorders
KNOWLEDGE	• Principles and diagnosis of brain death • Confounding conditions and confirmatory tests of brain death • Difference between coma, minimal conscious state and persistent vegetative state • Diagnosis and management of persistent vegetative states • Prognosis in chronic progressive neurological disorders • Professional and statutory framework governing living directives and end-of-life decisions including advanced directives • Principles of informed consent including the Montgomery vs. the Bolam standards • The basic principles of medical ethics: non-maleficence, beneficence, autonomy and equality

HEADACHE	
OBJECTIVE	To understand the etiology, differential diagnosis, investigation and initial management of patients presenting with acute and chronic headache
KNOWLEDGE	• Etiology and differential diagnosis of acute and chronic headache including headache associated with: benign headache syndromes, migraine, cluster headache and related syndromes, space occupying lesions, meningitic disorders, intracranial haemorrhage, trigeminal neuralgia, atypical craniofacial pain syndrome, low CSF pressure headache • Indications for investigation including MRI, lumbar puncture and angiography

MANAGEMENT AND LEADERSHIP	
CORE COMPETENCIES	Upon graduation, HSTs are expected to: • Allocate finite healthcare resources appropriately. • Manage and lead clinical teams. • Manage their practice and career effectively. • Serve in administration and leadership roles, as appropriate.
SUGGESTED READING	There are no prescribed texts, HSTs are expected to keep abreast with current literature. Suggested reading (last updated 22nd June 2020): RCSEd Non-technical skills for surgeons (NOTSS) https://www.rcsed.ac.uk/professional-support-development-resources/learning-resources/non-technical-skills-for-surgeons-notss Cohen-Gadol, A. The Neurosurgical Atlas https://www.neurosurgicalatlas.com/volumes/non-technical-skills-in-neurosurgery/leadership-principles Lipsman, N. et al "The Actualized Neurosurgeon": A Proposed Model of Surgical Resident Development. World Neurosurg 2017 Mar; 99:381386. doi:10.1016/j.wneu.2016.12.039 Somma, T. et al. From the Champion to the Team: New Treatment Paradigms in Contemporary Neurosurgery World Neurosurg 2019 Nov;131:141-148. doi:10.1016/j.wneu.2019.07.196
ASSESSMENT	Half-yearly HST assessment

PROFESSIONALISM AND ETHICS	
CORE COMPETENCIES	Upon graduation, HSTs are expected to: • Identify ethical expectations that impinge on common medico-legal issues. • Interpret ethical and legal requirements of the neurosurgical, and medical profession at large, into their daily practice. • Act ethically towards patients and colleagues. • Handle complaints including self-criticism or criticism from colleagues or patients. • Approach and deal with all patients with a non-discriminatory, non-judgmental attitude. • Employ a consultative approach with colleagues and other professionals. • Maintain professional standards in their role as a neurosurgeon and a Fellow of the College of Surgeons of Hong Kong.
SUGGESTED READING	There are no prescribed texts, HSTs are expected to keep abreast with current literature. Suggested reading (last updated 22nd June 2020): Oxford Handbook of Neuroethics. Editors: Illes, J. and Sahakian, B.J.. Oxford University Press. ISBN:9780199570706 Apr 2011 doi:10.1093/oxfordhb/9780199570706.001.000 Umansky, F. et al. Statement of Ethics in Neurosurgery of the World Federation of Neurosurgical Societies. World Neurosurg. Sep-Oct 2011;76(3-4):239-47. doi:10.1016/j.wneu.2011.06.001. Schmitz, D. et al. Informed Consent in Neurosurgery--Translating Ethical Theory Into Action. J Med Ethics. 2006 Sep;32(9):497-8. doi: 10.1136/jme.2005.013144. Muskens, I.S. et al. When Time Is Critical, Is Informed Consent Less So? A Discussion of Patient Autonomy in Emergency Neurosurgery. World Neurosurg. 2019 May;125:e336-e340. doi: 10.1016/j.wneu.2019.01.074. Apuzzo, M.L.J. Facets of Professionalism. World Neurosurg. 2013 Jan;79(1):1. doi: 10.1016/j.wneu.2012.11.050. Kanat, A. et al. Challenges to Neurosurgical Professionalism. Clin Neurol Neurosurg. 2010 Dec;112(10):839-43. doi: 10.1016/j.clineuro.2010.07.012.
ASSESSMENT	Half-yearly HST assessment