Expected competency levels in knowledge and clinical skills are defined for critical conditions, index procedures and the technical skills in the special interest areas of Neurosurgery.

WBA
Formative WBAs may be used to assess and provide feedback on any areas of clinical activity. However, other than for the critical conditions, index procedures or where they have been identified to address a concern, WBAs are optional and trainees, therefore, do not need to use WBAs to evidence their learning against each syllabus topic.

Standards for depth of knowledge during surgical training
In the three phases of Neurosurgery training the following methodology is used to define the relevant depth of knowledge required of the surgical trainee. Each topic within a phase has a competence level ascribed to it for knowledge ranging from 1 to 4 that indicates the depth of knowledge required:

1. knows of
2. knows basic concepts
3. knows generally
4. knows specifically and broadly

Standards for clinical and technical skills
The practical application of knowledge is evidenced through clinical and technical skills. Each topic within a phase has a competence level ascribed to it in the areas of clinical and technical skills ranging from 1 to 4:

1. Has observed

Exit descriptor; at this level the trainee:

- Has adequate knowledge of the steps through direct observation.
- Demonstrates that he/she can handle instruments relevant to the procedure appropriately and safely.
- Can perform some parts of the procedure with reasonable fluency.

2. Can do with assistance

Exit descriptor; at this level the trainee:

- Knows all the steps - and the reasons that lie behind the methodology.
- Can carry out a straightforward procedure fluently from start to finish.
- Knows and demonstrates when to call for assistance/advice from the supervisor (knows personal limitations).

3. Can do whole but may need assistance

Exit descriptor; at this level the trainee:

- Can adapt to well-known variations in the procedure encountered, without direct input from the trainer.
- Recognises and makes a correct assessment of common problems that are encountered.
- Is able to deal with most of the common problems.
- Knows and demonstrates when he/she needs help.
- Requires advice rather than help that requires the trainer to scrub.

4. Competent to do without assistance, including complications

Exit descriptor; at this level the trainee:

- With regard to the common clinical situations in Neurosurgery, can deal with straightforward and difficult cases to a satisfactory level and without the requirement for external input.
- Is at the level at which one would expect a UK consultant surgeon to function.
- Is capable of supervising trainees.

Phase 1 Neurosurgery Training

Overview

The purpose of phase 1 is to allow the trainee to develop the basic and fundamental surgical skills common to all surgical specialties, together with a broad foundation of theoretical knowledge, clinical experience, non-operative and operative skills as they relate to the core neurosurgical conditions.

At the end of Phase 1 there is a critical progression point for Phase 2 entry, assessed at the Annual Review of Competence Progression (ARCP), where trainees will demonstrate competencies in knowledge, clinical skills and professional behaviours commensurate with the CiPs and defined syllabus. MRCS must be achieved by this point in the training programme.

Trainees will be able to resuscitate when necessary, assess through a full neurological history and examination, establish a differential diagnosis, initiate and interpret investigations for patients presenting with a wide range of common neurological disorders.

The common emergencies that phase 1 trainees must learn to recognise and understand the management of brain and spinal trauma, spontaneous intracranial haemorrhage including subarachnoid haemorrhage and hypertensive intraparenchymal haematomas, acute hydrocephalus, acute raised intracranial pressure from brain tumours, epilepsy, acute spinal cord and nerve root compression including cauda equina syndrome. Trainees are encouraged to spend time on the ward and develop their diagnostic and management skills at every opportunity.

The common elective problems that phase 1 trainees must have some understanding of the management of include brain and spinal tumours, epilepsy, stroke and spinal degenerative disease. Trainees are encouraged to attend clinics and develop their diagnostic and management skills at every opportunity.

The key technical skills for phase 1 training are suturing, insertion of an ICP monitor, burr hole drainage of a CSDH, lumbar puncture and lumbar drain insertion, tapping of CSF reservoirs and shunts, placement of EVD’s and basic craniotomies. Trainees are encouraged to attend theatre and develop their surgical skills at every opportunity.

Phase 1 Capability in Practice

Capability in practice	Supervision level
1. Manages an outpatient clinic	Level IIa
2. Manages the unselected emergency take	Level IIa
3. Manages ward rounds and the on-going care of inpatients	Level IIb
4. Manages an operating list	Level I
5. Manages multi-disciplinary working	Level I

Phase 1 Critical conditions

Critical condition	Assessed by	Knowledge level Expected (see syllabus levels above)
Impaired consciousness and seizures	CBD or CEX	4
Cranial trauma	CBD or CEX	3
Acute hydrocephalus	CBD or CEX	3
Acute tumour presentations	CBD or CEX	2
Spontaneous intracranial haemorrhage	CBD or CEX	2
CNS infections	CBD or CEX	2
Spinal trauma	CBD or CEX	2
Spinal oncology	CBD or CEX	2
Degenerative spinal disorders and cauda equina syndrome	CBD or CEX	3
Emergency paediatric neurosurgery	CBD or CEX	1

Phase 1 Index procedures

Index procedure	Assessed by	Skill level expected (see syllabus levels above)
Lumbar puncture and lumbar drain insertion	PBA	4
Insertion of ICP monitor	PBA	3
Burr hole evacuation of chronic subdural haematoma	PBA	2
Insertion of external ventricular drain	PBA	2
Craniotomy	PBA	2
Lumbar decompression (approach)	PBA	2

Clinical Placements in Phase 1

Clinical placements in Phase 1 will include:

- At least 6 months in Neurosurgery attachments

Further attachments from related disciplines (minimum 3, maximum 5) including:

- Neurocritical care
- Neurology (including neurophysiology and neurorehabilitation)
- Neuroradiology
- Neuropathology
- A related surgical specialty
- Accident and Emergency Medicine

The further attachment placements during phase 1 are flexible and at the discretion of the programme director. The following principles apply:

- To promote flexibility the Shape of Training review requires that equivalent training already undertaken in other training programmes should be recognised where the appropriate CiPs have been achieved
- Trainees should not be required to work in specialty areas they have already undertaken earlier in their career for example during foundation training
- Flexible, bespoke training requirements should be supported wherever possible
- Training programme directors will be familiar with which specialties offer good training opportunities locally and placements in these specialties should be arranged
- Trainees on placements should receive training and are not primarily in these placements to support service requirements

Phase 1 Topics

CORE COMMON CONTENT MODULE

Basic Sciences

Objective	To acquire and demonstrate a knowledge of the basic science which underpins the practice of surgery
Knowledge	*Applied anatomy*: • Gross and microscopic anatomy of the organs and other structures • Surface anatomy • Imaging anatomy • Development and embryology This will include anatomy of thorax, abdomen, pelvis, perineum, limbs, spine, head and neck. *Physiology*: General physiological principles including: • Thermoregulation • Metabolic, ionic and acid/base homeostasis • Cardiorespiratory homeostasis • Haemostasis • Acid base balance This will include the physiology of specific organ systems relevant to surgical care including the cardiovascular, respiratory, gastrointestinal, urinary, endocrine, musculoskeletal and neurological systems. *Pharmacology*: • The pharmacology of drugs used in surgical practice, both for treatment and prophylaxis, including analgesics, antibiotics, anticoagulants and local anaesthetics • The pharmacology and recommended modification in the perioperative period of the common agents used for the treatment of chronic intercurrent disease • The pharmacological principles of general anaesthesia and intensive care medicine • The pharmacological principles relevant to the treatment of malignancy • The pharmacological principles of immunosuppression *Pathology*: General pathological principles including: • Necrosis and apoptosis • Inflammation and immunity including transplant rejection • Repair, regeneration and healing • Thrombosis and embolism • Shock, systemic inflammatory response syndrome and multiple organ failure • Neoplasia including carcinogenesis, the biology of tumour growth, metastasis and the principles of grading and staging • Genetics including genomics The pathology of specific organ systems relevant to surgical care including cardiovascular pathology, respiratory pathology, gastrointestinal pathology,

	genitourinary disease, breast, exocrine and endocrine pathology, central and peripheral, neurological systems, skin, lymphoreticular and musculoskeletal systems. *Microbiology*: • Infection control including sources of infection, asepsis, disinfection and sterilisation • General pathology of bacterial and viral disease including mechanisms of injury and systemic sepsis • Soft tissue infections including cellulitis, abscesses, necrotising fasciitis and gangrene • Hospital acquired infection, antibiotic governance and bacterial resistance • Prevention of the transmission of blood born viral infection during surgery *Medical physics*: • Principles of diagnostic and interventional imaging including plain and contrast radiography, ultrasound, CT, MRI, PET and radionuclide imaging • Principles of diathermy, LASER, ultrasonic aspiration • Principles of radiotherapy • Application of robotics and artificial intelligence to surgery *Medical statistics*: • Principles of screening • The null hypothesis and common tests used with parametric and non-parametric data

The clinical method in surgical practice

Objective	To demonstrate the knowledge and clinical skill necessary to assess and investigate a patient presenting to a surgical team
Knowledge	For each of the index conditions below: • epidemiology • common presentations • expected findings on history and examination • natural history • important investigations and likely findings • management options and published guidelines • prognosis
Clinical Skills	Take a tailored history and perform a relevant examination in an outpatient clinic Detect the need for and initiate resuscitation in an unwell patient Take a tailored history and perform a relevant examination for an acutely unwell patient Construct and investigate a differential diagnosis Facilitate a patient centred discussion of treatment options and agree on a management plan
Reference to other relevant syllabus items	Critical care Professional/leadership skills: good clinical care Surgical care of the paediatric patient

Index conditions	This section sets out those common and important conditions about which a working knowledge of the relevant clinical science and principles of management are essential for all core surgical trainees.	
Organ system	*Presentations*	*Conditions*
Abdomen	• Abdominal pain • Abdominal swelling • Change in bowel habit • Gastrointestinal haemorrhage • Dysphagia • Dyspepsia • Jaundice	• Appendicitis • Gastrointestinal malignancy • Inflammatory bowel disease • Diverticular disease • Intestinal obstruction • Adhesions • Abdominal hernias • Peritonitis • Intestinal perforation • Benign oesophageal disease • Peptic ulcer disease • Benign and malignant hepatic, gall bladder and pancreatic disease • Haemorrhoids and perianal disease • Abdominal wall stomata • Abdominal trauma including splenic injury
Breast	• Breast lumps and nipple discharge • Acute Breast pain	• Benign and malignant breast lumps • Mastitis and breast abscess
Vascular	• Chronic and acute limb ischaemia • Aneurysmal disease • Transient ischaemic attacks • Varicose veins • Leg ulceration	• Atherosclerotic arterial disease • Embolic and thrombotic arterial disease • Venous insufficiency • Diabetic ulceration • Vascular injury
Cardiac & respiratory		• Coronary heart disease • Valvular heart disease • Bronchial carcinoma • Obstructive airways disease • Tumours of the chest including carcinoma of the bronchus • Thoracic trauma
Genitourinary	• Loin pain • Haematuria • Lower urinary tract symptoms • Urinary retention • Renal failure • Scrotal swellings • Testicular pain	• Genitourinary malignancy • Urinary calculus disease • Urinary tract infection • Benign prostatic hyperplasia • Obstructive uropathy
Musculo-skeletal	• Acute limb pain and deformity • Chronic joint pain and deformity	• Simple fractures and joint dislocations • Fractures around the hip and ankle • Degenerative joint disease • Inflammatory joint disease including bone

	• Back pain	and joint infection • Compartment syndrome • Bony metastatic malignancy
Skin, head and neck	• Lumps in the neck • Skin lumps • Epistaxis • Upper airway obstruction	• Benign and malignant skin and subcutaneous lesions • Benign and malignant lesions of the mouth and tongue • Burns • Soft tissue trauma and skin loss • Infections related to the nose, ears, throat and face
Neurological	• Headache • Coma	• Intracranial tumour • Traumatic brain injury • Common entrapment neuropathies • Peripheral nerve injury • Spinal nerve root entrapment, spinal cord compression & cauda equina compression
Endocrine	• Acute endocrine crises	• Thyroid and parathyroid disease • Adrenal gland disease • Diabetes
Paediatric	• Abdominal pain • Vomiting • Constipation	• Pyloric disease • Intussusception • Undescended testis, PPV and inguinal hernia • Phimosis

Peri-operative care

Objective	To assess and manage preoperative risk and prepare a patient for theatre, to conduct safe surgery in the operating theatre environment and to provide medical care for the patient in the post- operative period.
<u>Pre-operative care</u>	
Knowledge	• Risk factors for surgery and scoring systems including ASA and VTE risk • Antibiotic and VTE prophylaxis guidelines • Principles of ambulatory day surgery including selection and discharge criteria • Ethical principles of, and legislative framework for, capacity and consent • Nutritional assessment methods and feeding options
Clinical skills	• The safe prescribing of pharmacological agents used for the treatment of chronic intercurrent disease, modified appropriately to the peri-operative period • The safe prescribing of measures for antibiotic and VTE prophylaxis • Assessing patient capacity • Obtaining consent for surgery • Communication with anaesthetic and scrub teams in advance • Planning perioperative nutrition in advance in partnership with the nutrition team • Engaging with multidisciplinary team discussions including those with oncology and interventional radiology

Intra-operative care		
Knowledge	• The patient safety movement and the evidence behind the WHO check list • The principles of positioning and pressure area care • Radiation protection legislation • Guidelines for tourniquet use • Safety requirements for use of sharps, LASER and diathermy • What to do when something goes wrong • Anaesthetic monitoring techniques	
Clinical skills	• Maintenance of communication with theatre team throughout procedure • Crisis management	
Technical skills and procedures	• Safe positioning of the patient on the operating table • Safe intraoperative use of sharps and diathermy • Completion of team briefing • Completion of WHO check list (time out and sign out)	2 3 1 3
Post-operative care		

Knowledge	• Delirium
	  ○ Epidemiology and prognosis of delirium
	  ○ Causes and clinical features of delirium
	  ○ The impact of delirium on patient, family and carers
	• Spectrum of post-operative complications
	• Guidelines for indications, prescription and management of complications of the transfusion of blood products	

Clinical skills	• Assessment of the unwell postoperative patient
	• Writing an operation note with clear post-operative instructions
	• Delivery of effective analgesia
	• Diagnosis and treatment of VTE
	• Post-operative monitoring and optimisation of fluid & electrolyte balance
	• Diagnosis and treatment of post-operative infection and sepsis
	• Diagnosis and treatment of transfusion reactions
	• Delirium
	  ○ Assessment of cognitive impairment seeking to differentiate dementia from delirium, with the knowledge that delirium is common in people with dementia
	  ○ Management of patients with delirium including addressing triggers and using non-pharmacological and pharmacological methods where appropriate
	  ○ Explanation of delirium to patients and advocates	

Basic surgical skills

Objective	To acquire and develop throughout the programme those generic technical skills common to all or many areas of surgical practice.
Knowledge	Surgical wounds: • Classification of surgical wounds • Principles of wound management • Principles underlying incision placement including cosmesis and Langer's lines, vascularity and function • Principles underlying wound closure including suture method, needle types and the physical and biological characteristics of suture material The range, nomenclature and functional design of surgical instruments

Technical skills and procedures	Effective hand washing, gloving and gowning	4
	Accurate, effective and safe administration of local anaesthetic	3
	Preparation and maintenance of an aseptic field	3
	Incision of skin and subcutaneous tissue: • Ability to use scalpel, cutting diathermy and scissors • Control of superficial bleeding using diathermy and ligation	3
	Closure of skin and subcutaneous tissue: • Accurate and tension free apposition of wound edges • Knot tying by hand and instrument	3
	Selection and placement of tissue retractors	2
	Insertion, fixation and removal of drains	2
	Appropriate selection and use of instruments to handle tissue with minimal trauma	2
	Taking biopsies, safe labelling and completion of request forms	2
	Anticipation of needs of surgeon when assisting	2
	Co-ordination of camera and instrument from a 2-dimensional display during surgical endoscopy	

Critical care

Objective	To demonstrate the knowledge and clinical and technical skills necessary to contribute to the management of critically unwell patients suffering from traumatic injuries or sepsis.	
<u>Trauma management</u>		
Knowledge	A systematic, prioritised method of trauma management such as that set out by the American College of Surgeons, Committee on Trauma Scoring systems for assessment of global injury severity including ISS	
Clinical skills	Resuscitation and early management of the patient who has sustained thoracic, head, spinal, abdominal and/or limb injury according to ATLS®, APLS or European Trauma Course guidelines	
Technical skills and procedures	Chest drain insertion	2
<u>Sepsis management</u>		
Knowledge	A systematic, prioritised method of managing the septic patient Recommendations of the surviving sepsis campaign including the “Sepsis 6”	
Clinical skills	Resuscitation and early management of the septic patient	
Technical skills and procedures	Surgical drainage of pus	2
<u>Intensive care medicine</u>		
Knowledge	Classification of levels of critical care Principles of organ support including: • Invasive monitoring of circulation and ionotropic support • Mechanical ventilation and tracheostomy Haemofiltration and haemodialysis	
Clinical skills	Assessment of a patient receiving critical care Surgical contribution, in discussion with the critical care team, to the management plan of a patient receiving critical care	

Surgical care of the paediatric patient

Objective	To assess and manage children with surgical problems, understanding the similarities and differences from adult surgical patients, within the appropriate legal and safeguarding frameworks.
Knowledge	An awareness of the normal physiological parameters at different ages Principles of vascular access in children Working knowledge of trust and Local Safeguarding Children Boards (LSCBs) and Child Protection Procedures Child protection law and the issues of consent in childhood Working knowledge of types and categories of child maltreatment
Clinical Skills	Recognise limitations of own knowledge and experience and seek early advice from dedicated paediatric teams History and examination of paediatric surgical patient Recognition of the unwell child Assessment of respiratory and cardiovascular status in a child Obtaining consent for operative treatment in a paediatric patient

Management of the dying patient

Objective	To demonstrate the knowledge and clinical skills necessary to manage the transition from life to death including palliation of symptoms, certification of death and the discussion of resuscitation status and organ donation.
Knowledge	Awareness of the public debate around resuscitation and palliative care, and organ donation Classification of organ donors The role of the coroner and the certification of death
Clinical Skills	Assessment and control of distress in the dying patient in collaboration with a palliative care team The diagnosis of death following irreversible cessation of brain-stem function Discussion of best interest including resuscitation status and limits of care with patient advocate Discussion of organ donation with family in collaboration with transplant coordinators

Health promotion

Objective	This syllabus module aims to enable all surgical trainees to develop the competencies necessary to support patients in caring for themselves; to empower them to improve and maintain their own health.
<u>General aspects</u>	
Knowledge	Damaging health and social issues such as excessive alcohol consumption, obesity, smoking and illicit drugs and the harmful effects they have on health The connection between mental health and physical health The importance of health education for promoting self-care for patients The GMC's requirement that doctors protect patients and colleagues from any risk posed by their own health
Clinical Skills	Modification of explanations to match the intellectual, social and cultural background of individual patients Patient centred care Identification and utilisation of opportunities to promote health including positive role modelling
Reference to other relevant	• Nutrition (Module 5, Perioperative Care) • Drugs and alcohol (Module 1, Pharmacology)

syllabus items	• Screening (Module 1, Pathology) • Child protection (Module 7, Surgical Care of the Paediatric Patient)
Obesity	
Knowledge	Classification of excess body mass The health risks posed by obesity including an increased incidence of coronary heart disease, type 2 diabetes, hypertension, stroke, and some major cancers Social, psychological and environmental factors that underpin obesity Physiological and metabolic effects of obesity on the surgical patient Available treatments for obesity including diet, exercise, medication and surgery
Clinical Skills	The ability to treat patients who are obese in a supportive and sensitive manner Assess and explain the higher risks for obese individuals undergoing surgery Management of cardiovascular, respiratory and metabolic complications in patients with obesity undergoing surgery Provide advice and guidance about weight loss to overweight and obese patients within the context of a multidisciplinary team
Dementia	
Knowledge	Clinical features of dementia and the distinction between it and delirium The impact of dementia on patient, family and carers Principles and key provisions of the relevant legislation regarding the safeguarding of vulnerable adults across the UK, such as the Mental Capacity Act 2005 and the Adult Support and Protection (Scotland) Act 2007
Clinical Skills	Recognises cognitive impairment and appropriately refers Management of surgical patients in the context of their dementia A range of techniques and strategies to communicate effectively with people with dementia and their carers/families Assessment of capacity, involvement of advocates and documentation of consent and best interests
Exercise and physical fitness	
Knowledge	Physical inactivity as an independent risk factor for ill health and obesity Relationship between physical exercise programmes and healthy eating and smoking cessation programmes Government behaviour change programmes such as 'Let's Get Moving' and 'Shift into Sports'
Clinical Skills	Utilisation of all patient interactions as opportunities for health and fitness promotion with particular reference to the prevention and management of long-term chronic conditions such as coronary heart disease, diabetes, hypertension, obesity, cancer, osteoporosis, peripheral vascular disease and depression and the promotion of health and well being Modification of advice on physical exercise to the specific requirements of individual patients

CORE NEUROSCIENCES

TOPIC	**Neuroanatomy**
Category	Core neurosciences
Objective	*To understand neuroanatomy and embryology*
Knowledge	Embryogenesis of the brain, spinal cord, skull and vertebral column including common anatomical variations and developmental abnormalities Structure, blood supply, innervation and three-dimensional relationships of the scalp, skull, meninges, orbit, cranial fossae, cranial foraminae and cranial nerves Structure, blood supply, innervation and three-dimensional relationships of the brain including cortical topography, projection and association tracts and organisation of the basal ganglia Structure, organisation and connections of the cerebellum, pons and brainstem. The cranial nerves and their relationships, visual and auditory pathways. Structure and three dimensional relationships of the ventricular system, choroid plexus, subarachnoid space and cisterns The cerebral circulation system including the Circle of Willis and principle regional and segmental blood supply, venous drainage and dural sinuses Structure, blood supply, innervation, surface and three-dimensional relationships of the vertebral column, spinal cord: ascending and descending tracts, spinal nerve roots and cauda equina Sympathetic and parasympathetic pathways, visceral and pelvic innervation and the control of sphincter function Brachial plexus, Lumbosacral plexus and the course, distribution and innervation of the major peripheral nerves
Clinical Skills	N/A

TOPIC	**Neurophysiology**
Category	Core neurosciences
Objective	*To understand the functional organisation and integration of the central nervous system*
Knowledge	Structure and function of neurones and glial cells including synaptic function, action potentials and axonal conduction Higher cerebral functions including sleep, coma, memory and disorders of the limbic system, control of motor function: ascending and descending pathways, basal ganglia and cerebellar function. the special senses Functions of the autonomic nervous system and hypothalamic-pituitary function Cerebral blood flow and metabolism including cerebral autoregulation and vasospasm, the blood brain barrier, cerebral oedema, cerebral ischaemia and neuroprotection Intracranial pressure dynamics and CSF hydrodynamics - production and absorption
Clinical Skills	N/A

TOPIC	Neuropharmacology
Category	Core neurosciences
Objective	*To understand the principles of neuropharmacology*
Knowledge	Receptor and ion channel function Neuropeptides and neurotransmitters Principles of pharmacological neuroprotection The pharmacology of anaesthetic agents, muscle relaxants, barbiturates, anticonvulsants and corticosteroids including: • mechanisms of action • pharmacodynamics • interactions
Clinical Skills	N/A

TOPIC	Neuropathology
Category	Core neurosciences
Objective	*To understand the neuropathology of infection, inflammation, ischaemia, 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, tumours and leucoencephalopathies Cytopathology of neurones and glial in response to ischaemia, 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 tumours Tumour biology, cell kinetics, tumour markers, immunocytochemistry
Clinical Skills	N/A

TOPIC	Neuroradiology
Category	Core neurosciences
Objective	*To understand the principles of neuroradiological imaging of the structure and function of the nervous system*

Knowledge	Interpretation of plain radiographs of the skull and spine Principles of computerised tomography of the brain, skull and spine Interpretation of CT scans with particular reference to acute spinal disorders, cranial trauma, hydrocephalus, intracranial tumours and spontaneous intracranial haemorrhage Principles of basic magnetic resonance imaging Interpretation of MRI scans with particular reference to acute spinal disorders, cranial trauma, hydrocephalus and intracranial tumours Principles of advanced magnetic resonance imaging including fMRI, DWI and spectroscopy Interpretation of angiographic images: CTA, MRA and DSA Principles of ultrasound including intraoperative and diagnostic use, doppler and the assessment of cerebral blood flow velocity Principles and uses of PET and SPECT scanning
Clinical Skills	N/A

TOPIC	**Clinical neurophysiology**
Category	Core neurosciences
Objective	*To understand the basic principles of clinical neurophysiology*
Knowledge	Principles of electroencephalography Principles of somatosensory, motor and brainstem evoked potential monitoring Peripheral neuropathies and entrapment neuropathies including: • structure and function of peripheral nerves • use of nerve conduction studies Disorders of the neuromuscular junction including: • structure and function of smooth and striated muscle • use of electromyographic studies
Clinical Skills	Interpretation of the results of EEG, EMG and NC studies

TOPIC	**Neuropsychology**
Category	Core neurosciences
Objective	*To understand the principles of neuropsychological assessment, application of the Mental Health Act*
Knowledge	The principles of neuropsychological assessment Common neuropsychological problems associated with head injury, subarachnoid haemorrhage, hydrocephalus, structural lesions of the frontal and temporal lobes and disorders of the limbic system
Clinical Skills	Ability to undertake bed-side assessment of cognition and memory

TOPIC	**Neurological rehabilitation**
Category	Core neurosciences

Objective	*To understand the principles of neurological rehabilitation*
Knowledge	The principles of neurological rehabilitation including strategies to optimise the recovery of cognition, communication, continence, selective movement, gait, self-care, psychological stability, social adjustment and employment
Clinical Skills	N/A

TOPIC	**Medical ethics**
Category	Core neurosciences
Objective	*To understand the ethical issues that commonly arise in the management of patients with neurological disorders*
Knowledge	Criteria for the diagnosis of brainstem death 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
Clinical Skills	Ability to empathise with and support patients and carers

TOPIC	**Neurogenetics**
Category	Core neurosciences
Objective	*To understand the principles of neurogenetic studies and their relevance to clinical practice*
Knowledge	Inherited neurological disorders Genetic control of neural connectivity Inborn errors of metabolism Molecular genetics of CNS tumours
Clinical Skills	N/A

COMMON NEUROLOGICAL PRESENTATIONS

TOPIC	**Headache - acute and chronic**
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with acute and chronic headache*

Knowledge	The aetiology 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 • trigemminal neuralgia • atypical craniofacial pain syndrome • Intracranial hypotension Indications for investigation including scanning, lumbar puncture and angiography
Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	**Weakness and paralysis**
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with weakness and paralysis*
Knowledge	Common causes of ocular, cranial nerve, limb, trunk and respiratory muscle weakness
Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	**Dizziness, unsteadiness and falls**
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with dizziness, unsteadiness and falls*
Knowledge	Common causes of cerebellar, vestibular, extrapyrammidal and autonomic dysfunction
Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	Pain and sensory loss
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with pain and sensory loss*
Knowledge	Common causes of musculoskeletal, neurogenic and neuropathic pain and sensory loss
Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	Hearing disorder
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with hearing loss*
Knowledge	Common causes of conductive and sensorineural hearing loss Principles of audiological assessment
Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans Interpretation of pure tone audiograms and auditory evoked potentials Presentation and summary of cases

TOPIC	Visual disorder
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with visual disorders*
Knowledge	Patterns of visual loss in relation to common bulbar, retrobulbar, sellar, parasellar and optic pathway disorders Analysis of diplopia and nystagmus in relation to common cranial nerve and brainstem disorders
Clinical Skills	Neurological history taking Neurological examination Use of computerised visual field assessment Detailed fundoscopy Establishing a neurological differential diagnosis Planning investigation

	Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	**Language and speech disturbance**
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with disturbances of language and speech*
Knowledge	Classification, causes and presentations of dysphasias, speech dyspraxia and dyslexia Classification, causes and presentations of dysarthria Role of speech and language therapists in assessment and treatment
Clinical Skills	Neurological history taking Neurological examination with assessment of dysphasia and dysarthria Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	**Swallowing disorders**
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with swallowing disorders*
Knowledge	Neurological causes of dysphagia Indications for laryngoscopy, videofluoroscopy, nasogastric and percutaneous gastric feeding
Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	**Disorders of the Sphincteric and sexual function**
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with sphincteric disorders*
Knowledge	Common causes of sphincteric and sexual dysfunction Interpretation of urodynamic studies

Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	**Movement disorder**
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with movement disorders*
Knowledge	Parkinson's disease Iatrogenic movement disorders Dystonic syndromes Choreiform syndromes
Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	**Memory and cognitive disorders**
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with disorders of memory and cognition*
Knowledge	Disorders of memory and cognition associated with head injury, subarachnoid haemorrhage, hydrocephalus, structural lesions of the frontal and temporal lobes and disorders of the limbic system
Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

TOPIC	**Behavioural disorders**
Category	Common neurological presentations
Objective	*To understand the aetiology, differential diagnosis, investigation and initial management of patients presenting with behavioural disorders*
Knowledge	The common acute and chronic presentations of organic and psychiatric behavioural disorders relating to alcohol and drug abuse, encephalitis, organic

	dementia, and psychosis
Clinical Skills	Neurological history taking Neurological examination Establishing a neurological differential diagnosis Planning investigation Interpretation of scans and other investigations Presentation and summary of cases

CRITICAL CONDITIONS

TOPIC	**Impaired consciousness and seizures**	**Phase 1 knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency management of patients presenting with impaired consciousness and non-traumatic coma*	
Knowledge	Aetiology, pathophysiology and differential diagnosis of altered consciousness and coma Assessment of the patient with impaired consciousness The emergency management and investigation of patients with deteriorating levels of consciousness or seizures	
Clinical Skills	Clinical assessment of patients with impaired consciousness or seizures Emergency management of patients with impaired consciousness or seizures Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Maintenance of airway Endotracheal intubation Lumbar puncture	

TOPIC	**Cranial trauma**	**Phase 1 knowledge level**
Category	Critical conditions	3
Objective	*To achieve competence in the emergency, intensive care and ward-based management of head-injured patients*	
Knowledge	Anatomy and blood supply of the scalp, cranium, meninges and brain Pathophysiology of head injury and of multiple trauma Emergency, intensive care and ward-based management of patients with a head injury Principles of operative interventions	

	The detection and management of complications Rehabilitation and prognosis of patients following a head injury Principles, diagnosis and confirmation of brain stem death	
Clinical Skills	Clinical assessment of patients with a head injury Emergency management of patients with a head injury Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Wound exploration, debridement and closure Burr hole drainage of chronic subdural haematoma Insertion of intracranial pressure monitor Principles of trauma craniotomy for acute subdural and extradural haematomas	

TOPIC	**Acute hydrocephalus**	**Phase 1 knowledge level**
Category	Critical conditions	3
Objective	*To achieve competence in the emergency, intensive care and ward-based management of patients with acute hydrocephalus*	
Knowledge	The pathophysiology of CSF circulation Applied surgical anatomy of the ventricular system Emergency, intensive care and ward-based management of patients with acute hydrocephalus and shunt failure Principles of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with hydrocephalus	
Clinical Skills	Clinical assessment of patients with acute hydrocephalus Emergency management of patients with acute hydrocephalus Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Lumbar puncture Insertion and taping of CSF reservoirs Insertion and maintenance of lumbar and ventricular drains Insertion of external ventricular drain	

TOPIC	**Acute tumour presentations**	**Phase 1 knowledge level**
Category	Critical conditions	2
Objective	*To achieve competence in the emergency, intensive care and ward-based management of patients with intracranial tumours*	

Knowledge	The neuropathology of primary and secondary intracranial tumours Functional cerebral anatomy Emergency, intensive care and ward-based management of patients with an intracranial tumour Principles of operative interventions The detection and management of complications Rehabilitation, further treatment and prognosis of patients with a brain tumour	
Clinical Skills	Clinical assessment of patients with an acute tumour presentation Emergency management of patients with an intracranial tumour Interpretation of imaging studies including MRI and CT Breaking bad news to patients and families	
Technical Skills and Procedures	None specified	

TOPIC	**Spontaneous intracranial haemorrhage**	**Phase 1 knowledge level**
Category	Critical conditions	2
Objective	*To achieve competence in the emergency, intensive care and ward-based management of patients with subarachnoid haemorrhages (SAH) and Spontaneous Intracerebral Haemorrhages (ICH)*	
Knowledge	Anatomy and Physiology of the cerebral arterial and venous circulations Aetiology and pathophysiology of SAH and ICH Emergency, intensive care and ward-based management of patients with spontaneous intracranial haemorrhage Principles of operative and neuroradiological interventions The detection and management of complications Rehabilitation and prognosis of patients following a spontaneous intracranial haemorrhage	
Clinical Skills	Clinical assessment of patients with a spontaneous intracranial haemorrhage Emergency management of patients with an intracranial haemorrhage Interpretation of imaging studies including MRI, CT and angiograms	
Technical Skills and Procedures	Lumbar puncture	

TOPIC	CNS infections	Phase 1 knowledge level
Category	Critical conditions	2
Objective	*To achieve competence in the emergency, intensive care and ward-based management of CNS infections*	
Knowledge	Aetiology and pathophysiology of CNS infections including surgery related infections, meningitis, cerebral abscess and subdural empyema Microbiological pathogens and antibiotic selection Emergency, intensive care and ward-based management of patients with CNS infections Principles of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with CNS infections	
Clinical Skills	Clinical assessment of patients with CNS infections Emergency management of patients with CNS infections Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Lumbar puncture	

TOPIC	Spinal trauma	Phase 1 knowledge level
Category	Critical conditions	2
Objective	*To achieve competence in the emergency, intensive care and ward-based management of spinal trauma*	
Knowledge	Epidemiology of spinal trauma Spinal biomechanics and the classification of injuries Pathophysiology of spinal cord injury Emergency, intensive care and ward-based management of patients with spinal injuries Principles of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with a spinal injury	
Clinical Skills	Clinical assessment of patients with a spinal injury Emergency management of patients with spinal trauma Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Use of external immobilisation including cervical collars Application of cranial-cervical traction Application of a halo-body jacket	

TOPIC	Spinal oncology	Phase 1 knowledge level
Category	Critical conditions	2
Objective	*To achieve competence in the emergency, intensive care and ward-based management of spinal oncology*	
Knowledge	The neuropathology of primary and secondary spinal tumours Clinical presentations of intramedullary, intradural extramedullary, extradural and bony spinal tumours including malignant spinal cord compression Emergency, intensive care and ward-based management of patients with spinal tumours Principles of operative interventions The detection and management of complications Rehabilitation, further treatment and prognosis of patients with spinal tumours	
Clinical Skills	Clinical assessment of patients with a spinal tumour Emergency management of patients with a spinal tumour Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	None specified	

TOPIC	Acute spinal disorders and cauda equina syndrome	Phase 1 knowledge level
Category	Critical conditions	3
Objective	*To achieve competence in the emergency, intensive care and ward-based management of acute spinal disorders especially cauda equina syndrome*	
Knowledge	Anatomy of the spine, spinal cord, autonomic and somatic nervous systems Physiology of spinal cord function and control of the bladder Pathophysiology of cauda equina syndrome, nerve root compression and spinal cord compression Emergency, intensive care and ward-based management of patients with acute spinal disorders Principles of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with acute spinal disorders	
Clinical Skills	Clinical assessment of patients with an acute spinal disorder Emergency management of patients with an acute spinal disorder Interpretation of imaging studies including MRI and CT	

Technical Skills and Procedures	None	

TOPIC	**Emergency paediatric neurosurgery**	**Phase 1 knowledge level**
Category	Critical conditions	1
Objective	*To achieve competence in the emergency management of paediatric neurosurgical patients*	
Knowledge	Paediatric physiology Pathophysiology of hydrocephalus, head injury and acute presentations of tumours and intracranial haemorrhage in children of all ages Child Safeguarding principles Understanding of Children's rights and surgical consent	
Clinical Skills	Clinical assessment of children with acute neurosurgical disorders Emergency management of children with acute neurosurgical disorders	
Technical Skills and Procedures	Lumbar puncture in children Taping of CSF reservoirs in children	

INDEX PROCEDURES

TOPIC	**Lumbar puncture and lumbar drain insertion**	**Phase 1 Technical Level**
Category	Index procedures	4
Objective	*To achieve competence in performing lumbar punctures and inserting lumbar drains*	
Knowledge	Indications and contraindications for diagnostic lumbar puncture Anatomy of the spine and spinal cisterns Interpretation of CSF microscopy and biochemistry	
Technical Skills and Procedures	Patient consent and preparation Selection of appropriate equipment Use of local anaesthetic Patient positioning Skin preparation Needle insertion and pressure measurement Inserting, connecting and securing a lumbar drain Post procedure care	

TOPIC	Insertion of ICP monitor	Phase 1 Technical Level
Category	Index procedures	3
Objective	*To achieve competence in the insertion of intraparenchymal ICP monitors*	
Knowledge	Indications for ICP monitoring Applied anatomy of the skull vault Calibration, zeroing and interpretation of ICP traces Potential complications of the procedure	
Technical Skills and Procedures	Patient consent and preparation Selection of appropriate equipment Use of local anaesthetic Patient positioning Skin preparation Burr hole / twist drill fenestration and insertion of probe Inserting, connecting and securing an ICP monitor Post procedure care	

TOPIC	Burr hole evacuation of chronic subdural haematoma	Phase 1 Technical Level
Category	Index procedures	2
Objective	*To achieve competence in burr hole evacuation of chronic subdural haematomas*	
Knowledge	Pathophysiology of chronic subdural haematomas Applied anatomy of the skull vault and subdural space Indications for surgery Surgical options Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	Patient consent and preparation Selection of appropriate equipment Use of local anaesthetic, and antibiotics Patient positioning Skin preparation Burr hole fenestration and drainage of subdural haematoma Closure Post procedure care	

TOPIC	Insertion of EVD	Phase 1 Technical Level
Category	Index procedures	2

Objective	*To achieve competence in inserting an EVD*	
Knowledge	Applied anatomy of the ventricles Indications for surgery Surgical options Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	Patient consent and preparation Selection of appropriate equipment Use of local anaesthetic, manitol and antibiotics Patient positioning Skin preparation Burr hole fenestration and insertion of EVD Inserting, connecting and securing an EVD Post procedure care	

TOPIC	**Craniotomy**	**Phase 1 Technical Level**
Category	Index procedures	2
Objective	*To achieve competence in performing a craniotomy*	
Knowledge	Applied anatomy of the meninges, skull and scalp Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	Patient consent and preparation Selection of appropriate equipment Use of local anaesthetic, manitol and antibiotics Patient positioning Skin preparation Skin incision and scalp management Skull fenestration and use of a craniotome Opening the dura Closing a craniotomy Post procedure care	

TOPIC	**Lumbar decompression (approach)**	**Phase 1 Technical Level**
Category	Index procedures	2
Objective	*To achieve competence in approach to decompressing the lumbar canal*	
Knowledge	Applied anatomy of the lumbar spine, discs, muscles and ligaments Indications for surgery	

	Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	Patient consent and preparation Selection of appropriate equipment Use of local anaesthetic and antibiotics Patient positioning Skin preparation Skin incision and approach to the posterior elements Closure Post procedure care	

Phase 2 Neurosurgery Training

Overview

During phase 2 trainees will consolidate the theoretical knowledge and clinical skills already gained during phase 1. They will develop their surgical judgement, decision making and operative competencies in:

- Emergency Neurosurgery including trauma (the general management of the head injured patients; surgical management of cranial trauma; neuro-intensive care of the head-injured patient and the role of post-traumatic neurological rehabilitation), infections (the general management of CNS infections e.g. ventriculitis, cerebral abscess, subdural empyema and spinal epidural abscess; the operative management of cerebral abscess by burr hole aspiration), acute hydrocephalus, intracranial haemorrhage and acute tumour presentations.
- Hydrocephalus including the assessment and operative management of adult patients with communicating and non-communicating hydrocephalus; the assessment of children with hydrocephalus; emergency external ventricular drainage in children with acute hydrocephalus and endoscopic third ventriculostomy.
- Neuro-Oncology including the multi-disciplinary management of patients with intracranial neoplasia; image-guided surgery applied to the management of patients with intracranial tumours; the operative management of supra-tentorial intrinsic tumours and the operative management of convexity meningiomas.
- Skull Base and Pituitary Surgery including management of the majority of cases, including acquisition of transferrable microsurgical skills and the surgical treatment of pituitary tumours.
- Neurovascular Surgery including management of all patients with acute presentations of neurovascular conditions including subarachnoid haemorrhage, intraparenchymal haemorrhage, intraventricular haemorrhage and massive cerebral or cerebellar infarctions
- Pain, Epilepsy and Functional including management of trigeminal neuralgia, seizures and movement disorders. Complications of procedures including infected or malfunctioning implants
- Spinal Surgery including management of patients with acute and elective presentations of cervical and lumbar spinal degenerative disease requiring operative intervention (eg disc prolapse causing radiculopathy, cauda equina syndrome or myelopathy). Emergency and surgical management of spinal infection, oncological disease and trauma. Extramedullary spinal cord tumours including the general and surgical management of patients with malignant spinal cord compression.
- Paediatric Neurosurgery including the emergency management of children with raised intracranial pressure, including operative management where delay due to transfer time will cause harm to the patient. Possible causes include traumatic brain swelling, intracranial haemorrhage (trauma or spontaneous), brain tumours and hydrocephalus. Elective management of paediatric hydrocephalus.
- Peripheral Nerve Surgery including the diagnosis of compressive lesions

By the end of phase 2, the standard expected is that a trainee can demonstrate the knowledge, clinical and professional skills of a day-one consultant and the ability to acquire microsurgical skills in Neurosurgery as defined by the syllabus. This is assessed at the ARCP. The ISB examination in Neurosurgery will normally be achieved by completion of phase 2.

Phase 2 Capability in Practice

Capability in practice	Indicative supervision level
1. Manages an outpatient clinic	Level III
2. Manages the unselected emergency take	Level III
3. Manages ward rounds and the on-going care of inpatients	Level III
4. Manages an operating list	Level III
5. Manages multi-disciplinary working	Level III

Phase 2 Critical conditions

Critical condition	Assessed by	Indicative knowledge level
Impaired consciousness and seizures	CBD or CEX	4
Cranial trauma	CBD or CEX	4
Spontaneous intracranial haemorrhage	CBD or CEX	4
Acute hydrocephalus	CBD or CEX	4
Intracranial tumours	CBD or CEX	4
CNS infections	CBD or CEX	4
Spinal trauma	CBD or CEX	4
Spinal oncology	CBD or CEX	4
Degenerative spinal disorders	CBD or CEX	4
Emergency paediatric neurosurgery	CBD or CEX	4

Phase 2 Index procedures

Index procedure	Assessed by	Indicative number (excluding assisted) by certification	Indicative skill level expected by the end of phase 2
Advanced adult supratentorial	PBA	10	3
Endoscopic and transphenoidal	PBA	10	3
Convexity and falcine meningiomas	PBA	10	3
Advanced adult infratentorial	PBA	10	3
Intradural spine	PBA	5	3
Complex spinal fusion	PBA	10	3
Advanced paediatric supratentorial	PBA	1	2
Advanced paediatric infratentorial	PBA	1	2

Clinical Placements in Phase 2

Clinical placements in Phase 2 will ensure that trainees are exposed to all areas of Neurosurgical practice. Trainees must participate in a neurosurgical on-call rota.

All trainees will undertake a minimum six-month placement in a paediatric neurosurgery service under the direct supervision of paediatric neurosurgeons with a full-time or major commitment to paediatric surgery. The service must provide a comprehensive range of paediatric neurosurgical care (with the exception of supra-regional services) and have an annual operative workload of at least 150 cases.

Trainees at ST3 level will need high levels of support especially when on call. Local arrangements should be made to provide this support and should include a named more senior trainee providing cover on call, mentoring from a more senior registrar colleague and rota flexibility to ensure ST3 trainees are not exposed to high risk shifts too early.

The organisation of clinical placements is at the discretion of the programme director. The following principles apply:

- The Shape of Training review identified that training is optimal in longer (6 month) rather than shorter (4 month) attachments
- Training programme directors will be familiar with parts of their training programme that provide training in key areas. Training surveys and logbook data can also be used to provide this information.
- Trainees should be placed flexibly in posts that support their training needs
- Trainees on placements should receive training and are not primarily in these placements to support service requirements

Phase 2 Topics

Cranial Trauma

TOPIC	**Early and surgical management of the head injured patient**
Category	Cranial Trauma
Objective	*To achieve competence in all aspects of the general and surgical management of head-injured patients*
Knowledge	Epidemiology and Outcomes of head injury Pathophysiology of head injury and of multiple trauma Emergency management of head injury Assessment and investigation of the patient with a head injury Medical management of acutely raised intracranial pressure Surgical management of head injury Indications for operative intervention Applied surgical anatomy Principles of peri-operative care Surgical approaches Complications of surgery and their management Indications for endoscopic and open closure of traumatic CSF fistulae

Clinical Skills	Clinical assessment of the head-injured and multiply-injured patient Prioritisation of clinical risk Interpretation of CT scans and plain radiology Ability to assess and advise on the transfer of head-injured patient using image-transfer and telemedicine
Technical Skills and Procedures	Craniotomy for supra and infratentorial extradural, subdural and intracerebral haematomas Lobectomy for haemorrhagic contusion Decompressive bifrontal craniotomy with extensive durotomy Subfrontal extradural or subdural repair of anterior fossa fractures Elevation of compound depressed skull fracture with dural repair Delayed cranioplasty of the skull vault Craniofacial repair of a CSF leak

TOPIC	**Neuro-intensive care and ward-based care of the head-injured patient**
Category	Cranial Trauma
Objective	*To achieve competence in the neurointensive care of head-injured patients*
Knowledge	Pathophysiology of head injury The management of raised intracranial pressure, impaired intracranial compliance, and cerebral ischaemia Prevention and management of secondary insults
Clinical Skills	Assessment of the unconscious patient Use and interpretation of multimodality cerebral monitoring Interpretation of CT scans Ability to advise on management of secondary complications and further surgical intervention
Technical Skills and Procedures	Insertion of ICP monitor

TOPIC	**Neurological rehabilitation following head injury**
Category	Cranial Trauma
Objective	*To understand the role of post-traumatic neurological rehabilitation*
Knowledge	The natural history of recovery from head injury Understanding of neurological, cognitive and behavioural disabilities following mild and severe head injury Risks of post-traumatic epilepsy and its management Concussion and sports related head injury
Clinical Skills	Ability to contribute to the multi-disciplinary assessment of head injured patients Ability to advise family and carers regarding prognosis, professional and lay support

Technical Skills and Procedures	None specified

CSF Pathologies

TOPIC	**Hydrocephalus**
Category	CSF pathologies
Objective	*To achieve competence the assessment and operative management of patients with communicating and non-communicating hydrocephalus.*
Knowledge	The pathophysiology of CSF production, circulation and absorbtion Applied surgical anatomy of the ventricular system Shunt technology including valve design and antibiotic impregnation of catheters Indications for external ventricular drainage, ventriculoperitoneal shunting, lumbar CSF drainage and shunting, endoscopic third ventriculostomy Complications of surgery Normal pressure hydrocephalus
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with hydrocephalus, including interpretation of CT and MRI scans and identification of shunt malfunction Identification of papillodoema Interpretation of pressure studies and CSF infusion studies
Technical Skills and Procedures	Insertion of ICP monitor Lumbar subarachnoid drainage and lumbar puncture External ventricular drainage Primary and revision procedures on ventriculoperitoneal shunts in all age groups Use of 3-D image-guidance or ultrasound for difficult ventricular cannulation Lumbo-peritoneal shunt Endoscopic third ventriculostomy

TOPIC	**Idiopathic and Venous Intracranial Hypertension**
Category	CSF pathologies
Objective	*To achieve competence the assessment and operative management of adult patients with raised intracranial pressure from venous or idiopathic causes.*
Knowledge	The pathophysiology and differential diagnosis of idiopathic and venous intracranial hypertension Applied surgical anatomy of the venous system Assessment and investigation of patients with idiopathic intracranial hypertension Medical management of idiopathic intracranial hypertension Indications for ICP pressure monitoring, lumbar puncture, lumbo-peritoneal shunt, ventriculoperitoneal shunt, subtemporal decompression, optic nerve fenestration and vascular stenting Complications of surgery and their management

Clinical Skills	The assessment, counselling and pre-operative preparation of patients with idiopathic intracranial hypertension, including interpretation of imaging and pressure studies and identification of shunt malfunction Identification of papillodoema
Technical Skills and Procedures	Insertion of ICP monitor Lumbar puncture Primary and revision procedures on ventriculoperitoneal and lumbo-peritoneal shunts Use of 3-D image-guidance or ultrasound for difficult ventricular cannulation

TOPIC	**Arachnoid cysts**
Category	CSF pathologies
Objective	*To achieve competence in the management of cranial and spinal arachnoid cysts*
Knowledge	The pathogenesis, grading and natural history of arachnoid cysts Indications for surgical intervention Selection of surgical approach including endoscopic, open fenestration and shunting Complications of surgery
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with an arachnoid cyst Interpretation of imaging studies
Technical Skills and Procedures	Endoscopic fenestration of arachnoid cyst Open fenestration of arachnoid cyst Shunting of arachnoid cyst

TOPIC	**Hindbrain Herniation and Syringomyelia**
Category	CSF pathologies
Objective	*To achieve competence in the management of craniocervical stenosis, hindbrain herniation and syringomyelia*
Knowledge	The pathogenesis and natural history of hindbrain herniation, cranicervical stenosis, syringomyelia and syringobulbia Familiarity with craniocervical congenital and acquired bony or ligamentous anomalies Indications for foramen magnum decompression or direct approaches to a syrinx Applied surgical anatomy of the craniocervical junction and spinal cord Selection of surgical approaches Principles of peri-operative care Complications of surgery
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with hind brain anomalies Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms and 3D spinal reconstructions

Technical Skills and Procedures	Foramen magnum decompression Syringostomy and syringo-pleural shunting

Neuro-oncology

TOPIC	**General principles of neuro-oncology**
Category	Neuro-oncology
Objective	*To achieve competence in the multi-disciplinary management of patients with intracranial neoplasia*
Knowledge	Classification, natural history and pathology including molecular classification, of benign and malignant intracranial neoplasia and cysts Genetic tumour syndromes including neurofibromatosis, tuberous sclerosis, von HippelLindau, multiple endocrine neoplasia, Turcot's and Li Fraumeni Pathophysiology of raised intracranial pressure associated with space occupying tumours Diagnostic imaging of intracranial tumours including the interpretation of CT and MRI scans and the role of advanced imaging including spectroscopy, PET and SPECT Principles of fractionated radiotherapy, stereotactic radiotherapy and radiosurgery including proton beam therapy Role of chemotherapy and immunotherapy Principles of clinical trials and their application to neuro-oncology Principles of palliative care
Clinical Skills	Clinical assessment of patients with raised intracranial pressure and space occupying lesions Ability to contribute to the multi-disciplinary management of patients with intracranial neoplasia Empathetic communication with patients and families
Technical Skills and Procedures	None specified

TOPIC	**Intrinsic tumours**
Category	Neuro-oncology
Objective	*To achieve competence in the operative management of Intrinsic tumours*
Knowledge	Pathology of glial tumours, lymphomas, metastases and benign intrinsic tumours including haemangioblastoma. Indications for surgery Applied surgical anatomy Principles of peri-operative care Complications of surgery An understanding of the principles and practice of frameless image-guided surgery, the principles of frame-based stereotactic surgery and the place of

	robotic surgery Principles and practice of awake craniotomy Techniques to maximise resection margins whilst avoiding eloquent cerebral cortex
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with intrinsic tumours Interpretation of CT and MRI scans Ability to work with the multidisciplinary team
Technical Skills and Procedures	Familiarity with image guidance set up and use Craniotomy for intrinsic tumours of the cerebral cortex and posterior fossa including convexity, midline, suboccipital and retrosigmoid approaches Image-guided biopsy of intrinsic tumours Use of pre-operative and intra-operative techniques to identify eloquent brain Use of pre-operative and intra-operative techniques to maximise tumour resection

TOPIC	**Meningiomas**
Category	Neuro-oncology
Objective	*To achieve competence in the operative management of mengingiomas*
Knowledge	Pathology and grading of meningiomas and solitary fibrous tumours Treatments for meningiomas including watch and wait, radiotherapy, stereotactic radiosurgery and the indications for surgery Applied surgical anatomy Principles of peri-operative care Complications of surgery
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with convexity, midline, lateral skull base, olfactory groove and intraventricular meningiomas
Technical Skills and Procedures	Resection of convexity meningioma Resection of parasagittal and falcine meningiomas Resection of olfactory grove meningioma Resection of lateral skull base meningioma

TOPIC	**Cerebellopontine angle tumours**
Category	Neuro-oncology
Objective	*To achieve competence in the management of patients with cerebellopontine angle tumours*
Knowledge	Pathology of Vestibular schwannomas, meningiomas, glomus tumours, dermoid and epidermoid cysts including knowledge of Neurofibromatosis type II. Relative indications for surgery, radiosurgery and conservative management Principles of intra-operative management of patients undergoing resection of CP angle tumours including 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, tumour size and position
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with CP angle tumours Interpretation of CT and MR scans
Technical Skills and Procedures	Retrosigmoid approach Subarachnoid dissection and exposure of the tumour and lower cranial nerves Subtotal microsurgical resection of acoustic neuroma

TOPIC	**Sellar and suprasellar mass lesions**
Category	Neuro-oncology
Objective	*To achieve competence in transphenoidal and cranial approaches to sellar and suprasellar mass lesions*
Knowledge	Pathology of pituitary adenoma, craniopharyngioma and Rathke's cleft cyst Pathophysiology of the hypothalamic-pituitary axis Investigation of patients with hypothalamic-pituitary axis lesions Medical treatments for pituitary adenomas and for pituitary failure Indications for surgery Selection of surgical approaches: pterional, interhemispheric, endoscopic or microsurgical transphenoidal Applied surgical anatomy of the skull base Principles of peri-operative care Complications of surgery and their management
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with pituitary, sellar and parasellar tumours Interpretation of CT and MRI scans
Technical Skills and Procedures	Endoscopic and microsurgical transphenoidal approach Pterional craniotomy for pituitary adenoma or craniopharyngioma

TOPIC	Intraventricular and pineal region tumours
Category	Neuro-oncology
Objective	*To achieve competence in the management of patients with pineal region and third ventricular tumours including colloid cysts*
Knowledge	Pathology of pineal region and intraventricular mass lesions including pineocytoma, pineoblastoma, germ cell tumours, meningiomas, choroid plexus tumours, glioneuronal tumours and colloid cysts Assessment of patients with pineal region tumours including the role of tumour markers Emergency management of patients presenting with hydrocephalus from a pineal or intraventricular mass Relative indications for surgery, radiosurgery and conservative management Applied surgical anatomy of midline structures Selection of surgical approaches including principles of endoscopic biopsy and/or resection Principles of intra-operative management of patients undergoing resection of pineal and ventricular tumours including colloid cysts Complications of surgery and their management
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with intraventricular and pineal region tumours Interpretation of CT and MRI scans
Technical Skills and Procedures	Insertion of EVD and VP shunt Interhemispheric and transcortical approach to the lateral and third ventricle Endoscopic biopsy of tumours, endoscopic third venriculostomy and endoscopic excision of colloid cyst

TOPIC	Skull and skull base tumours
Category	Neuro-oncology
Objective	*To achieve competence in the assessment of patients with skull and skull base lesions*
Knowledge	Pathology of skull and skull base abnormalities including fibrous dysplasia, lytic skull lesions, chordoma, chondrosarcoma and esthesioneuroblastoma, cranial nerve schwannomas, paragangliomas, adenoid cystic carcinomas, angiofibromas and nasopharyngeal carcinomas Assessment of patients with skull base mass lesions especially with regards to cranial nerve and vascular involvement Relative indications for surgery, radiotherapy, radiosurgery, proton beam therapy and conservative management Applied surgical anatomy of midline structures Complications of surgery and their management
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with mass lesions in the skull base or skull. Interpretation of CT and MRI scans

Technical Skills and Procedures	Resection of convexity skull lesion

Neurovascular

TOPIC	**Primary intracerebral haemorrhage**
Category	Neurovascular
Objective	*To achieve competence in the operative management of space-occupying spontaneous intracerebral haematomas*
Knowledge	Aetiology of supra and infratentorial intracerebral haemorrhage Pathophysiology of spontaneous intracerebral haemorrhage Indications for surgical evacuation Management strategies to reduce the risk of intra-operative re-bleeding in presence of suspected aneurysm or AVM including partial haematoma evacuation, pre or post-operative embolisation and definitive surgical treatment
Clinical Skills	Assessment of patients with intracerebral haematomas and raised intracranial pressure Interpretation of CT and MRI scans and identification of probable aetiology Indications for and interpretation of CT, MR and digital subtraction angiography
Technical Skills and Procedures	Insertion of external ventricular drain Craniotomy for supratentorial haematoma Decompressive craniectomy

TOPIC	**Aneurysmal subarachnoid haemorrhage**
Category	Neurovascular
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of aneurysmal subarachnoid haemorrhage*
Knowledge	Pathophysiology and general management of subarachnoid haemorrhage Investigation of patients with subarachnoid haemorrhage Management of non-aneurysmal subarachnoid haemorrhage Relative indications for endovascular and surgical interventions Prevention and management of delayed cerebral ischaemia, cerebral vasospasm and hydrocephalus
Clinical Skills	Clinical assessment and investigation of patients with aneurysmal SAH Non operative management of patients with aneurysmal SAH Management of delayed cerebral ischaemia
Technical Skills and Procedures	External ventricular drainage Lumbar subarachnoid drainage Ventriculoperitoneal shunting

TOPIC	Intracranial aneurysms
Category	Neurovascular
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of ruptured and unruptured intracranial aneurysms*
Knowledge	Aetiology, epidemiology and natural history of unruptured and ruptured intracranial aneurysms Angiographic and microsurgical anatomy of the cerebral circulation Indications for surgical management of intracranial aneurysms by clipping, trapping, microsurgical reconstruction and microvascular bypass Complications of surgery and their management
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with ruptured and unruptured aneurysms Interpretation of CT, MR and catheter angiography
Technical Skills and Procedures	Standard pterional and subfrontal approaches

TOPIC	Vascular malformations
Category	Neurovascular
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of vascular malformations*
Knowledge	Pathogenesis, aetiology, epidemiology and natural history of intracranial vascular malformations including AVMs, A-V fistulas, cavernomas and venous malformations Pathogenesis, aetiology, epidemiology and natural history of spinal vascular malformations including AVMs, A-V fistulas and cavernomas. Angiographic and microsurgical anatomy of the cerebral and spinal circulation Indications for embolisation and radiosurgery Indications for surgical management of malformations Complications of surgery, embolisation, Stereotactic radiosurgery and their management, including hyperperfusion syndromes
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with vascular malformations Interpretation of CT, MR and catheter angiography
Technical Skills and Procedures	Image-guided craniotomy and exposure of supratentorial AVM Image guided craniotomy and resection of cavernoma Ligation of spinal A-V fistula

TOPIC	Occlusive cerebrovascular disease
Category	Neurovascular
Objective	*To achieve competence in the clinical management of occlusive cerebrovascular disease*

Knowledge	The epidemiology, natural history and pathophysiology of extra- and intracranial atherosclerotic occlusive disease The epidemiology, natural history and pathophysiology of non-atherosclerotic occlusive diseases Principles of regional cerebral blood flow and metabolism measurement and imaging using CT and MRI perfusion techniques; SPECT and PET scanning Role of decompressive craniectomy in treating stroke Indications for stroke thrombolysis Principles of cerebral revascularisation by indirect synangiosis, low-flow EC-IC anastomosis and high flow EC-IC bypass grafting Indications for surgical treatment of carotid artery atherosclerosis
Clinical Skills	The assessment, counselling and pre-operative preparation of patients undergoing surgery for occlusive cerebrovascular disease Interpretation of CT, MR and digital subtraction angiography
Technical Skills and Procedures	Decompressive craniectomy

CNS Infection

TOPIC	**Intracerebral abscess and subdural empyema**
Category	CNS infection
Objective	*To achieve competence in the management of patients with CNS infections including ventriculitis, cerebral abscess and subdural empyema*
Knowledge	The aetiology and pathophysiology of intracranial sepsis including atypical infections such as TB, parasites and fungi Indications for burr hole drainage, ventricular drainage and craniotomy in the management of intracranial sepsis Indications for combined otorhinological procedures Applied surgical anatomy Principles of peri-operative care Surgical complications
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with intracranial sepsis Interpretation of CT and MRI scans Management of anti-microbial therapy
Technical Skills and Procedures	Image guided burr hole drainage of intracerebral abscess Insertion of external ventricular drain Craniotomy for subdural empyema, including parafalcine and retrosigmoid approaches Craniotomy and resection of frontal, temporal and cerebellar abscess

Spinal Trauma

TOPIC	**General management of the spinal injury patient**
Category	Spinal trauma
Objective	*To achieve competence in all aspects of the non-operative management of spinal injury patients.*
Knowledge	Pathophysiology of spinal cord injury Classification of spinal fractures Biomechanics of spinal stability Indications for traction and external stabilization Indications for and principles of open reduction and stabilization Principles of spinal injury rehabilitation
Clinical Skills	Clinical assessment of the spinal injury patient Management of spinal shock Interpretation of plain radiology, CT and MRI scans Liaison with spinal injury units
Technical Skills and Procedures	Use of external immobilisation including cervical collars Application of cranial-cervical traction Application of a halo-body jacket

TOPIC	**Cervical spine fractures**
Category	Spinal trauma
Objective	*To achieve competence in the general management of fractures of the cervical spine*
Knowledge	Pathophysiology of spinal cord injury and the classification of fractures in the axial and sub-axial cervical spine Biomechanics of spinal instability Cervical spine fractures associated with Ankylosing spondylitis Indications for traction and external stabilization Indications for and principles of open reduction, decompression and internal fixation
Clinical Skills	Clinical assessment of the spinal injury patient Management of spinal shock Interpretation of plain radiology, CT and MRI scans Liaison with spinal injury units Counselling and pre-operative preparation of spinal injury patients
Technical Skills and Procedures	Application of cranial-cervical traction Anterior cervical discectomy or corpectomy, insertion of cage and plating Posterior cervical decompression and fusion using lateral mass screws

TOPIC	**Thoraco-lumbar fractures**
Category	Spinal trauma
Objective	*To achieve competence in the general management of thoracolumbar fractures*
Knowledge	Pathophysiology of spinal cord injury and the classification of thoracolumbar fractures Biomechanics of spinal instability Indications for open reduction, decompression and stabilisation
Clinical Skills	Clinical assessment of the spinal injury patient Management of spinal shock Interpretation of plain radiology, CT and MRI scans Liaison with spinal injury units Counselling and pre-operative preparation of spinal injury patients
Technical Skills and Procedures	N/A

Spinal Oncology

TOPIC	**Malignant extradural spinal tumours**
Category	Spinal oncology
Objective	*To achieve competence in the general management of patients with malignant spinal cord compression and their surgical management.*
Knowledge	The pathophysiology of spinal cord compression The classification, aetiology and natural history of vertebral metastases and primary bony tumours of the vertebral column including lymphoma Spinal instability associated with vertebral malignancy Role of primary radiotherapy and adjuvant radiotherapy or chemotherapy Indications for surgical intervention and the principles of operative spinal decompression and stabilisation of patients with spinal cord metastases. Applied surgical anatomy Principles of peri-operative care Complications of surgery
Clinical Skills	Clinical assessment of patients with malignant spinal cord compression Interpretation of plain radiology, CT and MRI scans Liaison with medical and radiation oncologists The assessment, counselling and pre-operative preparation of patients with malignant spinal cord compression
Technical Skills and Procedures	Emergency posterior spinal decompression

TOPIC	**Intradural extramedullary and intramedullary tumours**
Category	Spinal oncology
Objective	*To achieve competence in the management of patients with intradural tumours*
Knowledge	Classification, natural history and molecular biology of intradural extramedullary spinal tumours including neurofibroma, schwannoma, meningioma, ependymoma and intramedullary tumours including ependymoma, astrocytoma, cavernoma and haemangioblastoma. Pathophysiology of spinal cord compression Indications for surgery and selection of surgical approach Applied surgical anatomy Principles of peri-operative care Complications of surgery and their management Awareness of the principles of spinal cord monitoring
Clinical Skills	Assessment, counselling and pre-operative preparation of patients with intradural spinal tumours Interpretation of spinal MRI scans
Technical Skills and Procedures	Microsurgical excision of intradural extramedullary tumours

Spinal Degenerative Disease

TOPIC	**Lumbar radiculopathies**
Category	Spinal degenerative disease
Objective	*To achieve competence in the surgical management of lumbar compressive radiculopathy*
Knowledge	Differential diagnosis especially peripheral neuropathies and spinal cord pathologies Indications for operative management of lumbar radiculopathies Classification of spondylolisthesis and indications for surgical fixation 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 Complications of surgery
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with lumbar radiculopathies Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms
Technical Skills and Procedures	Lumbar microdiscectomy Microsurgical lateral recess decompression Posterior decompression (laminotomy, hemilaminectomy etc) Revisional lumbar microsurgical discectomy with and without decompression

	Microsurgical lumbar discectomy for central disc protrusion with cauda equina compression

TOPIC	**Compressive cervical myeloradiculopathies**
Category	Spinal degenerative disease
Objective	*To achieve competence in the surgical management of compressive cervical myeloradiculopathies*
Knowledge	Differential diagnosis especially motor neurone disease, transverse myelitis and peripheral neuropathies. Indications for operative management of cervical myeloradiculopathies Applied surgical anatomy of the cervical spinal column with particular reference to the relationships between the bony elements, spinal cord, nerve roots and vertebral arteries Recognition and appropriate management of ossification of the posterior longtitudinal ligament, ankylosing spondylitis and cervical deformity Selection of surgical approaches Principles of peri-operative care Complications of surgery
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with cervical myeloradiculopathies Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms
Technical Skills and Procedures	Anterior cervical discectomy with and without fusion Anterior cervical corpectomy and fusion Posterior cervical foraminotomy Posterior cervical laminectomy, skip laminectomy, split laminectomy of trap door laminoplasty

Spinal Infection

TOPIC	**Spinal epidural abscess**
Category	Spinal infection
Objective	*To achieve competence in the operative management of spinal epidural abscess*
Knowledge	The aetiology and pathophysiology of spinal epidural abscess Indications for drainage of spinal epidural abscess by laminectomy or multiple laminotomies Applied surgical anatomy Principles of peri-operative care Surgical complications and their management Principles of peri-operative care

Clinical Skills	The assessment, counselling and pre-operative preparation of patients with spinal sepsis Interpretation of spinal CT and MRI scans Management of anti-microbial therapy
Technical Skills and Procedures	Drainage of spinal epidural abscess by laminectomy or multiple laminotomies

TOPIC	**Vertebral osteomyelitis and discitis**
Category	Spinal infection
Objective	*To achieve competence in the operative management of vertebral osteomyelitis and discitis*
Knowledge	The aetiology and pathophysiology of vertebral osteomyelitis and discitis, including pyogenic, tuberculous and atypical infections Indications for percutaneous and open biopsy Indications for spinal stabilization Principles of peri-operative care Surgical complications and their management
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with spinal sepsis Interpretation of spinal CT and MRI scans Management of anti-microbial therapy
Technical Skills and Procedures	Transpedicular and open vertebral and disc biopsy

Pain, Epilepsy and Functional

TOPIC	**Movement disorders**
Category	Pain, epilepsy and functional
Objective	*To understand the management of patients with movement disorders*
Knowledge	The aetiology and pathophysiology of movement disorders Indications for medical, minimally-invasive and surgical management Principles of deep brain stimulation for movement disorders Complications of surgery and their management
Clinical Skills	Surgical aspects of the multi-disciplinary assessment of patients with movement disorders
Technical Skills and Procedures	Management of complications of devices used to treat movement disorders

TOPIC	**Chronic pain**
Category	Pain, epilepsy and functional

Objective	*To understand the management of patients with chronic pain syndromes*
Knowledge	The aetiology and pathophysiology of chronic pain syndromes Indications for medical, minimally-invasive and surgical management Principles of deep brain stimulation, rhizotomy and lesioning for pain Complications of surgery and their management
Clinical Skills	Surgical aspects of the multi-disciplinary assessment of chronic pain patients Pre-operative counselling and preparation
Technical Skills and Procedures	Management of complications of devices used to treat pain

TOPIC	**Trigeminal neuralgia and hemifacial spasm**
Category	Pain, epilepsy and functional
Objective	To achieve competence in the surgical aspects of the multi-disciplinary management of patients with trigeminal neuralgia
Knowledge	Aetiology, epidemiology and natural history of trigeminal neuralgia and hemifacial spasm Differential diagnosis and management of related cranio-facial pain syndromes Medical management of cranio-facial pain Surface anatomy of the trigeminal and facial nerves and microsurgical anatomy of the CP angle Indications for surgical management of trigeminal neuralgia by peripheral neurectomy, percutaneous rhizotomy, radiofrequency rhizotomy, microvascular decompression or stereotactic radiosurgery Complications of surgery and their management
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with trigeminal neuralgia or hemifacial spasm Interpretation of posterior fossa CT and MRI scans
Technical Skills and Procedures	Microvascular decompression of the trigeminal or facial nerve Percutaneous trigeminal rhizotomy

TOPIC	**Epilepsy**
Category	Pain, epilepsy and functional
Objective	*To understand the management of patients with idiopathic and lesional epilepsy*
Knowledge	The aetiology and pathophysiology of idiopathic and lesional epilepsy Indications for medical and surgical management The assessment and surgical work-up for patients with seizures
Clinical Skills	Surgical aspects of the multi-disciplinary assessment of epilepsy patients Interpretation of CT, MRI and SPECT scans Pre-operative counselling and preparation
Technical	Management of complications of devices used to treat epilepsy

Skills and Procedures	

Paediatrics

TOPIC	**Paediatric head and spinal injury**
Category	Paediatrics
Objective	*To achieve competence the management of accidental and non-accidental paediatric head and spinal injuries.*
Knowledge	Pathophysiology of raised intracranial pressure in children following head injury Prevention and treatment of secondary insults relating to transfer and emergency surgery in head-injured children Medical management and intensive care in paediatric head injury Pathophysiology, legal and social aspects of non-accidental injury in children Management of perinatal trauma, growing fractures and penetrating injuries in children Indications for decompressive craniectomy in management of intractable increases in ICP Rehabilitation after mild, moderate and severe head injuries Diagnosis and certification of brain death in children Classification, assessment, investigation and management of paediatric spinal injuries (including SCIWORA)
Clinical Skills	Assessment and clinical management of children with head and spinal injuries
Technical Skills and Procedures	Subdural tap Insertion of ICP monitor Insertion of external ventricular drain Craniotomy for traumatic intracranial haematoma Elevation of depressed skull fracture

TOPIC	**Paediatric hydrocephalus**
Category	Paediatrics
Objective	*To achieve competence in the assessment of children with hydrocephalus. To undertake emergency external ventricular drainage in children with acute hydrocephalus*
Knowledge	The pathophysiology of CSF circulation Applied surgical anatomy of the ventricular system Indications for insertion of an access device, external ventricular drain, lumbar CSF drainage, shunting and third ventriculostomy Assessment of the neonate with hydrocephalus Principles of shunt function and selection Surgical complications and their management
Clinical Skills	Assessment of the ill child with hydrocephalus and impaired consciousness Differential diagnosis of shunt malfunction Interpretation of CT, MRI and ultrasound scans

Technical Skills and Procedures	Insertion, tapping and draining from a CSF reservoir External ventricular drainage including externalisation of VP shunts Ventriculo-peritoneal shunting in all age groups Third ventriculostomy

TOPIC	**Paediatric tumours**
Category	Paediatrics
Objective	*To achieve competence in the emergency neurosurgical management of children presenting with intracranial tumours*
Knowledge	Epidemiology, natural history, pathophysiology and clinical features of paediatric tumours especially medulloblastoma, ependymoma, pineal region tumours and low grade tumours. Emergency management of children presenting acutely with intracranial mass lesions
Clinical Skills	The assessment and clinical management of children presenting acutely with cranial tumours
Technical Skills and Procedures	Insertion of external ventricular drain

TOPIC	**Paediatric intracranial vascular disorders**
Category	Paediatrics
Objective	*To achieve competence in the emergency neurosurgical management of children presenting with intracranial vascular disorders*
Knowledge	Epidemiology, natural history, pathophysiology and clinical features of intraventricula haemorrhage, subarachnoid haemorrhage, haemorrhagic stroke and ischaemic stroke in children secondary to prematurity, intracranial aneurysms, arteriovenous malformations and fistulae, cavernomas, arterial dissection, moya-moya disease and venous sinus thrombosis Surgical and endovascular strategies for the management of acute intracranial vascular disorders in children
Clinical Skills	The assessment and clinical management of children presenting with spontaneous intracranial haemorrhage and acute cerebral ischaemia
Technical Skills and Procedures	Emergency operative management of spontaneous intracerebral haemorrhage

Peripheral Nerve Neurosurgery

TOPIC	**Peripheral nerve compression**
Category	Peripheral Nerve Surgery
Objective	*To achieve competence in carpal tunnel decompression. To achieve competence in the management of ulnar neuropathy*

Knowledge	Presentation, differential diagnosis and management of peripheral nerve compression syndromes especially those related to brachial plexus pathologies, ulnar nerve compression or carpal tunnel syndrome Interpretation of nerve conduction studies Indications for surgery
Clinical Skills	Diagnosis and investigation of patients with peripheral nerve compression syndromes
Technical Skills and Procedures	None specified

CRITICAL CONDITIONS

TOPIC	**Impaired consciousness and seizures**	**Phase 2 indicative knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency management of patients presenting with impaired consciousness and non-traumatic coma*	
Knowledge	Aetiology, pathophysiology and differential diagnosis of altered consciousness and coma Assessment of the patient with impaired consciousness The emergency management and investigation of patients with deteriorating levels of consciousness or seizures	
Clinical Skills	Clinical assessment of patients with impaired consciousness or seizures Emergency management of patients with impaired consciousness or seizures Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Maintenance of airway Endotracheal intubation Lumbar puncture	

TOPIC	**Cranial trauma**	**Phase 2 indicative knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward-based management of head-injured patients*	

Knowledge	Anatomy and blood supply of the scalp, cranium, meninges and brain Pathophysiology of head injury and of multiple trauma Emergency, intensive care and ward-based management of patients with a head injury Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients following a head injury Principles, diagnosis and confirmation of brain stem death	
Clinical Skills	Clinical assessment of patients with a head injury Emergency management of patients with a head injury Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Wound exploration, debridement and closure Burr hole drainage of chronic subdural haematoma Insertion of intracranial pressure monitor Craniotomy for acute subdural, extradural and interparenchymal haematomas, removal of penetrating objects and elevation of depressed skull fractures. Decompressive craniectomy for trauma	

TOPIC	**Acute hydrocephalus**	**Phase 2 indicative knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward-based management of patients with acute hydrocephalus*	
Knowledge	The pathophysiology of CSF circulation Applied surgical anatomy of the ventricular system Emergency, intensive care and ward-based management of patients with acute hydrocephalus and shunt failure Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with hydrocephalus	
Clinical Skills	Clinical assessment of patients with acute hydrocephalus Emergency management of patients with acute hydrocephalus Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Lumbar puncture Insertion and taping of CSF reservoirs Insertion and maintenance of lumbar and ventricular drains Insertion of external ventricular drain Shunt insertion and revision	

TOPIC	Acute tumour presentations	Phase 2 indicative knowledge level
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward-based management of patients with intracranial tumours*	
Knowledge	The neuropathology of primary and secondary intracranial tumours Functional cerebral anatomy Emergency, intensive care and ward-based management of patients with an intracranial tumour Principles and practice of operative interventions The detection and management of complications Rehabilitation, further treatment and prognosis of patients with a brain tumour	
Clinical Skills	Clinical assessment of patients with an acute tumour presentation Emergency management of patients with an intracranial tumour Interpretation of imaging studies including MRI and CT Breaking bad news to patients and families	
Technical Skills and Procedures	Craniotomy for supratentorial intrinsic tumour Craniotomy for infratentorial intrinsic tumour	

TOPIC	Spontaneous intracranial haemorrhage	Phase 2 indicative knowledge level
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward-based management of patients with subarachnoid haemorrhages (SAH) and Spontaneous Intracerebral Haemorrhages (ICH)*	
Knowledge	Anatomy and Physiology of the cerebral arterial and venous circulations Aetiology and pathophysiology of SAH and ICH Emergency, intensive care and ward-based management of patients with spontaneous intracranial haemorrhage Principles and practice of operative interventions and principles of neuroradiological interventions The detection and management of complications Rehabilitation and prognosis of patients following a spontaneous intracranial haemorrhage	

Clinical Skills	Clinical assessment of patients with a spontaneous intracranial haemorrhage Emergency management of patients with an intracranial haemorrhage Interpretation of imaging studies including MRI, CT and angiograms	
Technical Skills and Procedures	Craniotomy for interparenchymal haemorrhage including sylvian haematoma and AVM related haemorrhage	

TOPIC	**CNS infections**	**Phase 2 indicative knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward-based management of CNS infections*	
Knowledge	Aetiology and pathophysiology of CNS infections including surgery related infections, meningitis, cerebral abscess and subdural empyema Microbiological pathogens and antibiotic selection Emergency, intensive care and ward-based management of patients with CNS infections Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with CNS infections	
Clinical Skills	Clinical assessment of patients with CNS infections Emergency management of patients with CNS infections Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Lumbar puncture Burr hole aspiration of cerebral abscess Craniotomy for subdural empyema or cerebral abscess	

TOPIC	**Spinal trauma**	**Phase 2 indicative knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward-based management of spinal trauma*	

Knowledge	Epidemiology of spinal trauma Spinal biomechanics and the classification of injuries Pathophysiology of spinal cord injury Emergency, intensive care and ward-based management of patients with spinal injuries Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with a spinal injury	
Clinical Skills	Clinical assessment of patients with a spinal injury Emergency management of patients with spinal trauma Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Use of external immobilisation including cervical collars Application of cranial-cervical traction Application of a halo-body jacket Anterior cervical spine fusion, posterior cervical spine fusion	

TOPIC	**Spinal oncology**	**Phase 2 indicative knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward-based management of spinal oncology*	
Knowledge	The neuropathology of primary and secondary spinal tumours Clinical presentations of intramedullary, intradural extramedullary, extradural and bony spinal tumours including malignant spinal cord compression Emergency, intensive care and ward-based management of patients with spinal tumours Principles and practice of operative interventions The detection and management of complications Rehabilitation, further treatment and prognosis of patients with spinal tumours	
Clinical Skills	Clinical assessment of patients with a spinal tumour Emergency management of patients with a spinal tumour Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Decompression of malignant spinal cord compression in the cervical, thoracic and lumbar spine	

TOPIC	Acute spinal disorders and cauda equina syndrome	Phase 2 indicative knowledge level
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward-based management of acute spinal disorders especially cauda equina syndrome*	
Knowledge	Anatomy of the spine, spinal cord, autonomic and somatic nervous systems Physiology of spinal cord function and control of the bladder Pathophysiology of cauda equina syndrome, nerve root compression and spinal cord compression Emergency, intensive care and ward-based management of patients with acute spinal disorders Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with acute spinal disorders	
Clinical Skills	Clinical assessment of patients with an acute spinal disorder Emergency management of patients with an acute spinal disorder Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Lumbar laminectomy Lumbar discectomy Anterior cervical discectomy Posterior cervical decompression Laminectomy for epidural or subdural haematomas and empyemas	

TOPIC	Emergency paediatric neurosurgery	Phase 2 indicative knowledge level
Category	Critical conditions	4
Objective	*To achieve competence in the emergency management of paediatric neurosurgical patients*	
Knowledge	Paediatric physiology Pathophysiology of hydrocephalus, head injury and acute presentations of tumours and intracranial haemorrhage in children of all ages Child Safeguarding principles Understanding of Children's rights and surgical consent	

Clinical Skills	Clinical assessment of children with acute neurosurgical disorders Emergency management of children with acute neurosurgical disorders	
Technical Skills and Procedures	Lumbar puncture in children Taping of CSF reservoirs in children Shunt insertion and revision in all age groups EVD insertion in all age groups	

INDEX PROCEDURES

TOPIC	**Advanced adult supratentorial**	**Phase 2 indicative technical level**
Category	Index procedures	3
Objective	*To achieve technical competence in advanced adult supratentorial surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature, nerves and brain Indications for surgery Microsurgical dissection techniques Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures in those 16 years and over: Clipping of anterior circulation aneurysm Clipping of posterior circulation aneurysm Craniotomy and excision of AVM Craniotomy and excision of Cavernoma Hemispherectomy (functional or anatomic) for epilepsy Infratentorial, supracerebellar approach to pineal region tumour Interhemispheric approach to midline ventricular lesion (eg colloid cyst) Interhemispheric approach to pineal region tumour Lesionectomy for epilepsy Supratentorial, suboccipital approach to pineal region tumour Temporal lobectomy for epilepsy Transcranial approach to sellar or suprasellar lesion	

TOPIC	**Endoscopic and transphenoidal**	**Phase 2 indicative technical level**
Category	Index procedures	3
Objective	*To achieve technical competence in endoscopic and transphenoidal surgery*	

Knowledge	Applied anatomy of the sphenoid sinus, sella, pituitary and optic nerves Indications for surgery Use of an endoscope to perform complex surgery Complications of surgery and management of endocrine function Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures: Endoscopic biopsy of intrinsic cerebral tumour Endoscopic excision / drainage of ventricular lesion (eg colloid cyst) Endoscopic third ventriculostomy Other Endoscopic Procedure (except biopsy) Transphenoidal biopsy of sellar lesion (not adenoma) Transphenoidal hypophysectomy	

TOPIC	**Convexity and falcine meningiomas**	**Phase 2 indicative technical level**
Category	Index procedures	3
Objective	*To achieve technical competence in convexity and falcine meningioma surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature and brain Indications for surgery Microsurgical dissection techniques Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures: Excision of meningioma - convexity Excision of meningioma - falx Excision of meningioma - Other Excision of meningioma - parasagital Excision of meningioma - sphenoid ridge Excision of meningioma - subfrontal	

TOPIC	Advanced adult infratentorial	Phase 2 indicative technical level
Category	Index procedures	3
Objective	*To achieve technical competence in advanced adult infratentorial surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature, nerves and brain Indications for surgery Microsurgical dissection techniques Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures in those 16 years and over: Craniotomy for spontaneous ICH (infratentorial) Infratentorial skull base approach to skull base tumour Microvascular decompression of facial nerve Microvascular decompression of trigeminal nerve Middle fossa approach to vestibular schwannoma Midline approach to intrinsic brain stem or 4th ventricle tumour Midline approach to intrinsic cerebellar tumour Midline posterior fossa craniotomy and excision of meningioma Midline posterior fossa craniotomy for benign lesions (excl. meningioma) Retrosigmoid approach to intrinsic brain stem tumour Retrosigmoid approach to intrinsic cerebellar tumour Retrosigmoid approach to vestibular schwannoma Retrosigmoid craniotomy and excision of meningioma Retrosigmoid craniotomy for benign lesions (excl. schwanoma and meningioma) Translabrynthine approach to vestibular schwannoma Transoral / transfacial approach to skull base tumour	

TOPIC	Intradural spine	Phase 2 indicative technical level
Category	Index procedures	3
Objective	*To achieve technical competence in intradural spinal surgery*	
Knowledge	Applied anatomy of the spine, meninges, vasculature, spinal cord and nerves Indications for surgery Microsurgical dissection techniques Spinal cord monitoring	

	Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures: Biopsy of intramedullary spinal cord lesion Closure of encephalocoele Closure of myelomeningocoele Evacuation of primary spinal subdural haematoma Excision / debulking of intramedullary spinal cord lesion Excision of other intradural, extramedullary lesion Excision of spinal meningioma Excision of spinal neurofibroma Foramen magnum decompression including durotomy Other surgery for spinal dysraphism Surgery for spinal AVM Surgery for spinal cavernoma Untethering of spinal cord	

TOPIC	**Complex spinal fusion**	**Phase 2 indicative technical level**
Category	Index procedures	3
Objective	*To achieve technical competence in spinal fusion surgery*	
Knowledge	Applied anatomy of the vertebrae, ligaments, discs, musculature and nerves Indications for surgery Spinal decompression and fusion techniques Complications of surgery Management of anti-platelet and anti-coagulant medication	

Technical Skills and Procedures	A wide range of the following procedures: Spinal fixation **AND** Anterior cervical fusion Anterior Lumbar Interbody Fusion Anterior PEG spinal fixation Anterior thoracic fusion Occipito-Cervical fusion (with instrumentation) Other anterior cervical decompression Other anterior thoracic decompression Other decompressive posterior lumbar surgery Other posterior cervical decompression Other posterior thoracic decompression Posterior C1/2 spinal fixation Posterior cervical fusion Posterior Lumbar Fusion Posterior Lumbar Interbody Fusion Posterior thoracic fusion Open biopsy of spine (eg tumour, infection) Primary Posterior Cervical Laminectomy or laminoplasty Revision anterior cervical decompression Revision posterior cervical decompression Transoral excision of odontoid Primary anterior lumbar surgery for disc/degen disease Primary lumbar laminectomy for disc/degen disease Primary posterior lumbar discectomy Revision anterior lumbar surgery for disc/degen disease Revision posterior lumbar surgery for disc/degen disease	

TOPIC	**Advanced paediatric supratentorial**	**Phase 2 indicative technical level**
Category	Index procedures	2
Objective	*To gain experience in advanced paediatric supratentorial surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature, nerves and brain Indications for surgery Microsurgical dissection techniques in children Complications of surgery	

Technical Skills and Procedures	A wide range of the following procedures in children under 16: Clipping of anterior circulation aneurysm Clipping of posterior circulation aneurysm Craniotomy and excision of AVM Craniotomy and excision of Cavernoma Craniotomy for dural AVM Craniotomy for frontal intrinsic cerebral tumour Craniotomy for occipital intrinsic cerebral tumour Craniotomy for other intrinsic cerebral tumour Craniotomy for parietal intrinsic cerebral tumour Craniotomy for temporal intrinsic cerebral tumour Excision of meningioma - convexity Excision of meningioma - falx Excision of meningioma - Other Excision of meningioma - parasagital Excision of meningioma - sphenoid ridge Excision of meningioma - subfrontal Hemispherectomy (functional or anatomic) for epilepsy Interhemispheric approach to midline ventricular lesion (eg colloid cyst) Interhemispheric approach to pineal region tumour Lesionectomy for epilepsy Supratentorial craniotomy for benign lesions (excl. meningioma) Supratentorial, suboccipital approach to pineal region tumour Temporal lobectomy for epilepsy Transcranial approach to sellar or suprasellar lesion	

TOPIC	**Advanced paediatric infratentorial**	**Phase 2 indicative technical level**
Category	Index procedures	2
Objective	*To gain experience in advanced paediatric infratentorial surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature, nerves and brain Indications for surgery Microsurgical dissection techniques in children Complications of surgery	

Technical Skills and Procedures	A wide range of the following procedures in children under 16: Infratentorial, supracerebellar approach to pineal region tumour Midline approach to intrinsic brain stem or 4th ventricle tumour Midline approach to intrinsic cerebellar tumour Midline posterior fossa craniotomy and excision of meningioma Midline posterior fossa craniotomy for benign lesions (excl. meningioma) Retrosigmoid approach to intrinsic brain stem tumour Retrosigmoid approach to intrinsic cerebellar tumour Retrosigmoid craniotomy and excision of meningioma Retrosigmoid craniotomy for benign lesions (excl. schwanoma and meningioma) Transoral / transfacial approach to skull base tumour	

Phase 3 Neurosurgery Training

Overview

Phase 3 will allow a trainee to develop technically, especially with regards to the essential transferable microsurgical skills required of a day-one consultant in Neurosurgery and to focus on one (or two complementary) special interest areas of practice.

Phase 3 training in approved OOP schemes in external centres is encouraged subject to deanery approval. Completion of phase 3 occurs at the final ARCP with the award of an outcome 6.

Special Interest Training

To ensure the quality of emergency and continuing care of neurosurgical patients with appropriate liaison and cross referral all trainees are expected to have an understanding of the specialist areas of neurosurgical practice. During final phase training all trainees will undertake selected specialist operative procedures under direct supervision to consolidate their advanced (especially microsurgical) operative skills.

Trainees in special interest training will develop a comprehensive and in-depth knowledge of their field. By the end of special interest training they will be competent to undertake selected operative procedures relating to the common presentations in their specialist field without direct supervision. They will be competent to undertake other procedures in their field under the mentorship of a senior colleague. The special interest summaries indicate the breadth and depth of training required in phase 3 training.

Neuro-oncology

All trainees will be competent to manage patients with high grade intrinsic tumours, metastases and convexity meningiomas. Trainees with a special interest in neuro-oncology will participate fully in the multidisciplinary management of neuro-oncology patients and will be familiar with current developments in molecular neuro-oncology, emerging surgical techniques and the ethical, regulatory and practical considerations governing clinical trials in neuro-oncology. They will develop additional expertise as follows:

- Advanced surgical techniques: including awake craniotomy; stereotactic craniotomy, intraoperative neurophysiological monitoring; advanced image guidance with integration of functional data; intraoperative imaging techniques; the use of surgically delivered chemotherapy agents; third ventriculostomy
- Low-grade intrinsic tumours: the management of low grade intrinsic tumours using advanced techniques; optimal resection of lobar low grade intrinsic tumours
- Tumours of the ventricular system and pineal region: including surgical approaches to the third ventricle and pineal; transfrontal transventricular excision of intraventricular tumours and cysts; transcallosal transventricular excision of lesions of the third ventricle and foramen of Munro
- Brainstem tumours: including the management options for intrinsic brainstem tumours; stereotactic biopsy of accessible lesions
- Radiosurgery and stereotactic radiotherapy: including the principles of radiosurgery and stereotactic radiotherapy and the indications for their use as adjunctive and/or primary treatment modalities.

Skull-base and pituitary

Special interest training in skull base surgery will take place in units with extensive multi-disciplinary experience in the management of all common skull-base disorders. Trainees with a special interest in skull-base surgery will develop additional expertise as follows:

- Skull-base and craniofacial surgical access: including standard variations of fronto-basal, fronto-orbital, trans-zygomatic, infratemporal, transtemporal, far-lateral, transphenoidal and transmaxillary approaches
- Cranial base meningiomas: including resection of anterior fossa (olfactory groove and suprasellar) meningiomas; tentorial and petrous temporal meningiomas; petroclival meningiomas
- Pituitary and sellar tumours: including endoscopic (+/- microscopic) transphenoidal resection of pituitary tumours; pterional, subfrontal, interhemispheric and transventricular approaches to suprasellar tumours
- Vestibular schwannoma: including retrosigmoid and translabyrinthine approaches and knowledge of the application of middle fossa resection
- Other skull-base tumours: including the management of other cranial nerve schwannomas, glomus tumours and malignant primary and secondary tumours of the skull-base
- Management of cranio-facial trauma: including multi-disciplinary management of fronto-orbital disruption
- Repair of CSF fistulae: including the management of post-operative CSF fistulae; indications for endoscopic repair of a basal CSF fistula; techniques for open repair and skull-base reconstruction

Neurovascular

Special interest training will take place in units with extensive experience in the multi-disciplinary management of all common intracranial vascular disorders. These units should manage a minimum of 100 aneurysmal subarachnoid haemorrhages a year. Trainees with a special interest in neurovascular surgery will develop additional expertise in:

- Intracranial aneurysms: including surgical and endovascular strategies for the management of ruptured and unruptured intracranial aneurysms; surgical treatment of ruptured aneurysms of the anterior circulation; principles of microvascular reconstruction and bypass for complex aneurysms
- Intracranial vascular malformations: including surgical, endovascular and radiosurgical strategies for the management of arteriovenous malformations; surgical treatment of superficial cortical arteriovenous malformations, surgical and endovascular treatment of dural arteriovenous fistulae, image-guided resection of cavernomas
- Other vascular disorders: including the management of primary intracerebral haematomas; the management of venous occlusive disorders
- Management of stroke including indications for thrombolysis and endovascular clot retrieval; role and indications of decompressive craniectomy. Some trainees may consider developing some endovascular skills to remove clots from the intracranial vasculature
- Acute and chronic cerebral ischaemia: including the medical, surgical and endovascular management of intracranial arterial occlusive disease.

Pain, epilepsy and functional

Trainees with a special interest in functional neurosurgery will develop additional expertise as follows:

- Surgical management of pain: including the implantation of spinal cord stimulators; the insertion of intrathecal drug delivery systems; knowledge of ablative surgical treatment for pain including DREZ lesioning, cordotomy and myelotomy and of neuromodulatory techniques including peripheral nerve, motor cortex and deep brain stimulation.

- Neurovascular compression syndromes: including microvascular decompression of the trigeminal nerve; microvascular decompression of the facial nerve; percutaneous trigeminal rhizotomy
- Spasticity: including an in-depth understanding of medical and surgical treatments for spasticity; implantation of intrathecal drug delivery systems; knowledge of other surgical treatments for spasticity including phenol blocks, neurectomies and rhizotomy.
- Epilepsy: including the multidisciplinary assessment and preparation of patients for epilepsy surgery; stereotactic placement of depth electrodes and placement of subdural electrode grids; temporal lobectomy; selective amygdalohippocampectomy; callosotomy; insertion of vagal nerve stimulators; hemispherectomy; multiple subpial transections
- Movement disorders: including the multidisciplinary assessment and selection of patients with movement disorders e.g. Parkinsons's disease and dystonia; selection, targeting and placement of deep brain stimulation electrodes; management of neuro-stimulators; radiofrequency lesioning

Spine

On completion of a special interest year in spinal surgery trainees will be competent in all aspects of the emergency and urgent operative care of patients with spinal disorders. They will develop additional expertise as follows:

- Spinal trauma: including reduction and internal stabilisation of atlanto-axial, sub-axial and thoraco-lumbar fractures and dislocations
- Metastatic disease of the spine: including posterior decompression and stabilisation using pedicle screw, hook and sub-laminar wire constructs; corpectomy and instrumented reconstruction of the anterior column
- Primary tumours of the spine: including techniques for local ablation of benign lesions and en bloc resections of malignant tumours
- Intradural tumours: including the radical resection of intradural, extra-medullary tumours; biopsy and optimal resection of intramedullary tumours
- Syringomyelia and hind brain anomalies: including foramen magnum decompression, syringostomy, syringopleural shunting, untethering and duroplasty
- Advanced surgery of the ageing and degenerative spine: including the management of osteoporotic collapse, vertebroplasty, kyphoplasty; stabilisation of the osteoporotic spine; operative management degenerative spondylolisthesis and scoliosis
- The rheumatoid and ankylosed spine: including the management of atlanto-axial subluxation; cranial settling and odontoid migration; sub-axial degeneration; cervico-dorsal kyphosis
- Spinal deformity: including the multidisciplinary management of patients with spinal dysraphism, diastematomyelia etc

Paediatrics

On completion of a special interest year in paediatric neurosurgery trainees will be competent in all aspects of the non-operative neurosurgical management of children presenting with disorders of the nervous system. They will have detailed knowledge of the statutory framework governing the care of children, paediatric neurointensive care, the principles of paediatric neurorehabilitation and of the management of non-accidental injury. They will be competent to undertake all aspects of the emergency neurosurgical operative care of children and to undertake a range of elective procedures in the following fields with appropriate supervision:

- Hydrocephalus: including the insertion and revision of ventriculo-peritoneal, ventriculo-atrial and lumbo-peritoneal shunts; endoscopic third ventriculostomy; image-guided placement of ventricular catheters; management of neonatal post-haemorrhagic hydrocephalus

- Paediatric neuro-oncology: including stereotactic and image-guided biopsy of paediatric tumours; endoscopic biopsy of third ventricular tumours; resection of supratentorial and infratentorial intrinsic tumours; resection of suprasellar, third ventricular and pineal tumours; management of spinal cord tumours
- Paediatric head injury: including decompressive craniectomy; cranioplasty; management of growing fractures; craniofacial reconstruction; management of CSF fistulae
- Spinal dysraphism: including the management of neonatal spina bifida, meningoceles and encephaloceles; spinal cord tethering syndromes
- Congenital and acquired spinal deformity: including the management of syndromic spinal deformity and post-operative spinal deformity
- Craniofacial disorders: including the management of simple craniosynostosis, syndromic craniosynostosis, post-traumatic deformity

Phase 3 Capability in Practice

Capability in practice	Supervision level
1. Manages an outpatient clinic	Level IV
2. Manages the unselected emergency take	Level IV
3. Manages ward rounds and the on-going care of inpatients	Level IV
4. Manages an operating list	Level IV
5. Manages multi-disciplinary working	Level IV

Phase 3 Critical conditions

Critical condition	Assessed by	Phase 3 Knowledge level
Impaired consciousness and seizures	CBD or CEX	4
Cranial trauma	CBD or CEX	4
Acute hydrocephalus	CBD or CEX	4
Acute tumour presentations	CBD or CEX	4
Spontaneous intracranial haemorrhage	CBD or CEX	4
CNS infections	CBD or CEX	4
Spinal trauma	CBD or CEX	4
Spinal oncology	CBD or CEX	4
Degenerative spinal disorders and cauda equina syndrome	CBD or CEX	4
Emergency paediatric neurosurgery	CBD or CEX	4

Phase 3 Index procedures

Index procedure	Assessed by	Indicative number (excluding assisted) by certification	Technical skill level expected by certification
Advanced adult supratentorial	PBA	10	4
Endoscopic and transphenoidal	PBA	10	3 (4 if special interest)
Convexity and falcine meningiomas	PBA	10	4
Advanced adult infratentorial	PBA	10	4
Intradural spine	PBA	5	4
Complex spinal fusion	PBA	10	3 (4 if special interest)
Advanced paediatric supratentorial	PBA	1	2 (3 if special interest)
Advanced paediatric infratentorial	PBA	1	2 (3 if special interest)

Clinical Placements in Phase 3

Clinical placements in Phase 3 will ensure that trainees are exposed to microsurgical training in a specialist area of Neurosurgical practice. Trainees must participate in a neurosurgical on call rota. The organisation of clinical placements is at the discretion of the programme director. The following principles apply:

- The Shape of Training review identified that training is optimal in longer (6 month) rather than shorter (3-4 month) attachments
- Training programme directors will be familiar with parts of their training programme that provide training in key areas. Training surveys and logbook data can also be used to provide this information.
- Trainees should be placed flexibly in posts that support their training needs
- Trainees on placements should receive training and are not primarily in these placements to support service requirements

Phase 3 Topics
Advanced microsurgical skills

TOPIC	**Advanced Microsurgical skills**
Category	Advanced microsurgical skills
Objective	*To achieve competence in the essential transferable microsurgical skills*
Knowledge	Operating microscope technology and physics Endoscope technology and physics
Clinical Skills	Tissue handling and microsurgical dissection technique
Technical Skills and Procedures	Use of the endoscope and operating microscope to develop microsurgical skills can be undertaken in a wide variety of different advanced procedures including surgery for aneurysms, AVMs, tumours, epilepsy, skull base, pituitary, spine and spinal cord pathologies.

Neuro-oncology

TOPIC	**Advanced surgical techniques for intrinsic tumours**	**Phase 3 knowledge level**
Category	Neuro-oncology	4
Objective	*To achieve competence in the application of advanced surgical techniques to the management of patients with brain tumours*	
Knowledge	Indications for; applications of; advantages and disadvantages of various advanced surgical approaches and adjuncts	
Clinical Skills	Assessment, counselling and pre-operative preparation of patients undergoing neuro-oncological surgery Selection of appropriate advanced techniques based on clinical and imaging information	
Technical Skills and Procedures	Frameless, frame based and robotic stereotactic techniques Use of intra-operative drug delivery systems Awake craniotomy Intraoperative neurophysiological monitoring	

TOPIC	**Tumours of the ventricular system and pineal region**	**Phase 3 knowledge level**
Category	Neuro-oncology	4
Objective	*To achieve competence in the management of patients with intraventricular and pineal region tumours.*	

Knowledge	Epidemiology, natural history, genetic characteristics, pathology and clinical features of intraventricular and pineal region tumours Radiological and biochemical staging Surgical and non-surgical management options for low grade intrinsic tumours Surgical anatomy relevant to approaches to the lateral and third ventricles and the pineal region	
Clinical Skills	Counselling of patients regarding surgical treatment options for pineal and intraventricular tumours Choice of operative approaches based on tumour location and imaging	
Technical Skills and Procedures	Transcallosal and transcortical approaches to ventricular tumours Microsurgical resection of lateral intraventricular tumour Microsurgical resection of third ventricular tumour/colloid cyst Transfrontal endoscopic biopsy and third ventriculostomy Supracerebellar infratentorial approaches to the pineal Occipital transtentorial approaches to the pineal	

TOPIC	**Brainstem tumours**	**Phase 3 knowledge level**
Category	Neuro-oncology	4
Objective	*To achieve competence in the surgical aspects of the multidisciplinary management of patients with intrinsic brainstem tumours*	
Knowledge	Epidemiology, natural history, genetic characteristics, pathology and clinical features of brain stem tumours Management options for patient with brainstem tumours including open surgery, biopsy and radiotherapy	
Clinical Skills	Selection of open surgery or image guided biopsy for patients with brainstem lesions	
Technical Skills and Procedures	Stereotactic biopsy of brainstem lesions	

Skull Base and Pituitary

TOPIC	**Skull base meningiomas**	**Phase 3 knowledge level**
Category	Skull-base and pituitary	4
Objective	*To achieve competence in the neurosurgical aspects of the multidisciplinary management of cranial base meningiomas*	
Knowledge	Epidemiology, natural history, pathology and clinical presentation of meningiomas of the medial anterior, middle and posterior fossae Indications for radical or subtotal resection of skull-base meningiomas Indications for radiosurgical treatment Applied surgical anatomy of the skull base and craniofacial skeleton Selection of optimal approaches in relation to the presenting pathology and imaging	
Clinical Skills	Assessment and clinical management of patients with skull base meningiomas	
Technical Skills and Procedures	Anterior interhemispheric, fronto-orbital, zygomatic and temporo-zygomatic approaches Resection of anterior fossa meningioma: olfactory, planum sphenoidale and medial sphenoid wing Resection of clinoidal and suprasellar meningioma Resection of occipital, lateral petrosal and tentorial meningioma Resection of cavernous sinus and petroclival meningioma	

TOPIC	**Anterior and middle fossa skull base tumours**	**Phase 3 knowledge level**
Category	Skull-base and pituitary	4
Objective	*To achieve competence in the surgical management of patients with anterior and middle fossa tumours*	
Knowledge	Epidemiology, natural history, pathology and clinical presentation of benign and malignant tumours of the skull base including cranial nerve schwannomas, chordomas, paragangliomas, adenoid cystic carcinomas, angiofibromas and nasopharyngeal carcinomas Indications for radical or subtotal resection of skull-base tumours Indications for radiosurgical treatment Applied surgical anatomy of the skull base and craniofacial skeleton Selection of optimal approaches in relation presenting pathology and imaging	

Clinical Skills	Neurosurgical aspects of the multidisciplinary assessment and clinical management of patients with rarer skull base tumours Multidisciplinary working with neurotologists, maxillofacial surgeons and oncologists	
Technical Skills and Procedures	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 suction, intra-operative ventricular puncture and lamina terminalis fenestration Anterior interhemispheric, fronto-orbital, zygomatic and temporo-zygomatic approaches Frontobasal approaches to the anterior fossa and orbito-ethmoidal complex Transfacial and mid-face approaches to the skull base Lateral approaches to the infratemporal fossa and pterygo-palatine fossa Transtemporal approaches to the jugular bulb and petrous apex	

TOPIC	**Sellar and suprasellar mass lesions**	**Phase 3 knowledge level**
Category	Neuro-oncology	4
Objective	*To achieve competence in transphenoidal and cranial approaches to sellar and suprasellar mass lesions*	
Knowledge	Pathology of pituitary adenoma, craniopharyngioma and Rathke's cleft cyst Pathophysiology of the hypothalamic-pituitary axis Investigation of patients with hypothalamic-pituitary axis lesions Medical treatments for pituitary adenomas and for pituitary failure Indications for surgery Selection of surgical approaches: pterional, interhemispheric, endoscopic or microsurgical transphenoidal Applied surgical anatomy of the skull base Principles of peri-operative care Complications of surgery and their management	
Clinical Skills	The assessment, counselling and pre-operative preparation of patients with pituitary, sellar and parasellar tumours Interpretation of CT and MRI scans	
Technical Skills and Procedures	Endoscopic and microsurgical transphenoidal approach Pterional craniotomy for pituitary adenoma or craniopharyngioma	

TOPIC	Vestibular Schwannoma	Phase 3 knowledge level
Category	Skull-base and pituitary	4
Objective	*To achieve competence in the neurosurgical aspects of the multidisciplinary management of patients with vestibular schwanommas*	
Knowledge	Epidemiology, natural history, pathology and clinical presentation of sporadic and NFII-related vestibular schwanommas. Relative indications for surgery, radiosurgery and conservative management Principles of intra-operative facial nerve and BAEP 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, tumour size and position	
Clinical Skills	Neurosurgical aspects of the assessment and clinical management of patients undergoing v surgery Multidisciplinary working with neuro-otologists and oncologists Role of hearing therapy	
Technical Skills and Procedures	Retrosigmoid subtotal and radical resection of vestibular schwannoma Translabyrinthine resection of vestibular schwannoma	

Pain, Epilepsy and Functional

TOPIC	Surgical management of pain	Phase 3 knowledge level
Category	Pain, Epilepsy and Functional	4
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of patients with chronic pain syndromes*	
Knowledge	The aetiology and pathophysiology of chronic pain syndromes Indications for medical, minimally-invasive and surgical management Applied surgical anatomy Complications of surgery and their management	
Clinical Skills	Surgical aspects of the multi-disciplinary assessment of chronic pain patients Pre-operative counselling and preparation	
Technical Skills and	Spinal cord stimulation DREZ lesion	

Procedures	Open cordotomy Deep brain stimulation for pain	

TOPIC	**Neurovascular compression syndromes**	**Phase 3 knowledge level**
Category	Pain, Epilepsy and Functional	4
Objective	*To achieve advanced competence in the surgical aspects of the multi-disciplinary management of patients with neurovascular compression syndromes*	
Knowledge	Aetiology, epidemiology and natural history of trigeminal neuralgia, and glossopharyngeal neuralgia Differential diagnosis and management of related cranio-facial pain syndromes Medical management of cranio-facial pain Surface anatomy of the trigeminal nerve and microsurgical anatomy of the CP angle Indications for surgical management of trigeminal and glossopharyngeal neuralgia by peripheral neurectomy, percutaneous rhizotomy, radiofrequency rhizotomy, microvascular decompression Indications for stereotactic radiosurgery treatment of trigeminal neuralgia Complications of surgery and their management	
Clinical Skills	The assessment, counselling 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	
Technical Skills and Procedures	Percutaneous trigeminal rhizotomy Trigeminal microvascular decompression	

TOPIC	**Spasticity**	**Phase 3 knowledge level**
Category	Pain, Epilepsy and Functional	4
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of patients with spasticity*	
Knowledge	The aetiology and pathophysiology of spasticity Indications for medical, minimally-invasive and surgical management Applied surgical anatomy	

	Complications of surgery and their management	
Clinical Skills	Surgical aspects of the multi-disciplinary assessment of patients with spasticity Pre-operative counselling and preparation	
Technical Skills and Procedures	Intrathecal drug delivery Deep brain stimulation	

TOPIC	**Epilepsy**	**Phase 3 knowledge level**
Category	Pain, Epilepsy and Functional	4
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of patients with epilepsy*	
Knowledge	The pathophysiology of idiopathic and lesional epilepsy Indications for medical and surgical management Principles of ictal, interictal, sphenoidal and intraoperative EEG Principles of video-EEG monitoring Applied surgical anatomy Complications of surgery and their management	
Clinical Skills	Surgical aspects of the multi-disciplinary assessment of epilepsy patients Interpretation of CT, MRI and SPECT scans Pre-operative counselling and preparation	
Technical Skills and Procedures	Stereotactic placement of depth electrodes Placement of subdural electrode-grids Image-guided resection of cortical lesions Mesial temporal resection Vagal nerve stimulation Functional hemispherectomy Corpus callosotomy	

TOPIC	**Movement disorders**	**Phase 3 knowledge level**
Category	Pain, Epilepsy and Functional	4
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of patients with movement disorders*	

Knowledge	The aetiology and pathophysiology of movement disorders Indications for medical, minimally-invasive and surgical management Applied surgical anatomy Complications of surgery and their management	
Clinical Skills	Surgical aspects of the multi-disciplinary assessment of patients with movement disorders Interpretation of CT and MRI scans Pre-operative counselling and preparation	
Technical Skills and Procedures	Deep brain stimulation Microvascular decompression for hemi-facial spasm	

TOPIC	**Surgery for mental illness**	**Phase 3 knowledge level**
Category	Pain, Epilepsy and Functional	4
Objective	*To be familiar with current surgical treatment options for treatment resistant mental illness and in particular depression and obsessive compulsive disorder*	
Knowledge	Indications for surgical treatment of mental illness Ethical and regulatory aspects of surgical treatment of mental illness Surgical targets	
Clinical Skills	None	
Technical Skills and Procedures	None	

Neurovascular

TOPIC	**Intracranial aneurysms**	**Phase 3 knowledge level**
Category	Neurovascular	4
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of patients with intracranial aneurysms*	
Knowledge	The epidemiology, natural history, aetiology and pathophysiology of unruptured and ruptured intracranial aneurysms Vascular anatomy of the central nervous system Indications for surgical and endovascular treatment of intracranial aneurysms The principles of endovascular treatment	

	Indications for intra and extracranial bypass in the management of complex aneurysms	
Clinical Skills	Clinical assessment and management of patients with ruptured and unruptured intracranial aneurysms	
Technical Skills and Procedures	Pterional approach Interhemispheric approaches Temporo-zygomatic and related approaches Clipping of saccular anterior circulation aneurysm Clipping of complex anterior circulation aneurysm Harvest of saphenous vein and radial artery grafts	

TOPIC	**Intracranial arteriovenous malformations**	**Phase 3 knowledge level**
Category	Neurovascular	4
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of intracranial arteriovenous malformations (AVMs)*	
Knowledge	The epidemiology, classification, natural history, embryogenesis and pathophysiology of AVMs of the brain The indications for surgical, radiosurgical and endovascular treatment of asymptomatic, symptomatic and ruptured brain AVMs	
Clinical Skills	The assessment and clinical management of patients undergoing treatment of AVMs of the brain	
Technical Skills and Procedures	Evacuation of intracerebral haematoma associated with an AVM Microsurgical resection of cortical AVM	

TOPIC	**Intracranial dural arteriovenous fistulae**	**Phase 3 knowledge level**
Category	Neurovascular	4
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of intracranial dural arteriovenous fistulae (dAVFs)*	
Knowledge	Applied anatomy of the cerebral venous circulation The epidemiology, classification, natural history, pathogenesis and pathophysiology of intracranial dAVFs	

	The indications for surgical and endovascular treatment of asymptomatic, symptomatic and ruptured intracranial dAVFs	
Clinical Skills	The assessment and clinical management of patients undergoing treatment of intracranial dAVFs	
Technical Skills and Procedures	Exploration and closure of supratentorial dAVF	

TOPIC	**Cerebral ischaemia**	**Phase 3 knowledge level**
Category	Neurovascular	4
Objective	*To achieve competence in the surgical aspects of the management of patients with acute and chronic cerebral ischaemia*	
Knowledge	The epidemiology, natural history and pathophysiology of extra- and intracranial atherosclerotic occlusive disease The epidemiology, natural history and pathophysiology of non-atherosclerotic occlusive diseases Optimal medical management of occlusive and thrombo-embolic cerebrovascular disease Imaging of the chronically ischaemic brain to assess cerebral vascular reserve using CT or MRI Principles of non-invasive and invasive imaging of the extra and intracranial vasculature using ultrasound, transcranial Doppler, CT, MRI, catheter angiography and intraoperative ICG Principles of regional cerebral blood flow and metabolism measurement and imaging using CT and MRI perfusion techniques; SPECT and PET scanning Indications for endovascular intervention including intra-arterial thrombolysis; carotid angioplasty and stenting; intracranial angioplasty Principles of cerebral revascularisation by indirect synangiosis, low-flow EC-IC anastomosis and high flow EC-IC bypass grafting	
Clinical Skills	The assessment and clinical management of patients with acute and chronic cerebral ischaemia	
Technical Skills and Procedures	N/A	

Spine

TOPIC	**Spinal trauma**	**Phase 3 knowledge level**
Category	Spine	4
Objective	*To achieve competence in the operative management of fractures of the cervical and thoracolumbar spine*	
Knowledge	Pathophysiology of spinal cord injury Classification of cervical and thoracolumbar fractures Biomechanics of spinal instability Indications for halo traction and external stabilization Indications for and principles of open reduction and stabilization Applied surgical anatomy of cervical and thoracolumbar fracture-subluxations Relative indications for operative reduction and stabilisation by anterior and posterior approaches Management of post-traumatic spinal deformity and delayed sequelae	
Clinical Skills	Assessment and clinical management of patients with spinal injuries	
Technical Skills and Procedures	Application of cranial-cervical traction Instrumented stabilisation of subaxial fractures by anterior cervical plate and/or lateral mass screws Instrumented stabilisation of atlanto-axial fracture dislocation by anterior odonto-axial screws and/or posterior atlantoaxial screws Posterior craniocervical and cervicothoracic fusion Application of halo-body jacket Posterior reduction of thoracolumbar fractures using pedicle screws Combined anterior and posterior reduction and instrumented stabilisation of thoracolumbar fractures	

TOPIC	**Metastatic spinal disease**	**Phase 3 knowledge level**
Category	Spine	4
Objective	*To achieve competence in the management of patients with malignant secondary spinal cord compression*	

Knowledge	The pathophysiology of spinal cord compression The classification, aetiology and natural history of vertebral metastases Spinal instability associated with vertebral malignancy Indications for percutanous and open spinal biopsy Role of primary radiotherapy and adjuvant radiotherapy or chemotherapy Indications for spinal decompression with and without instrumented spinal stabilisation	
Clinical Skills	Clinical assessment of patients with malignant spinal cord compression Interpretation of plain radiology, CT and MRI scans Liaison with medical oncologists and radiotherapist Counselling and pre-operative preparation of patients with malignant spinal cord compression	
Technical Skills and Procedures	Decompressive thoracic and lumbar laminectomy with extradural tumour resection and pedicle screw stabilisation Anterior cervical corpectomy with anterior column reconstruction and anterior cervical plating Cervical lateral mass stabilization Vertebroplasty and Kyphoplasty	

TOPIC	**Intramedullary tumours**	**Phase 3 knowledge level**
Category	Spine	4
Objective	*To achieve competence in the management of patients with intramedullary spinal tumours*	
Knowledge	Classification, epidemiology, natural history and pathology of intramedullary spinal tumours Pathophysiology of spinal cord compression Indications for biopsy, subtotal and radical surgery Selection of surgical approaches Applied surgical anatomy Principles of peri-operative care Complications of surgery and their management Role of adjuvant treatment Indications for and interpretation of spinal cord monitoring	
Clinical Skills	None	
Technical Skills and Procedures	Microsurgical biopsy of intramedullary spinal cord tumour Subtotal microsurgical resection of intramedullary tumour Duroplasty	

TOPIC	Advanced surgery of the ageing and degenerative spine	Phase 3 knowledge level
Category	Spine	4
Objective	*To achieve competence in the advanced surgery of the ageing and degenerative spine*	
Knowledge	Techniques for operative stabilisation of the osteoporotic spine Principles of surgery for degenerative scoliosis Biomechanical principles of and indications for cervical and lumbar disc replacement Biomechanical principles of and indications for non-fusion spinal stabilization Indications for, techniques and complications of vertebroplasty and Kyphoplasty Principles of thoracoscopic and laparoscopic surgical techniques Presentation and natural history of thoracic disc prolapse	
Clinical Skills	Assessment and clinical management of patients with degenerative spinal disorders	
Technical Skills and Procedures	Pedicle screw instrumentation of the thoracic and lumbar spine Lumbar interbody fusion by posterior (PLIF) postero-lateral (TLIF) and extreme lateral (XLIF) fusion Lumbar anterior interbody fusion Single and multi-level cervical corpectomy with anterior cervical plating Anterior cervical discectomy and cervical arthroplasty Cervical laminectomy with lateral mass and/or pedicle screw stabilization Cervical laminoplasty Postero-lateral thoracic discectomy Anterior (transthoracic) discectomy Thoracoscopic techniques	

TOPIC	Rheumatoid disease	Phase 3 knowledge level
Category	Spine	4
Objective	*To understand the management of rheumatoid patients with atlanto-axial subluxation, cranial settling and related disorders*	
Knowledge	The pathology and natural history of rheumatoid spondylopathy Indications for operative management of atlanto-axial subluxation, cranial settling and related disorders Applied surgical anatomy of the craniocervical junction Selection of surgical approaches Principles of peri-operative care Complications of surgery	

Clinical Skills	The assessment, counselling and pre-operative preparation of patients with cervical myeloradiculopathies Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms and 3D spinal reconstructions	
Technical Skills and Procedures	Fusion surgery for atlanto-axial subluxation incuding craniocervical fusion and C1/C2 fusion. Awareness of the priniciples of transoral PEG resection.	

Paediatrics

TOPIC	**Paediatric neuro-oncology**	**Phase 3 knowledge level**
Category	Paediatrics	3
Objective	*To achieve competence in the surgical aspects of the multi-disciplinary management of children with tumours of the brain and spinal cord*	
Knowledge	Epidemiology, natural history and pathology of tumours of the central nervous system in children including medulloblastoma, pilocytic astrocytoma, high grade gliomas, supratentorial PNET, pineal region tumours, brain stem tumours and intramedullary spinal cord tumours Imaging of paediatric CNS tumours Radiological and biochemical staging of tumours 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 Availability of clinical (CCLG) trials Management of delayed spinal deformity associated with treatment of spinal cord tumours Consent issues in children Recognition of importance of mentorship in dealing with unfamiliar or complicated exposures and procedures	
Clinical Skills	Assessment and clinical management of children with tumours of the central nervous system Multidisciplinary approach to treating patients with paediatric brain tumours	

Technical Skills and Procedures	Emergency operative management of a deteriorating child with an intracranial haemorrhage and/or hydrocephalus secondary to tumour Use of CT, MRI, electromagnetic and ultrasound guided localisation of tumours of the brain and spine Stereotactic, image-guided and endoscopic biopsy of intracranial tumours Supratentorial craniotomy for hemispheric tumour 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 tumour Retrosigmoid approach to tumour presenting in the CP angle Laminoplasty approach to spinal cord tumours.	

TOPIC	**Paediatric head and spinal injury**	**Phase 3 knowledge level**
Category	Paediatrics	4
Objective	*To achieve competence in all aspects of the management of accidental and non-accidental paediatric head and spinal injuries.*	
Knowledge	Pathophysiology of raised intracranial pressure in children following head injury Prevention and treatment of secondary insults relating to transfer and emergency surgery in head-injured children Medical management and intensive care in paediatric head injury Pathophysiology, legal and social aspects of non-accidental injury in children Management of perinatal trauma, growing fractures and penetrating injuries in children Indications for decompressive craniectomy in management of intractable increases in ICP Rehabilitation after mild, moderate and severe head injuries Diagnosis and certification of brain death in children Classification, assessment, investigation and management of paediatric spinal injuries (including SCIWORA)	
Clinical Skills	Assessment and clinical management of children with head and spinal injury Understanding of the legal issues surrounding non-accidental injury Understanding of multi-disciplinary approach to non- accidental injury	

Technical Skills and Procedures	Insertion of ICP monitor Insertion of external ventricular drain Craniotomy for traumatic intracranial haematoma Repair of depressed skull fracture Anterior skull base repair	

TOPIC	**Paediatric Hydrocephalus**	**Phase 3 knowledge level**
Category	Paediatrics	4
Objective	*To achieve competence in all aspects of the management (operative and non-operative) of paediatric patients with hydrocephalus.*	
Knowledge	Pathophysiology and investigation of abnormal CSF dynamics in hydrocephalus and IIH Indications for third ventriculostomy and for shunt insertion Principles of shunt design and function Antenatal diagnosis of hydrocephalus and its prognosis Medical and ophthalmological treatment options for IIH.	
Clinical Skills	Assessment and clinical management of neonates and children presenting with hydrocephalus Assessment and clinical management of neonates and children presenting with shunt malfunction including obstruction, over-drainage and slit ventricle syndrome Interpretation of CT, MRI scans and ultrasound scans Antenatal counselling Consent in neonates and children	
Technical Skills and Procedures	Insertion of intracranial pressure monitor Insertion of ventricular access device in neonates Insertion and revision of ventriculoperitoneal shunt / subduroperitoneal shunt Insertion and revision of ventriculoatrial / ventriculopleural shunt Insertion and revision of lumboperitoneal shunt Endoscopic third ventriculostomy Endoscopic fenestration of loculated ventricles or intraventricular cysts CT, MRI and ultrasound guided ventricular access Management of arachnoid cysts by shunting, open or endoscopic fenestration	

TOPIC	Congenital spinal disorders	Phase 3 knowledge level
Category	Paediatrics	4
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 Epidemiogy, natural history and clinical features of congenital spinal disorders including dysraphism, tethered cord syndrome, diastematomyelia, Chiari malformations, Klippel-Feil syndrome, achondroplasia, Downs syndrome and other similarly presenting conditions Imaging of the neonatal and growing paediatric spine of children with congenital disorders commonly Antenatal diagnosis of dysraphism and its implications.	
Clinical Skills	Assessment and clinical management of children presenting with open or closed dysraphic spines and other congenital spinal abnormalities. Collaborative multidisciplinary approach, particularly with orthopaedic and plastic surgery	
Technical Skills and Procedures	Closure of myelomeningocoele Foramen magnum decompression for hind brain herniation 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 lipomyelomeningocoele Instrumented stabilisation and fusion in the treatment of congenital spinal disorders	

TOPIC	Craniofacial disorders	Phase 3 knowledge level
Category	Paediatrics	3
Objective	*To achieve competence in all aspects of the management (operative and non-operative) of children with simple craniosynostosis and cranial deformity after trauma or tumour* *To understand the management of children with syndromic craniosynostosis and encephalocoeles*	

Knowledge	Advances in the genetic understanding of craniofacial conditions Epidemiology, natural history and clinical features of simple and syndromic craniosynostosis including cosmetic, cognitive and ophthalmological complications 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	
Clinical Skills	Management of ophthalmic and airway emergencies in syndromic craniosynostosis Neurosurgical contribution to the multi-disciplinary management of children with craniofacial abnormalities Consent issues children Liaison with supraregional centres for designated cases.	
Technical Skills and Procedures	Cranioplasty using autologous, titanium or acrylic implants Surgical management of non-syndromic single suture synostosis (in the context of a multidisciplinary team)	

TOPIC	**Paediatric epilepsy**	**Phase 3 knowledge level**
Category	Paediatrics	3
Objective	*To understand the management of paediatric epilepsy and the assessment of children for epilepsy surgery*	
Knowledge	Classification, epidemiology, natural history and clinical features of epilepsy in childhood Clinical, encephalographic, videotelemetric and radiological assessment of children entering a surgical program Indications for, prognosis and complications of VNS, disconnection procedures and temporal lobe surgery	
Clinical Skills	Treatment of status epilepticus Neurosurgical contribution to the multidisciplinary assessment and clinical management of children in preparation for and undergoing epilepsy surgery	
Technical Skills and Procedures	Cortical lesionectomy VNS insertion/revision Invasive EEG recording by grid and depth electrode placement Surgery for temporal lobe epilepsy Non-temporal lobe resections Disconnection procedures	

TOPIC	Paediatric intracranial vascular disorders	Phase 3 knowledge level
Category	Paediatrics	3
Objective	*To achieve competence in the neurosurgical aspects of the multi-disciplinary management of children presenting with intracranial vascular disorders*	
Knowledge	Epidemiology, natural history, pathophysiology and clinical features of subarachnoid haemorrhage, haemorrhagic stroke and ischaemia stroke in children secondary to intracranial aneurysms, arteriovenous malformations and fistulae, cavernomas, arterial dissection, moya-moya disease and venous sinus thrombosis Surgical, endovascular and radiosurgical strategies for the management of intracranial vascular disorders in children	
Clinical Skills	The assessment and clinical management of children presenting with spontaneous intracranial haemorrhage, acute cerebral ischaemia and chronic cerebral ischaemia	
Technical Skills and Procedures	Emergency operative management of spontaneous intracerebral haemorrhage Resection of superficial vascular malformations and cavernomas Surgical management of cerebral ischaemia	

TOPIC	Paediatric spasticity and movement disorders	Phase 3 knowledge level
Category	Paediatrics	3
Objective	*To understand the principles of surgical management of spasticity and movement disorders in children*	
Knowledge	Clinical presentations of spasticity and other movement disorders in childhood Multi-disciplinary assessment of children entering a surgical program The indications for, prognosis and complications of intrathecal baclofen therapy, dorsal rhizotomy and deep brain stimulation in the management of spasticity and dystonia Awareness of indications for CNS modulating procedures in the management of pain and convulsive disorders	
Clinical Skills	Neurosurgical aspects of the multi-disciplinary assessment and management of children with spasticity and movement disorders Consent in children	

Technical Skills and Procedures	Baclofen pump insertion, assessment of function and revision Laminotomy for selective dorsal rhizotomy Removal/revision of pulse generator units	

CRITICAL CONDITIONS

TOPIC	**Impaired consciousness and seizures**	**Phase 3 knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency management of patients presenting with impaired consciousness and non-traumatic coma*	
Knowledge	Aetiology, pathophysiology and differential diagnosis of altered consciousness and coma Assessment of the patient with impaired consciousness The emergency management and investigation of patients with deteriorating levels of consciousness or seizures	
Clinical Skills	Clinical assessment of patients with impaired consciousness or seizures Emergency management of patients impaired consciousness or seizures Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Maintenance of airway Endotracheal intubation Lumbar puncture	

TOPIC	**Cranial Trauma**	**Phase 3 knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward based management of head-injured patients*	
Knowledge	Anatomy and blood supply of the scalp, cranium, meninges and brain Pathophysiology of head injury and of multiple trauma Emergency, intensive care and ward based management of patients with a head injury Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients following a head injury Principles, diagnosis and confirmation of brain stem death	
Clinical Skills	Clinical assessment of patients with a head injury Emergency management of patients with a head injury	

	Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Wound exploration, debridement and closure Burr hole drainage of chronic subdural haematoma Insertion of intracranial pressure monitor Craniotomy for acute subdural, extradural and interparenchymal haematomas, removal of penetrating objects and elevation of depressed skull fractures. Decompressive craniectomy for trauma	

TOPIC	**Acute Hydrocephalus**	**Phase 3 knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward based management of patients with acute hydrocephalus*	
Knowledge	The pathophysiology of CSF circulation Applied surgical anatomy of the ventricular system Emergency, intensive care and ward based management of patients with acute hydrocephalus and shunt failure Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with hydrocephalus	
Clinical Skills	Clinical assessment of patients with acute hydrocephalus Emergency management of patients with acute hydrocephalus Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Lumbar puncture Insertion and taping of CSF reservoirs Insertion and maintenance of lumbar and ventricular drains Insertion of external ventricular drain Shunt insertion and revision	

TOPIC	**Acute Tumour Presentations**	**Phase 3 knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward based management of patients with intracranial tumours*	

Knowledge	The neuropathology of primary and secondary intracranial tumours Functional cerebral anatomy Emergency, intensive care and ward based management of patients with an intracranial tumour Principles and practice of operative interventions The detection and management of complications Rehabilitation, further treatment and prognosis of patients with a brain tumour	
Clinical Skills	Clinical assessment of patients with an acute tumour presentation Emergency management of patients with an intracranial tumour Interpretation of imaging studies including MRI and CT Breaking bad news to patients and families	
Technical Skills and Procedures	Craniotomy for supratentorial intrinsic tumour Craniotomy for infratentorial intrinsic tumour	

TOPIC	**Spontaneous Intracranial Haemorrhage**	**Phase 3 knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward based management of patients with subarachnoid haemorrhages (SAH) and Spontaneous Intracerebral Haemorrhages (ICH)*	
Knowledge	Anatomy and Physiology of the cerebral arterial and venous circulations Aetiology and pathophysiology of SAH and ICH Emergency, intensive care and ward based management of patients with spontaneous intracranial haemorrhage Principles and practice of operative interventions and principles of neuroradiological interventions The detection and management of complications Rehabilitation and prognosis of patients following a spontaneous intracranial haemorrhage	
Clinical Skills	Clinical assessment of patients with a spontaneous intracranial haemorrhage Emergency management of patients with an intracranial haemorrhage Interpretation of imaging studies including MRI, CT and angiograms	
Technical Skills and Procedures	Craniotomy for interparenvhymal haemorrhage including sylvian haematoma and AVM related haemorrhage	

TOPIC	CNS infections	Phase 3 knowledge level
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward based management of CNS infections*	
Knowledge	Aetiology and pathophysiology of CNS infections including surgery related infections, meningitis, cerebral abscess and subdural empyema Microbiological pathogens and antibiotic selection Emergency, intensive care and ward based management of patients with CNS infections Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with CNS infections	
Clinical Skills	Clinical assessment of patients with CNS infections Emergency management of patients with CNS infections Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Lumbar puncture Burr hole aspiration of cerebral abscess Craniotomy for subdural empyema or cerebral abscess	

TOPIC	Spinal Trauma	Phase 3 knowledge level
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward based management of spinal trauma*	
Knowledge	Epidemiology of spinal trauma Spinal biomechanics and the classification of injuries Pathophysiology of spinal cord injury Emergency, intensive care and ward based management of patients with spinal injuries Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with a spinal injury	
Clinical Skills	Clinical assessment of patients with a spinal injury Emergency management of patients with spinal trauma Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Use of external immobilisation including cervical collars Application of cranial-cervical traction Application of a halo-body jacket Anterior cervical spine fusion, posterior cervical spine fusion	

TOPIC	Spinal Oncology	Phase 3 knowledge level
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward based management of spinal oncology*	
Knowledge	The neuropathology of primary and secondary spinal tumours Clinical presentations of intramedullary, intradural extramedullary, extradural and bony spinal tumours including malignant spinal cord compression Emergency, intensive care and ward based management of patients with spinal tumours Principles and practice of operative interventions The detection and management of complications Rehabilitation, further treatment and prognosis of patients with spinal tumours	
Clinical Skills	Clinical assessment of patients with a spinal tumour Emergency management of patients with a spinal tumour Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Decompression of malignant spinal cord compression in the cervical, thoracic and lumbar spine	

TOPIC	Acute Spinal Disorders and cauda equina syndrome	Phase 3 knowledge level
Category	Critical conditions	4
Objective	*To achieve competence in the emergency, intensive care and ward based management of acute spinal disorders especially cauda equina syndrome*	
Knowledge	Anatomy of the spine, spinal cord, autonomic and somatic nervous systems Physiology of spinal cord function and control of the bladder Pathophysiology of cauda equina syndrome, nerve root compression and spinal cord compression Emergency, intensive care and ward based management of patients with acute spinal disorders Principles and practice of operative interventions The detection and management of complications Rehabilitation and prognosis of patients with acute spinal disorders	
Clinical Skills	Clinical assessment of patients with an acute spinal disorder Emergency management of patients with an acute spinal disorder	

	Interpretation of imaging studies including MRI and CT	
Technical Skills and Procedures	Lumbar laminectomy Lumbar discectomy Anterior cervical discectomy Posterior cervical decompression Laminectomy for epidural or subdural haematomas and empyemas	

TOPIC	**Emergency paediatric neurosurgery**	**Phase 3 knowledge level**
Category	Critical conditions	4
Objective	*To achieve competence in the emergency management of paediatric neurosurgical patients*	
Knowledge	Paediatric physiology Pathophysiology of hydrocephalus, head injury and acute presentations of tumours and intracranial haemorrhage in children of all ages Child Safeguarding principles Understanding of Children's rights and surgical consent	
Clinical Skills	Clinical assessment of children with acute neurosurgical disorders Emergency management of children with acute neurosurgical disorders	
Technical Skills and Procedures	Lumbar puncture in children Taping of CSF reservoirs in children Shunt insertion and revision in all age groups EVD insertion in all age groups	

INDEX PROCEDURES

TOPIC	**Advanced Adult Supratentorial**	**Phase 3 technical level**
Category	Index procedures	4
Objective	*To achieve technical competence in advanced adult supratentorial surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature, nerves and brain Indications for surgery Microsurgical dissection techniques Complications of surgery Management of anti-platelet and anti-coagulant medication	

Technical Skills and Procedures	A wide range of the following procedures in those 16 years and over: Clipping of anterior circulation aneurysm Clipping of posterior circulation aneurysm Craniotomy and excision of AVM Craniotomy and excision of Cavernoma Hemispherectomy (functional or anatomic) for epilepsy Infratentorial, supracerebellar approach to pineal region tumour Interhemispheric approach to midline ventricular lesion (eg colloid cyst) Interhemispheric approach to pineal region tumour Lesionectomy for epilepsy Supratentorial, suboccipital approach to pineal region tumour Temporal lobectomy for epilepsy Transcranial approach to sellar or suprasellar lesion	

TOPIC	**Endoscopic and Transphenoidal**	**Phase 3 technical level**
Category	Index procedures	3 (4 if special interest)
Objective	*To achieve technical competence in endoscopic and transphenoidal surgery*	
Knowledge	Applied anatomy of the sphenoid sinus, sella, pituitary and optic nerves Indications for surgery Use of an endoscope to perform complex surgery Complications of surgery and management of endocrine function Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures: Endoscopic biopsy of intrinsic cerebral tumour Endoscopic excision / drainage of ventricular lesion (eg colloid cyst) Endoscopic third ventriculostomy Other Endoscopic Procedure (except biopsy) Transphenoidal biopsy of sellar lesion (not adenoma) Transphenoidal hypophysectomy	

TOPIC	**Convexity and falcine meningiomas**	**Phase 3 technical level**
Category	Index procedures	4
Objective	*To achieve technical competence in convexity and falcine meningioma surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature and brain Indications for surgery Microsurgical dissection techniques	

	Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures: Excision of meningioma - convexity Excision of meningioma - falx Excision of meningioma - Other Excision of meningioma - parasagital Excision of meningioma - sphenoid ridge Excision of meningioma - subfrontal	

TOPIC	**Advanced adult infratentorial**	**Phase 3 technical level**
Category	Index procedures	4
Objective	*To achieve technical competence in advanced adult infratentorial surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature, nerves and brain Indications for surgery Microsurgical dissection techniques Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures in those 16 years and over: Craniotomy for spontaneous ICH (infratentorial) Infratentorial skull base approach to skull base tumour Microvascular decompression of facial nerve Microvascular decompression of trigeminal nerve Middle fossa approach to vestibular schwannoma Midline approach to intrinsic brain stem or 4th ventricle tumour Midline approach to intrinsic cerebellar tumour Midline posterior fossa craniotomy and excision of meningioma Midline posterior fossa craniotomy for benign lesions (excl. meningioma) Retrosigmoid approach to intrinsic brain stem tumour Retrosigmoid approach to intrinsic cerebellar tumour Retrosigmoid approach to vestibular schwannoma Retrosigmoid craniotomy and excision of meningioma Retrosigmoid craniotomy for benign lesions (excl. schwanoma and meningioma) Translabrynthine approach to vestibular schwannoma Transoral / transfacial approach to skull base tumour	

TOPIC	Intradural Spine	Phase 3 technical level
Category	Index procedures	4
Objective	*To achieve technical competence in intradural spinal surgery*	
Knowledge	Applied anatomy of the spine, meninges, vasculature, spinal cord and nerves Indications for surgery Microsurgical dissection techniques Spinal cord monitoring Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures: Biopsy of intramedullary spinal cord lesion Closure of encephalocoele Closure of myelomeningocoele Evacuation of primary spinal subdural haematoma Excision / debulking of intramedullary spinal cord lesion Excision of other intradural, extramedullary lesion Excision of spinal meningioma Excision of spinal neurofibroma Foramen magnum decompression Other surgery for spinal dysraphism Surgery for spinal AVM Surgery for spinal cavernoma Untethering of spinal cord	

TOPIC	Complex Spinal Fusion	Phase 3 technical level
Category	Index procedures	3 (4 if special interest)
Objective	*To achieve technical competence in spinal fusion surgery*	
Knowledge	Applied anatomy of the vertebrae, ligaments, discs, musculature and nerves Indications for surgery Spinal decompression and fusion techniques Complications of surgery Management of anti-platelet and anti-coagulant medication	
Technical Skills and Procedures	A wide range of the following procedures: Spinal fixation AND Anterior cervical fusion Anterior Lumbar Interbody Fusion Anterior PEG spinal fixation Anterior thoracic fusion Occipito-Cervical fusion (with instrumentation)	

	Other anterior cervical decompression Other anterior thoracic decompression Other decompressive posterior lumbar surgery Other posterior cervical decompression Other posterior thoracic decompression Posterior C1/2 spinal fixation Posterior cervical fusion Posterior Lumbar Fusion Posterior Lumbar Interbody Fusion Posterior thoracic fusion Open biopsy of spine (eg tumour, infection) Primary Posterior Cervical Laminectomy or laminoplasty Revision anterior cervical decompression Revision posterior cervical decompression Transoral excision of odontoid Primary anterior lumbar surgery for disc/degen disease Primary lumbar laminectomy for disc/degen disease Primary posterior lumbar discectomy Revision anterior lumbar surgery for disc/degen disease Revision posterior lumbar surgery for disc/degen disease	

TOPIC	**Advanced paediatric supratentorial**	**Phase 3 technical level**
Category	Index procedures	2 (3 if special interest)
Objective	*To gain experience in advanced paediatric supratentorial surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature, nerves and brain Indications for surgery Microsurgical dissection techniques in children Complications of surgery	
Technical Skills and Procedures	A wide range of the following procedures in children under 16: Clipping of anterior circulation aneurysm Clipping of posterior circulation aneurysm Craniotomy and excision of AVM Craniotomy and excision of Cavernoma Craniotomy for dural AVM Craniotomy for frontal intrinsic cerebral tumour Craniotomy for occipital intrinsic cerebral tumour Craniotomy for other intrinsic cerebral tumour Craniotomy for parietal intrinsic cerebral tumour Craniotomy for temporal intrinsic cerebral tumour Excision of meningioma - convexity Excision of meningioma - falx Excision of meningioma - Other Excision of meningioma - parasagital Excision of meningioma - sphenoid ridge Excision of meningioma - subfrontal	

	Hemispherectomy (functional or anatomic) for epilepsy Interhemispheric approach to midline ventricular lesion (eg colloid cyst) Interhemispheric approach to pineal region tumour Lesionectomy for epilepsy Supratentorial craniotomy for benign lesions (excl. meningioma) Supratentorial, suboccipital approach to pineal region tumour Temporal lobectomy for epilepsy Transcranial approach to sellar or suprasellar lesion	

TOPIC	**Advanced paediatric infratentorial**	**Phase 3 technical level**
Category	Index procedures	2 (3 if special interest)
Objective	*To gain experience in advanced paediatric infratentorial surgery*	
Knowledge	Applied anatomy of the scalp, skull, meninges, vasculature, nerves and brain Indications for surgery Microsurgical dissection techniques in children Complications of surgery	
Technical Skills and Procedures	A wide range of the following procedures in children under 16: Infratentorial, supracerebellar approach to pineal region tumour Midline approach to intrinsic brain stem or 4th ventricle tumour Midline approach to intrinsic cerebellar tumour Midline posterior fossa craniotomy and excision of meningioma Midline posterior fossa craniotomy for benign lesions (excl. meningioma) Retrosigmoid approach to intrinsic brain stem tumour Retrosigmoid approach to intrinsic cerebellar tumour Retrosigmoid craniotomy and excision of meningioma Retrosigmoid craniotomy for benign lesions (excl. schwanoma and meningioma) Transoral / transfacial approach to skull base tumour	