

GUIDELINES FOR COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR DM IN NEUROANAESTHESIA

Preamble

There has been significant progress in the understanding of basic and clinical neurosciences which has paved way for improvement in practices and care. Clinical research and individual disorder directed management strategies have greatly changed the clinical outcomes in many neurological conditions. With more advanced monitors being available, the clinical management of neurological and neurosurgical patients has changed for the better. Therefore, there is a need for the clinical personnel involved in patient care to be aware of the advances in all the related fields of neurosciences. Such knowledge should also be disseminated to the post graduate students and clinicians to change the outcomes of patient care in the peripheral centers. In order to achieve the above goals and also promote basic and clinical knowledge in related fields, neuroanaesthesia has now established itself well as a specialty for the past 15 - 20 years. The evolution of neuroanaesthesia as a separate specialty has definitely improved the outcome of treatment of neurological and neurosurgical patients. It has been the general experience that institutions with dedicated neuroanaesthesia services have provided better care and optimal outcomes for patients with neurological diseases.

SUBJECT SPECIFIC OBJECTIVES

The students admitted to the course must be exposed to the entire range of cases in Neurosurgical (those requiring surgery as also those requiring management in neuro-intensive care) and Neurological diseases (especially, those requiring management in neuro-intensive care). The student needs to perform meticulous history taking, thorough clinical examination, examine the necessary investigations required for surgery, order diagnostic tests, which he/she thinks are necessary for optimal preparation of the patient for surgical procedures; perform procedures; counsel and manage patients, use the antimicrobial and other drugs based upon local institutional policy. They will also need to appropriately and rationally work with other departments to provide patient-focused care. The student should also know the various ethical issues involved in the intensive management of such patients.

The student should also be able to manage patients presenting for neuro-interventional procedures, both diagnostic as well as therapeutic. He /she should also learn the management of patients for MRI/CT scan.

Teaching Skills

The student should be exposed to the basic methodology of teaching and develop competence in teaching medical, paramedical and nursing students at the undergraduate and postgraduate levels.

The student must be able to acquire the skills to engage and transfer his/her knowledge in a clear and succinct manner and be able to motivate others to pursue further reading. The quality of the information must sustain to the high standards that are required to enhance the understanding of the subject discussed. This should include the ability to actively involve and guide the students in small groups and to provide them with the fundamentals of clinical methods and analytical thinking.

Research Skills

The students should gain the basic skills and knowledge to function as independent investigators. The students are exposed to state-of-the-art basic, translational, and clinical research and through active participation, develop a firm basis for continuing success in one or more of these areas. Skills include developing appropriate scientific knowledge and critical evaluation of the relevant literature, problem solving, design and interpretation of experiments, communication of progress and results in formal and informal settings, understanding national and international systems for funding of research, learn to write research protocols and sharpen critical thinking. Scientific professionalism would be stressed in clinical situations. Basic knowledge of statistics, along with clinical epidemiologic principles like appropriate study designs, critical appraisal of data management and analysis are also required.

Interpersonal and Communication Skills

Through experience in the pre-anaesthetic check up clinic, pain clinic, operation theatre, radiological diagnostic labs and Intensive Care Unit, the students would learn and practice

communication skills appropriate to the situation. In their clinics, they will practice the building of a professional relationship with the patients and will develop the skills of proper communication about educating the patient regarding his/her care during hospital stay. The patients would be provided information about all anticipated complications of surgery and anaesthesia and effect on outcome. In the operating room setting, they will acquire skills of working with different caregivers like surgeons, nurses, technicians and other paramedical staff. The operating room environment of the neurosurgery operation theatres also will give them the training for handling crisis situations like difficult airway, massive blood loss, air embolism, cardiac arrhythmias and cardiovascular collapse. The students will learn the importance of working as a team and will develop the skills of getting the best out of the paramedical and nursing staff. In the intensive care unit, they will learn to develop the communication skills to deal with sick patients and their anxious relatives. The students will also learn the art of working together with colleagues from other specialties. By getting the opportunity to make presentations and attending the seminars, journal club, case presentations, students will also learn the art of making good presentation and teaching students.

Professionalism

The students are required to practice professionalism in the areas of academic, clinical and research activities. Under appropriate supervision, they will have primary responsibility for managing anaesthesia care in the operating room and remote locations, running the pre-anaesthesia check up clinics and pain clinics and also for providing intensive care for seriously ill patients. They would be dealing with patients of various ages and ethnicities. Intellectual integrity is emphasized in all settings, including in the clinics, operating room, ICU, conference room, in the conduction of research and publications.

SUBJECT SPECIFIC COMPETENCIES

At the end of the course, the student should have acquired the following:

1. Demonstrate sufficient understanding of knowledge in neuroanaesthesiology and allied specialties like neurosurgery, neurology and neuroradiology.

2. Develop the ability to take pertinent history from the patient/relatives (in case of unconscious patients), perform relevant clinical examination, decide appropriate investigations and derive anaesthetic management plan.
3. Acquisition of a reasonable level of theoretical and practical knowledge that empowers him/her to provide safe peri-operative and critical care of neurologically ill patients.
4. Proficiency in performing the mandatory procedures independently and other procedures under limited supervision at the end of three years.
5. Proficiency in advanced patient monitoring techniques like intracranial pressure, cardiac output, electroencephalography, evoked potential, transcranial Doppler, cerebral oximetry, jugular venous oximetry, microdialysis and echocardiography.
6. Become effective communicators to patients, their family, colleagues, inter-departmental personnel, technicians, nursing staff, teachers and students.
7. Develop essential skills in conducting medical research, and present them in scientific fora and publish in relevant peer-reviewed journals.
8. Acquire skills in emergency neurosurgical and neurotrauma procedures

By the end of the course, the student should have acquired knowledge (cognitive domain), professionalism (affective domain) and skills (psychomotor domain) as per details given below:

A. Cognitive domain (theoretical knowledge)

The post graduate student should acquire knowledge in the following areas by the end of the training programme.

1. General principles related to neuroanesthesia
2. Basic Neuroanatomy and Neurophysiology
3. Respiratory physiology
4. Cardiovascular physiology:
5. Renal physiology
6. Metabolic disorders
7. Neurologic diseases
8. Specific Neurological diseases
9. Neuroinfections

10. Peripheral Motor Neuron Disease
11. Traumatic Brain Injury:
12. Pharmacology:
13. Brain Death:
14. Cerebral Vascular Accidents:
15. Subarachnoid Hemorrhage:
16. Toxicity of anaesthetic agents on the developing brain:
17. Monitoring in Critical Care:
18. Nutrition in the neuro-critical care
19. Neuroimaging
20. Neuro-rehabilitation
21. Chronic neurological diseases
22. Temperature regulation

The topics are given under syllabus.

B. Affective domain

The student:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

1. Clinical Skills:

All students pursuing DM Neuroanaesthesia are required to follow the following structured teaching/clinical training, as given below:

Exposure to whole range of cranial and spinal surgical procedures, cranial and spine trauma, spinal instrumentation, peripheral nerve repair, ventriculo-peritoneal shunt insertion, movement disorders, and exposure to awake craniotomy. The student should be exposed to anaesthesia management of neurosurgical patients in brain suite, management of patients in neurosurgical (postoperative and other critical patients) and neurological intensive care units.

➤ **In the intensive care unit, the student will learn:**

- to recognize complications arising in neurological patients,
- learn to sedate and manage patients on mechanical ventilation
- learn methodology of plasmapheresis in Myasthenia gravis and GB Syndrome patients
- use of fluids, vasoactive drugs and management of electrolyte disorders in ICU.
- insertion of central venous lines and arterial line with and without ultrasound guide
- learn to manage nutritional requirements in ICU
- learn prevention and management of deep vein thrombosis
- management of acute ischaemic stroke patients in Neurological ICU
- management of other critically sick neurological patients like status epilepticus, encephalitis, meningitis, multiple sclerosis etc.
- bronchoscopy in patient with diseased lungs and for collection of samples for microbiology and culture
- percutaneous dilatational tracheostomy
- management of difficult airway and specialized equipments
- emergency neurosurgical and neurotrauma procedures

➤ **In the neuroradiology/radiology interventional laboratory, they will be given exposure to diagnostic cerebral angiogram, carotid stent insertion, intra-arterial nimodipine infusion and embolization of cerebral aneurysm, arterio-venous malformation, vein of Galen malformation and carotico cavernous fistula. In addition, the student will also need to know:**

- management of ischaemic stroke for clot lysis or clot retrieval
- management of MRI and CT scan under MAC and general anaesthesia
- safety zones and other safety aspects in MRI room
- prevention and management of anaphylactic reactions to radiologic contrast media

➤ They will also be posted in **preanaesthesia clinic** for:

- a) preanaesthetic evaluation of patients for elective neurosurgical procedures
- b) the preoperative lab investigations need to be evaluated and special test need to be requested if required

➤ **In operation theatre**, the student should learn

- i) Induction, endotracheal intubation, positioning and maintenance of anaesthesia
- ii) Management of difficult airways
- iii) fluids, electrolytes, blood and blood products administration
- iv) ventilation in the intra operative period
- v) haemodynamic monitoring and management
- vi) basic electrophysiology- EEG, Evoked potentials
- vii) Management of blood gases and acid - base status

Syllabus

Course contents:

i) General principles:

1. General principles of Critical Care
2. Organization of Critical Care
3. An awareness of the importance of communication skills and interpersonal relationships
4. Various Scoring Systems
5. Admission and Discharge criteria in Neuro-intensive Care Unit
6. Transport of the patients – pre-hospital and intra-hospital
7. Internal Audit

8. Medical Ethics
9. Principles of consent taking and details of informed consent
10. Sterilization procedures
11. Maintenance of asepsis
12. Organizational capabilities, leadership qualities required to administer, manage and delegate responsibilities in Critical care
13. Training on development of protocols for Critical care management
14. Behaviour and team work in neuro critical care
15. Anaesthetic management of various CNS tumors

ii) Basic Neuroanatomy and Neurophysiology

1. Anatomy of the brain and spinal cord
2. Physiology of the brain and spinal cord
3. The cerebrospinal fluid circulation
4. Cerebral and spinal circulation, metabolism and effects of various anaesthetics (inhalational and intravenous agents)
5. Intracranial pressure and various herniation syndromes
6. Determinants of brain elastance, cerebral perfusion pressure, cerebral autoregulation, and metabolic coupling
7. Mechanism of neuronal injury and brain protection

(iii) Respiratory physiology

1. Physiology of spontaneous respiration and mechanical ventilation
2. Indications for mechanical ventilation
3. Modes of ventilation
4. Weaning from ventilatory support
5. Complications of mechanical ventilation – recognition and management
6. Monitoring during ventilatory support

(iv) Cardiovascular physiology:

1. Recognition and management of arrhythmias

2. Management of hemodynamic disturbances – hypotension, hypertension, myocardial ischemia, pulmonary edema and heart failure
3. Knowledge of commonly employed vasoactive and anti-arrhythmic drugs

(v) Renal physiology:

1. Fluid and electrolytes physiology and pathophysiology
2. Prevention, diagnosis and management protocol for acute kidney disease
3. Basic knowledge of dialysis

(vi) Metabolic disorders

1. Pathophysiology and management of the Electrolyte disturbances in neurosurgical patients
2. Acid-base disorders
3. Understanding of endocrine disorders

(vii) Neurologic diseases

1. Neurologic examination
2. Manifestations of lobar syndromes
3. Neurological illnesses which can cause altered sensorium and critical care management
4. Differential diagnosis and work-up of patients presenting to Critical care.
5. Evaluation of patients in altered mental status with various coma Scores, stroke score
6. Nomenclature/criteria of altered levels of consciousness (coma, persistent & permanent vegetative states, minimally conscious states, etc)
7. Pathophysiology, and therapy of coma arising from metabolic, traumatic, infectious, mass lesions, vascular-anoxic or ischemic, drug induced events

(viii) Specific Neurological diseases

1. Status epilepticus, refractory status epilepticus, super refractory status epilepticus, epilepsy and encephalopathies
2. Understanding the pharmacology and interactions of various anti-epileptic drugs
3. Guillian-Barrie syndrome
4. Muscle dystrophies with complication

5. Systemic illnesses causing neurological manifestations:
Neuropathy, myopathy, dyselectrolytemias, renal and hepatic failures, multi organ failure etc.
6. Myasthenia gravis
7. Stroke (cerebrovascular accidents) and CVT (cortical venous thrombosis)
8. Other neurological diseases requiring ICU management

(ix) Neuroinfections

1. Bacterial, Viral, Fungal meningitis
2. Causative organisms of community-acquired & noscomial meningitis / ventriculitis / abscesses along with preferred antibiotic agents
3. Describe the pharmacodynamic/ pharmacokinetic principles influencing CNS antibiotic activity

(x) Peripheral Motor Neuron Disease

1. Review the natural history/expression of motor neuron disease related to degenerative diseases, infectious agents and inflammatory conditions
2. List the changes that occur in denervated muscles and implications for use of medications with activity at the neuro-muscular junction
3. Understand the presentation of respiratory failure and indications for non-invasive and invasive ventilatory support
4. Indications for and problems associated with plasmapheresis and intravenous immunoglobulin
5. Review the non-neurologic complications and management of motor neuron disease (cardiac denervation, intestinal movement disorders)

(xi) Traumatic Brain Injury:

1. Pre-hospital care of the patient with neurologic injury
2. Resuscitation of the head injured
3. Airway management -conventional laryngoscopic intubation, insertion of LMA, fiberoptic intubation, manual inline stabilisation (MILS), use of videolaryngoscope and surgical airway

(xi) Pharmacology

1. Basic idea on pharmacodynamics and pharmacokinetics of drugs, drug interactions, complications of various drugs used in neurological patients
2. Sedatives and anaesthetic agents
3. Analgesics - Narcotics and non-narcotic agents
4. Muscle relaxants
5. Anticonvulsants
6. Vasopressors and inotropes
7. Antibiotics
8. Steroids

(xii) Brain Death:

1. Criteria, determination and certification of Brain death
2. Differential diagnosis e.g. drug induced, locked-in syndrome, etc
3. Organ donation: metabolic and hemodynamic management pending organ harvesting

(xiii) Cerebral Vascular Accidents:

1. Pathophysiology of stroke and management
2. Treatment modalities for arterial and venous stroke
3. Long term care of stroke patient, rehabilitation
4. Understand the indications/contraindications/side effects of intrarterial / intravenous thrombolysis in ischemic cerebrovascular accident
5. Describe the natural history, risk factors and management options for “malignant infarcts”. Understand about surgical options
6. Describe the natural history of intracerebral haemorrhage along with the role of early surgical interventional, and medical treatment (i.e. Blood pressure & glycemic control, administration of factor VIIa)

(xiv) Subarachnoid Hemorrhage:

1. Various types of cerebral aneurysms
2. Describe the common aneurysm locations leading to SAH
3. Understand the clinical and radiographic grades of SAH

4. Methods used to detect cerebral vasospasm & strategies to treat Cerebral vasospasm to prevent secondary ischemic stroke
5. Indications for temporary external ventricular drains / permanent Shunts
6. Non-neurological complications of SAH and their management
7. Surgical clipping and coiling of cerebral aneurysm
8. Giant intracranial aneurysms and their implications
9. Anastomotic procedures in cerebral ischemia

(xv) Toxicity of anaesthetic agents on developing brain

(xvi) Monitoring in Critical Care

1. Neurological monitoring at the bedside
2. EEG- understanding basic EEG, role of continuous EEG monitoring in ICU
3. Monitoring cerebral oxygenation
4. Monitoring cerebral blood flow
5. Monitoring biomarkers
6. Hemodynamic monitoring
7. Respiratory monitoring
8. Intracranial pressure monitoring

(xvii) Nutrition in the neuro-critical care

1. General principles and indications
2. Total parenteral nutrition—indications, advantages/ disadvantages
3. Enteral nutrition: indications, advantages, and side effects
4. Nutrition in presence of metabolic and systemic diseases

(xviii) Neuroimaging

1. Basics of neuroradiology
2. CT, MRI, TCD (Trans cranial Doppler), USG (Ultrasound)
3. Interventional Neuroradiologic procedures
4. Identify the basic structures in the central nervous system (ventricles, cisterns, sinuses, major anatomic landmarks)
5. List the imaging techniques/signs used to identify acute intracranial hemorrhages, mass lesions, arterial and venous lesions, and ischemic penumbras / infarcts

6. Distinguish imaging characteristics of SAH, epidural hematomas, subdural hematomas, intra - parenchymal hemorrhage and relate to anatomic structure
7. Understanding the concepts of medical and surgical managements of various emergencies based on imaging and various decision paradigms
8. Management of complications in neuroradiological procedures

(xix) Neuro-rehabilitation

Head injured and spinal cord injured patients

1. Prevention of acute problems
2. Attendant training and counselling
3. Understanding long term goals in neuro- rehabilitation

(xx) Chronic neurological diseases

1. Stroke
2. Brain tumours postoperative
3. Epilepsy

(xxi) Temperature regulation

1. Understand the physiology of temperature regulation in OT and ICU and management of hypothermia/ hyperthermia in the neuro-intensive care population

Psychomotor Domain

At the end of the course the student should be able to perform independently the following:

(I) Procedures in the OT and ICU

1. Arterial line placement
2. Central venous line placement
3. Tracheostomy – surgical and percutaneous dilatational tracheostomy
4. Chest drain insertion
5. Care of patients with invasive equipment e.g ICP monitor, EVD
Deep epilepsy electrode , grid, etc.
6. Patient controlled analgesia pump
7. Application of transcranial Doppler

8. Ultrasound and its applications
9. Bronchoscopy
10. Transfer of critical neurosurgical patients to different areas of hospital

(II) Traumatic Brain/Spinal Cord Injury

Management of TBI (Traumatic Brain Injury)

1. Assessment and resuscitation
2. Airway management
3. Laboratory and radiological investigations
4. Pathophysiology of head injury
5. Factors causing secondary injury
6. ICP (Intracranial pressure) - physiology and pathophysiology, and principles of management. Controversies of ICP monitoring in TBI
7. CPP (Cerebral perfusion pressure); its role in TBI management, concept of individualized CPP
8. ICP-CPP targeted management of TBI
9. Biochemical markers of brain injury, molecular and cellular mechanisms of injury
10. Brain Trauma Foundation Guidelines in the management of TBI / spinal cord Injury
11. Role of hyperventilation in traumatic brain injury
12. Methods available to measure/estimate ICP/ cerebral perfusion along with advantages and disadvantages of each method
13. Approaches to management of refractory ICP elevation

Management of Spinal cord injury

1. Resuscitation and care of the affected area
2. Airway management of C-spine injury
3. Pathophysiology of spinal cord injury
4. Conservative management of spine injury

5. Role of steroids administration in spinal cord trauma
6. Spinal shock and autonomic hyperreflexia
7. Care of the cardiovascular and pulmonary complications

(III) Miscellaneous

1. Sepsis - Pathophysiology and management
2. Haemodynamic management
3. Pregnancy and Neurosurgery
4. Cyanotic heart disease and neurosurgery
5. Multiple Organ Dysfunction Syndromes
6. Nosocomial infections
7. Antibiotics and immunotherapy
8. Reperfusion injury and antioxidants
9. Shock-types and management
10. Deep vein thrombosis prophylaxis, management and Pulmonary Embolism
11. Coagulopathies and their management
12. Infection Control in the ICU
13. Sterilisation procedures in ICU
14. Patient safety and prevention of adverse effects
15. Management of cardiac patients on antiplatelets/anticoagulants
16. Clinical Audit
17. Various ethical issues in Neurointensive care
18. End of life care issues in the intensive care unit

SUBJECT SPECIFIC LEARNING METHODS

1. **Journal Club:** The trainee will present a journal article relevant to neuroanaesthesia. The trainee is expected to present the article citing the relevance, background/context, study methods and statistical analysis, interpret results and discussion, summarize, present limitation and critically analyze the study methods and outcomes. The trainee should select good articles related to neuroanaesthesia, neurocritical care and neurotrauma from various

journals on Neuroanaesthesia, anaesthesia, Neurosurgical, neurocritical, neurotrauma, Journal of Neurosurgery, Anesthesiology, British Journal of Anaesthesia, Neurocritical Care and other reputed non-anaesthesia journals. A student should present at least two articles along with an interesting relevant case report.

2. **Lectures:** Attend didactic lectures on basic neurosciences, biostatistics, research methodology, teaching methodology, from external faculty of specialties related to the subject, medical ethics and legal issues related to neuroanaesthesia, neurointensive care practice etc. should be conducted once or twice a week.
3. **Subject Seminar:** The trainee will present a subject topic allocated after doing a comprehensive preparation, relevant literature search and present the topic in detail covering all the relevant aspects, clinical applications and engage audience and answers questions.
4. **Hospital Grand Rounds:** The trainee will attend the Hospital Grand Rounds weekly, which involves presentations from anaesthesia, neuroanaesthesia, neurosurgery, neurology and intensive care unit. **If core lectures are arranged at the beginning of the course from the teaching departments in the hospital the students must be permitted to attend.**
5. **Clinical Case Presentation:** The trainee will present a clinical case (either from anaesthesia point of view or some neurocritical care case) after performing thorough history and physical examination. Trainee will elicit physical and non-physical aspects in history, elicit all physical signs, formulate diagnosis/differential diagnosis and able to plan a comprehensive care plan for the patient.

Timing of teaching and days of teaching would entirely depend upon the local arrangement at the teaching institute.

6. Core Training:

Both learning and teaching should be integral part of the programme. The chain of learning from peers and teaching the juniors should never be broken.

- Intensive Care rounds and on-hands teaching in the operating theatre should be the mainstay of the teaching programme, rather than didactic lectures.

- Journal Club meetings should be held once a week
- A mortality/morbidity review and departmental audit should be held at least bimonthly to review all deaths and complications attributed to anaesthesia, if any.
- Unscheduled and informal discussions to be held as often as possible depending upon the variety and the number of procedures seen. This method could be an excellent teaching tool rather than totally regimented scheduling at this level of education.
- The students should be encouraged to undertake epidemiological and /or clinical research programme on selected topic. They should be taught the basic methods of research and reporting.
- The postgraduate students shall be required to participate in the teaching and training programme of undergraduate students and interns.
- The department should encourage e-learning activities.
- Student should have a minimum of one publication in indexed international journals/National journals during three years course.
- They should be encouraged to deliver lectures/ present papers at the CME programmes conducted at the National, State and Local Levels as this would not only help them to learn to deliver scientific lectures, but also boost their confidence .
- They should submit at least one scientific paper per year to the annual conference of the Indian Society of Neuroanaesthesiology and critical care.

7. A. BED SIDE TEACHING

- All the postgraduate trainees posted in Neurointensive care unit will carry out their clinical work under supervision of faculty. This would involve around 1- 2 hours of dedicated teaching, ICU round in the morning, and consultation liaison.

7. B. ADDITIONAL TEACHING/TRAINING

- All the postgraduate trainees are expected to attend regular CMEs, Conferences, Workshops; Small group teaching organized by local/national/international institutes and required to be abreast with the current knowledge and recent advances in the field of neuroanaesthesia and neurocritical care. They should participate in pain clinic for the

management of failed back (epidural steroids, facet block, etc), Complex regional pain syndrome II (CRPS II) of upper limb following brachial plexus trauma and neuropathic pain of trigeminal neuralgia.

8. Log book

Log books serve as a document of the trainee's work. The trainee shall maintain this Log book of the special procedures/ operations performed by him / her during the training period right from the point of entry and its authenticity shall be got regularly assessed by the faculty and certified by the concerned Postgraduate Teacher / Head of the Department. This shall be made available to the Board of Examiners for their perusal at the time of his / her appearing at the final exit Examination. The logbook should record cases anaesthetised (both in the operation theatre and also in the interventional neuroradiological / radiological lab and in the MRI and CT room) seen and presented, procedures performed, seminars, journal club and other (case) presentations. Log book entries must be qualitative and not merely quantitative, focusing on learning points and recent advances in the area and must include short review of recent literature relevant to the entry. It should also contain detailed documentation of a minimum of 5 interesting cases.

9. RESEARCH

A student shall be required to present at least two papers/posters at conferences of state, national or international levels. The work has also to be published or at least sent for publication in an Indexed journal before the completion of course. Three copies of each of the two papers; duly certified, shall be submitted by the student to the University 06 months before commencement of his/her final Examination for onward transmission to the examiners. Publication in an indexed journal is desirable as the University would be considering, that also in case it decides to provide awards to the best student.

Posting in allied Departments

A student should be posted to various allied departments, neurology (02 weeks) and neuroradiology/radiology (04 weeks) to acquire more knowledge. All students should be

posted to all the units of the concerned department equally by rotation to get training in all the units. All students should be exposed for one week each to modern principles of Clinical epidemiology and Biostatistics/Research methodology of the Institution. For this, he/she should attend lectures arranged by the Biostatistics and Epidemiology departments from time to time.

Training timeline during three years of residency in parent institute and outstation institutes

The training programme should aim to provide sound knowledge in the diagnostic and investigative aspects of Neuroanaesthesia. It will provide additional exposure to the student. In addition to the exposure to neuroanaesthesia at the institute it is desirable that the student will also receive an opportunity during the training period to spend a period of up to two weeks in other similar advanced centers for enriching his/her experience in monitoring/ other techniques (including neurosurgical), not available at students' institution.

The following Rotations are recommended

1. **Radiology** : To learn the basics in imaging techniques.:
 - a) To learn complications of contrast
 - Basics in other imaging modalities, such as CT angio and MR angiography.
 - b) To learn various problems in MRI room
 - c) To have basic knowledge of cerebral angiography and how to diagnose cerebral aneurysm, arteriovenous malformation, Moya-moya disease, cerebral vasospasm, etc.
2. **Neurology**: As many patients admitted in neuro ICU are from Neurology, a short rotation of two weeks through neurology would be helpful to the student.
3. **Clinical epidemiology** department for learning research methodology, biostatistics, etc.

During the training period, the student shall work on full time student basis under the head of the Division of the respective department of posting. He shall take part in all activities of the department including participation in seminars, conferences, teaching

assignments, ward duties, and other duties that may be assigned to him by the head of the Neurology/Neuroradiology/Radiology/ clinical epidemiology departments.

1. The programme of training will be divided as follows:

First Year

a) 06 months:

During the first 02 weeks, the student shall be posted in the operation theatre and will do pre-anaesthesia check up of the patients. The student will receive progressively greater responsibility for the anaesthetic management of patients. He /she will learn placement of arterial cannula and insertion of neck line under ultrasound guidance, how to make proper position of the patients and what are the problems faced during various neurosurgical positions. The student will learn all the advanced airway management equipments. The student will also learn how to handle patients with unstable cervical/suspected cervical spine injury, and how to perform fiberoptic intubation. The student will also learn neurophysiology monitoring and anaesthesia technique to monitor neurophysiology monitoring. The student will be responsible for preparation of anaesthesia record and mention postoperative intensive care instructions to the neuroanaesthesia posted in the neurointensive care.

b) 02 weeks in clinical epidemiology and biostatistics

c) 02 weeks in neurology

d) 04 weeks in neuroradiology/radiology

e) 01 month in pre-anaesthesia clinic

The student will look after pre-anaesthesia clinic. The student will examine all the prospective patients for the neurosurgical procedures. He/She will make sure that patients are physically fit to undergo anaesthesia/ surgery. If required he/she will refer the patients to other departments for management of underlying incidental systemic disease/s

f) 03 months in ICU

Next three months, the resident will be posted in the neurointensive care unit where the student will manage all the postoperative neurosurgical patients and critical neurology patients. The student will learn various techniques used in the neurointensive care.

Second Year

g) 09 months

The student will be rotated in all the operation theatres of neurosurgery so as to get exposure to work with all the consultants of neurosurgery and gets exposure to all kinds of neurosurgical procedures and management of neurotrauma patients. He/She will also do emergency duties; the frequency of this emergency duty will depend upon number of DM students.

h) 01 month: Pre-anaesthesia clinic

i) 02 months : The student will be posted in the ICU.

Third Year

The third year of posting will be as given below:

1. Four months in ICU - this will include neurological, neurosurgical and neuro-trauma patients
2. Two months of external postings to two or more other centres practicing neuroanaesthesia and critical care to gain different perspectives of care.
3. One month in other supporting departments of the parent Hospital like Neuroradiology, Transfusion Medicine, Neurology and Neurosurgery.
4. Five months in the operating room

During the training programme, patient safety is of paramount importance; therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently; for this purpose, provision of skills laboratories in medical colleges is mandatory.

ASSESSMENT

FORMATIVE ASSESSMENT, ie., during the training

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self directed learning and ability to practice in the system.

Quarterly assessment during the DM training should be based on:

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs

The student to be assessed periodically as per categories listed in postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT, at the end of the course

The summative examination would be carried out as per the Rules given in **POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000**.

The summative assessment examination shall include two heads:

- A. Theory examination.
- B. Practical, Clinical examination and Viva-voce.

Theory examination and Practical/Clinical, Viva-voce shall be separate heads of passing.

Theory examination shall comprise of four papers. Passing percentage shall be cumulatively 50% with minimum of 40% marks in each theory paper.

Practical /Clinical examination consisting of at least one long case, three short cases and viva-voce. Passing percentage shall be 50%.

Passing shall be separate for each head and failing shall be common, meaning thereby that clearance at theory and failure at practical / clinical shall amount to failure at Summative examination and vice versa.

1. Theory Examination

- 1) There shall be 4 theory papers of 3 hours each.

Paper I: Basic Sciences as applied to the subject

Paper II: Clinical Neuroanaesthesia and techniques in anaesthesia

Paper III: Clinical Neuroanaesthesia, interventional neuroradiology, and Neurointensive care

Paper IV: Recent advances in the subject

(c) Clinical / Practical and Oral Examination:

(i) Clinical presentation

Students shall examine a minimum one long case and 03 short cases.

- (ii) Oral Examination** shall be thorough and shall aim at assessing the student's knowledge and competence about the subject, investigative procedures, therapeutic techniques and other aspects of the specialty, which form a part of the examination.

Recommended reading:

Books (latest edition)

- Text Book of Neuroanaesthesia By JE Cottrell and Young
- Core Topics in Neuroanaesthesia by Matta, Menon and Smith
- Text Book of Neuroanesthesia By Albin
- Neurological and Neurosurgical Critical care by Ropper and Diringer
- Case studies in Neuroanaesthesia and neurocritical care –by J Andrzejowski and Sambamurthy
- Other anaesthesia books for postgraduates

Journals:

3-5 International and 02 national journals (indexed)

Postgraduate Student Appraisal Form

Clinical Disciplines

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM.....TO.....

Sr. No.	PARTICULARS	Not Satisfactory	Satisfactory	More Than Satisfactory	Remarks
		1 2 3	4 5 6	7 8 9	
1.	Journal based / recent advances learning				
2.	Patient based /Laboratory or Skill based learning				
3.	Self directed learning and teaching				
4.	Departmental and interdepartmental learning activity				
5.	External and Outreach Activities / CMEs				
6.	Thesis / Research work				
7.	Log Book Maintenance				

Publications

Yes/ No

Remarks* _____

***REMARKS:** Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.

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