

**Guidelines**  
**For**  
**Competency Based Training Programme**  
**DrNB- NEURO ANAESTHESIA**

**2021**



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## TABLE OF CONTENT

S.NO	CONTENT	PAGE NO.
I.	Objectives Of The Programme	3
II.	Teaching And Training Activities	4-5
III.	Syllabus	6-15
IV.	Log Book	16
V.	Recommended Text Books And Journals	17-18



## **I. OBJECTIVES OF THE PROGRAMME**

### **1. PROGRAMME GOAL**

The DrNB Neuroanaesthesia and Neurocritical Care course has been designed to train candidates by the anesthesiologists in the principles and practice of Neuroanaesthesia and Neurocritical care.

The students admitted to the course must be exposed to the entire range of cases in Neurosurgical (those requiring surgery as well as those requiring management in neuro-intensive care) and Neurological diseases (especially those requiring management in neuro-intensive care). The training program should enable the candidates to function independently as faculty / consultant in the anaesthetic / intensive care management of the patients with neurological disorders coming for neurosurgical / radiological intervention.

These goals will be achieved through a closely supervised, graduated in-service training programme, involving progressive practical training and education within the framework of the department and its related fields.

### **2. PROGRAMME OBJECTIVES**

At the end of the course, the candidate should be able to:

- i. Understand physiological and pathological basis of central nervous system disorders.
- ii. Understand the theoretical basis of organ dysfunction and critical illness .
- iii. Develop the knowledge and skills to diagnose critical illnesses and their complications.
- iv. Critically evaluate published literature and conduct independent clinical/basic science research investigation .
- v. Learn to practice evidence-based medicine in managing neurological patients .
- vi. Develop skills of communication with family members of critically ill patients .
- vii. Apply the highest ethical standards in the practice of medicine .
- viii. Become competent teacher of neuro anaesthesiology and actively participate in teaching programs and other academic activity .



## II. TEACHING AND TRAINING ACTIVITIES

The fundamental components of the teaching programme should include:

1. Case presentations & discussion - once a week
2. Seminar - once a week
3. Journal club - once a month
4. Grand round presentation (by rotation departments and subspecialties)- once a month
5. Faculty lecture teaching - once a month
6. Clinical Audit - once a month
7. One poster and one oral presentation at least once during their training period in a recognized conference.

The training programme would focus on knowledge, skills and attitudes (behavior). It is divided into theoretical, clinical and practical training in all aspects of the delivery of care. It also includes methodology of research and teaching.

1. **Theoretical:** The theoretical knowledge would be imparted to the candidates through discussions, journal clubs, symposia and seminars. The students are exposed to recent advances through discussions in journal clubs.
2. **Lectures:** The students should 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 neuro anaesthesia, neurointensive care practice etc. conducted once a week.
3. **Symposia:** Trainees would be required to present a minimum of 20 topics based on the curriculum over a period of three years to the combined class of teachers and students. A free discussion would be encouraged in these symposia. The topics of the symposia would be given to the trainees with the dates for their presentation.
4. **Clinical:** The trainee would be attached to a faculty member to be able to pick up methods of history taking, examination, prescription writing and management.
5. **Bedside:** The trainee would work up cases, learn management of cases by discussion with faculty of the department.
6. **Journal Clubs:** This would be a weekly academic exercise. A list of suggested Journals related to perioperative neurosciences and neurocritical care is given towards the end of this document. The candidate would summarize and discuss the scientific article critically. A faculty member will suggest the article relevant to neuro anaesthesia and moderate the discussion, with participation by other faculty members and resident doctors. The



contributions made by the article in furtherance of the scientific knowledge and limitations, if any, will be highlighted.

#### **7. Core Training:**

- i. Intensive care rounds and on-hands teaching in the operation theatre should be the mainstay of the teaching program.
- ii. A mortality/morbidity review and departmental audit should be held at least monthly to review all deaths and complications attributed to anaesthesia, if any.
- iii. Unscheduled and informal discussions to be held as often as possible depending upon the variety and the number of procedures seen.
- iv. The students should be encouraged to undertake epidemiological and /or clinical research programme on selected topics. They should be taught the basic methods of research and reporting.
- v. The postgraduate students shall be required to participate in the teaching and training programme of undergraduate students and interns.
- vi. All the postgraduate trainees should be encouraged to attend regular CMEs, Conferences, Workshops at state and national level.
- vii. The department should encourage e-learning activities.

- 8. Research:** The student would carry out a research project and write a thesis/ dissertation in accordance with NBE guidelines. He/ she would also be given exposure to take part in the research project going on in the departments.



### III. SYLLABUS

#### 1. General principles of Neuroanaesthesia and Neurocritical Care

- i. Organization of Neuroanaesthesia and Critical Care Set up
- ii. Emergency management and transport of pre hospital patients
- iii. Principles of consent taking and details of informed consent
- iv. An awareness of the importance of communication skills and interpersonal relationships
- v. Infection control measures and Sterilization procedures
- vi. Maintenance of asepsis
- vii. Responsibilities in neurosurgery operation theatre and neurointensive care units
- viii. Knowledge of various scoring systems, admission and discharge criteria
- ix. Perioperative care of neurosurgical cases
- x. Medical Ethics
- xi. Biomedical Waste Management
- xii. Basics of Research methodology and Bio-statistics
- xiii. Internal audit
- xiv. Training in Communication skills, interpersonal relationships, organizational capabilities, leadership qualities
- xv. Behaviour and team work

#### 2. Basic sciences

- i. **Neuroanatomy:**
  - a. Gross and applied anatomy of the brain, spinal cord, peripheral and autonomic nervous system
  - b. Embryological development of Central and peripheral nervous system
- ii. **Neurophysiology:**
  - a. Applied physiology of the brain and spinal cord
  - b. The cerebrospinal fluid circulation
  - c. Cerebral and spinal circulation and metabolism: Cerebral Perfusion Pressure (CPP), brain elastance, cerebral autoregulation, and metabolic coupling and their measurement methods
  - d. Effects of various anaesthetics (inhalational and intravenous agents)
  - e. Intracranial pressure (ICP) and its monitoring methods and various herniation syndromes
  - f. Determinants of cerebral perfusion pressure
  - g. Mechanism of neuronal injury and brain protection
  - h. Electrophysiology of CNS, EEG and Evoked Potentials
  - i. Mechanism of pain transmission in acute and chronic pain conditions.



**iii. Respiratory physiology**

- a. Physiology of spontaneous respiration and mechanical ventilation
- b. Indications for mechanical ventilation
- c. Modes of ventilation
- d. Weaning from ventilatory support
- e. Complications of mechanical ventilation – recognition and management
- f. Monitoring during ventilatory support

**iv. Cardiovascular physiology:**

- a. Recognition and management of arrhythmias
- b. Management of hemodynamic disturbances – hypotension, hypertension, myocardial ischemia, pulmonary edema and heart failure
- c. Knowledge of commonly employed vasoactive and anti-arrhythmic drugs

**v. Renal physiology:**

- a. Fluid and electrolytes physiology and pathophysiology
- b. Prevention, diagnosis and management protocol for acute kidney disease
- c. Basic knowledge of dialysis

**vi. Metabolic disorders:**

- a. Pathophysiology and management of the Electrolyte disturbances in neurosurgical patients
- b. Acid-base disorders
- c. Understanding of endocrine disorders

**vii. Neuropharmacology:**

- a. Basic idea of pharmacodynamics and pharmacokinetics of drugs, drug interactions, complications of various drugs used in neurological patients
- b. Sedatives and anaesthetic agents
- c. Analgesics - narcotics and non-narcotic agents
- d. Muscle relaxants
- e. Anticonvulsants, antipsychotics and antidepressants
- f. Vasopressors and inotropes
- g. Drugs for treating brain edema/ raised ICP, Parkinsonism, CNS infections, CNS malignancy, acute and chronic pain
- h. Radiocontrast media used in CNS investigations
- i. Corticosteroids, thrombolytic agents



**viii. Neuropathology:**

- a. Applied to brain and spinal cord lesions like tumors, tuberculosis, vascular lesions, infections, ischemic lesions, neuropathies etc.
- b. Common pathology tests relevant to neuroanesthesia .

**ix. Neuro-microbiology:**

- a. Neuro-infections .
- b. Pulmonary infections .
- c. Infections related to operating rooms and ICUs ,
- d. Nosocomial infections .

**3. Clinical science**

**i. Anaesthetic management of various neurosurgical cases**

- a. Perioperative management of neurosurgery for space occupying lesions (SOLs)/ brain tumors (supratentorial and infratentorial), neurovascular lesions (intracranial aneurysms, AVMs, anastomoses), spinal cord pathologies, posterior fossa lesions, skull base lesions, epilepsy, head injury, stroke, pituitary lesions etc.
- b. Anesthesia for Endovascular (neuro-interventional) surgery
- c. Anaesthesia for awake craniotomy, neuroendoscopy, stereotactic surgery (DBS & other functional neurosurgery), neuronavigation, gamma knife surgery, peripheral nerve repair
- d. Anaesthetic management of pediatric neurosurgery for congenital hydrocephalus, encephaloceles/ meningocele, craniosynostosis, neural tube defects and other congenital brain and spinal cord deformities and pediatric brain tumors .
- e. Difficult airway management, technique of one-lung anesthesia, and other airway related issues in Neuroanaesthesia .
- f. Perioperative cerebral protection strategies .
- g. Positions used in neuroanaesthesia (supine, prone, sitting, park-bench) .
- h. Perioperative basic and advanced monitoring (EEG, evoked potentials, Transcranial Doppler, ICP monitors, Ultrasound, CBF measurement, TEE)
- i. Anaesthetic management of patients undergoing neuro-investigations (CT, MRI, DSA): working knowledge of anatomic/ metabolic scanning related to neuroanaesthesia
- j. Anaesthesia for brain surgery in the intraoperative MRI suite.
- k. Recent advances relevant to the perioperative care of neurosurgical patients as well as critically ill patients with neurological diseases including general perioperative neuroscientific considerations, stroke, traumatic brain injury, monitoring, anesthetic neurotoxicity, and perioperative disorders of cognitive function.





ii. **Emergency neurological conditions and their management techniques**

a. **Management of Traumatic Brain Injury (TBI)**

- Pre-hospital care of patient with neurological injury
- Assessment and resuscitation
- Airway management - conventional laryngoscopic intubation, insertion of LMA, fiberoptic intubation, manual inline stabilization (MILS), use of video laryngoscope and surgical airway
- Laboratory and radiological investigations
- Pathophysiology of head injury
- Factors causing secondary injury
- ICP - physiology and pathophysiology, and principles of management
- Controversies of ICP monitoring in TBI
- CPP: its role in TBI management, concept of individualized CPP
- ICP-CPP targeted management of TBI
- Biochemical markers of brain injury, molecular and cellular mechanisms of injury
- Brain Trauma Foundation Guidelines in the management of TBI / spinal cord Injury
- Role of hyperventilation in traumatic brain injury
- Methods available to measure/estimate ICP/ cerebral perfusion along with advantages and disadvantages of each method
- Approaches to management of refractory ICP elevation

b. **Management of spinal cord injury**

- Resuscitation and care of the affected area
- Airway management of C-spine injury
- Pathophysiology of spinal cord injury
- Conservative management of spine injury

iii. **Cerebral vascular accidents**

- a. Pathophysiology of stroke and management
- b. Treatment modalities for arterial and venous stroke
- c. Long term care of stroke patient, rehabilitation
- d. Understanding the indications/contraindications/side effects of intrarterial / intravenous thrombolysis in ischemic cerebrovascular accident
- e. Describing the natural history, risk factors and management options for malignant infarcts
- f. Describing the natural history of intracerebral haemorrhage along with the role of early surgical interventional, and medical treatment (i.e. blood pressure & glycemetic control, administration of factor VIIa)



- iv. Subarachnoid hemorrhage**
- Various types of cerebral aneurysms
  - Describe the common aneurysm locations leading to SAH
  - Understand the clinical and radiographic grades of SAH
  - Methods used to detect cerebral vasospasm & strategies to treat cerebral vasospasm to prevent secondary ischemic stroke
  - Indications for temporary external ventricular drains/permanent shunts
  - Non-neurological complications of SAH and their management
  - Surgical clipping and coiling of cerebral aneurysm
  - Giant intracranial aneurysms and their implications
  - Anastomotic procedures in cerebral ischemia
- v. Understanding basics of neurological diseases**
- Neurologic examination
  - Differential diagnosis and work-up of patients presenting to neuro-critical care; coma scores and Stroke scores
  - Pathophysiology, and therapy of coma arising from metabolic, traumatic, infectious, mass lesions, vascular-anoxic or ischemic, drug induced events of patients following cranial and spinal surgery
  - Management of airway, ventilation, hemodynamics, fluid and electrolyte balance, raised ICP, brain edema/ ischemia.
  - Management of brain/spine injury, spinal cord lesions, neurological and neuromuscular disorders, status epileptics, stroke, subarachnoid hemorrhage.
  - Nutritional issues, physiotherapy, rehabilitation, open/ percutaneous tracheostomy.
- vi. Understanding and management of specific neurological diseases**
- Status epilepticus, refractory status epilepticus, super refractory status epilepticus, epilepsy and encephalopathies
  - Guillain-Barrie syndrome
  - Muscle dystrophies with complication
  - Systemic illnesses causing neurological manifestations: Neuropathy, myopathy, dys-electrolytemias, renal and hepatic failures, multi organ failure etc.
  - Myasthenia gravis
  - Stroke (cerebrovascular accidents) and CVT (cortical venous thrombosis)
  - Neuroinfections
    - Bacterial, viral, fungal meningitis
    - Causative organisms of community - acquired & nosocomial meningitis/ ventriculitis/ abscess along with preferred antibiotic agents
    - Describe the pharmacodynamic/ pharmacokinetic principles influencing CNS antibiotic activity
  - Peripheral motor neuron disease



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

**vii. Principles of neuro intensive and postoperative care**

- a. Management of airway, ventilation .
- b. Management of hemodynamics, fluid and electrolyte balance, raised ICP .
- c. Management of brain oedema/ ischemia .
- d. Management of brain/spine injury, spinal cord lesions .
- e. Neurological and neuromuscular disorders .
- f. Status epileptics, stroke, subarachnoid hemorrhage .
- g. Nutritional issues, physiotherapy, rehabilitation, open/ percutaneous tracheostomy .

**viii. Brain Death**

- a. Criteria, determination and certification of brain death
- b. Differential diagnosis e.g. drug induced, locked-in syndrome, etc .
- c. Organ donation: metabolic and hemodynamic management pending organ harvesting

**ix. Monitoring in critical care**

- a. Neurological monitoring: Evoked potentials, cranial nerve monitoring
- b. EEG: understanding basic EEG, role of continuous EEG monitoring in ICU .
- c. Monitoring cerebral oxygenation: NIRS, SjVO<sub>2</sub>, PbtO<sub>2</sub>
- d. Monitoring cerebral blood flow: TCD .
- e. Monitoring biomarkers .
- f. Hemodynamic monitoring: cardiac output .
- g. Respiratory monitoring: loops and waveforms of mechanical ventilation .
- h. Intracranial pressure monitoring .
- i. Renal: RRT .
- j. Coagulation: TEG, ROTEM .
- k. POCUS including ONSD .

**x. Nutrition in the neuro-critical care**

- a. General principles and indications .
- b. Total parenteral nutrition - indications, advantages/ disadvantages .
- c. Enteral nutrition: indications, advantages, and side effects .
- d. Nutrition in presence of metabolic and systemic diseases .



**xi. Neuroimaging**

- a. Basics of neuroradiology
- b. CT, MRI, TCD (Trans cranial Doppler), USG (Ultrasound)
- c. Interventional neuroradiologic procedures
- d. Identify the basic structures in the central nervous system (ventricles, cisterns, sinuses, major anatomic landmarks)
- e. List the imaging techniques/signs used to identify acute intracranial hemorrhages, mass lesions, arterial and venous lesions, and ischemic penumbras / infarcts.
- f. Distinguish imaging characteristics of SAH, epidural hematomas, subdural hematomas, intra - parenchymal hemorrhage and relate to anatomic structure
- g. Understanding the concepts of medical and surgical managements of various emergencies based on imaging and various decision paradigms
- h. Management of complications in neuroradiological procedures

**xii. Neuro- rehabilitation**

- a. Head injured and spinal cord injured patients
- b. Prevention of acute problems
- c. Attendant training and counseling
- d. Understanding long term goals in neuro- rehabilitation

**xiii. Temperature regulation**

- a. Understand the physiology of temperature regulation in OT and ICU
- b. Management of hypothermia/ hyperthermia in the neuro-intensive care population

**4. Miscellaneous**

- i. Sepsis - Pathophysiology and management
- ii. Management of carotid revascularization procedures
- iii. Management of acute and chronic pain, cancer pain, patient controlled analgesia
- iv. Pregnancy and neurosurgery
- v. Cyanotic heart disease and neurosurgery
- vi. Multiple organ dysfunction syndromes
- vii. Reperfusion injury and antioxidants
- viii. Shock-types and management
- ix. Deep vein thrombosis prophylaxis, management and pulmonary embolism
- x. Coagulopathies and their management
- xi. Patient safety and prevention of adverse effects
- xii. End of life care issues
- xiii. Pain clinic for the management of failed back (facet block, epidural steroids etc), complex regional pain syndrome II (CRPS II) of upper limb following brachial plexus trauma and neuropathic pain of trigeminal neuralgia



## 5. Clinical skills to be acquired:

- i. Preanaesthetic evaluation for elective and emergency neurosurgery
- ii. Anaesthetic and Perioperative management of various neurosurgical conditions
- iii. Intensive Care
  - a. Airway Management and Endotracheal Intubation (including video laryngoscopes, fiber optic bronchoscope, laryngeal mask airway and other supraglottic devices)
  - b. Central Venous Catheterization
  - c. Arterial Line Placement and Care
  - d. Temporary Cardiac Pacing
  - e. Cardioversion and Defibrillation
  - f. Pericardiocentesis
  - g. Chest Tube Insertion and Care
  - h. Bronchoscopy
  - i. Percutaneous Tracheostomy
  - j. Cerebrospinal Fluid Aspiration
  - k. Scalp block and other relevant nerve blocks
  - l. Interventional Ultrasound (central venous line placement, nerve blocks)
  - m. Cardiopulmonary Resuscitation
  - n. Management of Pain in the Critically Ill Patient
  - o. Routine Monitoring of Critically Ill Patients
  - p. Resuscitation of a head injured patient
  - q. Resuscitation of a high spinal cord injury patient
  - r. Minimally Invasive Hemodynamic Monitoring
  - s. Neurologic Multimodal Monitoring
  - t. Echocardiography in the Intensive Care Unit
  - u. Mechanical ventilation in neurological patients
  - v. Hemodynamic management in a neuro-ICU patient including ACLS,
  - w. Fluid & electrolyte management in neuro-ICU patient
  - x. ICP monitoring
  - y. TCD monitoring
  - z. Basics interpretation of EEG, Evoked potential, CT brain, MRI brain, DSA of cerebral vessels
  - aa. Management of blood gases and acid – base status
  - bb. Infection control in a neuro – ICU
  - cc. Bedside echocardiography
  - dd. Plasmapheresis
  - ee. Management of a brain dead donor
  - ff. Weaning from mechanical ventilation
  - gg. Transfer of critical neurosurgical patients to different areas of hospital



## 6. Diagnostic:

- i. Ultrasound evaluation of critically ill patients
  - a. Cardiac: Tamponade, ejection fraction estimation, intravascular volume status assessment, assessment of contractility
  - b. Abdomen: Detection of fluid/hem peritoneum, liver/spleen tear
  - c. Vascular: Deep vein thrombosis, placement of IV canula, CVP lines, arterial cannula
  - d. Lung: detection of pleural effusion, pneumothorax, rapid protocols like BLUE, RUSH, FAST.
- ii. Non - technical skills
  - a. Orders and prioritizes appropriate investigations
  - b. Principles of informed consent
  - c. Principles of crisis management, conflict resolution, negotiation and debriefing
  - d. Understand nonverbal communication with critically ill patients
  - e. Principles of delivering bad news to patients and families
  - f. Strategies to communicate complicated critical care issues to the general population
  - g. Scoring systems in ICU
  - h. Care during patient transportation
  - i. Internal clinical audit

## 7. Timeline for Training Programme

- i. First Year:
  - a. 6 months in OT (including trauma OT)
  - b. 1 month in pre anaesthetic clinic
  - c. 1 month in Neuroradiology
  - d. 4 months in ICU (including neurosurgery, neurology & trauma ICU)
- ii. Second Year:
  - a. 6 months in OT (including trauma OT)
  - b. 1 month in pre anaesthetic clinic
  - c. 1 month in Neuroradiology
  - d. 4 months in ICU (including neurosurgery, neurology & trauma ICU)
- iii. Third Year:
  - a. 1 month in Neuroradiology
  - b. 1 month in Neurology department
  - c. 4 months in ICU (including neurosurgery, neurology, trauma, pulmonary medicine, and cardiology ICUs)
  - d. 6 months in OT (including trauma OT)
  - e. Optional 1-month external posting at other centers (to be adjusted against 1 month of OT)
  - f.



iv. **Rotation:**

Rotation to other center(s) is required to get acquainted with anaesthesia for advanced neurosurgical techniques and neuromonitoring not available at the parent institute.

**8. Workshops:**

The candidate must be encouraged to attend workshops, especially hands-on training to increase the clinical competency. The following workshops are highly suggested

- i. Basic and advanced cardiac life support
- ii. Ultrasound in critically ill
- iii. Acute Neuro Care or other equivalents
- iv. Neuromonitoring

**9. Biostatistics and Research Methodology**

Minimum 15 days training in clinical research and methodology (during 1 year)

**10. Ethics:**

**11. Medico legal aspects relevant to the discipline:**

**12. Health Policy issues as may be applicable to the discipline:**

**13. Procedures to be performed independently:**

The minimum number and type of procedures to be done independently by the candidates is as follows:

i. Anaesthesia for Supratentorial Surgery.	50
ii. Anaesthesia for Neurovascular Surgery	30
iii. Anaesthesia for Posterior Fossa Surgery	30
iv. Anaesthesia for Pediatric Neurosurgery	30
v. Anaesthesia for Pituitary Surgery	20
vi. Anaesthesia for Neuroendoscopy	20
vii. Anaesthesia for Neuroradiology	30
viii. Anaesthesia for Spinal Surgery	40
ix. Anaesthesia for Surgeries requiring Neuromonitoring	15
x. Transcranial Doppler Monitoring	50
xi. Total Intravenous Anaesthesia (TIVA)	50
xii. Scalp Block	10
xiii. Fiberoptic Bronchoscopy	10
xiv. Percutaneous Tracheostomy	10



#### IV. LOG BOOK

Log book serves as a document of the trainee's work. A candidate shall maintain a log book of operations (assisted / performed) during the training period, certified by the concerned post graduate teacher / Head of the department / senior consultant.

This logbook shall be made available to the board of examiners for their perusal at the time of the final examination.

The log book should show evidence that the before mentioned subjects were covered (with dates and the name of teacher(s)) The candidate will maintain the record of all academic activities undertaken by him/her in log book.

- i. Personal profile of the candidate
- ii. Educational qualification/Professional data
- iii. Record of case histories
- iv. Procedures learnt
- v. Record of case Demonstration/Presentations, and presentations of Seniors and Journal Clubs
- vi. Every candidate, at the time of practical examination, will be required to produce performance record (logbook) containing details of the work done by him/her during the entire period of training as per requirements of the log book. It should be duly certified by the supervisor as work done by the candidate and countersigned by the administrative Head of the Institution.
- vii. In the absence of production of logbook, the result will not be declared.





## **V. RECOMMENDED TEXT BOOKS AND JOURNALS**

### **TEXT BOOKS**

1. Gupta & Gelb's Essentials of Neuroanesthesia and Neurointensive Care 2nd edn 2018
2. Cottrell and Patel's Neuroanesthesia edited by James Cottrell, Piyush Patel 6th edn 2016
3. Textbook of Neuroanesthesia and Neurocritical Care by Hemanshu Prabhakar, Zulfiqar Ali 2019
4. Complications in Neuroanesthesia by Hemanshu Prabhakar 1st edn 2016
5. Neurocritical Care Monitoring edited by Chad Miller, Michel Torby 2015
6. Handbook of Neuroanesthesia edited by Newfield, Cottrell 2015
7. Clinical Neuroanatomy edited by Richard Snell 8th edn 2019
8. Intraoperative Neurophysiological Monitoring edited by Aage Moller 3rd edn
9. Fundamentals of Neuroanesthesia edited by Ruskin, Rosenbaum, Rampil 2014
10. Intensive Care in Neurology and Neurosurgery edited by Godoy 1st edn 2013
11. Textbook of Neurointensive Care edited by Layon, Gabrielli, Friedman 2nd edn 2013
12. The NeuroICU Book by Kiwon Lee 2nd edn 2017
13. Oxford Textbook of Neurocritical Care. Edited by Smith, Citerio, Kofke 2016
14. Text Book of Critical Care (Shoemaker): Fink, Abraham, Vincent & Kochanek 7th Edn 2017

### **JOURNALS**

1. Journal of Neurosurgical Anesthesiology (JNA)
2. Journal of Neuroanesthesiology and Critical Care (JNACC)
3. Neurocritical Care
4. New England Journal of Medicine (NEJM)
5. Neurosurgery
6. Journal of Neurosurgery
7. Journal of Clinical Neuroscience
8. Journal of Neurotrauma
9. Acta Neurochirurgica (Wien)
10. Anesthesiology
11. British Journal of Anaesthesia (BJA)



12. Anesthesia and Analgesia
13. Anesthesia
14. Acta Anaesthesiologica Scandinavica
15. Anaesthesia and Intensive Care (AAIC)
16. Minerva Anesthesiologica (MA)
17. Journal of Clinical Anesthesia (JCA)
18. Journal of Anaesthesia (JA)
19. Journal of Clinical Monitoring and Computing
20. Canadian Journal of Anesthesia
21. European Journal of Anesthesiology
22. Current Opinion in Anesthesiology
23. Journal of Critical Care
24. Critical Care Medicine
25. Intensive Care Medicine
26. Indian Journal of Anaesthesia
27. Journal of Anaesthesiology and Clinical Pharmacology
28. Pain
29. Pain Medicine
30. Pain Practice

