

Curriculum

FNB Fellowship



Paediatric Anaesthesia

- ◆ Introduction
- ◆ Programme Goals and Objectives of The Programme
- ◆ Teaching and Training Activities
- ◆ Syllabus
- ◆ Log Book
- ◆ Recommended Text Books and Journals

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I. INTRODUCTION

Paediatric anaesthesia is an important super-specialty of anaesthesia required to train anaesthesiologists to function as a faculty/consultant/specialist, to carry out and help in conducting applied research in the field of paediatric anaesthesia and to plan and set-up an independent paediatric anaesthesia unit which can cater to paediatric surgery and intensive care. This specialty education in the field of paediatric anaesthesia and intensive care is necessary for the development of the concerned skills, knowledge, and attitudes. It leads to proficiency in clinical competency and makes one assume responsibility for the care of individual patients independently.

Paediatric anaesthesia deals with the anaesthetic and perioperative management of children from new born to 18 years of age. Although children suffer from diseases which are similar to those in adults, there are many diseases which are exclusive to this age group. Also, the anaesthetic management of children is very different from that of adults' due to the anatomical, physiological, pharmacological and psychological differences between the two. The presence of cardiac, pulmonary and metabolic diseases as well as babies with syndromes, translates into an anaesthetic technique unique to the paediatric age group which requires special expertise and training.

In many countries like USA, UK and Europe a postgraduate degree in anaesthesia is followed by specialty fellowship training in paediatric anaesthesia. In India, currently paediatric anaesthesia is practiced mostly by a physician who has a degree in anaesthesia. In general, paediatric anaesthesia represents only 12% of the total anaesthesia caseload; infants represent 1%, and neonates or preterm babies requiring anaesthesia are extremely rare.¹ Therefore, the global experience including India as well as the individual experience of an anaesthetist with small children is limited, except for a few highly qualified specialists. It has been seen that the perioperative mortality in small children is higher than that in adults.² In addition; it has been shown that the incidence of severe complications, e.g. bradycardia, cardiac arrest, laryngospasm or adverse respiratory events in general is highly dependent on the paediatric experience of the anaesthetist in charge.³ Thus, it is imperative that training programs in paediatric anaesthesia and intensive care be initiated in India.

1. Clergue F, Auroy Y, Pe' quignot F et al. French survey of anesthesia in 1996. *Anesthesiology* 1999;91:1509-20.

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2. Bhanaker SM, Ramamoorthy C, Geiduschek JM et al. Anesthesia-related cardiac arrest in children: Update from Pediatric Perioperative Cardiac Arrest Registry. *Anesth Analg* 2007;105:344-50.
 3. von Ungern-Sternberg BS, Boda K, Chambers NA, et al. Risk assessment for respiratory complications in paediatric anaesthesia: a prospective cohort study. *Lancet* 2010;376:773-83.

II. PROGRAMME GOALS AND OBJECTIVES OF THE PROGRAMME

1. Programme Goals:

- a) The primary aim is to standardize the training of an anaesthetist in the specialty of Paediatric Anaesthesia to improve standards of care and reduce mortality and morbidity rates of paediatric anaesthesia in India.
- b) To train anaesthetists in the safe practices and latest advances of Paediatric Anaesthesia so that they are able to provide safe anesthesia to children in the perioperative period.

2. Objectives

The specialty program in paediatric anaesthesia will ensure optimal patient care and an opportunity to develop skills in clinical care & judgment, teaching, administration & research. Paediatric anaesthesia specialist will be proficient not only in providing anaesthesia care for neonates, infants, children and adolescents undergoing a wide variety of surgical, diagnostic, and therapeutic procedures, but also in pain management, intensive care & advanced life support. To meet these goals, the program will provide exposure to a wide variety of clinical problems in paediatric patients that are necessary for the development of these clinical skills. After completion of the course the specialist will be able to perform the following:

- a) Provide perioperative anaesthesia & intensive care for neonates, infants, children & adolescents undergoing a wide variety of surgical, diagnostic & therapeutic procedures.
- b) Provide perioperative pain relief to children of all ages.
- c) Have proficiency in paediatric advanced life support.
- d) Teach, train and mentor postgraduate students in paediatric anaesthesia.
- e) Plan, conduct and publish research in the field of paediatric anaesthesia

III. TEACHING AND TRAINING ACTIVITIES

1. Training

Area of rotation	Total duration of rotation (months)	1st year	2nd year
Elective and emergency Paediatric Surgery (Urogenital/ Thoracic/ Orthopaedics/ Eye OTs)	15 months	7 months	8 months
Plastic/ ENT/ Neurosurgery/ Cardiac OTs	4 months	2 months (Plastic/ ENT 1 month each)	2 months (NS/ Cardiac 1 month each)
NORA (Dental sedation, CT scan, MRI, Radiotherapy, GE endoscopy, DSA, Cath lab)	2 months	1 month (CT, DS, Cath lab)	1 month (MRI, DSA, GE endoscopy, RT)
NICU	1 month		1 month
PICU	1 month	1 month	
Emergency Room	1 month	1 month	
Total	24 months	12 months	12 months

***Rotation in the above OTs will include duties in PAC clinic and pain services**

2. Teaching/Academic Activities (moderated by core faculty)

The Fellow will be directly mentored by course director and the responsibility of the course exposure lies entirely with the hospital and the course director.

The academic program should include the following:

- a) Journal Club & critical appraisal: This would be a weekly academic exercise. Candidate will be expected to select articles for presentation from reputed paediatric anaesthesia journals and discuss their suitability for presentation with the moderator.
- b) Faculty Lecture
- c) Case presentations (List of suggested cases)

Long Cases	Short Cases
<p style="text-align: center;">Tracheo-esophageal Fistula</p> <ol style="list-style-type: none"> 1) Congenital Diaphragmatic Hernia 2) Duodenal/ileal atresia 3) Portal hypertension 4) Thoracic cases – decortication, congenital cystic adenoid malformation (CCAM), congenital lobar diseases 5) Congenital heart disease (acyanotic/cyanotic) for non cardiac surgery 6) Scoliosis 	<ol style="list-style-type: none"> 1) Meningomyelocele/ Hydrocephalus 2) Cleft lip/palate 3) Ophthalmology cases: Congenital cataract, squint, Glaucoma, retinoblastoma 4) Hernia, undescended testes, hypospadiasis 5) Adenotonsillectomy 6) Foreign body bronchus 7) Orthopedic cases – CTEV, DDH

- d) Seminars
- e) Audit of the surgical cases which were provided anaesthesia will be presented per month and critical events during this period discussed.
- f) PALS course certification is mandatory during the course. Any other course like NALS would be desirable but not compulsory.
- g) Poster/Paper presentation in national/international conference – at least one during the course.

- h) Attendance in one National/ International Paediatric Conference per year is mandatory. Representation in more than 1 educational activity will be encouraged.
- i) The student would be required to present at least 12 case discussions and 12 symposia at his/her department during the course.

3. Internal assessment:

Each student would be assessed regarding their regularity, practical application, inquisitiveness, expression, research work, participation in discussion of cases/ward round. The candidate would also be assessed on their scientific knowledge of the subject, skills and competencies and presentation in classes, conferences.

4. Practical competencies

The candidate should be able to inculcate the following practical proficiencies:

Direct Observed Procedures
<p>Communication</p> <p>Establish an effective relationship with both paediatric patients and parents emphasizing understanding, trust, empathy, and confidentiality</p> <p>Communicate a concise assessment and perioperative anaesthetic management plan with the parents and attending staff</p>
<p>Preoperative</p> <p>Assessment of child for gestational age, URI, fasting duration, medical co-morbidities and premedication plan</p> <p>Knowledge of fasting guidelines</p>
<p>Arterial and Venous access (infant/neonate/child)</p> <ul style="list-style-type: none"> • Assess possibility of securing venous access, both peripheral and central (internal jugular, Femoral, PICC) for fluid resuscitation • Arterial line insertion • Umbilical artery catheterization

<p>Airway</p> <ul style="list-style-type: none"> • Airway assessment of child • Bag and Mask Ventilation technique • Technique of endotracheal intubation of all ages including infants and neonates • Supraglottic airway device placement • One lung ventilation technique based on age of child
<p>Management of Difficult airway</p> <ul style="list-style-type: none"> • Proficiency in use of Videolaryngoscope/FOB /Bougie/ stylet/ cricothyroidotomy • Extubation of a difficult airway
<p>Regional anaesthesia techniques</p> <ul style="list-style-type: none"> • Central neuraxial – Subarachnoid, epidural and caudal blocks • Peripheral and fascial plane nerve blocks – Brachial plexus, Femoral, Popliteal, TAP, Paravertebral, ESB, ES, II-IH • Pain scales: FLACC, CRIES, CHEOPS etc.
<p>Fluid management</p> <ul style="list-style-type: none"> • Fluid assessment of child posted for emergency surgery • Fluid management in neonate/infant
<p>Ultrasound</p> <p>Use of USG for POCUS (Lung, Fluid assessment, Transthoracic Echo, Focused Assessment with sonography in trauma, Airway), nerve blocks and arterial and venous cannulation</p>
<p>Routine and advanced monitoring</p> <p>ECG, SpO₂, EtCO₂, Temperature probes for core and skin temperature monitoring</p> <p>Peripheral nerve stimulator</p> <p>BIS/Entropy</p> <p>End-tidal anaesthetic gases</p> <p>Intraoperative ventilatory management</p> <p>Positioning of child in lithotomy, prone and lateral position</p>
<p>Postoperative management in PACU</p> <p>Discharge criteria</p> <p>Pain assessment and treatment</p>

Oxygen therapy

Resuscitation

- | |
|---|
| <ul style="list-style-type: none">• Paediatric advanced life support (PALS) |
|---|

IV. SYLLABUS

1. Developmental aspects

- a) Basic developmental embryology
- b) Transition from intrauterine to extrauterine life
- c) Neonatal physiology
- d) Transition from neonatal period to infancy

2. Anatomical and physiological differences between small children and adults

- a) The airway and respiratory system
- b) The cardiovascular system
- c) Water, electrolytes and the kidney
- d) The liver and gastrointestinal tract
- e) The central nervous system
- f) Hematology
- g) The immune system
- h) The endocrine system
- i) Metabolism and temperature control

3. Pharmacological differences in drug kinetics and dynamics

- a) Inhalational agents
- b) Intravenous induction and maintenance agents
- c) Opioids and non-opioid analgesics
- d) Local anaesthetic agents
- e) Muscle relaxants
- f) Adjuncts (anti-emetics and antimuscarinics)

4. Preoperative assessment and preparation

- a) History taking and clinical examination – Interaction with children
- b) Criteria for investigations
- c) Blood group and cross match
- d) Preoperative management of

-
- URTI
 - Heart murmurs
 - Bronchial asthma, cystic fibrosis, OSA
 - Seizures, cerebral palsy, muscular dystrophy
 - GE reflux
 - Renal insufficiency, dyselectrolytemia
 - Thalassemia, sickle cell disease
 - Intraabdominal and thoracic tumours, chemotherapy
 - Type 1 diabetes and pheochromocytoma
 - Metabolic disorders
- e) Selection for day care and discharge criteria
- f) Fasting guidelines
- g) Communication with child and family
- Management of uncooperative children
 - Age related behaviour and anxiety
 - Anxiolytic medication
 - Non-pharmacological interventions
 - Consent

5. Equipment, techniques and monitoring

- a) Equipment
- Face masks – anatomical, Randel Baker mask, other types
 - Oro- and naso-pharyngeal airways
 - Supraglottic airway devices – CLMA, PLMA, Igel etc.
 - Tracheal and tracheostomy tubes (plain, cuffed, preformed, armoured, Cole, laser)
 - Laryngoscopes (curved and straight blades, videolaryngoscope)
 - Fiberoptic bronchoscope
 - Breathing circuits
 - ❖ Jackson Rees modification of Ayre's t-piece
 - ❖ Circle absorption breathing system
 - Anaesthesia machine
 - Ventilators
- b) Techniques
- Anaesthesia for a term and preterm neonate – tracheoesophageal fistula, congenital diaphragmatic hernia, atresia, omphalocele and gastrochisis, necrotizing enterocolitis
 - IV access skills
 - ❖ Routine sizes, sites and fixation for peripheral cannulae

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- ❖ Central venous lines: indications, devices, techniques and complication
 - ❖ PICC line
 - ❖ Ultrasound guidance for vascular access
 - ❖ Intraosseous access
 - ❖ Care of long term central venous lines
 - Inhalational induction
 - Maintenance of anaesthesia
 - Management of laryngospasm
 - RSI and Modified RSI
 - Maintenance of body temperature
 - Common problems in recovery (including criteria for discharge)
- c) Monitoring
- Cardiovascular, respiratory, CNS, neuromuscular, temperature
 - Indications for invasive monitoring

6. Management of the airway

- a) Assessment of the paediatric airway
- b) Identification of the child with a difficult airway
 - Congenital syndromes
 - Airway obstruction, congenital and acquired
- c) Equipment used in management of the paediatric airway
- d) Basic and advanced paediatric airway skills
- e) Techniques for management of difficult airway
- f) Complications associated with difficult airway management

7. Resuscitation

- a) Causes of paediatric arrest
- b) Structured approach to assessing critically ill or injured children
 - Airway
 - Breathing
 - Circulation
 - Disability
- c) Life support algorithms
 - Basic Life Support
 - Neonatal Resuscitation
 - Choking Child
 - Advanced Life Support
- d) Structured approach to treating the seriously ill child

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- Breathing difficulties
 - ❖ Airway emergencies
 - ❖ Respiratory failure
 - Child in shock:
 - ❖ Fluid Loss
 - ❖ Sepsis
 - ❖ Anaphylaxis
 - ❖ Heart failure
 - ❖ Abnormal cardiac rhythm
 - Decreased conscious level
 - ❖ Raised intracranial pressure
 - ❖ Meningitis
 - ❖ Convulsions
 - ❖ Metabolic coma
 - Structured approach to treating the seriously injured child
 - ❖ Airway and C-spine stabilization
 - ❖ Initial assessment ABCD
 - ❖ The child with chest injuries
 - ❖ The child with abdominal injuries
 - ❖ The child with head injuries
 - ❖ The child with spinal injuries
 - ❖ The burnt or scalded child
 - Initiation of Intensive Care for the critically ill child.
 - Principles of safe transfer of the critically ill child
 - Stopping resuscitation
 - ❖ Role of parents
 - ❖ DNR orders

8. Major hazards

- a) Management of malignant hyperthermia, anaphylaxis, major haemorrhage
- b) Communicating risk
- c) Risk management
- d) Human factors and error

9. Pain management including regional techniques

- a) Pain neurophysiology
- b) Nociception and the response to injury
- c) Analgesic pharmacology
- d) Multimodal analgesia

-
- e) Range of drugs, routes of administration and techniques available for acute postoperative pain
 - Paracetamol, NSAIDs, Opioids
 - Oral/PR, Continuous infusions, Patient/Nurse controlled analgesia, Spinal/Epidural, Caudal, blocks of upper limb, lower limb, thoracoabdominal blocks – TAP, ES, Ilio-inguinal block, penile block, serratus anterior, intercostal
 - Use of adjuncts – ketamine, clonidine, dexmedetomidine, fentanyl
 - Use of ultrasound guidance
 - f) Non-pharmacological approaches of pain management
 - g) Management of common complications of pain management
 - h) Paediatric Pain Management Services
 - Protocols and Guidelines
 - Safety
 - Monitoring
 - Education

10. Congenital and inherited diseases

- a) Knowledge and awareness of the anaesthetic implications of commonly presenting paediatric medical conditions
- b) Anaesthetic implications of congenital inherited conditions – Down syndrome, Pierre Robin, Goldenhar, Treacher Collins, Mucopolysaccharidoses, Apert's, Charge association, VATER, Osteogenesis Imperfecta

11. General surgery

- a) Common problems of neonatal and small infant anaesthesia
- b) Acute Abdomen and RSI
- c) Laparoscopic surgery techniques and implications
- d) Hernia Repair, Orchidopexy, Appendicectomy, Exploratory Laparotomy for tumors/cyst removal/excisions/resection anastomosis etc.
- e) Brachial sinus/ fistula excision, cystic hygroma, tongue tie release etc.

12. Urology and renal transplantation:

- a) Cystoscopy, PUV Fulguration
- b) Nephrectomy
- c) D J Stent insertion and removal
- d) Pyeloplasty

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- e) Hypospadias repair
 - f) Orchiectomy

13. Ear, nose and throat surgery

- a) Associated anomalies and airway pathology – choanal atresia
- b) General anaesthetic considerations – laryngeal papilloma, bronchoscopy
- c) The shared airway
- d) Laser surgery
- e) Post anaesthetic care
- f) Obstructive sleep apnoea – adenotonsillectomy

14. Ophthalmic surgery

- a) Retinopathy of prematurity
- b) Cataract
- c) Glaucoma
- d) Corneal transplant
- e) Vitreoretinal surgery
- f) Squint

15. Dental, maxillofacial and plastic surgery

- a) Behavioral issues
- b) Temporomandibular joint ankylosis
- c) Cleft lip and palate
- d) Craniofacial surgery
- e) Trauma
- f) Reconstructive surgery

16. Orthopaedic surgery

- a) Use of tourniquets
- b) Cerebral palsy
- c) Scoliosis surgery
- d) Trauma
- e) CTEV Correction
- f) Fracture fixations
- g) Hip Spica
- h) Bone Tumor Excision

17. Neurosurgery

- a) Hydrocephalus

-
- b) Meningocele
 - c) Space occupying lesion like medulloblastoma, astrocytoma, SDH/EDH drainage
 - d) Head injury
 - e) Trans-sphenoidal surgery
 - f) VP Shunt insertion/revision
 - g) Craniosynostosis
 - h) Tumours

18. Cardiac and thoracic surgery

- a) Management of the child with cardiac disease undergoing non-cardiac surgery
 - Endocarditis prophylaxis
 - Assessment of anaesthetic risk
- b) Pathophysiology of common cardiac lesions - Shunts like VSD/ASD/AVSD/PDA, Cyanotic lesions like Tetralogy of Fallot (including management of a 'spell'), Transposition of the Great Arteries, Coarctation of the aorta, Valve stenosis, single ventricle
- c) Preoperative assessment and investigations including the implications of Cyanotic heart disease, Re-do surgery, Pulmonary hypertension
- d) Blood gas analysis
- e) Principles of cardiopulmonary bypass and cardioplegia
- f) Pharmacology of inotropes – types, uses & doses, antifibrinolytics, heparin, haemostasis and blood product use
- g) Thoracic surgery – one lung ventilation, VATS, thoracotomy

19. Anaesthesia/sedation in remote location

- a) CT, MRI
- b) Interventional radiology – DSA
- c) Cardiac catheterization
- d) Dental sedation
- e) Radiotherapy
- f) GE endoscopy

V. LOG BOOK

The student will maintain a “log book” of all the cases and procedures done. The student will also keep a record of seminars, journal clubs, and clinical meetings performed by him in the logbook.

1. Entry of all surgical cases anaesthetized (routine and emergency)
2. Entry of NORA location cases
3. The entry in the logbook should include: name, age, gender, surgical procedure, anaesthesia technique, pain technique used, any critical event if present should be detailed.

VI. RECOMMENDED TEXT BOOKS AND JOURNALS:

1. Books

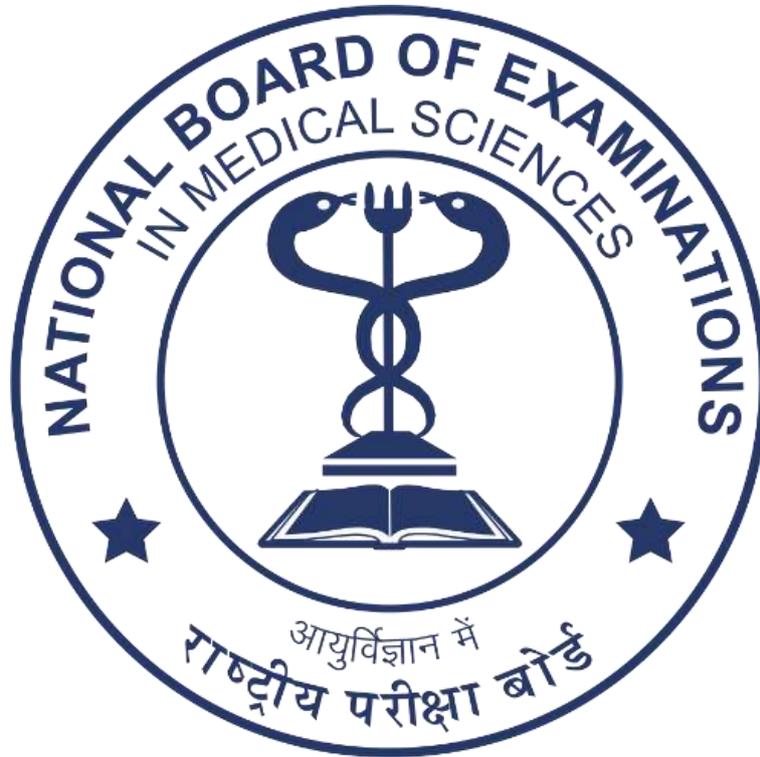
- a) Gregory’s Pediatric Anesthesia. Edited by George. E. Gregory, Dean. B. Andropoulas. Sixth edition 2020, Publisher Wiley - Blackwell Publishing Ltd.
- b) Smith’s Anesthesia for infants and children. Peter J. Davis, Franklyn P. Cladis, Etsuro K. Motoyama. Tenth Edition 2021, Publisher Elsevier Mosby.
- c) Science and Practice of Pediatric Critical Care Medicine. Derek S. Wheeler, Hector R. Wong, Thomas P. Shanley. Second edition 2009 by Springer – Verlag London Ltd.
- d) Pediatric Critical Care. Bradley P. Fuhrman, Jerry J. Zimmerman. Sixth edition 2020, Publisher Elsevier Saunders.
- e) Peripheral nerve blocks – A color atlas. Jacques E Chelly. Third edition 2009, Publisher Lippincott Williams & Wilkins.
- f) Essentials of regional anesthesia. Alan David Kaye, Richard D. Urman, Nalini Vadivelu. Springer 2012.

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- g) A Practice of Anesthesia for Infants and Children. Charles J. Cote, Jerrold Lerman, I. David Todres. Sixth edition 2018, Elsevier.
 - h) Pediatric Cardiac Anesthesia. Carol L. Lake. Fourth edition 2004, Lippincott Williams and Wilkins
 - i) Anesthesia for Genetic, Metabolic, and Dysmorphic Syndromes of Childhood. Victor C. Baum, Jennifer E. O'Flaherty. 3rd edition 2014, Wolters Kluwer Health
 - j) Manual of Pediatric Anesthesia: With an Index of Pediatric Syndromes. David J. Steward, Charles J. Cote, Jerrold Lerman. Sixth edition, 2009, Churchill Livingstone

2. Journal

Access to two national and 2 International journals is compulsory. The suggested journals include:

- a) Pediatric Anesthesia
- b) Anesthesiology
- c) British Journal of Anaesthesia
- d) Canadian Journal of Anesthesia
- e) Indian Journal of Anaesthesia
- f) Journal of Anaesthesiology and Clinical Pharmacology



आयुर्विज्ञान में राष्ट्रीय परीक्षा बोर्ड
स्वास्थ्य एवं परिवार कल्याण मंत्रालय, भारत सरकार
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