Editorial

Pediatric Neuroanesthesia: Time for A New Superspecialty

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Pediatric neuroanesthesia is a specialized field focusing on the perioperative management of infants and children undergoing neurosurgical procedures or those with neurological conditions. Because of the inherent physiological and anatomical variations in the developing brain, this subspecialty blends the principles of pediatric anesthesia with particular considerations of neuroanesthesia. Pediatric neuroanesthesia as a potential superspecialty should be dealt with the developments in pediatric neurosurgery, much like the development of neuroanesthesia as a specialty was explored in relation to the evolution of neurosurgery. A sizable percentage of neurosurgical procedures involve pediatric neurosurgery. Children were occasionally the subject of neurosurgery from prehistoric times until the Harvey Cushing era. As a specialty, pediatric neurosurgery was just getting started when pioneering neurosurgeons like Harvey Cushing and Walter Dandy worked on children with hydrocephalus or a recently discovered brain tumor. As early as the 1950s, Franc Ingraham began teaching and training in pediatric neurosurgery and founded the first center for treating neurosurgical problems in children.[1] As a result, he is regarded as the Father of Pediatric Neurosurgery. He is recognized for having described therapeutic approaches for neurosurgical conditions like subdural hematomas, spina bifida, diastematomyelia, hydrocephalus, and craniosynostosis. *Neurosurgery in Infancy and Childhood*, the first pediatric neurosurgery textbook, was written by Ingraham and his protégé, Donald Matson. Numerous neurosurgical operations were attempted during this time under anesthesia, with differing degrees of success. Harvey Cushing, a pioneer of neurosurgery and anesthetics, recommended ether anesthesia while limiting the use of chloroform in children.[2] Lane (1892) was the first to report a craniectomy for craniosynostosis in a child using an ACE (alcohol, chloroform, and ether) cocktail. Nevertheless, the child passed away during the recovery phase, most likely due to anesthesia.[3] With time, numerous improvements have been made in the materials and techniques used, including endoscopy and image guidance.

Lately, pediatric neurosurgery has become a recognized area of neurosurgery that addresses the particular difficulties and factors that a child with a central nervous system (CNS) disorder presents. There is a growing demand for pediatric neuroanesthesiologists with the necessary training and expertise to provide committed care for these children. Most procedures, methods, and equipment used in pediatric neuroanesthesia are like general pediatric anesthesia. Children's anatomy and physiology differ from those of adults. Therefore, perioperative anesthetic care must take these variances into account. The anesthesiologist always faces difficulties in pediatric patients when performing invasive treatments and maneuvers, such as managing the airway, vascular cannulation, and positioning for surgery. Compared with older children and adults, neonates and children react to stress (bradycardia) quite differently; they have poor metabolic regulation and are more likely to experience hypothermia. Together with the fundamental physiological variations, neuroanesthesiologists have a deeper comprehension of the neurological pathology and issues surrounding intracranial pressure; they are crucial to the best possible care of these children, significantly impacting the result.

Some neurological problems are unique to children, and this is partially because they are linked to genetic abnormalities. Numerous syndromes with multisystem, including CNS symptoms, have been documented, and the attending anesthesiologist needs to be aware of the issue. The anesthesiologist must be well versed in a variety of pathological conditions, including intracranial tumors, intractable epilepsy syndromes, craniofacial abnormalities, neurotrauma, hydrocephalus, neural tube defects (NTDs), craniovertebral junction abnormalities (Chiari malformations), and neurovascular diseases. The discovery of open fetal myelomeningocele repair reversed the Chiari II deformity and began advancements in fetal neurosurgery.[4] Prenatal therapy for NTDs and hydrocephalus has produced better results in prospective investigations.[5] Arteriovenous malformation is the most prevalent intracranial circulation abnormality in

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children. Early care is necessary due to their significant risk of cerebral bleeding. Treatment options have advanced in many ways, from endovascular procedures to open surgeries.[6] Eloquent cortical tumors and epilepsy have both been treated with awake brain operations in children. Generalized dystonias have been treated with deep brain stimulation, which has historically been used to treat Parkinson's disease.[7] In 2003, the guidelines for the medical management of severe traumatic brain injury (TBI) in children were published.[8] These guidelines, which are frequently revised, were developed by the Brain Trauma Foundation after extensive research, even though the entity TBI in children was recognized much earlier. When it comes to treating pediatric TBI patients, there is still a knowledge gap. Roy Chowdhury and colleagues reviewed the literature on nutritional management in pediatric TBI patients in this issue of the *Journal of Neuroanaesthesiology and Critical Care* (*JNACC*), including energy needs, nutritional assessment, nutrition initiation, different feeding techniques available, malnutrition detection, and the effect of malnutrition on patient outcomes.[9] Although neuroanesthesiologists or pediatric anesthesiologists have been attending pediatric neurosurgeries routinely in their practice by virtue of their clinical experience and advanced exposure, it is wise to believe that full-time trained pediatric neuroanesthesiologists, as a separate group, will create new dimensions to the perioperative and intensive care management of such children. Similar to pediatric neurosurgery, structured training programs in pediatric neuroanesthesia are uncommon. In most countries, pediatric anesthesiologists typically handle the perioperative care of these children who undergo neurosurgery. However, more neuroanesthesiologists with experience in pediatric anesthesia are managing perioperative care due to the growth in neuroanesthesia fellowship programs. The leading pediatric anesthesia fellowship program at Cincinnati Children's Hospital in the United States includes an advanced pediatric neuroanesthesia fellowship. The leading pediatric neuroanesthesiologists in the Indian subcontinent are neuroanesthesiologists with adequate exposure to pediatric neurosurgery. Advanced training in pediatric neuroanesthesia was part of the first Neuroanesthesiology Doctorate of Medicine (DM) program at the All India Institute of Medical Sciences (AIIMS), New Delhi. The National Institute of Mental Health and Neuro-Sciences (NIMHANS), Bangalore; Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum; Jawaharlal Institute of Postgraduate Medical Education & Research (JIPMER), Chandigarh; Christian Medical College (CMC), Vellore; Govind Ballabh Pant Institute of Postgraduate Medical Education and Research (GIPMER); and AIIMS-like institutions in Rishikesh, Bhubaneswar, and Bhopal were among the national institutions to introduce DM courses. However, these hospitals are not the only ones that practice pediatric neuroanesthesia. Several corporate hospitals have introduced a 3-year neuroanesthesia superspecialty program called Doctorate of National Board (DrNB) initiated by the National Board of Examinations (NBE) with advanced training in pediatric neuroanesthesia. With the help of the Indian Society of Neuroanaesthesiology and Critical Care (ISNACC), numerous other hospitals began offering a 1-year fellowship that required significant exposure to pediatric neurosurgery procedures.

The late 1960s saw the first publications of specialized literature on pediatric neuroanesthesia.[10] In many professional conferences and scientific publications, Solpicio Soriano and Boston Children's Hospital colleagues have emphasized the importance of pediatric neuroanesthesiologists for neurosurgery in children.[11] Over the past 20 years, more studies have been added to the literature, reflecting the growing awareness of this field. Special issues on pediatric neuroanesthesia have been published in different journals. Multiple books are also available as references to the practice of pediatric neuroanesthesia.

With the introduction of innovative diagnostic modalities like functional magnetic resonance imaging, surgical techniques including microneurosurgery, endoscopy, stereotactic and robotic operations, and endovascular techniques, neurosurgery as a specialty is fast changing. A growing number of these methods are also being used in pediatric neurosurgery. To give these children the proper perioperative care for neurosurgery, the anesthesiologist needs to be up-to-date on the most recent advancements. Recognizing pediatric neuroanesthesia as a distinct subspecialty or superspecialty of neuroanesthesia or pediatric anesthesia is crucial in this respect.

Thanks to the essential pioneering work of physicians, surgeons, and academic leaders, neuroanesthesia has undergone tremendous evolutionary changes throughout the past several decades. It is safe to say that pediatric neuroanesthesia, one of the more recent additions to the medical subspecialties group, provides anesthesiologists with a wide range of clinical and research opportunities. For pediatric neuroanesthesia to thrive, a sufficient level of expertise in pediatric anesthesia, neurosurgical anesthesia, and critical care must be combined. Training programs must be established to provide a suitable curriculum in light of the breadth of the broad specialties involved. It is reasonable to anticipate that this superspecialty will significantly contribute to clinical management and research, providing better outcomes for needy patients.

Conflict of Interest
Girija Prasad Rath, MD, DM, is the Executive Editor of the *JNACC*, Secretary of ISNACC, Executive Member (India) of the Asian Society for Neuroanesthesia and Critical Care (ASNACC), and President-Elect of the Society for Neuroscience in Anesthesiology and Critical Care (SNACC). A significant part of this editorial was presented as a lecture during the 3rd Prof (Dr.) N N Sinha Memorial Oration held at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, India.

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