

Emerging trends in paediatric neurosurgical anaesthesia: Time for subspeciality?

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Rudin Domi

Anesthesiologist-Intensivist, University of Medicine, Faculty of Medicine, Tirana, Albania

Address for correspondence: Prof. Rudin Domi,
University of Medicine, Faculty of Medicine, Tirana, Albania.
E-mail: rdomi73@yahoo.it

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Paediatric neurosurgical anaesthesia is a highly specialised and evolving field, presenting unique challenges and demanding specific expertise. Advancements in technology and surgical techniques have significantly expanded the scope of paediatric neurosurgery. This growth necessitates a dedicated subspeciality within anaesthesia to address the distinct physiological and surgical challenges presented by paediatric neurosurgical patients. The subspecialisation in paediatric neuroanaesthesia may markedly improve the safety outcomes, correlating directly with the experience level of the anaesthesia providers.^[1]

UNDERSTANDING PAEDIATRIC NEUROPHYSIOLOGY

A thorough understanding of paediatric neurophysiology is paramount for neuroanaesthesiologists. Unlike other paediatric procedures, neuroanaesthesia requires precise knowledge of age-related neurodevelopmental changes. For instance, cerebral blood flow varies significantly with age, starting at approximately 4 ml/100 g/min in premature infants and increasing to around 100 ml/100 g/min in older children.^[2] In addition, the cerebral metabolic rate of oxygen and glucose consumption is significantly higher in children than in adults.^[2,3] In children, autoregulation is guaranteed by a mean arterial pressure that varies between 20 and 40 mmHg, becoming closer to adult

values by age 10.^[4] These physiological differences necessitate tailored anaesthetic management strategies to ensure optimal cerebral perfusion and metabolic support during neurosurgical procedures. A highly experienced paediatric neuroanaesthesiologist can guarantee optimal treatment and patient safety.

Minimally invasive approach

Minimally invasive techniques are increasingly being utilised in paediatric neurosurgery, offering the benefits of direct visualisation of brain structures (skull base, ventricles, spinal cord), reduced surgical trauma, fewer complications and faster recovery times. Endoscopic methods are employed for various procedures, including endonasal neurosurgery for sellae turcica tumours, endoscopic third ventriculostomy, third ventricle tumour and craniosynostosis repairs. While the evidence-based conclusions for these techniques are still developing,^[5] early reports suggest a lower incidence of complications, but postoperative meningitis remains a significant concern. The incidence of meningitis after an endoscopic approach is reported to be 1.8%, and postoperative cerebrospinal fluid leakage markedly increases meningitis.^[6] Anaesthetic considerations for these procedures include managing potential bleeding, hypothermia and the risks associated with surgical leaks and infections.^[7]

BLOOD LOSS MANAGEMENT IN PAEDIATRIC NEUROSURGERY

Managing blood loss is a critical concern in paediatric neurosurgical procedures, especially in cases of craniosynostosis and surgeries for intracranial malignancies. Even small amounts of blood loss can have significant haemodynamic consequences in children, leading to shock and hypoperfusion. Preoperative assessment must account for potential hypovolemia due to factors like increased intracranial pressure-induced vomiting, the use of diuretics (mannitol, furosemide) and malnutrition, which can mask real anaemia by haemoconcentration. The role of antifibrinolytics, such as tranexamic acid, in reducing surgical blood loss is still debated, although some studies suggest their efficacy.^[8,9] Anaesthesiologists must carefully monitor and manage intraoperative bleeding, considering the patient's age and weight, to maintain haemodynamic stability and cerebral perfusion.

CONCLUSION

Paediatric neurosurgical anaesthesia is a field that demands a high level of expertise and continuous adaptation to new techniques and understandings of paediatric physiology. The trends highlighted in this editorial underscore the importance of specialised training in paediatric neuroanaesthesia, the adoption of minimally invasive surgical approaches, sitting position consequences, different neurophysiology and vigilant blood loss management to improve outcomes. As this field evolves, ongoing research and clinical practice will further refine and enhance the care provided to these young patients.

ORCID

Rudin Domi: <https://orcid.org/0000-0003-4594-7815>

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