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# CME LECTURES

## PAEDIATRIC NEUROANAESTHESIA

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Paediatric neuroanaesthesia is a challenging specialty requiring special considerations. This talk will highlight the differences from the adult neurosurgical practice.

**Differences in Neuroanatomy and Physiology**
Brain weight at birth represents a larger percentage of total body weight compared to adults (10% versus 20%) and it reaches 80% of the adult size at 2 years of age. The cerebral blood flow (CBF) in children is age related and approximately double that of adults between 3-12 years of age i.e. 100 mls/100g of brain tissue/minute. The response of CBF to $PaCO_2$ is blunted in neonates when $PaCO_2$ is <30mm of Hg. Autoregulation also occurs over a narrower range in children. The cerebral perfusion pressure is age related. The CSF has a higher rate of production. Cerebral metabolic rate of $O_2$ consumption is 5 mls/100 grams of brain tissue/minute compared to 3.5mls/100g/min in adults

The blood brain barrier in infants has immature transport mechanisms. The intracranial pressure (ICP) in infants is 0-6mm of Hg.

**Neuropathology**
The increase in ICP is difficult to diagnose and clinical signs of raised ICP are nonspecific. Slow increase is compensated by expansion of cranium.

Common malignancies in children are astrocytoma (35%), medulloblastoma (18%) and ependymoma (13%). Both supra and infratentorial lesions occur with equal frequency.

**Anaesthesia for craniotomy in children**
The preoperative assessment should focus on identifying signs of change in cerebral compliance, any neurological deficits, presence of airway reflexes, contracted blood volume and any associated pathology. Midazolam premedication by various routes produces minimal alterations in ventilation in children but is contraindicated if signs of raised ICP are present.

Inhalation induction with sevoflurane, $N_2O$ and $O_2$ is an accepted technique if an iv line is not present but the control of ventilation should be taken over as quickly as possible. The choice of agents does not seem to affect the outcome. Short acting narcotics combined with $N_2O/O_2$ and low dose isoflurane along with muscle relaxation is an accepted technique. It is assumed that the effects of various pharmacological agents on CBF, $CMRO_2$ and brain volume are similar to adults but available information is limited.

Supine position with head elevation is required in majority of cases but prone or sitting position may be used in some centers.
The use of recombinant factor VII a (r FVII a) has recently been described in series of patients to control intraoperative bleeding but additional studies are needed. Postoperatively the child should be observed in an ICU.

**Specialized procedures**

*Shunt procedures*

There is usually presence of intracranial hypertension. Rapid CSF drainage can lead to an abrupt decrease in blood pressure. Also ventriculoatrial shunts have an increased risk of air embolism.

**Encephalocele and Myelomeingocele repair**

This is usually undertaken in neonatal period and children have a higher incidence of anomalies of other systems. The child can be intubated in the lateral position. If nerve testing is planned then neuromuscular blockers should be used judiciously. Large blood loss can occur in large lesions where undermining of skin is required.

**Craniosynostosis correction**

This surgery is done in a wide variety of conditions which results in premature closure of fontanellae. Major anaesthetic problems are difficult airway, significant and rapid blood loss and venous embolism.

**Anaesthesia for Neuroradiological procedures**

These procedures may require either sedation or a full GA. The main goal is to achieve immobility of patients in order to obtain high quality images in shortest possible time. Recent guidelines were published in 2004 as SIAARTI – SARNePI guidelines for sedation in paediatric neuroradiology. These guidelines cover patient evaluation, oral intake of food, venous access, monitoring, recommendations for emergency equipment, drugs for sedation and post sedation care.

**Head injury**

Head trauma is a major cause of mortality in paediatrics. As compared to adults, children present with diffuse cerebral oedema rather than haematoma. Scalp lacerations are common and can result in significant blood loss. Compound or depressed fractures, and those associated with haematoma require surgical repair. Haemodynamic instability is usually due to preload deficit from associated trauma. The principles of head injury management are the same as in adults, although the prognosis is better compared to adults.

**Vascular anomalies**

Vascular anomalies can present with intracerebral bleeds in newborns. The child can also present with congestive cardiac failure in case of large anomalies. Larger lesions may also require special techniques like deep hypothermia or cardiac bypass. Bleeding is a major hazard and blood and blood products should be available in the operating room, and arrangements to deal with sudden and massive blood loss.

## References


1. Van de Wiele B. Anesthesia for neurosurgery in Infants & Children. ASA Refresher Course lectures, Las Vegas, Oct 2004 No 232.
2. Hughes CW. Anesthesia management of pediatric neurological disorders. The pediatric anaesthesia hand book 276-289.
3. Newfield P. Pediatric neuroanesthesia. Problems in Anesthesia Vol 4, No 1, March 1990, 155-171.
4. Newfield P, Hamid RKA. Anesthesia for Pediatric Neurosurgery in Anesthesia and Neurosurgery. page 501-529. Eds James E Cottrell, David S. Smith. 4th ed. Mosby Inc St Louis.
5. Levati A, Paccagnella F, Pietrim D et al. SIAARTI – SARNe PI guidelines for sedation in pediatric neuroradiology. Minerva Anestesiologica, Vol 70; 675-715.
6. Soriano SG, Eldredge EA, Rockoff MA. Pediatric Neuroanaesthesia. Anesthesiology Clin N Am. 20 (2002) 389-404.
7. Heisel M, Nagib M, Madsen L, Alsheikh M, Bendel A. Use of recombinant factor VII a (rF VII a) to control intraoperative bleeding in pediatric brain tumour patients. Pediatric Blood Cancer 2004; 43(6): 703-5.
8. Eldredge E, Sonario S, Rockoff M. Pediatric Neurosurgical Anaesthesia Chapter 22. in practice of Anaesthesia for infants and children 2001. Cote Todris.