Hot Topics in Paediatric Anaesthesia 2015

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1 Considerable interest has been shown in the marginal gains to optimise both short term and long-term outcomes in the preterm infant. The data from the NEOPAIN trial has strongly suggested that even subtle reductions of blood pressure associated with sedative and analgesic agents, can cause acute neurological injuries but also more subtle effects on long term developmental outcomes. Similar concerns with regards data on hyperventilation/ low $PaCO_2$, its effects on cerebral vasoconstriction and neurodevelopment have given rise to several ongoing long term studies in this age group. Clinical interests have centred on tighter control of blood pressure through improved monitoring, more careful administration of anaesthetic agents and earlier use of inotropes to maintain cardiovascular performance during surgery. The importance of maintaining tighter control on arterial carbon dioxide and oxygen has driven changes in ventilator management in the operating room that match the standards required within NICU and PICU: “Taking the intensive care into the operating room”. There has also been renewed interest in operating on the most vulnerable patients within PICU and NICU, accepting that there is a trade off in operating conditions for the surgical team that may be outweighed by the benefits to the patient by remaining within the intensive care environment

2. Near infrared spectrometry has given valuable information during surgery on organ perfusion oxygenation and wellbeing. Initially NIRS was used almost exclusively in the operating room during paediatric cardiac surgery, but as experience has grown and the benefits have been demonstrated, this monitor has been moved into NICU PICU and the general paediatric operating room. Further outcome studies are urgently needed.

3. In addition to the physiological effects of anaesthesia on blood pressure, the direct effects of anaesthetic agents on the developing brain has continued to cause concern. The initial findings that GABA-A agonists (which include volatile anaesthetic agents and benzodiazepines) plus NMDA receptor antagonists (ketamine) had effects on the rodent brain in terms of both histological change and behavioural development caused some concern. However, the extension of studies into higher animals and even primates did not give reassurance that this was not a potential problem in humans. Current epidemiological studies have suggested that multiple exposures to anaesthetic agents at a young age may have neurodevelopmental consequences, but the case is far from proved. Prospective RCT’s have been difficult although the international GAS study is hopeful of shedding more light on the subject. Not all anaesthetic drugs are associated with apoptosis: alpha-2 agonists (clonidine, dexmedetomidine), Xenon, opioids and local anaesthetics do not appear to cause problems and there is some evidence that alpha-2 agonists confer some

protection against the apoptotic effect of other agents. Concerns have been raised that the exposure to some of these drugs in NICU and PICU is far greater than the short exposure associated with anaesthesia.

3. Xenon is a rare gas that needs to be produced from fractional distillation of air. As well as being an anaesthetic agent that is devoid of apoptotic actions on the brain and may be protective from the effects of other anaesthetic agents, it also has been shown to modify the effects or ischaemic reperfusion injury. Trials on effects of xenon in neonates who have suffered birth asphyxia are continuing and it may have other applications in situations such as cardiac surgery where ischaemia is inevitable. Due to its rarity and expense, delivery of xenon requires a complete rethink of delivery of anaesthetic gases.

5. Work on adults undergoing non-cardiac surgery by Henrick Kehlet and others have demonstrated that good analgesia but early active mobilisation can avoid many of the postoperative complications associated with a less danaesthesiathesia analgesia and convalescence programme. This has given rise to studies in fast track and even ultra-fast track surgery in infant cardiac surgery, with stress reduction in the operating theatre combined with on-table extubation immediately after surgery. Results, documenting fast track approaches and outcome are encouraging and have potential to expand into other aspects of major paediatric surgery.

6. Data on blood loss, adverse effects of administration blood products, and the use of antifibrinolytic drugs have challenged the current management strategies in paediatric surgeries that are associated with significant blood loss (craniofacial spinal and cardiac surgeries). There is increasing interest in developing protocols that have more relaxed attitudes to triggers for replacement of blood and blood components. Additionally, side effects of tranexamic acid and epsilon amino caproic acid appear to be mild and their ability to substantially reduce blood loss are well documented leading to calls that antifibrinolytics should be used more routinely in paediatric surgery.