

Paediatric anaesthesia update

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A year of Pediatric Anesthesia publications were reviewed, 3 papers¹⁻³ on topical but disparate areas within the sub-specialty were chosen. None of these publications or pieces of research are definitive, all are open to criticism wrt methodology, all however address an important or difficult question for our specialty. They form the nidus for a brief update in each of these areas.

The three topics touched on are

- 1) Pain management post -tonsillectomy
- 2) The impact of language on stress and anxiety in hospitalised children
- 3) The long-term neurological outcome following neonatal surgery

For all three papers I will briefly summarise current knowledge, then reflect on what the paper adds and next outline knowledge deficits and gaps that remain.

Pain Management post-tonsillectomy

Impact of a revised postoperative care plan on pain and recovery trajectory following pediatric tonsillectomy; Ped Anes 2021 31(7) 778-786

Background and what is Known

- 1) Up to 75%⁴ of children report severe pain following tonsillectomy
- 2) Pain resolution generally occurs over 1 week to 10 days
- 3) Patterns of pain are not consistent ie peak tends to be day 2/3 and then decrease over a week in about 2/3, however for 1/3 continued moderate pain out to one week and beyond⁵
- 4) Analgesic use is suboptimal⁴ – what is prescribed is not given regularly by parents and even when parents report their child has moderate or severe pain many parents give no analgesics
- 5) Analgesic prescription at discharge may be suboptimal or absent
- 6) NSAIDS in addition to paracetamol are superior to paracetamol alone⁵
- 7) Paracetamol and NSAIDS may be insufficient for 30% of children in the first few postoperative days
- 8) Many centres are recommending strong opioids for home discharge
- 9) There are frequent representations (>30%) in the week following surgery and many of these are for pain control

The paper

- 1) Premise: Solutions to insufficient analgesia have been postulated to include parental education, clear and thorough written information, ensuring appropriate prescription at discharge, advice to give paracetamol and NSAID regularly and strong opioid for rescue
- 2) Methods: In response to a prior audit at the author's institution a protocol discharge script and clear parental education, written information and parental coaching prior to discharge and an analgesic diary were introduced. Regular paracetamol and ibuprofen with prn rescue oxycodone were prescribed. Ongoing regular nursing education to support parental education was established.

Outcomes reported

- 3) A script at discharge was present for >90% of patients at discharge for paracetamol and ibuprofen cf 55% in the prior epoch.
- 4) 90% children receive analgesia on first 7 days but only 53% received the full regular regime for the first 5 days
- 5) For children who had their pain rated as moderate to severe by the caregiver only 50% received oxycodone rescue
- 6) Oxycodone disposal – 40 % of parents disposed of and mostly did not follow the recommendation to return leftovers to the pharmacy/hospital
- 7) 1/3 had POV or nausea
- 8) Pain remained poorly controlled. 1/3 severe pain day 2 to 5, mean time for mod/sever pain was 5 days (range 0 to 12)
- 9) 40% of patients visited GP or ED and for 40% of these visits pain was the reason

What this paper adds

- 1) Simple education of parents insufficient
- 2) Prescription, dispensing and administration of simple analgesics has improved but is still suboptimal
- 3) Greater compliance has not impacted on pain severity, or significant shortening of the time in pain

Further reflections and future directions

- 4) Need exploration of the reasons for failure to comply with prescribed analgesic regime – can be contributed to by failure to recognise pain, inconvenient dosing schedules, child refusal, parental concern re side-effects or addiction potential, actual side effects or poor understanding (eg if child is comfortable the parent may stop regime and not understand that the child is comfortable because they have stable analgesic concentrations.)
- 5) Need exploration of failure of analgesia
- 6) Role of non-pharmacological strategies

What we can do currently (even while acknowledging these are insufficient!)

- 1) Educate and ensure parents and staff understand importance of regular analgesics and rescue
- 2) Written information

The impact of language on stress and anxiety in hospitalised children

Adult behavior toward the child before surgery and pediatric emergence delirium; Pediatric Anesthesia 2022 32(1) 43-48

What is known

Stress and Anxiety in children during a hospital visit

- 1) Stress and anxiety during hospital admission is common
- 2) peaks at induction of anaesthesia
- 3) correlates with greater postoperative behavioural changes and these persist for up to 12% at one year
- 4) Anxiety and coping can be modified by language and non-pharmacological strategies that build coping

- 5) Parents and HCW often unwittingly use language and words that escalate stress and anxiety in children

Wake up distress or delirium

- 1) Common in an unmodified anaesthetic
- 2) Multifactorial – anaesthetic drug choices, distress at induction, child native temperament are all important

What this paper adds

- 1) Language styles/techniques that are known to escalate anxiety are correlated with wakeup distress
- 2) Reassurance and giving control of medical choices to the child positively predicted wakeup distress

What we still don't know

- 1) How do we teach and train staff and parents to optimise language and interactions with children?
- 2) Can we reduce distress, wakeup delirium and long-term behavioural outcomes in children by communicating more effectively

What we can do now

- 1) Inform ourselves re: language and nocebo/placebo effects with language
- 2) Manage anxiety and stress in children with both pharmacological and non-pharmacological techniques
- 3) Address systems within our institutions

The long-term neurological outcome following neonatal surgery

Intraoperative cerebral oxygen saturation and neurological outcomes following surgical management of necrotizing enterocolitis: Predictive factors of neurological complications following neonatal necrotizing enterocolitis; Pediatric Anesthesia 2022 32(3) 421-428

What is known about perioperative harm in neonates

- 1) A single short anesthetic is safe⁶
- 2) Major surgery (>120minutes) and multiple surgeries are associated with mild to moderate brain injury, impaired brain growth and mild to moderate neurodevelopmental outcomes⁷
- 3) Poorer neurodevelopmental outcome is known after major non cardiac congenital and neonatal surgery such as that for gastroschisis⁸, oesophageal atresia and necrotising enterocolitis. There is uncertainty about the relative role of the intraoperative period in relation to prematurity, NICU course, surgery itself and other potential harm associated with /from the underlying congenital condition.
- 4) The neonatal brain is vulnerable. In this period there is rapid velocity of and multiple complex processes taking place in the developing brain⁷.
- 5) Evidence suggests that the interplay of the triad of vascular immaturity, inflammation and possible drug neurotoxicity/neuroprotection are the likely pathophysiological mechanism⁷
- 6) Critical events (hypotension and decrease of O2 saturations to <85% the most common) occur during 35% of neonatal anaesthetics⁹
- 7) Complication are 16% at 30 days and mortality 3.2% at 90 days⁹
- 8) Co-occurrence of hypotension, hypoxemia and anaemia are associated with increased morbidity⁹

- 9) Up to 75% of neonates have been reported to have mild to moderate neuroimaging abnormalities such as punctate white matter injury, intraventricular and periventricular haemorrhage and subdural haemorrhage following non cardiac congenital surgery¹⁰. 11 % are reported to have subclinical peri and postoperative seizures unrelated to demonstrated radiological brain injury.

What is known about the use of NIRS in predicting and preventing neurological harm

- 1) Evidence (inconsistent) from cardiac surgery and NICU that NIRS may predict the occurrence of neurological complications and MRI lesions. Unknown whether low intraoperative NIRS predicts poor neurodevelopmental outcome¹¹
- 2) Intraoperatively approx. 2% of <6/12 infants have episodes of severe cerebral desaturations¹¹
- 3) Hypotension intraoperatively is common in <6/12 but poorly correlated with cerebral desaturation^{7,11}

Study and findings

- 1) 32 neonates NEC (necrotising enterocolitis) surgery
- 2) 25 had preoperative imaging – all normal
- 3) 9 had severe neurological outcome (2 IVH and 7 periventricular leukomalacia) at 1 year
- 4) 7 of those with a poor outcome had not had preoperative imaging (ie injury not definitively attributed to intraoperative period)
- 5) As expected they were all sicker NEC babies (higher Bell classification),
- 6) Decrease of NIRS >36% from baseline independently predicted 90% of the patients with severe neurological outcome
- 7) Nadir of NIRS and decreased NIRS per se are NOT associated with systemic desaturation

What this paper adds

- 1) Establishes a relationship between intraoperative cerebral desaturation and poor neurological outcome
- 2) Provides a target to avoid
- 3) Cerebral desaturation and systemic desaturation are NOT concurrent – the former likely represents cerebral blood flow decrease/poor cerebral autoregulation rather than poor systemic circulation
- 4) Cerebral saturation is a valuable intraoperative monitor

What knowledge gaps remain

- 1) Definitive documentation normal imaging preop and abnormal postop and association to NIRS
- 2) Interplay of CO₂, blood pressure, oxygenation, hemoglobin, pulmonary pressures, NIRS and outcome unknown

What we can do now

- 1) Routinely use NIRS in neonates
- 2) Respond to low NIRS and low MAP
- 3) Aim for stability (eg hypertension may also be bad!)

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