Paediatric anaesthesia

**Anaesthetic safety in the use of the Macintosh oral laryngeal spray**

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We hypothesized 3 questions.

1: With a single, maximal hand-squeeze of the Macintosh laryngeal spray atomizer (MLSA) bulb, is it possible to administer a toxic dose of local anaesthetic (LA) to small infants?

2: Is there a difference between the amount of LA spray deliverable between two different clinicians with a single maximal hand squeeze of the atomizer bulb?

3: Within any individual MLSA, is a single maximal hand squeeze of the atomizer bulb going to deliver a consistent volume of LA spray?

Seven MLSA devices were tested. The amount of LA expelled with a single maximal bulb hand squeeze was collected. This sequence was repeated 5 times with each of the 7 MLSA by two investigators.

The volumes of 2% LA delivered per single maximal squeeze of the 7 Macintosh atomizer bulbs by investigators one and two, was 0.54 ± 0.7 ml and 0.31 ± 0.4 ml respectively. This difference between users was statistically significant (p < 0.0001). A statistically significant difference in spray volume was found among the MLSA (p < 0.0001), and was not dependent upon the user (interaction term p value < 0.12). Pairwise comparisons among the devices indicated all delivered different volumes from each other with the exception of two, but not statistically significantly different from each other (p < 0.7). A statistically significant difference in spray volume was found among the Macintosh devices (p < 0.0001), and was not dependent upon the user (interaction term p value < 0.12). Volumes were consistent among the five spray measurements within each user and device (p < 0.52).

Only fill the MLSA with a safe dose of LA, predetermined for each patient prior to use.

**Anaesthetic-induced apoptotic neurodegeneration in the neonatal rat spinal cord**

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Exposure to anaesthetic agents triggers apoptotic neurodegeneration in the neonatal rat brain1 however whether apoptosis also occurs in the spinal cord, a crucial target for analgesic and anaesthetic agents, is unknown. A myriad of potential functional effects of apoptosis in the spinal cord are possible, we have focused our investigations so far on the effects on nociceptive signalling pathways.

Seven day old Sprague-Dawley rats were exposed to 25% oxygen along with 75% nitrogen or 75% nitrous oxide + 0.75% isoflurane for 6 hours (n = 6/group). The rats were sacrificed immediately after anaesthesia, and their spinal cords removed and lumbar sections were sliced for caspase-3 immunohistochemistry. The severity of apoptotic neurodegeneration was assessed by counting the number of caspase-3 positive cells in the spinal cord. To examine whether an effect on nociceptive signalling was present the tail flick latency test (TFLt) was employed on postnatal days (PND) 8, 15 and 30 (n = 6/group).

Anaesthesia for 6 hours increased the number of caspase-3 positive cells relative to air exposure (p < 0.01, Fig. 1). However tail flick latencies did not differ between the groups at PND 8 (air 2.36 ± 0.3s vs anaesthesia 2.57s ± 0.3s), PND 15 (air 4.02s ± 1.74s vs anaesthesia 3.60s ± 1.05s) and PND 30 (air 3.99s ± 0.3s vs anaesthesia 4.02s ± 0.5s). Gross motor abnormalities were not observed in either group.

Anaesthetic-induced neurodegeneration occurs in the spinal cord in addition to the brain. Despite apoptosis being evident in both the dorsal and ventral horns, nociceptive spinal reflex signalling is not affected. Further studies utilising more complex nociceptive and motor tests are underway to elucidate whether there is a functional correlate to the biochemical evidence of apoptosis.

**Acknowledgements:** Westminster Medical School Research Trust

**References:**
Effect of lipid emulsion infusion on the levobupivacaine-induced cardiac toxicity on newborn piglet

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Recent data of the literature showed the interest of the use of lipid emulsion infusion (LEI) in the treatment of local anaesthetics cardiac toxicity. The present studies were undertaken to determine if this method is similarly efficient with levobupivacaine (LB) in a newborn model piglets.

Electrocardiogram, arterial blood pressure and oxygen saturation were continuously recorded in anesthetized piglets. 10 mg/kg/min of LB were injected until the appearance of a cardiovascular collapse defined by: mean arterial blood pressure (MAP) below of 50% of the initial value. The resuscitation was then started, and Intralipide® 20% (Soybean purified oil, Kabi Fresenius France) was infused (4 ml/kg in 1 min then 0.25 ml/kg/min). The resuscitation went on during 30 min or until the recovery of an efficient and stable cardiac activity. Blood sample was obtained to measure LB plasma concentration at the collapse. The results were expressed as mean ± SD.

9 piglets (5 females and 4 males) 8.2 ± 1.7 days of age, weighing of 3 ± 0.7 kg were included. The average time of occurred collapse was 3.7 ± 1.5 min. Both cumulative dose and plasma concentration of LB to the collapse were respectively 10.8 ± 3.3 mg/kg and 25.8 ± 16 µg/ml. Among the 9 piglets, 6 recovered an efficient and stable cardiac activity, after time rescue of 6.7 ± 3.4 min. The dose of LEI administered was 5.1 ± 1.6 ml/kg.

These preliminary results seem to be in favour of using LEI in the treatment of LB cardiac toxicity. They must be confirmed by a comparative study with and without LEI.

References:

Intercostal nerve block for post-appendectomy pain relief in children

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The advantages of pain relief in children are well known. Regional analgesia can be a safe and efficacious method of providing this, while avoiding side effects of other analgesics. Use of intercostals blocks has been previously described but their use in children is limited. Reported success rate varies. Our objective was to evaluate the efficacy of intercostal nerve block to provide intraoperative analgesia for appendectomy in children.

An audit of children undergoing appendectomy under general anaesthesia and intercostal nerve blocks was performed. Informed consent was obtained from the parent and child where appropriate. Each received T10-12 intercostal nerve block post induction, using bupivacaine 0.5% with adrenaline 1:200 000, 0.1ml/kg. Some were ultrasound guided.

75 children (35 female, 42 male), aged 3–15 years and weighing 11.5–56kg received blocks. 98.6% required no additional analgesia in the immediate post op period. Duration of analgesia, in those that could be adequately assessed, ranged from 8–12 hours. Only one child required additional fentanyl. No complications, including pneumothorax, or toxicity were observed.

Intercostal nerve blockade is a useful alternative for early post appendectomy analgesia in children. It is an underutilized method of analgesia that may provide better quality pain relief with fewer side effects. Its success rate may be improved when sonograph assisted.

References:
Neuraxial ultrasound findings in neonates with anorectal malformation

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Ultrasonography is becoming an important adjunct to regional anaesthesia. Technical advances have allowed improved definition of lumbar-sacral spinal images in neonates and infants. The value of ultrasonography in placement of epidural catheters in children has been described.1 2 Nested in one of these studies, it was noted that there was a high incidence of spinal variants associated with infants with anorectal malformations (ARMs). This review aims to report on the spectrum of these variants.

The neuroaxis of neonates and infants with ARMs, in whom epidural or caudal block were planned, were imaged. Images were obtained in a longitudinal plane using SonoSite180+ portable ultrasound using a 5–10 MHz linear hockey stick probe. Findings, including age, weight, gender and associated conditions were recorded.

To date, 19 infants (8 females, 11 males), aged 1 day to 2.5 years, weighing 1.88–14 kgs have been imaged. 13 children had a spinal variant identified on ultrasound. 11 exhibited a ‘syrinx’. 3 infants had other anomalies. Neuraxial block was subsequently performed in 15 children, with no complications.

Spinal anomalies in infants with ARMs is reported but seldom diagnosed in the neonatal period. As the use of ultrasonography increases, identification of these findings has important clinical implications that include early recognition of normal variants that mimic pathology and true spinal pathology.5 Consequently, contraindications can be assessed and safety improved.

References:
5. Lowe L

Operating room extubation in pediatric congenital heart surgery

Infantile Cardiologic Hospital Dr Gilberto Rodríguez Ochoa, Caracas, Venezuela

Evaluate the characteristics of patients for cardiac surgery extubated on operating room as well as average intensive care unit stay in relation to mean postoperative patients.

Retrospective data was evaluated of 204 records and finally 181 were obtained, the 23 remainder were excluded because they do not required cardiopulmonary bypass. Pre, peri and post operative characteristics were evaluated as well as average intensive care unit stay in relation to mean patients’ population.

39, 95% of the surgical patients were extubated in the operating room, 14, 45% of them were 3 in complexity Aristotle scale. Extubated patients showed average hematocrit > 30%, Aortic Clamp time < 45 min, Lactate levels <4 mmol/l and mild hypothermia management was used. There was significantly different (p <0.05) on reduction in intensive care unit stay in patients extubated in operating room in relation to general patient in post operated of ventricular septal defects, Tetralogy of Fallot repair and totally anomalous pulmonary venous connection.

Operating room extubation is not always possible, for those patients in whom it is feasible, the benefits include early recovery and simplified postoperative care, increased family and patient satisfaction, less complication related to prolonged intubation and lesser hospital stay. Prospective studies are necessary to achieve the really impact on costs and savings.

References:
Preoperative anxiety in children managed with the music telephone and midazolam

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The study was undertaken on 100 children undergoing ENT operations. 50 children were in the control group and 50 children were given the toy telephone. They were all assessed with the visual analogue scale (VAS). The goal was to see if the music toy reduced anxiety. This was part of a larger study of 1000 patients, using the VAS to measure anxiety.

The toy telephone has a walkman audio system in the base. Microphones are placed in the listening ear piece of the phone. The volatile anaesthetic agent is administered in the mouth part of the toy phone. The VAS and workings of the phone, were shown to the children during the preoperative assessment. The child’s anxiety was assessed again when the child arrived in the operating theatre reception area. Photos to explain in PPP.

As all the children received midazolam 0.1 to 0.25 mg/Kg orally preoperatively, it was difficult to assess the effect of the music and telephone toy. The vast majority of the children 71% had much less anxiety when assessed in the operating room reception area. Only 3% of the children had more anxiety due to crying children in the recovery room next door. 21% stated that they had no anxiety at all. 6% claimed to have no change in their level of anxiety.

Events occurring in the ward and operating room reception area such as crying children, influenced the results. The effect of anxious parents as well as the child’s fear of needles also influenced the results. The Music phone is a useful method of relieving anxiety in children but difficult to assess accurately.

Acknowledgements: Prof Antony Hodgson Department of Medical Research SESIAHS for approval by the Research Ethics Board.

References:

Psoas compartment catheters for perioperative pain management in children

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Psoas compartment catheters (PCC) have been shown to be effective for pain management in children and adults after hip and femur surgeries. We evaluated the efficacy of psoas catheters versus epidurals or IV opioid for children with hip/femur surgery in our institution.

We did a retrospective matched case-control study. Cases were children who received psoas catheters for intra- and postoperative pain treatment for surgery on the hip and/or femur. Controls were patients who underwent similar surgical procedures and received either an epidural preoperatively, or no regional technique. Primary outcome variables were pain scores, amount of opioid used, and opioid side effects. Block complications were also recorded.

24 children were enrolled: 12 cases and 12 controls (6 with epidurals, 6 without). Children with PCCs received less intraoperative fentanyl as compared to control patients (0.7 vs 1.8 mcg/kg). PACU morphine administration was also lower (32.7 vs 71.0 mcg/kg). Morphine use postoperatively was less in the PCC versus the opioid group (14.0 vs 70.3 mcg/kg/hr), but more than the epidural group (0.5mcg/kg/hr). PONV incidence was similar in all groups. Diphenhydramine use for pruritis was three times higher in the control group. Lorazepam use was higher in the PCC group (1.7 vs 0.4 mcg/kg/hr). There were no block complications. One patient in the opioid group required catheterization for urinary retention. Continuous peripheral nerve techniques are gaining popularity in pediatric population, however, there are little data on safety and efficacy of these techniques. Perceived advantages of peripheral nerve blocks as compared to epidurals include less risk of spinal cord injury, no need for bladder catheterization, and unilateral motor block.

PCCs may provide better perioperative analgesia with fewer side effects than opioid-based techniques. Further research concerning dosing and management of PCCs in children is required.

References:
Severe hypoxic brain injury in a neonate despite continuous pulse oximetry

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Case Report: A four-month old ex 36-week premature infant with a history of Trisomy 21 and tracheomalacia was scheduled for laryngoscopy, bronchoscopy, and aortopexy for an aberrant innominate artery compressing her trachea. Induction, maintenance, and emergence from anesthesia were uneventful except two short episodes of desaturation with SpO2’s in the 80’s during bronchoscopy. The baby remained intubated postoperatively with an arterial line in place, and was transferred to the NICU. Upon arrival, she was awake and moving all 4 extremities and appeared comfortable. In the NICU, she became progressively more agitated overnight requiring sedation and opioids. Despite normal electrolytes, relative euvolemia, and no significant desaturations in the NICU, the baby developed respiratory acidosis and became more somnolent the morning following surgery. Twenty-four hours after surgery without warning, her pupils became sluggish and unequal. A brain CT revealed diffuse severe cerebral edema with transtentorial and cerebellar tonsillar herniation. Both a CT angiogram and echocardiogram showed no aortic dissection, vascular, or cardiac etiology to explain this mortal brain injury.

Several factors can cause ischemic brain injury in neonates leading to diffuse cerebral edema including hypoxia, hyperoxia, hypotension, acidosis, hypoglycemia, and infections. Episodes of cerebral hypoxia have been documented in preterm infants by other methods of monitoring such as NIRS (near-infrared spectroscopy) and transcutaneous PO2.1,2

Continuous pulse oximetry has been a valuable and integral monitor decreasing morbidity and mortality significantly perioperatively. Other methods of cerebral oxygenation monitoring may also prove useful in high risk patients during the perioperative period.

References:
2. Bonhorst B. Pulse oximeters' reliability in detecting hypoxemia and bradycardia: comparison between a conventional and two new generation.

Ten years of paediatric epidurals – the Christchurch experience

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Until recently there were no large scale audits of the complications related to paediatric epidurals. The National Pediatric Epidural Audit (NPEA)3 has allowed anaesthetists to accurately assess the risks of epidural infusions.

A retrospective audit was conducted of the data for paediatric epidurals for the 10 years from April 1996-2006 at Christchurch Hospital, New Zealand.

During the 10 years from April 1996–2006 709 epidurals were inserted. There were 5 serious adverse events. Using the NPEA classification system, there was one grade 1 adverse event (epidural abscess), two grade 2 adverse events (local anaesthetic toxicity) and two other events (respiratory depression) not classified by NPEA. There were no long term sequelae. The age range was 0–15 years (average age 4 years). There were 10 high thoracic epidurals (T6 and above), 80 mid thoracic epidurals (T7–T10), 273 low thoracic epidurals (T10–T12), 336 lumbar epidurals, 5 caudal catheters and 5 unknown. Patient/parent satisfaction scores reflected the high quality of the service, with 534/709 patients/parents reporting satisfaction scores much better or better than expected, 659 would recommend it as the mode of analgesia of choice and 662 would have an epidural for a repeat procedure.

The recently published NPEA has a lower incidence of adverse events compared to previous reports. However, the authors comment that there is an increased incidence of drug error and local anaesthetic toxicity in centres performing less than 100 epidurals/year. They relate this to a lack of familiarity with the management of the technique. We would like to share the experience in Christchurch to demonstrate that with effective training and team work smaller centres can successfully administer an effective paediatric epidural service.

Acknowledgements: Hamish Horton and Richard Craig.

References:
The value of preoperative bronchoscopy in oesophageal atresia

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The location of a tracheo-oesophageal fistula (TOF) in neonates presenting with oesophageal atresia has significant anaesthetic and surgical implications. Few authors advocate preoperative bronchoscopy for this condition. The aim of this prospective study was to evaluate the data collected from preoperative bronchoscopy.

The presence of other abnormalities/associations were noted.

<table>
<thead>
<tr>
<th>Fistula position</th>
<th>KEH</th>
<th>RXH</th>
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<tbody>
<tr>
<td>Oesophageal atresia:</td>
<td>103 (55 male)</td>
<td>52 (27 male)</td>
</tr>
<tr>
<td>&lt; 0.5 cm of carina:</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>0.75–1 cm of carina:</td>
<td>32</td>
<td>15</td>
</tr>
<tr>
<td>&gt;1 cm of carina:</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>At the carina:</td>
<td>42</td>
<td>16</td>
</tr>
<tr>
<td>Left main bronchus:</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Right main bronchus:</td>
<td>2</td>
<td>1</td>
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</tbody>
</table>

We analysed 2 sets of results: from King Edward Hospital (KEH) from 1993–2001 and Red Cross Hospital (RXH) from 2001 to the present. Bronchoscopy was performed under general anaesthesia with spontaneous respiration. The TOF was identified and its distance from the carina measured.

There were 2 cases of pulmonary agenesis and 1 of pulmonary sequestration. Seven laryngeal clefts were noted in the Red Cross patients. Gastric deflation was achieved in 23 cases.

The surgical approach was changed to a cervical approach in 3 cases, and a left thoracotomy in 1 (right sided aortic arch). There were no complications related to bronchoscopy.

Preoperative bronchoscopy is safe and a useful investigation in neonates with oesophageal atresia. It facilitates anaesthetic planning and appropriate ET tube placement, gastric decompression, tracheo-bronchial toilet and surgical planning.

**References:**

Transversus abdominis plane block as an alternative analgesic for children undergoing appendicectomy: a preliminary report

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The Transversus Abdominis Plane (TAP) Block has recently been described in adults, but not in children. The aim of this report is to describe the block in children with particular regard to providing analgesia for children undergoing appendicectomy. This single injection technique is preferable to multiple intercostal nerve blocks.

With informed consent, a TAP block was placed under ultrasound guidance after induction of general anaesthesia in children undergoing appendicectomy. With the child in the supine position, the triangle of Petit was identified on the right iliac crest. A needle was advanced at right angles to the skin, a “pop” sensation was detected as the external oblique muscle was traversed. On further advancement a second “pop”, as the transversus abdominis was traversed, signalled entry into the transversus abdominis fascial plane. After negative aspiration, 0.2 –0.3ml.kg bupivacaine 0.5% with adrenaline 1:200000 was injected. The exact location was confirmed by ultrasonography. Pain scores and time to first analgesia were assessed in the immediate post-operative period.

To date, 2 children aged 10–12 years weighing 34–42kg received a TAP block using 10ml 0.5% bupivacaine with adrenaline. Children were comfortable in recovery with pain scores < 2 and no nausea, one complained of a sore throat. Time to first analgesia was 8–10 hours. Both received IV paracetamol intraoperatively for pyrexia.

This preliminary report suggests that TAP block is an effective method for providing analgesia in the immediate post-operative in children undergoing appendicectomy. The optimal dose for children and the potential for continuous catheter placement need to be explored.

**References:**