TIVA for tonsillectomy
Peter Squire, RCH

Airway protection
Apnea monitoring +/- post-op ventilation (HDU or PICU)
Safe environment
Extended analgesia

477 cases of under 12yo T&A’s (Feb 13-Feb 14)
Incr. with ‘blitz lists’
Approx 10-12 per week, far less than other centres!
Advantages of Sevo

• “You just breathe it”
• Treats needle-phobic parents
• Doesn’t need EMLA or Angel
• You don’t have to prepare it
• You can assess the degree of airway obstruction
• ‘Relatively’ quick offset
• Gives you 101 chances to get the cannula in!
Disadvantages of Sevo

• “It stinks”
• It pollutes
• Requires a vaporiser
• Makes you chuck (PONV)
• Makes you mad (Emergence Agitation)
• Gives you laryngospasm
• Puts the surgeon to sleep
• Malignant Hyperthermia
• Rhabdomyolysis
Malignant Hyperthermia vs Rhabdomyolysis

Central core disease (MH)
Known spontaneous Rhabdomyolysis
Muscular dystrophy
Duchenne’s
Benefits:
Post-operative nausea and vomiting

A meta-analysis of nausea and vomiting following maintenance of anaesthesia with propofol or inhalational agents

J. R. Sneyd, A. Carr, W. D. Byrom* and A. J. T. Bilski*

Department of Anaesthesia, Derriford Hospital, Derriford Road, Plymouth PL6 8DH, UK
* Zeneca Pharmaceuticals, Mereside, Alderley Park, Macclesfield, Cheshire, UK

70 trials (57 adult, 13 children)
4074 vomiting as end-point; 3516 nausea; 742 n and v

“3.5 and 5.7-fold reductions in vomiting in adults and children when propofol used ”
Volatile anaesthetics may be the main cause of early but not delayed postoperative vomiting: a randomized controlled trial of factorial design C.C Apfel et al

5 way factorial design (gender, type of surgery, anaesthetic maintenance, opioid use, antiemetic use)

1180 patients (593 children) elective ENT or strabismus surgery

Strongest risk factor for vomiting was use of volatile anaesthetics compared with propofol
(Odds ratio for Iso and Sevo were 3.4 and 2.8)
**BJA 2002; Apfel et al (ctd)***

Early post-op period (0-2 hrs) showed volatiles as also being the clear risk factor (40% PONV cw 10% PONV with propofol) (Adjusted Odds ratios: Iso 19.8, Sevo 14.5)

Depends somewhat on degree of exposure

“Irrespective of volatile type this factor alone was several orders of magnitude stronger than all other factors (including antiemetics) in early post-op period”
“PONV is debilitating, costly and prevalent”

2X incr vomiting in children

Adenotonsillectomy, squint repair, herniae, orchiopexy and penile surgery

Use of Propofol and avoiding volatiles was most efficacious measure (1A evidence)

Should we be extending the benefit to paediatric day-case?
Benefits:
Post Anaesthesia Emergence Delirium (PAED)

6-60% (depends on age, surgery and how it's measured)
16 retinoblastoma kids
1-5 yo
All had Sevo induction
Randomised to Sevo or Propofol
Had alternate agent for next exam

....good study but small numbers!
<table>
<thead>
<tr>
<th>Study design</th>
<th>Population</th>
<th>Premedication</th>
<th>Analgesia</th>
<th>EA incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sevoflurane only</td>
<td>322 children</td>
<td>None</td>
<td>Alfentanil, fentanyl, or regional blocks</td>
<td>Sevoflurane 25.7%</td>
</tr>
<tr>
<td></td>
<td>Age 3-12 y</td>
<td></td>
<td></td>
<td>Propofol/halothane 9.4%</td>
</tr>
<tr>
<td></td>
<td>Day surgery or ENT surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sevoflurane vs sevoflurane induction, isoflurane</td>
<td>128 children</td>
<td>None</td>
<td>Penile, caudal, or ilioinguinal/iliohypogastric</td>
<td>Sevoflurane 51.8%</td>
</tr>
<tr>
<td>maintenance</td>
<td>Age 1-6 y</td>
<td></td>
<td>block</td>
<td>Sevoflurane/isoflurane 32.1%</td>
</tr>
<tr>
<td></td>
<td>Subumbilical surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sevoflurane only</td>
<td>68 children</td>
<td>Midazolam 0.5 mg/kg, or clonidine 2 or 4 μg/kg</td>
<td>Penile block and rectal paracetamol 30 mg/kg</td>
<td>Midazolam 60%</td>
</tr>
<tr>
<td></td>
<td>Age 1-6 y Circumcision</td>
<td></td>
<td></td>
<td>Clonidine 2 μg/kg</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40%, 4 μg/kg 25%</td>
</tr>
<tr>
<td>Total intravenous anesthesia (TIVA)</td>
<td>53 children</td>
<td>None</td>
<td>Fentanyl 2 μg/kg or caudal block</td>
<td>Sevoflurane 23.1%</td>
</tr>
<tr>
<td>Sevoflurane vs propofol TIVA</td>
<td>2-36 mo Ambulatory surgery</td>
<td></td>
<td></td>
<td>Propofol 3.7%</td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sevoflurane vs propofol TIVA</td>
<td>186 children</td>
<td>None</td>
<td>Fentanyl 2 μg/kg</td>
<td>Sevoflurane 20%-42%</td>
</tr>
<tr>
<td></td>
<td>Age 2-11 y ENT surgery</td>
<td></td>
<td></td>
<td>Propofol 5%-11%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sevoflurane vs propofol TIVA</td>
<td>88 children</td>
<td>None</td>
<td>None</td>
<td>Mean PAED scale</td>
</tr>
<tr>
<td></td>
<td>Age 2-6 y MRI</td>
<td></td>
<td></td>
<td>score significantly lower for propofol group</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Sevoflurane vs propofol TIVA</td>
<td>50 children</td>
<td>None</td>
<td>Alfentanil 20 μg/kg, acetaminophen 20 mg/kg, or ibuprofen 10 mg/kg, and local infiltration of site</td>
<td>Sevoflurane 46%</td>
</tr>
<tr>
<td></td>
<td>Age 3-10 y Tonsillectomy</td>
<td></td>
<td></td>
<td>Propofol 9%</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sevoflurane vs propofol TIVA</td>
<td>16 children</td>
<td>Midazolam 0.5 mg/kg PO</td>
<td>Acetaminophen 30 mg/kg prn</td>
<td>Sevoflurane 38%</td>
</tr>
<tr>
<td></td>
<td>Age 1-5 y Eye surgery</td>
<td></td>
<td></td>
<td>Propofol 0%</td>
</tr>
<tr>
<td>Propofol as adjunct to sevoflurane</td>
<td>80 children</td>
<td>Midazolam 0.5 mg/kg PO</td>
<td>Paracetamol 15 mg/kg IV</td>
<td>Propofol 19.5%</td>
</tr>
<tr>
<td></td>
<td>Age 2-6 y</td>
<td></td>
<td></td>
<td>Saline 47.2%</td>
</tr>
<tr>
<td></td>
<td>Strabismus surgery</td>
<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propofol 1 mg/kg vs saline</td>
<td>84 children</td>
<td>None</td>
<td>Nitrous oxide</td>
<td>Propofol 4.8%</td>
</tr>
<tr>
<td></td>
<td>Age 2-7 y MRI</td>
<td></td>
<td></td>
<td>Saline 26.8%</td>
</tr>
</tbody>
</table>

Table 3. Emergence Agitation (EA) Studies Divided by Anesthetic Technique With EA Incidence
ENT indicates ear, nose, and throat; PAED, Pediatric Anesthesia Emergence Delirium; MRI, magnetic resonance imaging; prn, as Needed
Benefits:
Laryngospasm/ Bronchospasm

Risk assessment for respiratory complications in paediatric anaesthesia: a prospective cohort study

Britta S von Ungern-Sternberg, Krisztina Boda, Neil A Chambers, Claudia Rebmann, Chris Johnson, Peter D Sly, Walid Habre

Lancet 2010; 376; p773
Prospective multivariate analysis
9297 questionnaires
Cost of anaesthetic

Fentanyl (100 mcg) 57¢
Dexamethasone (8mg) 88¢
Tramadol (100mg) 77¢
N.Saline (500ml) $1.27
IV Paracetamol (500 mg) $ 2.34
Remifentanil (1mg) $3.30
Granisetron (1 mg) $7.25
Clonidine (150 mcg) $9.20
Parecoxib (40 mg) $16.60
Isoflurane bottle (250 ml) $88
Sevoflurane bottle (250 ml) $142.50

Propofol (200mg) 77¢
## Volatile consumption

<table>
<thead>
<tr>
<th>Agent</th>
<th>MW</th>
<th>MAC % (Datex default for 3yr old pt)</th>
<th>Volume volatile / litre gas flow @ 1 MAC</th>
<th>Volume of 1ml of volatile at 20oC</th>
<th>portion of a ml of volatile per ltr FGF @ 1 MAC</th>
<th>Cost of bottle</th>
<th>Volume bottle</th>
<th>Cost per ml</th>
<th>Cost of 1 MAC in 1 l FGF per minute</th>
<th>Cost of 1 MAC for 1 hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sevoflurane</td>
<td>200</td>
<td>2.65</td>
<td>26</td>
<td>182</td>
<td>0.143</td>
<td>147</td>
<td>250</td>
<td>$0.59</td>
<td><strong>$0.08</strong></td>
<td>$5.04</td>
</tr>
<tr>
<td>Isoflurane</td>
<td>184.5</td>
<td>1.5</td>
<td>15</td>
<td>195</td>
<td>0.077</td>
<td>80</td>
<td>250</td>
<td>$0.32</td>
<td><strong>$0.02</strong></td>
<td>$1.48</td>
</tr>
<tr>
<td>Desflurane</td>
<td>168</td>
<td>7.8</td>
<td>78</td>
<td>208</td>
<td>0.375</td>
<td>235</td>
<td>240</td>
<td>$0.98</td>
<td><strong>$0.37</strong></td>
<td>$22.03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Volume of sevo at 8% per l FGF</th>
<th>Volume of 1ml of volatile at 20oC</th>
<th>portion of a ml of volatile per ltr FGF</th>
<th>Cost of bottle</th>
<th>Volume bottle</th>
<th>Cost per ml</th>
<th>Cost of 8% Sevo for litre FGF per minute</th>
<th>Cost of 8% Sevo per minute for 6l FGF</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>182</td>
<td>0.440</td>
<td>147</td>
<td>250</td>
<td>$0.59</td>
<td><strong>$0.26</strong></td>
<td>$1.55</td>
</tr>
</tbody>
</table>
Taking TIVA outside RCH

Dr. Balvinder Kaur
Staff Anaesthetist
Health for Humanity

Surgical non profit mission working in the Obras Hospital, Antigua Guatemala

Performed over 180 surgeries in 10 days of operating

Over 50 palate and lip repairs with an average of 4-8 cases a day in 2 operating rooms.
The Set Up and Recipe

SET UP
• Mostly IV inductions
• T-piece connected to patient
• 2mg/kg propofol, 10mcg/kg remifentanil
• Propofol/remi mixture of 10mg/ml; 2.5-5mcg/ml
• 250-300mcg/kg/min
• Spont vent on Ayre’s T-piece circuit

ADVANTAGES
• Smooth wake up
• No need to rely on anaesthesia machine-old, adult ventilator
• Minimal airway irritation and no incidence of laryngospasm
• Preferred wake up by recovery staff who had limited paediatric exposure