TIVA in Children:
Why is it not more popular?

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How popular is TIVA in paediatric anaesthesia?
A national survey of propofol infusion use by paediatric anaesthetists in Great Britain and Ireland

MATTHEW HILL BMedSci BMBS MRCPCH FRCA*, WILLIAM PEAT MBChB† AND SIMON COURTMAN BMedSci BMBS FRCA MSc‡

*Department of Anaesthesia, Royal Devon and Exeter Hospital, Exeter, †Department of Anaesthesia, Leeds General Infirmary, Leeds and ‡Department of Anaesthesia, Derriford Hospital, Plymouth, UK

Frequency of use of propofol infusions by paediatric anaesthetists

<table>
<thead>
<tr>
<th>Frequency of use</th>
<th>Never</th>
<th>Rarely</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of anaesthetists (%)</td>
<td>73 (30)</td>
<td>99 (41)</td>
<td>38 (16)</td>
<td>23 (10)</td>
<td>1</td>
<td>8 (3)</td>
</tr>
</tbody>
</table>
A national survey of propofol infusion use by paediatric anaesthetists in Great Britain and Ireland

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Reasons for using propofol infusions:

• Reduced PONV
• Quality of recovery
• Neurological monitoring
• Avoidance of volatiles
### CHAPTER 18 | Total intravenous anaesthesia

**Table 18.2.** Techniques used to maintain anaesthesia in those UK Activity Survey cases (actual results) where general anaesthesia was induced in theatres, and Certain/probable and Possible cases of AAGA. *counted as TIVA (952; 6.6%)

<table>
<thead>
<tr>
<th>Technique</th>
<th>AAS</th>
<th>AAGA</th>
<th>Ratio AAGA: Activity Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile agent</td>
<td>13,479</td>
<td>112</td>
<td>0.89</td>
</tr>
<tr>
<td>Propofol infusion TCI*</td>
<td>764</td>
<td>14</td>
<td>1.94</td>
</tr>
<tr>
<td>Propofol infusion not TCI*</td>
<td>82</td>
<td>2</td>
<td>2.50</td>
</tr>
<tr>
<td>Intermittent boluses*</td>
<td>106</td>
<td>1</td>
<td>1.00</td>
</tr>
<tr>
<td>Both volatile agent and propofol infusion</td>
<td>48</td>
<td>7</td>
<td>17.00</td>
</tr>
<tr>
<td>Total</td>
<td>14,479</td>
<td>136</td>
<td></td>
</tr>
</tbody>
</table>
What are the reasons?

• There’s too much PK variation between patients
• Models aren’t accurate and haven’t been validated
• I can’t use my adult models in children
• I can’t use effect-site targeting in children
• Many paediatric patients have a gas induction, so I can’t use TIVA
• IV induction is too painful
• You can’t measure the propofol concentration in the same way you can measure volatiles
• I can’t use Minto for remifentanil in children
• If I use propofol/remi in children I will have to intubate them all
• TIVA is too much hassle
• TIVA is expensive and wasteful in children
• TIVA causes more awareness
• There is no benefit to TIVA in children
• Children are more likely to get Propofol-related Infusion Syndrome
What are the reasons?

- Pharmacokinetic reasons
- Practical reasons
- Safety reasons
- Cost reasons
What are the reasons?
Pharmacokinetic reasons

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Wake up concentrations in children

What are the reasons?
Pharmacokinetic reasons

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Paediatric TCI models

About 20 published models – only two commercially available

- **Paedfusor** – developed in 1990s
  Showed need for larger bolus and greater infusion rates in children
  Can be used down to 5kg and 1 year

- **Kataria** – also developed in 1990s
  Based on samples from >50 children
  Age range 3-16 years
  Minimum weight 15kg
Paedfusor Model

- It shows how age as a covariate influences the PK parameters
- PK data doesn’t change until 13yrs except $k_{10}$
- Maximum age & weight for this programme - 16 yrs & 61kg (same for Kataria)

Table 1 ‘Paedfusor’ propofol pharmacokinetic data set

<table>
<thead>
<tr>
<th>Age 1–12 yr</th>
</tr>
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<tbody>
<tr>
<td>$V_1=458.4\times weight$</td>
</tr>
<tr>
<td>$k_{10}=0.1527\times weight^{-0.3}$</td>
</tr>
<tr>
<td>$k_{12}=0.114$</td>
</tr>
<tr>
<td>$k_{21}=0.055$</td>
</tr>
<tr>
<td>$V_2=V_1\times k_{12}/k_{21}$</td>
</tr>
<tr>
<td>$V_3=V_1\times k_{13}/k_{31}$</td>
</tr>
<tr>
<td>$k_{13}=0.0419$</td>
</tr>
<tr>
<td>$k_{30}=0.26$</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Age 13 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_1=400.0\times weight$</td>
</tr>
<tr>
<td>$k_{10}=0.0678$</td>
</tr>
<tr>
<td>Other constants as above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age 14 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_1=342.0\times weight$</td>
</tr>
<tr>
<td>$k_{10}=0.0792$</td>
</tr>
<tr>
<td>Other constants as above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age 15 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_1=284.0\times weight$</td>
</tr>
<tr>
<td>$k_{10}=0.0954$</td>
</tr>
<tr>
<td>Other constants as above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age 16 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_1=228.57\times weight$</td>
</tr>
<tr>
<td>$k_{10}=0.119$</td>
</tr>
<tr>
<td>Other constants as above</td>
</tr>
</tbody>
</table>

Maximum bolus size

- Weight <15 kg=3 mg
- Weight <30 kg=6 mg
- Weight >30 kg=12 mg

*British Journal of Anaesthesia 95 (1): 110–13 (2005)*
Accuracy of the ‘Paedfusor’ in children undergoing cardiac surgery or catheterization

A. Absalom¹*, D. Amutike¹ ⁴, A. Lal², M. White³ and G. N. C. Kenny¹
Accuracy of Paedfusor Model
(acceptable values in brackets)

- Bias (MPE) 4.1% (10%)
- Precision (MAPE) 9.7% (20%)
- ‘Wobble’ 8.3%
- Performs better than adult models
• PK performance estimates in children suggest the Kataria model performs poorly

• PK performance estimates for Paedfusor suggest greater accuracy (although not as good as previously)

• The Marsh Paediatric is the best performing model, but we can’t currently use it

• The study also demonstrates the poor performance of adult models in children
# A General Purpose Pharmacokinetic Model for Propofol

Douglas J. Eleved, PhD,* Johannes H. Proost, PhD,* Luis I. Cortínez, MD,† Anthony R. Absalom, MD,* and Michel M. R. F. Struys, MD*†

(Anesth Analg 2014;118:1221–37)

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Model</th>
<th>MDPE, (%)</th>
<th>MDAPE, (%)</th>
<th>Good prediction error, (APE ≤20%)</th>
<th>Poor prediction error, (APE &gt;60%)</th>
<th>Predictive performance metric, (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young children</td>
<td>Final model</td>
<td>−3.8</td>
<td>18.0</td>
<td>54.5</td>
<td>7.0</td>
<td>47.5</td>
</tr>
<tr>
<td></td>
<td>Coppens²</td>
<td>−15.3</td>
<td>23.0</td>
<td>44.3</td>
<td>8.1</td>
<td>36.2</td>
</tr>
<tr>
<td></td>
<td>Short⁵³</td>
<td>2.4</td>
<td>20.9</td>
<td>47.6</td>
<td>11.6</td>
<td>36.0</td>
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<tr>
<td></td>
<td>Rigby-Jones⁵⁴</td>
<td>−9.3</td>
<td>22.8</td>
<td>45.0</td>
<td>10.7</td>
<td>34.3</td>
</tr>
<tr>
<td></td>
<td>Knibbe¹¹</td>
<td>−7.4</td>
<td>24.5</td>
<td>42.2</td>
<td>11.1</td>
<td>31.1</td>
</tr>
<tr>
<td>Children</td>
<td>Final model</td>
<td>−3.7</td>
<td>19.3</td>
<td>52.3</td>
<td>5.5</td>
<td>46.8</td>
</tr>
<tr>
<td></td>
<td>Coppens²</td>
<td>−10.8</td>
<td>19.7</td>
<td>50.9</td>
<td>6.4</td>
<td>44.5</td>
</tr>
<tr>
<td></td>
<td>Marsh (children)³</td>
<td>−11.3</td>
<td>20.7</td>
<td>48.3</td>
<td>5.4</td>
<td>42.8</td>
</tr>
<tr>
<td></td>
<td>Paedfuso⁵²</td>
<td>−9.3</td>
<td>23.0</td>
<td>44.8</td>
<td>6.0</td>
<td>38.8</td>
</tr>
<tr>
<td></td>
<td>Rigby-Jones (multicenter)⁵⁵</td>
<td>3.8</td>
<td>22.3</td>
<td>45.3</td>
<td>7.5</td>
<td>37.8</td>
</tr>
</tbody>
</table>
What are the reasons?
Pharmacokinetic reasons

• There’s too much PK variation between patients
• Propofol models aren’t accurate and haven’t been validated
• I can’t use my adult models in children
• I can’t use effect-site targeting in children
• I can’t use Minto for remifentanil in children
Paedfusor – effect of age

30kg, 140cm boy – initial target 6μg/ml, reducing to 3μg/ml – total time of procedure 40 minutes

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Total propofol dose (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>30.8</td>
</tr>
<tr>
<td>14</td>
<td>26.3</td>
</tr>
<tr>
<td>16</td>
<td>21.4</td>
</tr>
</tbody>
</table>

This demonstrates the effect of age on propofol requirements for a given weight
Adult models in children

Paedfusor

Marsh
Adult models in the bigger ‘child’

• Do we treat them as adults and use Marsh?
• Do we use PF and fudge the weight and target?
• Allometric scaling probably applies
• If physiologically an adult treat as an adult
What are the reasons?
Pharmacokinetic reasons

- There’s too much PK variation between patients
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Remifentanil TCI

- Minto model
- Minimum weight 30kg
- Minimum age 12yrs (can use in younger if weight >30kg)
- Almost linear relationship between target and infusion rate
Remifentanil TCI

Remi $C_p$ (ng/ml) vs Remi infusion rate (mcg/kg/min)

<table>
<thead>
<tr>
<th>Target (ng/ml)</th>
<th>0.1</th>
<th>0.2</th>
<th>0.25</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.75</th>
<th>1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>1.5</td>
<td>3</td>
<td>3.5</td>
<td>4.5</td>
<td>6</td>
<td>7.5</td>
<td>11</td>
<td>15</td>
</tr>
</tbody>
</table>
Remifentanil - Pharmacokinetics

<table>
<thead>
<tr>
<th>Model</th>
<th>CL (ml·kg(^{-1})·min(^{-1}))</th>
<th>V1 (ml·kg(^{-1}))</th>
<th>VDss (ml·kg(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigby-Jones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 kg</td>
<td>93</td>
<td>92</td>
<td>233</td>
</tr>
<tr>
<td>10.5 kg</td>
<td>68</td>
<td>92</td>
<td>233</td>
</tr>
<tr>
<td>27 kg</td>
<td>54</td>
<td>92</td>
<td>233</td>
</tr>
<tr>
<td>40 kg</td>
<td>49</td>
<td>92</td>
<td>233</td>
</tr>
<tr>
<td>Davis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean 27 kg</td>
<td>47</td>
<td>84</td>
<td>235</td>
</tr>
<tr>
<td>Minto</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight proportional (adults)</td>
<td>34</td>
<td>67</td>
<td>236</td>
</tr>
</tbody>
</table>

LBM 45 89 341

How much remifentanil?

Munoz H et al. Anesth Analg 2007; 104: 77-80

- Adults (20-60yrs) vs children (3-11yrs)
- \( IR_{50} \) block somatic response to skin incision
- Propofol 6\( \mu \)g/ml \( \rightarrow 3 \) \( \mu \)g/ml
- \( IR_{50} \) adults = 0.08 \( \mu \)g/kg/min
- \( IR_{50} \) children = 0.15 \( \mu \)g/kg/min

Older children seem to handle remi like adults
What are the reasons?
Pharmacokinetic reasons

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- I can’t use my adult models in children
- I can’t use Minto for remifentanil in children
- I can’t use effect-site targeting in children
Effect-site targeting in children

- We are using an adult $k_{e0}$ value
- Paediatric values are higher and change with age
- Dependent on PK dataset used
Time to propofol $C_e$ 3.0μg/ml at different target concentrations*

*For a $k_{e_o}$ value of 0.26
What are the reasons?

Practical reasons

• Many paediatric patients have a gas induction, so I can’t use TIVA
• IV induction is too painful with TIVA
• If I use propofol/remi in children I will have to intubate them all
• TIVA is too much hassle
• There is no benefit to TIVA in children
What are the reasons?

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• There is no benefit to TIVA in children
Induction

- Most younger children at BCH have a gas induction
- All children expressing a preference for gas induction have one
- Overall about 75% of children anaesthetised at BCH have a gas induction
- Does this matter when using TIVA?
- No – switch to TIVA when asleep
What are the reasons?

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Pain on induction

• Rate of propofol infusion normally fixed but can be adjusted
• Balance between slow induction & pain
• Set lower target (5-6μg/ml)
• Use analgesia (remifentanil)
• Use local anaesthetic (lignocaine)
• Adult patients undergoing propofol TCI anaesthesia (Marsh) with induction target of 3.4μg/ml
• Three remi doses 2,4 and 6ng/ml (Minto model)
• Significantly less incidence of pain in R₄ and R₆ groups
• Also pain less severe
• No difference between 4 and 6ng/ml

What are the reasons?

Practical reasons

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• There is no benefit to TIVA in children
TIVA – Airway management

- Most patients will need ventilating, but not all patients need intubation
- Many can be managed with an LMA
- Depends on remi dose being administered
- Younger children more resistant to the respiratory depressant effects
What are the reasons?

Practical reasons

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TIVA - The ‘Faff Factor’

• Infusions have to be made up
• Lines have to be connected and primed
• Pumps have to be programmed
• Total time on average about 6 minutes per patient
• Need to be proactive and organised – don’t leave it all until the patient is in the anaesthetic room
What are the reasons?

Practical reasons

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Why TIVA? – Necessity

- Known MH patient or strong family history
- MH susceptibility or risk
- Muscular dystrophy
- Patients requiring muscle biopsy
Why TIVA? – Benefit

- Previous postop N&V or high risk, e.g. strabismus, Ts&As, orchidopexy
- Scoliosis surgery
- Airway procedures
- Recent URTI
- Less airway complications
Emergence delerium

- Common in younger children following sevoflurane anaesthesia
- Can be inconsolable in recovery
- Distressing for patient, parents and recovery staff
- Incidence and severity greatly reduced with propofol-based TIVA
What are the reasons?

Safety reasons

• You can’t measure the propofol concentration in the same way you can measure volatiles.
• TIVA causes more awareness.
• Delivery problems may go unrecognised.
• Children are more likely to get Propofol-related Infusion Syndrome.
What are the reasons?

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• You can’t measure the propofol concentration in the same way you can measure volatiles
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Propofol measurement – Practical Systems

Blood – Peloros System

Breath – Owlstone Lonestar
IS THE END-TIDAL PARTIAL PRESSURE OF ISOFLURANE A GOOD PREDICTOR OF ITS ARTERIAL PARTIAL PRESSURE?

F. J. FREI, A. M. ZBINDEN, D. A. THOMSON AND H. U. RIEDER

Arterial isoflurane tension = 45 – 80% of end-tidal!!!
BIS in Paediatric TIVA

- Don’t bother using if <1 yo
- Not as good in children
- Maintain margin of safety (40-55)
- Try and avoid paralysis
- Act on evidence of responsiveness (more propofol)
Response of bispectral index to neuromuscular block in awake volunteers†

P. J. Schuller*, S. Newell, P. A. Strickland, and J. J. Barry

Department of Anaesthesia & Intensive Care, Cairns Hospital, PO Box 902, Cairns QLD 4870, Australia

*corresponding author, e-mail: peterj.schuller@gmail.com
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<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Awareness in children

**Awareness During Anesthesia in Children: A Prospective Cohort Study**

Andrew J. Davidson, MBBS, GradDipEpiBiostats, FANZCA†, Grace H. Huang, BMedSci*, Caroline Czarnecki, BMedSci*, Margaret A. Gibson, BN, RN*, Stephanie A. Stewart, BN, RN*, Kris Jamsen, BSc, PGDipStats†, and Robyn Stargatt, PhD, MAPS§

*Department of Anaesthesia and Pain Management, The Royal Children’s Hospital, Parkville, Victoria, Australia; †Department of Pharmacology, University of Melbourne, Melbourne, Victoria, Australia; ‡Clinical Epidemiology and Biostatistics Unit, The Royal Children’s Hospital, Parkville, Victoria, Australia; and §Department of Psychology, The Royal Children’s Hospital, Parkville, Victoria, Australia

Anesth Analg 2005;100:653–61

- Over 1000 children studied
- Incidence 0.8%
- All >5 yo
- No TIVA cases

**Intraoperative awareness during paediatric anaesthesia**

H. J. Blussé van Oud-Alblas 1 2, M. van Dijk 2, C. Liu 1, D. Tibboel 2, J. Klein 1 and F. Weber 1

1Department of Anaesthesiology and 2Department of Paediatric Surgery, Erasmus University Medical Centre—Sophia Children’s Hospital, Dr Molewaterplein 60, 3015 GJ Rotterdam, The Netherlands

Br J Anaesth 2009; 102: 104–10

- Over 900 children studied
- Incidence 0.6%
- All >6 yo
- One TIVA case (MRI)
What are the reasons?
Safety reasons

• You can’t measure the propofol concentration in the same way you can measure volatiles
• TIVA causes more awareness
• Delivery problems may go unrecognised
• Children are more likely to get Propofol-related Infusion Syndrome
Table 18.1. Potential problems with drug delivery from intravenous anaesthesia pumps

<table>
<thead>
<tr>
<th>Problem</th>
<th>Prevention / Detection / Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV cannula disconnection or ‘tissuing’ (i.e. subcutaneous rather than IV infusion)</td>
<td>Cannula or central venous catheter visible and accessible during procedure</td>
</tr>
<tr>
<td>Disconnection of infusion tubing from pump or at an intermediate connection point</td>
<td>Pump and tubing connections visible; use of Luer lock syringes</td>
</tr>
<tr>
<td>Low battery / pump paused</td>
<td>Modern pumps usually have an audible alarm</td>
</tr>
<tr>
<td>Occlusion of IV cannula; tap or clamp closed</td>
<td>Pump high infusion pressure alarm</td>
</tr>
<tr>
<td>‘False’ occlusion alarm because of small cannula or long infusion tubing</td>
<td>Adjustable high infusion pressure alarm and users trained in their adjustment</td>
</tr>
<tr>
<td>‘Backtracking’ of propofol into intravenous fluid infusion tubing when the infusions are given through the same cannula/catheter lumen</td>
<td>One-way valves to prevent back-tracking</td>
</tr>
<tr>
<td>Use of 1% propofol in a pump which has been programmed for the use of 2% protocol or vice versa</td>
<td>Stocking of only one concentration of propofol</td>
</tr>
<tr>
<td>When using infusions of both propofol and remifentanil, insertion of the propofol syringe into the pump programmed for remifentanil and vice versa.</td>
<td>Prominent pump displays with the drug name and perhaps colour-coding of the pump LCD displays to match the colour of the syringe labels</td>
</tr>
</tbody>
</table>
SAFE ANAESTHESIA LIAISON GROUP
Guaranteeing Drug Delivery in Total Intravenous Anaesthesia

SALG RECOMMENDATIONS

Current policy and practice for Total Intravenous Anaesthesia in both adults and children is reviewed to ensure that:

1. When administering TIVA a non-return valve is always used on any intravenous fluid line
2. Sites of intravenous infusions should be visible so they may be monitored for disconnection, leaks or infusions into subcutaneous tissues
3. When using equipment, it is essential that clinical staff know its uses and limitations
4. Organisations give preference to clearly labelled intravenous connectors and valves

Local practice should be audited and staff encouraged to report further incidents.
What are the reasons?
Safety reasons

- You can’t measure the propofol concentration in the same way you can measure volatiles
- TIVA causes more awareness
- Delivery problems may go unrecognised
- Children are more likely to get Propofol-related Infusion Syndrome
• 21 patients <16 yrs:
  Mean max. propofol dose/duration
  13.7mg/kg/hr and 2.4 days
  71% consistent with PRIS

• 68 adult patients >16 yrs
  Mean max. propofol dose/duration
  7.2mg/kg/hr and 7.3 days
  31% consistent with PRIS
First case report in 1999:
18mo arthrogryposis – prolonged orthopaedic procedure

Mitochondrial respiratory chain deficiency

acidosis
Large anion gap and base deficit
Bradyarrhythmias
Recovered after 14 days
PROPOFOL

- MCADD/LCADD
- Hereditary channelopathy
- SIRS
- Inotropes/glucocorticoids
- Tendency to hypoglycaemia
PRIS – Does it occur with Anaesthesia?

4 recent case reports in children:

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Diagnosis</th>
<th>Prop dose (mg/kg/hr)</th>
<th>Prop duration (hours)</th>
<th>Signs of PRIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Cerebral aneurysm</td>
<td>6.5</td>
<td>8</td>
<td>A, HT, ↑CPK</td>
</tr>
<tr>
<td>7</td>
<td>Osteogenesis imperfecta</td>
<td>13.5</td>
<td>2.5</td>
<td>LA</td>
</tr>
<tr>
<td>12</td>
<td>Mitral valve disease</td>
<td>&lt;3</td>
<td>15</td>
<td>LA</td>
</tr>
<tr>
<td>16</td>
<td>Mitral valve disease</td>
<td>&lt;3</td>
<td>8</td>
<td>LA</td>
</tr>
</tbody>
</table>

A - Acidosis; LA – Lactic acidosis; HT – Hypotension; CPK – creatine phosphokinase
PRIS – Does it occur with Anaesthesia?

- 53 children undergoing spinal surgery
- 11 children in ‘control’ group
- Acid-base, lactate, propofol and triglyceride levels measured hourly and postop
- DNA from white cells and muscle for resp chain enzyme activity

Propofol Infusion Syndrome: A Prospective Analysis of Biochemical Markers during IV Anesthesia – Polaner D, ASA Meeting 2009
PRIS – Does it occur with Anaesthesia?

- Data from 50 patients presented
- Similar size/weight for both groups
- Average length of procedure 4.9 vs 3.0 hours
- Triglyceride levels elevated in propofol group
- Associated with increased C10 and C18 acylcarnitines

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Propofol Infusion Syndrome: A Prospective Analysis of Biochemical Markers during IV Anesthesia – Polaner D, ASA Meeting 2009
PRIS – Does it occur with Anaesthesia?

- 11 patients in propofol group and none in control group had elevated lactate.
- C6 acylcarnitine showed trend to increasing with duration of surgery in propofol group.
- Genetic and mitochondrial analysis ongoing.

Propofol Infusion Syndrome: A Prospective Analysis of Biochemical Markers during IV Anesthesia – Polaner D, ASA Meeting 2009.
What are the reasons?
Cost reasons

• TIVA drugs are more expensive than volatile anaesthetics
• You can’t share an ampoule of remifentanil between patients
• You have disposable costs with TIVA
• The pumps are very expensive
What are the reasons?

Cost reasons

• TIVA drugs are more expensive than volatile anaesthetics
• You can’t share an ampoule of remifentanil between patients
• You have disposable costs with TIVA
• The pumps are very expensive
Cost of anaesthetic drugs

- Propofol – generic = 59p per 20mls
- Remifentanil – off-licence = 76p per mg
- Sevoflurane – depends on induction, flows and MAC (250 mls = £60)
- Largely depends on how they are used
- Propofol and remi have an increased cost based on the size of the patient
- Overall a small proportion of the procedure costs
- Hidden benefits of TIVA
What are the reasons?
Cost reasons

• TIVA drugs are more expensive than volatile anaesthetics
• You can’t share an ampoule of propofol or remifentanil between patients
• You have disposable costs with TIVA
• The pumps are very expensive
Drug sharing

• Opioid sharing regarded as bad practice by MHRA and AAGBI – not actually illegal
• Need to be able to account for how much CD has been used/discarded
• Propofol sharing less of a problem
• Cost of remifentanil off-licence makes this less of a consideration
What are the reasons?

Cost reasons

• TIVA drugs are more expensive than volatile anaesthetics
• You can’t share an ampoule of remifentanil between patients
• You have disposable costs with TIVA
• The pumps are very expensive
Disposable costs

- Need new syringes and administration set with each patient
- Cost about £4
- No disposable costs with volatile anaesthesia
What are the reasons?

Cost reasons

• TIVA drugs are more expensive than volatile anaesthetics
• You can’t share an ampoule of remifentanil between patients
• You have disposable costs with TIVA
• The pumps are very expensive
Pump costs

- Open TCI pumps allow the use of generic propofol
- TCI propofol more efficient than using mass rate infusion
- Can be obtained as part of a deal with a smart pump manufacturer
Conclusions

• The use of TIVA continues to be relatively unpopular in both paediatric and adult practice
• There are very few reasons why TIVA can’t be used in children and in many situations there are definite advantages
• All anaesthetists should be able to give a good quality TIVA anaesthetic
THANK YOU!