Initiating Labour Analgesia in 2020:
Predicting the Future
Epidurals, CSEs, Spinal Catheters, Epidrum & Epiphany

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FLYING SAUCERS FOR EVERYBODY!

Within ten years you may be commuting by plastic saucer, flying from your backyard.

By Frank Tinsley

SAUCER rises vertically, flies conventionally.

IT IS a bright morning in 1965. At precisely eight a.m. Joe Lees emerges from the back door of his lakeside cottage, only 75 miles from his job in the city. In the graveled center of his backyard his jaunty new plastic saucer rests lightly on three tiny balloon tires.

Greeting his neighbor who rides with him, Joe lifts a flush flap in the saucer's rounded nose. He turns a recessed locking handle and throws back the bubble-like windshield. Spring loaded, like the hoods of today's cars, the enclosure lifts easily. As it does, the interlinked nose cone swings down to form a handy step.

Joe's neighbor steps up over the low instrument pedestal and then across the folded pilot's seat to his perch in the rear. Joe follows, slams the windshield shut and...
Frightening view of the future
Eisenach – some day, labor analgesia will just be a pill
Spinal Anesthesia Adjuvants

• **Opioids**
  – Morphine, fentanyl, sufentanil

• **Adrenergic receptor agonists**
  – Clonidine, epinephrine, phenylephrine

• **Cholinergics**
  – Neostigmine

• **GABA agonists**
  – Midazolam, baclofen

• **NMDA antagonists**
  – Ketamine

• **NSAIDs**
  – Ketorolac

• **Steroids**
• **Somatostatin**
• **Adenosine**
• **Magnesium**
The cell bodies depicted in the brainstem lie within several brainstem nuclei including nucleus raphe magnus, the subcoeruleus nucleus, and the lateral vestibular nucleus.

The cell bodies depicted in the spinal cord lie within the dorsal horn gray matter.

NE = norepinephrine
ACh = acetylcholine
P = projection neuron

local anesthetic

DORSAL ROOT GANGLION

NERVE ENDING
Fentanyl

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DORSAL ROOT GANGLION

NERVE ENDING

mu receptor

serotonin
dopamine
others

enkephalin

local anesthetic
Neostigmine

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DORSAL ROOT GANGLION

NERVE ENDING
Neostigmine

- Intrathecal neostigmine administration causes prohibitive nausea and vomiting.

- However, *epidural* administration can provide analgesia without nausea.
Neostigmine

- **For labor analgesia (epidural)**
  - Abstract presented at SOAP 2010

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
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<tbody>
<tr>
<td><strong>Fentanyl 2ug</strong></td>
<td>17.0 ± 3.38</td>
<td>13.50 ± 6.26</td>
<td>13.28 ± 3.85*</td>
<td>12.86 ± 4.96*</td>
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<tr>
<td><strong>Average bupivacaine used, ml/hr</strong></td>
<td></td>
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<td>(PCEA only)</td>
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<tr>
<td><strong>Average bupivacaine used, ml/hr</strong></td>
<td>18.86 ± 4.52</td>
<td>15.70 ± 6.02</td>
<td>15.62 ± 6.21</td>
<td>15.26 ± 8.84</td>
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<tr>
<td>(PCEA plus physician top-up)</td>
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*significantly different from control (group A)
Neostigmine

  
  • “Epidural Neostigmine: Will It Replace Lipid Soluble Opioids for Postoperative and Labor Analgesia?”
    – Big maybe, of course
    – Efficacy is well documented
    – No respiratory depression or pruritus
    – No concerns for controlled substance diversion/documentation
    – Safety profile looks good, but remains to be thoroughly tested long-term
    – Neostigmine still should not be used outside research setting

Remifentanil
IV PCA - Remifentanil

• Early reports optimistic
• Rapid on/off
  – Seems ideally suited
  – Peak effect 2-2.5 min from bolus
• Subsequent reports mixed

IV PCA - Remifentanil
IV PCA - Remifentanil
IV PCA - Remifentanil

2 minutes
IV PCA - Remifentanil
IV PCA - Remifentanil

- Timing of intravenous patient-controlled remifentanil bolus during early labor
  - Attempt to bolus 140s prior to contraction
  - No improvement in analgesia

Novel LOR methods

• I have no relationship with any of these companies
Novel LOR methods

- Episure AutoDetect Syringe
Novel LOR methods

- Epidrum
Novel LOR methods

• By uncoupling the means of advancement from the means of epidural space detection, the Epidrum offers the following benefits:
  – two hands on needle improve control
  – visual signal more readily interpreted and can be supervised
  – continuous pressure in device gives the quickest possible signal change
  – in the future Epidrum may allow use of smaller gauge needles
Novel LOR methods

The Future of Labor Analgesia?
Ultrasound
(Thank you, Dr Teoh!)
Ultrasound

Ultrasound

• Is it the future?
  – Assist with difficult placement
    • Scoliosis
    • Previous lumbar spinal surgery
    • Obesity
  – Teaching tool
  – Safety
    • Hematoma
    • Spinal cord/Nerve injury
Ultrasound

- Is it the Future?
  - *Lumbar ultrasound: useful gadget or time-consuming gimmick?*

  - Increased Cost
  - Lack of proven benefit
  - Increased procedural time
  - Unproven safety of US
  - Slippery slope of regulator requirements

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<td>Vascular Access</td>
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## Ultrasound

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The future of US

• Real time ultrasound
The Future of Labor Analgesia Maintenance
The Evolution of Labor Analgesia
The Evolution of Labor Analgesia

- Intermittent bolusing
- Continuous infusion
- PCEA
- PIEB
- Smart Pumps
The Evolution of Labor Analgesia

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The Evolution of Labor Analgesia

Intermittent bolusing

Continuous infusion

PCEA

PIEB

Smart Pumps
The Evolution of Labor Analgesia

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Smart Pumps
“Visualizing Tip” Needles

- Not to be confused with epiduroscopy
- Various methods used to detect physical differences in tissues

- “Optically guided insertion”
  - Three optical fibers embedded in Tuohy needle shaft
  - One emits light; two absorb light
  - Optical spectra are analyzed

Rathmell et al Anesthesiology 2010;113:1406-18
“Visualizing Tip” Needles

Rathmell et al Anesthesiology 2010;113:1406-18
“Visualizing Tip” Needles

- Needle-shaped Ultrasound probe

Chiang et al. Anesthesiology 2011;114:1320-4
“Visualizing Tip” Needles

Chiang et al. Anesthesiology 2011;114:1320-4
Pharmacogenetics

• Drug delivery tailored to genome
  – Better analgesia
  – Fewer side effects
  – Lower toxicity (e.g. slow metabolizers)
  – Alternative drug choices
Pharmacogenetics

- **SNP** = Single Nucleotide Polymorphism

- Ex. Sickle Cell Disease
  - SNP results in Glutamic acid for Valine on haemoglobin
Pharmacogenetics

• Mu opioid receptor SNP
• Position 118 of the gene
• A118G allele (adenine/guanine substitution)

• Results in two different mu-opioid receptor proteins
Pharmacogenetics

- Fentanyl for labor analgesia

Nelson et al. 2002; 96: 1070-3
Pharmacogenetics

• Fentanyl for labor analgesia

ED50 = 26.8ug

ED50 = 17.7ug

Landau et al. Pain 2008; 139: 5-14
Pharmacogenetics

• Let’s get clinical.....
  – Labor analgesia duration
  – Cesarean section postop analgesia

Sia et al. Anesthesiology 2008; 109: 520-6
Wong et al. IJOA 2010; 19: 246-53
Camorcia et al. IJOA 2012; 21: 40-1
Pharmacogenetics

- Editorial 2012

“The promise of pharmacogenetics in labor analgesia...tantalizing, but not there yet.”

Wong. IJOA 2012; 21: 105-8
Pharmacogenetics

• Editorial 2012
  – Confounding variables
    • Age
    • Race
    • Parity
    • Induction vs spontaneous labour
    • Use of oxytocin
    • Time of day or night
    • Presence of family members

Wong. IJOA 2012; 21: 105-8
Pain prediction

• Pain requirements after CS are variable
• Giving the same IT morphine dose to all:
  – Overdose in some
  – Underdose in others

Granot et al. Anesthesiology 2003; 98: 1422-6
Pan et al. Anesthesiology 2006; 104: 417-25
Pain prediction

• Experimental pain prior to planned CS (thermal stimulus)
• Compared to reported pain after CS

Granot et al. Anesthesiology 2003; 98: 1422-6
Summary
Labor Analgesia 2020

- Eisenach’s Pills
- Spinal Adjuncts
- Novel methods of LOR
- PIEB and Smart pumps
- Ultrasound guided epidural
- Visualizing tip needles
- Pharmacogenetics
- Pain prediction
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