General anaesthesia (GA) for caesarean birth: an update

Mike Paech
Emeritus Professor, UWA
Department of Anaesthesia and Pain Medicine
King Edward Memorial Hospital, Perth, Western Australia
Disclosures

Nil
Learning objectives

Reflect on the role of GA in 2017

Review why GA in this population is, arguably, no longer as “scary”

To improve knowledge about practice options with regard to GA
- preoxygenation & airway management
- pre-induction & induction drugs
- neuromuscular blocking drugs
- intraoperative & postop analgesia
What is the role of GA for caesarean birth in 2017?

Low rates (<10%) in many high-resource countries… but not so in many others

Typically for emergency cases
• immediate fetal delivery < 15 min from decision or failed regional block

Occasionally for elective cases
• medical & obstetric reasons or patient request

Sometimes the sickest patients and typically the greatest urgency!

But have a low threshold to use GA if it appears safe and is appropriate
  e.g. to avoid delays (contentious – Palmer et al. Anaesthesia 2018 Apr 6. doi: 10.1111/anae.14296) or to control intraoperative pain
Does a trainee in the obstetric unit still get anxious when they hear “She needs a GA”?

1. Mortality rates have fallen dramatically although serious morbidity twice as common as with neuraxial anaesthesia

2. Failed intubation appears to be less common (and less problematic?)

Rajagopalan et al IJOA 2017 single USA unit, retrospective cohort n=695
- 1% had AFOI
- 94% intubated at first attempt
- 0.4% (1 in 250) failed intubation, but all before 2010 & all rescued with LMA

Incidence 1 in 250 to 1 in 500

McDonnell et al. IJOA 2008 n=1095 / Quinn et al. UK BJA 2013
Kinsella et al. IJOA 2015 / D’Angelo et al. Anesthesiology 2014
Does a trainee in the obstetric unit still get anxious when they hear “She needs a GA”?

Safety Improvements

- Technical & non-technical skill training
- Simulation & practice drills / team training
- Clinical practice guidelines
- Videolaryngoscopes & better equipment
- Comfort with continuing GA using a SGA

OAA/DAS. Anaesthesia 2015
Q1
Should every second & third trimester pregnant woman have a rapid sequence induction with cricoid pressure?

What do we know?

1. There is no clinical evidence it works to reduce aspiration
2. There is some evidence for harm due to increased airway management difficulty; adverse haemodynamic events; increased risk of awareness & regurgitation
Rapid sequence with cricoid?

Complications of anaesthesia (only one of which is aspiration) are responsible for < 1% severe morbidity (incidence < 1 in 10,000 births) 10th Scottish Audit Report 2014

n = 4,891 intubated GA emergency CB, 60% using cricoid pressure. 11 deaths from aspiration.

Table 4 Significant risk factors for regurgitation and maternal death among those receiving endotracheal anaesthesia

<table>
<thead>
<tr>
<th></th>
<th>Regurgitation on induction</th>
<th>Regurgitation at any time</th>
<th>Maternal death (any cause)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cricoid pressure applied</td>
<td>2.60 (1.05 to 6.47)</td>
<td>0.80 (0.57 to 1.13)</td>
<td>1.88 (1.10 to 3.20)</td>
</tr>
<tr>
<td>Untrained anaesthetist</td>
<td>4.35 (1.98 to 9.54)</td>
<td>1.90 (1.24 to 2.91)</td>
<td>2.36 (1.29 to 4.34)</td>
</tr>
<tr>
<td>Preoperative complications</td>
<td>5.63 (2.48 to 12.7)</td>
<td>2.11 (1.40 to 3.17)</td>
<td>20.9 (11.5 to 37.9)</td>
</tr>
<tr>
<td>Regurgitation at any time</td>
<td></td>
<td></td>
<td>3.80 (1.81 to 7.98)</td>
</tr>
</tbody>
</table>
My thoughts: use rapid sequence usually, viz..

- aspiration prophylaxis, antiemetic, head up position (all unproven but very low risk of harm)
- good anaesthetic depth and neuromuscular block (unproven)
- have correctly applied cricoid pressure until it causes an issue (unproven but low risk: might save your insurance company some money)
- intubate rapidly (some support)

Cricoid pressure is still the “gold standard’ but traditional dogma may have misled us into using an unproven, poorly performed and potentially harmful technique ........so also have a very low threshold for its release
How are some managing the airway these days?

To intubate, or not to intubate………?

More evidence supporting the safety of LMAs

- Three studies to 2012: n=4,767 selected elective cases & no aspiration = highest risk 1 in 1,500
- Four more -
  - RCT n=60, PLMA vs TT
  - Retro n= 56 LMA including emergency cases
  - RCT n=80 i-gel vs TT
  - Prospective n=584 Supreme LMA

Which SGA device? Take your pick ...............
What are others doing these days?

Sajayan et al. BJA 2016  UK national survey

The majority -

- Preoxygenated using end-tidal oxygen monitoring (42% used CPAP & 17% bag-mask ventilated during the apnoeic period)
- Used head-up tilt 20 degrees or more
- Used induction opioids (mainly fentanyl)
- Used propofol
- Used sux or roc, depending on the clinical situation
- Always used cricoid pressure

“The classical technique was seldom used”
Advocates for changes in practice

Nasser & Babatunde. BJA 2015
- call to change to propofol

Devroe et al. Curr Opin Anesthesiol 2015
- propofol (ketamine, etomidate) & sevo
- rocuronium 1 mg/kg & sugammadex
- cricoid and RSI
- remifentanil when useful

Cosentino & Maddox. Australasian Anaesthesia 2015 (awareness)
- propofol suitable
- nitrous oxide and overpressure of volatile to multiple MAC
- minimise muscle relaxants after delivery
New techniques for GA

Pre-oxygenation

Reports of high-flow nasal or buccal oxygen during apnoeic phase (5-15 L/min), incl. THRIVE (70 L/min)
Q2
Is the move to propofol induction a reasonable change?

Propofol results in a longer duration of unconsciousness than thio.

Was NAP5 “induction with thiopentone is a risk factor for accidental awareness” [probably due to under-dosing & syringe swaps], another nail in its coffin?

It appears so - and has been driven by necessity in most countries.
Is the move to propofol induction a reasonable change?

Several old studies found comparable outcomes, except propofol induced greater maternal hypotension; gave more rapid initial maternal recovery; and more early neonatal depression (lower 1-min Apgars)

Fawad Alam et al. Professional Med 2006

Tumukunde et al. BMC Anesthesiology 2015

RCT n=150
1-min Apgar < 7 post-prop 2/kg 47% vs 32% post-thio 4 /kg (P=0.07)

Figure 2 Percentage of neonates with a postpartum Apgar score < 7.
Is the move to using opioids pre-induction a reasonable change?

Yes, sometimes important e.g. to obtund the response to laryngoscopy or improve intubating conditions

But routine opioid? (contentious)

- reduces MAC but not MAC awake: unlikely to prevent awareness
- reduces propofol conc. to prevent movement, but not for response to command
- reduces early neonatal Apgar scores, but doesn’t necessarily increase need for neonatal airway support (Karbasy. Med J Islam Repub Iran 2016)
- reduces need for neuromuscular blocker post-delivery
Controlling the response to airway instrumentation

Effective methods -

• magnesium 30 mg/kg  

• remifentanil 1 mcg/kg  
  Yoo et al. IJOA 2013

• others (alfentanil 10 mcg/kg / fentanyl 4 mcg/kg / GTN 100-200 mcg / lidocaine 1.5 mg/kg)
Hypothesis: Could comparable intubating conditions and block recovery be achieved with rocuronium and suxamethonium?

Design: S-B RCT non-inferiority

Primary outcome: time to intubation

Sample size: 240 to detect difference not > 20 s

Interventions: roc 1 mg/kg (+ sug) or sux 1 mg/kg (+ roc & neo)
### Results

**Table 2. Evaluation of Times Recorded During the Procedure According to Intention to Treat**

<table>
<thead>
<tr>
<th></th>
<th>ROC group (n = 120)</th>
<th>SUX group (n = 120)</th>
<th>Difference in means (95% CI)</th>
<th>P&lt;sup&gt;e&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Median (minimum–maximum)</td>
<td>Median (minimum–maximum)</td>
<td>P&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Time from induction to first wave on EtCO&lt;sub&gt;2&lt;/sub&gt; curve (s)</td>
<td>87 (28)</td>
<td>85 (34–200)</td>
<td>84 (36)</td>
<td>78 (33–284)</td>
</tr>
<tr>
<td>Time from induction to ST 10% (s)</td>
<td>65 (25)</td>
<td>59 (22–170)</td>
<td>61 (29)</td>
<td>56 (20–258)</td>
</tr>
<tr>
<td>Time from ST 10% to EtCO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>22 (17)</td>
<td>18 (1–150)</td>
<td>23 (25)</td>
<td>19 (0–248)</td>
</tr>
<tr>
<td>Time from induction to clamping the umbilical cord (s)</td>
<td>347 (116)</td>
<td>318 (178–878)</td>
<td>321 (76)</td>
<td>304 (187–604)</td>
</tr>
<tr>
<td>Time from incision to delivery (s)</td>
<td>256 (113)</td>
<td>234 (77–770)</td>
<td>232 (71)</td>
<td>211 (109–498)</td>
</tr>
<tr>
<td>Time from induction to PTC 1 (min)</td>
<td>43 (17)</td>
<td>40 (10–129)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Time from surgical skin closure to tracheal extubation (min)</td>
<td>14 (10)</td>
<td>10 (2–45)</td>
<td>9 (6)</td>
<td>8 (0–35)</td>
</tr>
<tr>
<td>Time from neuromuscular blockade reversal to TOF ratio &gt;0.9 (s)</td>
<td>104 (63)</td>
<td>86 (10–322)</td>
<td>420 (689)</td>
<td>254 (50–4156)</td>
</tr>
<tr>
<td>Surgery duration (min)</td>
<td>36 (10)</td>
<td>35 (20–78)</td>
<td>35 (10)</td>
<td>34 (18–94)</td>
</tr>
<tr>
<td>Total procedure time (min)</td>
<td>53 (16)</td>
<td>50 (29–133)</td>
<td>46 (14)</td>
<td>44 (29–163)</td>
</tr>
</tbody>
</table>
Suxamethonium .....or rocuronium?

Advantages of rocuronium

- non-inferior time to intubation (dose 1 mg/kg)
- less myalgia
- block can be reversed more predictably (~ 3 min vs ~ 10 min)

Kosinova et al. IJOA 2017
Suxamethonium .....or rocuronium?

**Disadvantages** of rocuronium

- variability of onset is greater
- requires sugammadex “on hand”
- unclear if anaphylaxis risk is less, same or more
- placental transfer roc/sug unclear ("thought to be small"); neonatal impact contentious
Q3.
Is nitrous oxide still “in”?

Nitrous is theoretically useful due to concentration effect and second gas effect and weak anaesthetic effect - unless a high oxygen fraction is required or a long induction-to-delivery interval is likely. Karasawa et al. Euro J Anaesthesiol 2003
And how about the volatile?

As awareness is a major risk,

it seems wise to ‘overpressure’ volatile after induction (± get BIS below 30) until skin incision

• 20-45% on 2% sevoflurane in nitrous oxide at 7 L/min post-induction have a positive isolated forearm test

• rate constant for equilibration of effect site with alveolar conc. is 2 min for desflurane & 4 min for sevo or isoflurane (all with nitrous oxide)
And how much volatile during maintenance?

Suggest near 1 MAC e.g. ≥ 1.5% sevo or 5% des, plus N₂O

- hypnotic effect of volatile unchanged in pregnancy  
  Ueyama et al. Anesthesiology 2010
- myometrial response to oxytocin is normal  
  Yoo et al. Anesth Analg 2006
Post-delivery practices

Oxytocin & carbetocin
- research showing efficacy of Syntocinon < 5 IU not conducted under GA

Analgesia
- prescribe postop multimodal oral / systemic analgesics
- consider IV methadone bolus
- consider TAP blocks
- in difficult pain management patients, consider -
  - preop single-dose gabapentin or pregabalin
  - intraop lidocaine infusion
  - low-dose ketamine infusion
Postop analgesia after GA - analgesics

**Multimodal**

- regular paracetamol & NSAID if not CI
- regular low-dose SR opioid or tramadol + IR rescue (e.g. tramadol; buprenorphine [minimal transfer to breastmilk; low risk of respiratory depression; low risk of diversion]; oxycodone etc.)

**Patient-controlled oral analgesia touted for ERAS**

Original Article

Patient-controlled oral analgesia versus nurse-controlled parenteral analgesia after caesarean section: a randomised controlled trial

A. Bonnal, 1 A. Dehon, 1 N. Nagot, 2 V. Macioce, 3 E. Nogue 4 and E. Morau 1

1 Doctor, Department of Anaesthesiology, Arnaud de Villeneuve University Hospital, Montpellier, France
2 Medical Epidemiologist, 3 Research Fellow, 4 Biostatistician, Clinical Research and Epidemiology Unit, Medical Information Department, Montpellier University Hospital, Montpellier, France
IV methadone

Russell et al. IJOA 2013 retrospective case control

Table 3 Analgesic outcomes

<table>
<thead>
<tr>
<th></th>
<th>Methadone (n = 25)</th>
<th>Controls (n = 50)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worst pain score</td>
<td>0 (0–3.5 [0–6])</td>
<td>4.5 (0–6 [0–10])</td>
<td>0.0002</td>
</tr>
<tr>
<td>VNPS ≥7</td>
<td>0</td>
<td>22%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Opioid analgesia required</td>
<td>16%</td>
<td>69%</td>
<td>0.0001</td>
</tr>
<tr>
<td>Opioid consumption in morphine equivalents (mg)</td>
<td>2.2 ± 6.2</td>
<td>8.5 ± 9.3</td>
<td>0.0007</td>
</tr>
<tr>
<td>Post-PACU to 24 h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worst pain score</td>
<td>3 (2–5 [0–8])</td>
<td>4 (3–5 [1–10])</td>
<td>0.06</td>
</tr>
<tr>
<td>Opioid consumption in morphine equivalents (mg)</td>
<td>73 ± 59</td>
<td>135 ± 75</td>
<td>0.0001</td>
</tr>
<tr>
<td>24–48 h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worst pain score</td>
<td>2 (1–4 [0–6])</td>
<td>2.5 (2–4 [0–8])</td>
<td>0.6</td>
</tr>
<tr>
<td>Opioid consumption in morphine equivalents (mg)</td>
<td>40 ± 42</td>
<td>68 ± 51</td>
<td>0.008</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opioid consumption in morphine equivalents (mg)</td>
<td>115 ± 94</td>
<td>213 ± 104</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

Fig. 1 Total postoperative opioid consumption in intravenous morphine equivalents (mg) by the intraoperative intravenous methadone dose.
Postop analgesia after GA - regional

TAP blocks or local wound infiltration (similar opioid consumption)

Modest benefit from single-shot blocks
Careful about LA toxicity with TAP blocks (esp. epidural converted to GA)
• multiple case reports of convulsions
• borderline toxic plasma conc. 30 min after 20 mL ropivacaine 0.5% each side
Key points: GA in obstetrics

GA should neither be widely used nor consistently avoided

Regimens are an evolving area of clinical practice (but limited science & poor evidence for better outcomes)

Difficult airway management is important but appears of diminishing concern

Awareness remains a significant concern
New regimens are an evolving area of clinical practice (but limited science & poor evidence for better outcomes) - time will tell!

Propofol is very widely used
Opioid pre-delivery is more widely used
Intubation after RSI remains the norm but SGAs have a place
Choice of sux or roc/sug presents a new debate
Initial overpressure with desflurane or sevoflurane & including nitrous oxide seems rational
Low-dose oxytocin & carbetocin are not validated as yet
Tailor post-delivery analgesia to your logistics
Thanks
That was meant for me.