General anesthesia for cesarean section: what’s new?

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General anesthesia for cesarean section: what’s new?
History

- **1847**: first obstetrical anesthesia with ether by Simpson
- **1853**: Queen Victoria GA with chloroform by Snow
- **Beginning of 20th century**: first GAs for CS with ether
- **1935**: thiopentone is discovered
- **1946**: gastric aspiration is described by Mendelson
- **1951**: suxamethonium (succinylcholine) is discovered
Thiopentone and suxamethonium
intravenous induction in semi-sitting position

Intubation

GA maintenance with nitrous oxide and oxygen

but …

No preoxygenation
Mask ventilation before intubation
No cricoid pressure
No halogenated anesthetics
ADVANTAGES
Speed of anesthesia
Muscle relaxation

DISADVANTAGES
Mendelson’s syndrome
Failed intubation


From “Why Mothers Die 2000-2002”
Cricoid pressure to control regurgitation of stomach contents during induction of anaesthesia

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Summary

Backward pressure of the cricoid cartilage against the cervical vertebrae can be used to occlude the oesophagus (a) to control regurgitation of stomach or oesophageal contents during induction of anaesthesia, or (b) to prevent gastric distension from positive-pressure ventilation applied by facepiece or mouth-to-mouth respiration. It is contraindicated during active vomiting.
ANAESTHESIA FOR CAESAREAN SECTION

An Evaluation of a Method using Low Concentrations of Halothane and 50 per cent of Oxygen

By

D. D. Moir


Preoxygenation

Thiopentone and suxamethonium

intravenous crush induction

Intubation

GA maintenance with O₂/N₂O (50:50) and 0.5% halothane (+ tubocurarine)

<table>
<thead>
<tr>
<th>Anaesthetic</th>
<th>N₂O/O₂ (50:50)</th>
<th>N₂O/O₂ (50:50)</th>
<th>N₂O/O₂ (70:30) halothane analgesia</th>
<th>50 cases</th>
<th>50 cases</th>
<th>25 cases</th>
<th>20 cases</th>
</tr>
</thead>
</table>

The addition of 0.5 per cent of halothane vapour to a basic thiopentone, nitrous oxide, muscle relaxant anaesthetic technique does not increase blood loss at Caesarean section, does not affect the incidence of hypotension, and is likely to ensure unconsciousness. By permitting the administration of 50 per cent of oxygen with nitrous oxide, the condition of the newborn infant is likely to be improved. The use of 0.8 per cent of halothane vapour does not increase blood loss but is associated with a high incidence of hypotension and for this reason is not advisable.
Maternal deaths from anesthesia

General anesthesia for cesarean section: what’s new?

Epidemiology
GA for cesarean section

Epidemiology

More indications:
- podalic presentation
- multiple pregnancy
- maternal wish

Demographic factors:
- ↑ maternal age
- ↑ maternal obesity
- ↑ multiple pregnancy

More frequent use of neuraxial techniques

Aneesthetist’s training

Number of GA for CS

Number of anesthetists
EDITORIAL

The demise of general anesthesia in obstetrics revisited: prescription for a cure

Should the decreased rate of general anesthesia in obstetrics be concerning to academic teachers of obstetric anesthesia from a patient-safety perspective? We, and others, believe so, but how is this issue

We strongly believe the answer to this problem lies in surrogate training modalities like simulation-based training, which allows practitioners to focus on and refine necessary behavioral, communication, leadership, and sometimes technical skills required in crises and to develop experience in uncommonly encountered situations without any potential of patient harm. Furthermore,
General anesthesia for cesarean section: what’s new?

Anesthetic technique
General anesthesia for cesarean section: what’s new?

Anesthetic technique

Rapide sequence induction?
Why a rapide sequence induction?

- Significant decrease in pulmonary aspiration

Only 4 maternal deaths from pulmonary aspiration over 10 millions births in UK during 15 years!
Traditional rapid sequence induction is an outmoded technique for Caesarean section and should be modified.


Proposer: Levy DM
Opposer: Meek T
Why is traditional rapid sequence induction outmoded?

- Thiopentone is not the first choice
- Suxamethonium is not the first choice
- Cricoid pressure is useless and dangerous
General anesthesia for cesarean section: what’s new?

Anesthetic technique

Which agent for induction?
Why propofol instead of thiopentone?

- More frequently used
- Less expensive
- Faster recovery
- Better recovery
- Less PONV
GA for cesarean section: which agent for induction?

Why not propofol?

- Pain with injection
- More hypotension
- More bradycardia
- More awareness
- More neonatal depression
Propofol should be the agent of choice for caesarean section under general anaesthesia.

Proposer : Duggal K
Opposer : Russell R
General anesthesia for cesarean section: what’s new?

Anesthetic technique

Which myorelaxant for induction?
GA for cesarean section: which myorelaxant for induction?

**Why not succinylcholine?**

- Anaphylactic reaction
- Malignant hyperthermia
- Prolonged effect with pregnancy
- Hyperkaliemia
GA for cesarean section: which myorelaxant for induction?

**Why succinylcholine instead of rocuronium?**

- **Better intubation conditions**
- **Faster effect**
- **Shorter duration of effect**
GA for cesarean section: which myorelaxant for induction?

**Succinylcholine vs Rocuronium**

- **Succinylcholine** vs. **Rocuronium**


**Graph 1:**
- Comparison of time to laryngoscopy after fasciculations
- **Succinylcholine** vs. **Rocuronium**
- **Succinylcholine** 1 mg/kg
- **Rocuronium** 0.6 mg/kg
- Time to have an endotracheal tube in place

**Graph 2:**
- Intubation conditions
- **Succinylcholine** vs. **Rocuronium**
- Intubations conditions

**Data:**
- N=90
- Intubation conditions: Excellent, Good, Poor
GA for cesarean section: which myorelaxant for induction?

**Succinylcholine vs Rocuronium**

One molecule will probably change our vision:

\[
C_{72}H_{104}Na_8O_{48}S_8
\]

\[\text{Suggamadex}
\]

\[\text{ORG 25969}\]
General anesthesia for cesarean section: what’s new?

- Anesthetic technique
- Opioids at induction?
GA for cesarean section: opioids at induction?

**Remifentanil 0.5 µg/kg + 0.2 µg/kg/min**

GA for cesarean section: opioids at induction?

**Remifentanil 1 µg/kg iv**

<table>
<thead>
<tr>
<th></th>
<th>Remifentanil Group (n = 20)</th>
<th>Control Group (n = 20)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum values</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic arterial pressure, mmHg</td>
<td>127 (12.6)</td>
<td>165 (23.0)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Mean arterial pressure, mmHg</td>
<td>98 (8.6)</td>
<td>123 (15.9)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Heart rate, beats/min</td>
<td>112 (8.4)</td>
<td>126 (15.4)</td>
<td>0.0008</td>
</tr>
<tr>
<td><strong>Minimum values</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic arterial pressure, mmHg</td>
<td>85 (11.4)</td>
<td>102 (19.5)</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean arterial pressure, mmHg</td>
<td>55 (16.5)</td>
<td>75 (13.9)</td>
<td>0.0002</td>
</tr>
<tr>
<td>Heart rate, beats/min</td>
<td>76 (8.2)</td>
<td>79 (15.7)</td>
<td>0.35</td>
</tr>
<tr>
<td><strong>Interventions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased intravenous infusion</td>
<td>2 (10%)</td>
<td>1 (5%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Ephedrine required</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>NS</td>
</tr>
<tr>
<td>Atropine required</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>NS</td>
</tr>
</tbody>
</table>

Values are mean (SD) or number (%).

NS = not significant.

UV/MA = 0.73
UA/UV = 0.60

2/20 neonates → naloxone

General anesthesia for cesarean section: what’s new?

Anesthetic technique

Cricoid pressure?
Cricoid pressure in emergency rapid sequence induction
John Butler and Ayan Sen
doi:10.1136/emj.2005.030205

► CLINICAL BOTTOM LINE
There is little evidence to support the widely held belief that the application of cricoid pressure reduces the incidence of aspiration during a rapid sequence intubation.

...technique. Concern has been expressed that cricoid pressure may interfere with airway management, obscuring the laryngeal view and creating difficulties in passing the endotracheal tube. This may lead to a failure of airway techniques and subsequent morbidity and mortality. The
General anesthesia for cesarean section: what’s new?

Specific risks
General anesthesia for cesarean section: what’s new?

Specific risks

Difficult intubation
GA for cesarean section: specific risks

Difficult intubation in obstetrics


Table 19.3 Results of obstetric airway studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Grade 3 + 4 % (95% CI)</th>
<th>Difficult intubation % (95% CI)</th>
<th>Failures % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wong &amp; Hung 1999</td>
<td>1.99% (0.04–5.7%)</td>
<td>1.99% (0.04–5.7%)</td>
<td>0.7% (0.01–3.6%)</td>
</tr>
<tr>
<td>Bamard &amp; Jenkins 2000</td>
<td>–</td>
<td>–</td>
<td>0.4% (0.2–0.5%)</td>
</tr>
<tr>
<td>Ramadhani et al. 1996</td>
<td>3.5% (2.1–5.4%)</td>
<td>–</td>
<td>0.6% (0.1–1.6%)</td>
</tr>
<tr>
<td>Tsien et al. 1998</td>
<td>5.8% (3.9–8.1%)</td>
<td>0.4% (0.047–1.1%)</td>
<td>–</td>
</tr>
<tr>
<td>Hawthorne et al. 1996</td>
<td>–</td>
<td>4.4% (0.2–0.6%)</td>
<td>–</td>
</tr>
<tr>
<td>Dhalwal et al. 1996</td>
<td>3.6% (2.1–5.6%)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Yeo et al. 1992</td>
<td>2.2% (0.2–3.0%)</td>
<td>–</td>
<td>0.0% (0–1.1%)</td>
</tr>
<tr>
<td>Rocke et al. 1992</td>
<td>2.3% (1.2–2.6%)</td>
<td>2% (1.3–2.8%)</td>
<td>0.13% (0.016–0.48%)</td>
</tr>
<tr>
<td>Samsoon &amp; Young 1967</td>
<td>1.8% (1.2–2.6%)</td>
<td>–</td>
<td>0.35% (0.14–0.72%)</td>
</tr>
<tr>
<td>Glassenberg et al. 1990</td>
<td>–</td>
<td>2.2% (1.5–3.2%)</td>
<td>0.37% (0.12–0.86%)</td>
</tr>
<tr>
<td>Glassenberg et al. 1990</td>
<td>–</td>
<td>2.6% (1.5–4.0%)</td>
<td>0.2% (0.34–0.74%)</td>
</tr>
</tbody>
</table>

Table 19.4 Results of non-obstetric airway studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Grade 3 + 4 % (95% CI)</th>
<th>Difficult intubation % (95% CI)</th>
<th>Failures % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wong &amp; Hung 1999</td>
<td>1.54% (0.4–3.9%)</td>
<td>1.54% (0.4–3.9%)</td>
<td>0% (0–1.1%)</td>
</tr>
<tr>
<td>Yamamoto et al. 1997</td>
<td>1.3% (1.0–1.6%)</td>
<td>1.3% (1.0–1.6%)</td>
<td>–</td>
</tr>
<tr>
<td>El-Ganzouri et al. 1996</td>
<td>6.1% (5.6–6.6%)</td>
<td>6.1% (5.6–6.6%)</td>
<td>0% (0–0.02%)</td>
</tr>
<tr>
<td>Koay 1998</td>
<td>0.66% (0.47–0.92%)</td>
<td>0.7% (0.50–0.97%)</td>
<td>–</td>
</tr>
<tr>
<td>Dhalwal 1996</td>
<td>–</td>
<td>1.95% (1.7–2.2%)</td>
<td>–</td>
</tr>
<tr>
<td>Rose &amp; Cohen 1994</td>
<td>–</td>
<td>1.8% (1.6–2.0%)</td>
<td>0.3% (0.23–0.39%)</td>
</tr>
<tr>
<td>Yeo et al. 1992</td>
<td>1.8% (0.057–4.1%)</td>
<td>–</td>
<td>0% (0–1.0%)</td>
</tr>
<tr>
<td>Dellil et al. 1990</td>
<td>–</td>
<td>1.2% (0.05–0.2%)</td>
<td>–</td>
</tr>
<tr>
<td>Samsoon &amp; Young 1987</td>
<td>–</td>
<td>–</td>
<td>0.045% (0.03–0.06%)</td>
</tr>
</tbody>
</table>

Intubation difficulty : 1-6%
Intubation failure : 0,1-0,6%
Difficult intubation in obstetrics


No evidence of any difference at present

but ... this could change soon because:

Obesity prevalence ↑
Maternal age ↑

Preeclampsia ↑

Recognized factors for a difficult intubation
General anesthesia for cesarean section: what’s new?

Specific risks

Awareness
Influence of the anesthetic regimen on awareness

**Table 1.** General anaesthesia for Caesarean section. (Incidence of awareness and dreaming).

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Aware</th>
<th>Dreamt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>434</td>
<td>3 (0.7%)</td>
<td>28 (6.4%)</td>
</tr>
<tr>
<td>1983</td>
<td>548</td>
<td>7 (1.3%)</td>
<td>47 (8.6%)</td>
</tr>
<tr>
<td>1984</td>
<td>323</td>
<td>6 (1.8%)</td>
<td>22 (6.8%)</td>
</tr>
<tr>
<td>1985</td>
<td>345</td>
<td>6 (1.7%)</td>
<td>25 (7.2%)</td>
</tr>
<tr>
<td>1986</td>
<td>385</td>
<td>2 (0.5%)</td>
<td>24 (6.2%)</td>
</tr>
<tr>
<td>1987</td>
<td>344</td>
<td>1 (0.3%)</td>
<td>13 (3.8%)</td>
</tr>
<tr>
<td>1988</td>
<td>404</td>
<td>3 (0.7%)</td>
<td>19 (4.7%)</td>
</tr>
<tr>
<td>1989</td>
<td>293</td>
<td>0</td>
<td>11 (3.7%)</td>
</tr>
</tbody>
</table>

Thiopentone 3-4 mg/kg
Halothane 0,5%

Thiopentone 5-7 mg/kg
Isoflurane 1%

Chin KJ, Yeo SW. Bispectral index values at sevoflurane concentrations of 1% and 1.5% in lower segment cesarean delivery. Anesth Analg 2004;98:1140-4, table of contents.
Take home messages I

- General anesthesia is needed for 5-10% of cesarean sections, most frequently in emergency situations.

- Decreasing rate of general anesthesia is associated with decreasing anesthetists’s training. Simulation-based training is becoming mandatory.

- Except a significant increase in anesthetic agents dosage, recommended anesthetic technique is identical to the one described 40 years ago by Donald D. Moir.

- Thiopentone (5-7 mg/kg) is the first choice for induction. Propofol (2.5-3 mg/kg) is an acceptable second choice.
GA for cesarean section: what’s new?

Take home messages II

- Succinylcholine (1-1.5 mg/kg) is the first choice as myorelaxant. Rocuronium (1 mg/kg) is an acceptable second choice. Suggamadex will possibly change this recommendation in the future.

- Cricoid pressure (Sellick’s manoeuvre):
  - Is frequently bad applied.
  - May interfere with airway management.
  - Has not proved to reduce the incidence of aspiration during a rapid sequence intubation.

- 0.75 MAC volatile anesthetic agent (sevoflurane, isoflurane, desflurane) in an oxygen/nitrous oxide mixture is the first choice for anesthesia maintenance until birth.
Take home messages III

- Opioids should not be used routinely in general anesthesia for cesarean delivery because of neonatal respiratory depression.

- Remifentanil is a useful adjunct for improving maternal hemodynamics stability during GA for CS when there is clear maternal indication (severe preeclampsia notably) and adequate facilities for neonatal resuscitation.

- The BIS monitor may help in determining the concentration of volatile anesthetic necessary for adequate depth of anesthesia between induction and birth and thus decrease the risk of awareness.
THANK YOU for your attention!