Newborn outcomes after cesarean section for fetal distress in BC

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Disclaimer:

All inferences, opinions, and conclusions drawn in this publication are those of the authors, and do not reflect the opinions or policies of Perinatal Services BC.
CS rates by Province/Territory 2011

- Nunavut*: 12.8%
- Manitoba: 21.1%
- Saskatchewan: 21.7%
- Yukon*: 22.1%
- Nova Scotia: 23.4%
- Alberta: 24.5%
- Canada: 26.8%
- Ontario: 27.0%
- British Columbia: 28.6%
- Prince Edward Islands: 27.6%
- New Brunswick: 29.4%
- Newfoundland and Labrador: 29.7%

Source: Statcan.ca
CS Rates in BC

Data Source: Perinatal Services BC

Source: Statcan.ca
Indications for CS in BC

1. Repeat cesarean section
2. Dystocia
3. Fetal distress
4. Malpresentation
5. Pre-existing maternal conditions
6. Maternal conditions arising during pregnancy
   - Placenta previa
   - Placenta abruption
   - Placenta accreta
   - Uterine rupture
   - Pre-eclampsia
**Mother**

- Infection
- Thrombosis
- Hemorrhage
- Surgical injury
- Complications related to anesthetics
- Placentation problems in subsequent pregnancy

**Fetus**

- Respiratory distress
- Surgical injury
Costs due to cesarean section

- The cesarean section
- Prolonged hospital stay
- Further surgery after delivery
- Re-admission to hospital
- Admission to ICU
Fetal Distress

- Non-reassuring fetal status (NRFS) indicating that the fetus is compromised
Introduction

Heart rate
Accelerations
Decelerations
Movement
Contractions

Fetal distress??

Long-term adverse neonatal outcomes
Aims

- To describe rates of low Apgar (<7) and abnormal umbilical cord pH and base excess among neonates delivered by emergency CS for fetal distress

- To describe the accuracy of Apgar scores and umbilical cord gases for the prediction of severe neonatal morbidity

- To investigate the incidence of severe morbidity in neonates delivered by cesarean section for non-reassuring fetal status
Study design

- Descriptive study
- Sample: n=8466
  - Births in BC, 2007-11
  - Singleton pregnancy
  - Term gestation
  - Delivered by emergency cesarean section for the primary indication of non-reassuring fetal status
Outcomes

- Hypoxic Ischemic encephalopathy (HIE)
- Neonatal intensive care unit level III stay of ≥ 2 days
- Ventilatory support
- Composite measure of above and neonatal death
Analysis

- Measured rates of Apgar scores <7 at 1 and 5 minutes, umbilical cord arterial pH and base excess.
- Calculated the predictive accuracy of Apgar scores and umbilical cord blood gasses using sensitivity and specificity and the area under the receiving operator curve, to predict severe neonatal morbidity.
- Assessed rates of severe neonatal morbidity indicators individually and as a composite among newborns delivered by emergency CS.
Results  Neonates delivered for fetal distress

Apgar < 7 at 1 minute
19.9%
1685 / 8463 neonates

Data Source: Perinatal Services BC
Neonates delivered for fetal distress

Apgar < 7 at 5 minutes
3.9%
330 / 8458 neonates

Data Source: Perinatal Services BC
Neonates delivered for fetal distress

Data Source: Perinatal Services BC
Neonates delivered for fetal distress

Data Source: Perinatal Services BC

- pH < 7.20
- 23.7%
- 1705 / 7193 neonates
Neonates delivered for fetal distress

Data Source: Perinatal Services BC
Neonates delivered for fetal distress

Data Source: Perinatal Services BC

\[ \text{pH} < 7.10 \]

6.5%

468 / 7193 neonates
Neonates delivered for fetal distress

Data Source: Perinatal Services BC
Neonates delivered for fetal distress

Data Source: Perinatal Services BC
Neonates delivered for fetal distress

Data Source: Perinatal Services BC

BE < - 12
2.9%
189 / 6516 neonates
Hypoxic ischemic encephalopathy (n = 35)

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apgar 1 minute &lt; 7</td>
<td>89%</td>
<td>80%</td>
<td>0.92 (0.87-0.97)</td>
</tr>
<tr>
<td>Apgar 5 minutes &lt; 7</td>
<td>77%</td>
<td>96%</td>
<td>0.94 (0.89-0.99)</td>
</tr>
<tr>
<td>Umbilical cord pH &lt; 7.10</td>
<td>66%</td>
<td>94%</td>
<td>0.91 (0.84-0.98)</td>
</tr>
<tr>
<td>Base excess &lt; - 12 mmol / L</td>
<td>62%</td>
<td>97%</td>
<td>0.94 (0.91-0.97)</td>
</tr>
</tbody>
</table>

Data Source: Perinatal Services BC
NICU level III stay ≥ 2 days (n = 62)

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</thead>
<tbody>
<tr>
<td>Apgar 1 minute &lt; 7</td>
<td>57%</td>
<td>80%</td>
<td>0.72 (0.66-0.79)</td>
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<tr>
<td>Apgar 5 minutes &lt; 7</td>
<td>32%</td>
<td>96%</td>
<td>0.73 (0.66-0.80)</td>
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<tr>
<td>Umbilical cord pH &lt; 7.10</td>
<td>29%</td>
<td>94%</td>
<td>0.74 (0.66-0.81)</td>
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<tr>
<td>Base excess &lt; - 12 mmol / L</td>
<td>20%</td>
<td>97%</td>
<td>0.75 (0.69-0.81)</td>
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</tbody>
</table>

Data Source: Perinatal Services BC
Ventilatory support (n = 126)

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<tr>
<th>Condition</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>AUC</th>
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</thead>
<tbody>
<tr>
<td>Apgar 1 minute &lt; 7</td>
<td>89%</td>
<td>81%</td>
<td>0.91 (0.88-0.98)</td>
</tr>
<tr>
<td>Apgar 5 minutes &lt; 7</td>
<td>65%</td>
<td>97%</td>
<td>0.91 (0.88-0.94)</td>
</tr>
<tr>
<td>Umbilical cord pH &lt; 7.10</td>
<td>40%</td>
<td>94%</td>
<td>0.75 (0.69-0.81)</td>
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<tr>
<td>Base excess &lt; -12 mmol/L</td>
<td>31%</td>
<td>98%</td>
<td>0.78 (0.72-0.83)</td>
</tr>
</tbody>
</table>

Data Source: Perinatal Services BC
Composite long-term adverse outcome

Hypoxic Ischemic encephalopathy (HIE)

OR

Neonatal intensive care unit stay of ≥ 2 days

OR

Ventilatory support

OR

Neonatal death
## Composite long-term adverse outcome (n = 167)

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<th>Specificity</th>
<th>AUC</th>
</tr>
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<tbody>
<tr>
<td>Apgar 1 minute &lt; 7</td>
<td>80%</td>
<td>81%</td>
<td>0.87 (0.84-0.90)</td>
</tr>
<tr>
<td>Apgar 5 minutes &lt; 7</td>
<td>54%</td>
<td>97%</td>
<td>0.86 (0.82-0.89)</td>
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<tr>
<td>Umbilical cord pH &lt; 7.10</td>
<td>36%</td>
<td>94%</td>
<td>0.76 (0.71-0.81)</td>
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<tr>
<td>Base excess &lt; -12 mmol/L</td>
<td>28%</td>
<td>98%</td>
<td>0.78 (0.73-0.82)</td>
</tr>
</tbody>
</table>

Data Source: Perinatal Services BC
Discussion

- The majority of neonates delivered by emergency CS for NRFS in BC do not have abnormal Apgar scores or umbilical cord gas values.

- Apgar and pH scores obtained after cesarean section for fetal distress are consistent with current reports in literature
  
  - Apgar < 7 at 1 minute → 19.9% vs 27%
  - Apgar < 7 at 5 minutes → 3.9% vs 4%, 15%
  - Umbilical cord pH < 7.10 → 6.5% vs 6%
  - Base excess < -12 → 2.9%
Discussion

- The best overall predictor for our composite outcome was Apgar < 7 at one minute.
- Overall, Apgar scores were better predictors than cord gases for severe neonatal morbidity.
- Predictors had lowest sensitivity for NICU stay.
Discussion

Alternatives to (or in conjunction with) EFM:

- Scalp pH, scalp lactate
  - Correlate with umbilical cord pH and lactate
  - Correlate poorly with Apgar scores

Source 1: Julkunen, 2012
Some questions

- With better (than EFM) screening/diagnostic tools for non-reassuring fetal status can we safely reduce the number of CS?

- Are practitioners adhering to SOGC guidelines for use of EFM in diagnosing NRFS?

- Should SOGC (similar to NICE guidelines in the UK) decide that CS should not be undertaken on the basis of EFM alone?
Conclusions

• The incidence of abnormal Apgar scores and umbilical cord gas values is very low among neonates delivered by emergency cesarean section for non-reassuring fetal status in BC.

• EFM remains therefore a non-specific screening tool for NRFS after implementation of 2007 SOGC guidelines

• One minute Apgar score ≤7 is the most sensitive predictor of severe neonatal morbidity