“New” devices for the Obstetric Anaesthetist:
from RoTEM to Rainbow and CTrach to CMAC
- a solution for every problem or a false sense of security?

Chris Elton
University Hospitals of Leicester
Monday 11th November 2013
Church House Westminster
Declaration of Interest

• Site Lead for OBS2 study (Multicentre Fibrinogen replacement in MOH) funded by CSL Behring with equipment support from TEM International GmbH
Its New But Is it Any Good?
“New” Devices

• Stuff you already knew...........

• Treat heavy bleeding with blood and blood products

• Check Haemoglobin before giving blood

• Assess the airway preoperatively, ask for help and wake up if necessary
“New” Devices

• Replace something we’ve been doing for ages with something new.................

• Assessing Coagulation
• Haemoglobin Monitoring
• Airway Devices
Obstetric Bleeding

• Fibrinogen is increased in pregnancy
• Decreasing fibrinogen is the first to fall in OH
• Volume replacement cause dilutional coagulopathy
• Fibrinolysis may occur
Assessing Coagulation-Lab Tests

- Routinely measure PT, APTT, Platelets, Fibrinogen
- Tests give historical snapshot
- Lab Fibrinogen (Clauss Assay) is the last result to come back

- Traditional approach transfusion thresholds are very conservative
- One approach is to give early blood, FFP, (cryo), platelets
- Another approach is to use point of care testing and give targeted products
The Fibrinogen Story

- PT/APTT poor correlation with bleeding progression
- Platelet count correlates with subsequent PPH
- Fibrinogen concentration correlates with incidence and severity of bleeding
- Fibrinogen < 2g/litre may be appropriate trigger for replacement
- FFP is not an efficient replacement for fibrinogen
- (Cryoprecipitate unavailable in many countries)
Haemostatic monitoring during postpartum haemorrhage and implications for management

C. Solomon\textsuperscript{1*}, R. E. Collis\textsuperscript{2} and P. W. Collins\textsuperscript{3}
ROTEM/TEG

- Whole blood test
- Tests coagulation from clot initiation to clot lysis
- Speed of clot formation
- Clot strength and stability
- Clot Lysis
- Some results available in minutes
Torsion wire

Pin

Whole blood

Cuvette

Maximal Amplitude

Amplitude @ 60 min
1  oscillating axis
2  counterforce spring
3  light beam from LED
4  mirror
5  detector (electr. camera)
6  sensor pin
7  cuvette with blood sample
8  fibrin strands & platelet aggregates
9  heated cuvette holder
10 ball bearing
11 data processing unit
TEG vs ROTEM

- Standard TEG is a single test
- Measurement of fibrinogen available

- Standard ROTEM tests are multiple assays
  - INTEM, EXTEM, FIBTEM, APTEM

- Measures of fibrinogen use platelet inhibitor
Rotational Thromboelastometry (ROTEM®)

The ROTEM analyser provides a trace similar to that of the TEG with related parameters including clotting time (CT) and maximum clot firmness (MCF). Additional tests include:

<table>
<thead>
<tr>
<th>Test</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTEM</td>
<td>Contains phospholipid and ellagic acid as activators and provides information similar to that of the APTT</td>
</tr>
<tr>
<td>EXTEM</td>
<td>Contains Tissue Factor as an activator and provides information similar to that of the PT</td>
</tr>
<tr>
<td>HEPTEM</td>
<td>Contains lyophilised heparinase for neutralising heparin</td>
</tr>
<tr>
<td>APTEM</td>
<td>Contains aprotinin for inhibiting fibrinolysis</td>
</tr>
<tr>
<td>FIBTEM</td>
<td>Utilises cytochalasin D, a platelet inhibitor which blocks the platelet contribution to clot formation, allowing qualitative analysis of the functional fibrinogen component.</td>
</tr>
<tr>
<td>ECATEM</td>
<td>Contains Ecarin and so is similar to the Ecarin Clotting Time. This makes it very sensitive to presence of direct thrombin inhibitors.</td>
</tr>
</tbody>
</table>
A  ROTEM® coagulation profiles of healthy parturients

B  ROTEM® coagulation profiles showing obstetric coagulopathy, e.g. during PPH
Assessment of coagulation in the obstetric population using ROTEM® thromboelastometry

S. Armstrong, a R. Fernando, a K. Ashpole, b R. Simons, c M. Columb d
Use of FIBTEM/TEG for fibrinogen estimation

- FIBTEM uses platelet inhibitor Cytochalasin D (EXTEM)
- Result in 10 mins
- Reasonable evidence base

- TEG FF uses Abciximab to inhibit platelets
- Similarly rapid results
- Smaller evidence base

- Cytochalasin D may be better inhibitor of platelets than Abciximab
Use of TEG/ROTEM in Fibrinolysis

- Fibrinolysis can be seen as decrease in clot strength on TEG/ROTEM trace
- APTEM uses aprotinin to inhibit fibrinolysis
- May provide rapid evidence of fibrinolytic activity (eg in AFE)
Hyperfibrinolysis diagnosed by rotational thromboelastometry in a case of suspected amniotic fluid embolism

N.F. Collins, M. Bloor, N.J. McDonnell
TEG vs ROTEM

- TEG/ROTEM tells you something is wrong
- TEG is commonly performed as a single test
- ROTEM commonly performed as multiple tests
- FIBTEM is established way of estimating fibrinogen
- IF fibrinogen concentration required then ROTEM may be preferable
Limitations

• Bypass primary haemostasis
• Cannot assay platelet function
• Training and updating staff may be a problem
• May reinforce view that we should wait for abnormality before treating bleeding with blood products
Masimo-Rainbow Radical -7
Masimo-Rainbow Radical -7

- Finger Co-Oximeter
- Measures Hb Spo2 COHb MetHb
- “Pleth Variability Index”, Perfusion Index
The Accuracy of Noninvasive and Continuous Total Hemoglobin Measurement by Pulse CO-Oximetry in Human Subjects Undergoing Hemodilution

Mark R. Macknet, MD, Martin Allard, MBChB, FRCA, Richard L. Applegate, II, MD, and James Rook, DO

Anesthesia & Analgesia December 2010 - Volume 111 - Issue 6 - p 1424–1426

Table 1. SpHb Accuracy by tHb Range

<table>
<thead>
<tr>
<th>tHb range</th>
<th>All values</th>
<th>(\leq \pm 1.0) g/dL</th>
<th>(\leq \pm 1.5) g/dL</th>
<th>(\leq \pm 2.0) g/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 g/dL</td>
<td>79 (24%)</td>
<td>64 (81%)</td>
<td>78 (99%)</td>
<td>79 (100%)</td>
</tr>
<tr>
<td>10–11.9 g/dL</td>
<td>160 (48%)</td>
<td>115 (72%)</td>
<td>141 (88%)</td>
<td>153 (96%)</td>
</tr>
<tr>
<td>12–15 g/dL</td>
<td>96 (29%)</td>
<td>69 (72%)</td>
<td>83 (86%)</td>
<td>91 (95%)</td>
</tr>
<tr>
<td>7.5–15 g/dL</td>
<td>335 (100%)</td>
<td>248 (74%)</td>
<td>302 (90%)</td>
<td>324 (97%)</td>
</tr>
</tbody>
</table>

CONCLUSION

This study of the first commercialized noninvasive pulse CO-Oximetry found that its SpHb measurement is accurate to 1 g/dL (1 SD) compared with laboratory CO-Oximeter tHb measurement in subjects undergoing hemodilution. Future studies should examine SpHb accuracy in other populations and its impact on clinical decision making.
Accuracy of non-invasive measurement of haemoglobin concentration by pulse co-oximetry during steady-state and dynamic conditions in liver surgery

J. J. Vos¹*, A. F. Kalmar¹, M. M. R. F. Struys¹, R. J. Porte², J. K. G. Wietasch¹, T. W. L. Scheeren¹ and H. G. D. Hendriks¹
A Comparison of Three Methods of Hemoglobin Monitoring in Patients Undergoing Spine Surgery

Ronald D. Miller, MD, MS,* Theresa A. Ward, BSN, RN,* Stephen C. Shiboski, PhD,† and Neal H. Cohen, MD, MPH, MS*
A Comparison of Three Methods of Hemoglobin Monitoring in Patients Undergoing Spine Surgery

Ronald D. Miller, MD, MS,* Theresa A. Ward, BSN, RN,* Stephen C. Shiboski, PhD,† and Neal H. Cohen, MD, MPH, MS*

Anesthesia & Analgesia:
April 2011 - Volume 112 - Issue 4 - p 858–863

Table 1. Groups Based on Magnitude of Differences Between Noninvasive (SpHb) and Laboratory Co-Oximeter (tHb) Hemoglobin Concentration (g/dL)

<table>
<thead>
<tr>
<th></th>
<th>&lt;0.5 g/dL</th>
<th>0.5-1.0 g/dL</th>
<th>1.1-1.5 g/dL</th>
<th>1.6-2.0 g/dL</th>
<th>&gt;2.0 g/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial (SpHb - tHb)</td>
<td>4 (4)</td>
<td>3 (6)</td>
<td>4 (5)</td>
<td>4 (3)</td>
<td>5 (2)</td>
</tr>
<tr>
<td>All other (SpHb - tHb)</td>
<td>15 (6)</td>
<td>8 (21)</td>
<td>14 (12)</td>
<td>9 (11)</td>
<td>12 (8)</td>
</tr>
<tr>
<td>Total</td>
<td>19 (10)</td>
<td>11 (27)</td>
<td>18 (17)</td>
<td>13 (14)</td>
<td>17 (10)</td>
</tr>
</tbody>
</table>

Table 2. Groups Based on Magnitude of Differences Between HemoCue (HCue) and Laboratory Co-Oximeter (tHb) Hemoglobin Concentration (g/dL)

<table>
<thead>
<tr>
<th></th>
<th>&lt;0.5 g/dL</th>
<th>0.5-1.0 g/dL</th>
<th>1.1-1.5 g/dL</th>
<th>1.6-2.0 g/dL</th>
<th>&gt;2.0 g/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial (HCue - tHb)</td>
<td>15</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>All other (HCue - tHb)</td>
<td>50</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>12</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
CASE REPORTS

Non-invasive measurement of hemoglobin during cesarean hysterectomy: a case series

A.J. Butwick, G. Hilton, E.T. Riley, B. Carvalho
• Looked at Studies assessing accuracy
• Focused on accuracy 6-10g/dl
• Concluded not accurate enough to guide transfusion
Although the possibility of continuously monitoring hemoglobin remains attractive, particularly in actively bleeding patients, some progress has to be made by the manufacturers to improve the accuracy of the devices until we can safely use them in clinical practice.

It is important to consider that a new technique for the bedside measurement of hemoglobin should demonstrate that it is either superior to that one we use daily (e.g., HemoCue®, Cypress, California) or at least equivalent.
Masimo-Rainbow Radical -7

- May be less accurate in hypovolaemia/low perfusion
- May overread if HB low
- Should not guide transfusion
- May be useful for trends
C-Trach

- Modification of ILMA
- Camera
- Light Source
- Integrated Screen
- Rechargeable Battery
Storz C-MAC
RESPIRATION AND THE AIRWAY

Randomized controlled trial comparing the McGrath videolaryngoscope with the C-MAC videolaryngoscope in intubating adult patients with potential difficult airways

I. Ng¹, A. L. Hill¹², D. L. Williams¹², K. Lee¹ and R. Segal¹

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**Fig 1** Comparison of time to intubation (s) between the McGrath group and the C-MAC group. Values are in median, inter-quartile range, maximum and minimum. *Statistically significant, P<0.001.*

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>McGrath group (n=65)</th>
<th>C-MAC group (n=65)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngoscopic view</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>60</td>
<td>50</td>
<td>0.027</td>
</tr>
<tr>
<td>≥ 2</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Number of intubation attempts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>45</td>
<td>58</td>
<td>0.009</td>
</tr>
<tr>
<td>&gt;1</td>
<td>20</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Proportion of successful to failed intubations</td>
<td></td>
<td></td>
<td>0.208</td>
</tr>
<tr>
<td>Ease of intubation 1 (difficult)– 10 (easy)</td>
<td>6 (5–8)</td>
<td>9 (8–10)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Any complications</td>
<td>6</td>
<td>1</td>
<td>0.115</td>
</tr>
<tr>
<td>Haemodynamic change from baseline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart rate (%)</td>
<td>21.7 (0.2)</td>
<td>26.5 (0.2)</td>
<td>0.23</td>
</tr>
<tr>
<td>Systolic arterial pressure (%)</td>
<td>2.5 (0.2)</td>
<td>3.1 (0.2)</td>
<td>0.10</td>
</tr>
</tbody>
</table>
Comparison of the C-MAC® videolaryngoscope with the Macintosh, Glidescope®, and Airtraq® laryngoscopes in easy and difficult laryngoscopy scenarios in manikins

J. McElwain,¹ M.A. Malik,¹ B.H. Harte,² N.M. Flynn²,³ and J.G. Laffey⁴
Comparison of the C-MAC® videolaryngoscope with the Macintosh, Glidescope®, and Airtraq® laryngoscopes in easy and difficult laryngoscopy scenarios in manikins

J. McElwain,¹ M.A. Malik,¹ B.H. Harte,² N.M. Flynn²,³ and J.G. Laffey⁴
Comparison of three videolaryngoscopes: Pentax Airway Scope, C-MAC\textsuperscript{TM}, Glidescope\textsuperscript{®} vs the Macintosh laryngoscope for tracheal intubation\textsuperscript{*}

W. H. L. Teoh,\textsuperscript{1} S. Saxena,\textsuperscript{2} M. K. Shah\textsuperscript{3} and A. T. H. Sia\textsuperscript{4}

<table>
<thead>
<tr>
<th></th>
<th>Airway Scope (n = 100)</th>
<th>C-MAC (n = 100)</th>
<th>Glidescope (n = 100)</th>
<th>Macintosh (n = 100)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intubation time; s</td>
<td>20.6 (11.5)</td>
<td>31.9 (17.6)</td>
<td>31.2 (15.0)</td>
<td>22.4 (13.6)</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>Ease of blade insertion</td>
<td>0 (0–0 [0–70])</td>
<td>0 (0–0 [0–30])</td>
<td>0 (0–10 [0–60])</td>
<td>0 (0–0 [0–80])</td>
<td>0.006†</td>
</tr>
<tr>
<td>Ease of tracheal tube insertion</td>
<td>0 (0–8.75 [0–60])</td>
<td>10 (0–20 [0–90])</td>
<td>0 (0–20 [0–80])</td>
<td>0 (0–20 [0–90])</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>Quality of view</td>
<td>0 (0–10 [0–70])</td>
<td>0 (0–10 [0–50])</td>
<td>0 (0–20 [0–60])</td>
<td>0 (0–20 [0–100])</td>
<td>0.024†</td>
</tr>
<tr>
<td>Cormack and Lehane grade</td>
<td>97/3/0/0</td>
<td>87/11/2/0</td>
<td>78/21/1/0</td>
<td>58/37/5/0</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Number of intubation attempts; 1/2/3/4</td>
<td>95/5/0</td>
<td>93/7/0</td>
<td>91/8/1</td>
<td>98/2/0</td>
<td>NS</td>
</tr>
<tr>
<td>Manoeuvres to aid intubation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Readjust patient's head</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>NS</td>
</tr>
<tr>
<td>External laryngeal pressure</td>
<td>0</td>
<td>31</td>
<td>11</td>
<td>38</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Advance blade</td>
<td>11</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>0.004</td>
</tr>
<tr>
<td>Withdraw blade</td>
<td>5</td>
<td>16</td>
<td>11</td>
<td>3</td>
<td>0.004</td>
</tr>
<tr>
<td>Increase lifting force</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>7</td>
<td>NS</td>
</tr>
<tr>
<td>Relax lifting force</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0.007</td>
</tr>
<tr>
<td>Use of stylet</td>
<td>0</td>
<td>17</td>
<td>100</td>
<td>2</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>Use of bougie</td>
<td>0</td>
<td>22</td>
<td>0</td>
<td>13</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Desaturation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Mucosal bleeding</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Lip bleeding</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>NS</td>
</tr>
<tr>
<td>Dental injury</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Oesophageal intubation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Postoperative sore throat</td>
<td>1</td>
<td>8</td>
<td>15</td>
<td>3</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
C-MAC D Blade
First Clinical Evaluation of the C-MAC D-Blade Videolaryngoscope During Routine and Difficult Intubation

Erol Cavus, MD,* Tobias Neumann, MD,* Volker Doerges, MD,* Thora Moeller, MD,† Edwin Scharf, MD,* Klaus Wagner, MD,† Berthold Bein, DEAA, MD,* and Goetz Serocki, MD*

www.anesthesia-analgesia.org

February 2011 • Volume 112 • Number 2

Figure 3. Improvement of Cormack–Lehane grade from conventional direct laryngoscopy (DL) to C-MAC D-Blade view in patients with difficult airway (n = 20).
Indirect videolaryngoscopy with C-MAC D-Blade and GlideScope: a randomized, controlled comparison in patients with suspected difficult airways

Serocki G, Neumann T, Scharf E, Dörges V, Cavus E

Minerva Anestesiol. 2013 Feb; 79(2):121-9
<table>
<thead>
<tr>
<th>Group</th>
<th>Direct Laryngoscopy</th>
<th>D-Blade-CMAC</th>
<th>GlideScope®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngoscopy</td>
<td>(n =95)</td>
<td>(n=95)</td>
<td>(n =95)</td>
</tr>
<tr>
<td>time (sec)</td>
<td>13.2 ± 6.3</td>
<td>10.8 ± 4.3</td>
<td>12.0 ± 5.8</td>
</tr>
<tr>
<td></td>
<td>[4.0 – 36.0]</td>
<td>[4.0 – 34.0]</td>
<td>[5.0 – 40.0]</td>
</tr>
<tr>
<td>Intubation</td>
<td>(n =32)</td>
<td>(n =32)</td>
<td>(n =31)</td>
</tr>
<tr>
<td>first attempt</td>
<td>27 (84)</td>
<td>27 (84)</td>
<td>29 (94)</td>
</tr>
<tr>
<td>second attempt</td>
<td>1 (3)</td>
<td>4 (13)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>third attempt</td>
<td>0</td>
<td>1 (3)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>failed</td>
<td>4 (13)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>time* (sec)</td>
<td>11.2 ± 5.6</td>
<td>17.7 ± 9.7</td>
<td>18.7 ± 14.0</td>
</tr>
<tr>
<td></td>
<td>[5.0 – 26.0]</td>
<td>[8.0 – 33]⁺</td>
<td>[9.0 – 34.0]⁺⁺#</td>
</tr>
</tbody>
</table>
There are several differently designed video and optical enhanced devices that claim superiority, and hope to be crowned the gold standard of airway management. At this point in time, save for a few outliers, there are few significant clinically important differences between these devices.
Problems

- A good view does not mean easy intubation
- Longer intubation time
- Cables etc. —get in the way
- Angled blade requires use of stylet or bougie
- Risk of “catching” on arytenoids
- Increased risk of injury (seen with Glidescope)
- Fibreoptic intubation remains “gold standard”
• 93 patients, Good Mouth opening
• Sedated with Remifentanil
• Transtracheal lignocaine. Extensive pre attempt preparation
• Tolerated Guedel Airway
• McGrath vs Fibreoptic Laryngoscope
Awake Fiberoptic or Awake Video Laryngoscopic Tracheal Intubation in Patients with Anticipated Difficult Airway Management

A Randomized Clinical Trial

Charlotte V. Rosenstock, M.D., Ph.D.,* Bente Thøgersen, M.D.,† Arash Afshari, M.D., Ph.D.,‡ Anne-Lise Christensen, M.D.,§ Claus Eriksen, M.D.,§ Mona R. Gätke, M.D., Ph.D.[¶]

Anesthesiology, V 116 • No 6 1210 June 2012

<table>
<thead>
<tr>
<th></th>
<th>Flexible Fiberoptic Intubation (n = 43)</th>
<th>McGrath® VL Intubation (n = 41)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to tracheal intubation, s</td>
<td>80 [33–424] [58–117]</td>
<td>62 [20–678] [55–109]</td>
<td>0.17*</td>
</tr>
<tr>
<td>Number of attempts, (%)</td>
<td>34 (79.1)</td>
<td>29 (70.7)</td>
<td>0.64</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8 (18.6)</td>
<td>10 (24.4)</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>1 (2.3)</td>
<td>2 (4.9)</td>
<td>—</td>
</tr>
</tbody>
</table>
Blunder that killed my wife

By JANE FEINMANN

Last updated at 09:42 12 December 2006

Elaine Bromiley kissed her husband Martin and their children Victoria, then six, and Adam, five.

"Bye-ee," she called to them, waving as she was wheeled down the corridor towards the operating theatre.

The otherwise healthy 37-year-old had suffered for years from chronic sinusitis, an inflammation of the nasal passages. Then, early in 2005, one of her eye sockets became infected.

The threat of permanent damage to the optic nerve led her surgeon to recommend a minor operation to straighten the inside of the nose - a possible contributory factor.

Once they'd said their goodbyes, Martin and the children went home to wait for word that Elaine was awake and ready to see them all again. It never came. Two hours after she'd gone into theatre, Martin received a call from the Ear, Nose and Throat (ENT) surgeon to say Elaine was having difficulty waking up.

Fighting for changes to clinical practice: Dad Martin, with his children Victoria and Adam
C-MAC

- Use CMAC with Macintosh blade routinely
- Use direct or indirect
- Allows training
- Switch to D blade if difficult

- NO SUBSTITUTE FOR PROPER ASSESSMENT
- NO SUBSTITUTE FOR A PLAN
• ROTEM may give rapid assessment of coagulopathy
• Early use of bood products may be more important
• Continuous Hb may be useful but not for blood transfusion decisions
• Videolaryngoscopy may improve intubation success
• Videolaryngoscopy should be seen as part of an airway plan
“New” Devices

• Stuff you already knew..........

• Treat heavy bleeding with blood and blood products

• Check Haemoglobin before giving blood

• Assess the airway preoperatively, ask for help and wake up if necessary
New Needles
Chemotherapy

Bone marrow

Intrathecal methotrexate
Cranial radiotherapy (18 Gy)
Asparaginase 6000 (U/m² sc)
Vincristine (1.5 mg/m² iv)
Daunorubicin (45 mg/m² iv)
Prednisolone (40 mg/m² po)
Etoposide (100 mg/m² iv)
Cytarabine,
(100 mg/m² iv 12 hourly)
Thioguanine (80 mg/m² po)
Mercaptopurine (75 mg/m² po)
Methotrexate (20 mg/m² po)
Co-trimoxazole (po)

Week 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

Basic treatment scheme for UKALL X trial (sc=subcutaneous, iv=intravenous, po=by mouth).
What Could Go Wrong?
International Intrathecal Deaths

- **US**
  - Ascending myeloencephalopathy due to intrathecal vincristine sulfate 1983 Cancer, 51: 2041–2047

- **Iran**
  - Death due to intrathecal tranexamic acid instead of Bupivacaine

- **Korea**
- **Hong Kong**
- **Thailand**
- **Argentina**
- **Germany**
- **France**
- **Australia**
Is this a problem in Anaesthesia?

• A woman of slight build had a low dose infusion epidural during labour and was delivered by forceps. She had some bleeding and intravenous fluid and syntocinon infusions were started.
• Shortly after she had a grand mal convulsion followed by ventricular fibrillation from which she could not be resuscitated.
• She had received 150 ml of a 500 ml bag of 0.1% bupivacaine in saline intravenously in error
Mr Justice Irwin said it would be impossible to establish exactly what went wrong. He said there must have been some “lapse or breach of duty” on the part of the medical staff.”
Skin Preparation
How could this happen? Hospital blunder turns a family's joy into heartbreak

August 21, 2010

Patient's husband tells of anguish
The husband of a patient who was mistakenly injected with cleaning fluid during an epidural speaks of his wife's pain and suffering.

A horrific medical mistake during the birth of her child has left a Sydney woman in agony - and her infant son without his mother's embrace, reports Julie Robotham.

ALEXANDER ZHENG'S cot is still unassembled in a Hurstville apartment, where he has never been.

Home. for now, is a bassinet wedged into a room in the high-rise building the family share.
Swabstick containing 2% chlorhexidine in 70% alcohol
Air dried 3 min
Easy Spinal. 12.5mg bupivacaine, 12.5mcg fentanyl
Severe burning pain
Spinal used for uneventful CS
Severe headache post partum
Communicating hydrocephalus
Loss of bladder and bowel control. Weakness. Numbness
Progressive weakness and numbness
The sting in the tail: antiseptics and the neuraxis revisited

1) Cover equipment during application of prep
2) Remove containers and sponges from area before uncovering
3) Allow fluid to dry
4) Check gloves for contamination (?double glove)
Original Article

An evaluation of non-Luer safety connectors for neuraxial procedures*

P. Sharpe¹, S. Scott² and J. M. Gross¹
## Flow assessment (Bench)

<table>
<thead>
<tr>
<th></th>
<th>Sarstedt Surety</th>
<th>BD</th>
<th>Pajunk Surety</th>
<th>Neurax</th>
<th>Smiths</th>
<th>Vygon Surety</th>
<th>BBraun Surety</th>
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<tbody>
<tr>
<td><strong>Hub (s) Lat</strong></td>
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<tr>
<td><strong>Mean (SD)</strong></td>
<td>25.2 (1.5)</td>
<td>15.1 (0.7)</td>
<td>13.9 (1.1)</td>
<td>23.2 (0.4)</td>
<td>17 (0.8)</td>
<td>4.2 (0.3)</td>
<td>6.0 (0.3)</td>
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<tr>
<td><strong>0.5ml (s) Lat</strong></td>
<td>128 (8.6)</td>
<td>99 (6.6)</td>
<td>139 (9.6)</td>
<td>135 (3.1)</td>
<td>101 (5.3)</td>
<td>43 (2.5)</td>
<td>62 (3.2)</td>
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<tr>
<td><strong>Hub (s) Sit</strong></td>
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<tr>
<td><strong>Mean (SD)</strong></td>
<td>6.6 (0.3)</td>
<td>4.7 (0.3)</td>
<td>4.0 (0.4)</td>
<td>5.6 (0.2)</td>
<td>4.0 (0.1)</td>
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<tr>
<td><strong>0.5ml (s) Sit</strong></td>
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## Summary slide
(Satisfaction)

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<tr>
<td>(%)</td>
<td>Better</td>
<td>37</td>
<td>3</td>
<td>39</td>
<td>24</td>
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<tr>
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<td>Worse</td>
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So what did we do?

- Decided we should change rather than wait
- Settled on Surety based system
- BBraun evaluated as top option
- Training package, communication, logistics planning
- Running live with this since 2nd October 2013
Spinal Non Luer

• Benefits for Chemotherapy
  • Standard Drugs
  • Prepackaged Prepared
  • Closed System

• Anaesthesia
  • Drugs drawn up/mixed by anaesthetist
  • Often not checked
  • Possibility of error/contamination
  • Possibility of equipment mismatch
  • Possibility of equipment breakage
  • NO PREPARED or PREPACKAGED drugs
  • Open system
Needles

- Sarstedt
- BBraun
- Pajunk
- Vygon
Connectors

Pajunk

Vygon

BBraun

Sarstedt
Syringe
Epidural Non Luer

- Drugs Drawn Up/Mixed by Anaesthetist
- Often not checked
- Possibility of error/conamination
- Possibility of equipment mismatch
- Possibility of equipment breakage
- Some PREPARED or PREPACKAGED drugs
- Still vulnerability for infusions
This Really Happened........

• Anaesthetist draws up drugs for epidural
• Anaesthetist puts in epidural
• Notices drip not running
• Asks Midwife to flush drip
• Midwife draws up saline 10mls puts it down
• Anaesthetist tapes down epidural
• Then Midwife............
• ............picks up 20ml syringe of epidural mixture from sterile trolley and gives it intravenously
Non-Luer Connectors

• Few benefits to anaesthesia
• No drug preparation
• Administered drugs prone to user error
• Administered drugs prone to contamination
• Infusions not dedicated yet
• Benefits may come from
  • Better checking
  • Better drug isolation
  • Care with contaminants (skin prep)