Improving Rural Trauma Outcomes: Local Damage Control?

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Enhanced Surgical Skills Program
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Session Objectives

• Define problem of high injury mortality rates in rural jurisdictions.

• Define potential role of surgical first responders providing damage control interventions to reduce injury mortality.

• Define how trauma/surgical networks may assist local surgical programs.

• Define potential trauma training programs for ESS physicians.
Disclosures

Injury Hospitalization Rates in BC by Region

Source: CIHI
Injury Hospitalization Rates in Australia

Source: AIHW (per 100,000)

Death rates due to MVC in BC

<table>
<thead>
<tr>
<th>HA</th>
<th>Pop.</th>
<th>Rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>0.3M</td>
<td>25.4</td>
</tr>
<tr>
<td>Interior</td>
<td>0.7M</td>
<td>21.0</td>
</tr>
<tr>
<td>Island</td>
<td>0.7M</td>
<td>9.5</td>
</tr>
<tr>
<td>Coastal</td>
<td>1.1M</td>
<td>5.6</td>
</tr>
<tr>
<td>Fraser</td>
<td>1.5M</td>
<td>8.7</td>
</tr>
</tbody>
</table>
Rural vs. Urban Injury Death Rates in US (per 100,000)

Rogers et al. J Trauma 1999

Pre-hospital: Time to death following injury
BC Coroner’s Database (Hours)

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>p25</th>
<th>p50</th>
<th>p75</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHA-NW</td>
<td>0.2</td>
<td>1</td>
<td>6.7</td>
</tr>
<tr>
<td>FHA</td>
<td>0.9</td>
<td>6</td>
<td>66.8</td>
</tr>
<tr>
<td>VCHA</td>
<td>0.9</td>
<td>6</td>
<td>41.7</td>
</tr>
<tr>
<td>VIHA</td>
<td>1.1</td>
<td>7.7</td>
<td>78.6</td>
</tr>
</tbody>
</table>

NW prehospital times: 48% >1h, 21% > 2h, 13% > 3h
RR Death 7.0 for EHS response > 30 min²
Pre-hospital: Place of Death for MVC (%)

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Hospital</th>
<th>Road</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHA-NW</td>
<td>20</td>
<td>77</td>
<td>3</td>
</tr>
<tr>
<td>FHA</td>
<td>41</td>
<td>55</td>
<td>4</td>
</tr>
<tr>
<td>IHA</td>
<td>28</td>
<td>63</td>
<td>9</td>
</tr>
<tr>
<td>VCHA</td>
<td>46</td>
<td>48</td>
<td>6</td>
</tr>
<tr>
<td>VIHA</td>
<td>36</td>
<td>56</td>
<td>8</td>
</tr>
<tr>
<td>BC</td>
<td>35</td>
<td>59</td>
<td>6</td>
</tr>
</tbody>
</table>

BC Coroner’s Database, Simons 2010, Squire 2014

Problem: Urban-rural divide in injury risk and death

• Rural populations more likely to:
  – Be injured
  – Die from injury
  – Die before reaching definitive care

• Disparity:
  – Not subtle
  – Resistant to evolving trauma systems

• Failure of current trauma system design
**Solution:** Reducing rural injury risk and death

- Prevention
- Improved pre-hospital services
  - Earlier discovery, rapid transport, better bleeding control & pre-hospital resuscitation
- Rapid evacuation to definitive care
- **Improved initial local stabilisation**
  - Local damage control interventions?
  - Role for ESS physicians?
- Fully networked rural-urban trauma system

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**Preventing Death Following Injury**

![Diagram showing causes of trauma death with time intervals and percentages]

*Figure 1-3 Causes of Trauma Death. Source: Adapted from “Trauma” by DD Trunkey in Scientific American (1983:249:31). Copyright © 1983 by Scientific American, Inc. All rights reserved.*
Airway

Array of new airway techniques available to secure airway.

Cricothyroidotomy – a ‘need-to-have’ skill as likely will be plan Z (after plans A, B, C, etc. have failed)

Breathing

Standard set of interventions work for majority of thoracic trauma patients:

- Pain management.
- Needle/tube thoracostomy
- Additional chest tubes as needed
- Intubation
- Mechanical ventilation
- Open pneumothorax management
Bleeding

A. Stopping the bleeding

B. Resuscitation of shock

B. Resuscitation of Shock

Damage Control Resuscitation (DCR)
- Transient responder? unable to stop bleeding?
  If so, you are in DCR mode: assume patient is coagulopathic, acidotic & at risk for hypothermia.

  - Stop what bleeding you can
  - Limit crystalloid
  - Empiric use of blood products
  - Keep warm
  - TXA?, Fibrinogen concentrate?
  - Permissive hypotension
A. Stop the Bleeding
Part 1 – The Easy (extremity)

• Close lacerations

• Splint Fractures
A. Stop the Bleeding

Part 1 – The Easy (extremity)

- Close lacerations
- Splint Fractures
- Wrap/pack pelvic #s
- Tourniquets
A. Stop the Bleeding
Part 1 – The Easy (extremity)

- In scope for most ED Physicians and GPs
- Covered in ATLS and STB courses

A. Stop the Bleeding
Part 2 – Harder (Junctional)

- Pressure dressing
- Hemostatic dressings
- Catheter tamponade
A. Stop the Bleeding
Part 2 – Harder (Junctional)

• Mostly in scope for ED Physicians and GPs
• Covered in ATLS and especially STB courses

A. Stop the Bleeding
Part 3 – Hardest (cavitary)

• Abdominal bleeding
A. Stop the Bleeding
Part 3 – Hardest (cavitatory)

- Abdominal bleeding
- Pelvic bleeding

A. Stop the Bleeding
Part 3 – Hardest (cavitatory)

- Abdominal bleeding
- Pelvic bleeding
- Cardiac bleeding
A. Stop the Bleeding
Part 3 – Hardest (cavitatory)
Surgical Damage Control

• Beyond scope of most ED Physicians and GPs
• Requires:
  – Baseline surgical skill set (ESS?)
  – Additional operative trauma skills
  – Local surgical capability
  – Supportive surgical network
• Skills covered in DSTC course

A. Stop the Bleeding
Part 3 – Surgical Damage Control

• DC Trauma Laparotomy
  – Hemorrhage control
    • Packing,
    • Splenectomy, Nephrectomy
    • Mesenteric ligation
  – Contain contamination
  – Abbreviated closure
A. Stopping the Bleeding
Part 3 – Surgical Damage Control

• DC Trauma Laparotomy
• Pelvic packing

A. Stopping the Bleeding
Part 3 – Surgical Damage Control

• Trauma Laparotomy
• Pelvic packing
• EDT vs. pericardiocentesis
CNS: Intracranial bleeding

- Acute neurological deterioration with:
  - EDH
  - Acute SDH

Burr holes/Craniotomy
- Specialist only?
- Generalist surgeon?
- FP-ESS?

Role of Telemedicine
- Surgical decision making
- Procedural mentor

Surgical First Responder
Trauma Tool Kit

Procedures/Resus
- Intubation
- Cricothyroidotomy
- Tube thoracostomy
- IV/IO access
- DCR
- Pericardiocentesis
- Splinting & wrapping #s
- Wounds & tourniquets
- Ultrasound

Damage control surgery
- Laparotomy
  - Packing liver
  - Splenectomy, Nephrectomy
  - Mesenteric ligation
  - Temporary closure
- Pelvic packing
- Resus. thoracotomy
- Burr holes/craniotomy
- Escharotomy fasciotomy

ATLS +/- STB  
ESS +/- Add on
### Proposed Trauma Tool Box

<table>
<thead>
<tr>
<th>ESS Curriculum</th>
<th>Trauma Tool Box</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Basic Operative Mgt (1-3)</td>
<td>Laparotomy</td>
</tr>
<tr>
<td>2. Abdominal presentations (4-8)</td>
<td>Packing liver</td>
</tr>
<tr>
<td>- Hernia, perianal, endo, appe</td>
<td>Splenectomy, Nephrectomy</td>
</tr>
<tr>
<td>3. Pregnancy Mgt (9-10)</td>
<td>Mesenteric ligation</td>
</tr>
<tr>
<td>- Operative VD, C section, etc.</td>
<td>Temporary closure</td>
</tr>
<tr>
<td>4. Non abdominal (11-17)</td>
<td>Pelvic packing</td>
</tr>
<tr>
<td>- Wnds, STSG, CTS, tendon, CS</td>
<td>Escharotomy, fasciotomy</td>
</tr>
<tr>
<td>5. Basic Principles (18-23)</td>
<td>Resus thoracotomy</td>
</tr>
<tr>
<td>- Laparoscopy &amp; endoscopy</td>
<td>Burr holes/craniotomy</td>
</tr>
<tr>
<td>- Laparotomy (20)</td>
<td>Laparotomy</td>
</tr>
<tr>
<td>- Ultrasound (22)</td>
<td>Packing liver</td>
</tr>
</tbody>
</table>

### ESS Trauma Training Program

- Proof of concept – current pilot project
- Selection of candidates
- Prerequisite training/experience
- Practice environment
- Curriculum and program delivery
- Network development
- On site, real time support, tele-mentoring
- Evaluation and quality assurance