Reducing Rural Injury Death

Regional Rounds
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Objectives

• Define problem of excess rural injury death in BC and Canada.
• Awareness of initiatives in BC aimed at reducing rural injury death.
• Awareness of:
  – Programs to support community surgeons
  – Pilot project involving GP surgeons beginning in IHA in April 2018.
Disclosures
M. 69 y.o. helmeted motor cyclist.
Wipes out on curve doing 60k.
I. C/o chest and hip pain, SOB
V. RR 28, HR 100, SBP 90
T. Collar, back board
Cariboo Memorial Hospital ED

I° Survey & Adjuncts

A. Speaking
B. Crepitus & \(\downarrow\) AE on L, RR=30,
C. 120, 85/50, pale, sweaty
D. GCS 14, PERL
E. Unstable pelvis
A. Speaking
B. Crepitus & ↓ AE on L, RR=30,
C. 120, 85/50
D. GCS 14, PERL
E. Unstable pelvis

Adjuncts:
- CXR & PXR:
- FAST –ve
- ABG: 7.23, 40, 61, 16, -9,
- Lab: Hb 97, SaO$_2$= 89%
Oxygen by mask and chest tube:
  • $\text{SaO}_2$ improves then slowly deteriorates
  • Intubated: $\text{SaO}_2$ improves again

2 LB IVs bolus NS then 2u PRBC:
  • SBP improves then falls (transient responder)
  • Pelvis wrapped

WL Gen Surgeon & VGH Trauma Surgeon called
  • WL general surgeon ‘nothing to offer’
  • VGH trauma surgeon ‘not optimistic’
• Decision made to transfer via BC Bedline
• Destination and transport options discussed
  – BLS ground to Kamloops (3-4h) vs.
  – ALS fixed wing to Vancouver (4-5h)
• Resuscitation plan developed
• Anticipated 4-5 hour transfer
• Prognosis poor, expected demise en route
Death Following Injury

Immediate:
- Brain laceration
- Brainstem laceration
- Spinal cord laceration
- Aorta rupture
- Heart rupture

Early:
- Epidural hematoma
- Subdural hematoma
- Hemopneumothorax
- Pelvis fractures
- Long bone fractures
- Abdominal injuries

Late:
- Sepsis
- Multiple organ failure

50% 30% 20%

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.
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Death Following Injury

Preventable Deaths (Urban vs. Rural Trauma System)

Immediate:
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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>

Simons et al. J Trauma 2010
Pre-hospital: Place of Death for MVC (%)
BC Coroner’s Database

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Hospital</th>
<th>Scene</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>
</tbody>
</table>

Simons et al. J Trauma 2010
Rural Trauma: Challenges

[Images of urban and rural settings with percentages标注80% and 20%]
Rural Trauma: Challenges
Rural Trauma: Challenges
• Delayed EHS response
• Long drive times to scene
• Bystander care only for prolonged period
• BLS capabilities
  – Limited scene stabilisation & resuscitation
• No major trauma centres close by
• Limited HEMS/Autolaunch coverage
Rural Hospitals

- Limited resources (blood bank, OR, lab, Dx)
- Limited trauma training/expertise
- Limited experience (Infrequent major trauma)
- Limited or no surgical capability
- Skill set
- Barriers to transfer
- Poorer outcomes
System: Definitive Care
Hubs & Spokes, Transport
Problem: Excess Rural Injury Death

• Rural populations:
  – More likely to get injured
  – More likely to die from injury
  – More likely to die before reaching hospital

• Outcome disparity:
  – Not subtle and increasing over time
  – Resistant to trauma system implementation

• Failure of trauma system design
Solutions:
Reducing Rural Injury Death

• Prevention
• Discovery and first responder actions
• Prehospital services
• Transportation options
• Rural hospital services
  – Surgical Damage Control
• Transfer and definitive care
• Overall system design
Reducing Rural Injury and Death: Prevention

a. Prevention

Rural targeted
Risk populations identified
Multi-agency response
- safe system approach
Reducing Rural Injury and Death: Improving Trauma Services

b. Improving rural trauma care:

1. prehospital services

2. hospital services
Reducing Rural Injury and Death: Discovery and Bystander Response

1. Discovery times

2. First responder actions
Reducing Rural Injury and Death: Pre-hospital: EHS Response

1. Discovery times
2. First responder actions
3. EHS Access
1. Discovery times
2. First responder actions
3. EHS Access
4. EHS response
   - Ground BLS
   - HEMS/HART
   - Autolaunch
   - EFWD
1. Discovery times
2. First responder actions
3. EHS access
4. EHS response
5. EHS intervention
   - Hemostasis
   - Resuscitation

Reducing Rural Injury and Death:
Pre-hospital: EHS Interventions
Reducing Rural Injury and Death: Destination Protocols

1. Discovery times
2. First responder actions
3. EHS Access
4. EHS response
5. EHS intervention
6. System development
   - Destination protocols
   - Level 3 trauma centres
   - Hospital bypass
b. Improving rural trauma care:

1- Prehospital services

2- Rural hospital services
Rural Hospital Services:
System design: Level Designation

- Designated lead (1 & 2) trauma centre(s)
- Designated level 3 centres
- Appropriate resourcing all levels 1-5
- Role clarity & transfer agreements.
- Hub and spoke integration.
Rural Hospital Services: Education & Training Support

- Lead centre(s) role
- Standard courses
- On site when possible
- Team based
- Simulation based
- CPG dissemination
- Info available on net
- Access to Hub
Rural Hospital Services: Practice Guidelines & Resourcing

- System design
- Education and training
- Resuscitation
  - DCR Approach
  - Blood products
Rural Hospital Services:
Rural Surgical Services

- System design
- Education and training
- Resuscitation
- Surgical services
  - Community general surgeons
Rural Hospital Services: Community General Surgeons

Supporting the ‘generalist’ surgeon: DSTC, opportunities to upgrade skills, Tele-health

Redefining & preparing the future ‘generalist’ surgeon
Rural Hospital Services: GP Surgeons

- System design
- Education and training
- Resuscitation
- **Surgical services**
  - Community general surgeons
  - GP Surgeons (FP-ESS) Role?
Rural Hospital Services: Surgical First Responders

- Many remote communities in IHA without general surgeons.
- FP-ESS presence throughout rural BC and esp. in IHA.
- Potential role in trauma system? (CMAJ/CJS 2015, Banff 2016/18).
- Broad based interest in this topic: (TAC, CAGS, SRPC, CFPC, SOGC).
- Pilot project in IHA: Training ‘surgical first responders’.
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.
Reducing Rural Injury and Death: Airway Control

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)
Fully in scope for rural GPs
Reducing Rural Injury and Death: Breathing

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

- Needle/tube thoracostomy
- Additional chest tubes as needed
- Intubation
- Mechanical ventilation
- Open Ptx management
Reducing Rural Injury and Death: Breathing

Standard set of interventions work for majority of thoracic trauma patients:
- Needle/tube thoracostomy
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- Intubation
- Mechanical ventilation
- Open Ptx management

Consider also:
- Autotransfusion for Htx

Generally in scope for GPs
Reducing Rural Injury and Death: Bleeding

Two aspects to consider:

A. Stopping the bleeding
Reducing Rural Injury and Death: Bleeding

Two aspects to consider:

A. Stopping the bleeding

B. Resuscitation of shock
Reducing Rural Injury and Death:  
B. Resuscitation of Shock

Transient responder? Unable to stop bleeding? If so you are in Damage Control Resuscitation (DCR) mode. Assume patient is coagulopathic & acidotic.

- Stop what bleeding you can
- Limit crystalloid
- Empiric use of blood products
- Keep warm
- TXA?, Fibrinogen concentrate?
- Permissive hypotension

Requires access to appropriate blood products
A. Stopping the Bleeding
Part 1 – The Easy (Extremity)

• Close lacerations
A. Stopping the Bleeding
Part 1 – The Easy (Extremity)

• Close lacerations
• Splint Fractures
A. Stopping the Bleeding
Part 1 – The Easy (Extremity)

• Close lacerations
• Splint Fractures
• Wrap pelvic #s
A. Stopping the Bleeding
Part 1 – The Easy (Extremity)

- Close lacerations
- Splint Fractures
- Wrap pelvic #s
- Tourniquets
A. Stopping the Bleeding
Part 1 – The Easy (Extremity)

• In scope for most GPs and ED docs

• Covered in training and ATLS® and STB courses.
A. Stopping the Bleeding
Part 2: Harder (Junctional)

- Pressure, packing
- Hemostatic dressings
- Catheter tamponade
- Operative control, shunt
A. Stopping the Bleeding
Part 2: Harder (Junctional)

- Out of ‘comfort zone’ for most GPs and ED docs and many community surgeons.

- Skills covered in STB and DSTC courses.
A. Stopping the Bleeding
Part 3 – Hardest (Cavitatory)

• Abdominal bleeding
A. Stopping the Bleeding
Part 3 – Hardest (Cavitatory)

- Abdominal bleeding
- Pelvic bleeding
A. Stopping the Bleeding
Part 3 – Hardest (Cavitatory)

- Abdominal bleeding
- Pelvic bleeding
- Cardiac bleeding
A. Stopping the Bleeding
Part 3: Hardest (Cavitatory)

- Out of scope for GPs including FP-ESS docs.
- Challenge for any surgeon, esp. community surgeons.
- Skills covered in DSTC course but requires further experience and reinforcement for realistic competency.
A. Stopping the Bleeding
Damage Control Laparotomy

- Hemostasis
  - Liver packing,
  - Splenectomy, nephrectomy
  - Mesenteric ligation
- Contain GI contamination
- Abbreviated closure (VAC)
A. Stopping the Bleeding
Pre-peritoneal pelvic packing

- DC Laparotomy
- Pelvic packing
A. Stopping the Bleeding
ED Thoracotomy, Cardiorrhaphy

- DC Laparotomy
- Pelvic packing
- EDT vs. pericardiocentesis
• Acute neurological deterioration with:
  – EDH
  – Acute SDH

Burr holes/Craniotomy
• Specialist ?
• Generalist surgeon ?
• FP-ESS ?
Surgical First Responder
Trauma Tool Kit

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

Operations:
- DC Trauma Laparotomy
  - Packing liver
  - Splenectomy
  - Mesenteric ligation
  - Temporary closure
- Pelvic packing
- Escarotomy, fasciotomy
- Resus. thoracotomy
- Burr holes/craniotomy
- Vascular shunts

ATLS + STB

DSTC + ?
Proposed ESS Curriculum & Trauma Tool Box

ESS Curriculum
1. Basic Operative Mgt (1-3)
2. Abdominal presentations (4-8)
   - Hernia, perianal, endo, appe
3. Pregnancy Mgt (9-10)
   - Operative VD, C section, etc.
4. Non abdominal (11-17)
   - Wounds, STSG, CTS, tendon
5. Basic Principles (18-23)
   - Laparoscopy & endoscopy
   - Laparotomy (20)
   - Ultrasound (22)

Trauma Add on
DC Trauma Laparotomy
   - Packing liver
   - Splenectomy, nephrectomy
   - Mesenteric ligation
   - Temporary closure
Pre-peritoneal pelvic packing
Escarotomy, fasciotomy
Resus thoracotomy
Burr holes/craniotomy
Vascular exposure +/- shunts

ESS

DSTC + Mini Fellowship
Surgical First Responders: Pilot FP-ESS Trauma Training Program

- Identification of candidates and prerequisites
- Training program:
  - ‘Mini-fellowship’ in trauma centre (VGH), 6 weeks
  - Specific courses: ATLS, STB, DSTC
  - Reinforcement in OR with trauma/acute care surgeons
  - Longitudinal care of major trauma patients
- Optimising practice environment, (resources, etc.)
- Establish strong network of support (in real time)
- Technology support: (e.g. telemedical, teleradiology)
- Evaluation & Quality Assurance
Supporting our rural communities: Networks

• Concept of fully integrated system.

• Hubs supporting spokes
  – On site training
  – Organic relationships
  – Transfer agreements
  – Real time telemedicine
  – Mini-fellowships
  – To and fro between sites
  – Quality assurance program
Supporting our rural communities: Technology

- Teleradiology/PACS
- YouTube Videos
- Remote Telementoring
Index Case - Outcome

Made it to VGH:
• 8u PRBC, 4u FFP
• 20 L normal saline
• On 40 mcg Levophed
• SBP 70, SaO$_2$ 82%
• Full on ACS

Massive transfusion
Decompressive laparotomy
Pelvic angio-embolization
Multiple ORs
Discharged to rehab day 27
Index Case - Lessons

- Time to death postponed
- Better DCR
- Better surgical stabilization
- Knowledge gap
- Telemedical opportunity
- Autotransfusion
- Referral delay
- EHS blood products
Reducing Rural Injury Death: Summary

- Outcome disparity significant
- Trauma systems have failed to address
- Multifaceted response required including
  - Robust rural centre (level 3/5) support
  - Community surgeon support
  - New FP-ESS initiative in IHA
- Network and technology support