

# 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

# Index Case



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<sup>o</sup> Survey & Adjuncts

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



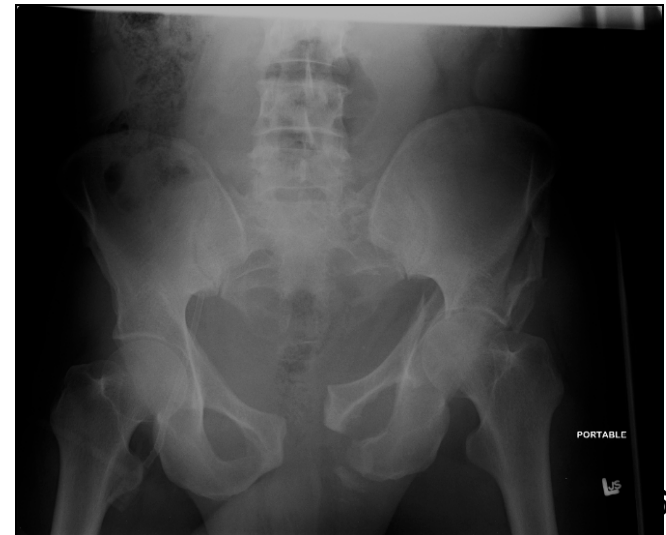
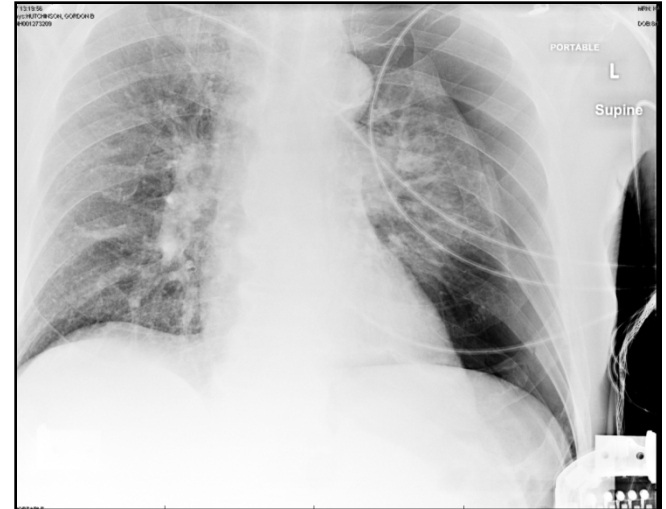
# Cariboo Memorial Hospital ED

## 1<sup>o</sup> Survey & Adjuncts

- 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<sub>2</sub>= 89%



# Cariboo Memorial Hospital ED

## Response to Interventions

Oxygen by mask and chest tube:

- SaO<sub>2</sub> improves then slowly deteriorates
- Intubated: SaO<sub>2</sub> 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'

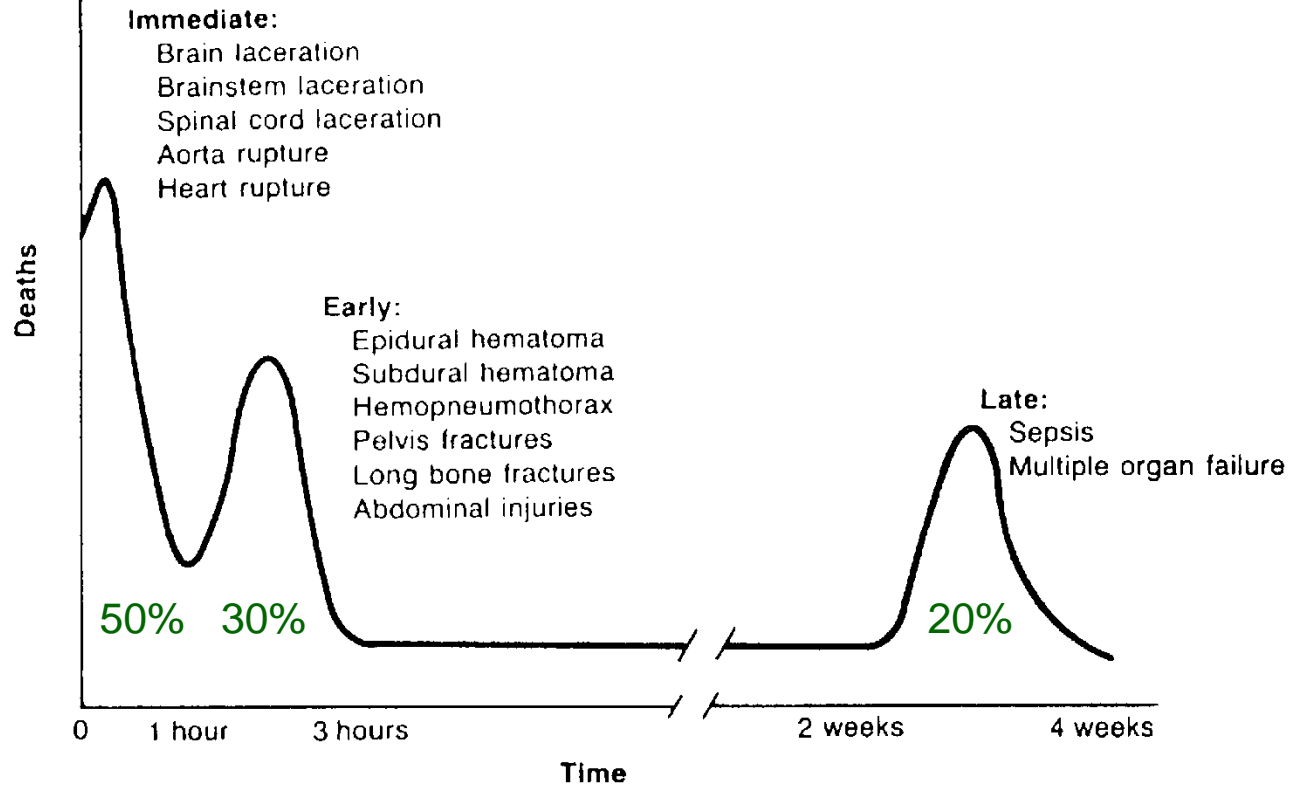
## Cariboo Memorial Hospital ED

# ED Disposition

- 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

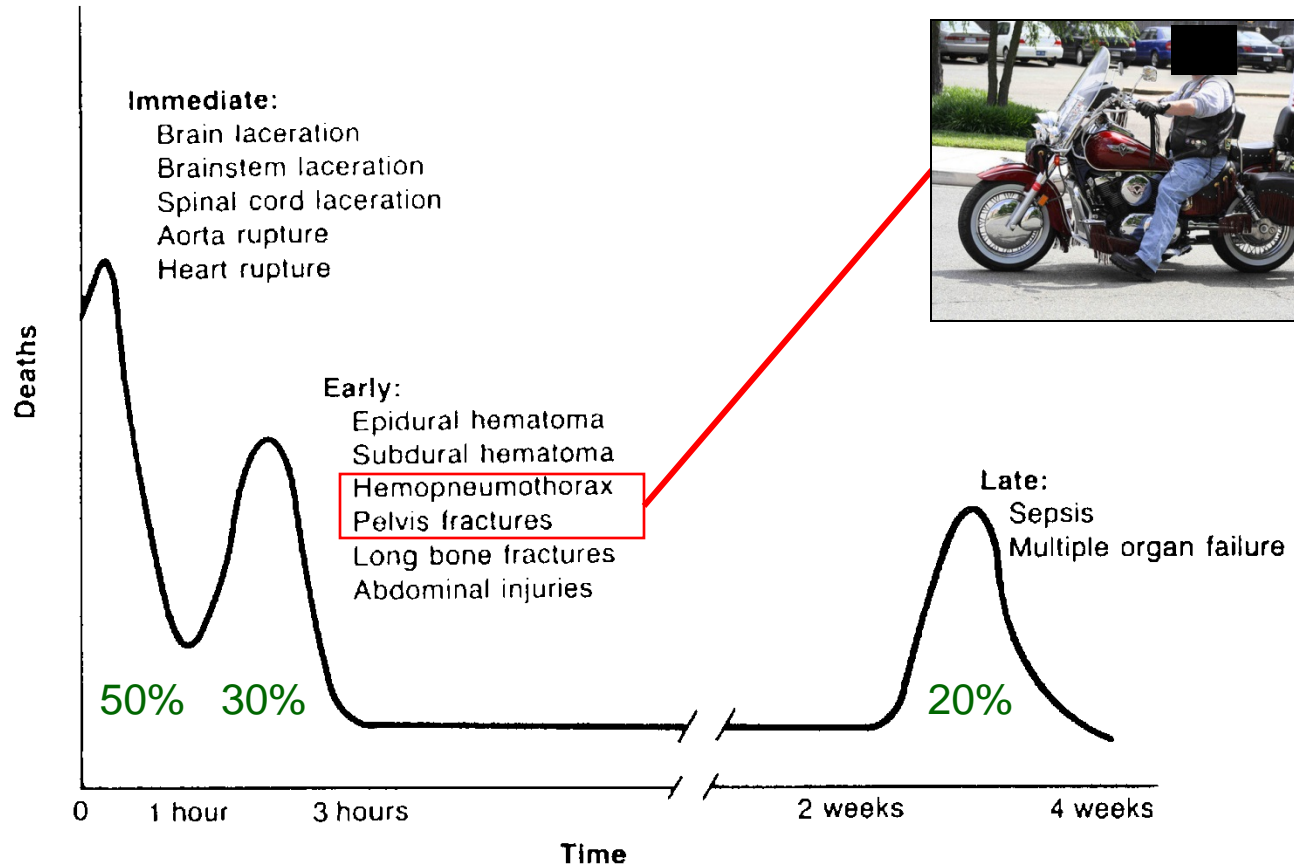


# Death Following Injury



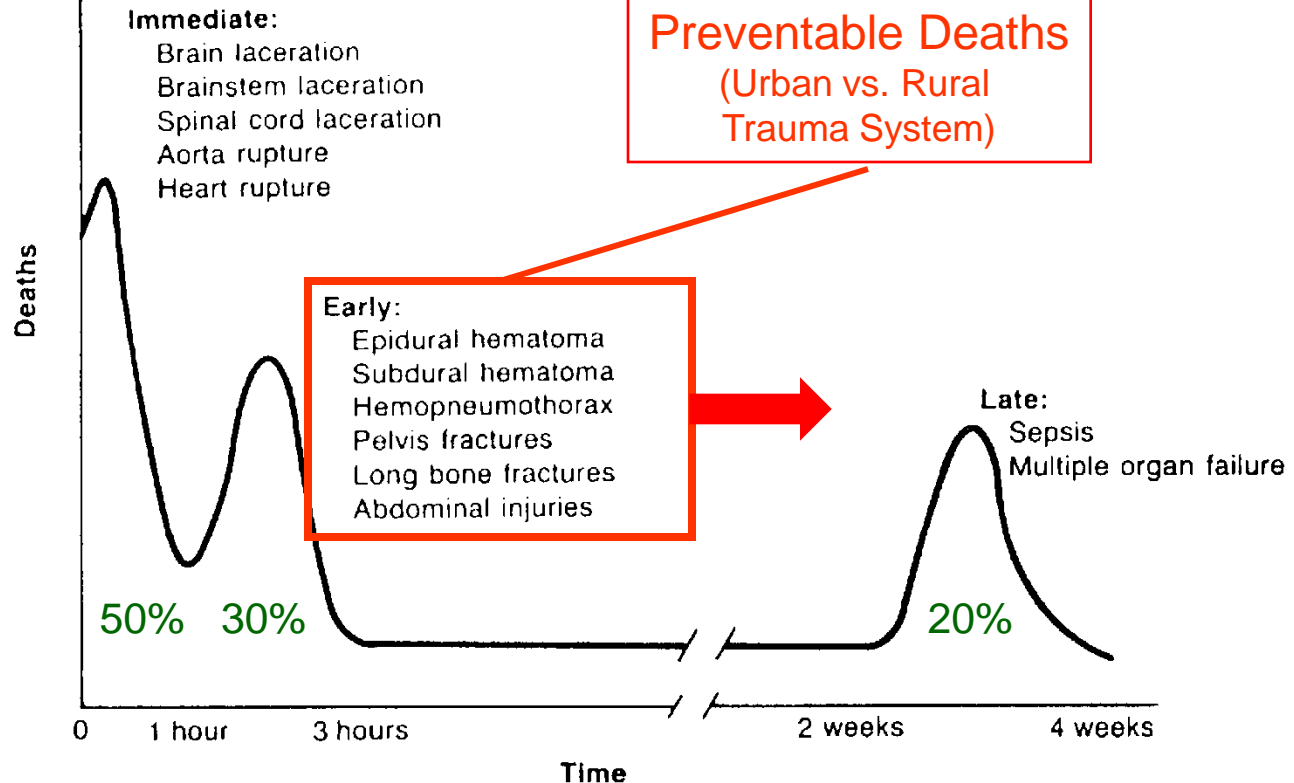
**Figure 1-3** Causes of Trauma Death. *Source:* Adapted from "Trauma" by DD Trunkey in *Scientific American* (1983;249:31). Copyright © 1983 by Scientific American, Inc. All rights reserved.

# Death Following Injury



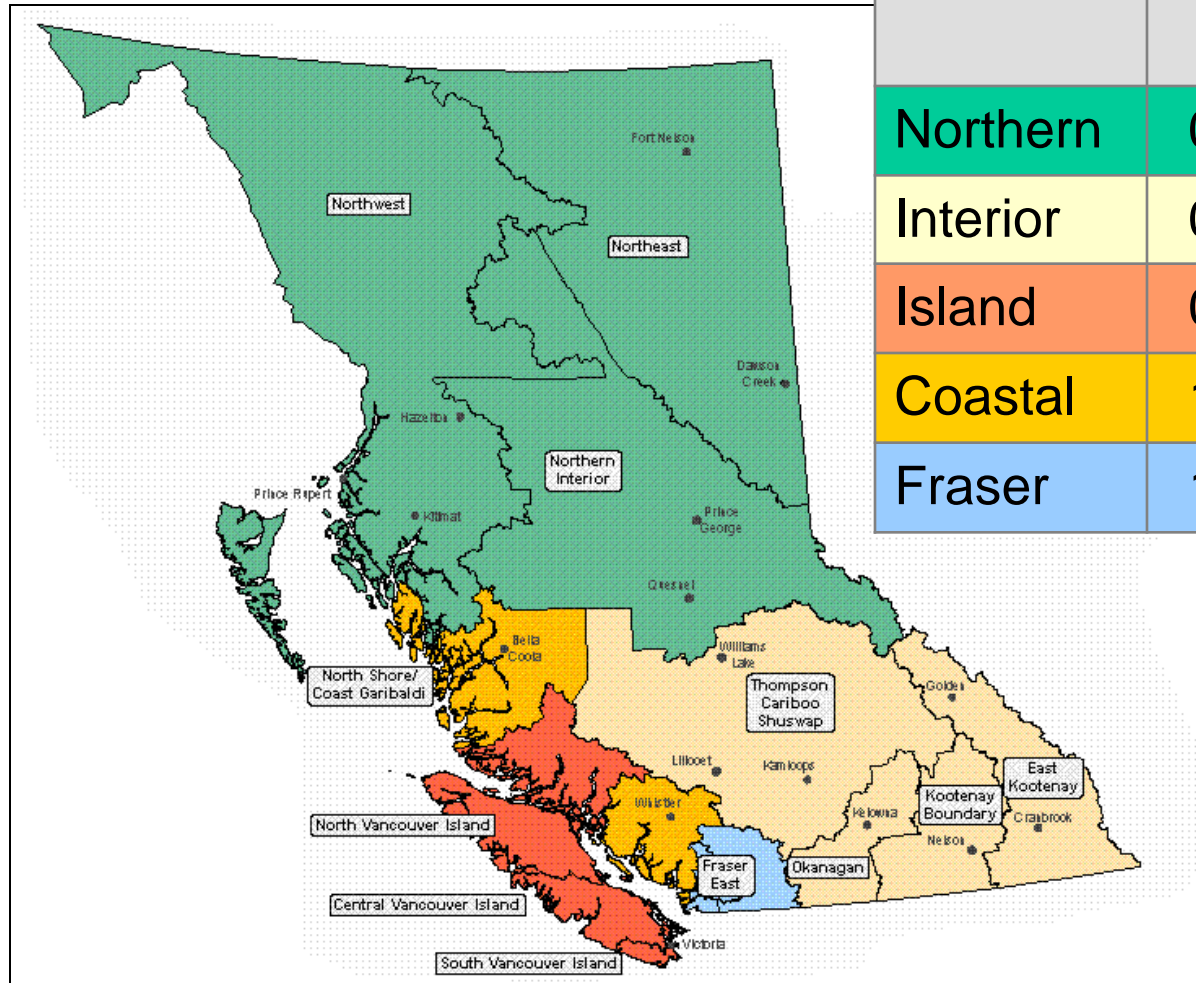
**Figure 1-3** Causes of Trauma Death. *Source:* Adapted from "Trauma" by DD Trunkey in *Scientific American* (1983;249:31). Copyright © 1983 by Scientific American, Inc. All rights reserved.

# Death Following Injury



**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.

# Death rates due to MVC in BC



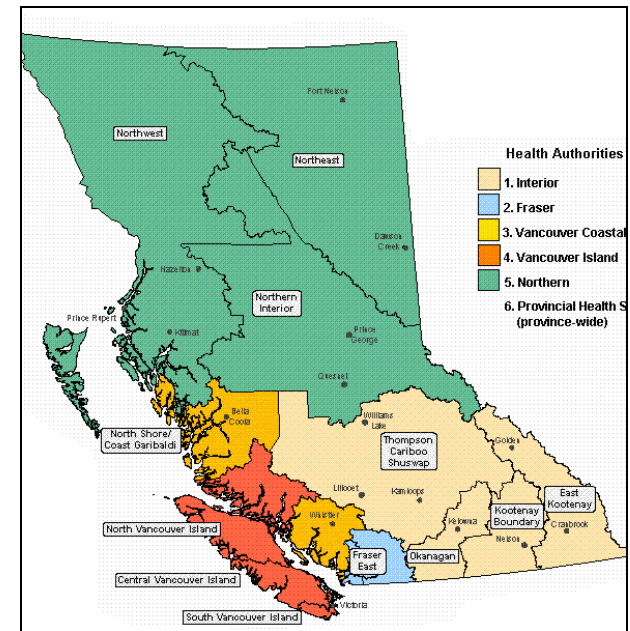
HA	Pop.	Rate per 100,000
Northern	0.3M	25.4
Interior	0.7M	21.0
Island	0.7M	9.5
Coastal	1.1M	5.6
Fraser	1.5M	8.7

Simons et al. J Trauma 2010

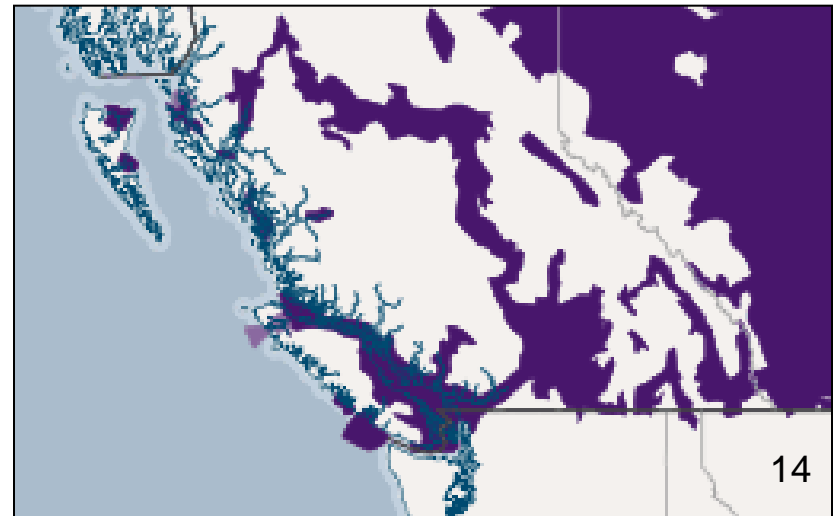
# Pre-hospital: Place of Death for MVC (%)

## BC Coroner's Database

Jurisdiction	Hospital	Scene	Other
NHA-NW	20	<b>77</b>	3
FHA	41	55	4
IHA	28	<b>63</b>	9
VCHA	46	48	6
VIHA	36	56	8

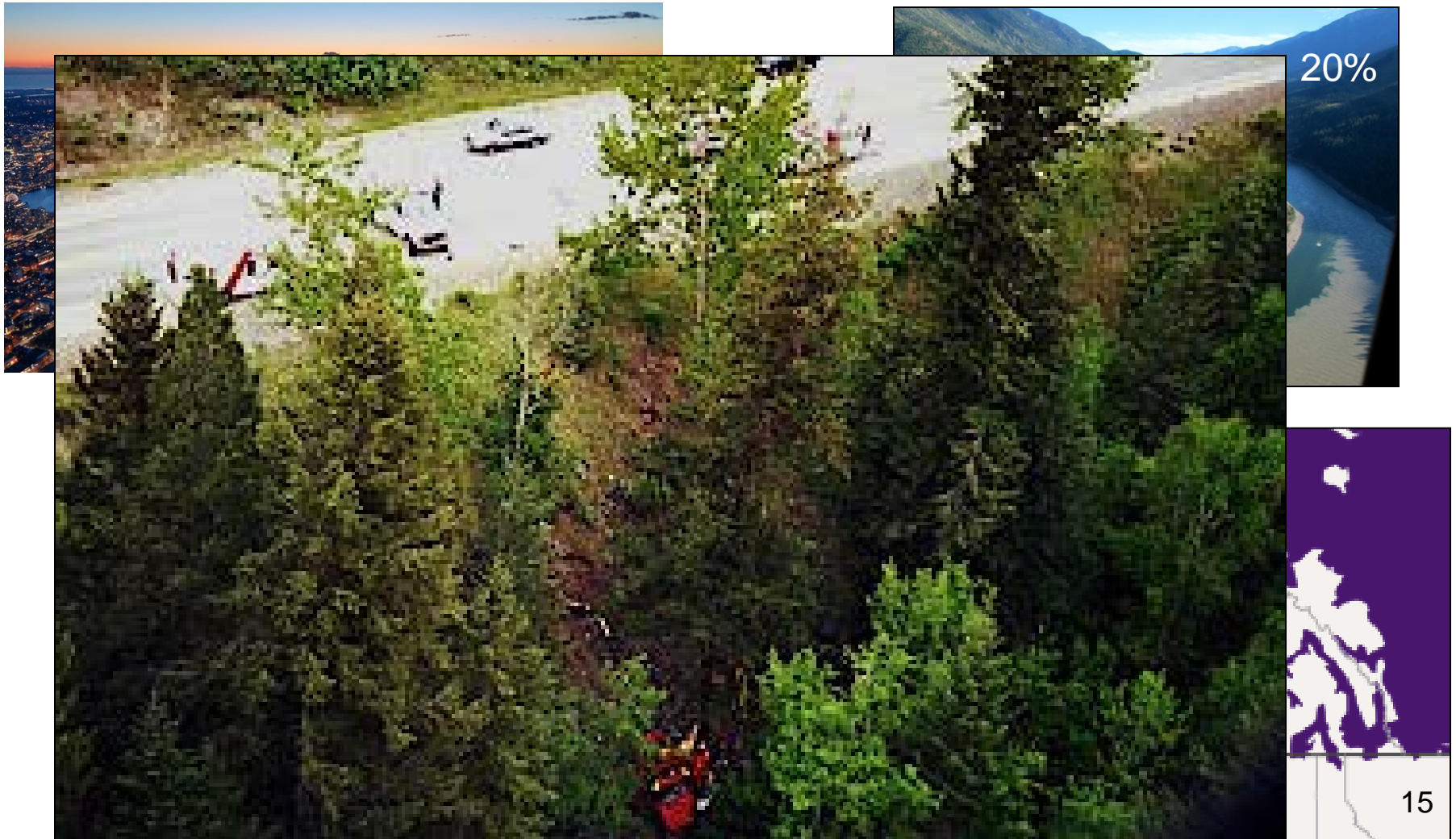


# Rural Trauma: Challenges

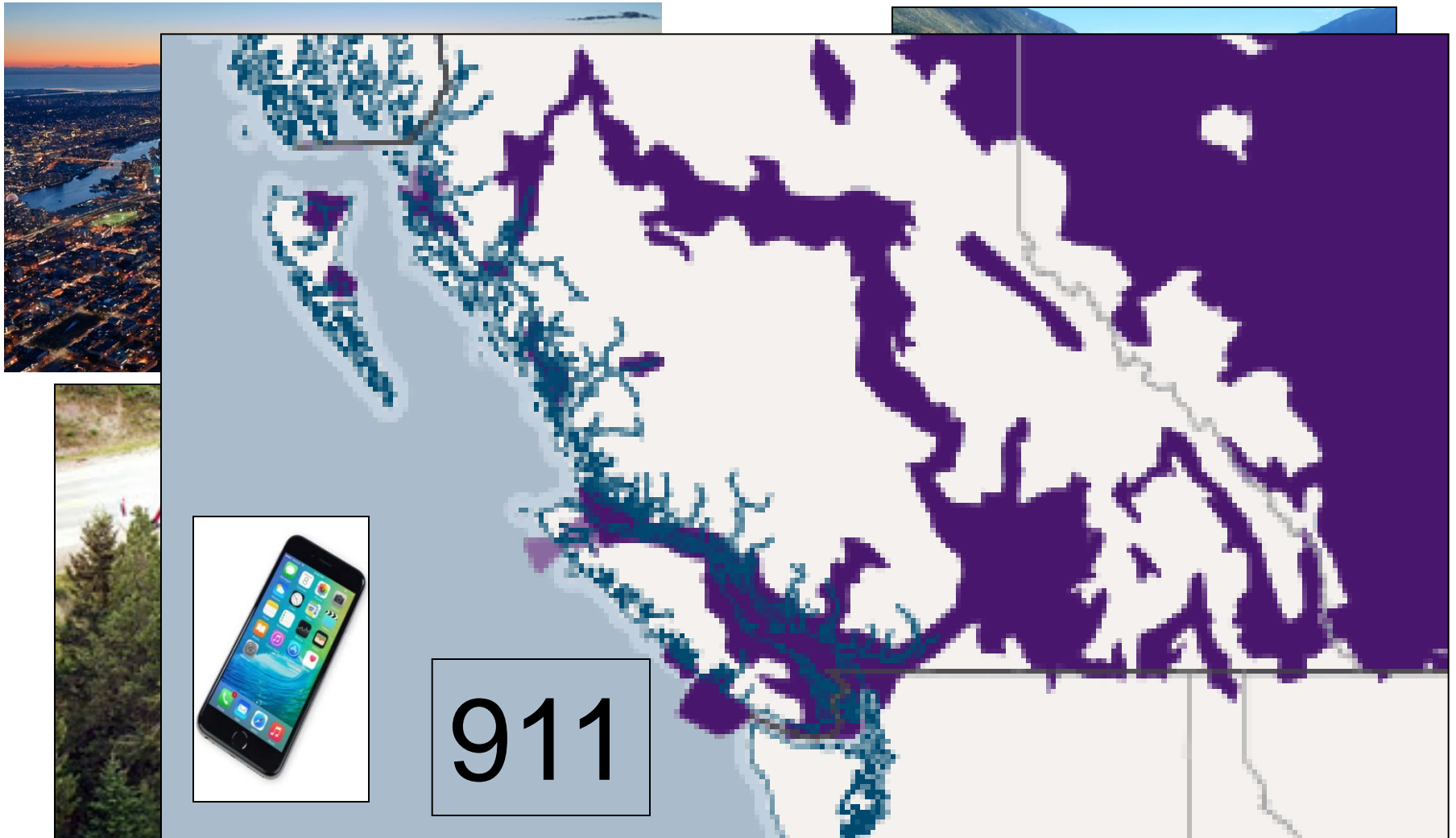




# Rural Trauma: Challenges



# Rural Trauma: Challenges





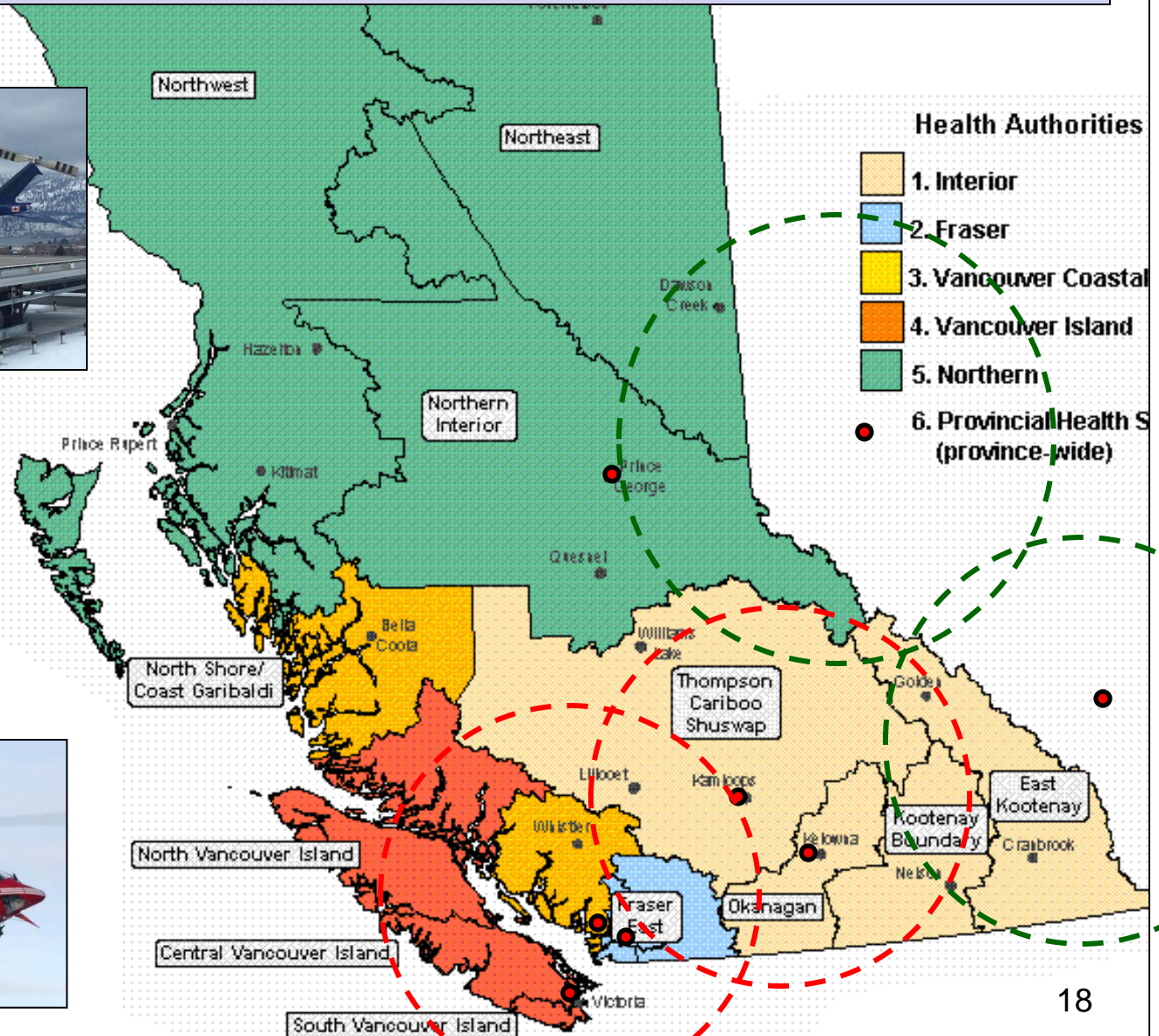
# Prehospital: Rural EHS Response

- 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

# Prehospital: HEMS Coverage



BCEHS/  
HART  
STARS



# Rural Hospitals

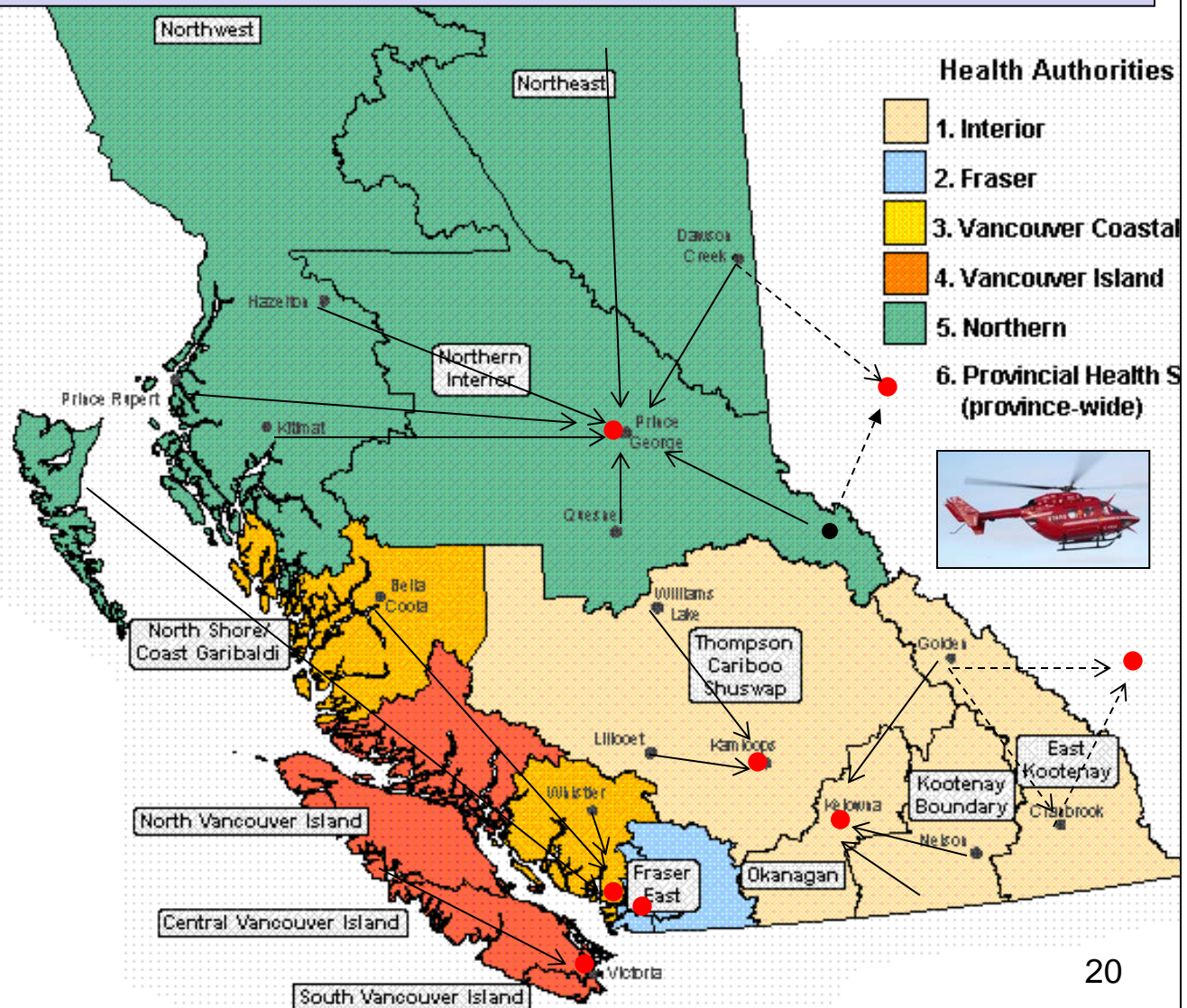
- Limited resources (blood bank, OR, lab, Dx)
- Limited trauma training/expertise
- Limited experience (Infrequent major trauma)
- Limited or no surgical capability
- ↓ Skill set
- Barriers to transfer
- Poorer outcomes





# 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:

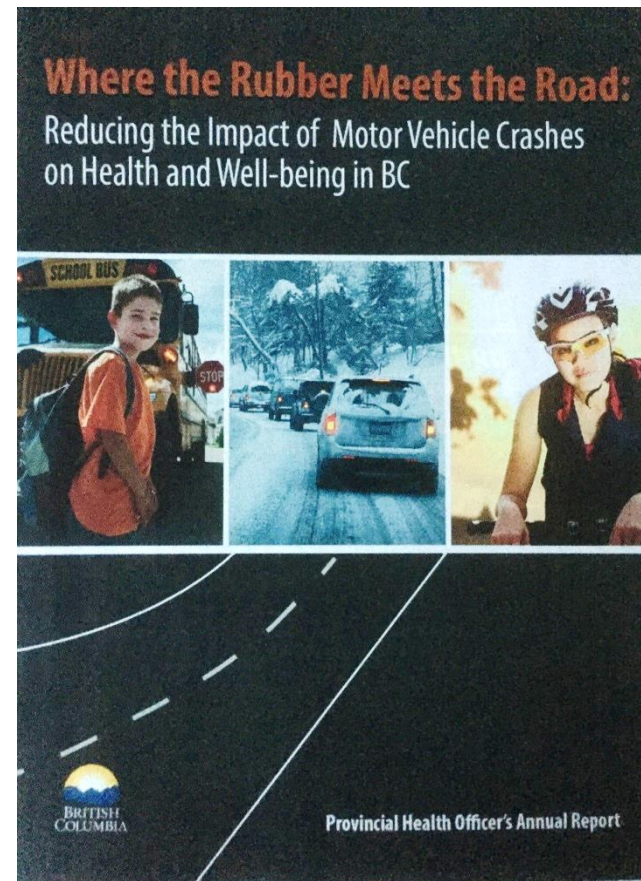
## Reducing Rural Injury Death

- 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  
Systems approach  
- 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

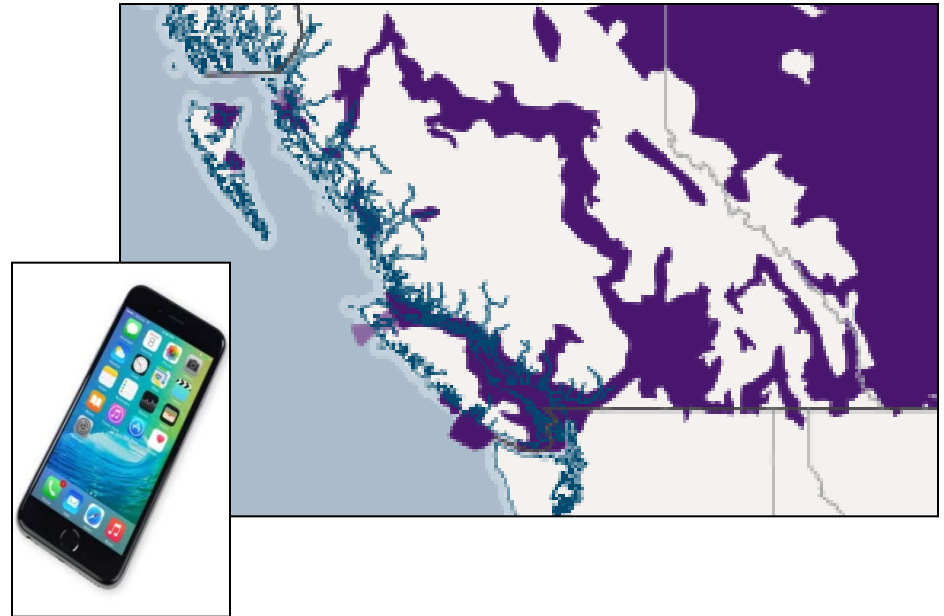


## 2. First responder actions



# Reducing Rural Injury and Death: Pre-hospital: EHS Response

1. Discovery times
2. First responder actions
3. **EHS Access**



911

# Reducing Rural Injury and Death: Pre-hospital: EHS Response

1. Discovery times
2. First responder actions
3. EHS Access
4. **EHS response**
  - Ground BLS
  - HEMS/HART
  - Autolaunch
  - EFWD



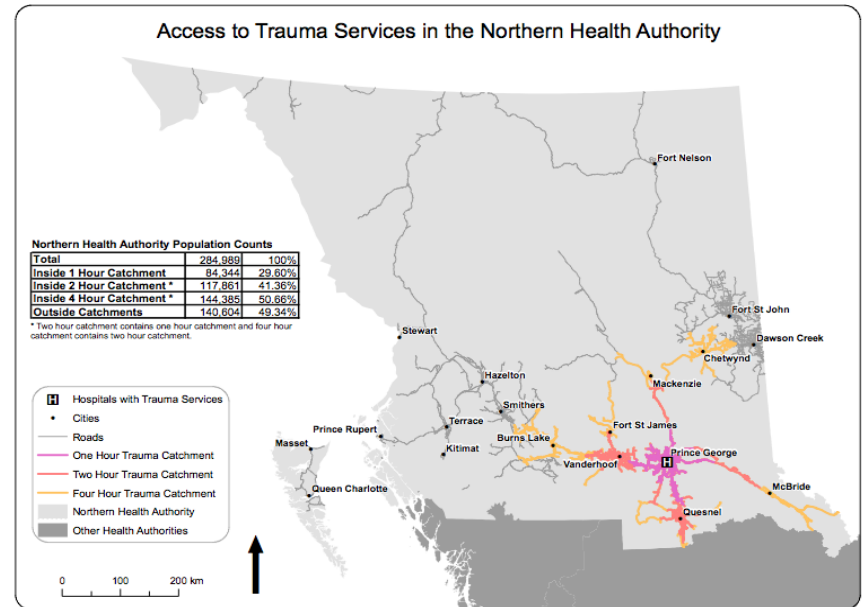
# Reducing Rural Injury and Death: Pre-hospital: EHS Interventions

1. Discovery times
2. First responder actions
3. EHS access
4. EHS response
5. **EHS intervention**
  - Hemostasis
  - Resuscitation



# 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



# Reducing Rural Injury and Death: Rural Hospital Services

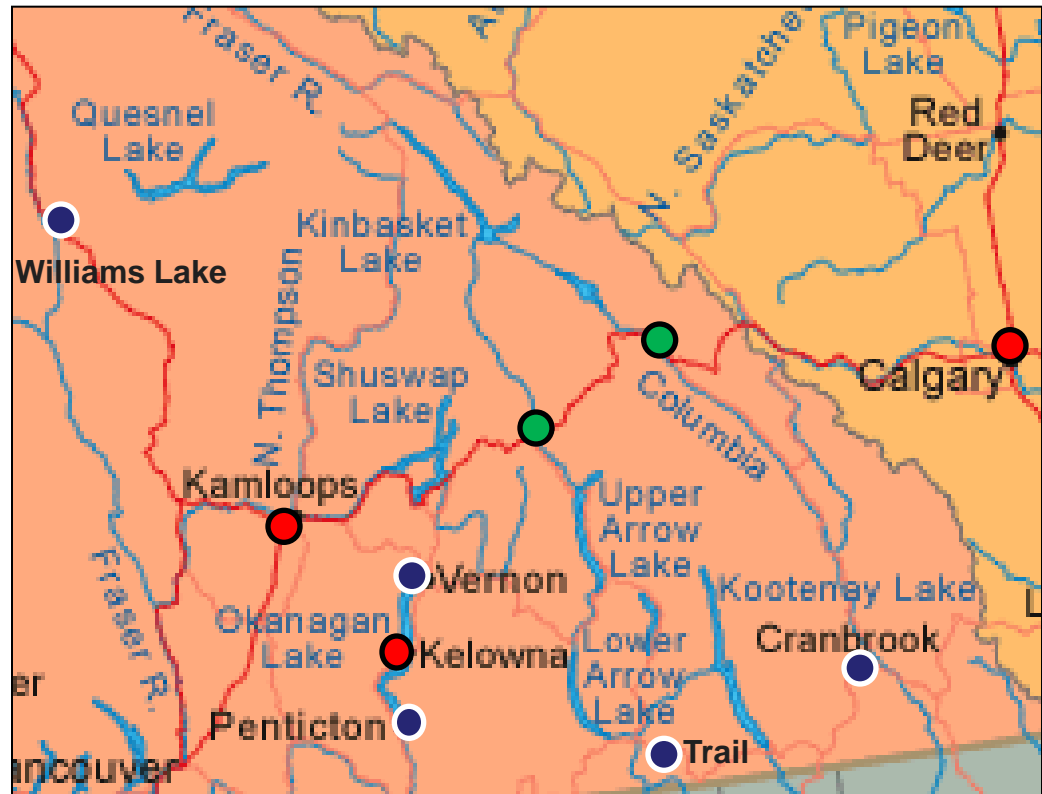
## **b. Improving rural trauma care:**

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

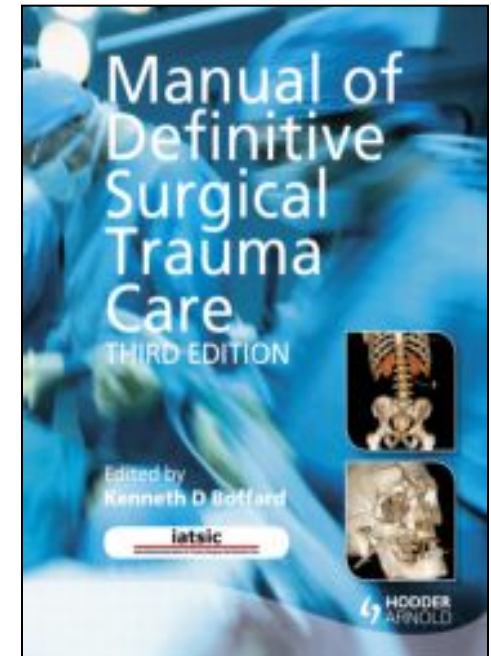
- System design
- Education and training
- Resuscitation
- **Surgical services**
  - **Community general surgeons**



# Rural Hospital Services: Community General Surgeons

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

Redefining & preparing the future 'generalist' surgeon



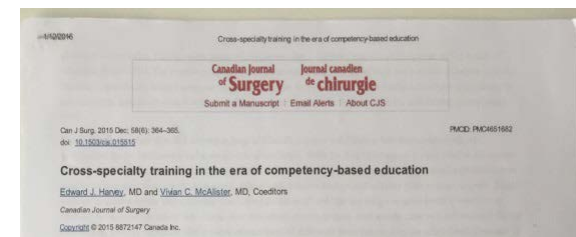
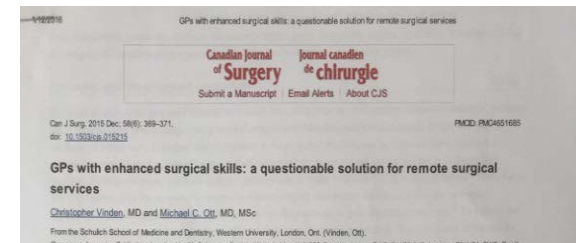
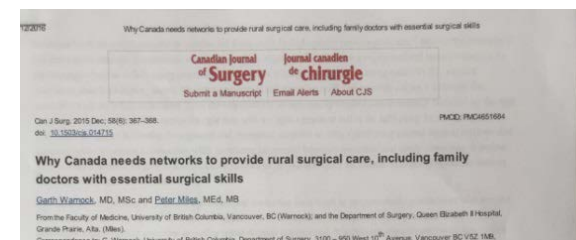
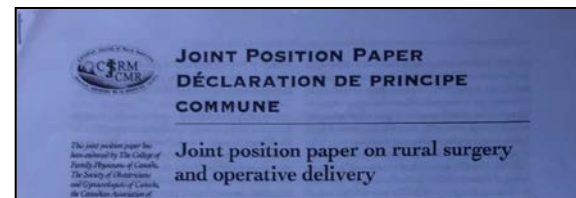
# Rural Hospital Services: GP Surgeons

- System design
- Education and training
- Resuscitation
- **Surgical services**
  - Community general surgeons
  - **GP Surgeons (FP-ESS) Role?**

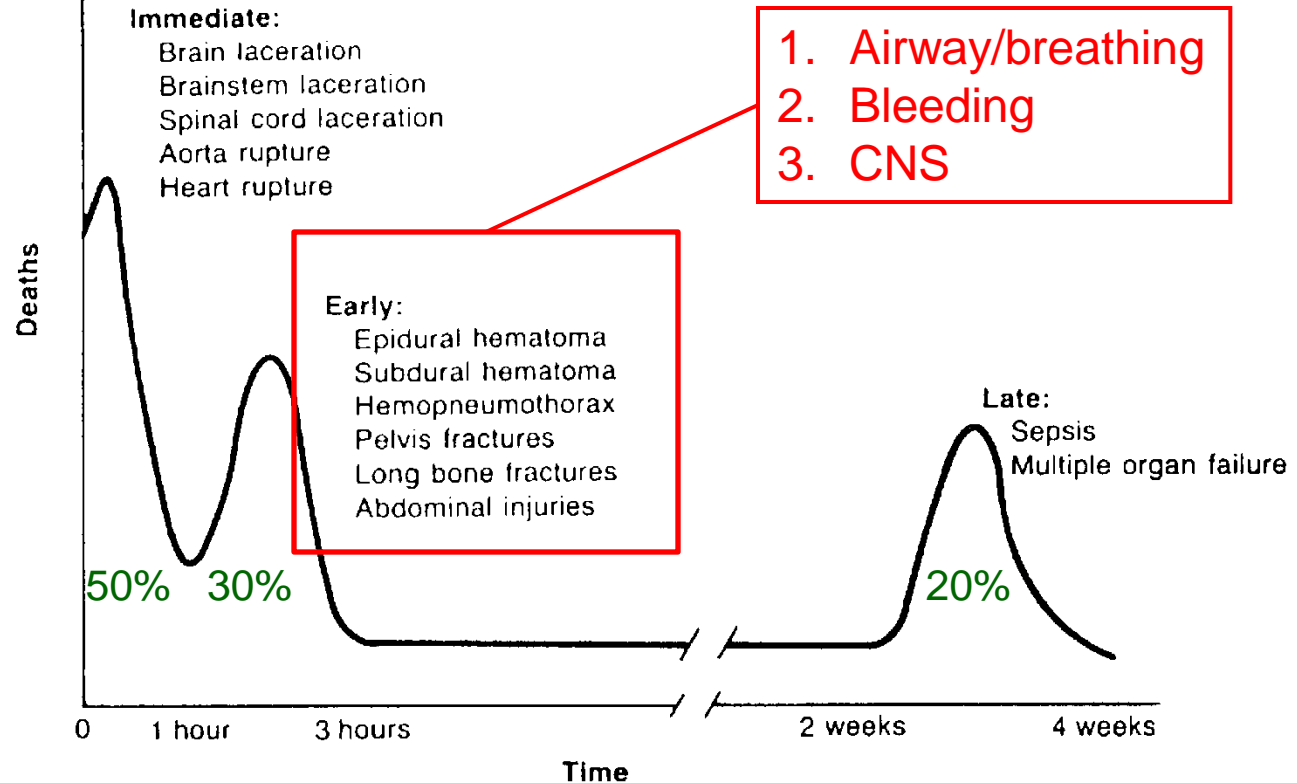


# Rural Hospital Services: Surgical First Responders

- 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'.



# Preventing Death Following Injury



**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.

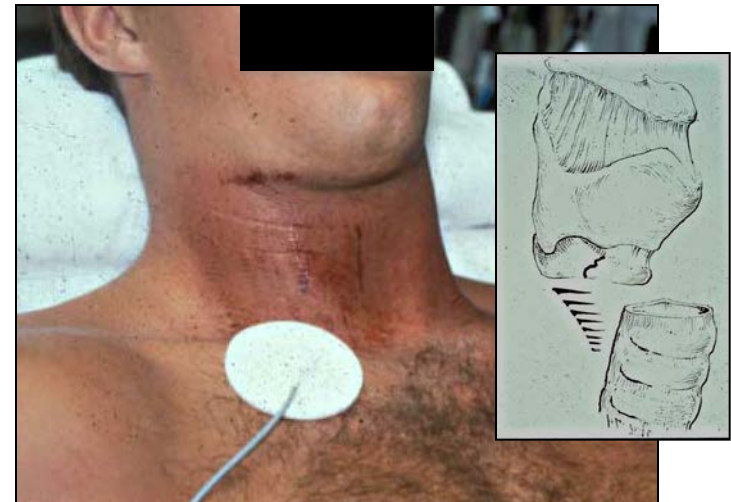
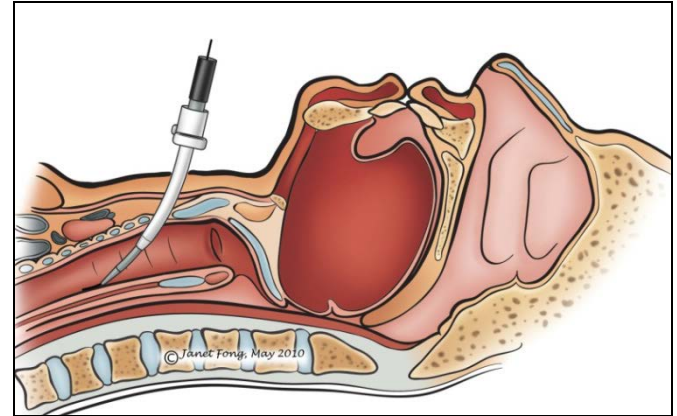


# Reducing Rural Injury and Death: Airway Control

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

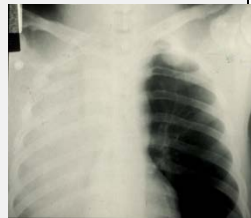
Standard set of interventions work for majority of thoracic trauma patients:

- Needle/tube thoracostomy
- Additional chest tubes as needed
- 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)

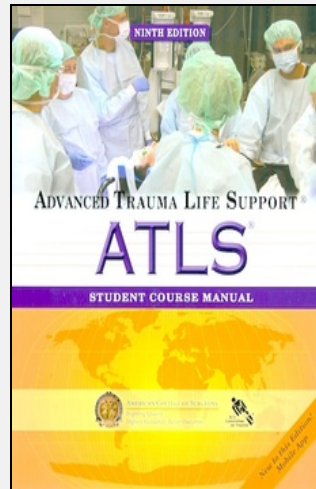
- Close lacerations
- Splint Fractures
- Wrap pelvic #s
- Tourniquets



# A. Stopping the Bleeding

## Part 1 – The Easy (Extremity)

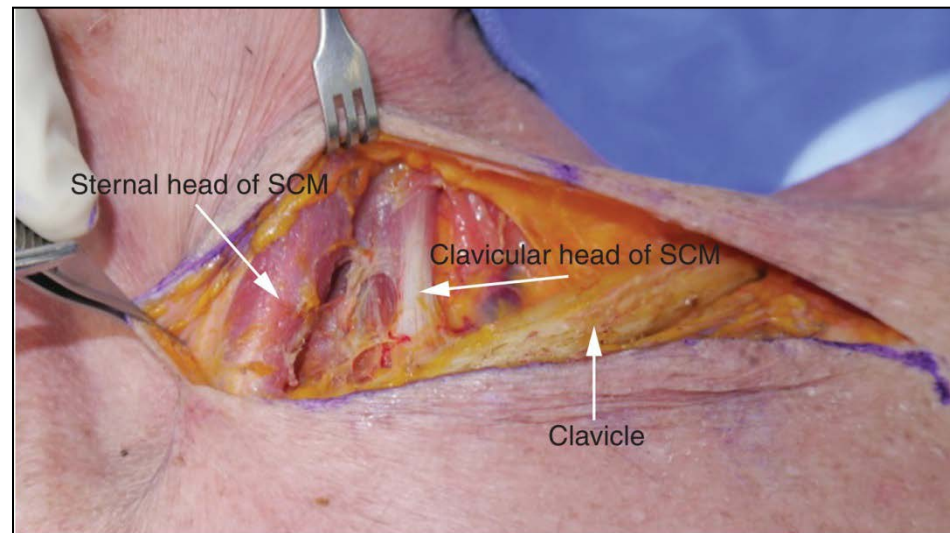
- In scope for most GPs and ED docs
- Covered in training and ATLS® and STB courses.



# A. Stopping the Bleeding

## Part 2: Harder (Junctional)

- Pressure, packing
- Hemostatic dressings
- Catheter tamponade
- Operative control, shunt

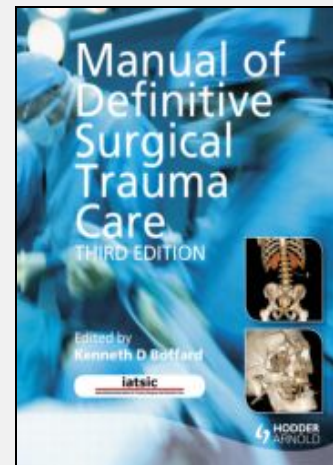




# A. Stopping the Bleeding

## Part 2: Harder (Junctional)

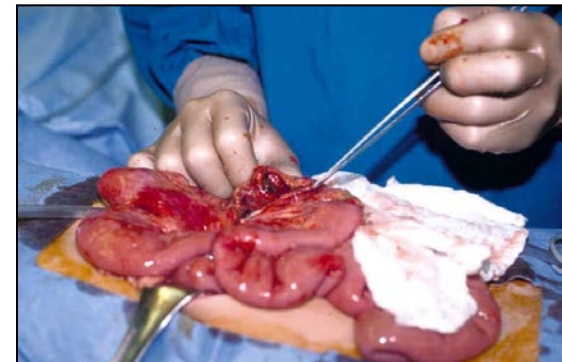
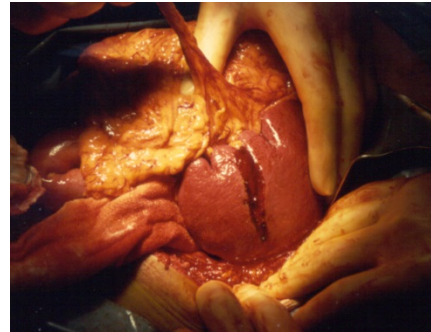
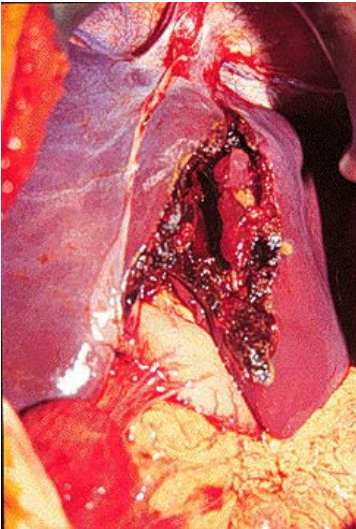
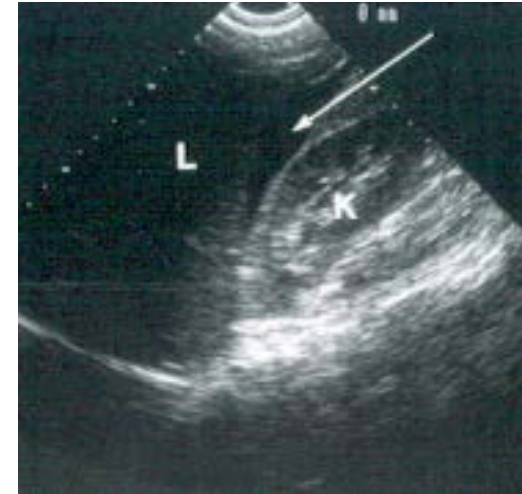
- Out of 'comfort zone' for most GPs and ED docs and many community surgeons.
- Skills covered in STB and DSTC courses.



# A. Stopping the Bleeding

## Part 3 – Hardest (Cavitatory)

- Abdominal bleeding

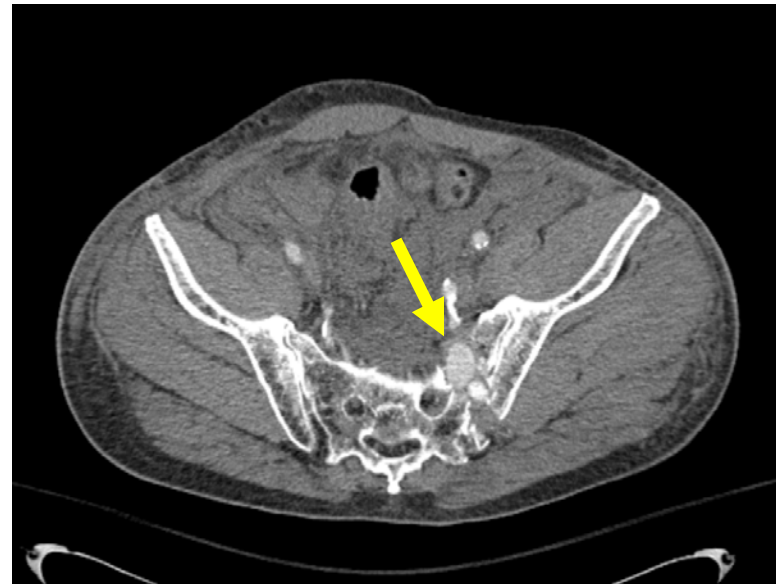




# A. Stopping the Bleeding

## Part 3 – Hardest (Cavitatory)

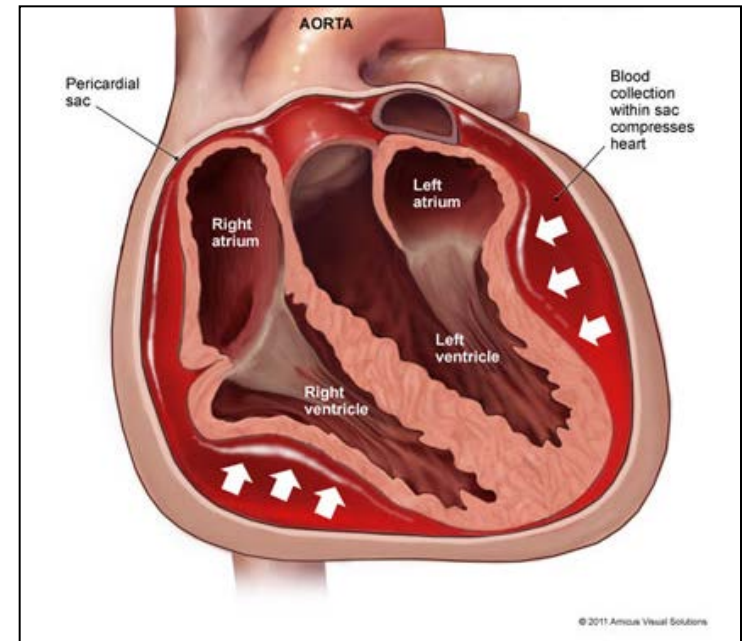
- Abdominal bleeding
- Pelvic bleeding



# A. Stopping the Bleeding

## Part 3 – Hardest (Cavitatory)

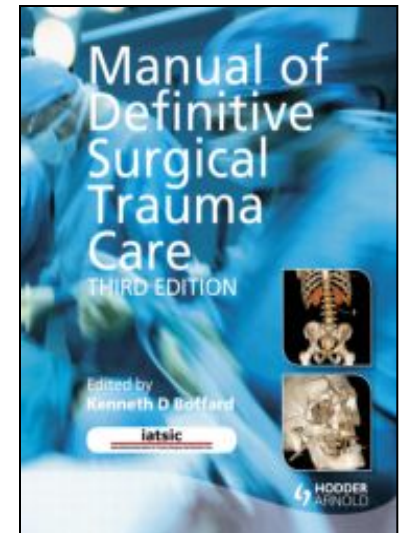
- Abdominal bleeding
- Pelvic bleeding
- Cardiac bleeding



## A. Stopping the Bleeding

### Part 3: Hardest (Cavitory)

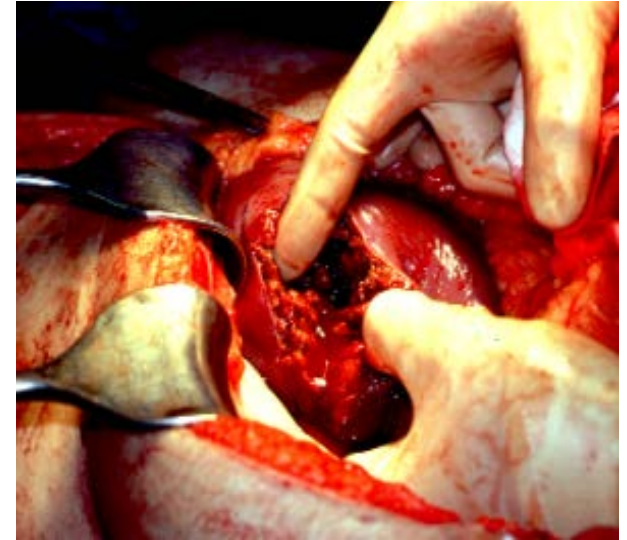
- Out of scope for GPs including FP-ESS docs.
- Challenge for any surgeon, esp. community surgeons.
- Skills covered in DSTC course but requires further experience and reinforcement for realistic competency.



# A. Stopping the Bleeding

## Damage Control Laparotomy

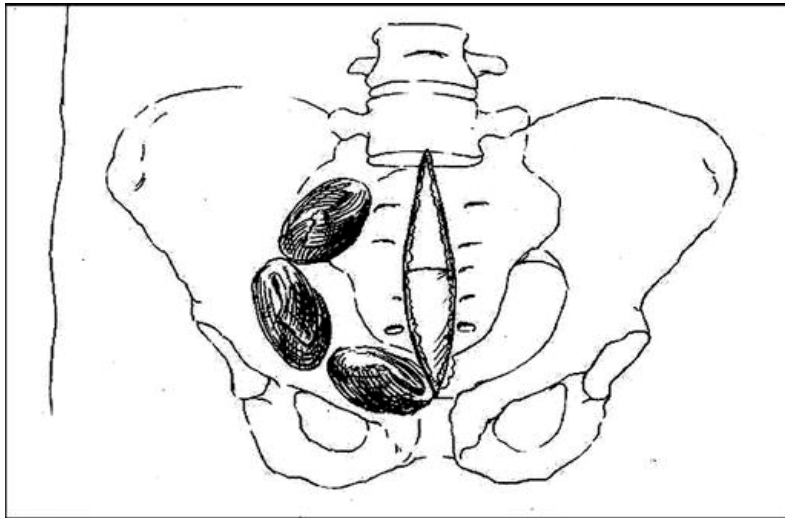
- Hemostasis
  - Liver packing,
  - Splenectomy, nephrectomy
  - Mesenteric ligation
- Contain GI contamination
- Abbreviated closure (VAC)



## A. Stopping the Bleeding

# Pre-peritoneal pelvic packing

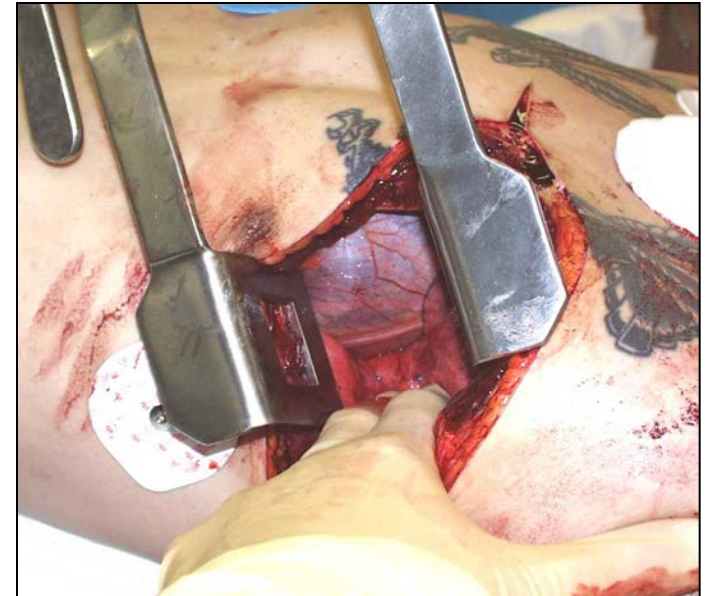
- DC Laparotomy
- Pelvic packing



# A. Stopping the Bleeding

## ED Thoracotomy, Cardiorrhaphy

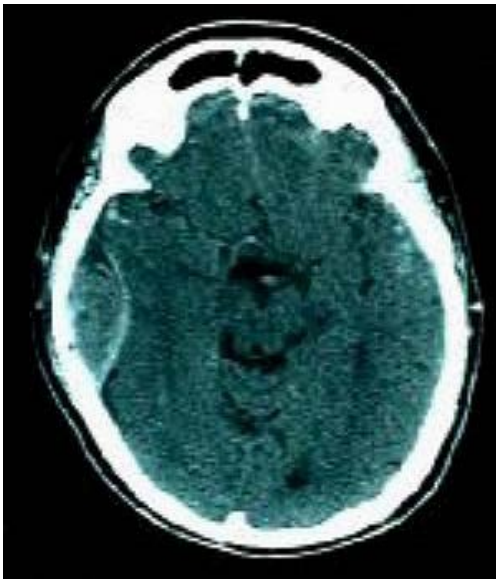
- DC Laparotomy
- Pelvic packing
- EDT vs. pericardiocentesis





# CNS

- 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

**ATLS + STB**

## Operations:

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

**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)

**ESS**

## 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

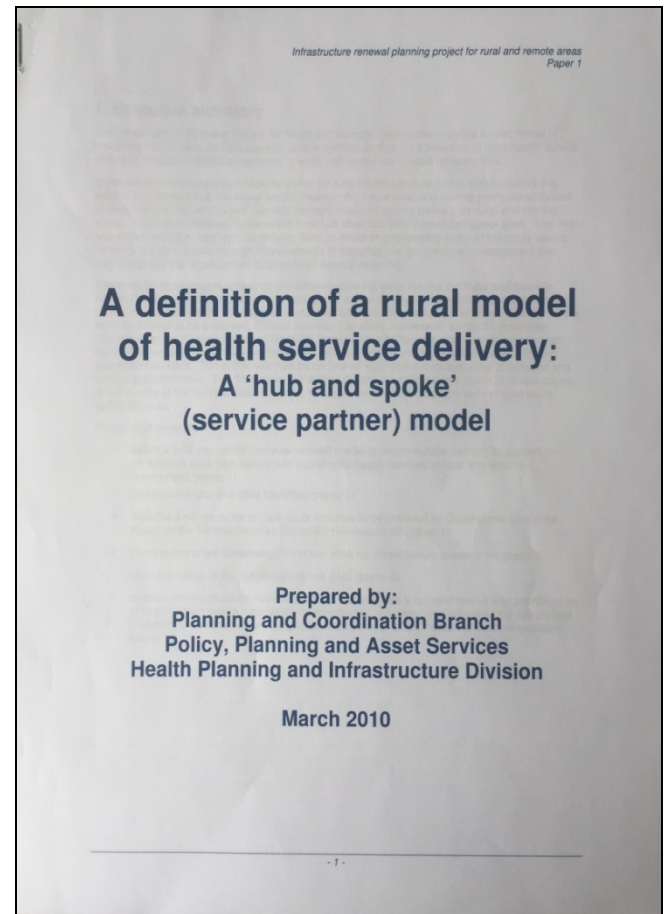
**DSTC + Mini Fellowship** 61

# 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





# Index Case - Outcome



Made it to VGH:

- 8u PRBC, 4u FFP
- 20 L normal saline
- On 40 mcg Levophed
- SBP 70, SaO<sub>2</sub> 82%
- Full on ACS

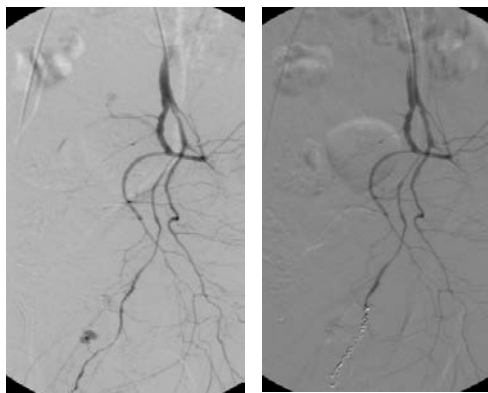
Massive transfusion

Decompressive laparotomy

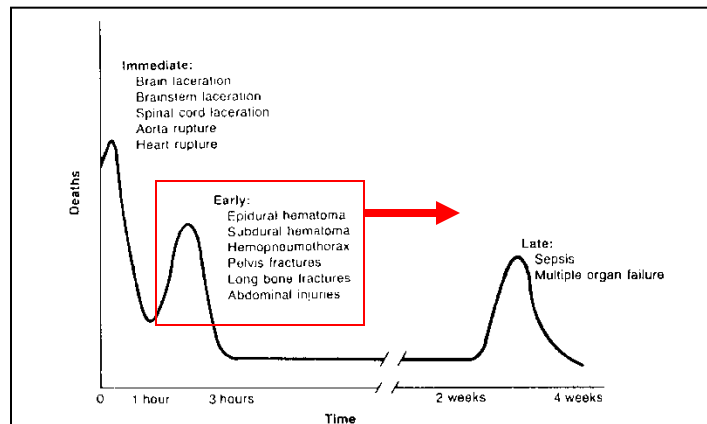
Pelvic angio-embolization

Multiple ORs

Discharged to rehab day 27



# Index Case - Lessons



**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.

- 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

