Trauma: The ideal system a view from the West
Trauma System, CRHA

Trauma Patient - EMS Response

PHI ≥ 4
Tertiary Trauma Centre
FMC & ACH

PHI < 4
District Trauma Centre
PLC & RGH
41F Motor vehicle rollover

- Arrives awake. BP 138/76. P 90
- C/o mild diffuse aches and pains.
- CBC, CXR
- Admitted
- Spines cleared.
41F Motor vehicle rollover

- Day 1, Confused
- Repeat CBC, Hgb 66
- Transported by ground, BLS to tertiary trauma centre. 2 hours.
41F Motor vehicle rollover

• Received by trauma Team. ED Physician, RN’s, RT, surgery, Radiology tech.
• BP 100/78, P105, GCS 14
• ABC’s. Spinal precautions, CXR, PXR, Complete spines, CT head C spine, abdomen/pelvis.
• Ongoing bleeding - Lap/packing for liver injury.
• Additional injuries
  – C2 # - Halo
  – Facial # - Non op
Thag Anderson becomes the first fatality as a result of falling asleep at the wheel.
30M Motor bike crash

- Transported to regional centre
- 20 minutes by EMS, Spine board, IV’s, O2
- GCS 8
- 80/60, p130
In Canada, there are approximately 1.04 million potential years of life lost prematurely due to all causes of death. Overall, deaths due to trauma are the second leading cause of potential years life lost (PYLL). There were 305,439 potential years life lost prematurely due to injury in 1996, representing 29% of the total Canadian PYLL in 1996.

For those aged 1 to 44 years, however, deaths due to trauma remain the leading cause of potential years life lost (PYLL). A total of 261,015 potential life years were lost in this age group due to injury accounting for almost half (47%) of the total Canadian PYLL in 1996.
30M Motor bike crash

- ABC’s by ED team, Intubated, 2 IV’s, crystalloid and blood, initial bloodwork, ABGs, CXR, PXR
- Obvious shock and extremity injuries.
- Trauma Team Activation - GS, Ortho
30M Motor bike crash

- To OR for persistent hypotension 88/60, p120 post 2 units PRBCs
- Transport team activated, transport from ICU immediately post op to Tertiary trauma centre. Ongoing resuscitation and rewarming.
30M Motor bike crash

- Tertiary Trauma team receives patient. CT head, C spine, abdomen pelvis
- CT Head mild diffuse edema, no hemorrhage
- Angio-embolization of R int. iliac, repacked
- To ICU, correct coagulopathy, acidosis
- ORIF Pelvis day 2.
30M Motor bike crash

- ICU day 2-10, SIRS, Sepsis. ARDS, Coma
- Gradual recovery
- Day 11-20 Trauma Service. DVT - PE Anticoagulated. Gradual CNS recovery
- Day 21 transferred to MSSK rehab. Outpatient brain injury follow-up.
- Trauma and Ortho follow-up.
Crown: We would have Dr Kortbeek recognized as an expert in trauma.

Judge: The court recognizes Dr Kortbeek as an expert witness in Trauma for the purposes of these proceedings.

Judge: (To witness) what is Trauma anyway? E.R. right?
Trauma
Triage
Hospital standards
Accreditation
The system
Trauma System
Accreditation Guidelines

THE TRAUMA ASSOCIATION
OF CANADA

RESOURCES FOR OPTIMAL CARE OF THE INJURED PATIENT: 1999

COMMITTEE ON TRAUMA
AMERICAN COLLEGE OF SURGEONS
The Trauma Centre

- Complete, Coordinated Efficient Care
- Outreach / Education
- Research
- Registry
- Trauma Systems

- Accreditation / Verification
- Outcomes
Overview FMC

Infrastructure
Admin
Service
Standards
Trauma Bay
Role of the General Surgeon

1. Attendance at Major Trauma Resuscitations, supports the ED Doc in initial resuscitation
2. Mobilizes the hospitals resources for major trauma
3. Provides Immediate OR access
4. Designated receiving service with expertise in trauma care.
Trauma team Activation

- GCS < 9
- Hypotention with BP < 90
- Blood Transfusion en route or on arrival
- GS wound H&N & Trunk
- ED Discretion
- Intubated Patient or Acute Respiratory Failure
- Severe Hypothermia
How do we know we have good trauma centres?

- A) The region and ministry have designated your hospital a trauma center.
- B) The Federal government says we have the best health care system in the world.
- C) The lobby is very nice and shiny.
- D) Meets national minimum standards, (verified) and standard performance measures are published (and public).
41F Motor vehicle rollover

- Alert, Stable. Fellow passenger deceased at scene.
- 20 minutes from regional centre. 12 minutes from rural hospital.
Performance indicators & Questionnaire

- TTLs and ATLS?
- Road trip, who goes? Who admits? Trauma ward/unit? ICU access?
- Quality council, who, what, where and when?
- Pre-hospital times?
- Resuscitation times?
- Time to OR for shock, fractures, craniotomies?
- Outcomes, dead or alive?
- Unrecognized injuries, complications?
How Do We Perform?
Performance Indicators & Outcomes

Welcome to the Liverpool Trauma Website

Welcome to the Trauma Department at Liverpool Hospital, a teaching hospital of the University of New South Wales in Sydney, Australia.

To enjoy the Liverpool Trauma Web Site fully, we invite you to become a member of LivTrauma. You will be able to enjoy Trauma cases and complete multiple choice questionnaires. More interactive sections will be added as we continue to develop the web site. So in the mean time enjoy your Liverpool Trauma web site and click here to become a member.

The thirteenth SWAN Trauma Conference will be held on 29th and 30th July, 2005. Click here for details. Seven international speakers have been confirmed. Book early to avoid disappointment and enjoy the benefits of the early bird rate.

- interim programme for this year's SWAN meeting
- interim programme for this year's SWAN meeting - REGISTRATION FORM
- Click here for submission of free papers
Mortality

Did the patient die at the FMC trauma centre?

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003/2004, n = 860</td>
<td>87</td>
<td>773</td>
</tr>
<tr>
<td>2002/2003, n = 767</td>
<td>92</td>
<td>675</td>
</tr>
<tr>
<td>2001/2002, n = 790</td>
<td>92</td>
<td>698</td>
</tr>
</tbody>
</table>

n = all patients arriving at FMC trauma centre.
Evaluating Trauma Care: The TRISS Method

Major Trauma Outcome Study (MTOS) - a study in which TRISS scoring, age, and mechanism of injury were used to calculate norms for survival in a regression analysis of 80,000 patients with trauma in 139 North American hospitals. The norms were updated in 1990. Patients with a survival probability (Ps) of 0.5 or less are expected to die and those with a Ps greater than 0.5 are expected to live. The Major Trauma Outcome Study cohort has been widely used as a benchmark for comparing outcomes in patients with trauma using the TRISS methodology. It can be used to identify unexpected outcomes in populations and in individual patients.

FMC TRISS 2004

**Fiscal Year: April 1, 2003 - March 31, 2004**

<table>
<thead>
<tr>
<th></th>
<th>z Score</th>
<th>W Score</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Blunt</td>
<td>2.94</td>
<td>2.6</td>
<td>585</td>
</tr>
<tr>
<td>Adult Penetrating</td>
<td>0.93</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>Paediatric</td>
<td>0.23</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Total Subset</td>
<td>3.06</td>
<td>2.62</td>
<td>612</td>
</tr>
</tbody>
</table>

**Data: 1995 – 2004**

<table>
<thead>
<tr>
<th></th>
<th>z Score</th>
<th>W Score</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Blunt</td>
<td>5.54</td>
<td>1.95</td>
<td>3833</td>
</tr>
<tr>
<td>Adult Penetrating</td>
<td>1.84</td>
<td>-</td>
<td>166</td>
</tr>
<tr>
<td>Paediatric</td>
<td>0.61</td>
<td>-</td>
<td>13</td>
</tr>
<tr>
<td>Total Subset</td>
<td>5.80</td>
<td>1.99</td>
<td>4012</td>
</tr>
</tbody>
</table>

For 1995 - 2004, there were 1.99 more survivors per 100 than would have been expected from the major trauma outcome study.
Known Transport Time by Calgary EMS

Time spent transporting patient to trauma centre, direct from scene, by Calgary EMS (responder):
   Yes = Transport time is known (time responder left scene and time responder arrived at trauma centre);
   No = Transport time is unknown (time responder left scene and/or time responder arrived at trauma centre).

- Minimum - Time spent transporting patient to trauma centre by Calgary EMS (responder) where transport time is known (time responder left scene and time responder arrived at trauma centre).
- Maximum - Time spent transporting patient to trauma centre by Calgary EMS (responder) where transport time is known (time responder left scene and time responder arrived at trauma centre).
- Average - Time spent transporting patient to trauma centre by Calgary EMS (responder) where transport time is known (time responder left scene and time responder arrived at trauma centre).

Note: Transport time information provided by Calgary EMS.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Yes</th>
<th>% Yes</th>
<th>No</th>
<th>% No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calgary EMS time documentation</td>
<td>183</td>
<td>82.4%</td>
<td>39</td>
<td>17.6%</td>
</tr>
<tr>
<td>Minimum</td>
<td>2 min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>47 min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>16.6 min</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RESUSCITATIVE PHASE
### Trauma Team Leader (TTL) Response Time

**Was the TTL response time ≤ 20 minutes?**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003/2004, n = 210</td>
<td>202</td>
<td>8</td>
</tr>
<tr>
<td>2002/2003, n = 196</td>
<td>181</td>
<td>15</td>
</tr>
<tr>
<td>2001/2002, n = 231</td>
<td>209</td>
<td>22</td>
</tr>
</tbody>
</table>

- n = all patients with trauma team activation and a known trauma team leader response time (excludes direct admits)
- Unknown trauma team response times (25) excluded from response time analysis.
41F Motor vehicle rollover

- Destination?

- A) Rural hospital 12 min
- B) Regional hospital 20 min
- C) Tertiary trauma 90 min
- D) Mayo Clinic A long time
DEFINITIVE CARE
Femur Fracture

Did the patient have operative management of the femur fracture within 24 hours of arrival to FMC trauma centre?

There was a 70.9% increase in the number of patients qualifying for this indicator this year.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003/2004, n = 53</td>
<td>51</td>
<td>2</td>
</tr>
<tr>
<td>2002/2003, n = 31</td>
<td>25</td>
<td>6</td>
</tr>
<tr>
<td>2001/2002, n = 55</td>
<td>50</td>
<td>5</td>
</tr>
</tbody>
</table>

n= all patients with operative management of femur fracture.
Delayed Diagnosis/Missed Injury

Did the patient have a delayed diagnosis or missed injury during hospitalisation at the FMC trauma centre?

Of the missed injuries, 62.5% were extremity, 18.8% were spinal, 12.5% were thorax, and 6.2% were facial.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001/2002, n = 764</td>
<td>46</td>
<td>718</td>
</tr>
<tr>
<td>2002/2003, n = 741</td>
<td>32</td>
<td>709</td>
</tr>
<tr>
<td>2003/2004, n = 839</td>
<td>16</td>
<td>823</td>
</tr>
</tbody>
</table>

n = all patients admitted to FMC Trauma Centre.
### Admitting Physician

Was the patient admitted under a surgeon or intensivist at the FMC trauma centre?

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003/2004, n = 838</td>
<td>809</td>
<td>29</td>
</tr>
<tr>
<td>2002/2003, n = 740</td>
<td>718</td>
<td>22</td>
</tr>
<tr>
<td>2001/2002, n = 764</td>
<td>752</td>
<td>12</td>
</tr>
</tbody>
</table>

n = all patients admitted to FMC Trauma Centre.

NOTE: Excludes patient admitted for palliative care.
What is a trauma system?

- Delivers access to the appropriate level of organized trauma care to the inhabitants of a defined geographic area.

- Right patient, right place, right time!
What Are The Issues?

- Time from injury to tertiary care can be up to 12 hours in Alberta
- Trauma care across Alberta variable
- Tertiary Trauma services are confined to large urban centres
- Golden hour of trauma care - Trauma patients must reach definitive care quickly to minimize death or disability.
Surface transport extremely difficult or non-existent; winter transportation hazardous, time consuming.

'Golden hour' may extend to hours / days.

Prehospital care provided by municipalities; determined by local medical direction, not provincial or national standards.
Proposed Sites

Level 1 Trauma Centres:
- Calgary
- Edmonton

Proposed Level II Trauma Centres:
- Lethbridge
- Medicine Hat
- Red Deer
- Grande Prairie
- Fort McMurray
Merger’s & Acquisitions

Committee

Triage

Joint training & research

Policies & procedures

Cross appointments & privileges
# Pre-Hospital Index

<table>
<thead>
<tr>
<th>Blood Pressure:</th>
<th>Respiration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;100</td>
<td>Normal</td>
</tr>
<tr>
<td>86-100</td>
<td>Laboured / Shallow</td>
</tr>
<tr>
<td>75-85</td>
<td>&lt;10 / min or needs intubation</td>
</tr>
<tr>
<td>0-74</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulse:</th>
<th>Consciousness:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;120</td>
<td>Normal</td>
</tr>
<tr>
<td>51-119</td>
<td>Confused / Combative</td>
</tr>
<tr>
<td>&lt;50</td>
<td>No Intelligible Words</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Penetrating Trauma Abd/Chest:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Yes</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Score: 0-20
The Pine Lake Tornado as viewed from space. The Pine Lake Tornado was rated as an F3 on the Fujita Tornado Damage Scale by Environment Canada. The satellite images show the development of the cell as it travels eastward towards Pine Lake. The cell that spawned the tornado was well lit by a late afternoon sun and was clearly visible from Red Deer, Lacombe and points on Highway 2.

Note the well developed southern edge of the cloud. This cloud formation was clearly visible by several amateurs in Red Deer and Lacombe at around 1830 hrs MDT (0030 UTC) some 45 minutes before this satellite photo was taken. This image was taken some 10 to 15 minutes after touch down as the tornado headed east.
Organized trauma systems, which standardize care of the seriously injured, prioritize access to emergency, diagnostic and surgical services, and rigorously measure performance as part of a trauma quality improvement program have, again and again, reduced mortality and morbidity.

Triage systems are well defined. E.g. PHI and MOI.

National standards for Trauma care organization and infrastructure.

Trauma care processes can be defined and measured.

A Trauma system is much more than a great trauma hospital.
Pre-Hospital Index

- PHI: 0 - 3
  - Surgery, 3%
  - Mortality, 0%

- PHI: 4 - 7
  - Surgery, 22%
  - Mortality, 0%

- PHI: 8 - 20
  - Surgery, 57.9%
  - Mortality, 53%
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Positive Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extrication Time &gt; 20 min</td>
<td>40.0%</td>
</tr>
<tr>
<td>Ejection</td>
<td>22.4%</td>
</tr>
<tr>
<td>Occupant Death</td>
<td>21.4%</td>
</tr>
<tr>
<td>Steering Wheel Deformity Or Structural Intrusion &gt; 20 in</td>
<td>19.0%</td>
</tr>
<tr>
<td>Auto versus pedestrians</td>
<td>17.9%</td>
</tr>
<tr>
<td>Fall &gt; 15 ft</td>
<td>14.3%</td>
</tr>
</tbody>
</table>
### Predictive Value of Scores

<table>
<thead>
<tr>
<th>Triage Tool</th>
<th>Sensitivity</th>
<th>PPV</th>
<th>Specificity</th>
<th>NPV</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHI Alone</td>
<td>41%</td>
<td>40%</td>
<td>98%</td>
<td>98%</td>
<td>97%</td>
</tr>
<tr>
<td>MOI Alone</td>
<td>73%</td>
<td>18%</td>
<td>91%</td>
<td>99%</td>
<td>90%</td>
</tr>
<tr>
<td>Combined Score</td>
<td>78%</td>
<td>17%</td>
<td>89%</td>
<td>99%</td>
<td>89%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Triage Tool</th>
<th>Undertriage</th>
<th>Overtriage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHI Alone</td>
<td>59%</td>
<td>2%</td>
</tr>
<tr>
<td>MOI Alone</td>
<td>27%</td>
<td>9%</td>
</tr>
<tr>
<td>Combined Score</td>
<td>22%</td>
<td>11%</td>
</tr>
</tbody>
</table>

\[ P \leq 0.001 \]