Do Trauma Centres Make a Difference?

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Academic Unit, CUHK
The Workers!
Outline

1. Trauma in Hong Kong – burden of disease

2. Definitions
   - History of trauma systems and centres

3. System changes in Hong Kong

4. The future
Facts!

Trauma

- Leading cause of death in the under 40’s
- Heavy burden on society

Death and long term morbidity after major injury depends on

- Severity of injury
- Standards of treatment
- Time to receive optimal care
Mechanisms of Major Trauma
2001-2006 (PWH)
Do Trauma Centres Make a Difference?

- What is a Trauma Centre?
- What does it mean to make a difference?
‘Trauma’

Greek word - ‘bodily injury’

‘Optimal Hospital Resources’ for Care of the Injured Patient 1976’. American College of Surgeons

‘Resources for Optimal Care of the Injured Patient 1990 - 99’. American College of Surgeons
History of Trauma Centres
History of Trauma Centres

Military

- 1800s Napoleonic wars
  - First trauma centres

- 1950/60s Korean conflict/Vietnam war
  - Minimise time to definitive care

Civilian

- 1970s Civilian
Early Beginnings

West JG and others
• Systems of Trauma Care: a study of two counties. Arch Surg 1979
• Impact of regionalisation. The Orange County experience. Arch Surg 1983

‘Trauma systems reduce preventable deaths’.
Early Beginnings

Champion HR et al
• Improvement in outcome from trauma centre care.
  Arch Surg 1983

- 6 years historical study
- Compare years 1-2 with 5-6
- Trauma resuscitation system
- Major trauma: ISS>15
- 13.44 excess survivors per 100 patients
Facts?

- Mortality and morbidity after major injury are REDUCED by:
  - Early, effective resuscitation.
  - Rapid transport from the scene to ....
  - Appropriate hospital.
    - Definitive care.
Trauma Center

- Clear United States criteria

Components:
- Administrative
- Operational/Clinical
- Qualitative Principles
- Quantitative Practicalities

- Leadership System
- Development
- Legislation
- Finances

- Prevention
- Number / Training
- Definitive Care
- Evaluation / Audit
- Staff
- Prehospital Care
- Information system
- Research
Purpose of Trauma System

To match a facility’s resources with a patient’s needs so that optimal and cost effective care is achieved
6/8 Trauma System Characteristics

1. Legal authority assigns agency
2. Formal, public process for trauma centre designation
3. Continuum of services
4. Triage criteria including bypass
5. Seriously injured patients access trauma centre
6. Trauma centres strategically located
7. Agency monitors care
8. Continuous audit of processes
# Trauma Centre Designation and Trauma Systems – Example

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Level</th>
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Trauma Centre

- Immediately available, on site, 24 hours a day
  - Emergency physicians
  - Surgeons
  - Anaesthetists
  - Nurses
  - Equipment

Specialists
- Trained
- Experience
A systematic review and meta-analysis comparing outcome of severely injured patients treated in trauma centers following the establishment of trauma systems. J Trauma. 2006.
Any reductions in mortality from regionalising major trauma care in shire areas of England would probably be modest compared with reports from the United States.

Nicholl J and Turner J. Effectiveness of a regional trauma system in reducing mortality from major trauma: before and after study. BMJ. 1997

- Controlled before an after study
- Trauma Centre v Two ‘control’ regions
- ISS>15
- No difference in mortality
Tension???

- Few high quality Trauma Centres (and many other non-TCs)
  - Much experience and resources for a few
  - Little experience and resources for others

OR

- Many ‘moderate/low’ quality Trauma Centres
  - Moderate experience for everyone!
Inverse Relationship Between Volume and Mortality!

Trauma Centres:

Low-volume (< 140 Pts) v High-volume (> 200 Pts)

Odds Ratio for Mortality: 1.3 (95% CI 1.01-1.66; P = 0.04).

Smith RF and others.
The impact of volume on outcome in seriously injured trauma patients: two years' experience of the Chicago trauma system.
J Trauma. 1990.
Freeman J, Nicholl J, Turner J.


- ISS >15
- 14 emergency departments
- 5 to 96 patients per year!

……. evidence that patients with complex needs, such as the multiple injured or those with head injuries, had better outcomes [in higher volume centres].
‘only volume of patients treated had a direct impact on survival outcome.’

Pasquale MD, et al.
Outcome analysis of Pennsylvania trauma centers: factors predictive of non-survival in seriously injured patients.
J Trauma. 2001

- Retrospective analysis
- Adults
- 13,942 patients
- Logistic regression
No Critical Relationship Between Volume and Survival: > or < 240 Patients!

12,254 patients
Trauma Centres – Level I better than Level II:

- Lower mortality
- Better functional outcome

*Ann Surg 2005*

The effect of trauma center designation and trauma volume on outcome in specific severe injuries.

Demetriades D and others.
‘…designated trauma centers [must] see a high volume of seriously injured patients.’
Trauma Centre Criteria: Volume and Severity

- **Trauma admissions**: 1,200 per year
- **Patients with ISS>15**: 240 per year
- **35 patients per surgeon**
ISS > 15

Criteria: Patients with ISS>15 = 240 per year

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Count</th>
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<tr>
<td>PMH</td>
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<td>PWH</td>
<td>150</td>
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<tr>
<td>QEH</td>
<td>228</td>
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<tr>
<td>QMH</td>
<td>62</td>
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<tr>
<td>TMH</td>
<td>71</td>
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Major Trauma in Hong Kong
2006

Total major trauma cases
Per year
=610

Hong Kong only needs TWO or THREE trauma Centres at the most
Trauma Diversion 5 Steps

1. Cardiac arrest OR 2. Cannot maintain airway & breathing

3. Does the patient fit any physiological criteria?
   - NO
     - Closest Hospital
   - Yes
     - Trauma Centre

4. Does the patient fit any anatomical criteria?
   - NO
     - Closest Hospital
   - Yes
     - Trauma Centre

5. Exclusion criteria?
Trauma ‘Diversion’:
Primary Diversion
Secondary Transfer
### Appropriateness of Diversion in PWH 2006

<table>
<thead>
<tr>
<th>Appropriateness of diversion</th>
<th>No. of patients (Total 136)</th>
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<tbody>
<tr>
<td>Correct Diversion</td>
<td>106 (77.9% on diverted patients)</td>
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<tr>
<td>Over Diversion</td>
<td>13 (9.6% on diverted patients)</td>
</tr>
<tr>
<td>Under Diversion</td>
<td>17 (12.5% on diverted patients)</td>
</tr>
<tr>
<td><strong>Total % of correct diversion</strong></td>
<td><strong>1521 - (13 + 17)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1521 (Total no. of trauma in NTEC)</strong></td>
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<tr>
<td></td>
<td><strong>= 98%</strong></td>
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</table>
Call to Closest hospital (ANHN/NDH) 40min

+ 

Closest hospital to PWH 137 min

Secondary diversion 177min

PTD Call to PWH 49 min

Average Time Saved 128min
Primary Trauma Diversion in HA hospital
## Pilot Study and Roll Out

<table>
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<tr>
<th>Clusters</th>
<th>Trauma Service Networking</th>
<th>Date</th>
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<tr>
<td>NTEC</td>
<td>AHNH → PWH</td>
<td>07. Nov. 2003</td>
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<tr>
<td></td>
<td>NDH → PWH</td>
<td>01. Sept. 2004</td>
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<td>Paediatric Trauma diversion</td>
<td>13. June. 2005</td>
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<tr>
<td>HKWC</td>
<td>RH → QMH</td>
<td>01. April. 2005</td>
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<tr>
<td>NTWC</td>
<td>YCH → PMH</td>
<td>01. Jan. 2006</td>
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<tr>
<td>KCC</td>
<td>TKOH → QEH</td>
<td>01 Jul. 2006</td>
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Pediatrics Trauma Diversion (Age<12)

Jun 2005 – Dec 2006 (1.5 Year)

30 Patients

16 (53%) PTD
- 4 (25%) major trauma
- 12 (75%) minor trauma

12 (75%) correct diversion
4 (25%) over diversion

14 (47%) STD
- 4 (26%) major trauma
- 10 (71%) minor trauma

8 (57%) correct diversion
4 (29%) under diversion
2 (14%) self-attended
Do trauma teams make a difference?
A single centre registry study

Timothy H. Rainer*, N.K. Cheung, Janice H.H. Yeung, Colin A. Graham

<table>
<thead>
<tr>
<th>Variables</th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>P-value</th>
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<td>( P_s ) groups</td>
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<tr>
<td>0–0.25</td>
<td>152000</td>
<td>0–( \alpha )</td>
<td>0.9776</td>
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<tr>
<td>0.26–0.50</td>
<td>0.6</td>
<td>0.03–10.1</td>
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<td>0.51–0.75</td>
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<td>0.76–0.95</td>
<td>1.4</td>
<td>0.5–4.1</td>
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<td>0.96–1.00</td>
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<td>0.1–4.4</td>
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\( *P_s \), probability of survival.
W Score for Survivors
- Whole Process from Injury to Death or Discharge
Trend of W Score - UK

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<tr>
<th>Years</th>
<th>Excess Survivors</th>
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<tr>
<td>1997</td>
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<td>1998</td>
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<td>2006</td>
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<td>2001-2006</td>
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Hospital Trauma System:
- Trauma Team
- Trauma Team Activation
- Trauma Committee
- Monthly Audit Meeting
- Guidelines and Protocols

Pre-Hospital Trauma Diversion
Survival in PWH 2006 Compared with US Database

- **W Score** 1.44
  - = 1.44 more Survivors than predicted/100 patients

- **Z Score** 1.69 (± 1.96 SD)
  - Difference is not significant

- **M Score** 0.96 (>0.85)
  - Case mix is comparable
Survival in 2006
Compared with UK Database

- **W Score** 3.8
  - = 4 more Survivors than predicted/100 patients

- **Z Score** 4.11
  - Difference IS significant

- **M Score** 0.95
  - Case mix is comparable
Key Points

- **Concentrated resources in a SPECIALIST CENTRE** is better than diluted resources in many small centres

- **Shorter TIME to DEFINITIVE CARE** improves morbidity and reduces mortality

- **Patients with major injuries should arrive at the TRAUMA CENTRE AS SOON AS POSSIBLE**
  - Bypassing nearest hospital;
  - Transfer to trauma centre
Conclusions

- Mortality statistics
  - Equivalent to US average
  - Better than UK average?

- Hong Kong does not need more than THREE Trauma Centres
Thank You!
HA 5 Trauma Centre
Trend of W Score _USA

HA Central Committee on Trauma Service:
- Established 5 Trauma Centre
- Trauma Team
- Trauma Team Activation
- Trauma Nurse coordinator
- Annual Trauma Audit and report
- Primary Trauma Diversion

<table>
<thead>
<tr>
<th>Years</th>
<th>W score</th>
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<td>1996</td>
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