The role of a Neurotrauma Protocol in the retrieval of patients with TBI

Dr Mark Elcock
Senior Director
Retrieval Services & Counter Disaster Unit
Queensland Department of Health
Presentation Outline

- Background and History
- Review of Retrospective Data
- Summary
Retrieval Services in Queensland prior to August 2004

- Emergency Departments
- Intensive Care Units
- RFDS
- Careflight Queensland

- Fragmented & Regional
- Uncoordinated tasking
- No strategic direction or oversight
- Inconsistent decision making
- Inefficient coordination
- Non standardised
  - Credentialing & Training
  - Policy & Operating Procedures
  - Quality & Safety Review
  - Retrieval teams
Evolution of Retrieval Services

- **Between 2004-2006**
  - Consolidation into 2 Hubs (North & South)
  - Separate clinical models and providers
- **Post January 2006**
  - Retrieval Services Queensland and QCC
  - Statewide Coordination with standardised SOP
  - Single retrieval provider and standard datasets
  - Single governance
- **Potential for before and after comparisons**
North Queensland

- 0.927 (1.7) million km²
- 0.74 (4.66) million people
- 1 Tertiary Centre Townsville (Neurosurgery)
- 3 Regional Centres; Cairns, Mount Isa & Mackay
- Trauma; High death & separation rate
- Relatively self sufficient
By Comparison

Thursday Island to Brisbane – 2200km
Auckland to Sydney – 2178km
Cairns to Brisbane – 1434km
Cape Reinga to Stewart Is – 1397km
North Queensland Neurotrauma Protocol

Background

- Minimal politics and good clinical networks in NQ
- Single neurosurgical centre in NQ
- Neurosurgical Society of Australasia Guidelines.
- Streamlining of processes was commenced in 2003.
- Endorsed by TTHTRC, NAHS ED Network & NAHS CEO

Objectives

- Reduce time to definitive care & improve patient outcomes.
- Rapid access to neurosurgical definitive care, < 2 hours from Cairns and Mackay.
- Maximise efficiency of aeromedical retrieval systems.
- Simplification of communication and referral pathways.
Inclusion Criteria

- Patients retrieved, resourcing the most appropriate transport and escort, to TTHED as rapidly and safely as possible:
  - Glasgow Coma Scale (GCS) $\leq 9$ attributable to a clinically obvious head injury.
  - Deteriorating head injury with falling GCS.
  - Compound head injury.
  - Acute, surgically correctable lesion on CT scans.
Neurotrauma Protocol Fundamentals

- Aeromedical cases only.
- Bypassing of smaller or usual referral facilities (P or IHT)
- Rapid referral to QCC and Medical Coordinator
- Centralised decision making and tasking
- Retrieval direct to TTH irrespective of ICU bed status
- Streamlined communication (internal and external)
- Consultant to Consultant discussions
- TTHTRC and Queensland Trauma Registry will perform a review of outcomes occurring as a result of the implementation of the Protocol.
Prior to 2006
- Patchy take up and dissemination
- No resources for education
- Evolving system
- Still not fully integrated

Post 2006
- Concerted roll out
- Standardised system
- Dedicated resources
- Improved data
- Central governance
Comparison; Before & After

Combined with other standardised practices, had it and other initiatives made any difference?

Jan 2009; It was decided to perform a pre and post review of the impact of the NQ Neurotrauma Protocol.

“Do formal protocols reduce the time to definitive care”

- Ethics approval
- Queensland Trauma Registry Reports requested.
Major intracranial injury transferred to The Townsville Hospital for definitive care between 1\textsuperscript{st} January 2004 and 31\textsuperscript{st} January 2008.

- In total, 223 patients transferred to TTH following intracranial injury, as defined by NDSIS V2.1.
- Comparison of two time periods
  - Time Period 1
    - 01/01/04 to 15/01/06; 106 patients
  - Time Period 2
    - 16/01/06 to 31/01/08; 117 patients

Report and data supplied by the Queensland Trauma Registry (May 09)
## Comparative Age/Sex/Mechanism Data

<table>
<thead>
<tr>
<th></th>
<th>TIME 1 (n=106)</th>
<th>TIME 2 (n=117)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>74% (78)</td>
<td>78% (91)</td>
</tr>
<tr>
<td>Predominant Age Group Male</td>
<td>40-49yrs (19)</td>
<td>20-29yrs (23)</td>
</tr>
<tr>
<td>Predominant Age Group Female</td>
<td>0-9yrs (9)</td>
<td>20-29yrs (6)</td>
</tr>
<tr>
<td>Injuries &lt; age 50 Male</td>
<td>76%</td>
<td>78%</td>
</tr>
<tr>
<td>Injuries &lt; age 60 Female</td>
<td>82%</td>
<td>73%</td>
</tr>
<tr>
<td>External Cause of Injury</td>
<td>Falls/Collision 53% RTC 38%</td>
<td>Falls/Collision 55% RTC 40%</td>
</tr>
</tbody>
</table>
## Comparative Types of Injury

<table>
<thead>
<tr>
<th>Condition</th>
<th>Time 1 (n=106)</th>
<th>Time 2 (n=117)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subdural Haematomas</td>
<td>51</td>
<td>69</td>
</tr>
<tr>
<td>Contusions</td>
<td>37</td>
<td>39</td>
</tr>
<tr>
<td>Vault Fractures</td>
<td>32</td>
<td>29</td>
</tr>
<tr>
<td>Basilar Fractures</td>
<td>27</td>
<td>30</td>
</tr>
<tr>
<td>Extradural Haematomas</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td>SAH</td>
<td>16</td>
<td>27</td>
</tr>
<tr>
<td>Oedema</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>ICH</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>DAI</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
## Comparative Referral Patterns

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Time 1 (n=106)</th>
<th>Time 2 (n=117)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cairns Base</td>
<td>36</td>
<td>41*</td>
</tr>
<tr>
<td>Mackay Base</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>Mount Isa Base</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Ayr</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Charters Towers</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Atherton</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Proserpine</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Seen at two Hospitals before referred to definitive care</td>
<td>12</td>
<td>21</td>
</tr>
</tbody>
</table>
## Transfer Time Frames

<table>
<thead>
<tr>
<th>Transfer Time Frame</th>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Pts</td>
<td>Median</td>
</tr>
<tr>
<td>Time to retrieval time activation</td>
<td>34</td>
<td>110min</td>
</tr>
<tr>
<td>Time spent at referring hospital</td>
<td>74</td>
<td>50min</td>
</tr>
<tr>
<td>Total Transfer Time</td>
<td>77</td>
<td>121min</td>
</tr>
</tbody>
</table>

**Variables to note:**
- Improved data collection between T1 & T2
- New CT Scanners (Mt Isa and Proserpine)
- Increased proportion of long distance transfers (Mt Isa doubled in T2)
# Outcome Measures

<table>
<thead>
<tr>
<th></th>
<th>Time 1 (n=106)</th>
<th>Time 2 (n=117)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median LOS</td>
<td>8.5 days</td>
<td>10 days</td>
</tr>
<tr>
<td>IQR LOS</td>
<td>4-18 days</td>
<td>5-17 days</td>
</tr>
<tr>
<td>Bed Days</td>
<td>1323 days</td>
<td>2650 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ICU admission</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICU Median LOS</td>
<td>65% (69)</td>
<td>68% (79)</td>
</tr>
<tr>
<td>IQR LOS</td>
<td>4 days</td>
<td>4 days</td>
</tr>
<tr>
<td>ICU Bed Days</td>
<td>2-8 days</td>
<td>1-9 days</td>
</tr>
<tr>
<td></td>
<td>410 days</td>
<td>446 days</td>
</tr>
<tr>
<td><strong>Death Rate</strong></td>
<td>12% (13)</td>
<td>14.5% (17)</td>
</tr>
</tbody>
</table>
“Do formal protocols reduce the time to definitive care”

**MEASURE: Time to Urgent Craniotomy**

<table>
<thead>
<tr>
<th>Patient Status</th>
<th>Time 1 (n=106)</th>
<th>Time 2 (N=117)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Patients requiring urgent craniotomy</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Craniotomy within 4 hours</td>
<td>16 (61.5%)</td>
<td>23 (82.14%)</td>
</tr>
<tr>
<td>Craniotomy not performed within 4 hours</td>
<td>10 (38.5%)</td>
<td>5 (17.86%)</td>
</tr>
</tbody>
</table>

>50% reduction in Craniotomy NOT performed in 4 hours
Summary of Findings

- Age and sex distribution: similar
- External cause and type of injury: similar
- Referral patterns: similar
- Transfer time frames: T2 activation times worse
- Outcome measures and death rates: similar
- Time to urgent craniotomy: Marked Improvement

Needs another review, from 2008 to now, more specific to the urgent craniotomy cohort; Outcomes may be different.
NQ Neurotrauma Protocol

Where was the difference between T1 and T2?

Patient meeting criteria

Patient associated with CBHED/MBHED or Peripheral hospital

Contact QCC 1300 799 127

QCC will contact TTHED Floor Consultant and relay clinical details and ETA

Neurosurgical Registrar/Consultant on call

1. Fast track anaesthetist
2. Operating theatres

RFDS Mt Isa/Cairns Primary Response

Intensive Care Consultant

Rate Limiting Step
Summary

• Not particularly scientific
  – Small numbers, incomplete data, multiple variables

• Sadly, no improvement in retrieval time frames but similar review of major non-intracranial injury showed improvement in all transfer time frames (ENoTG).

• A Neurotrauma Protocol does reduce time to urgent craniotomy in NQ, with main improvements due to improved in-hospital communications, processes and logistics.

INTEGRATED TRAUMA AND RETRIEVAL TEAMS AND SYSTEMS WORK
High Performance Teams
Addendum

- Increased education in NQ and statewide roll out of Early Notification of Trauma Guidelines.
- Further alignment and centralisation of RFDS primary and IHT response and procedures in NW Queensland.
- Expanded to all Neurosurgical Emergencies; SAH.
- Principles expanded to South Queensland where there are 3 neurosurgical centres. If all full, QCC decides. Clinician buy in fundamental.
- Similar principles now being implemented in STEMI and CVA across Queensland.
- Translation to New Zealand?
Thank You

Questions/Comments

Thanks to;

Queensland Trauma Registry
• Natalie Dallow
• Judith Brennan