Management of Acute Spinal Cord Injury

Charles Greenough

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The Problem

569 Admissions to Sheffield Spinal Centre

• 52 cord injuries missed at presentation (9 %)
• Median delay 4 days (10 hours – 6 weeks)
• 26 mismanaged (50 %)
The Problem

52 Missed injuries

Where?
The Problem

52 Missed injuries

- C 1/2 1
- C3 – C6 28
- C7/T1 4
- Thoracic 14
- Lumbar 5
The Problem

26 mismanaged patients

- 7 developed a deficit
- 19 deteriorated, 9 to complete paralysis
- 6 died
The Problem

Associated features (52 patients)

- 36 multiple trauma
- One third significant head injury
- 13 early ventilation
- 9 alcohol
- 7 “hysteria”
The Problem

Radiological features (52 patients)

• 18 poor quality
• 11 failure to demonstrate whole region
• 4 of uninjured region
• 10 unrecognised soft tissue swelling
• 6 no vertebral injury

Poonoose et al. TRAUMA 2002
The Problem

1998 Admissions to Hexham Spinal Centre

- Average delay – 44 Days
- Avoidable Complications – 40%
THINK SPINAL INJURY
Think Spinal Injury

- Road traffic accident
- A fall or jump from a height
- Impact or crash injuries
- Multiple trauma
- Loss of consciousness
- Back or neck pain or guarding
Distribution of Spinal Fractures in a Major Centre

<table>
<thead>
<tr>
<th>Region</th>
<th>Distribution</th>
<th>Neuro-deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical</td>
<td>62 %</td>
<td>75</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 - T10</td>
<td>15 %</td>
<td>88 %</td>
</tr>
<tr>
<td>T11 - L2</td>
<td>20 %</td>
<td>70 %</td>
</tr>
<tr>
<td>L3 - L5</td>
<td>3 %</td>
<td>59 %</td>
</tr>
<tr>
<td>Sacrum</td>
<td>0.3 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>
Multiple Fractures

Occur in 4.5 percent

Three major patterns :-

- Primary C 4-7    Secondary T11-L5
- Primary T 1-4    Secondary C1-7
- Primary T 12- L2 Secondary L4-L5
CARE OF ACUTE SPINAL CORD INJURY
Handling Cord Injury Patient

- Neutral supine position
- Immobilise Cervical Spine
Breathing - Observation

- Presence, rate & depth of respiration's
- Asymmetry of the chest
- Paradoxical breathing in cervical injuries

What?
- Cough impaired in cervical & thoracic injuries
- Increased risk of aspiration and consolidation of secretions
Paradoxical Breathing

- **Breathing IN**
- Diaphragm contracts
- Chest drawn IN
- Abdomen pushed OUT

- **Breathing OUT**
- Diaphragm relaxes
- Chest pushed OUT
- Abdomen drawn IN
Breathing - Observation

• Presence, rate & depth of respiration's
• Asymmetry of the chest
• Paradoxical breathing in cervical injuries
• Cough impaired in cervical & thoracic injuries
• Increased risk of aspiration and consolidation of secretions
Breathing - Action

• Continuously monitor oxygen saturation levels
• Monitor and maintain Sa 02 - 95% or above
• Administer oxygen
• Dry O2 for short term use only. If longer O2 required then it should be humidified
• Monitor blood gases regularly
• Elective ventilation may be needed
Deterioration of Respiratory Function

Why?
Deterioration of Respiratory Function

- Fatigue of innervated muscles
- Chest trauma
- Ascension of spinal cord lesion
- Retained secretions
Intubation

- Neutral cervical position
- BEWARE Vaso-Vagal shock *(What?)*
- Pre-oxygenate
- Hyperventilate
- Topical anaesthetic
- Atropine – How Much?
Vaso-Vagal Shock

- Interruption sympathetic control
- Sympathetic Outflow?
- Sensory distribution of Vagus?
- Blood pressure falls - loss of vasomotor control
- Heart rate slows - unopposed action of vagus nerve
Intubation

- Neutral cervical position
- BEWARE Vaso-Vagal shock
- Pre-oxygenate
- Hyperventilate
- Topical anaesthetic
- Atropine – *How Much?*
Intubation

- Neutral cervical position
- **BEWARE** Vaso-Vagal shock
- Pre-oxygenate
- Hyperventilate
- Topical anaesthetic
- Atropine – 0.3 – 0.6 mg
Neurogenic Shock

- Interruption sympathetic control
- T6 and above
- Blood pressure falls - loss of vasomotor control
- Heart rate slows - unopposed action of vagus nerve
- BEWARE concealed blood loss in anaesthetic patient
Neurogenic Shock

- Hypotensive
- Bradycardic pulse of good volume
- Peripherally warm and dry
Circulation - Action

- Monitor BP
- Maintain a systolic BP of 90 - 100 mmHg
- Urinary output of 30 mls per hour
- Administer IV fluids
- NB. DO NOT over infuse
- Inotropes may be necessary
- CVP line may be indicated
Circulation - Observation

- Bradycardia

Action?
Circulation - Action

• Rate < 40 - Atropine How Much?

• BEWARE Abnormal Vaso-Vagal response
  – Logrolling too quickly
  – tracheal suction
  – N.G. tube

• Thoracic injuries - cardiac contusion - arrhythmia
Circulation - Action

- Rate < 40 - Atropine 0.3 – 0.6 mg
- BEWARE Abnormal Vaso-Vagal response
  - Logrolling too quickly
  - tracheal suction
  - N.G. tube
- Thoracic injuries - cardiac contusion - arrhythmia
Pressure Sores

Causes ?
Pressure Sores

- Lack of sensation
- Lack of muscle activity below the level of injury
- Reduced microvascular circulation
Skin - Observation

• Check all pressure areas for any possible causes of local pressure
Skin - Action

- Remove any objects from patients clothing
- Logroll patient to remove foreign bodies
- Heels vulnerable, use a small pillow
- Spinal board - two hours maximum
- Pressure relief 2 hourly
- BEWARE removing straps with head huggers in situ
- Protect risk areas at all times
Temperature

Problem ?
Temperature

- Neurogenic shock - dilated vessels - lose heat
- Inability to shiver
- Hypothermia
Temperature - Action

- Sheet, space blanket then blankets
- BEWARE fire risk oxygen and space blankets
Paralytic Ileus - Observation

- Listen to abdomen for presence of bowel sounds
- Observe for abdominal distension
- Potential risk of stress ulceration

Action?
Paralytic Ileus - Action

- Nil - by - mouth
- Naso-gastric tube - free drainage
- Administer Cimetidine or Ranitidine intravenously
Bladder - Observation

- Avoid over-distension of the bladder
**Bladder - Action**

- Insert foley catheter - free drainage
- Priapism - do not attempt urethral catheterisation
- Supra-pubic catheter (How?)
Bowel Management

• Reflexic Bowel (above conus)
  – Digital stimulation
  – Suppositories
  – Micro enemas
  – Time
  – Bed or toilet
  – CHECK
Bowel Management

• Flaccid Bowel (conus and cauda equina)
  – Digital stimulation
  – Suppositories
  – Enemas
  – Manual evacuation
  – Bed or toilet
  – CHECK
Manual evacuation

• Specific guidance from RCN that this is a necessary and appropriate treatment in the neuropathic bowel

Steroids

NASCIS 2

- Methyl prednisolone 30 mg/Kg  162
- Naloxone 5.4 mg/Kg  154
- Placebo  171
Steroids

NASCIS 2 – All data, intention to treat
Methyl pred Vs. Placebo

<table>
<thead>
<tr>
<th></th>
<th>6/52</th>
<th>6/12</th>
<th>12/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>Sensory</td>
<td>n.s.</td>
<td>p &lt; 0.05</td>
<td>n.s.</td>
</tr>
</tbody>
</table>
### Steroids

**NASCIS 2** – Delivered < 8 hours, one year, percentage recovery of lost motor function

<table>
<thead>
<tr>
<th></th>
<th>Methyl pred.</th>
<th>Placebo</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>7.0</td>
<td>1.6</td>
<td>n.s.</td>
</tr>
<tr>
<td>Incomplete</td>
<td>44.1</td>
<td>20.7</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>
Steroids

NASCIS 2 – Incomplete lesions, one year, percentage recovery of lost motor function

Methyl pred.  Placebo
< 8 hours  44.1  20.7  p < 0.05
> 8 hours  34.1  48.5  p < 0.05
n.s. ?

Best Buy !
Steroids

Two Other RCTs

- Petitjean et al 1998
- Otani et al 1994

- No differences observed at one year
Steroids

Complications

• Infection
• Perforated DU
• Hyperglycaemia
• etc.
Steroids

British Association of Spinal Cord Injury Specialists, June 2000

The use of high dose steroids in the management of spinal cord injury cannot be supported on current evidence

NOT INDICATED
Anticoagulation

- Prophylaxis mandatory
Surgical Management

- Initial Stabilisation
- Decompression
- Post Traumatic Syrinx
- Surgical Stabilisation
Initial Stabilisation

- Cervical Traction
- Regular detailed neurological examination
Surgical Management - Decompression

- Some Neurological recovery invariable in incomplete lesions

- Recovery by at least 1 Frankel grade is normal
Cord Decompression

Effect On Recovery Controversial
– Animal Vs. Human Evidence
  – Complete/Incomplete
  – Speed Of Compression
    » Percussion Injury
  – Cord / Cauda Equina
Neurological Recovery

- Surgery < 24 hours is safe
- Reduction of dislocation early improves Neurology
- Surgery < 24 hours reduces ITU stay and complication rate
- Effect < 12 hours (Tator)?
- STASCIS Trial early results favourable

Cord Decompression

Mandatory

- Major Disc Fragments
- Incomplete Lesions In Kyphosis
- Cauda Equina
- Deteriorating Neurology
Surgical Management

Post traumatic syringomyelia

• Retrospective study of 295 patients with spinal cord injury.
• Mean Follow-up 6.4 years (2-34)
• 172 conservative, 123 surgically treated
Syrinx - conclusions

Post-traumatic Syrinx formation occurred in 20% in a series of 295 patients. It was significantly more common in:

- Patients with # dislocations
- Non Operatively treated patients
- Cervical & Thoracic injuries
Surgical Stabilisation

Allows early rehabilitation

• 33 of 41 mobilised < 3 weeks
• 8 failed to mobilise :-
  – 4 pressure sores
  – 1 head injury
  – 1 failure of fixation
  – 2 decision of rehabilitation team

Basu et al, ISSLS 2002
Surgical Stabilisation

- Cord injury requires modified technique
- No muscle protection
- Two up, two down
Surgical Stabilisation

• Reduces co-morbidity
  – ITU days, ARDS, duration of ventilation
  – (Halo jacket reduces breathing by 50 %)
• Safe in experienced hands
• Allows early mobilisation
• Reduces pain on turning
• Reduces late deformity / syrinx
• Reduces nursing load
Surgical Stabilisation

Requires

• Experienced Spinal Surgeon
  – MUST allow un-braced mobilisation
• Experienced Anaesthetist
• Highly skilled nurses
• Major spinal surgery centre
• Spinal surgeons should see results
Surgical Stabilisation

• Complications of Surgery
  – Anaesthesia (*Most dangerous time?*)
  – Neurological deterioration
  – Infection
  – Wound Healing
  – Instrumentation
    » Misplaced
    » Inadequate
Mobilisation

- The area of necrosis will be surrounded by an area of impaired perfusion
- The acute injury **MUST BE NURSED FLAT**
- Subsequent mobilisation must be preceded by tilt tabling and careful neurological observation
Surgical Stabilisation

Complications of Management

• Pressure Sores can take weeks of bed rest to heal, completely negating value of surgery
• Bowel management is usually poor
• ITU care of skin and bowel often lacking
### Pressure Sore

<table>
<thead>
<tr>
<th>Ward</th>
<th>Grade</th>
<th>Site of sore</th>
<th>Level of Injury</th>
<th>Date of Injury</th>
<th>Date of Referral</th>
<th>Date of Admission</th>
<th>Total Bed rest days</th>
<th>Bed rest at home</th>
<th>Mobilisation date</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITU NGH</td>
<td>4</td>
<td>Sacrum, Buttock, Heels</td>
<td>T 10</td>
<td>23/12/08</td>
<td>16/01/09</td>
<td>16/01/09</td>
<td>165</td>
<td>83</td>
<td>03/07/2009</td>
</tr>
<tr>
<td>Days to - Total Days</td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td></td>
<td>0</td>
<td>24</td>
<td></td>
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</table>
Mobilisation

- To allow a cord injured patient to sit on a pressure sore is negligent management

Spinal Injuries Association UK
Conclusion

• Spinal Cord Injured Patients are extremely vulnerable and are best managed in a spinal cord injury bed

• Telephone advice and outreach liaison are always available from your local friendly spinal cord injury centre