Management of Acute Spinal Cord Injury

Charles Greenough

24th January 2011

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

Region	Distribution	Neuro-deficit
Cervical %	62 %	75
T1 - T10	15 %	88 %
T11 - L2	20 %	70 %
L3 - L5	3 %	59 %
Sacrum	0.3 %	100 %

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 02 for short term use only. If longer 02 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

Digital Rectal Examination and Manual removal of Faeces. Guidance for Nurses. RCN 2004, Pubn. code 000934

Bowel Care for People with established Spinal cord Lesions. National Patient Safety Agency, 15 Sept 2004, www.npsa.nhs.uk/advice)

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

	6/52	6/12	12/12
Motor	n.s.	n.s.	n.s.
Sensory	n.s.	$p < 0.05$	n.s.

Steroids

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

	Methyl pred.	Placebo	
Complete	7.0	1.6	n.s.
Incomplete	44.1	20.7	$p < 0.05$

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. ?	p < ??	

Best Buy !

Steroids

Two Other RCT s

- **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

Fehlings and Perrin, Systematic Review, SPINE 31: S28–S35, 2006

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

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

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