SPINAL CORD INJURY (SCI) PATIENT: ACUTE PRESENTATION, ATLS AND ASSOCIATED INJURIES

WORLD SPINE CARE
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WORLD SPINE CARE

• Prof Scott Hildaman

• Prof C Norddin

• Pof Emre Acaraglu
MENTORSHIP

- Prof. EMRE ACARAGLU
- Phenomenon teacher
- Great researcher
- Deformity surgery
- Tumor surgery
PROF SELCUK PAUGLOLOU

- Cervical surgery
- Microdiscectomy
- Intramedullary tumours
- Minimally invasive
- Perfectionist
- Borderline OCD
• Epidemiology

• Pathophysiology

• Associated injuries

• ATLS & Grading system

• Primary care concepts

• Role of Surgery

• Conclusion
EPIDEMIOLOGY OF SPINAL CORD INJURIES

Incidence

50 injuries per million per year

1 in 40 patients admitted to a major trauma centre suffers an acute SCI

- Cervical injuries 50%
- Thoracic fractures 20%-30%
- Thoraco-lumbar junction 15%

SCI mortality at the time of accident or on arrival to A/E – 48%-79%
EPIDEMIOLOGY OF SPINAL CORD INJURIES

- Thoracic injuries more often produce complete SCI

- Initial Complete injury: cervical spine shows greatest likelihood of recovery VS Thoracic spine
PROGNOSTIC FACTORS FOR SURVIVAL

• Age of the patient

• Level of injury
  C1-C3 6.6 times higher mortality vs Paraplegia

  C4-C5 2.5 times higher

  C6-C8 1.5 times higher
CAUSES OF SPINAL CORD INJURIES

- Road traffic accident 40%-45%
- Falls (voluntary or involuntary) 15%-30%
- Sports and domestic accidents 15%-25%

young pts: high velocity trauma
older pts: falls from minor heights
PATHOPHYSIOLOGY OF SCI

Primary lesion of the gray matter by impact

1. Compression and release
2. Sustained compression
3. Distraction
4. Transaction

Primary lesion leads to immediate cell death, axonal disruption, vascular and metabolic changes
SECONDARY LESION

Metabolic cascade causing a secondary lesion

3 main theories

1. **Free Radical formation** leading to cell membrane lipid peroxidation

2. **Vascular Mechanism**

   acute reduction in blood flow at level of lesion

   Affects mainly the grey matter

   Loss of auto regulation
Secondary lesion

- \textit{Apoptosis} of oligodendrocytes of the white matter and extension of the lesion to adjacent levels.

Multiple cavitations of the central cord
### SCI Associated Injuries

<table>
<thead>
<tr>
<th>Type of Bony Injury</th>
<th>Incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor fracture (including compression)</td>
<td>10</td>
</tr>
<tr>
<td>Fracture dislocation</td>
<td>40</td>
</tr>
<tr>
<td>Dislocation only</td>
<td>5</td>
</tr>
<tr>
<td>Burst fracture</td>
<td>30</td>
</tr>
<tr>
<td>SCIWORA</td>
<td>5</td>
</tr>
<tr>
<td>SCIWORET (included cervical spondylosis)</td>
<td>10</td>
</tr>
</tbody>
</table>

SCIWORA = spinal cord injury without obvious radiologic abnormality; SCIWORET = spinal cord injury without obvious radiologic evidence of trauma.
ASSOCIATED INJURIES

- Isolated SCI injury occurs in 20%
- Associated injuries resent in 45% of patients with SCI
- 50% of TL fractures: Pulmonary or aortic injury
- Haemothorax
- Pneumothorax
- Lung collapse
ASSOCIATED INJURIES

• 40% of cervical fractures have Cranial injury

• Fractures of the limbs and pelvis

• Global mortality of 7% in isolated SCI

• 17% if associated injury
SUSPECT SPINAL CORD INJURY IN POLYTRAUMA

Types of accidents

- Road traffic accident and fall or jump from height
- An accident resulting in impact or crush injuries
- An accident resulting in multiple trauma
- An accident resulting in loss of consciousness
SUSPECT SPINAL CORD INJURY IN POLYTRAUMA

Symptoms

Following injury the patient complains of back or neck pain and appears to be guarding their back or neck.

The patient complains of any sensory changes or loss such as numbness or tingling.

The patient is unable to pass urine.

Flaccid paralysis is the predominant clinical finding.
EVOLUTION OF REFLEXES IN SCI


- 50 subjects admitted within 24 h following SCI

0-24 hrs

Appearance Pathological Reflexes

Delayed plantar response (DPR)-

- first reflex to appear and can often be observed in the emergency
- persistence of the DPR beyond 7 days associated with severe SCI

No Bulbocavernous Reflex
1-3 DAYS

Emergence of cutaneous reflexes

- BC
- AW Begin to appear within 24 hrs
- CR

- Deep Tendon Reflexes are absent at this stage (D.T.R)
4 DAYS - 1 MONTH

- Early hyper-reflexia

- Appearance D.T.R
SPASTICITY/HYPER-REFLEXIA (1–12 MONTHS)

- spasticity/hyper-reflexia (1–12 months)
- The DPR has disappeared in the majority of cases
- Cutaneous reflexes, DTRs, and the BS become hyperactive
- Bladder recovery 4-6 weeks
THE CLASSIFICATION OF NEUROLOGICAL FUNCTION

Frenkel-1969

ASIA-1984
ASIA IMPAIRMENT SCALE

A. ‘Complete’ Total motor and sensory loss in S4-S5

B. Incomplete ‘sensory only’ sensory sparing
   No motor function extending to S5

C. Incomplete ‘Motor useless’ motor sparing of no functional value Key muscles less grade 3

D. Incomplete ‘motor useful’ motor sparing of functional value. Majority of key muscles grade 3 or better

E. Normal ‘recovery’ no functional deficit
ADVANCED TRAUMA LIFE SUPPORT

ATLS

- Pre-hospital care . lessons from the military
- Golden hour ‘ATLS’ . Massive early bld products
- Primary survey
- Secondary survey . Platinum ‘10 minutes’
- In hospital care
- Rehabilitation
TRANSPORTATION

- Hachen-1974 Switzerland-Nationwide Emergency Transportation for spinal injury pts
  : Ten year follow-up protocol

Early transport from the site of the accident to the SCI center is associated decrease mortality

Immediate medical specific treatment of the spinal injury” facilitates neurological recovery

Cervical spinal cord injuries have a high incidence of pulmonary dysfunction, respiratory support measures should be available during transport.
SPINAL TRAUMA SOME FUNDAMENTAL CONCEPTS

• Avoidance of secondary complications

• Neurologic stability

• Spine Stability

• Referral to trauma center with dedicated spine team
PRIMARY CARE FUNDAMENTAL CONCEPTS

- Airway management
- Blood pressure
- Corticosteroids ???

Avoidance of secondary lesions due to:

Hypoxia/Hypercapnia
Hypotension
Anaemia
Hypothermia
Acidosis
Hyperthermia- and hypoglycemia
AIRWAY MANAGEMENT

- Intubation necessary in 60%-80% patients
- Normoxia
- Normocarpnia

During blade insertion:
  - minimal displacement
  
  With blade elevation:
  - superior rotation of C0-C1
  
  Inf rotation    C2-C5

With tracheal intubation
- Superior rotation of C0-C1

Crosby et al. Anaesthesiology 2006
BLOOD SUPPLY OF THE SPINAL CORD

- Anterior spinal artery and postero-lateral arteries
- Precarious supply of the thoracic segment
Autoregulation of spinal cord perfusion
SYMPHATHOLYSIS IN SPINAL SHOCK

- High thoracic and cervical
- Aggravating factor
- Decreased spinal perfusion
- Increase in secondary lesion
SYSTEMIC VASCULAR ALTERATIONS

- Reduced H.R
- Cardiac rhythm irregularities
- Reduced MAP
- Reduced peripheral vascular resistance
- Compromised cardiac output
- Systemic Hypotension + Loss of Auto-regulation
  (Cord Ischemia)
RESPIRATORY DYSFUNCTION

- Common after traumatic cord injury
- Cervical cord injury C5/C4 & above
- Reduced Vital Capacity
- Inspiratory capacity
- Hypoxemia
- Exerbation of SCI
• ICU Monitoring allows the early detection of
  
  hemodynamic instability,
  cardiac rate disturbances,
  pulmonary dysfunction
  
  Hypoxemia

• SCI injury pts appear to be best managed in the ICU setting for the first 7 to 14 days
BLOOD PRESSURE MEASUREMENT

Aggressive volume management

Consider associated hemorrhagic lesions

Iso-osmotic solutions for primary care

Noradrenaline

Mean arterial blood pressure >85mmHg for 7 days

Systolic blood pressure >120mmHg

75% of patients with SCI have at least one event of SBP< 90mmHg
HIGH DOSE CORTICOSTEROID PROTOCOLS

- **NASCIS I**
  Brecken MB. *JAMA* 1984;251:45-52
  Methylprednisolone 30 mg/kg → 5.4 mg/kg 48h

- **NASCIS II**

- **NASCIS III**
  Brecken MB. *JAMA* 1997;277:1997-604

- **NASCIS n...**
  Brecken MB. *Cochrane Database of Systematic Reviews* 2012, Issue 1. Art. No. CD001046
ADVERSE EFFECTS OF CORTICOSTEROIDS

• Presumed anti inflammatory effect at the spinal cord un-proven

• Increased rates of septic complications

• Respiratory distress syndromes

• Pulmonary embolism

• Corticosteroids induce peaks of hyperglycemia
TIMING OF SURGICAL INTERVENTION

- Interview of 971 spine surgeons in the world
- Majority of surgeons (80%) operates on incomplete deficits (ASIA B-D) <24hr
- Deterioration of ASIA score represents an emergency for surgery
- Opinions divergent concerning complete deficits (ASIA A)
Controversy in complete deficits ASIA A

No benefit if surgery < 24hrs

No influence of the delay on neurologic prognosis, but general complications and hospital stay are decreased

Eventual neurologic benefit if intervention <8 hrs

Experimental model on dogs: Neurologic recovery if decompression < 3 hrs
• Overall superior rates of recovery, particularly amongst ASIA grade A patients, early surgery compared to delayed

• patients who underwent early surgery were more likely to improve at least 2 ASIA grades at follow-up
SPECIFICITY OF THE POLY-TRAUMA PATIENT

Early stabilization leads to less on mechanical ventilation & lower pulmonary complications

Shorter intensive care unit and hospital stays

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Early Versus Late Stabilization of the Spine in the Polytrauma Patient

John R. Dineen, MD,* Leah Y. Cameron, MD, MS,* Joseph Riina, MD,† David G. Schwartz, MD,† and Mitchell B. Harris, MD,

The timing of spinal stabilization in polytrauma and in patients with spinal cord injury
Christian Schinkel and Alexander P. Anastasiadis

Current Opinion in Critical Care 2008, 14:685–689
KEY MESSAGES

• Suspect spinal injury in polytraumased patients

• Immobilization to avoid secondary injury to the cord

• Early transportation to a specialised centre

• Consistent neurological charting Use ASIA grade

• Monitor Blood pressure and Respiratory function

• Early surgery