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

WORLD SPINE CARE

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Tiro Mmopelwa

MB BCh MRCS FCS(Orth)
Diploma EuropeanSpine, Fellowship Spine Surgery .

WORLD SPINE CARE

- Prof Scott Hildaman

- Prof C Norddin

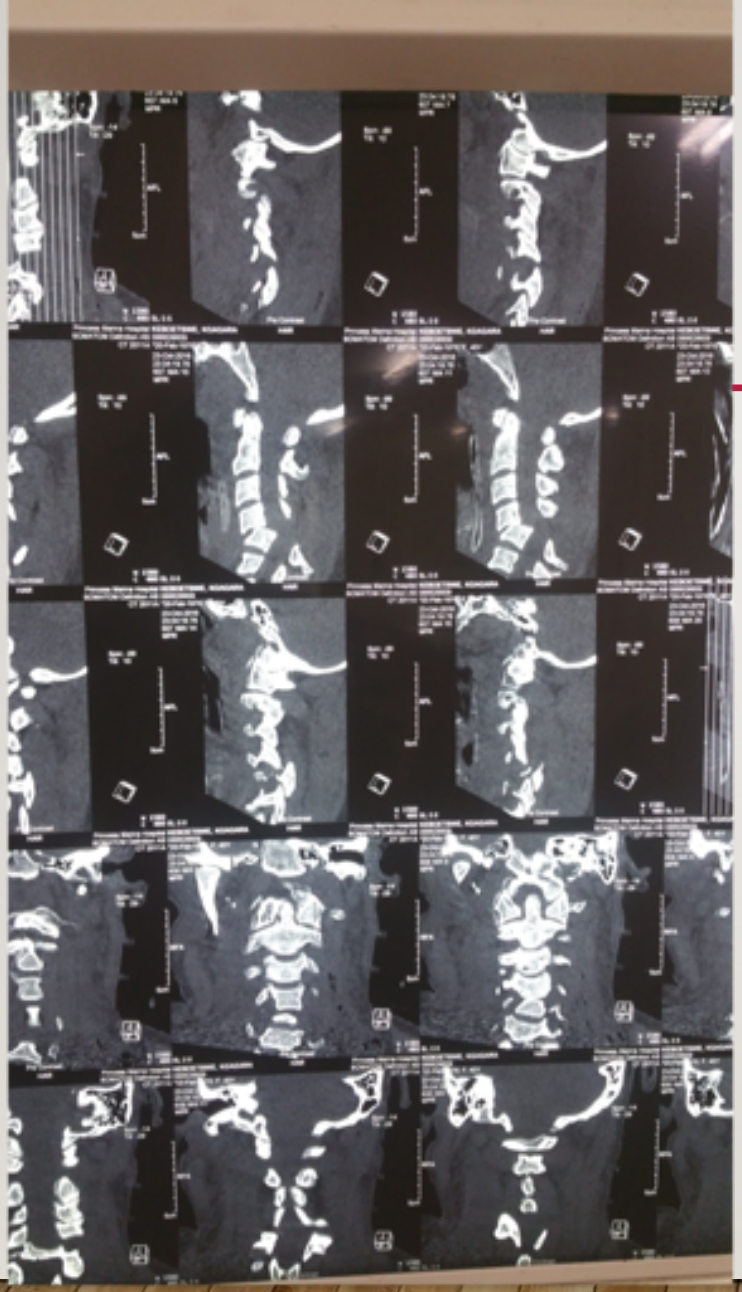
- Pof Emre Acaraglu

MENTORSHIP

- Prof EMRE ACARAGLU
- Phenomenon teacher
- Great researcher
- Deformity surgery
- Tumor surgery

PROF SELCUK PAUGLOLU

- 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%


AMBULANCE


TOYOTA


POLICE
999

EPIDEMIOLOGY OF SPINAL CORD INJURIES

Severity of Neurologic Injury	Incidence (%)
Complete ASIA Grade A	45
Incomplete ASIA Grade B	15
Incomplete ASIA Grade C	10
Incomplete ASIA Grade D	30

ASIA = American Spinal Cord Association grading system for severity of neurologic deficit after acute SCI.

- 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 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

.Apoptosis of oligodendrocytes of the white matter and extension of the lesion to adjacent levels.

Multiple cavitations of the central cord

SCI ASSOCIATED INJURIES

Type of Bony Injury	Incidence (%)
Minor fracture (including compression)	10
Fracture dislocation	40
Dislocation only	5
Burst fracture	30
SCIWORA	5
SCIWORET (included cervical spondylosis)	10

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

Ko HY, Ditunno Jr JF, Graziani V, Little JW. The pattern of reflex recovery during spinal shock. Spinal Cord 1999; 37: 402–409.

- 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 Bulbocavenous 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

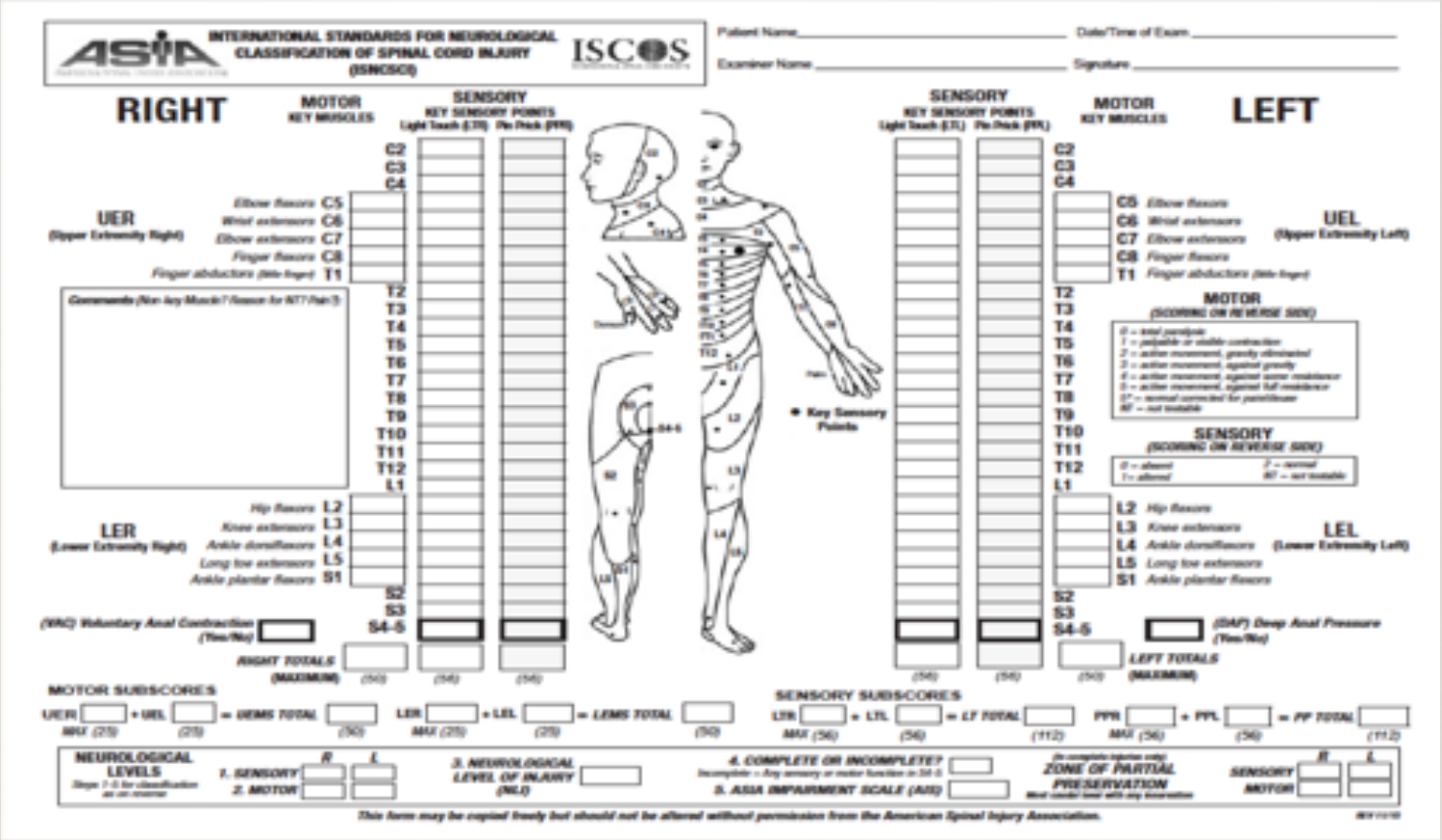
SPASTICITY/HYPER-REFLEXIA (1–12 MONTHS)

- 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

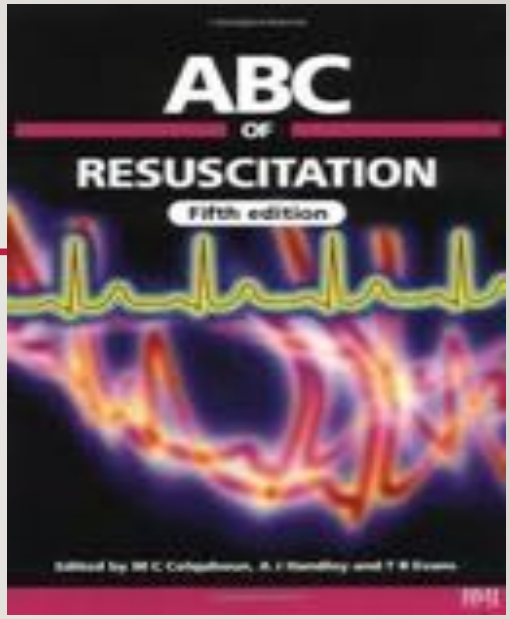
Immediate medical specific treatment of the spinal injury" facilitates neurological recovery

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

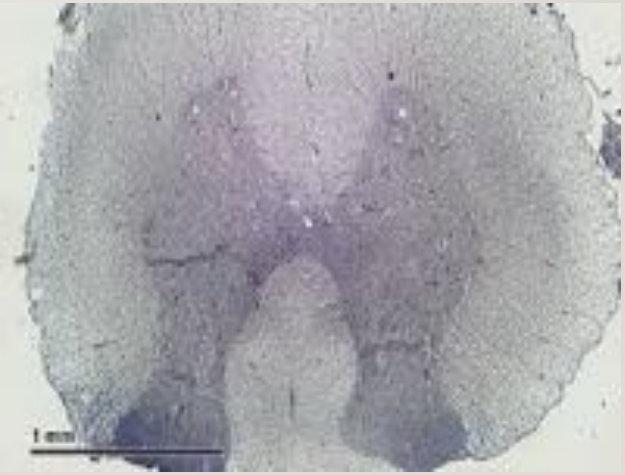
Hypotension

Anaemia

Hypothermia

Acidosis

Hyperthemia- and hypoglycemia



AIRWAY MANAGEMENT

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

During blade insertion:

minimal displacement

With blade elevation:

superior rotation of C0-C1

Inf rotation C2-C5

With tracheal intubation

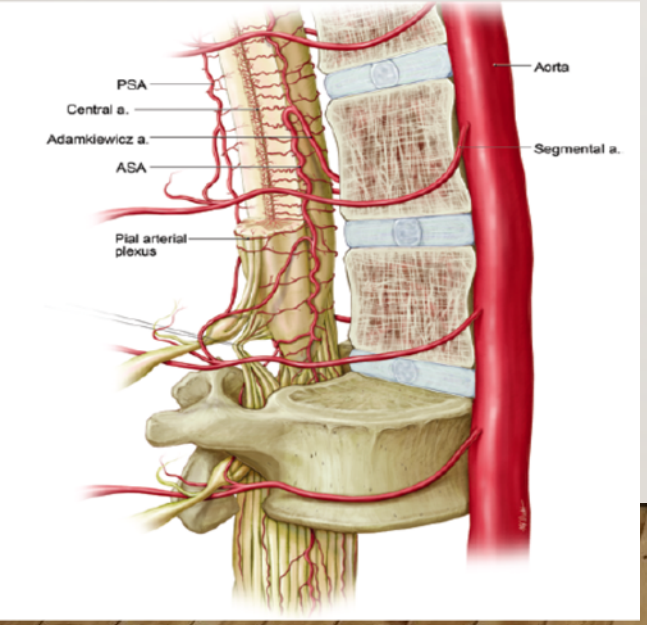
Superior rotation of C0-C1

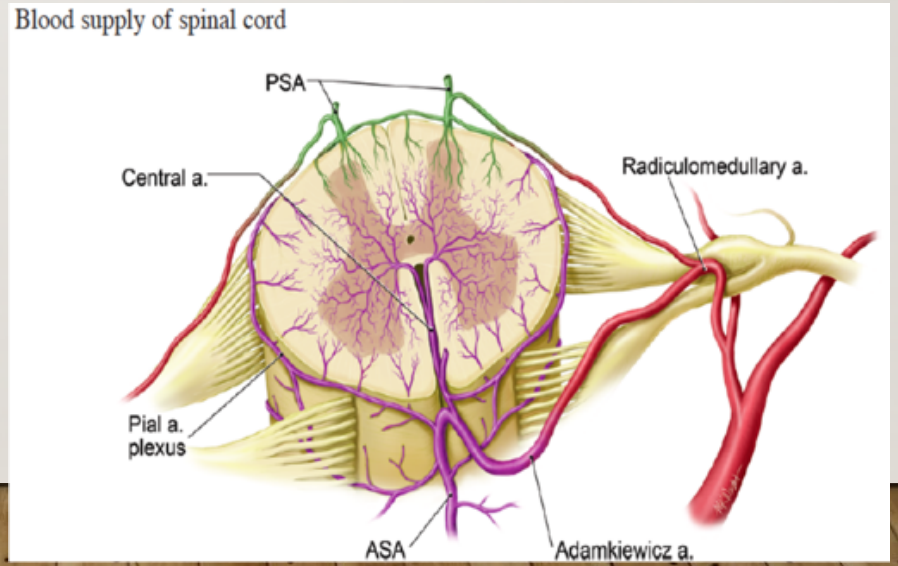
Crosby et al. Anaesthesiology 2006

BLOOD SUPPLY OF THE SPINAL CORD

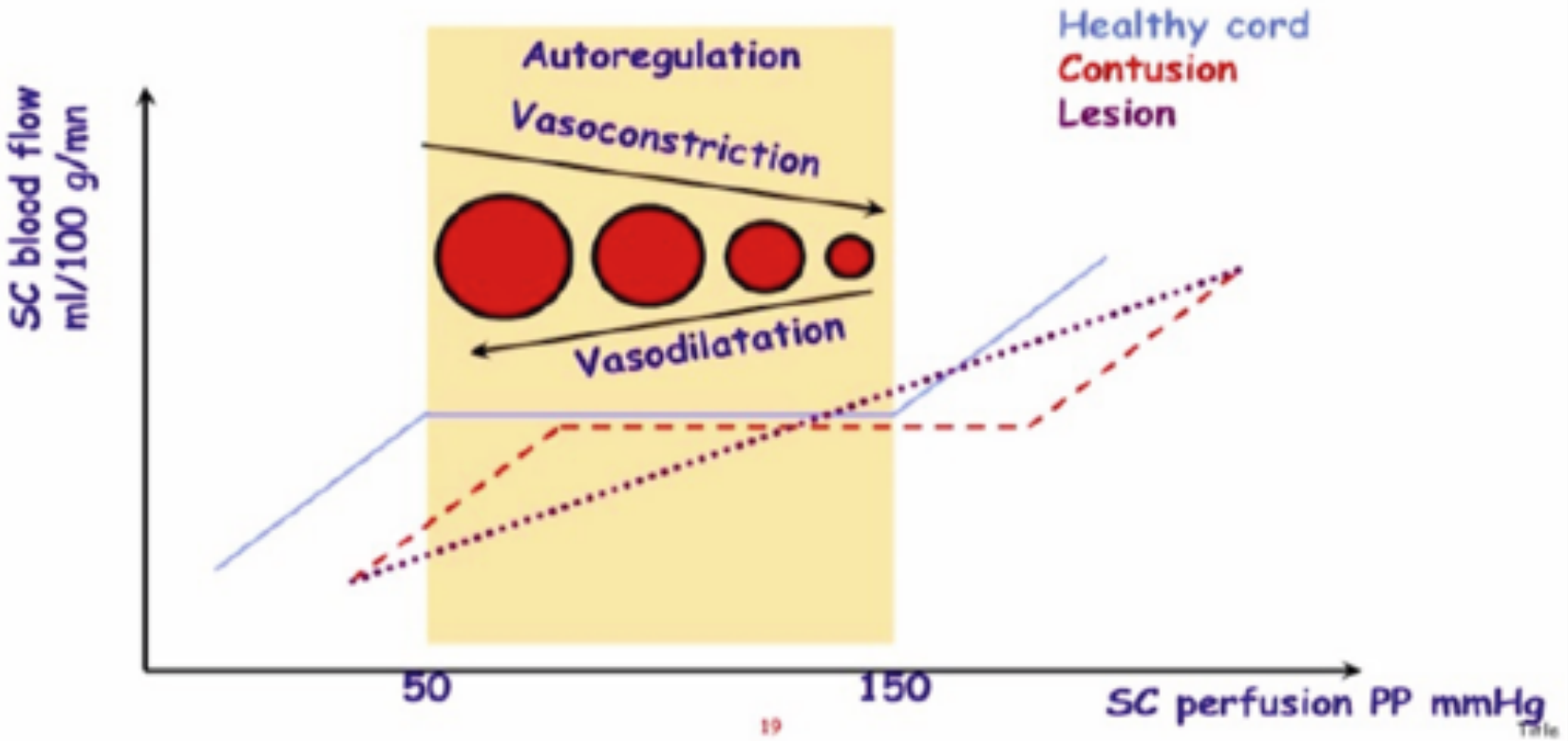
- Anterior spinal artery and postero-lateral arteries

- Precarious supply of the thoracic segment



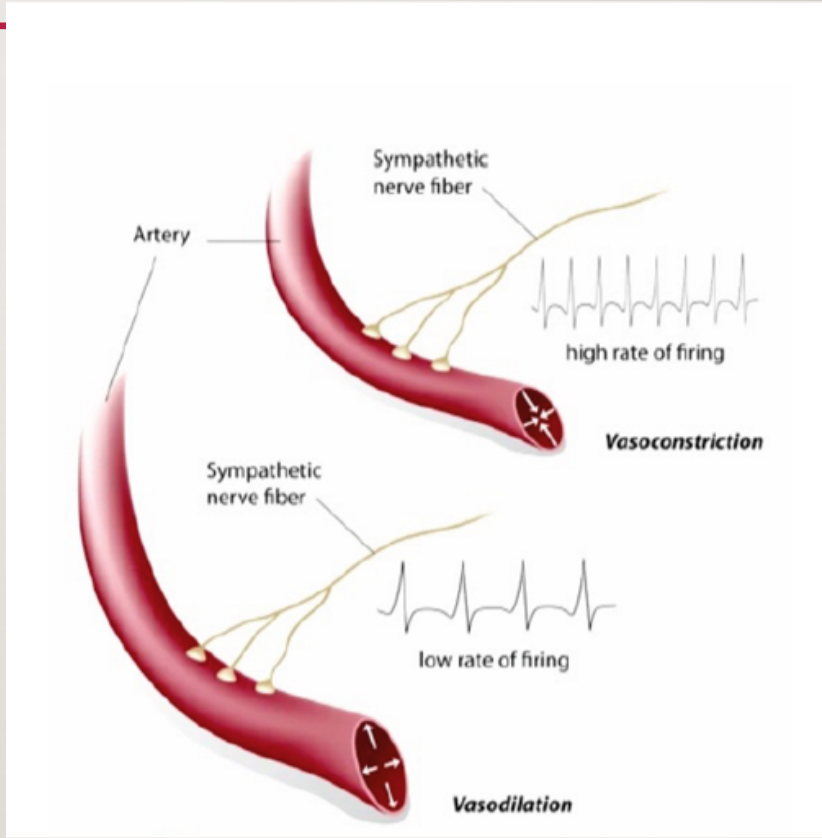


Autoregulation of spinal cord perfusion



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

EARLY ICU CARE

Botel et al, 1997, Spinal Cord

Lehmann et al, 1987, JACC

Reines HD et al, 1987 Neurosurgery

Zach, et al, 1976 Paraplegia

McMichan JC et al, 1980 JAMA

Tator, et al, 1984,Canadian J Surg

- 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

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

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Current Practice in the Timing of Surgical Intervention in Spinal Cord Injury

Michael G. Fehlings, MD, PhD, FRCSC, FACS,*† Doron Rabin, MD, FRCSC,*†
William Sears, MB, BS, FRACS,‡ David W. Cadotte, MSc, MD,*†
and Bizhan Aarabi, MD, FACS, FRCSC§

- 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

Schinkel et al.Cur Opin Crit Care 2008, Vaccaro et al. Spine 1997,Pointilllart et al.Spinal ord 2000,

Petitjean et al. J Trauma 1995, Rahimi-Movaghar et al.J Spinal Cord Med 2006

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

McKinley et al. Arch Phys Med Rehab 2004

Eventual neurologic benefit if intervention <8 hrs

Cengiz et al, Arch Orthop Trauma Surg 2008, Papadopoulos et al. J Trauma 2002, Rabinowitz et al. Spine 2008

Experimental model on dogs: Neurologic recovery if decompression < 3 hrs

Delamarter et al. J Bone Joint Surg Am 1995, Carlson et al. J NeuroTrauma 1997, Carlson et al J Bone Joint Surg Am 2003

OPEN ACCESS Freely available online PLoS one

Early versus Delayed Decompression for Traumatic Cervical Spinal Cord Injury: Results of the Surgical Timing in Acute Spinal Cord Injury Study (STASCIS)

Michael G. Fehlings[1*], Alexander Vaccaro[2], Jefferson R. Wilson[1], Anoushka Singh[1], David W. Cadotte[1], James S. Harrop[2], Bizhan Aarabi[3], Christopher Shaffrey[4], Marcel Dvorak[5], Charles Fisher[5], Paul Arnold[6], Eric M. Massicotte[1], Stephen Lewis[1], Raja Rampersaud[1]

- Overall superior rates of recovery, particularly amongst ASIA grade A patients, early surgery compaerd 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

Early *Versus* Late Stabilization of the Spine in the Polytrauma Patient

John R. Dimar, MD,* Leah Y. Cannon, MD, MSc,* Joseph Riina, MD,† David G. Schwartz, MD,† and Michel B. Haris, 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 polytraumazed patients
- Immobilalization 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