SPINAL CORD INJURIES

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INTRODUCTION

- Mortal condition recognised since antiquity
- First described in the Edwin Smith papyrus 2500BC
- “An ailment not to be treated”.
- 90% of afflicted patients in WWI died within 1year
- Ideal management demands immediate evacuation and intensive therapy of the injured patient

INCIDENCE

- UK statistics show an incidence of 10-15 per million of population.
- SA statistics show 35-40 per million of population.
- First world statistics show main cause to be MVA's.
- SA shows mainly interpersonal violence combined with MVA's.

DISTRIBUTION OF INJURIES

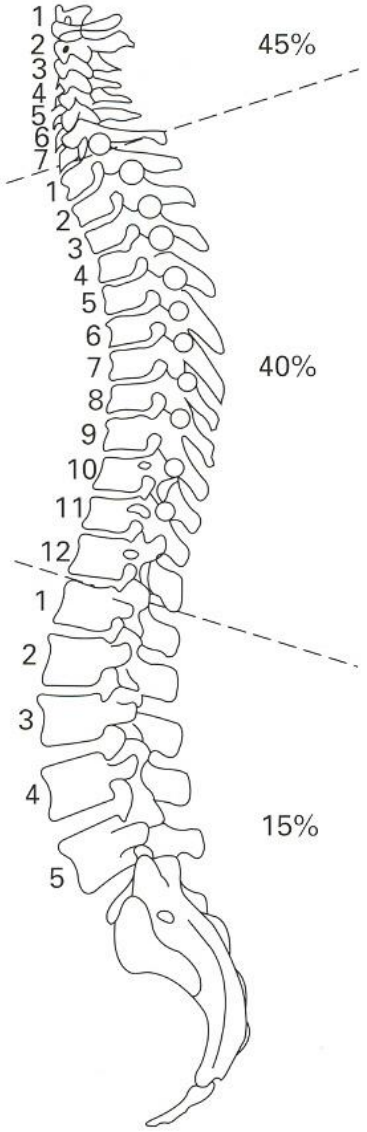
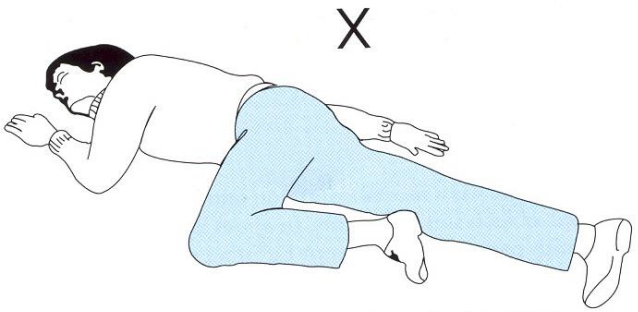


Figure 1.2 Proportion of cervical, thoracic, and lumbar injuries in 126 patients with spinal cord trauma admitted to the Duke of Cornwall Spinal Treatment Centre, 1997–99.

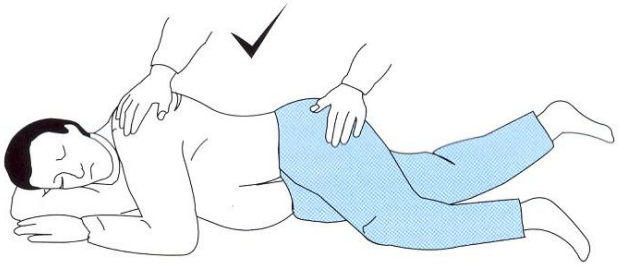
MANAGEMENT AT THE SCENE OF THE ACCIDENT

- Unconscious patient SCI assumed until proven otherwise
- Basic ABC of resuscitation needs to be adhered to
- Airway takes precedence over all other injuries and must be secured
- Tracheal intubation indications are similar to other trauma patients
- Once airway is secured intravenous access is established

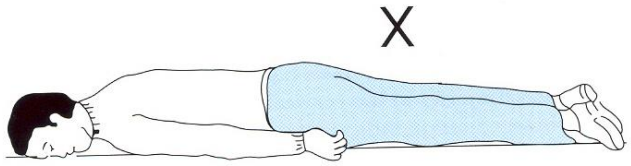
POSITIONING



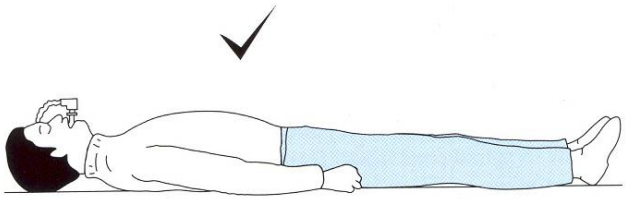
(a) Coma position—note that the spine is rotated.



(b) Lateral position—two hands from a rescuer stabilise the shoulder and left upper thigh to prevent the patient from falling forwards or backwards.



(c) Prone position—compromises respiration.



(d) Supine position—if patient is supine the airway must be secure, and if consciousness is impaired, the patient should be intubated.

Figure 1.3 Positions.

EVACUATION AND TRANSFER

- Both short and long splints need to be used to prevent movement of the spinal column
- Used in conjunction with rigid neck collars
- Remember to keep neck in neutral position (age differential)
- For transportation patient should be supine if conscious, and intubated if not.
- Hard objects should be removed from pockets as these can cause pressure areas
- Remember that patients are poikilothermic

INITIAL MANAGEMENT AT RECEIVING HOSPITAL

PRIMARY SURVEY

- Principals of ATLS should be adhered to
- A-airway B-breathing C-circulation
- If all of these have been attended to one can start with the secondary survey

SECONDARY SURVEY

- If no life threatening injuries are apparent palpation of the spine in the supine position can be done by sliding hand under the patient
- More comprehensive examination done during log-roll – note signs of bruising or deformity
- Priapism and diaphragmatic breathing invariably indicate a higher spinal cord lesion
- Log-roll provides ideal opportunity to remove patient from spinal board (maximum time on board should be 30 minutes)

IDEAL POSITION

CONUNDRUM: ABDOMINAL TRAUMA

Box 2.2 Diagnosis of intra-abdominal trauma often difficult because of:

- impaired or absent abdominal sensation
- absent abdominal guarding or rigidity, because of flaccid paralysis
- paralytic ileus

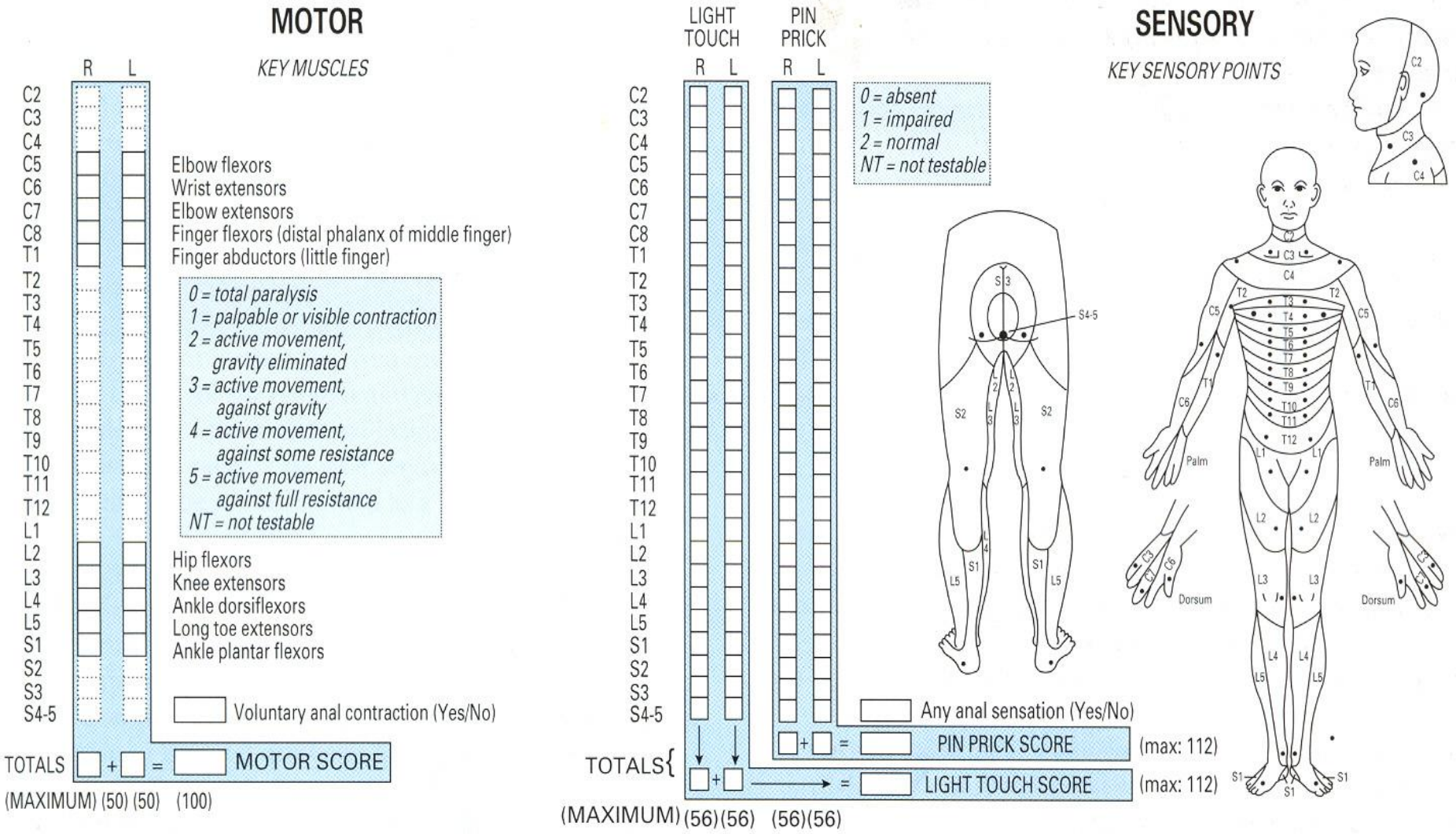
Box 2.3 If blunt abdominal trauma suspected

- peritoneal lavage
- abdominal CT scan with contrast

NEUROLOGICAL ASSESSMENT

- Sensation to pin prick (spinothalamic tracts)
- Sensation to fine touch and joint position sense (posterior columns)
- Power of muscle groups according to the Medical Research Council scale (corticospinal tracts)
- Reflexes (including abdominal, anal, and bulbocavernosus)
- Cranial nerve function (may be affected by high cervical injury, e.g. dysphagia).

ASIA SCALE



NEUROLOGICAL LEVEL
The most caudal segment with normal function

SENSORY R L
MOTOR

COMPLETE OR INCOMPLETE?
Incomplete = Any sensory or motor function in S4-S5

ASIA IMPAIRMENT SCALE

ZONE OF PARTIAL PRESERVATION
Caudal extent of partially innervated segments

SENSORY R L
MOTOR

ASIA GRADES

Box 2.5 ASIA Impairment Scale—used in grading the degree of impairment

A = Complete. No sensory or motor function is preserved in the sacral segments S4–S5

B = Incomplete. Sensory but not motor function is preserved below the neurological level and extends through the sacral segments S4–S5

C = Incomplete. Motor function is preserved below the neurological level, and the majority of key muscles below the neurological level have a muscle grade less than 3

D = Incomplete. Motor function is preserved below the neurological level, and the majority of key muscles below the neurological level have a muscle grade greater than or equal to 3

E = Normal. Sensory and motor function is normal

MUSCLES NOT LISTED

Diaphragm—C3,4,5
Shoulder abductors—C5
Supinators/pronators—C6
Wrist flexors—C7
Finger extensors—C7
Intrinsic hand muscles—T1
Hip adductors—L2,3
Knee flexors—L4,5 S1
Toe flexors—S1,2.

REFLEXES TO BE CHECKED

Biceps jerk	C5,6
Supinator jerk	C6
Triceps jerk	C7
Abdominal reflex	T8–12
Knee jerk	L3,4
Ankle jerk	L5,S1
Bulbocavernosus reflex	S3,4
Anal reflex	S5
Plantar reflex	

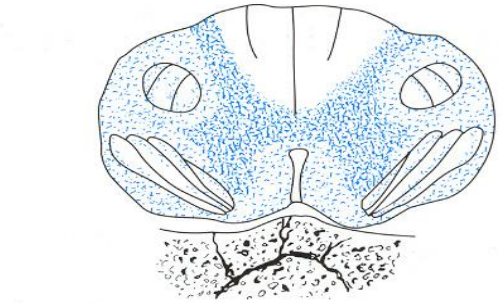
SPINAL SHOCK

- Classical definition: Areflexia in initial period of the injury
- Rare for all reflexes to be absent
- By consensus spinal shock ends when bulbocavernosus reflex returns in supra-sacral lesions
- Consider diagnosis when patient is hypotensive with bradycardic

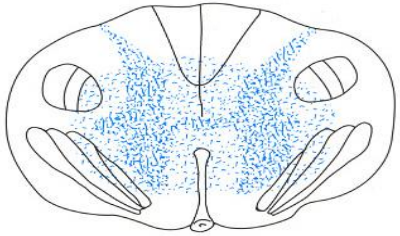
PARTIAL SPINAL CORD INJURY

- Several syndromes can be present
- Anterior cord syndrome : loss of power, reduced pain + temperature below lesion
- Central cord syndrome: arms affected worse than legs
- Posterior cord syndrome: loss of proprioception
- Brown-Sequard: diminished power and proprioception on injured side, contra-laterally normal power and temperature perception

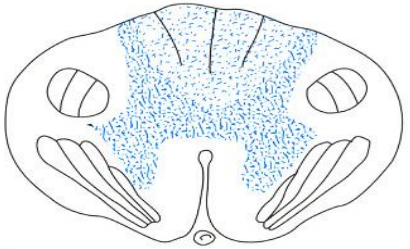
PARTIAL CORD LESIONS



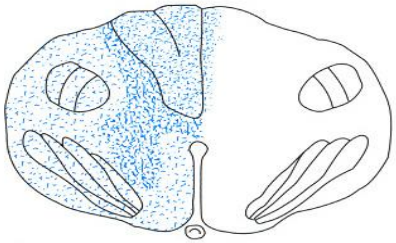
Anterior cord syndrome



Central cord syndrome



Posterior cord syndrome



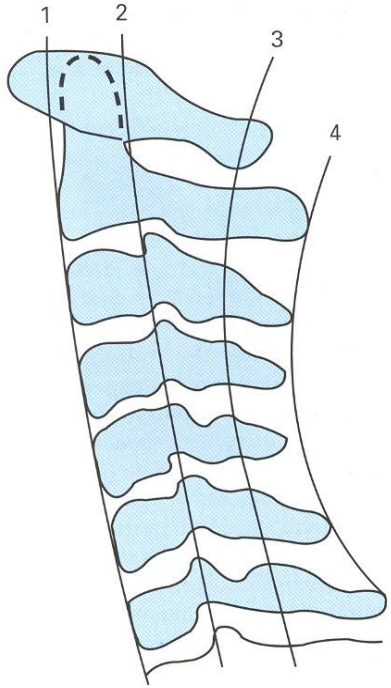
Brown–Séquard syndrome

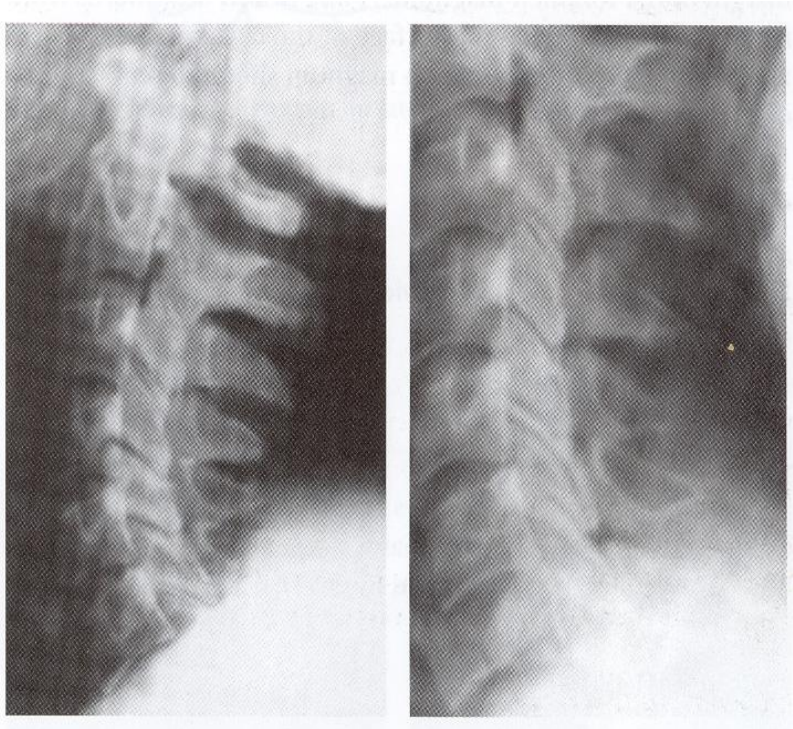
RADIOLOGICAL INVESTIGATIONS

CERVICAL SPINE

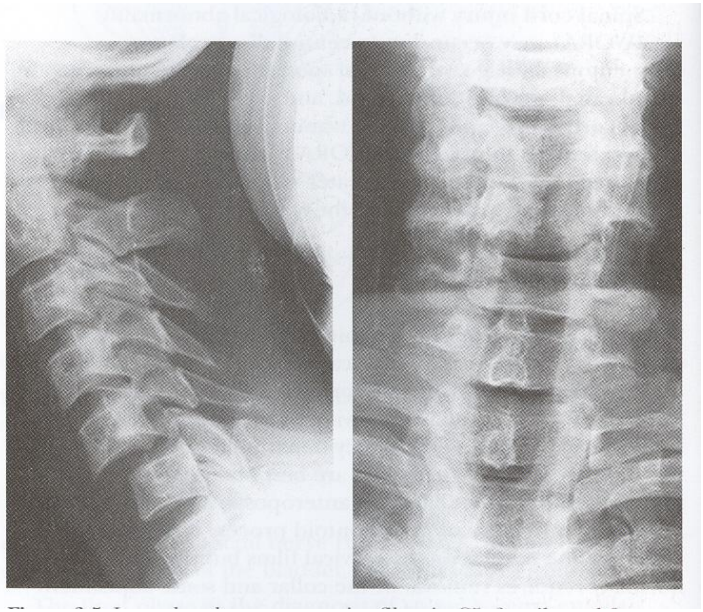
- First X-ray should be a lateral of the C-spine (must demonstrate C7/T1)
- AP views and open mouth to be done in X-ray department. Oblique views may be helpful as well as swimmers views
- Interpretation according to the ABC rules is imperative. A – alignment B – bones C – cartilage and S – for soft tissues

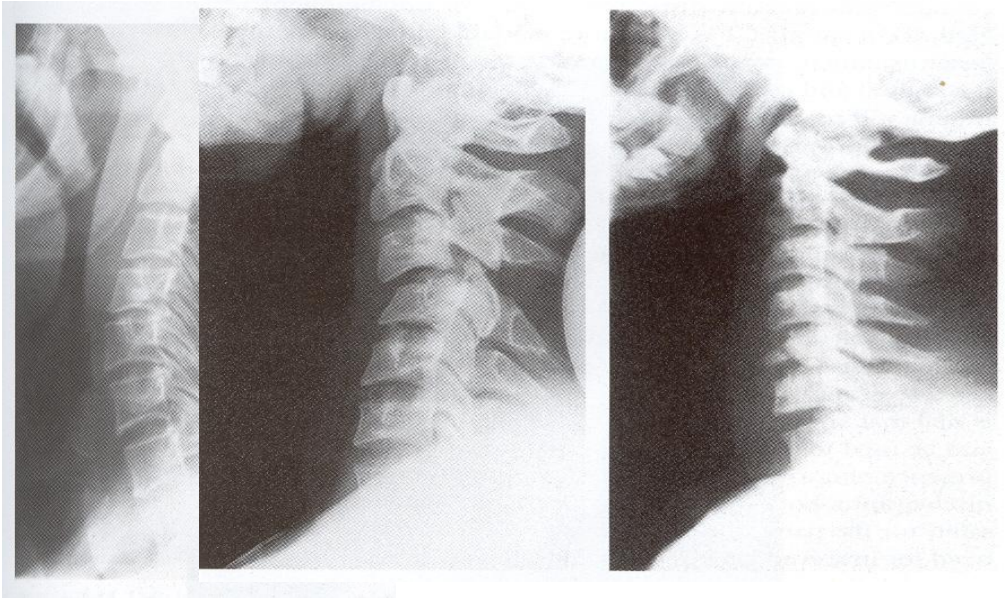
C-SPINE INTERPRETATIONS





C-SPINE INTERPRETATIONS

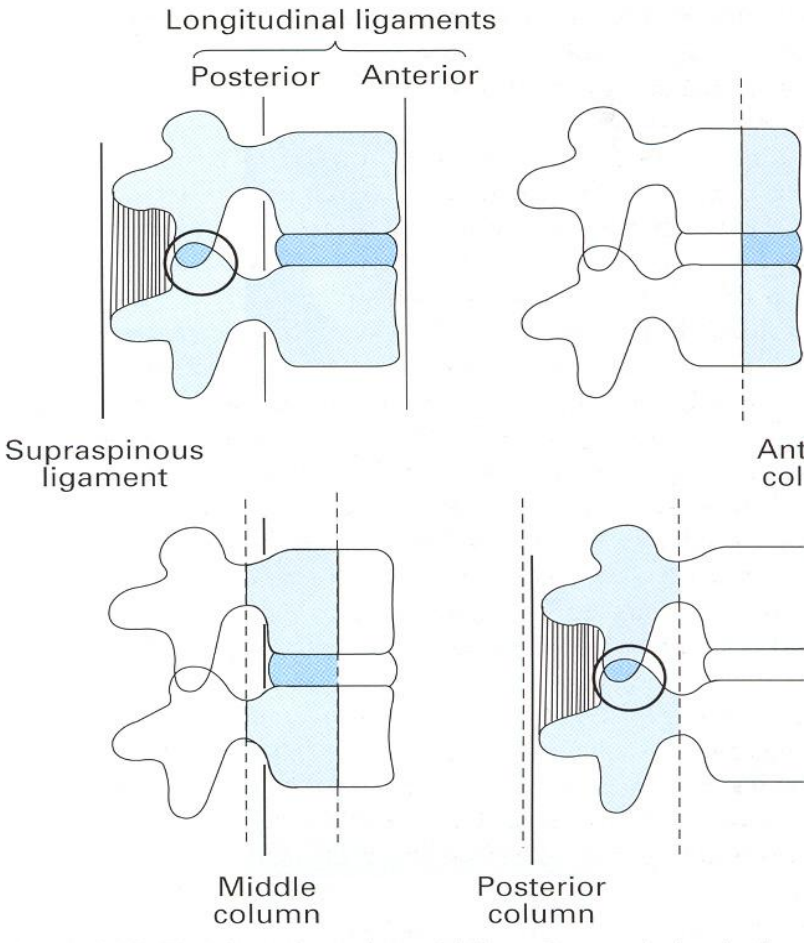




THORACIC AND LUMBAR SPINE

- Remember that 10-20% of cases double level injury occurs
- The major consideration is whether or not an injury is stable or unstable
- To decide we use Denis classification which divides the spinal vertebrae into three columns
- If any two of these columns are affected, injury is unstable

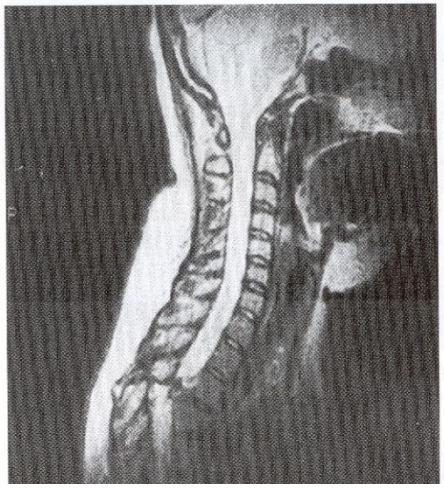
CLASSIFICATION OF DENIS



FURTHER INVESTIGATIONS

- As is mandatory with ATLS principles, radiological investigations should include a standard chest X-ray, a pelvic view, as well as any other parts injured
- CT scanning and MRI investigations are helpful tools in the surgical management of these patients, as well as for diagnostic purposes, but rarely alter the management

CT AND MRI SCANS



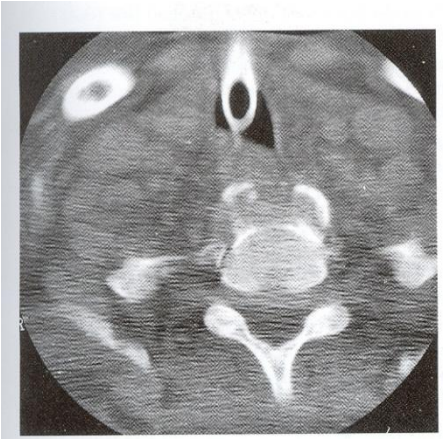
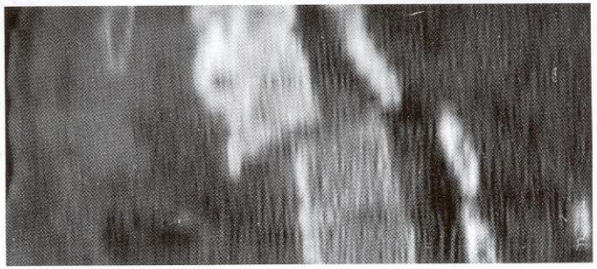


Figure 3.15 MRI showing transection of the spinal cord asso
a fracture of T4.



EARLY MANAGEMENT AND COMPLICATIONS

RESPIRATORY COMPLICATIONS

- Respiratory insufficiency is very common especially in the higher SCI due to inter-costal paralysis, partial phrenic nerve palsy, impaired ability to expectorate, and/or V/Q
- In paraplegia associated rib fractures and pulmonary contusions may also complicate

RESPIRATORY COMPLICATIONS

- Regular physiotherapy with breathing exercises is vital to prevent atelecthasis
- Respiratory function should be monitored by measuring oxygen saturation, vital capacity, and blood gases
- A rise in PCO2 and a vital capacity of less than 15ml/kg denotes respiratory failure and might necessitate ventilatory support
- The decision to intubate or withhold support should not be difficult. If the patient has made it thus far, he/she should be afforded every possible chance of survival

CARDIOVASCULAR COMPLICATIONS

- Haemorrhage from associated injuries is the most common cause of post-traumatic shock and must be treated vigorously
- However it must be realized that in traumatic tetraplegia the sympathetic outflow is interrupted resulting in unopposed vagal action leading to bradycardia and hypotension
- Pharyngial suction stimulates the vagal nerve and can produce bradycardia – atropine should be kept handy

CARDIOVASCULAR COMPLICATIONS

- Bradycardia of less than 50 beats a minute and hypotension of less than 80mmHg systolic pressure needs to be addressed
- Urine output of more than 1ml/kg/h is a good indication of adequate perfusion
- If the above goals cannot be obtained inotropic support with dopamine preferably, is indicated
    - CVP readings are most helpful in monitoring preload

PROPHYLAXIS AGAINST THROMBO EMBOLISM

- SCI is associated with a very high risk of thrombo-embolic complications
- Prophylaxis is definitely indicated, the timing however is controversial. Immediate anti-coagulation can lead to further hemorrhage in the cord, thus my recommendation is to start with LMWH at 72 hours post-injury
- Mechanical devices such as stockings, foot pumps, may have a role to play, but can lead to catastrophic skin complications if not properly monitored

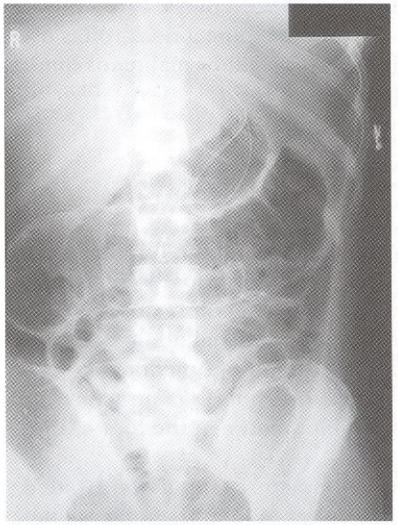
INITIAL BLADDER MANAGEMENT

- Over distension of the bladder is catastrophic and can lead to prolonged a-reflexic bladders with reflux
- All patients should be catheterized to prevent this complication and to aid in the monitoring of the resuscitation
- A silicone coated or a silastic catheter is ideal for this purpose and in the initial phases should be left on free drainage

GASTRO-INTESTINAL TRACT

- Severe SCI is associated with prolonged paralytic ileus. This may lead to over distension of the abdomen and splinting of the diaphragm → respiratory compromise
- Therefore patients should ideally have a naso-gastric tube inserted
- Acute peptic ulceration due to stress response is a devastating complication – H_2 receptor antagonist or a proton pump inhibitor should be started immediately and continued for the first three weeks

GASTRO-INTESTINAL COMPLICATIONS



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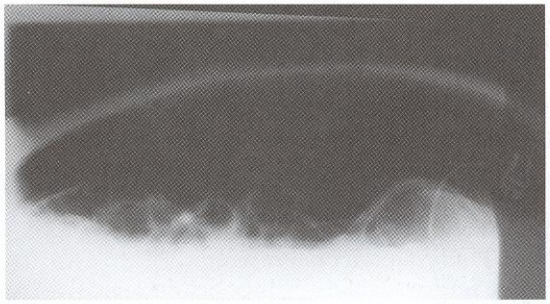

STEROIDS AND ANTIBIOTICS

- The role of steroids is controversial and surrounded by conflicting evidence
- Currently best practice guidelines suggest the use of steroids if the patient is admitted within 8 hours of injury
- Methylprednisolone at a dosage of 30mg/kg in the first hour followed by 5.4mg/kg/h for the next 23 hours
- Routine antibiotics is not indicated and only established infections should be treated

SKIN AND PRESSURE AREAS

- The patient should be off a spinal board within 30min. There after regular 2 hourly turns of the patient maintaining spinal alignment should be done
- The most devastating complication, aside from death, is a pressure sore

THIS MUST BE PREVENTED AT ALL COST

ANALGESICS

- Pain management in the acute phase is essential and often overlooked
- Intramuscular injections are fraught with dangers, firstly due to skin problems and secondly, unpredictable absorption
- Preferred route of administration is therefore intravenous – opiods are the most effective; titrations according to effect

AUTONOMIC DYSREFLEXIA

- Pounding headache
- Profuse sweating
- Flushing or blotchiness above level of lesion
- Danger of intracranial haemorrhage

Treatment of autonomic dysreflexia

- Remove the cause
- Sit patient up
- Treat with:

  Nifedipine 5–10 mg capsule—bite and swallow

  or

  Glyceryl trinitrate 300 µg sublingually

If blood pressure continues to rise despite intervention, treat with antihypertensive drug e.g. phentolamine 5–10 mg intravenously in 2·5 mg increments

- Spinal or epidural anaesthetic (rarely)

BIOCHEMICAL DISTURBANCES

Box 6.6 Biochemical disturbances

Hyponatraemia

Acute —due to excessive intravenous fluids

Chronic —systemic sepsis
—excessive oral fluid intake
—drug induced e.g. carbamazepine

Treatment—treat sepsis
—control fluid intake
—review drugs
—furosemide, potassium supplements
—demeclocycline (occasionally)

Hypercalcaemia

Symptoms—constipation

Treatment—hydration
—achieve diuresis
—oral disodium etidronate or intravenous disodium pamidronate

CONCLUSION

- The early management of these severely injured patients determines the eventual outcome of this injury to a large degree.
- It is both challenging and rewarding
- Sticking to the rules and tips mentioned will enable you to successfully manage your patient and ensures that he/she arrives at a rehabilitation facility in optimal condition.
- One final thought – leave no stone unturned to get your patient into a recognised rehab unit as soon as possible

THANK YOU