1. Incidence 3.2 - 5.2 / 10^5 of new spinal injured patients

2. Highest prevalence 15 - 24 years of age > 55 years of age

3. Male:Female upto 3.5:1

4. Causes of SCI

   50% motor vehicle accidents

   20-30% falls

   12-21% gun shots

   6-7% sport related activities

5. Hospitalisation costs

   low level paraplegia $ 50,000 - 90,000

   quadriplegia with respiratory dependent $170,000 - 250,000

6. Prevention is much better than treatment

7. Immediate patient care

   100/300 admitted patient reported a delayed or missed Dx (Bohlman)

Factors leading to delayed diagnosis have included

1. Concurrent head injury

2. Altered state of consciousness

3. Poor radiographic visualisation

4. Multiple injury

8. Evaluation of patient

2. Palpation for localisation of pain

3. Neurological examination

Cranial nerve

Motor & Sensory function

Reflexes

Rectal tone

Balbacavernosus Reflex

Incontinence (Loss of control of bladder, bowel)

4. Primary treatment focus on the ABC’s of resuscitation

9. Two most common causes of pre-hospital death in SCI

Aspiration of gastric contents

Shock

10. Radiographic examination

Indication at cervical spine film

1. All alert, sober patients who have neck pain or tenderness

2. Neurological deficit

3. Poly-trauma

4. Cranio-facial injury

5. Unconscious with sustained trauma

11. Unconscious patient need x-ray evaluation to confirm

12. Standard x-ray

1. Lateral cross table cervical spine *First

2. AP

3. Odontoid: opened mouth

4. Oblique

13. For C7-T1 x-ray
1. Tract down shoulder

2. Swimmer’s (twinning)

14. CT (Computed Tomography)
Standard: 5mm sections
Thin section: 2-3mm (for suspect areas)
Sagittal reconstruction

15. MRI
Advantage: visualisation of spinal soft tissue structures
clear definition of canal compromise
Disadvantage: limited availability
high expense
poor resolution with motion
requirement of non ferrous equipment

16. Tomography: less frequent
odontoid
facet & lateral mass

17. Flexion-Extension x-ray
Neck pain: normal neurologic exam
normal plain x-ray
undersupervision & active through a pain free ROM

18. Unstable fracture
1. Bilateral facet dislocation
2. Fracture dislocation
3. Cervical vertebral fractures with > 11.5° of angular rotation
≥ 3.5mm of sagittal translation
4. Neurological deficit
19. Risk of SCI is greater in narrow spinal diameters

Cervical stenosis Ratio of cervical canal: Width of cervical body < 0.8

20. Spinal chord injury without radiographic abnormality (SCIWORA)

Typically occurs on - very young patients
- older individuals with cervical spondylosis

21. Cervical region is prone to injury

The coupling of a large mass: the head
To a lever arm of great flexibility: the C-Spine
Fracture - dislocation: Most common cause of cervical spinal chord injury

22. Physiologic effects of cervical spine chord injury

Loss of sympathetic tone

Bradycardia

Hypotension

Decreased respiratory exercise

23. Hypoxia → localised ischaemia of the chord injury

The goal should be to maintain a minimum

PaO2 > 100 TORR
PaCO2 < 45 TORR


loss of peripheral sympathetic vascular tone

↓

Pooling of blood in the extremities

Inadequate central venous return

Bradycardia: Parasympathetic effects of vagus nerve

(P < 60/min. or normal)
25. Resuscitation from neurogenic shock

1. Trendelenberg position: \( \downarrow \) pooling of peripheral blood
2. IV of atropine (0.4mg): block vagal effects
3. Vasopressor
4. Large volume of IV fluid may caused CHF

26. Spinal shock: a condition of altered spinal cord conduction with transient loss of all motor, sensory and reflex function caudal to the level of the injury \( \sim \) 48 hours

+ Bulbocavernous reflex or anal wink reflex

definitive neurologic status cannot be assessed until the cessation of spinal shock

27. Spinal Shock: 48 hours

Bulbocavernous reflex

Anal wink

Definitive neurologic status: cessation of spinal shock

28. Spinal cord injury

transmission of energy \( \rightarrow \) micro haemorrhage in centre grey matter

loss of neuroconduction in adjacent with matter

29. Two theories on how this spinal cord lesion progresses

A. Vascular theory: interrupted blood flow \( \rightarrow \) to microvascular endothelial damage + thrombus formation \( \rightarrow \) Ischaemia in the central grey matter

B. Neuronal theory: traumatic distortion of neurologic membrane of the axon

30. Neurologic classification

SCI are classified as

1. Complete: no motor or sensory function
2. Incomplete: caudal to the level of the injury

complete lesion in 46% in cervical injury (Fine et al)

31. Incomplete cord injury

Anterior cord syndrome
Central cord syndrome

Brown-Sequard syndrome

Posterior cord syndrome

32. Central cord syndrome

most common

most often in elderly with pre-existing cervical spondylosis who sustain a hyperextension injury

greater loss function to the upper extremity than the lower extremity with variable sensory sparing

fair prognosis

33. Anterior cord syndrome

second most common

loss of neurologic function in anterior 2/3 of the spinal cord (related to vascular insufficiency)

affected regions

Spinothalamic: pain and temperature

Corticospinal: motor

function sparing posterior columns (position sense, proprioception, vibration, deep pressure)

greater motor loss in the legs than the arms

mechanism of injury flexion-compression

worst prognosis

34. Brown-Sequard syndrome

damages half of the cord

causing of ipsilateral motor loss and position/proprioception loss and contralateral pain and
temperature loss (usually two levels below the insult)

best prognosis

35. Posterior cord syndrome

very rare

loss of dorsal column function (deep pressure and proprioception)
prognosis is good
motor is preserved
walking is extremely difficult or impossible because of persistent impairment of proprioception

36. Single cervical root lesion
commonly associated with acute disk protrusion or facet dislocation
often associated with vertebral body rotation
most commonly C5 or C6, leading to deltoid of biceps weakness and usually unilateral

37. The functional classification system of Frankel et al 5 grades (A-E)
Frankel A: complete paralysis
B: no voluntary motor, but preserve sensation
C: useless motor function
D: useful voluntary motor function, but not normal
E: normal function

38. Level of the injury is defined as the most caudad nerve root that innervates muscles that demonstrate at least antigravity strength provided that the next cephalad level is normal.

39. Initial immobilisation and realignment
Gardner-Wells Tongs: 1cm above tips of ears in line with the external auditory meatus
Rotating bed

40. Pharmalogic Rx: methylprednisolene
Mechanisms of action
1. Decrease oedema
2. Anti-inflammatory effect
3. Protection of neuronal membranes by scavenging of O2 free radicals

41. Recommendation dose of Methylprednisolene
1. IV bolus 30mg/kg BW > 15 min.
2. Followed by IV 5.4mg/kg BW/Hr for 23 hours
Start within 8 hours after SCI

42. Absolute indication for emergent surgery
Progressive neurological deterioration with irreducible canal compromise

43. Contraindication for surgery
Deteriorating neurologic status without canal compromise:
Irreversible ascending necrosis of the cord

44. SCI unit
Decrease complete spinal cord injuries 65% to 46%
Overall mortality 20% to 9%

45. Future direction: research trends in
Blocking secondary injury
Biomechanical cascade
Direct manipulation of CNS regeneration & enhancement of neuronal function
Axonal regeneration & neurologic tissue transplantation

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