

SPINAL CORD INJURY-GSW

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Bones and Spine

EPIDEMIOLOGY-mechanism

- Most common cause of traumatic cord inj.:
 - #1 MVA (45%)
 - #2 Fall (22%)
 - #3 Violence (16%)
 - #4 Sports (13%)
- After 1990, Gsw now #2 leading cause (25%)

Epidemiology-Patient population

- **Traumatic SCI**
 - mean age: 30.5
 - male: 80%
 - non-white: high
- **GSW**
 - mean age: 25
 - male: 94%
 - nonwhite: 96%

BALLISTICS

- $E = 1/2 MV^2$

BALLISTICS-

Mechanisms of Tissue Damages

- *1. Crush*
 - Wound size
- *2. Shock wave*
 - >500 fps
 - area compressed move away
 - Air containing viscera more susceptible
- *3. Temporary cavitation*
 - >1000 fps
 - Region of bruising become necrotic

PATIENT EVALUATION

- ABC
- Vascular and visceral injuries stabilization
- *Physical examination:*
 - Wound exam.
 - neurological evaluation
 - ? methylprednisolone 30mg/kg + 5.4mg/kg/hr x23hrs.
 - x ray + CT(retain bone/bullet fragm.)

SENSORY EXAMINATION

- Check with both light touch (cotton) and pin prick (safety pin)

0 = absent

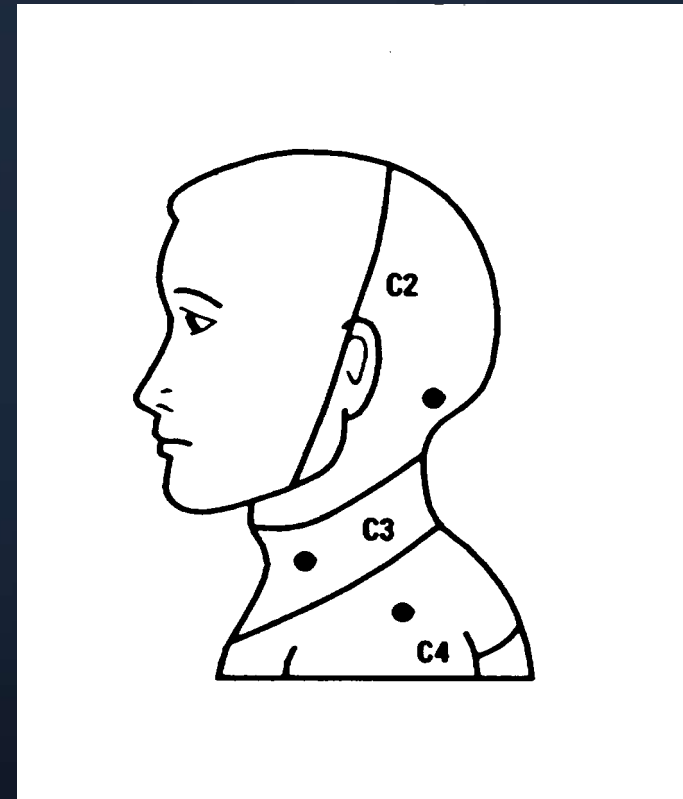
1 = impaired (partial or altered appreciation)

2 = normal

NT = not testable

Sensory Examination

- C2 occipital protuberance
- C3 supraclavicular fossa
- C4 top of AC joint
- C5 lateral antecub. fossa
- C6 thumb
- C7 middle finger
- C8 little finger



SENSORY EXAMINATION

- T1 medial antecub. fossa
- T4 nipple line
- T10 umbilicus
- T12 Inguinal lig
- L2 mid ant. thigh
- L3 Medial fem.cond.
- L4 medial malleolus

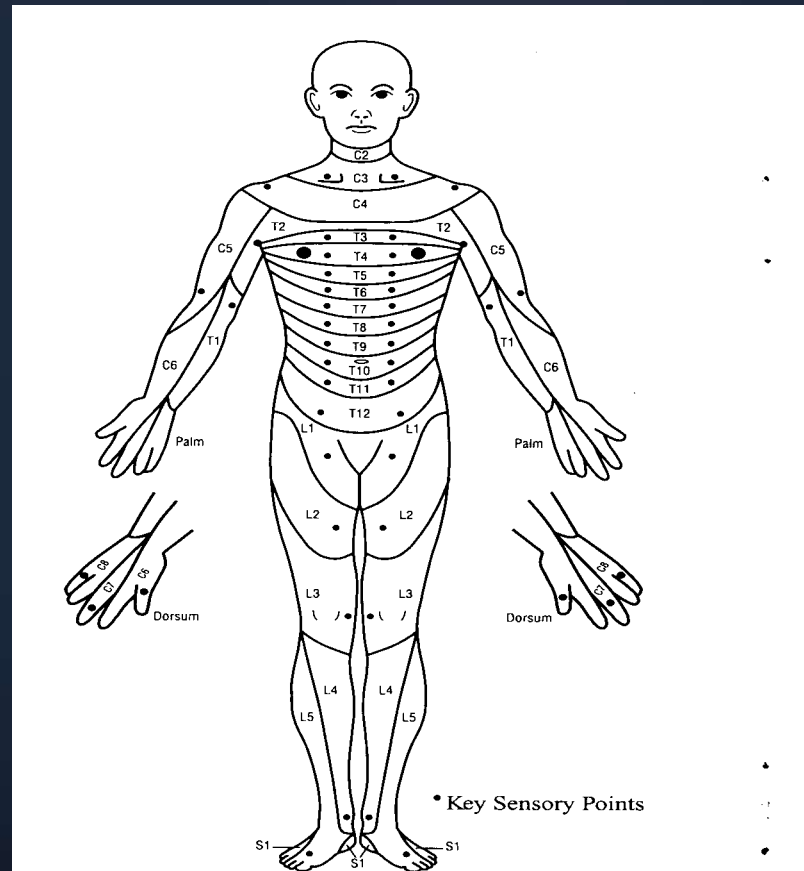
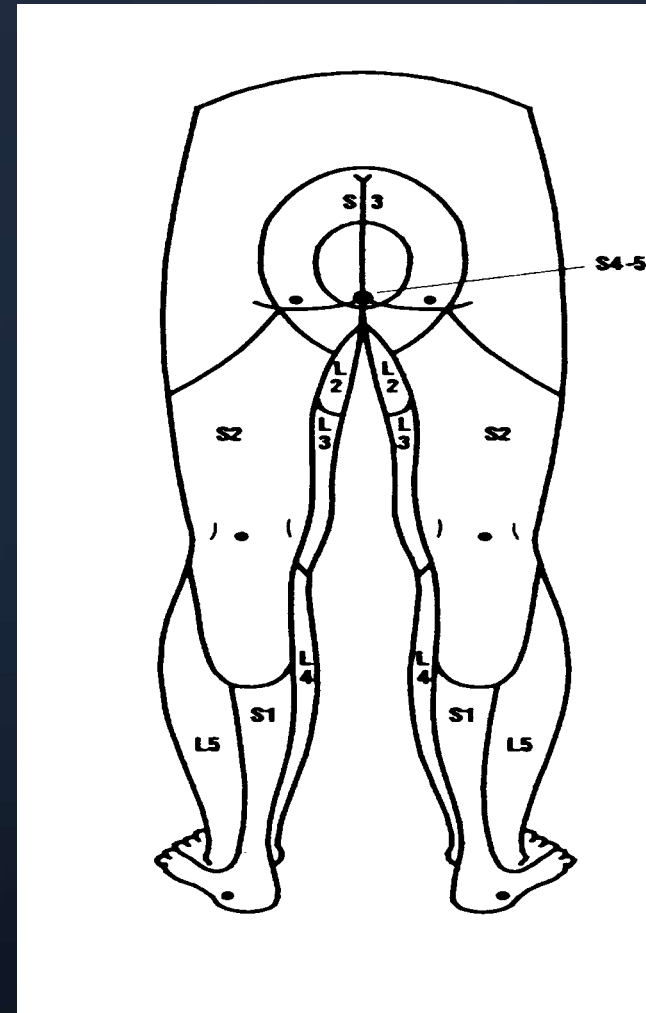


FIGURE 1

SENSORY EXAMINATION

- L5 dorsum foot
- S1 lateral heel
- S2 mid popliteal fossa
- S3 ischial tuberosity
- S4-5 perianal area



MOTOR EXAMINATION

<u><i>Grade</i></u>	<u><i>Definition</i></u>
0	total paralysis
1	visible contraction
2	active , FROM (gravity eliminated.)
3	active, FROM (against gravity)
4	active, FROM (against mod.rest.)
5	Active, FROM (against full.rest.)

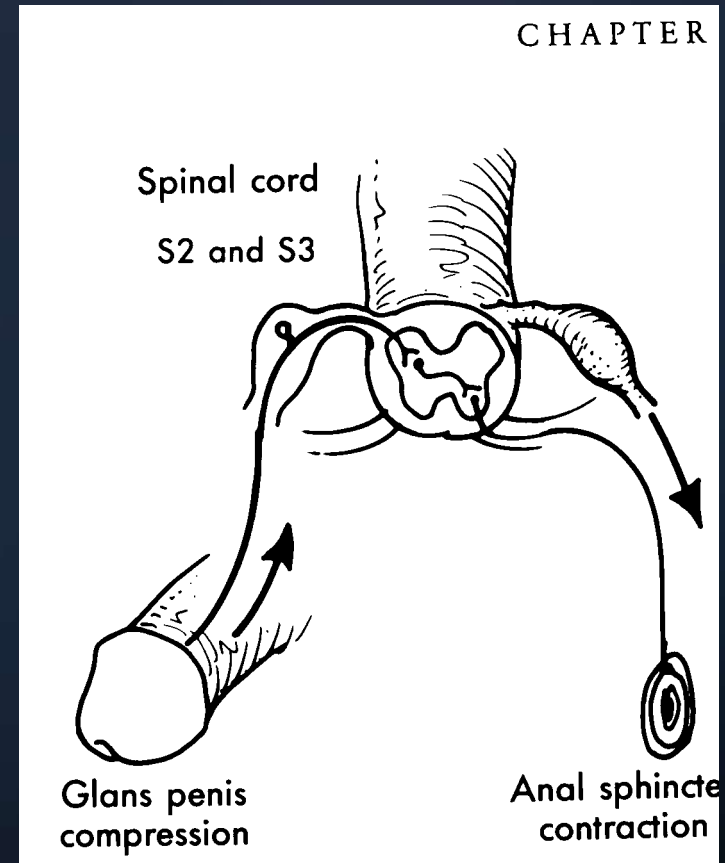
MOTOR EXAMINATION

C5	Elbow flexor	Bicep
C6	Wrist extensor	ECRB
C7	Elbow extensor	Triceps
C8	Finger flexor	FDP to MF
T1	SF abduction	ADM
L2	hip flexor	iliopsoas
L3	knee extensor	quads
L4	Ankle dorsiflexor	Tib ant
L5	Long toe extensor	EHL
S1	Ankle plantarflexor	Gastroc/soleus

BULBOCAVERNOSUS REFLEX

Spinal Shock

- Cord dysfunction based on physiological disruption.
- charact. by paralysis, hypotonia, areflexia.
- Resolution marked by return of reflex below level of injury.



DEFINITIONS

- *Neurological level* - The most caudal segment of the cord with normal sensory and motor function.
- *Motor level* - Muscle with grade of 3, with more rostral key muscle grade of 5.

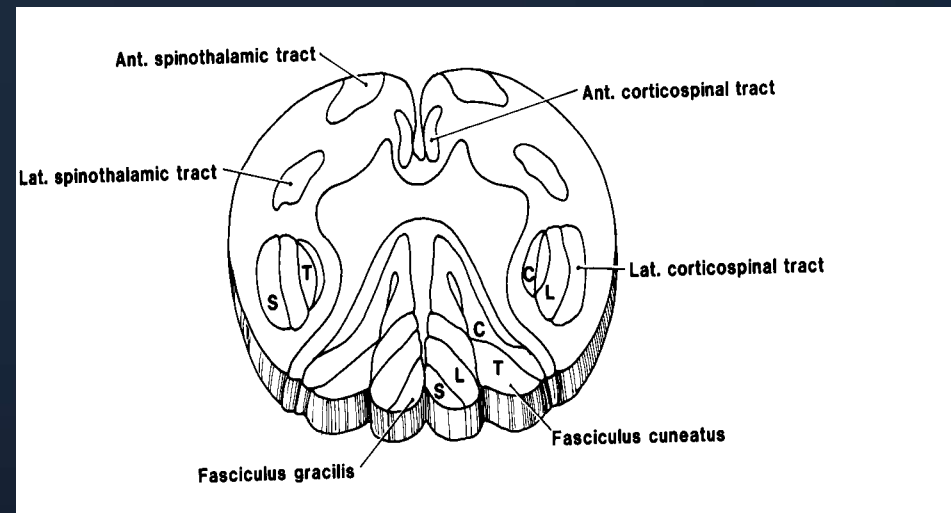
DEFINITIONS

- *Incomplete* = Partial preservation of sensory and/or motor function below the neurological level and includes the lowest sacral segment.
- *Complete* = Absence of sensory and motor function in the lowest sacral segment.

ANATOMY

Sacral Sparing

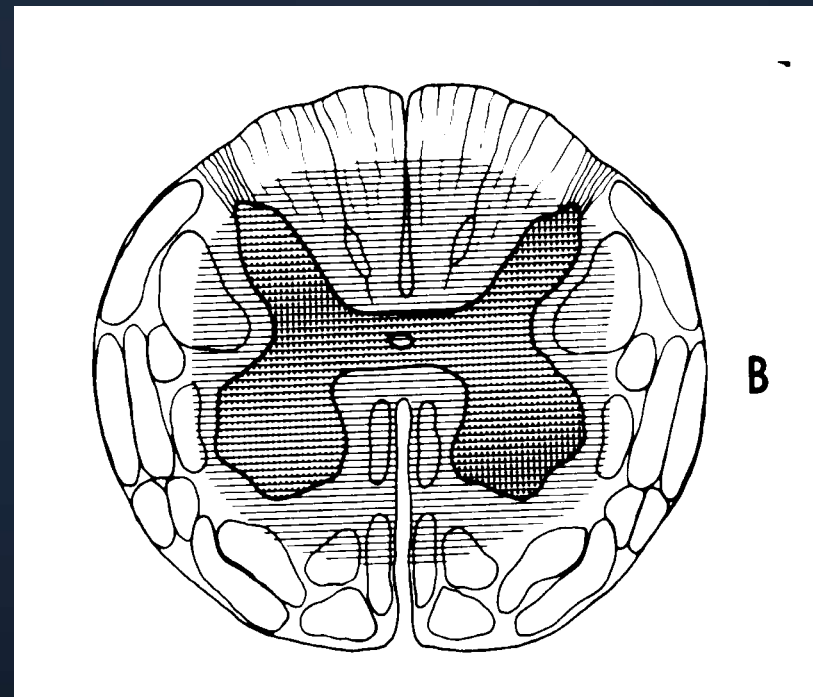
- Sacral structures are most peripheral in
 - lateral corticospinal
 - spinothalamic
 - posterior column
- Indicates some structural continuity of long tracts, so better functional recovery.



INCOMPLETE CORD INJURY

Central Cord

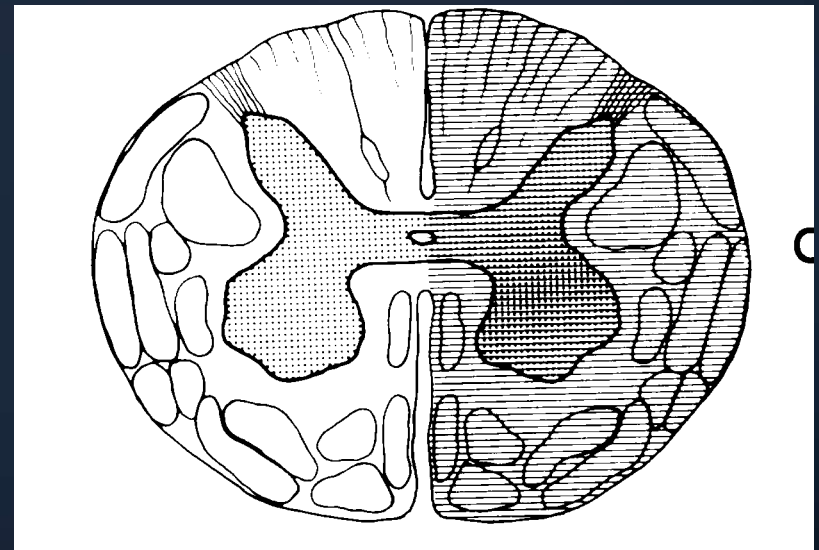
- Lesion at C-spine central area
- arm tract > leg tract (corticospinal area)
- Variable sensory sparing, usually has sacral sparing
- 50% return of Bow/bladder



INCOMPLETE CORD INJURY

Brown-Sequard

- Lesion produces ipsilateral motor/proprioceptive loss and contralateral pain and temperature loss.



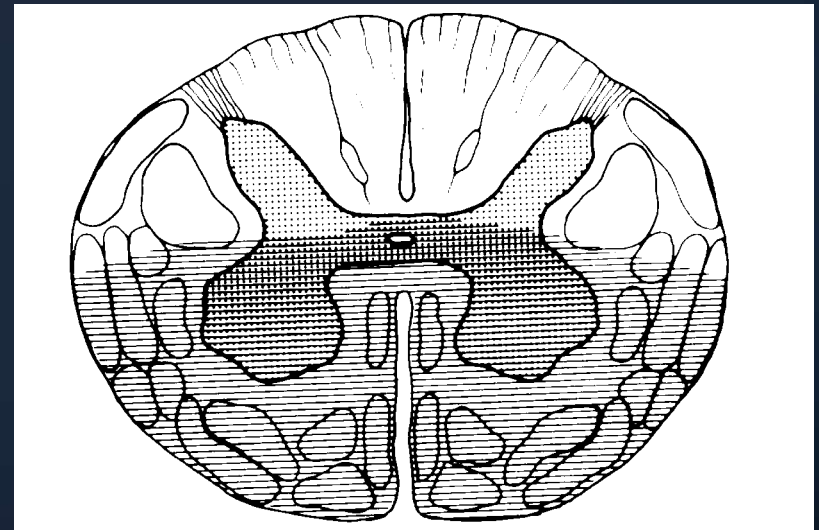
INCOMPLTE CORD INJURY

Anterior cord

- Variable loss of motor, pain/temp, preserve deep touch, position sense and vibratory sensation.

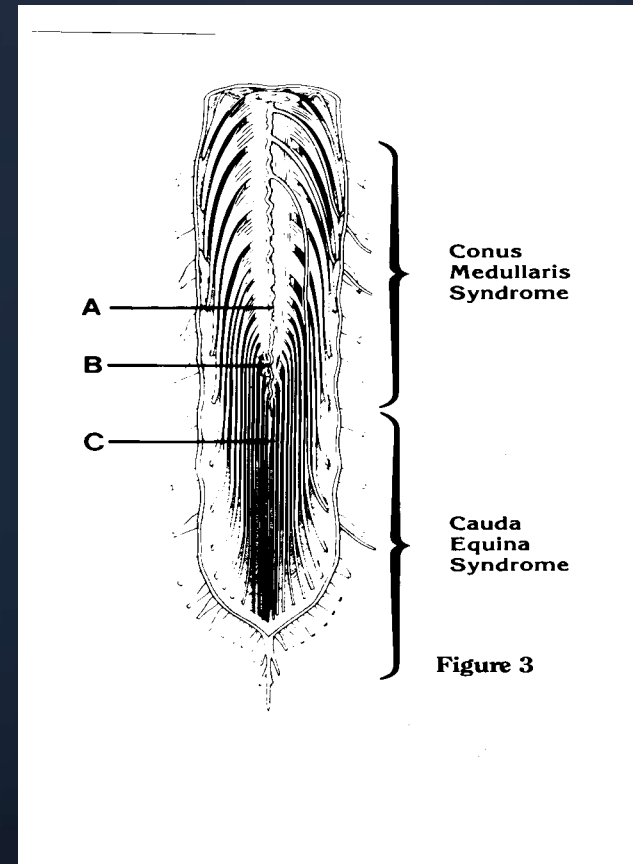
Posterior cord

- opposite of anterior cord.



Cauda Equina Vs. Conus Medullaris Syndrome

- Both result in areflexic bowel/bladder/lower limbs.
- Conus(T11-L2) is irreversible and cauda equina (peripheral nerves) has possibilities of return of functions.

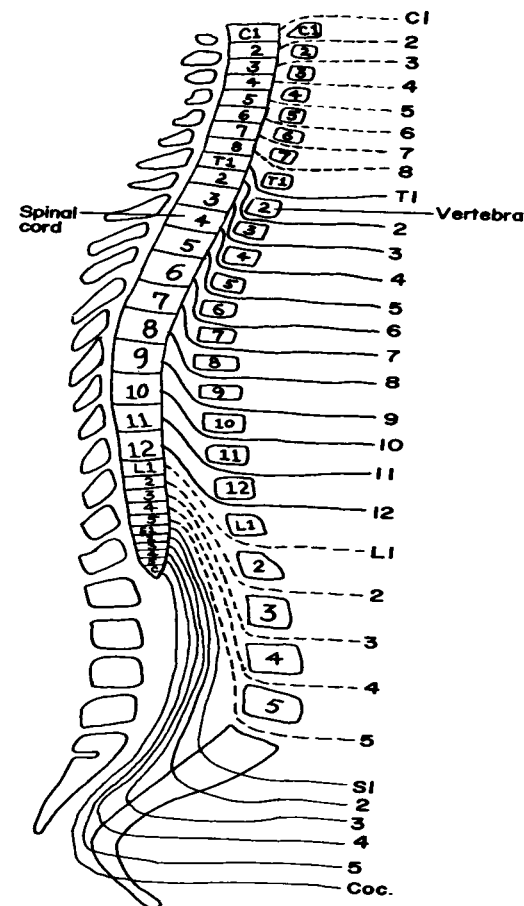


INDICATIONS FOR BULLET REMOVAL

- Retain bone or bullet fragments in canal of lumbar region.
- Increasing neurological deficit.
- Spinal instability
- High energy GSW.

LUMBAR VS. THORACIC

- Anatomy
 - nerve roots.
 - CNS Vs. PNS.
 - Stability



3 The spinal nerves. C, cervical; T, thoracic; L, lumbar; S, sacral; Coc., coccyx nerve.

STABILITY AFTER GSW

- 1300 spinal GSW, none had instability.
 - (Meyer,Apple,Bohlman, 1988, contemp orthop)
- Rancho reported instability only if fractures of both facets or pedicles.
- Flex/extension radiographs .
- Posterior lumbar spinal fusion with short segment fixation or anterior cervical fusion with strut grafting if needed.

LEVEL VERSUS COMPLETENESS OF SCI

	<u><i>Freq.</i></u>	<u><i>Comp</i></u>	<u><i>incomp</i></u>
<i>C1-C7</i>	20%	58%	42%
<i>T1-T11</i>	50%	70%	30%
<i>T12-L5</i>	30%	33%	67%

NEUROLOGICAL RECOVERY

Improvement- Asia motor score

C1-C7 17.8 points

T1-T11 4.8 points

T12-L5 10.8 points

NEUROGLOCAL RECOVERY

	Complete	incomplete
no neurologic improvement	2/3	2/3
neurologic improvement	1 level (25%)	1 level to full recovery(1/3)

NEUROLOGIC RECOVERY

AMBULATION

comp tetra	0%
comp para	6%
incomp tetra	73%
incomp para	82%

INCOMPLETE CORD SYND.

(all mechanism)

<u><i>SYNDROME</i></u>	<u><i>FREQ</i></u>	<u><i>RECOV.</i></u>
Central	#1	75%
Anterior	#2	10%
Brown-Sequard #3		>90%
Posterior	rare	N/a