INDEPENDENT LEARNING: DISC HERNIATION IN THE NATIONAL FOOTBALL LEAGUE: ANATOMICAL FACTORS TO CONSIDER IN REVIEW

CDC REPORT - CAUSES OF DISABILITY, 2005

TABLE 2. Main cause of disability among civilian noninstitutionalized U.S. and percentages, by sex — United States, 2005

Condition[§]	All persons		
	Estimated population[†]	%	(95% CI[¶])
Arthritis or rheumatism	8,552	19.0	(18.0–20.0)
Back or spine problems	7,589	16.8	(15.9–17.7)
Heart trouble	2,988	6.6	(6.0–7.2)
Lung or respiratory problem	2,224	4.9	(4.4–5.4)
Mental or emotional problem	2,203	4.9	(4.4–5.4)
Diabetes	2,012	4.5	(4.0–5.0)

REVIEW QUESTIONS ABOUT DISC HERNIATION IN THE NATIONAL FOOTBALL LEAGUE

QUESTION 1- **The most common site of disc herniation was at level L5-S1 which was much greater than the frequency of occurrence at L1-L2, L2-L3 or L3-L4. Based upon your knowledge of vertebral anatomy, what are two factors that could contribute to the high frequency of occurrence at L5-S1?**

DISC HERNIATIONS IN DIFFERENT REGIONS

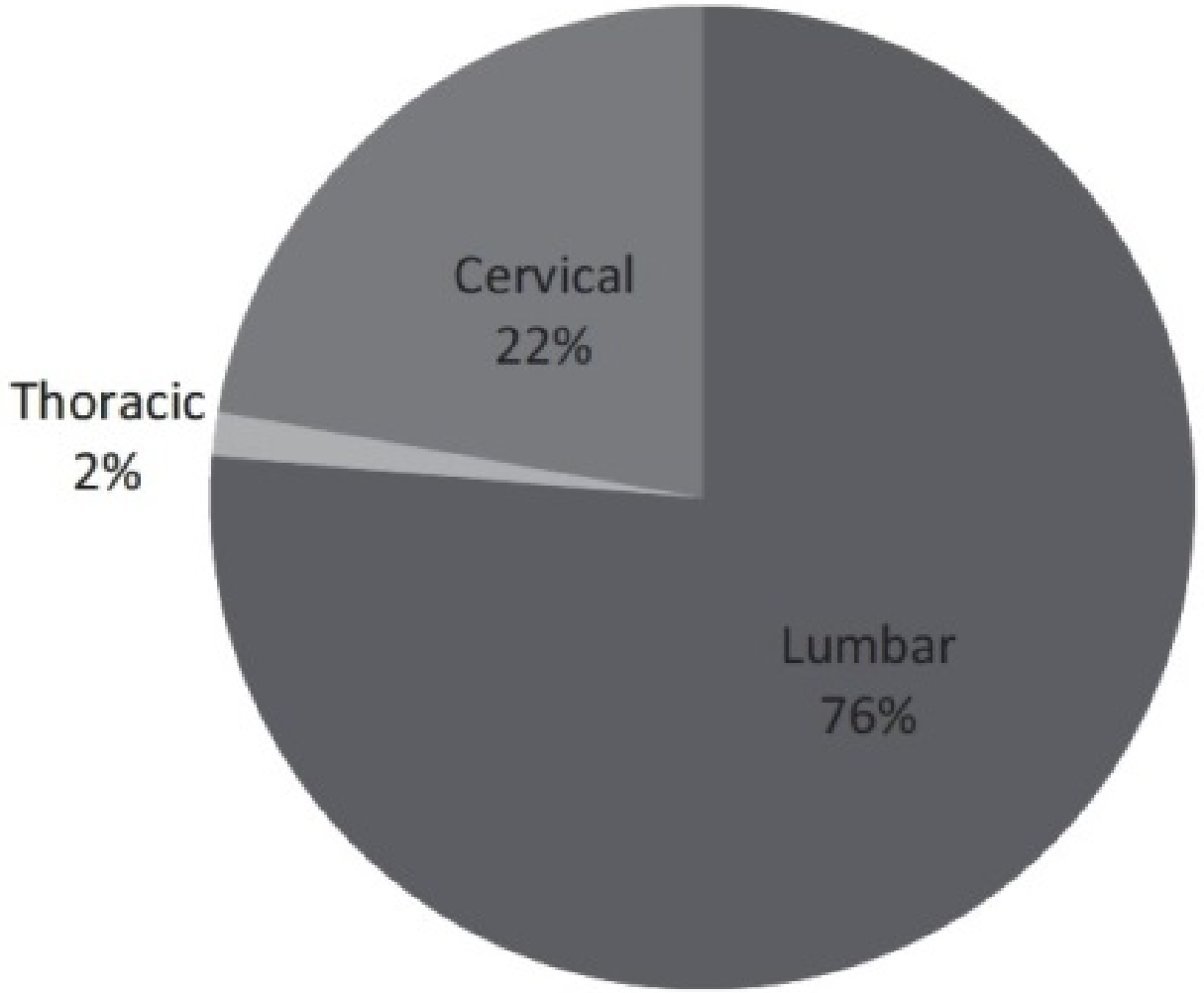


Figure 3. Injuries by anatomic location.

TABLE 1. Herniations by Anatomic Location		
Location	**Injury Level**	**Total**
Cervical	C2–C3	1
	C3–C4	14
	C4–C5	13
	C5–C6	14
	C6–C7	5
	C7–T1	1
	Not specified	13
Thoracic	Not specified	4
Lumbar	L1–L2	2
	L2–L3	1
	L3–L4	3
	L4–L5	29
	L5–S1	39
	Not specified	136
Total		275

NUMBER OF HERNIATIONS PER YEAR

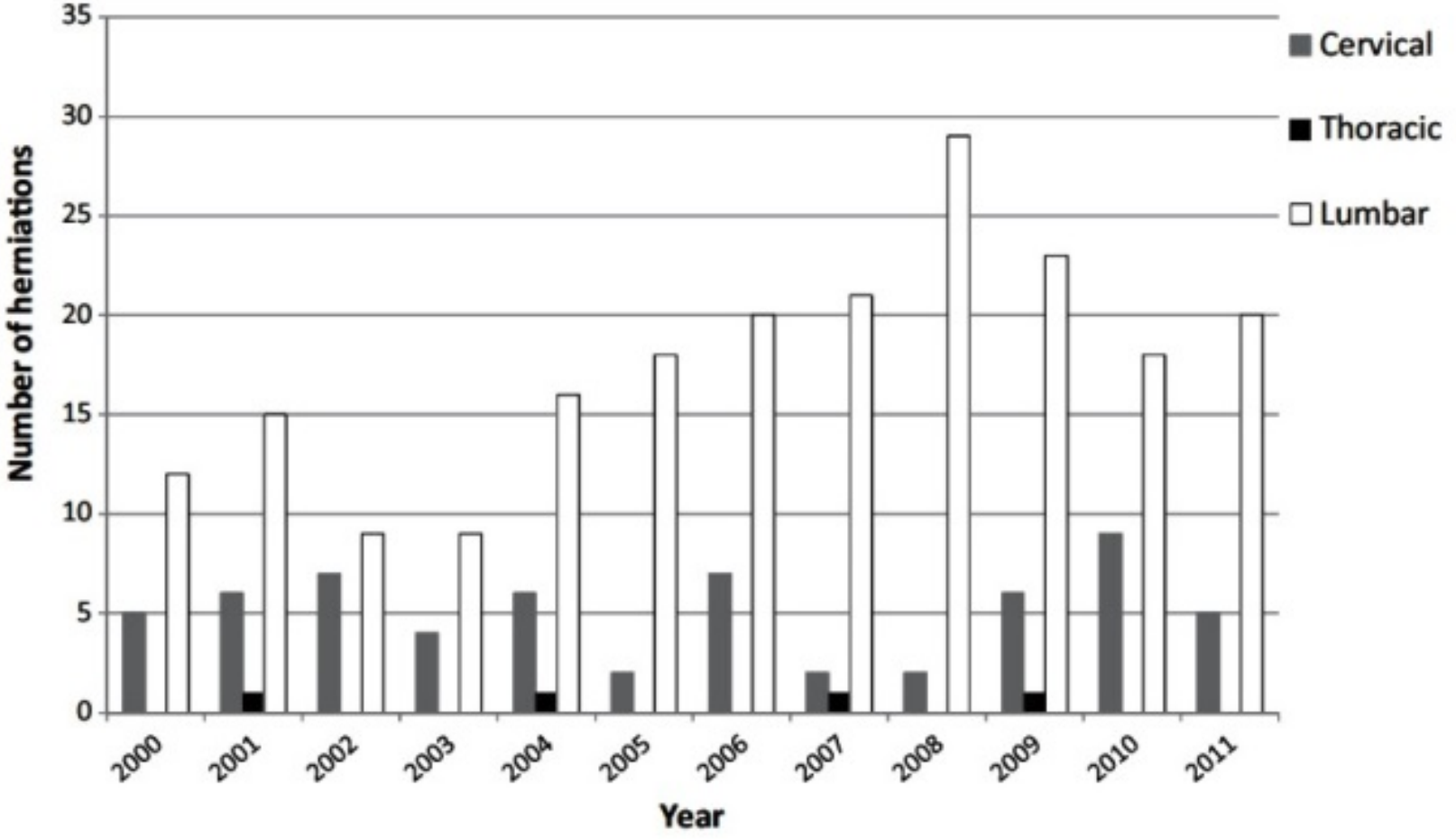
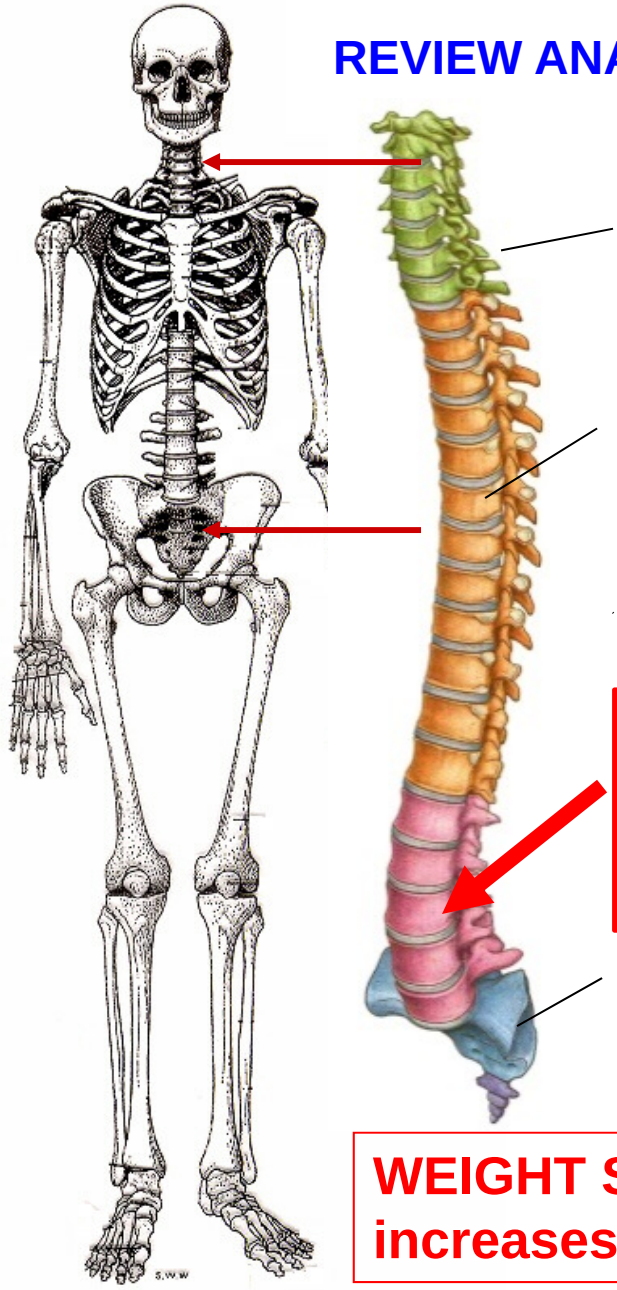


Figure 2. Number of herniations by year.

REVIEW ANATOMY: WEIGHT SUPPORTED BY VERTEBRAE



Cervical (neck) - support ONLY head

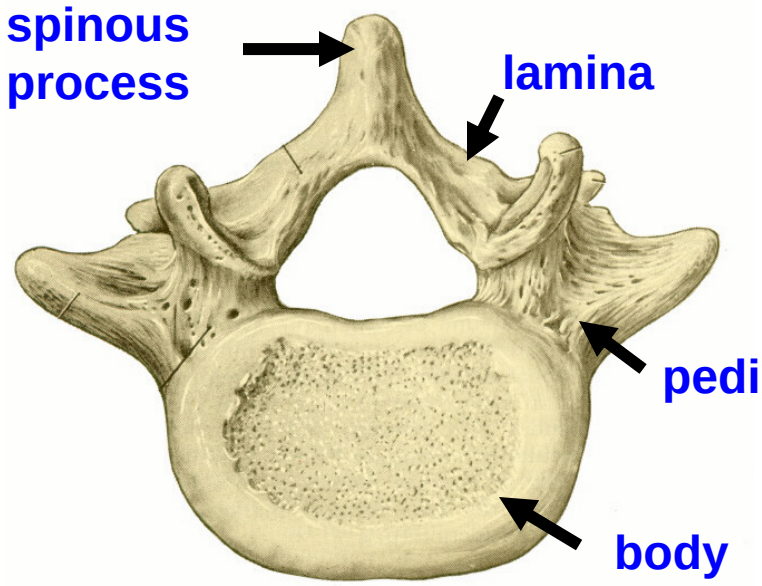
Thoracic (chest) - support head, neck + upper extremities

Lumbar (lower back) - support head + neck + upper extremities + thorax

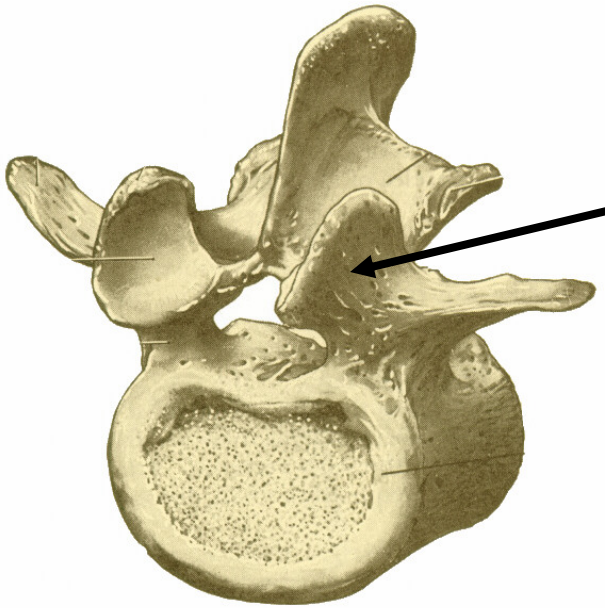
Sacral (pelvis) - fused vertebrae; transmit forces to pelvis

WEIGHT SUPPORTED BY VERTEBRAL COLUMN - increases from cervical to thoracic to lumbar regions

2) LOWER SPINE EXTENSION : MOVEMENTS PERMITTED IN LUMBAR REGION OF SPINE

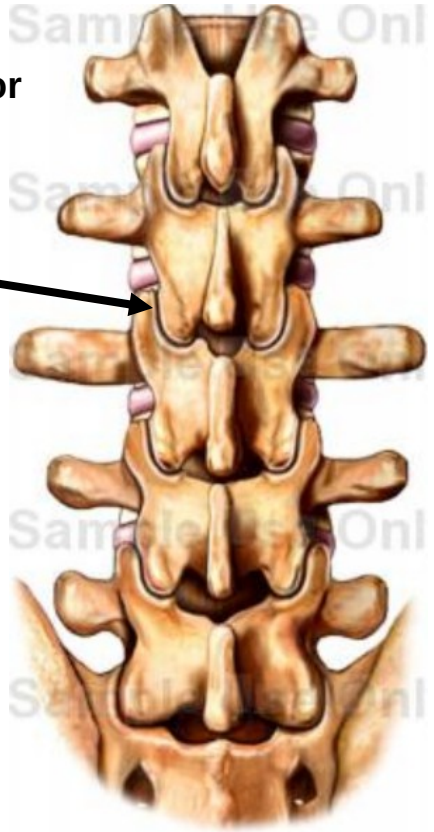


Bodies - hefty
Pedicles - stout
Lamina - thick
Spinous Processes - broad



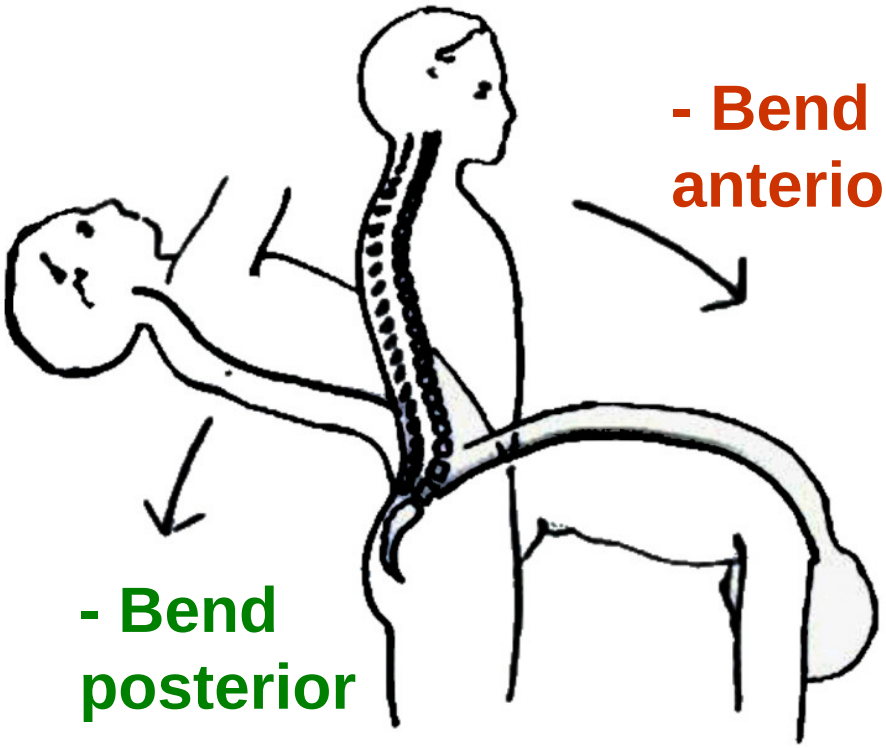
Articular processes in sagittal plane - permit flexion-extension movements of spine

posterior view



E. MOVEMENTS OF VERTEBRAL COLUMN

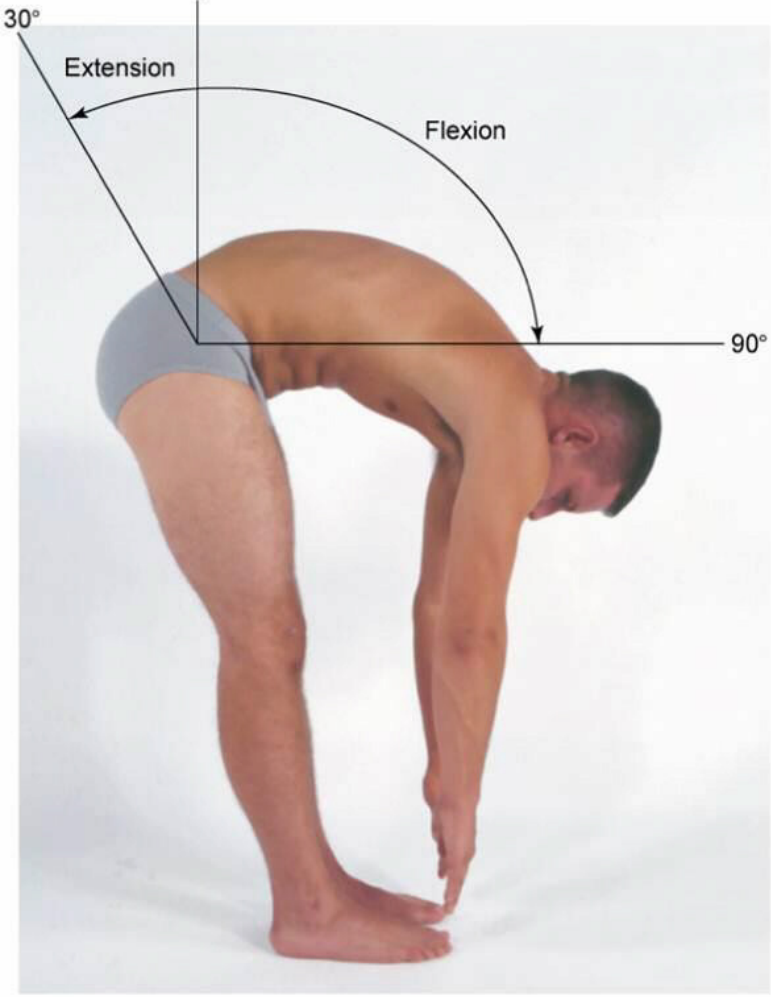
a. Extension b. Flexion



- Bend anterior

- Bend posterior

a. Extension b. Flexion



Flexion-Extension of back occurs in Lumbar region of spine

REVIEW QUESTIONS ABOUT DISC HERNIATION IN THE NATIONAL FOOTBALL LEAGUE

QUESTION 1- The most common site of disc herniation was at level L5-S1 which was much greater than the frequency of occurrence at L1-L2, L2-L3 or L3-L4. Based upon your knowledge of vertebral anatomy, what are two factors that could contribute to the high frequency of occurrence at L5-S1?

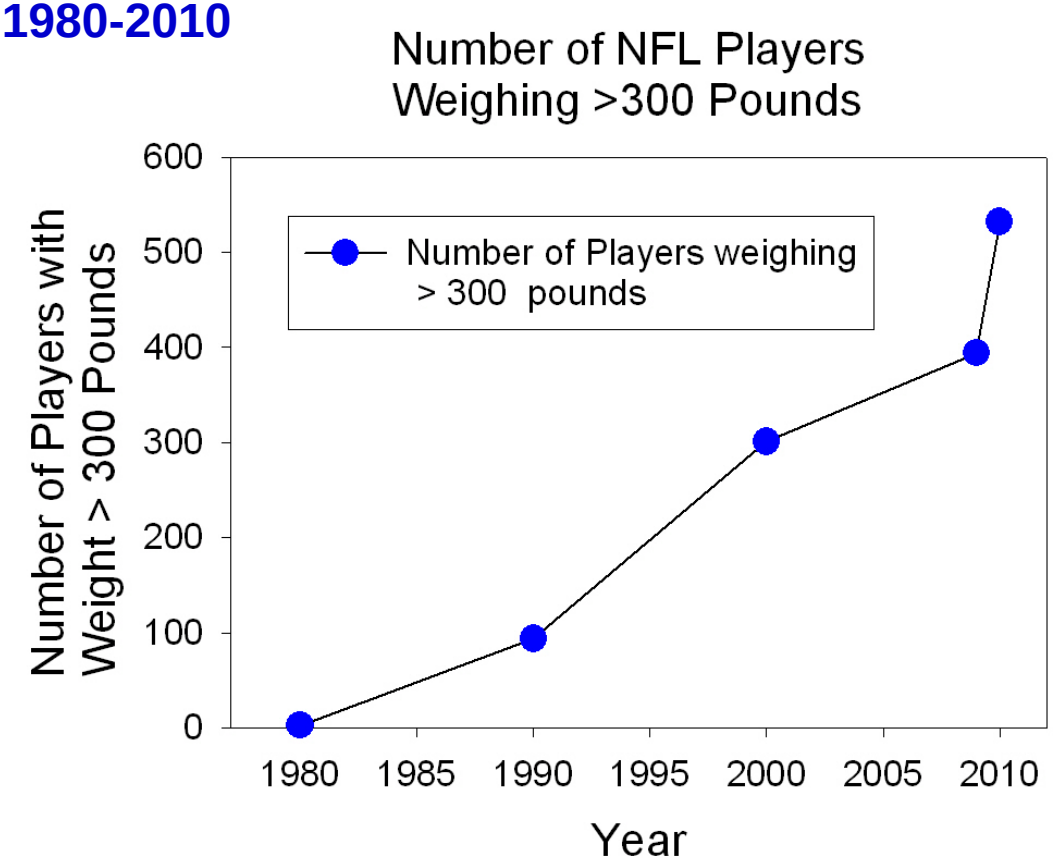
Article page 1937 - 'In the lumbar spine, **high loading from the weight of the linemen, rigorous weight training, and forcible lower spine extension during blocking likely play a role in lumbar herniations'**

ARTICLE ALSO DISCUSSES INCREASE IN WEIGHT OF FOOTBALL PLAYERS IN NFL

F = ma

force = mass X acceleration

1980-2010



Source of data: Associate press study reported in http://www.nytimes.com/2011/01/29/sports/football/29weight.html?pagewanted=all
See also: Weigh in Results for Lineman 2014: http://www.sbnation.com/nfl/2014/2/20/5426884/nfl-combine-2014-offensive-line-weigh-in-results-greg-robinson

FORCIBLE LOWER SPINE EXTENSION DURING BLOCKING: PRACTICE DRILL

LUMBAR EXTENSION

START POSITION

INITIAL CONTACT

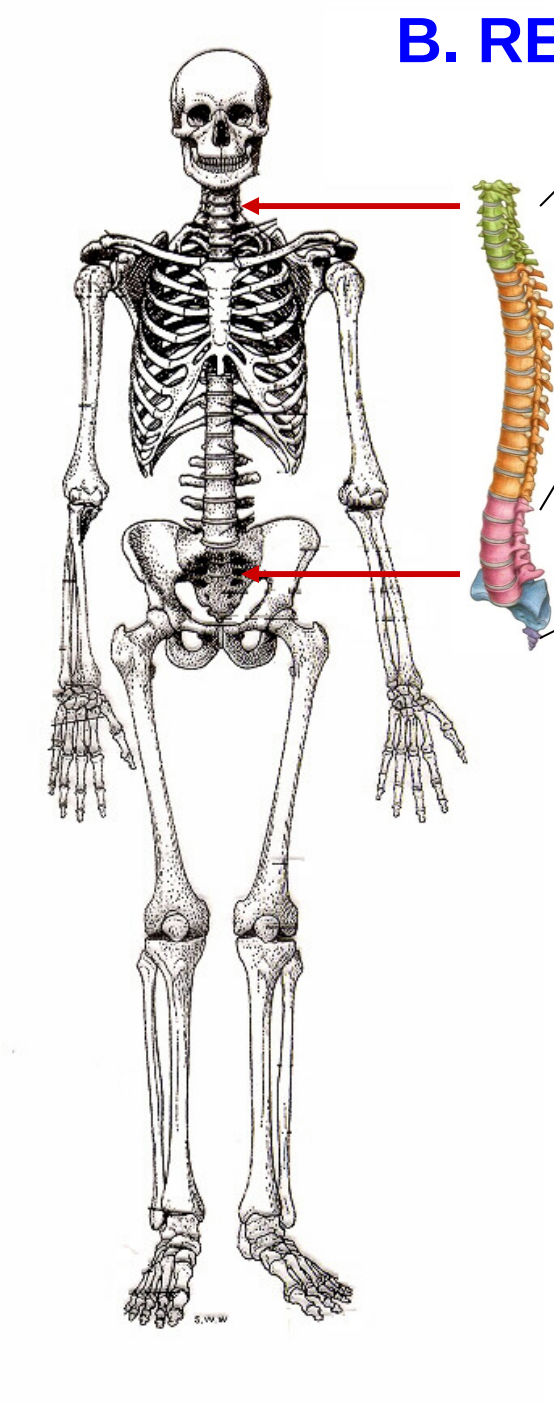
PUSH PLAYER BACK

from: Techniques & Drills for Creating Championship Lineman
http://www.youtube.com/watch?v=wINZ3fsH6j4


CHAMPIONSHIP
Productions
com
Start
1:54 PM
10/17/2016

<u>QUESTION 2-</u> The second most common region for disc herniation was in the Cervical spine. What aspect of the anatomy of cervical vertebrae could contribute to the relatively high frequency of occurrence of herniation in this region?

B. REGIONS OF VERTEBRAL COLUMN



Cervical (neck) - 7 vertebrae (C1-C7)

Thoracic (chest) - 12 vertebrae (T1-T12)

Lumbar (lower back) - 5 vertebrae (L1-L5)

Sacral (pelvis) - 5 fused vertebrae (S1-S5)

Coccygeal (tail) - 3 - 5 vertebrae (Co1-Co3)

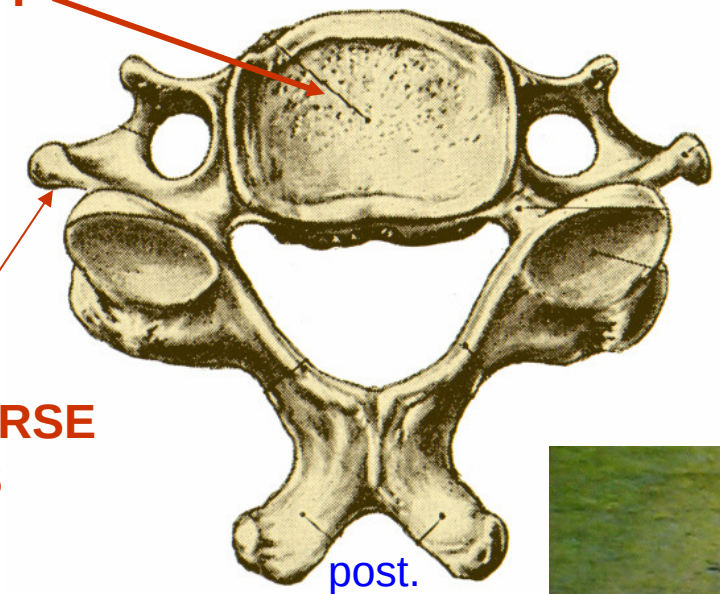
Note: Bodies increase in size from rostral to caudal = superior to inferior

CERVICAL VERTEBRA

NOSE

BODY

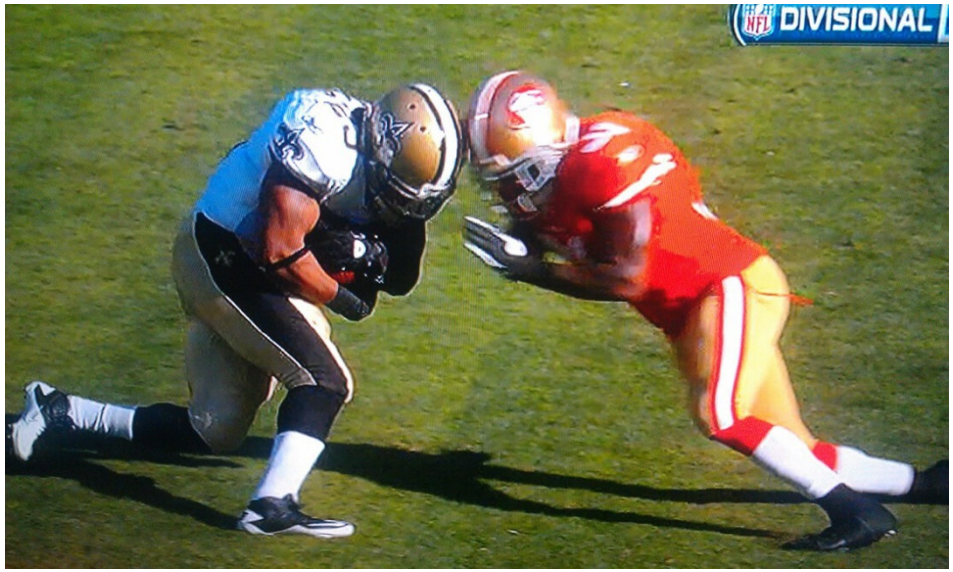
ant.



post.

TRANSVERSE PROCESS

- **body is small**



Helmet to Helmet contact in NFL - force transmitted through cervical vertebrae

<u>QUESTION 2-</u> The second most common region for disc herniation was in the Cervical spine. What aspect of the anatomy of cervical vertebrae could contribute to the relatively high frequency of occurrence of herniation in this region?

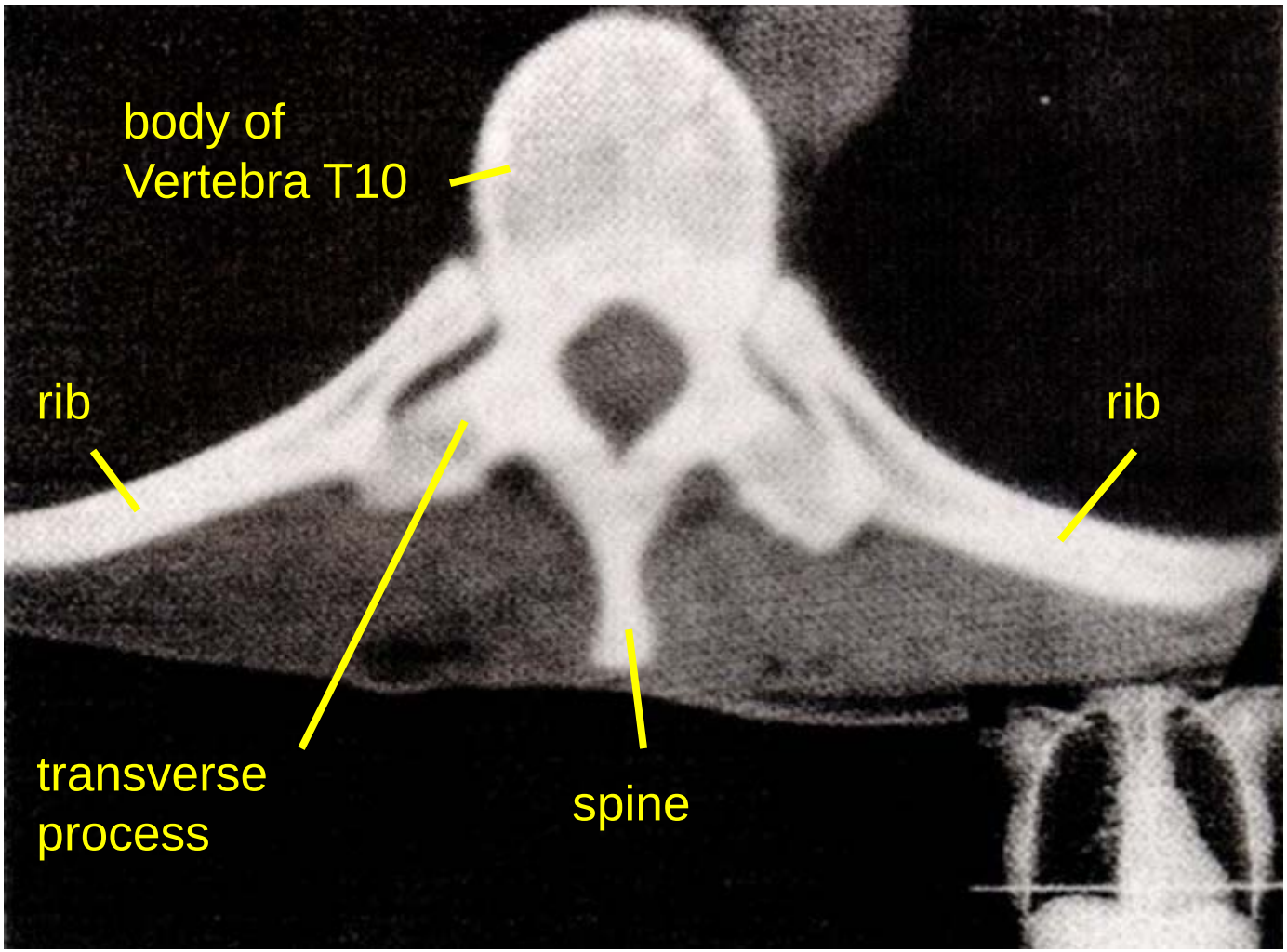
Review Anatomy:

1) vertebral bodies increase in size from superior to inferior

2) bodies of cervical vertebrae (and, therefore intervertebral discs) are small

<u>QUESTION 3-</u> Disc herniation was rare in the thoracic region. Name one specialization of thoracic vertebrae that could contribute to the infrequency of occurrence of herniations in this region?

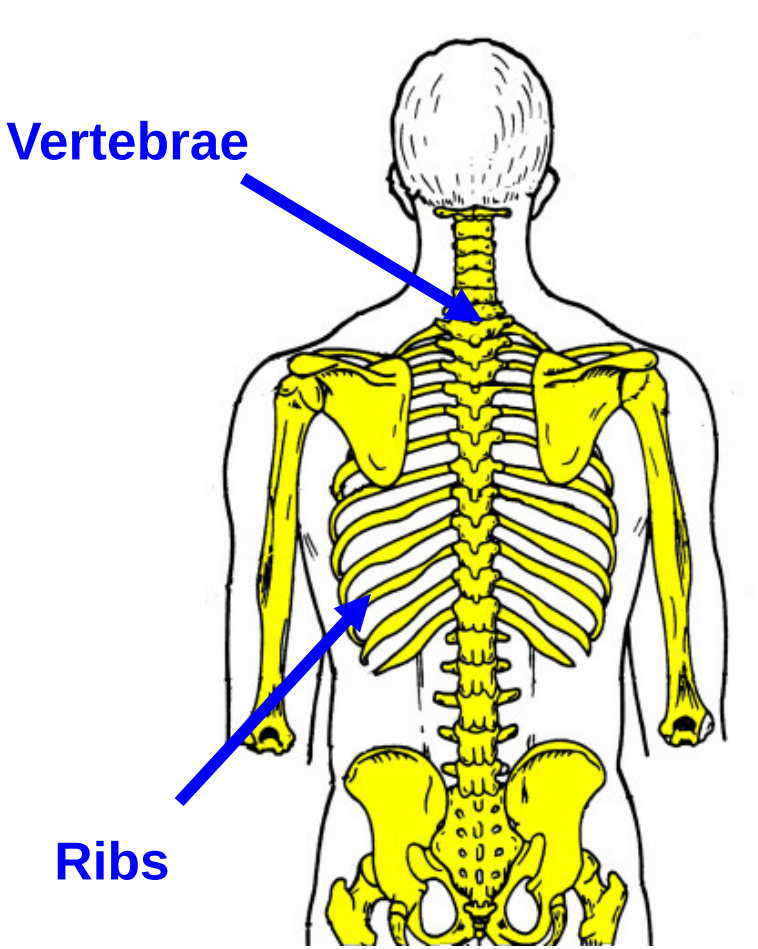
CT OF THORACIC VERTEBRA



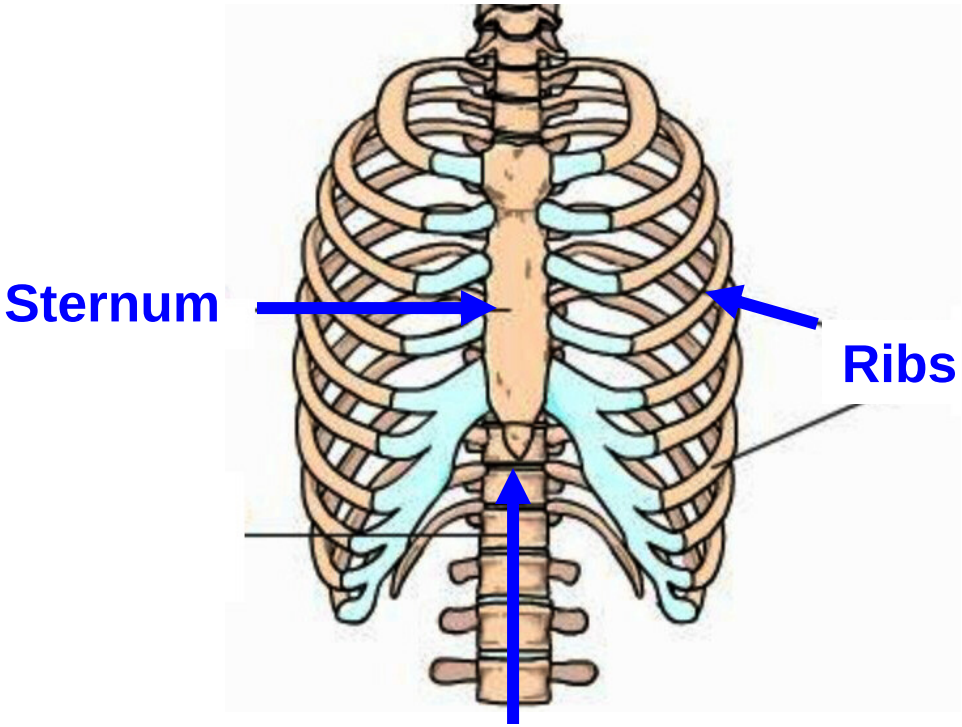
Note: In radiographic images (CT= Computed Tomography and X rays) bone and metal appear white, air is black; soft tissues appear grey

THORACIC VERTEBRAE ARE STABILIZE BY RIBS WHICH ATTACH ANTERIORLY TO STERNUM

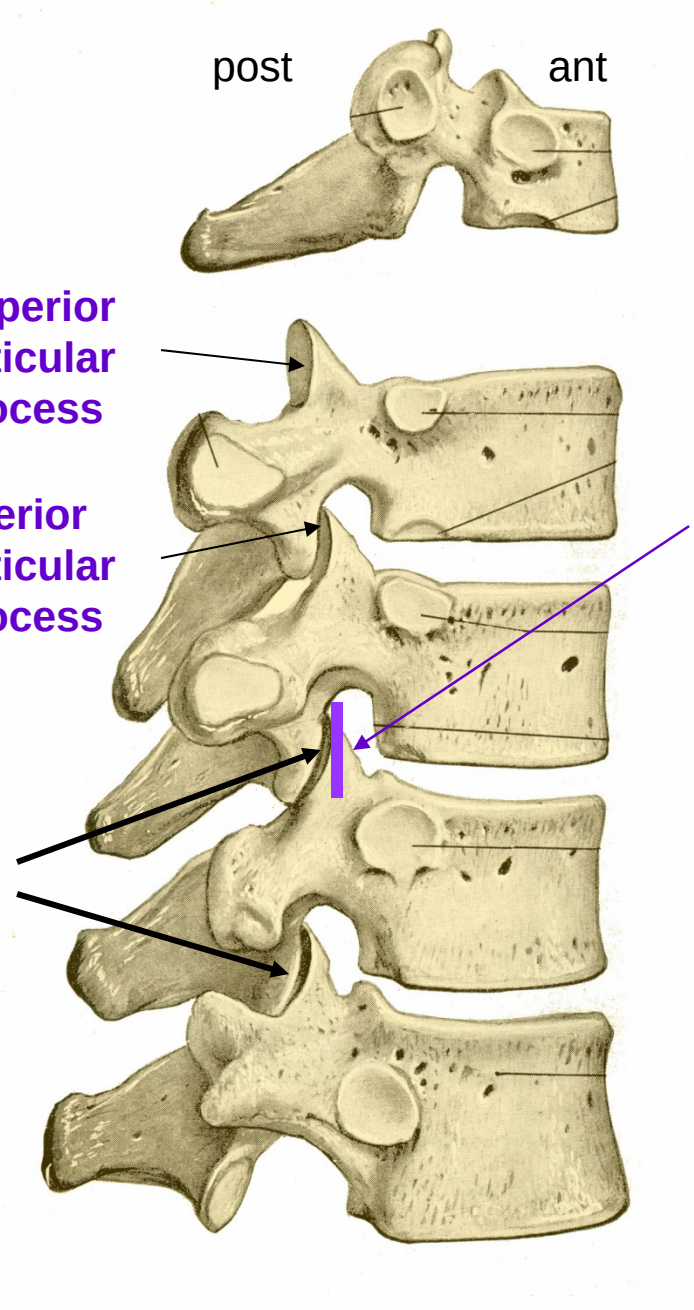
Dorsal view of skeleton



Ventral view of thorax



LATERAL VIEW OF THORACIC VERTEBRA

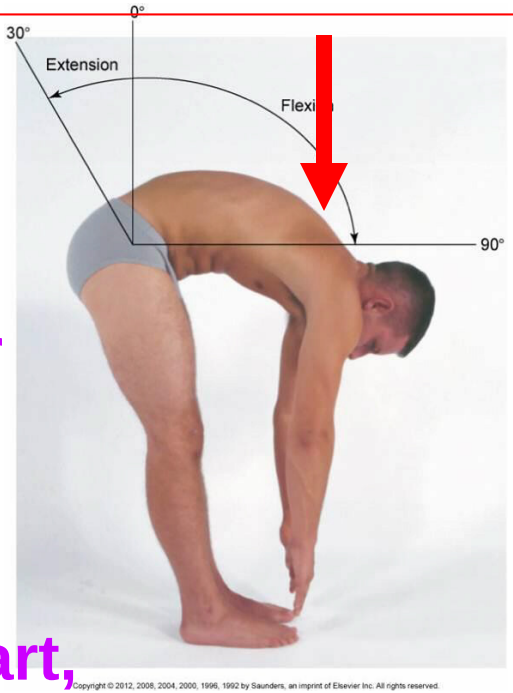


3. Costal Facets for Ribs - Body - Facets for Heads of rib; Transverse Process - Facets for Tubercle

THORAX IS NOT BENT WHEN SPINE IS FLEXED

5. Articular Processes in coronal plane

permit some rotation - little or no flex-extend (also limited by ribs); useful - no flex down on heart, lungs



QUESTION 3- Disc herniation was rare in the thoracic region. Name one specialization of thoracic vertebrae that could contribute to the infrequency of occurrence of herniations in this region?

REVIEW ANATOMY -

1) Thoracic vertebrae are stable due to posterior attachment of ribs. Anteriorly ribs are attached anteriorly to form thoracic cage.

2) Articular process - In thorax, articular processes are in coronal plane, preventing flexion-extension movements.

QUESTION 4- The highest number of injuries to spinal nerves occurred in the Cervical region. Based upon your knowledge of vertebral anatomy, what could contribute to the high rate of occurrence of nerve injuries in this region?

TYPE OF INJURIES: NERVE INJURIES IN CERVICAL REGION

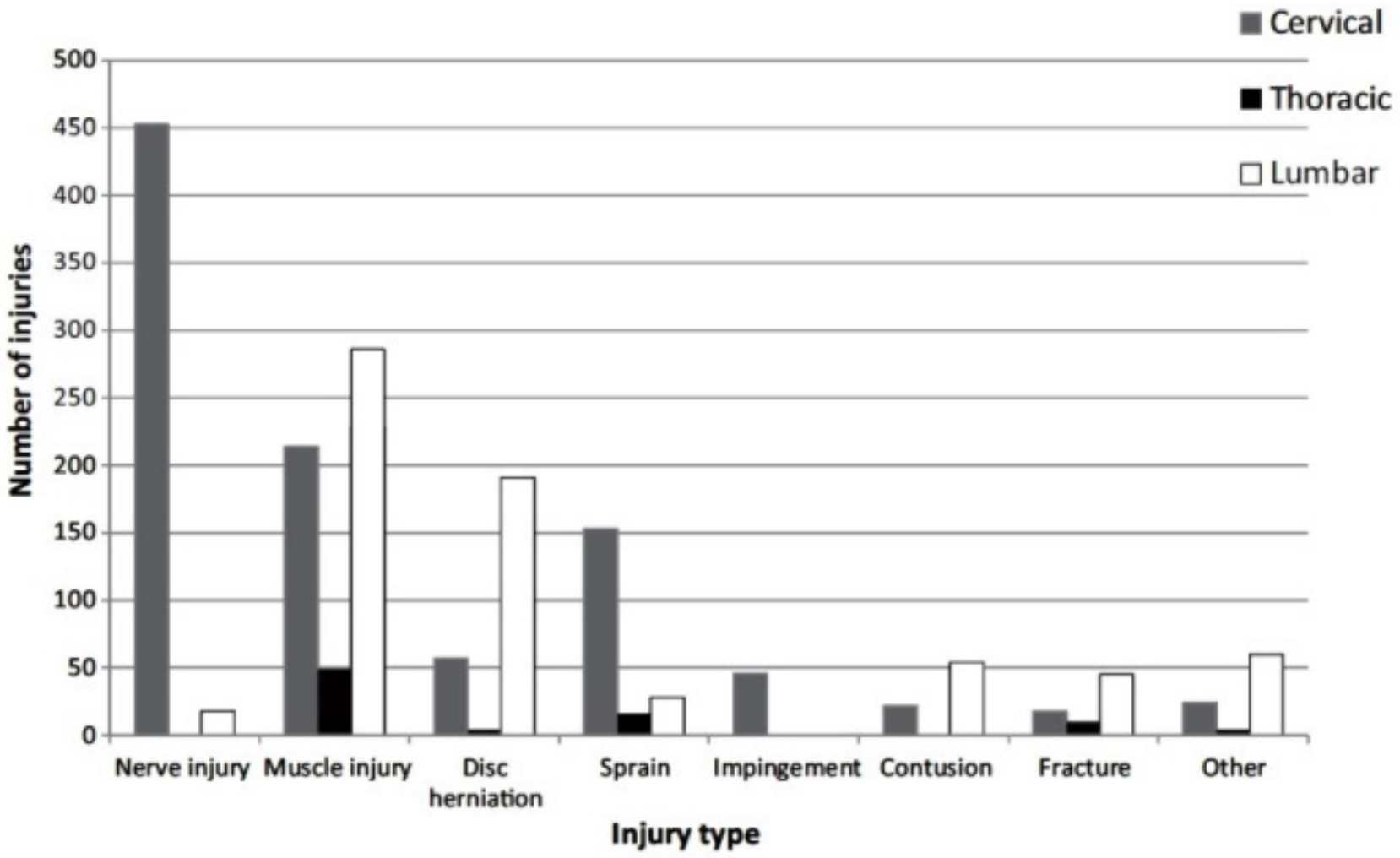


Figure 1. Number of injuries by injury type.

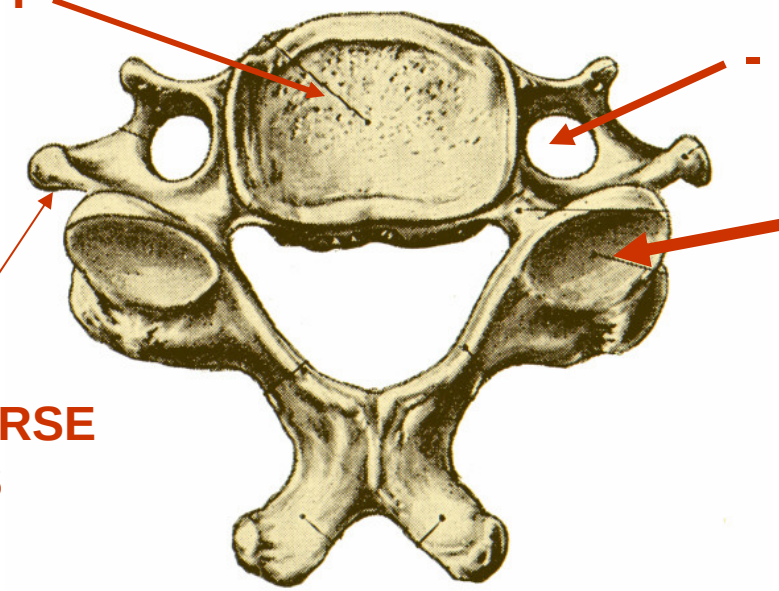
CERVICAL VERTEBRA

NOSE

BODY

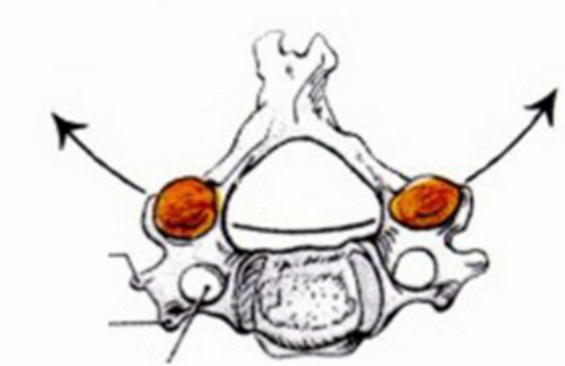
ant.

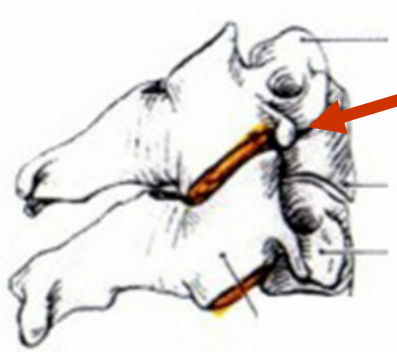
- body is small



ARTICULAR FACETS - angled superiorly & medially
- considerable freedom of movement

TRANSVERSE PROCESS





permit considerable flexion-extension, lateral flexion, rotation - useful - move head

MOVEMENTS OF HEAD AND NECK: body language

FLEXION - anterior

YES

EXTENSION - posterior

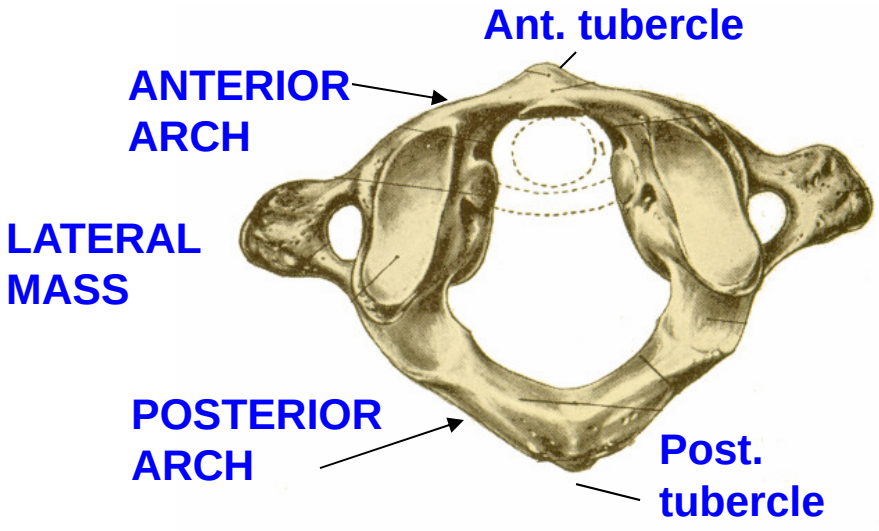
MAYBE

LATERAL FLEXION - head on shoulder, face forward

NO

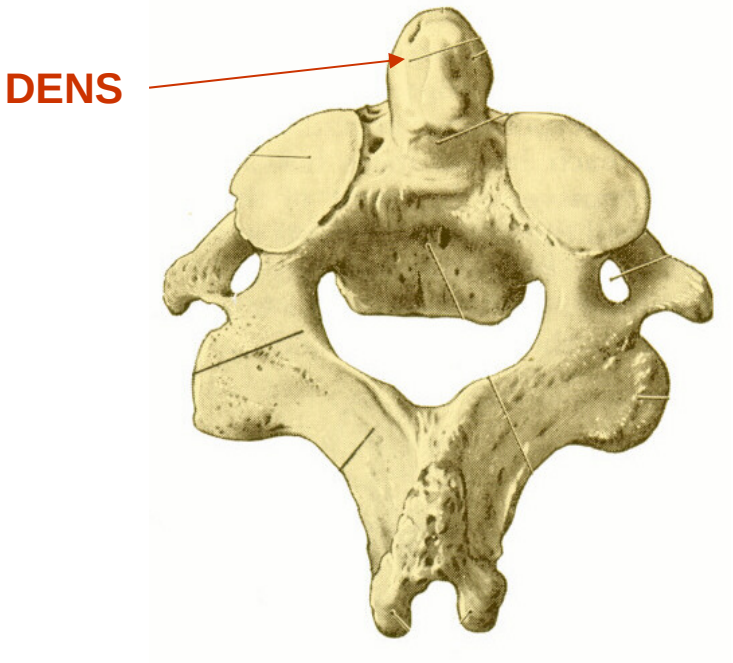
ROTATION - face turned, look over shoulder

FIRST CERVICAL VERTEBRA = C1 (ATLAS)



1) has no body only ring of bone
2) Anterior and Posterior Arches and Lateral mass
3) bumps on arches - Ant. and Post. Tubercles
4) has Foramina Transversaria
5) superior articular facets to occipital bone of skull; permits Flex-Ext 'yes' movement of head

SECOND CERVICAL VERTEBRA = C2 (AXIS)



1) has peg-like Odontoid process = Dens (may be fused body of C1)
2) joint between C1-C2 is pivot joint allowing rotation; Rotation = 'no' movement of head; joint is important in hanging

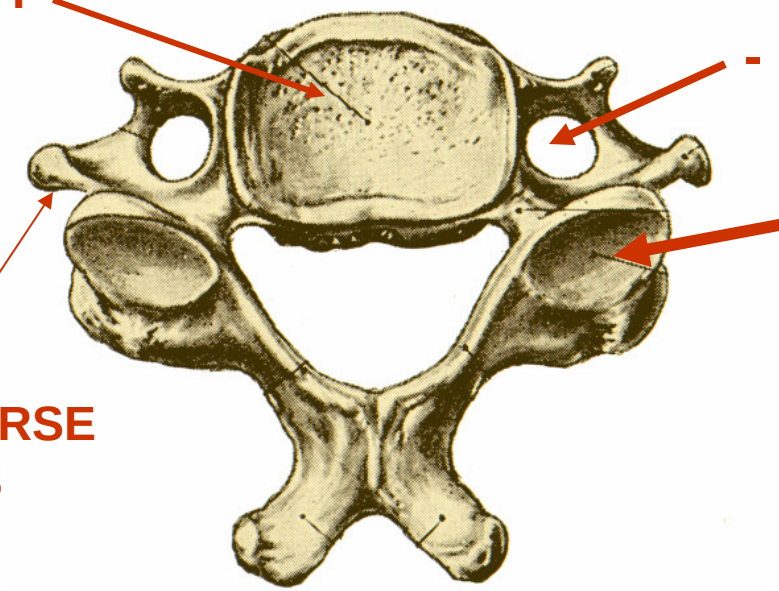
CERVICAL VERTEBRA

NOSE

BODY

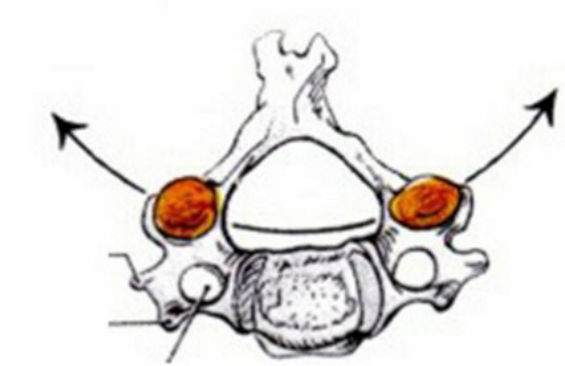
ant.

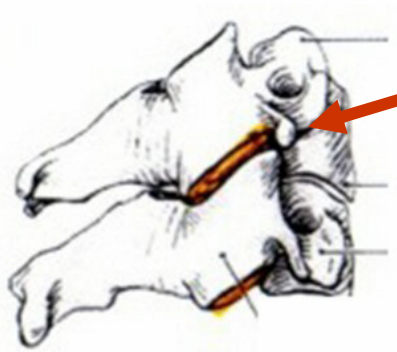
- body is small



ARTICULAR FACETS - angled superiorly & medially
- considerable freedom of movement

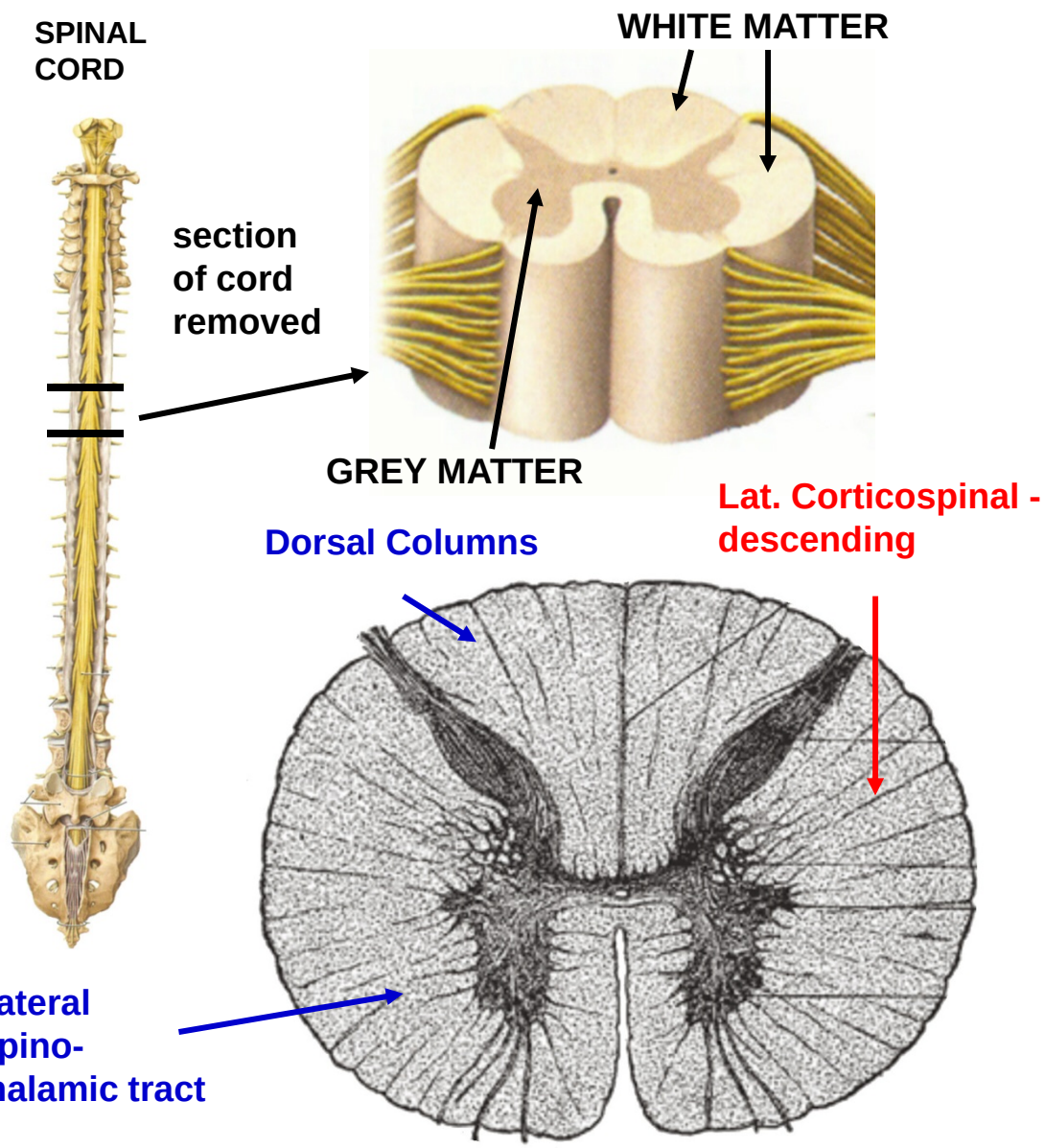
TRANSVERSE PROCESS





permit considerable flexion-extension, lateral flexion, rotation - useful - move head

GENERAL TERMINOLOGY: ORGANIZATION OF SPINAL CORD

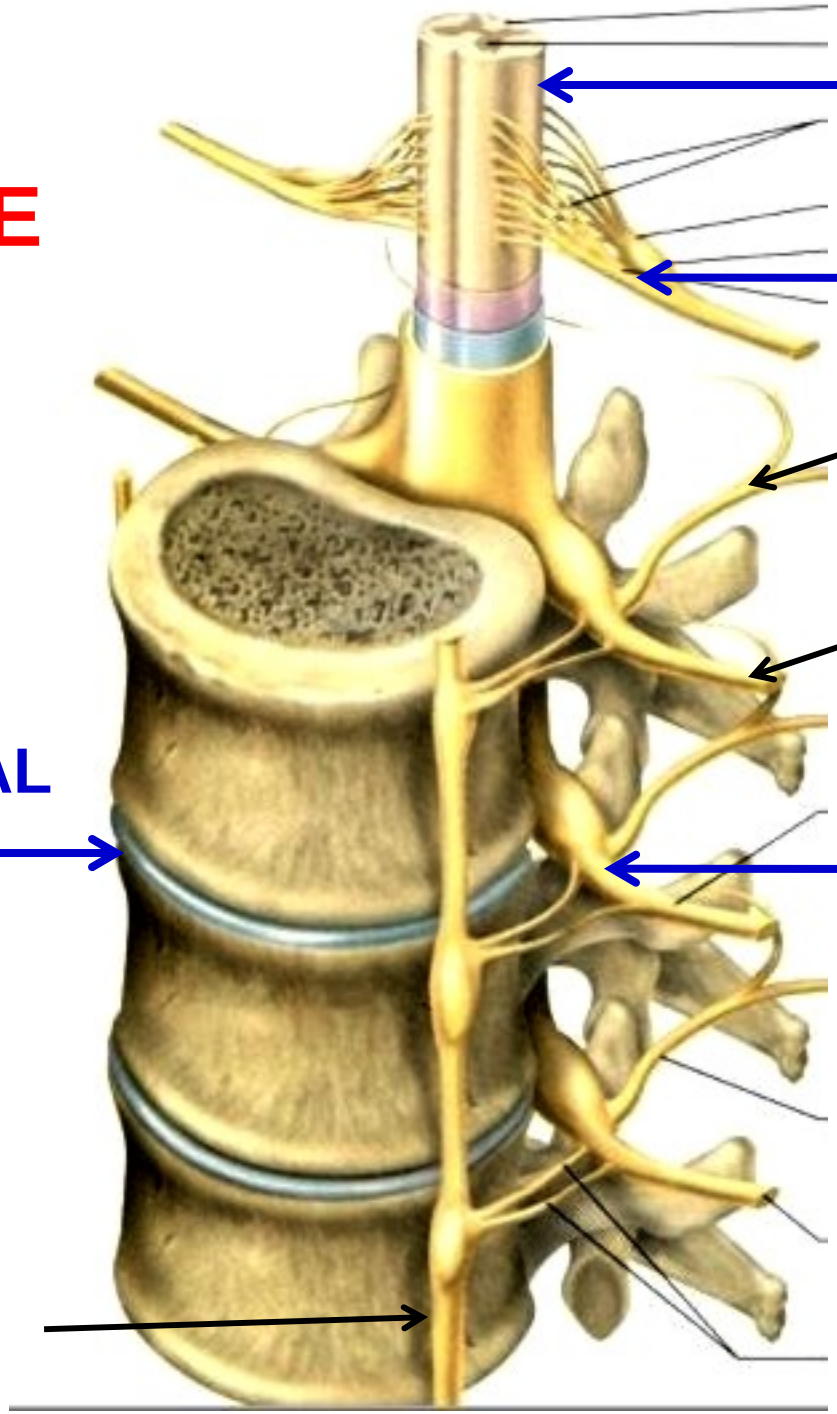


Grey and white matter - some nervous tissue appears white because of myelin.

1. **'White matter'** of nervous system is composed of **myelinated** axons. Ascending and descending tracts (axons from and to other places).
ex. **Ascending** -
Dorsal Columns
Spinothalamic tract
ex. **Descending -**
Corticospinal tract

2. **'Grey matter'** is composed of everything else in nervous system (mainly cell bodies, unmyelinated axons, etc.).
Neurons form synapses mostly in Grey matter.

NERVE DAMAGE



SPINAL CORD

SPINAL NERVE

DORSAL PRIMARY RAMUS

VENTRAL PRIMARY RAMUS

INTER-VERTEBRAL DISC

SPINAL NERVE

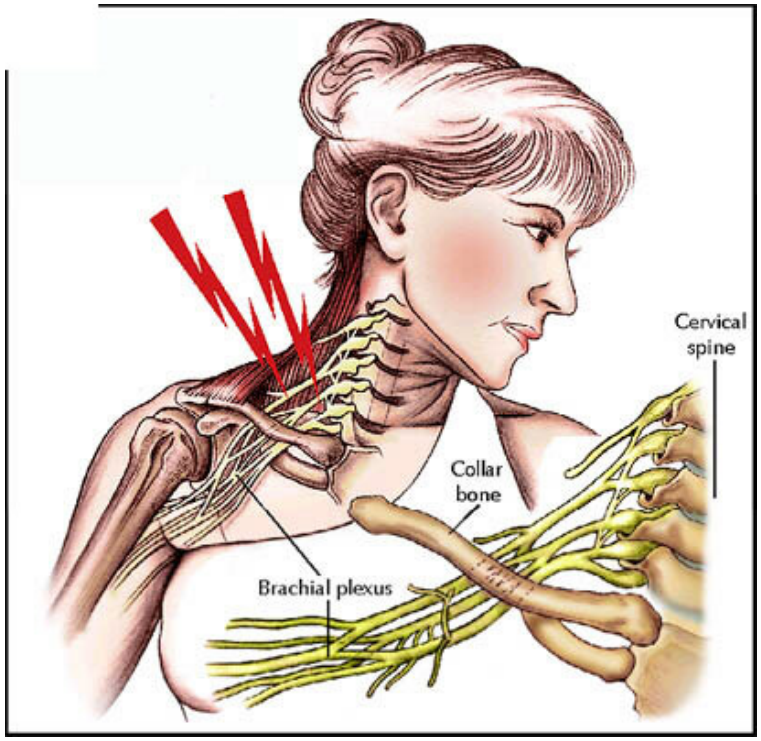
SYMPATHETIC CHAIN

Excessive bending of neck can damage Spinal Nerves

EXCESSIVE BENDING OF NECK CAN INJURE SPINAL NERVES

Excessive bending of neck can damage Spinal Nerves

Tackling in NFL - photo of Ahmed Brooks tackling Drew Brees (quarterback of New Orleans Saints)



Brachial Plexus innervates upper extremity - most ventral primary rami from Cervical spinal nerves (C5-T1)