INDEPENDENT LEARNING: DISC HERNIATION IN THE NATIONAL FOOTBALL LEAGUE: ANATOMICAL FACTORS TO CONSIDER IN REVIEW
<table>
<thead>
<tr>
<th>Condition</th>
<th>Estimated population†</th>
<th>%</th>
<th>(95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthritis or rheumatism</td>
<td>8,552</td>
<td>19.0</td>
<td>(18.0–20.0)</td>
</tr>
<tr>
<td>Back or spine problems</td>
<td>7,589</td>
<td>16.8</td>
<td>(15.9–17.7)</td>
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<tr>
<td>Heart trouble</td>
<td>2,988</td>
<td>6.6</td>
<td>(6.0–7.2)</td>
</tr>
<tr>
<td>Lung or respiratory problem</td>
<td>2,224</td>
<td>4.9</td>
<td>(4.4–5.4)</td>
</tr>
<tr>
<td>Mental or emotional problem</td>
<td>2,203</td>
<td>4.9</td>
<td>(4.4–5.4)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2,012</td>
<td>4.5</td>
<td>(4.0–5.0)</td>
</tr>
</tbody>
</table>
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

- **Lumbar**: 76%
- **Cervical**: 22%
- **Thoracic**: 2%

*Figure 3. Injuries by anatomic location.*
<table>
<thead>
<tr>
<th>Location</th>
<th>Injury Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical</td>
<td>C2–C3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>C3–C4</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>C4–C5</td>
<td>13</td>
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<tr>
<td></td>
<td>C5–C6</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>C6–C7</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>C7–T1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Not specified</td>
<td>13</td>
</tr>
<tr>
<td>Thoracic</td>
<td>Not specified</td>
<td>4</td>
</tr>
<tr>
<td>Lumbar</td>
<td>L1–L2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>L2–L3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>L3–L4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>L4–L5</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>L5–S1</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Not specified</td>
<td>136</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>275</td>
</tr>
</tbody>
</table>
NUMBER OF HERNIATIONS PER YEAR

Figure 2. Number of herniations by year.
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 VERTEBRAE 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
E. MOVEMENTS OF VERTEBRAL COLUMN

a. Extension

- Bend posterior

b. Flexion

- Bend anterior

Flexion-Extension of back occurs in Lumbar region of spine
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

1980-2010

Number of NFL Players Weighing >300 Pounds


\[ F = ma \]
force = mass x acceleration
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
QUESTION 2- 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
Helmet to Helmet contact in NFL - force transmitted through cervical vertebrae
QUESTION 2- 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
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?
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
3. Costal Facets for Ribs - Body - Facets for Heads of rib; Transverse Process - Facets for Tubercle

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

THORAX IS NOT BENT WHEN SPINE IS FLEXED
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.
- Body is small

**Articular Facets** - angled superiorly & medially - considerable freedom of movement

Permit considerable flexion-extension, lateral flexion, rotation - useful - move head
MOVEMENTS OF HEAD AND NECK: body language

FLEXION - anterior
EXTENSION - posterior

LATERAL FLEXION - head on shoulder, face forward
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
- body is small

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

permit considerable flexion-extension, lateral flexion, rotation - useful - move head
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
   - 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.
Excessive bending of neck can damage Spinal Nerves.
EXCESSIVE BENDING OF NECK CAN INJURE SPINAL NERVES

Excessive bending of neck can damage Spinal Nerves

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

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