NEW TRENDS IN MANAGEMENT OF CHRONIC NON SURGICAL LOW BACK PAIN

Essay

Submitted for Fulfillment of Master Degree in Anesthiology

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List of abbreviations

- **ACC:** Anterior cigulate cortex.
- **CNS**: Central nervous system.
- **CT**: computed tomography.
- **DHSC**: Dorsal horn of the spinal cord.
- **EMG**: Electromyogram.
- **ESTs**: Epidural steroid injections.
- **FR**: Functional restoration.
- **GABA**: Gamma amino butyric acid.
- **IASP**: International association for the study of pain.
- **IC**: Insular cortex.
- **IDD**: Internal disc disruption.
- **IDET**: Intradiscal electrothermal therapy.
- **IPGs**: Implanted pulse generator.
- **LBP**: Low back pain.
- **MRI**: Magnetic resonance imaging.
- **NMDA**: N-methyl-D-aspartate.
- **NRM**: Nucleus raphe magnus.
- **NRT**: Neuro-reflexotherapy.
- **NSAIDs**: Non steroidal anti-inflammatory drugs.
- **PAG**: Peri-aqueductal gray
- **PENS**: Percutaneous electrical nerve stimulation.
- **PGs**: Proteoglycans.
- **PXR**: Plain X-ray.
- **RF**: Radiofrequency.
- **RIT**: Regenerative injection therapy.
- **SCS**: Spinal cord stimulation.
- **SI**: Somatosensory cortex.
- **SII**: Secondary somatosensory cortex.
- **SIJI**: Sacroiliac joint injections.
- **SLR**: Straight leg raising test.
- **SSRI**: Selective serotonin reuptake inhibitors.
- **TENS**: Transcutaneous electrical nerve stimulation.
- **WDR**: Wide dynamic range.

Introduction

Low back pain (LBP) is a substantial health problem. It affects up to 80% of the adult population[1] and accounts for considerable healthcare and socioeconomic costs.[2] International guidelines for the management of LBP recommend an initial triage to facilitate effective management of the problem.[3] This classification process differentiates between specific spinal pathology, nerve root pain and simple or non-specific low back pain (NSLBP).[4] Most authorities suggest further staging the problem by symptom duration into acute, sub acute or chronic.[5-7] NSLBP represents about 85% of LBP patients seen in primary care[8] and the vast majority of LBP patients seen by physical therapists are classified under this label.

In a small group of acute patients, the problem fails to resolve as it should. Perhaps 10% will go on to develop chronic, disabling LBP.[9-11] This group utilizes the majority of resources allocated[12] and subsequently there has been a considerable research effort to develop and evaluate effective treatments for this group.

Aim of the work:

The aim of this essay is to make a focus on new trends and recent advances used in management of chronic non surgical low back pain.

Chapter I

Anatomy of the back

1-The vertebral column

Vertebral column is midline structure extending from the base of the skull above to the pelvis below. It provides protection for the spinal cord and transfers weight through the pelvis, as well as having an extensive area for muscular attachment. It consists of bony vertebrae connected by intervertebral fibrocartilaginous discs.[13]

The vertebral column acts like an elastic column with alternating curves. In the adult, there are two areas that are convex anteriorly: cervical and lumbar curvatures and two areas that are concave anteriorly: thoracic and sacral curvatures. The spinal curves increase the shock absorbing capacity of the vertebral column and facilitate its stability and equilibrium. Because it has four curves the spine is 10 times more resistant to loading than if there were no curves (fig.1).[13,14]

There are twenty-four true vertebrae which are seven cervical, twelve thoracic and five lumbar. There are nine false vertebrae, which consist of the sacrum (five fused vertebrae) and the coccyx (four fused vertebrae).[14]

a) Cervical Vertebrae (C1 – C7)

These bones form a flexible framework for the neck and support the head. The first cervical vertebra is called the atlas and the second is called the axis. The atlas' shape allows the head to nod "yes" and the axis' shape allows the head to shake "no" (Fig. 2).

b) Thoracic Vertebrae (T1 – T12)

The thoracic vertebrae increase in size from T1 through T12. They are characterized by small pedicles, long spinous processes, and relatively large intervertebral foramina (neural passageways), which result in less incidence of nerve compression (Fig. 3).

c) Lumbar Vertebrae (L1 – L5)

The lumbar vertebrae graduate in size from L1 through L5. These vertebrae bear much of the body's weight and related biomechanical stress. The pedicles are longer and wider than those in the thoracic spine. The spinous processes are horizontal and more squared in shape. The intervertebral foramina (neural passageways) are relatively large but nerve root compression is more common to happen than in the thoracic spine (Fig. 4).

d) Sacral Spine

The sacral spine is a triangular bone located just below the lumbar vertebrae. It consists of four or five sacral vertebrae in children, which become fused into a single bone after age 26. The sacrum forms the back wall of the pelvic girdle and moves with it.

e) Coccyx

Immediately below the sacrum, there are five additional bones, fused together to form the Coccyx (tailbone).

Functions of the Vertebral or Spinal Column Include:

Protection	• Spinal Cord and Nerve Roots • Many internal organs
Base for Attachment	• Ligaments • Tendons

	• Muscles
Structural Support	• Head, shoulders, chest • Connects upper and lower body • Balance and weight distribution
Flexibility and Mobility	• Flexion (forward bending) • Extension (backward bending) • Side bending (left and right) • Rotation (left and right) • Combination of above
Other	• Bones produce red blood cells • Mineral storage

2- The intervertebral foramina

The Intervertebral foramina are openings between vertebrae through which spinal nerves and vessels leave the spinal canal and extend to other parts of the body; also called neural foramina. And their sizes are variable due to placement, pathology, spinal loading and posture. They become narrow by arthritic degenerative changes and space-occupying lesions like tumors, metastases and spinal disc herniations.

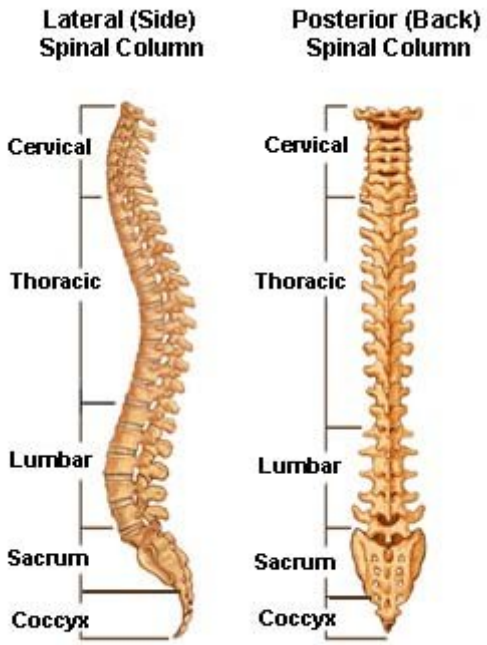
It looks like an inverted teardrop and has the following boundaries:

-Superior margin: the pedicle of the vertebra above.

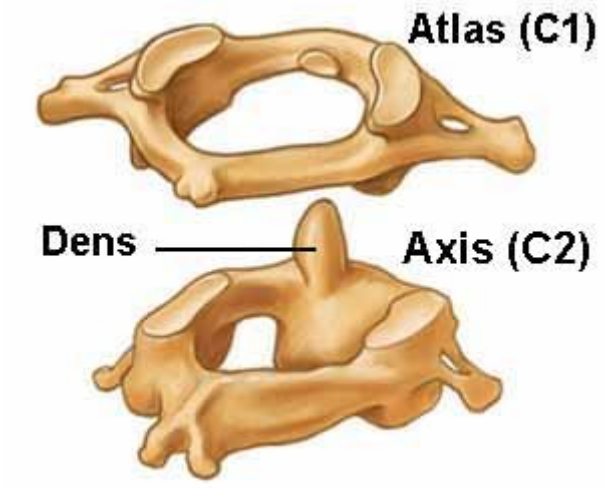
-Inferior margin: the pedicle of the vertebra below.

-Anterior margin: the posterior aspect of the vertebral body above then the disc and the body of vertebra below.

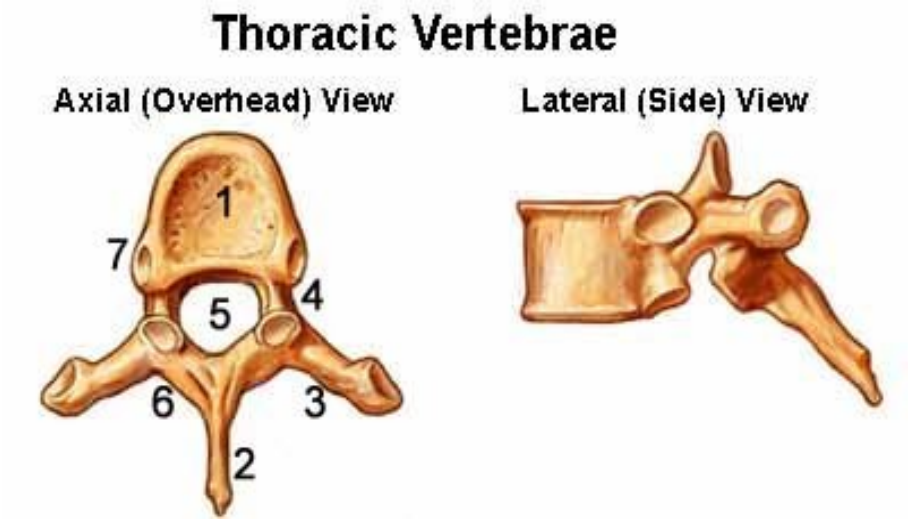
-Posterior margin: the articular process.



(Fig. 1)



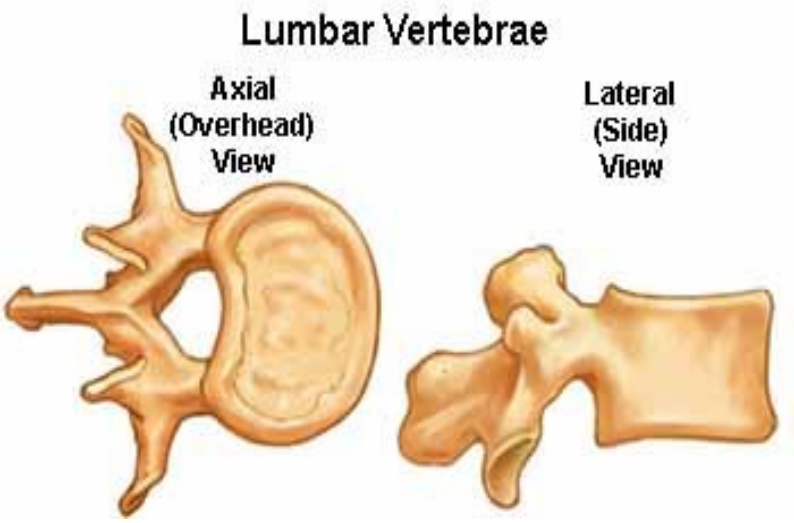
(Fig. 2)



1-Vertebral Body **2**-Spinous Process **3**-Transverse Facet

4-Pedicle **5**-Foramen **6**-Lamina **7**-Superior Facet

(Fig. 3)



(Fig. 4)

3-The intervertebral joints "facet joints" (Fig. 5)

Other names for these joints are Zygapophyseal or Apophyseal Joints. Each vertebra has two sets of facet joints. One pair faces upward (superior articular facet) and one downward (inferior articular facet). There is one joint on each side (right and left). Facet joints are hinge–like and link vertebrae together. They are located at the back of the spine (posterior).

Facet joints are synovial joints. This means each joint is surrounded by a capsule of connective tissue and produces a fluid to nourish and lubricate the joint. The joint surfaces are coated with cartilage allowing joints to move or glide smoothly (articulate) against each other.

These joints allow flexion (bend forward), extension (bend backward), and twisting motion. Certain types of movement are restricted. The spine is made more stable due to the interlocking nature to adjacent vertebrae.

4-The intervertebral discs (Fig. 5,6)

The intervertebral discs make up one fourth of the spinal column's length. As a person ages, these discs compress and shrink, resulting in a distinct loss of height (generally between 0.5 and 2.0cm) between the ages of 50 and 55 years.[15] There are no discs between the Atlas (C1), Axis (C2), and Coccyx. Discs are not vascular and therefore depend on the end plates to diffuse needed nutrients.

The intervertebral disk is a fibrocartilaginous structure, biconcave in configuration, and situated between contiguous vertebral bodies serving as the spine's shock absorbing system, which protect the vertebrae, brain, and other structures (i.e. nerves). The discs allow some vertebral motion:

extension and flexion. Individual disc movement is very limited, however considerable motion is possible when several discs combine forces.

They are composed of an annulus fibrosus and a nucleus pulposus.

The annulus fibrosus is a strong radial tire–like structure made up of lamellae; concentric sheets of collagen fibers connected to the vertebral end plates. The sheets are orientated at various angles. The annulus fibrosus encloses the nucleus pulposus. The nucleus pulposus contains a hydrated gel like matter that resists compression.[16]

Although both the annulus fibrosus and nucleus pulposus are composed of water, collagen and proteoglycans (PGs), the amount of fluid (water and PGs) is greatest in the nucleus pulposus. PG molecules are important because they attract and retain water. The amount of water in the nucleus varies throughout the day depending on activity.[4]

5-The spinal ligaments (Fig. 7)

Ligaments are fibrous bands or sheets of connective tissue linking two or more bones, cartilages or structures together. One or more ligaments provide stability to a joint during rest and movement. Excessive movements such as hyperextension or hyperflexion may be restricted by ligaments. Further, some ligaments prevent movement in certain directions. There is a complicated series of ligaments that connect the various components of the vertebral column and these ligaments may be summarized as follows:

A) The anterior longitudinal ligament:

It is a strong, broad fibrous band that runs along the anterior surface of the vertebral bodies, from C2 to the sacrum. It adheres to the anterior surface of the vertebral bodies and the disc. This strong ligament helps to

maintain the stability of the joints between the vertebral bodies and helps prevent hyperextension of the vertebral column.[17]

B) The posterior longitudinal ligament:

It is a narrower, weaker band than the anterior longitudinal ligament. It runs along the posterior aspect of the vertebral bodies, within the vertebral canal. It is attached to the intervertebral discs and the posterior edges of the vertebral bodies from the axis (C2) to the sacrum. The posterior longitudinal ligament also helps to prevent hyperflexion of the vertebral column and posterior protrusion of the nucleus pulposus of the disc.[17]

C) The ligamentum flavum (Yellow ligament):

It is broad, elastic, fibrous bands that join the laminae of adjacent vertebral arches which extend almost vertically from the lamina above to the lamina below. The ligamentum flavum was given its name because its fibres consist mainly of yellow elastic tissue. The ligaments are attached superior to the anterior surfaces of the inferior borders of a pair of laminae and inferiorly to the posterior surfaces of the superior border of the next succeeding pair. The ligamentum flava help to preserve the normal curvature of the vertebral column and to straighten the column after it has been flexed. The ligamentum flavum is also attached to the medial aspects of the facet joints which may restrict their range of motion. [14,18]

D) The supraspinous ligament:

It is a strong fibrous cord attached to the tips of the spinous processes from the seventh cervical vertebra to L4 or L5 but never in sacrum. The supraspinous ligament is the extension of the nuchal ligament in the thoracolumbar region. Injury to this ligament may occur as a result of direct trauma, but it is considered to be an athletic injury due to overstretching of ligament fibres, particularly when jumping.[19]

E) The interspinous ligament:

It is thin and membranous, connect adjoining spinous processes and extend from the root to the apex of each process. They meet the ligamenta flava in front and the supraspinal ligament behind. The ligaments are narrow and elongated in the thoracic region, broader, thicker, and quadrilateral in form in the lumbar region, and only slightly developed in the neck.[18]

F) The intertransverse ligament:

These are ligaments connecting adjacent transverse processes, consists of a few scattered fibres, except in the lumbar region where they are membranous and more substantial.

G) The ligamentum nuchae:

Superior extension of the supraspinous ligaments and extends from C7 to the occiput.[13]

6-Muscles of the back

There are 2 main groups of muscles in the back: superficial muscles and deep muscles.

A) Superficial muscles of the back:

These are muscles of the upper limb connecting it to the vertebral column and they include the following muscles.

1. Trapezius.
2. Latissimus dorsi.
3. Rhomboideus major and minor.