Facet Joint Injection versus Radiofrequency Facet Neurotomy as an Adjuvant Therapy in Conservative Management of Chronic Low Back Pain

A Thesis
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by

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Abbreviations:

MBB : medial branch blocks.
CGRP : calcitonin gene-related peptide.
chAT choline acetyl transferase.
CLBP: Chronic low back pain
CT : Computed Tomography.
DBH : dopamine B-hydroxylase.
DRG : Dorsal root ganglion.
FBSS : Failed back surgery syndrome.
LBP : Low back pain
MRI :Magnetic resonance imaging.
PRF : Pulsed radiofrequency.
ST : sympathetic trunk.
RC : rami communicantes.
RF : Radiofrequency.
TN : Trigeminal Neuralgia

Introduction

The vertebral column normally consists of 24 separate bony vertebrae, together with 5 fused vertebrae that form the sacrum, and usually 4 fused vertebrae that form the coccyx ***(Alison Middleditch & Jean Oliver, 2005).***

It is not unusual for variations to occur, particularly at the lumbosacral junction where the first sacral segment may exist as a separate vertebra, lumbarization of the first sacral vertebra, Sacralization of the fifth lumbar vertebra is another variant, in which there is complete or incomplete incorporation of the fifth lumbar vertebra into the sacrum. Hemivertebrae and fused vertebrae may also occur ***(Alison Middleditch & Jean Oliver, 2005).***

The vertebral column is composed of alternating vertebrae and intervertebral (IV) discs supported by robust spinal ligaments and muscles. All of these elements, bony, cartilaginous, ligamentous, and muscular, are essential to the structural integrity of the spine ***(A. Rawls and R. E. Fisher 2010).***

The spine serves three vital functions:
a) Protecting the spinal cord and spinal nerves, b) Transmitting the weight of the body, and c) Providing a flexible axis for movements of the head and the torso ***(A. Rawls and R. E. Fisher 2010***

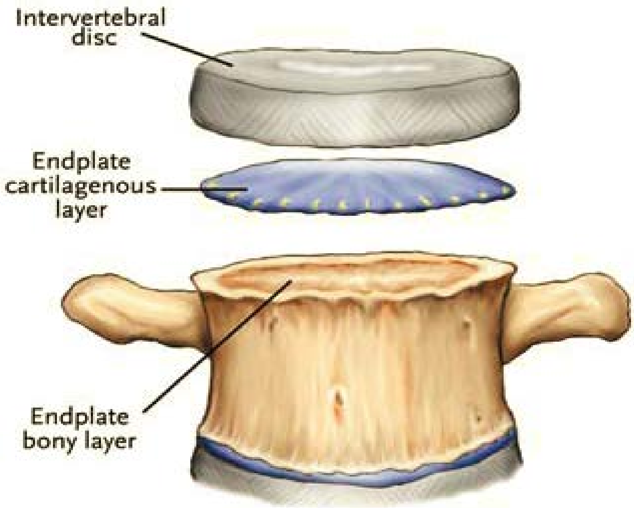

Fig: 1 – Basic structure of the vertebral column
(A.Rawls and R.E. Fisher 2010).

The vertebral column is capable of extension, flexion, lateral flexion (side to side), and rotation. However, the degree to which the spine is capable of these movements varies by region ***(A.Rawls and R.E.Fisher 2010).***

When viewed from the side, the vertebral column displays five curves in the upright posture, two cervical and one each thoracic, lumbar and sacral. The thoracic and the sacrococcygeal curvatures are established in fetal development, while the cervical and the lumbar curvatures develop during infancy ***(A.Rawls and R.E. Fisher 2010).***

There are normally two cervical curves in the cervical spine: the upper cervical curve extending from the occiput to the axis, and the longer lordotic curve of the lower cervical spine extending from the axis to the second thoracic vertebra. The lower cervical curve is convex forwards and is the reverse of the upper cervical curve ***(Alison Middleditch & Jean Oliver, 2005).***

Fig 2 - The normal curves of the spine.
(Alison Middleditch & Jean Oliver,2005).

The thoracic curve is concave forwards, extending from T2 to T12. The concavity is due to greater depth of the posterior parts of the vertebral bodies in this region ***(Alison Middleditch & Jean Oliver, 2005).***

The lumbar curve is convex forwards and extends from T12 to the lumbosacral junction and it is convex anteriorly. The sacral curve extends from the lumbosacral junction to the coccyx. Its anterior concavity faces downwards and forwards. The shape of these curves varies in normal spines and it is frequently altered by pathological changes ***(Alison Middleditch & Jean Oliver, 2005).***

In utero, the vertebral column is in total flexion. The upper cervical, thoracic and sacral curves, which are concave anteriorly during fetal life, retain the same curvature after birth and are therefore called primary curves. The lower cervical curve begins to develop in the third month of intrauterine life and is accentuated as the child starts to hold its head upright at 3 months and as it sits upright at 6-9 months ***(Alison Middleditch & Jean Oliver, 2005).***

The cervical curvature arises in response to holding the head upright, while the lumbar curvature develops as an infant begins to sit upright and walk ***(A.Rawls and R.E. Fisher 2010).***

Development of the lumbar curve occurs as the child learns to stand and walk. The lower cervical and lumbar curves are secondary or compensatory curves. The secondary spinal curves gradually develop during the first three months of life and become established by puberty ***(Rickenbacher et al., 1985).***

The secondary spinal curves have an important function in helping to dissipate vertical compressive forces, thereby providing the spine with a shock-absorbing capacity. If the vertebral column were straight, vertical compressive forces would be transmitted through the vertebral bodies to the intervertebral discs alone. The curves of the spine thus ensure that the ligaments of the spine absorb some of the compressive forces ***(Alison Middleditch & Jean Oliver, 2005).***

Vertebral column components:

A. Vertebral bodies and intervertebral disks:

The vertebral bodies consist of a shell of compact bone surrounding a core of trabecular bone and red marrow. In addition, hyaline cartilage forms vertebral end plates on the superior and inferior surfaces of each body. The body bears 80% of the loads applied to the spine. The vertebral bodies, in conjunction with the IV discs, bear and transmit weight; as a result, the bodies increase in size from the cervical to the lumbar region. However, as weight is then transferred to the lower extremities via the sacrum, the bodies subsequently decrease in size ***(A.Rawls and R.E. Fisher 2010).***

The vertebral arch is located posterior to the vertebral body and consists of two pedicles and two laminae. The superior and inferior notches of adjacent pedicles form the intervertebral foramina, which transmit the spinal nerves. Disruption of these foramina (e.g., by a herniated disc) can compress the spinal nerves, leading to both sensory and motor deficits ***(A. Rawls and R. E. Fisher 2010).***

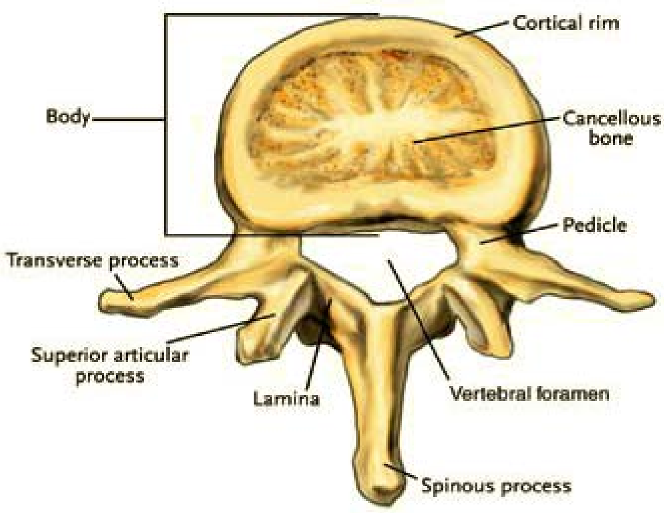

Fig 3 - The components of a vertebra
(A. Rawls and R. E. Fisher 2010).

In addition to protecting the spinal cord and spinal nerves, the vertebral arch also has a number of processes that provide sites for muscle and ligament attachment. The spinous processes, located at the junction of the laminae, and the transverse processes, located at the pedicle-lamina junctions, provide attachment sites for ligaments as well as the erector spinae and transversospinalis muscle groups ***(A. Rawls and R. E. Fisher 2010).***

In addition, the transverse processes articulate with the costal tubercles to form the costovertebral joints. Finally, the superior and the inferior articular processes of adjacent vertebrae interlock to form the zygapophysial (or facet) joints. These synovial joints permit gliding movements and their orientation largely determines the ranges of motion that are possible between adjacent vertebrae ***(A.Rawls and R.E. Fisher 2010).***

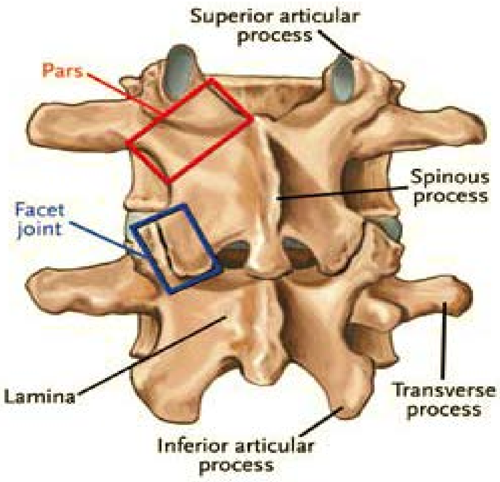

Fig: 4- Facet joint articulation between lumbar vertebrae
(A.Rawls and R.E. Fisher 2010).

Most of the vertebral bodies articulate superiorly and inferiorly with IV discs, forming secondary cartilaginous joints or symphyses. However, an IV disc is not present between the atlas and the axis, and the sacral and coccygeal IV discs ossify progressively into adulthood. Representing up to 25% of the total length of the spine, the IV discs act as shock absorbers and enhance spinal flexibility, particularly in the