Decompression Only versus Decompression and Instrumented Fusion for Surgical Management of Symptomatic Degenerative Lumbar Spinal Stenosis

A Systematic Review

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Eslam Mohammed Ameen El Shahat

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List of Abbreviations

Abbr.		Full-term
LCS	**:**	Lumbar Canal Stenosis
LF	**:**	Ligamentum Flavum
ALL	**:**	Anterior Longitudinal Ligament
PLL	**:**	Posterior Longitudinal Ligament
LSTV	**:**	Lumbosacral Transitional Vertebra
L1-L5	**:**	Lumbar Vertebra 1st - Lumbar Vertebra 5th
VB	**:**	Vertebral Body
AF	**:**	Annulus Fibrosis
NP	**:**	Nulclus Pulposus
SAP/IAP	**:**	Superior Articular Process
IAP	**:**	Inferior Articular Process
SSL	**:**	SupraSpinous Ligament
ISL	**:**	Interspinous Ligament
DLSS	**:**	Degenerative lumbar spine stenosis
CSF	**:**	Cerebro Spinal Fluid
DRG	**:**	Dorsal Root Ganglion
AP view	**:**	Anteroposterior view
MRI	**:**	Magentic Resonance Images
ILL	**:**	IlioLumbar Ligament
LBP	**:**	Low Back Pain
LIF	**:**	Lumbar Interbody Fusion
PLIF	**:**	Posterior Lumbar Interbody Fusion
MI-TLIF	**:**	Minimal Invasive-Transforaminal Interbody Fusion
ALIF	**:**	Anterior Lumbr Interbody Fusion
LLIF	**:**	Lateral Lumbar Interbody Fusion
OLIF/ATP	**:**	Oblique Lumbar Interbody Fusion/Anterior To Psoas

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Introduction

I. Rationale and justification of the study

Lumbar Canal Stenosis (LCS) is a developmental or congenital narrowing of the spinal canal that produces compression of the neural elements before their exit from the neural foramen. This is usually due to the common occurrence of spinal degeneration that occurs with aging. The spinal canal demonstrates narrowing, attributed most frequently to acquired degenerative or arthritic changes such as hypertrophy of the articulations surrounding the canal, intervertebral disc herniation or bulge, hypertrophy of the ligamentum flavum, osteophytes formation and degenerative spondylolisthesis. The narrowing may be limited to a single motion segment or it may be more diffuse spanning two or more motion segments. **(1)**

The early symptoms of lumbar canal stenosis include bouts of low back pain. After a few months or years, this may progress to claudication. The pain may be radicular, following the classic neurologic pathways. This occurs as the spinal nerves or spinal cord become increasingly trapped in a smaller space within the canal. **(2)**

The classic presentation of LCS is neurogenic claudication, but other symptoms can occur as heaviness, weakness, sensation of tingling, pricking, or numbness and leg cramps, as well as bladder symptoms. Symptoms are most

commonly bilateral and symmetrical, but they may be unilateral; leg pain is usually more troubling than back pain. [2]

Non-surgical treatment, such as physiotherapy, analgesic drugs and epidural steroids injection is effective in LCS with mild or occasionally moderate pain. [3] Failure of conservative treatment is an indicator to consider surgical intervention. Surgical treatment is usually performed in patients with moderate-to-severe limitation and/or patients with progressive limitation of activities of daily living, and only after correlation of patients' presentation to radiological examinations. [4]

II. Aim of the Work

To review and summarize available knowledge on the rule of decompression only versus decompression and instrumented fusion in the management of degenerative lumbar canal stenosis.

III. Objectives

To compare the efficacy and effectiveness of decompression alone versus decompression and instrumented fusion in the management of degenerative lumbar canal stenosis as regards improvement of symptoms as a primary outcome and complications dependent on the intervention being considered, duration of the operation, blood loss, length of hospital stay, reoperation rate and operation costs as secondary outcomes.

Anatomy of Lumbar Spine

Overview

The lumbar spine consists of 5 moveable vertebrae numbered L1-L5. The complex anatomy of the lumbar spine is a remarkable combination of these strong vertebrae, multiple bony elements linked by joint capsules, and flexible ligaments/ tendons, large muscles, and highly sensitive nerves. It also has a complicated innervation and vascular supply. [5]

The lumbar spine is designed to be incredibly strong, protecting the highly sensitive spinal cord and spinal nerve roots. At the same time, it is highly flexible, providing for mobility in many different planes including flexion, extension, side bending, and rotation.

Gross Anatomy

Bones

The lumbar vertebrae, numbered L1-L5, have a vertical height that is less than their horizontal diameter. They are composed of the following 3 functional parts:

- The vertebral body, designed to bear weight.
- The vertebral (neural) arch, designed to protect the neural elements.
- The bony processes (spinous and transverse), which function to increase the efficiency of muscle action. [8]

The lumbar vertebral bodies are distinguished from the thoracic bodies by the absence of rib facets. The lumbar vertebral bodies (vertebrae) are the heaviest components, connected together by the intervertebral discs. The size of the vertebral body increases from L1 to L5, indicative of the increasing loads that each lower lumbar vertebra absorbs. Of note, the L5 vertebra has the heaviest body, smallest spinous process, and thickest transverse process. **(6)**

The intervertebral discal surface of an adult vertebra contains a ring of cortical bone peripherally termed the epiphysial ring. This ring acts as a growth zone in the young while anchoring the attachment of the annular fibers in adults. A hyaline cartilage plate lies within the confines of this epiphysial ring.

Each vertebral arch is composed of 2 pedicles, 2 laminae, and 7 different bony processes (1 spinous, 4 articular, 2 transverse) (see the following image), joined together by facet joints and ligaments. **(11)**

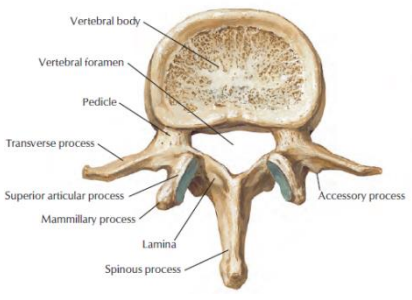

Figure (1): Superior view of lumbar vertebra **(25)**

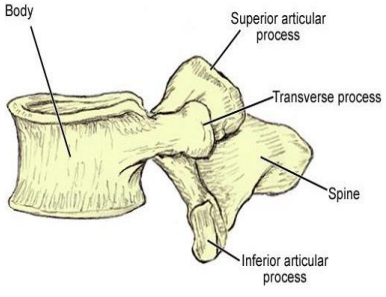

Figure (2): Lateral view of lumbar vertebra **(25)**

The pedicle, strong and directed posteriorly, joins the arch to the posterolateral body. It is anchored to the cephalad portion of the body and function as a protective cover for the cauda equina contents. The concavities in the cephalad and caudal surfaces of the pedicle are termed vertebral notches.

Beneath each lumbar vertebra, a pair of intervertebral (neural) foramina with the same number designations can be found, such that the L1 neural foramina are located just below the L1 vertebra. Each foramen is bounded superiorly and inferiorly by the pedicle, anteriorly by the intervertebral disc and vertebral body, and posteriorly by facet joints. The same numbered spinal nerve root, recurrent meningeal nerves, and radicular blood vessels pass through each foramen. Five lumbar spinal nerve roots are found on each side.[11]

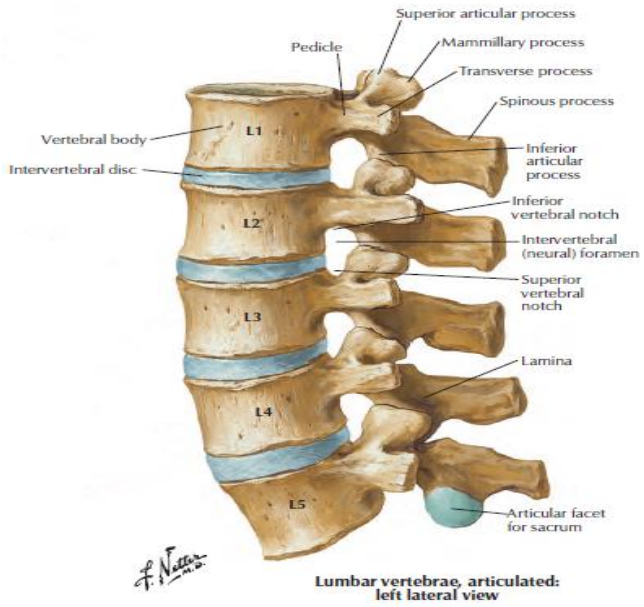

Figure (3): Lumbar vertebrae articulated lateral view [25]