

## IMAGING OF THE LUMBAR SPINE

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### Introduction

Back pain affects all of us at some point during our lifetimes. I view the spine as similar to the mast of a ship. The mast/spine is inherently weak unless supported by the fixed cables and rigging. In the spine the rigging and cables are provided by the muscles, tendons, and ligaments that surround the spine and the more lateral and superficial musculature that provides the attachment points of that rigging. Although there is probably a genetic component to muscular and ligamentous strength, we can all benefit by exercise which can strengthen our fibrous soft tissues and muscles, improving the stability of the spine.

Weak muscles and ligaments result in spine instability which results in excessive motion between vertebral bodies, causing the periosteal attachments to pull slightly off the bone with localized inflammation and subsequent heterotopic bone formation and spurring. There can be localized pain due to the constant periosteal stripping and inflammation, hypertrophic spurring can impinge upon the spinal canal or foramina with nerve compression, and muscle spasms occur. If God blesses us with a large spinal canal there is more room for things to go away before the nerves are compressed. This is my simplified summary of the pathophysiology of benign back pain.

Nerve root levels are defined by their peripheral anatomic distribution and numbered by the foramen that they exit through in the spine. For example, the L4 root passes through the L4-5 foramen and supplies a distinct set of muscles and cutaneous nerves. The counting of the lumbar vertebra is, however, variable. There are seven cervical vertebral bodies. There may be 11, 12, or 13 thoracic vertebral bodies and there can be 4, 5, or 6 lumbar vertebral bodies. If there is suspicion of abnormal vertebral counting on the imaging the radiology report should state the concern and how the counting will occur for that study. As an example, we may say that there is a transitional vertebra at lumbosacral junction counted as S1 with the lumbar type vertebra above this counted as L5. Whether it is right or wrong, this defines the counting levels. Don't be surprised if your clinical nerve root symptoms don't exactly match the dictated level pathology.

### Imaging

There are three main types of imaging in the spine, plain films, CT, and MRI. With plain film imaging, 3 films usually suffice, but if more detailed information on the facet joints and possible pars defects is desired then a total of five films including obliques can be obtained.

CT provides the best information on the bony structures with reformatted views in the sagittal and coronal planes giving information on bony canal, bony foraminal stenosis, and the degree of facet hypertrophy. There is soft tissue evaluation with CT, but the bone visualization is its forte.

MRI provides the best evaluation of the soft tissue around and within the spine. It gives the best information regarding disc integrity, extrusions, and any soft tissue encroachment in the canal and foramina. For benign disease, CT and MRI are typically done without contrast enhancement. Contrast administration can be reserved for those patients suspected of have spine infection or malignancy. Infection and malignancy will frequently show up on the non-contrast images and, if it is suspected by the imaging radiologist, the patient can be brought back for post contrast imaging for a more thorough evaluation. The other advantage of routine non contrast MRI over CT is that it can show edema in the bone and soft tissues. I believe that edema correlates with pain. It can localize active facet and disc degeneration that could benefit from pain management injection.

Benign back pain generally slowly resolves over a week or two and imaging can be delayed, awaiting resolution of the symptoms. If there is something suspicious about the history, suggesting that there may be a possibility of malignancy, infection, or vertebral compression, then more immediate imaging would be indicated. If you believe that the back pain is benign and will resolve, you can order plain films while waiting for resolution. If the pain does not resolve or is more worrisome, the ideal exam is a non-contrast MRI of the spine. If you are contemplating some type of pain management injection or surgery, those patients definitely need imaging with MRI to direct their therapy. I would reserve CT evaluation for those patients that can't have MRI due to electronic hardware, those with trauma, or at the neurosurgeon's discretion for operative guidance.

If a patient has significant instability and severe canal stenosis with nerve root compression, surgical decompression and stabilization may provide some relief. Surgery, however, brings on its own set of issues. Operative fusion across a level results in more motion above and below the fusion with eventual development of significant degenerative change and symptoms related to the adjacent levels.

Disc material that is extruded through the annulus results in inflammatory reaction, causing pain from the inflammation and increasing the size of the extrusion with greater impression upon adjacent nerve roots. Although this can be extremely painful, the inflammatory response aids the body in resorbing the extruded material. Large disc extrusions can get completely resorbed over a few months. The pain may resolve completely but it is possible to have persistent symptoms which may be due to residual scarring and adhesions around the nerve root. Unfortunately, surgery can result in the same thing. Disc protrusions, on the other hand, don't tend to resorb since their disc material remains contained by the annulus and they can therefore result in more chronic symptoms.