Interventional Approach To Low Back Pain

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This is the brief treatise on the interventional approach to managing spinal pain with special reference to low back pain. This article discusses predominantly low back pain but the same principles apply to neck pain and thoracic pain, with some variation. I also want to stress that the treatment of spinal pain, as in most chronic pain conditions, must have a multidisciplinary approach. There is no one single modality that is most effective for treating spinal pain. In most cases, a few of these modalities have to be done simultaneously. For example, physical therapy in conjunction with interventional pain management or weight loss, smoking cessation in conjunction with core strengthening exercises.

According to the **American Society of Interventional Pain Physicians (ASIPP)**, interventional pain management is "a discipline of medicine devoted to the diagnosis and treatment of pain related disorders." For patients with back pain, interventional pain management techniques are especially useful both from a diagnostic as well as a therapeutic point of view. Interventional pain physicians have a wide array of treatment modalities that they can use to manage spinal pain.

In order to understand treatment of low back pain one has to understand the anatomy. Briefly, the spine is composed of bones, nerves, ligaments, joints, muscles and a unique structure called the intervertebral disc.

Lumbar vertebrae

There are five lumbar vertebrae. The anterior part of each vertebra is called the vertebral body. It is a box shaped structure. The top and bottom surfaces are smooth and perforated by tiny holes. Projecting from the back of the vertebral body are two solid pillars of bone called pedicles. There is a sheet of bone that projects from each pedicle towards the midline called the lamina, thus forming a neural arch. The arch surrounds the nerve elements that pass through the spine. Narrowing of this arch is known as central stenosis. Projecting from the posterior aspect of the vertebra are four articular processes. These articulate with the vertebrae above and below to form facet joints. As with joints elsewhere in the body, the facet joints are lined with a cartilage and surrounded by a capsule. The facet joints are prone to age-related arthritis, arthrosis (age-related degenerative changes) and injury.

When the spine is viewed from the side, one can see the intervertebral foramina, an oval opening through which the spinal nerves exit the spinal canal. These are formed by the pedicles of the vertebrae above and below and are bordered by the disc anteriorly and the facet joint posteriorly. The height (size) of the foramen is thus determined by the height of the intervertebral disc but, may also be narrowed by hypertrophy or overgrowth of the facet joint with arthritis. Narrowing of the intervertebral foramen is called foraminal stenosis and, when there is associated impingement of the nerves, it may result in radiating pain down the leg or "radiculopathy."

Inflammation of the nerves has been proposed as a significant contributor towards low back pain.

Intervertebral disc

The intervertebral disc is a layer of strong, soft tissue interposed between the vertebral bodies. It is deformable. The structure of the intervertebral disc is unique. It is designed to transfer the load from the upper vertebra to the lower vertebra without collapsing; deformable enough to accommodate rocking movement of the spine; and sufficiently strong to be not injured during movement. The intervertebral disc has a central soft core known as the nucleus pulposus. It is surrounded by collagen fibers arranged in a highly organized pattern called annulus fibrosus. The third component of the intervertebral disc is the vertebral endplate. These are two layers of cartilage which from the upper and lower aspects of the disk.

The Sacroiliac Joint

The pelvic girdle is formed by the iliac bones and the sacrum. The sacrum forms a joint on each side with the iliac bones called the sacroiliac joints. It does not exhibit active movement but does move passively. Its chief role is to act as a stress relieving joint. As with joints elsewhere, the sacroiliac joint is also prone to arthritic changes and injury. The sacroiliac joint is a very common site for low back pain, especially in women. Sacroilitis is recognized as part of the spectrum of ankylosing spondylitis and other spondylarthropathies, psoriatic arthritis and arthritis related to inflammatory bowel disease such as Ulcerative Colitis and Crohn's disease. The more common condition is Sacroiliac Joint Dysfunction often attributed to hypermobility or hypomobility of the joint. It may also be seen in some patients who have a long-standing history of lumbar fusion. These patients usually present with lower back pain, gluteal pain and hip joint pain. The pain radiates into the groin and lower extremities. The pain increases with sitting, weight-bearing as in standing, walking up the stairs, forward flexion, sexual intercourse and menstrual periods. Pain from the sacroiliac joint is best diagnosed clinically. There is no value to a radiological examination. The treatment is usually a fluoroscopically guided intra-articular steroid injection. Radiofrequency rhizotomy of the sacroiliac joint is also an option.

Muscles of the lower back

There are three major groups of muscles in the lower back: the Psoas major which lies on the anterolateral aspect of the lumbar spine; the Quadratus Lumborum and the intertransversarii laterales connect the lateral aspect of the spine and the posterior lumbar paraspinous muscles, which cover the posterior aspect of the spine.

Piriformis muscle

The piriformis muscle lies anterior to the gluteal muscles. It originates from the sacrum and attaches to the greater trochanter of the femur. The sciatic nerve usually passes below the piriformis muscle, but in approximately 15% of cases it passes through the muscle. A spasm of the piriformis muscle will irritate the sciatic reproducing radicular symptoms to the lower extremity. The piriformis muscle is closely related to the sacroiliac joint and the hip joint. Dysfunction of the sacroiliac joint may cause spasm of the piriformis muscle inducing radicular symptoms in the lower extremity. It is diagnosed by stretching the muscle, which reproduces the pain. An EMG of the muscle may be helpful in detecting hyperactivity or spasms that may result in irritation or compression of the sciatic nerve. The treatment is to stretch the muscle with or without trigger point injections. In some of the more refractory cases botulinum toxin injections have been helpful.

Radiculopathy or radiculitis

Radicular pain is a result of inflammation or irritation of the spinal nerve or its roots. The characteristic radicular pain (nerve root pain) is usually described by patients as a well defined shooting or stabbing pain in the lower back that extends into the leg. In most patients with lumbar radiculopathy the pain radiates into the leg below the knee after the ankle level. The distal symptoms are usually numbness and tingling. Radiculopathy and radiculitis are usually in a specific dermatomal distribution. This implies that a nerve root has been affected. This is distinct from radiation which is not in any specific dermatomal distribution and is considered a referred pain For example, consider a patient presenting with pain in the lower back and leg: if it is because of a nerve inflammation from the nucleus pulposus it would be in a very specific sensory dermatome; if it is because of inflammation of the lumbar facet joint, then it is not along a sensory distribution.

Pain from lumbar facet joints is predominantly in the lower back, with radiation into the leg usually above the knee. It is in a non-specific sensory dermatomal distribution. Some of the causes of lumbar facet joint pain are osteoarthritis, rheumatoid arthritis, fracture of the facet joint and capsular tear. It is exacerbated with extension of the spine or axial rotation of the spine. Radiofrequency rhizotomy is a long-term option for lumbar facet joint pain. It is a procedure in which pain signals are "turned off" through the use of heated electrodes applied to the sensory nerves from the facet joints. Once the pain from the lumbar facet joints is decreased, patients benefit from lumbar stabilization or core strengthening exercises.

Hip joint

Pain from the hip joint may radiate into the lower back, gluteal region or the groin. It may also radiate down the leg. Prolonged hip joint pain can result in sacroiliac joint dysfunction and muscle spasms in the lower back.

A patient presenting with low back pain and lower extremity pain may be suffering from:

Discogenic pain

Injury to the disk can be painful due to two mechanisms. The nerve endings in the annulus fibrosus are exposed to enzymes and breakdown products as a result of the deterioration process of the disk. Inflammatory chemical mediators are released that trigger nociceptive pain at the nerve endings. This causes an inflammation of the spinal nerve root resulting in radicular pain to the lower extremity. Radicular pain caused by a herniated nucleus pulposus is aggravated by activities such as lifting, bending, straightening, sneezing or coughing or any activity that increases nerve root tension such as straight leg raising. Pain is often relieved by standing or sleeping with a pillow under the knees. An epidural steroid injection performed under fluoroscopy guidance at the correct level helps decrease inflammation.

Facet joint pain

Inflammation of the facet joints causes pain in the lower lumbar region with a referral pattern to the lower extremity. Management of this pain is usually lumbar facet intra articular steroid injection under fluoroscopy guidance, or radiofrequency rhizotomy.

Sacroiliac joint pain

Sacroiliac joint dysfunction or sacroiliitis presents as a pain in the lumbosacral region, usually with radiation to the leg. It may are may not be associated with piriformis muscle spasm, in which case the patient presents with radicular pain. Management of this pain is usually a sacroiliac intra articular joint injection under fluoroscopy, or trigger point injections to the piriformis muscle followed by stretching.

Hip joint pain

This usually presents as pain in the lower back, gluteal region, groin, upper thigh or outer buttocks. The pain may radiate down the leg. It may also be associated with piriformis syndrome. An intra-articular steroid injection is diagnostic as well as therapeutic. It is performed under fluoroscopy guidance.

Trochanteric bursitis

The greater trochanteric bursa is situated between the femur and the insertion of the gluteus medius and minimus muscles into the greater trochanter of the femur. Inflammation of the trochanteric bursa presents as pain over the lateral aspect of the thigh with radiation down the leg, usually as far as the knee. Patients with low back pain often have a compensated gait resulting in trochanteric bursitis. Very often lateral hip pain may be caused by tendinitis of the gluteal muscles which in turn inflames the trochanteric bursa. It is very common in middle aged women and is also associated with obesity and arthritis. Diagnosis may be made by eliciting tenderness over the lateral hip or asking the patient to stand on one leg at a time which reproduces the pain. Treatment is to correct the etiology of the bursitis, NSAID's, or a steroid injection into the bursa.

Knee and ankle joint pain

Although pain from these joints does not cause lower back pain patients have an antalgic gait, resulting in exacerbation of their lower back pain.

Muscular pain

This is a very common cause of acute lower back pain. Trigger point injections are injections of local anesthetic performed into a muscle. On examination

they present as taut bands with hyperirritable spots. Stretching exercises in conjunction with trigger point injections helps relieve this myofascial pain.

The role of steroids in spinal pain

Inflammation of the nerves has been proposed as a significant contributor towards low back pain. Nerve roots have been shown to be swollen and inflamed on myelography and during surgery. The nucleus pulposus induces marked inflammatory change in the nerve roots dura mater and the spinal cord. High levels of inflammatory phospholipase A2 activity have been recorded in lumbar disc herniations.

Steroids decrease inflammation by inhibiting the action of phospholipase A2. Phospholipase A is an enzyme responsible for the release of arachidonic fatty acids from cell membranes at the site of inflammation. This is the rate limiting step in the production of prostaglandins and leukotriens.

They also block transmission of nociceptive C fiber. Blocking the transmission of nociceptive input is attributed to a direct membrane action and not to an anti-inflammatory effect of the steroid.

References

1. Kurz, LT. The pathogenesis and natural history of lumbar disc disease: disc degeneration and herniation. Semin. *Spine Surg*. 1994;6(3):170–9.
2. Saal JS, et al. High levels of inflammatory phospholipase A2 activity in lumbar disc herniations. *Spine.* 1990;15:674–8.
3. Berg A. Clinical and myelographic studies of conservatively treated cases of intervertebral disc protrusion. *Acta Chir Scand.* 1953;104:12–9.
4. Klimiuk PS, et al. Serial measurements of fibrinolytic activity in acute low back pain and sciatica. *Spine. 1987;*19:925–8.
5. Dougherty C, Dougherty JJ. Evaluating hip pathology in trochanteric pain syndrome, *J Musculoskeletal Med*. Aug 2008;25(9).
6. Williams BS, Cohen SP (2009). Greater trochanteric pain syndrome: a review of anatomy, diagnosis and treatment. *Anesth Analg.* 2009 May;108(5):1662–70.
7. Johansson A, Hao J, Sjolund B. Local corticosteroid application blocks transmission in normal nociceptive C fibers. *Acta Anaesthesiol Scand.* 1990;34:335–8.

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