Introduction and Background

The overall lifetime prevalence of back pain is more than 70% in all industrial countries. The ramifications of this pain on society include the loss of 1.4 working days per person per year which makes up 10-15% of all sickness related absences. Back disorders are also responsible for a quarter of all disabling occupational injuries, with an estimated 12 million people in the workforce with low back impairment, and 5 million with disability on the basis of back pain.

The exact etiology of low back pain is difficult to diagnose due in part to the complex structure of the spine. In the early 1900’s, it was hypothesized that dislocation and distraction of the sacroiliac joint was a common cause for low back pain. In 1911, Goldthwait postulated that “the peculiarities of the facet joint” were responsible for low back pain and instability. By the next two decades, the pathology of the facet joints was gaining even more notoriety as a possible cause of back pain with the introduction of the term “facet syndrome” by Ghormley in 1933. Multiple studies soon followed focusing on the possible etiology for low back pain. With Mixter and Barr’s description of intervertebral disc herniations as a cause for low back pain and sciatica, the treatment for low back pain shifted over the next 30-40 years. It was only when physicians began to realize that lumbar laminectomy and nerve root decompression were not resulting uniformly in relief of low back pain that the attention turned back to other potential causes.

There are many possible causes or pain generators for low back pain including, but not limited to, lumbar paraspinal muscles, supraspinous ligament, posterior longitudinal ligament, vertebral bodies, facet joints and intervertebral discs. Hirsch, in 1963, first demonstrated that low back pain can be reproduced or provoked by injecting hypertonic saline in the region of the facet joints. This theory was confirmed in 1976 by Mooney and Robertson.

Anatomy and Physiology of the Lumbar Facet Joint

The lumbar facet, or apophyseal or zygapophyseal, joints are formed by the superior and inferior articular processes of articulating vertebrae. On the dorsolateral surface of each superior articular facet is a prominence known as the mammillary body, or process. There is also an accessory process which arises from the dorsal surface of the transverse
The nerve supply of the lumbar facet joints is derived from the dorsal primary ramus of the nerve root. The nerve which appears to be most closely associated with the joint is the medial branch of the dorsal primary ramus, and anatomical studies have delineated that each facet joint receives innervation from two successive medial branches. Bogduk and Long clearly established the anatomy of these nerves (Figure 2). They noted that the lumbar dorsal rami of L1-L4 differ from that of L5. At the L1-L4 levels, each dorsal ramus arises from the spinal nerve at the level of the intervertebral disc. It enters the back through a foramen in the intertransverse ligament. About 5mm from its origin, the dorsal ramus divides into a medial and lateral branch. The lateral branches continue into the longissimus and iliocostalis muscles of the erector spinae apparatus. The medial branch runs caudally and dorsally, lying against bone at the junction of the root of the transverse process with the root of the superior articular process. Here, the medial branch enters a fibro-osseous canal, created by the superior articular process, the transverse process, the accessory process, and the mammillo-accessory ligament. This ligament is often calcified, creating an entirely bony canal.

Once emerging from this canal, the medial branch runs medially and caudally, just caudal to the facet joint, and becomes embedded in the fibrous tissue surrounding the joint. It continues across the lamina just deep to the multifidus muscle and sends a branch to the interspinalis muscle and the multifidus muscle. Terminal branches of the medial branch supply the ligaments and periosteum of the vertebral arches and spines.

The medial branch gives off two sets of branches to the facet joints, named by Bogduk and Long the proximal and distal facet joints. The proximal facet nerve supplies the rostral aspect of the next lower joint. Thus, each facet nerve from the medial branch is related to it laterally, and the distal facet nerve from the next rostral segment. This fact has important implications for facet nerve block and denervation procedures, as both branches need to be blocked or...
lesioned to completely denervate a single joint.

At the L5 level, the transverse process is replaced by the sacral ala, and the L5 dorsal ramus arises from the spinal nerve just outside the L5-S1 intervertebral foramen, passing dorsally over the sacral ala in a groove formed by the junction of the ala with the root of the superior articular process of the sacrum. The medial branch arises as the nerve passes in this groove, and then wraps medially around the posterior aspect of the lumbosacral (L5-S1) facet joint, terminating in the multifidus muscle.

The biomechanical function of the facet joints is well-recognized. When standing, the lumbar facets carry approximately 16% of the spinal compressive load. They are relatively unloaded while sitting. Yang and King have demonstrated that lumbar facets carry 3-25% of the spinal load in normal conditions, and up to 47% of the load when the facets are arthritic. There is a close relationship between the intervertebral disc integrity, facet loads and spinal degeneration. With disc-space narrowing, as frequently occurs with spinal degeneration, there is increased load in the facet joints, especially in extension. The facet capsules are primarily loaded in flexion and in rotation, and thus the facet joints are the primary resistors against rotational or torsional forces. There is controversy as to whether increased loading of facets is a natural function designed to preserve the intervertebral disc, or whether this represents a pathological change capable of giving rise to pain.

Lumbar Facet Syndrome

Lumbar facet syndrome, first termed by Ghormley in 1933, has been the diagnosis given to patients who have primarily axial low back pain. Patients typically describe this pain as a dull, deep, achy pain. Facet-related pain can be referred into the groin, hip and posterior leg to the back of the knee. Aggravating factors for this pain include, prolonged periods of standing or sitting, as well as extension of the lumbar spine. Some patients report worse pain with stiffness in the morning upon arising, while others report increased pain at the end of the day due to sitting all day at work. This pain is usually acutely worsened with Valsalva events such as coughing or sneezing.

Patients with lumbar facet syndrome often have tenderness in the lumbar paraspinal region, presumably over the facet joints. They have provocative pain with lumbar extension and rotation simultaneously, reproducing their pain. Neurologic examination for patients with facet syndrome is usually unremarkable for abnormal findings.

Radiographic studies can sometime confirm the diagnosis of lumbar facet syndrome when used in conjunction with the history and physical exam. Plain radiographs can demonstrate degenerative changes and narrowing of the facet joints. MRI studies can show facet arthropathy and facet joint effusions.
studies have tried to desensitized the facet joints using radiofrequency coagulation, injection of neurolytic phenol solution and cryoablation.14, 15

Radiofrequency Ablation of the Facet Joint

Radiofrequency facet joint denervation is a percutaneous, nonsurgical procedure to desensitize facet joints that have been identified as the major pain generator for axial low back pain. Using special insulated needles, a heat lesion is created around the region of the dorsal ramus medial branch nerves that come from above and below the facet joint in question. In addition, sensory and motor stimulation is done at the time of needle placement, prior to the radiofrequency ablation, to confirm proximity to the sensory dorsal ramus medial branch nerve while avoiding the spinal nerve root. Stimulation is carried out, using a frequency of 50 Hz and a current up to 1 mA for sensory detection, and a frequency of 2 Hz with current between 3-5 mA for motor stimulation. A positive stimulation is that which reproduces the patient’s pain, without producing other sensory or motor findings in the lower extremity or buttocks. Once the stimulation pattern is acceptable, a radiofrequency lesion is created by passing current through the electrode to raise the tissue temperature to 60-80 degrees centigrade for 60-90 seconds. Adequate local anesthesia and intravenous sedation is used during this portion of the procedure, as it may be quite uncomfortable. Complications from radiofrequency lumbar facet ablation are few, if the procedure is performed correctly. Most patients will experience significant muscular pain for several days after the procedure.

Common possible complications, such as infection and bleeding, are more likely to arise from needle placement than the actual radiofrequency ablation. Another clinical entity encountered in some patients is that of post-denervation neuritis. It manifests as, what is typically described as, a sunburn-like feeling in the paralumbar region. It is usually more annoying than painful, and resolves spontaneously in all cases within six to eight weeks. The exact etiology of this
symptom is unclear. Some practitioners recommend treating the patient with membrane stabilizing agents such as gabapentin or pregabalin.

Pain relief from lumbar radiofrequency facet denervation has ranged from a dismal 9% to a gratifying 83%.

Comparison between studies is very difficult. As in many of the earlier studies, it is not clear whether an appropriate target was actually used. In some cases, it is not clear whether any type of diagnostic block was performed to identify the pain generator before radiofrequency facet denervation.

Conclusion

Chronic low back pain is a predominant problem in our society that places a heavy social and economic burden in our lives. While there can be many causes or pain generators for low back pain, radiofrequency facet denervation is one interventional, nonsurgical treatment that can provide significant pain relief to improve overall function and minimize requirements for medications.

References


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