Degenerative Lumbar Spinal Stenosis: Diagnosis and Management
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Abstract
Lumbar Spinal Stenosis (LSS) is one of the most common spinal pathologies in the United States. LSS is a degenerative spine disorder that affects primarily people over the age of 50 and is one of the most common diagnoses requiring surgical intervention in this age group. This article aims to summarize the presentation, examination, work up, and management of the patient with LSS as well as touch upon some the latest clinical trials to aid in the practice of evidence based medicine.

Keywords: Lumbar Spinal Stenosis; Lumbar stenosis; Spinal stenosis

Introduction
Lumbar Spinal Stenosis (LSS) is one of the most common spinal pathologies in the United States. LSS is characterized by narrowing of the spinal canal creating compression of the neural structures causing a constellation of symptoms that may include low back pain, lower extremity radiculopathy, neurogenic claudication, and gait impairment. The rates of spinal stenosis increases to significant amounts as the population of the US ages and the average life span increases [1,3]. As the number of old age people continue to grow in the United States, it can be expected that the prevalence of LSS will also increase.

Spinal Stenosis is generally classified as either congenital or acquired. Congenital spinal stenosis is found in individuals who have short pedicles, which decreases the area of the spinal canal. This is very common in individuals with achondroplasia, but may also occur in people of normal stature [2]. Acquired spinal stenosis is much more common and is caused by central and lateral canal stenosis secondary to spinal degeneration. This stenosis is caused by facet and ligamentum flavum hypertrophy, foraminal stenosis, disc herniation, and osteophyte formation [2,3].

Symptoms and Physical Exam
Patients with LSS most commonly present with low back pain and neurogenic claudication. As in all spinal pathologies, a thorough history regarding the patient’s symptoms is indicated. Symptoms of LSS usually have a very insidious onset and progress slowly [4]. Symptoms may be either unilateral or bilateral. Patients often complain of pain in the back, buttocks, thighs, calves, and feet when walking. This pain is often exacerbated when walking longer distances. Generally, the pain experienced is relieved at rest. Classically, these symptoms are exacerbated when the spine is in extension, such as walking down a hill, but relieved while the spine is flexed such as leaning forward on a cart. This constellation of symptoms is defined as, neurogenic claudication [5]. Extension of the spine decreases the volume of the spinal canal exacerbating the symptoms, while flexion increases the volume of the spinal canal relieving symptoms. Gait abnormalities and bladder and bowel disturbances should also be assessed for in these patients.

Systematic reviews, looking at the diagnostic accuracy of clinical tests in patients with lumbar spinal stenosis revealed that the symptoms of radiating leg pain and thigh pain when standing up had the highest sensitivity for LSS. Also, the absence of symptoms when seated, or the improvement of symptoms with forward bending, as well as wide based gait were useful for ruling in LSS [6,7].

A thorough spine exam should be performed in all patients with suspected LSS. The exam should begin with the inspection of the overall spinal alignment. Tenderness to palpation of the lumbosacral spine can sometimes be present. Range of motion of the spine should be noted, and decreased lumbar motion is not uncommon. Range of motion of the hips and knees to assess for degenerative arthritis should also be performed. Provocative tests such as straight leg raises may help differentiate symptoms of stenosis with that of a disc herniation. One should also assess for lower extremity muscle strength, which may be reduced in patients with LSS. Sensation for light touch and vibratory sense should be assessed. Reflexes should also be assessed. Gait pattern and Romberg test should be considered as part of a complete physical examination in these patients. In patients with abnormal gait patterns, cervical myelopathy should also be considered [4,6].

The differential diagnosis of LSS is broad. One should rule out other common causes of lower extremity symptoms. Degenerative osteoarthritis of the hip or knee can cause similar lower extremity symptoms, and should be explored. Vascular claudication can also present similarly to neurogenic claudication, so peripheral vascular disease should be ruled out as a potential cause of lower extremity pain [8]. A thorough vascular examination should be performed. In patients with atypical claudication ankle-brachial index may be useful as a screening test to determine whether the origin is vascular in nature [9]. Neurologic disorders such as diabetes with peripheral neuropathy, or a peripheral compressive neuropathy may also present with similar symptoms, and their diagnosis should be ruled out as a potential cause of the patient’s symptoms [4].

Imaging and Diagnostic Examinations
Imaging is often necessary in patients with LSS to determine the exact level of stenosis and to determine the severity of the stenosis. The current mainstay of spinal imaging for Lumbar Spinal Stenosis is magnetic resonance imaging (MRI). MRI can identify nerve compression and can also be used to determine the cross-sectional area of the spinal canal. In a patient where surgical intervention is being considered, MRI can be very useful in the determination of the spinal levels requiring decompression, and other anatomic considerations [4,8]. Studies have shown that the inter-reader reliability of central canal stenosis, soft tissue canal area, and thecal sac area was substantial.
of the patient's symptoms, baseline functional status, and the patient’s goals should warn the patient about. It may also be used but generally only work for short term symptom relief of the natural history of the disorder [22]. Steroids and muscle relaxants are not recommended for chronic pain control as they have no effect on the pain of some people persisted even after decompression spine surgery, but resolved with total hip arthroplasty [17]. This shows that even sometimes with a thorough history, physical exam and imaging, an exact cause of the patient’s pain can still be elusive.

Recent evidence reveals that another diagnostic modality that can help in the diagnosis of LSS is electromyography. Studies show that in elderly patients electromyography is superior to MRI in determining which patients were symptomatic or asymptomatic [18,19]. Electromyography has been shown to have a high specificity in determining which patients were symptomatic or asymptomatic [20].

Standard lumbar spine AP and Lateral X-rays may be helpful in determining the extent of degeneration of the spine. Findings such as disc space narrowing, facet joint hypertrophy, and osteophyte formation should be noted [8]. X-rays can also help to rule out other pathologic conditions such as tumors or fractures. Spondylolisthesis should also be noted. Dynamic flexion and extension views should be obtained which will help to determine if there is any evidence of spinal instability causing the symptoms [4].

Nonoperative Management

Treatment of lumbar spinal stenosis is generally a multimodal approach that may culminate in surgical intervention if symptoms cannot be controlled with nonoperative methods. Although there is no great evidence, NSAID medication is often recommended as a first line attempt to control the symptoms of LSS [21]. Stronger analgesics such as narcotic medications can be used for a very short period of time but are not recommended for chronic pain control as they have no effect on the natural history of the disorder [22]. Steroids and muscle relaxants may also be used but generally only work for short term symptom relief [4]. Gastrointestinal upset and bleeding is a side effect that the provider should warn the patient about.

As in most musculoskeletal diagnoses, a multidisciplinary approach is often used in the treatment of spinal stenosis. A thorough assessment of the patient’s symptoms, baseline functional status, and the patient’s goals of treatment should be taken into consideration when directing a treatment plan. Since the spectrum of the LSS is quite broad varying from occasional pain and neurogenic claudication to severe disability and bowel and bladder dysfunction, a multimodal approach if often necessary help the patient achieve their goals of treatment. Physical therapy and occupational therapy is often used to help the patient either return to their baseline functional status, or to help them complete their activities of daily living in safe and effective manner. Both of these providers also have the ability to recommend possible assistive devices such as walkers, wheelchairs, or scooters to help increase mobility.

In patients who are not surgical candidates, the focus of treatment turns to symptom control. Pain management specialists can help patients control their pain. Physiatrists and occupational therapists can help the patient to maintain mobility, and even urologists can be utilized to help the patient to deal with potential bladder dysfunction.

Physical therapy is also an often used and prescribed treatment modality in patients with LSS. Although once again there is very little scientific evidence that a course of physical therapy can help with the overall treatment of spinal stenosis, it is advocated the patients receive a nonoperative trial of both NSAID medication and physical therapy prior to consideration for surgery [12]. There are many different treatment modalities for physical therapy. Classically, for patients with LSS, flexion type exercises has been advocated for symptom relief. A recent study has shown that manual physical therapy may be more effective than flexion type exercises in the treatment of LSS [23]. Epidural steroid injections have also been used to treat patients with LSS. An injection of a steroid mixed with a local anesthetic is used and is injected locally into the affected area. Although the actual mechanism of their action is poorly understood, it is thought that the local anti-inflammatory effect decreases symptoms [24]. Studies have shown that epidural steroid injections can be beneficial to patients when combined with NSAIDs and a home exercise program [14].

Operative Management

Operative treatment is reserved for patients who have failed the nonoperative management of LSS and are good surgical candidates. A good surgical candidate is a patient in which after a thorough history, physical, and workup demonstrates that his pain is indeed secondary to spinal stenosis and other causes of pain and claudication have been ruled out. Patients with multiple medical comorbidities which may be very high risk for surgery should be treated nonoperatively if possible.

Prior to surgical intervention, the surgeon must determine which, what type of surgery would be the most beneficial for the surgical candidate. For LSS with no evidence of instability, a lumbar decompression surgery via a laminectomy with no fusion is indicated. A laminectomy is performed to decompress the neural elements, but care must be taken to preserve the majority of the facet joint or iatrogenic spinal instability may also be indicated [25]. In patients who exhibit spinal instability in dynamic flexion and extension views, or those who have evidence of spondylolisthesis, decompression along with fusion is often indicated [4,8]. There is however increasing evidence that the rate of decompression and fusion is increasing when compared to that of sole decompression in the treatment of LSS [26].

There have been many studies looking at the effectiveness of just decompression surgery versus decompression and fusion. There is still no absolute consensus in the literature, but a systematic review article performed by Resnick et al. in 2005 in the Journal of Neurosurgery recommended that in patients with pure lower extremity symptoms with no evidence of spondylolisthesis only decompression should be performed [27]. He also recommended that in patients with LSS and
spondylolisthesis a decompression and fusion should be performed [28]. The NASS surgical guidelines recommended decompression alone for patients with predominantly lower extremity symptoms [14].

There have been several studies exploring the effectiveness of decompressive surgery in the treatment of LSS. The results of these studies vary tremendously and standardization has historically been poor due to lack of a standardized outcome measure. Many studies use functional and pain score testing to determine the effectiveness of surgical intervention, while others use exercise testing such as the bicycle or treadmill tests [29]. A study performed at the Brigham and Women’s Hospital revealed a 15% reoperation rate, with 30% of the study population still experiencing severe pain after surgery with a minimum of 2.8 years of follow up [30]. In another study out of Schulthess Hospital in Zurich, they randomized patients with LSS into 3 groups viz., decompressive laminectomy, decompressive laminectomy with one level fusion, and decompressive laminectomy with multilevel fusion. This study revealed that after 28 months of follow up, the 3 groups had similar pain and functional outcomes. They concluded that arthrodesis was not necessary after decompressive laminectomy in patients with no evidence of spinal instability [31].

One of the landmark in spine surgery was randomized control trials, The Spine Patient Outcomes Research Trial (SPORT) demonstrated the superiority of surgical treatment of LSS when compared to nonoperative management. In this randomized study, 289 patients were randomized into a surgical or nonsurgical group. Although there was significant crossover in each of the groups, analysis showed that the patients who had undergone surgical decompression for LSS had significantly better outcomes than those treated nonoperatively. The outcome measures that were analyzed in this study were several pain and functional outcome scores. There was minimum of two years of follow up in this study [32]. In a four year follow up study involving the SPORT trial participants, the significance of continued improvement in pain and functional outcomes was still maintained [33]. Systematic reviews looking at all the randomized trials for LSS have also determined the superiority of surgery over conservative treatment [34].

With the advent of the thought of developing newer muscle and bone sparing approaches, several new techniques were developed to treat LSS. Procedures such as the laminotomy, microendoscopic laminotomy, laminoplasty, and foraminotomy have been shown to be effective in the treatment of LSS [35]. In a laminoplasty, the posterior elements are expanded, usually via a bone block technique effectively expanding the volume of the spinal canal and relieving the symptoms of LSS. With this amount of bone preservation, iatrogenic instability is less likely to occur [36]. Even newer techniques, such as the iO-Flex system, are minimally invasive and use a flexible microblade to help decompress the neuroforamina [23].

Another new technique for the treatment of LSS is the X-Stop implant. The X-Stop implant is an interpinous distraction device that reduces pathologic extension at the symptomatic levels, hence decreasing the symptoms of LSS. A randomized multicenter study looking at 100 patients treated with the X-Stop device versus 91 patients treated conservatively revealed that a significant improvement in pain and functional scores those treated with the X-Stop when compared to the control group. This study also showed higher patient satisfaction scores in the X-Stop group [37]. A recent randomized study looking at 100 patients who were randomized to either decompressive laminectomy or the X-Stop implant revealed similar pain and functional outcome scores at 2 years follow up. However, the X-Stop group had 26% reoperation rate when compared to only 6% in the decompression group [38].

Although the treatment for LSS has been straightforward decompression for many years, newer techniques and advances in the field of spine surgery have revealed several new, advanced, and minimally invasive techniques. The level of evidence of the effectiveness of these techniques however, is yet to be determined.

References


