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ABSTRACT

As spinal stenosis affects a large number of patients compromising their quality of life, pain management is of vital importance. The purpose of this study is to review the methods of pain management in patients with spinal stenosis, in hospital, in doctor's office and at home.

A thorough search was performed at the online PUBMED database using the following keywords: "conservative treatment" OR "non-surgical treatment" OR "conservative management" OR "non-surgical management" AND "pain" AND "spinal stenosis". The search results showed 253 posts. After checking titles and summaries, 131 articles were rejected as not relevant with pain management in spinal stenosis. Of the 122 publications that remained and were evaluated, 29 were rejected for specific reasons. Thus there were 93 studies left for the current review.

Pain management of patients with spinal stenosis is initially conservative, especially if the symptoms are simply numbness and pain. Conservative treatment includes analgesic drugs, physical therapy, steroid injections and acupuncture. However, there is little high quality evidence for the evaluation of non-operative treatment of pain due to spinal stenosis. When conservative management is inefficient, operative treatment displays satisfactory results.

KEY WORDS: spinal stenosis, pain, primary management

Introduction

Spinal stenosis is defined as a condition in which there is a narrowing of the spinal canal, with subsequent pressure on the spinal cord or spinal nerves. It may be congenital or acquired. The acquired type of spinal stenosis is usually degenerative, and therefore occurs mostly in middle-aged or older people (over 50 years of age) (1).

In addition to the spinal canal, stenosis may involve lateral foramina. It is more common in the lumbar spine, less in the cervical spine and very rarely in the thoracic, where the range of the spinal canal is smaller and the allowable spinal and disc movements are much less. Spinal stenosis can

impair nerve roots and cause damage to the distribution of the root being pressed. In more severe cases, in the cervical spine, it can cause cervical myelopathy and in the lumbar spine it can cause cauda equina syndrome. (2).

The most common symptom of lumbar spinal stenosis is neurogenic claudication, which is defined as "pain from intermittent compression and/or ischemia of a single or multiple nerve roots within an intervertebral foramen or the central spinal canal" (3). Back pain can range from simple discomfort to very severe pain. The pain is always aggravated by standing and walking, while it is reduced with the patient sitting or bending forward. This is due to the fact

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that, during extension of the lumbar spine, the spinal canal narrows, while in the sitting or forward bending positions, the canal is widened and the patient is relieved. Numbness and tingling in the legs are often reported, and some patients complain of leg cramps during sleep at night (4).

As spinal stenosis affects a large number of patients, compromising their quality of life, pain management is of vital importance. The goal of this study is to review the methods of pain management in patients with spinal stenosis, at hospital, at the doctor's office and at home.

A thorough search was performed at the online PUBMED database with the following keywords: "conservative treatment" OR "non-surgical treatment" OR "conservative management" OR "non-surgical management" AND "pain" AND "spinal stenosis".

Discussion

The search results revealed 253 posts. After checking titles and summaries, 131 articles were rejected as non-relevant with spinal stenosis' pain management. Of the 122 publications that remained and were evaluated, 29 were rejected for specific reasons, leaving 93 studies for the current review (Table 1).

The initial approach of any patient with spinal stenosis should be conservative, in order to improve its clinical symptoms, especially pain. Conservative treatment may include the use of brace, physiotherapy, exercises, steroid injections, anti-inflammatory and analgesic drugs (5-9). It should be noted that the goal of conservative treatment is to relieve pain, improve claudication and overall quality of life of the patient, but it is impossible to widen the spinal canal with conservative measures (10,11). A large percentage of patients with spinal stenosis have a satisfactory response to conservative treatment and no surgery is required. The effectiveness of conservative treatment is checked within 3-6 months; if there is no improvement in the patient's quality of life, then he should resort to surgery (12-15). Conservative treatment may be more beneficial for young patients in comparison to elderly patients, where surgical management may have superior results (16).

Conservative treatment

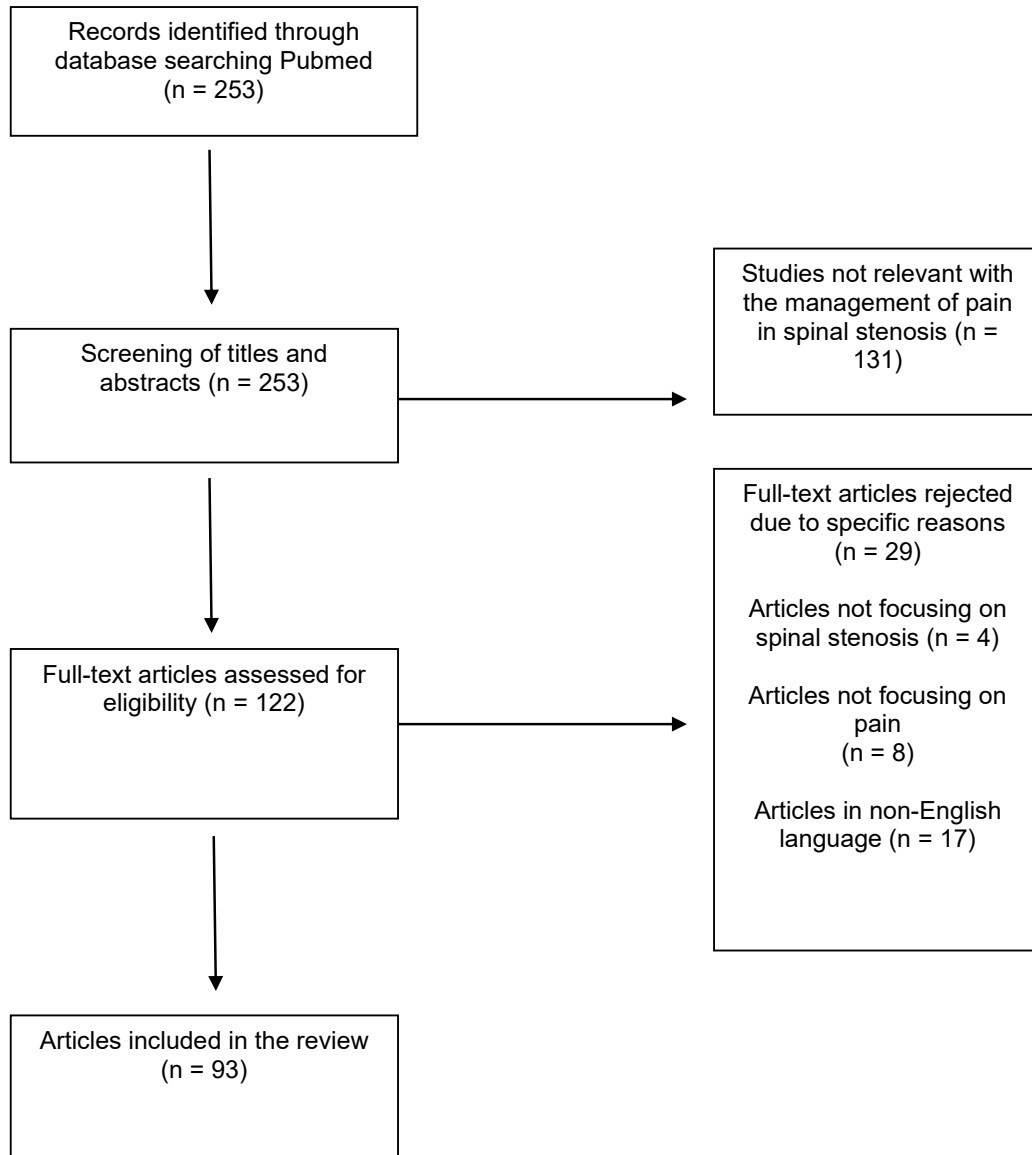
Analgesic drugs: a variety of per os and topical analgesic drugs are available to treat pain of spinal stenosis, including opioids and non-opioids, and adjuvant analgesics. These drugs include paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs) and opioids that can be administered at

home or at hospital.

Paracetamol, although less effective for acute pain than NSAIDs, is a reasonable first choice treatment because of its favorable safety and cost profile. It has analgesic but not anti-inflammatory properties (17). In combination with opioid analgesics, paracetamol can be administered for severe pain. NSAIDs are among the most commonly used drugs for musculoskeletal pain due to their established efficacy, as anti-inflammatory and analgesic agents. Their effectiveness has been documented in numerous acute and chronic conditions of musculoskeletal pain including spinal stenosis (18-20). NSAIDs are generally preferred over opioids due to their established efficacy and limited potential for abuse. However, they have a number of side effects (cardiovascular, nephrotoxic, gastrointestinal) and the risk of complications is dose-dependent. For this reason, increasing the dose of an NSAID should be done with caution and alternative therapies should be used if the effectiveness does not increase (20). Paracetamol and NSAIDs are generally effective for mild to moderate musculoskeletal pain and their activity is enhanced when given in combination (21).

Opioids are used in cases where paracetamol and NSAIDs cannot achieve adequate pain control (22). Opioids are usually kept as a second-line treatment for musculoskeletal pain that does not respond to paracetamol and NSAIDs. Despite the effectiveness of morphine and its opioid analogues in the acute regulation of pain, these drugs generally have poor efficacy in the regulation of chronic pain. This can be attributed, in part, to patients' tendency to develop tolerance to these drugs and the impact of side effects (constipation, nausea, indigestion, headaches, euphoria, confusion, drowsiness, lethargy, urinary retention) associated with opioid administration. However, these risks are often overestimated, and opioids are often the only option for severe pain and may be a good option for specific groups of patients, such as the elderly. They can also be an alternative when long-term NSAID treatment is not recommended (23). For spinal stenosis, prolonged opioid use has been correlated with female sex, obesity and prior opioid use (24). In these patients, opioids may be used perioperatively at lumbar decompression and spinal fusion surgery (25, 26).

Muscle relaxants have been shown to be effective in patients with pain-associated muscle spasm, but the magnitude of the effect could not be measured. A systematic review found strong evidence that some muscle relaxants are superior to placebo in treating acute low back pain, but

Table 1. Flowchart of the study

there is little evidence of their efficacy in treating chronic low back pain (27). Alternatively, for chronic musculoskeletal pain, tricyclic antidepressants and serotonin-norepinephrine reuptake inhibitors may be used. These drugs increase the levels of serotonin, norepinephrine, and / or dopamine in the central nervous system. It is believed that the increased concentrations of these neurotransmitters lead to the downward regulation of pain transmission (28). Gabapentin has been observed to improve pain intensity, but causes mild to moderate drowsiness and/or dizziness (29). Pregabalin has

been administered in the treatment of neuropathic pain in patients with lumbar spinal stenosis where NSAIDs show no benefit (30). One study has shown that calcitonin is superior to paracetamol in relieving pain in patients with lumbar spinal stenosis (31).

Physical therapy: physical therapy is a standard treatment of neurogenic claudication; however, current data has not established its role. It is commonly recommended for patients with mild or moderate lumbar spinal stenosis. Physical therapy has three goals: (i) strengthen the muscles around the

spine, (ii) maintain their flexibility, and (iii) improve patient's balance. Classical physiotherapy may offer a temporary remission of the symptoms, but they may return soon (32-37). It has been found that physical therapy may postpone spinal surgery at least for one year (38). According to a multi-center, randomized study in United States, physical therapy was associated with improvement in quality of life and a reduced rate of progression to surgery, within one year. However, the level of pain was not affected (39). In a systematic review published in 2016, it was demonstrated that exercise is effective in pain reduction and decreases anger, depression, and mood disturbance providing physiological stability (40). There are studies reporting that physical therapy is potentially as efficient as surgery (41,42). The role of exercise is especially important in people with spinal stenosis and can significantly improve patients' clinical symptoms (43,44). However, the short-term efficacy of exercise is not yet established as it is based on low quality data. Exercise should include strengthening of the deep supporting muscles of the lumbar spine and pelvis, treadmill or stationary cycling, lordosis reduction exercises, chest stretching, balance exercises, flexibility training and posture control (45-48). Flexion-distraction exercises of the lumbar spine are effective for pain relief among patients with lumbar spinal stenosis (49, 50). The best combination of these exercises and their frequency, duration, and appropriate setting is unclear (51,52). Evidence has shown that supervised physical therapy is more effective than a home-based exercise program (53-55).

Steroid injections: an important step of the conservative treatment is spinal steroid injections. They are applied right next to the irritated nerves, to control the inflammation, under computed tomography guide (56). Steroid injections appear to provide a good short-term relief for a maximum of 6 months, but their long-term use is questionable (57-59). Spinal infusions have shown promising results, especially, in combination with physical therapy. Their duration, however, ranges between two weeks and six months (60).

Epidural steroid injections are a relatively safe and less invasive alternative to surgical intervention. When compared to NSAIDs, caudal epidural injections containing steroids and local anesthetics provide faster pain relief in patients with spinal stenosis. They are a preferable and low cost choice for the management of subacute/chronic low back and radicular pain, if applied by experienced specialists (61-66). Additionally, the use of local anesthetic, may provide superior pain relief (67). Transforaminal epidural steroid injections are being

used widely for controlling radicular pain induced by lumbar foraminal spinal stenosis; however they demonstrate short-term efficacy (68,69). Lumbar interlaminar epidural injections are more efficient than caudal epidural injections in lumbar central spinal stenosis (70). Nevertheless, there are little data that support the efficacy of epidural injections in pain relief in patients with spinal stenosis (71). A systematic review by Liu *et al* observed that epidural injections offered minimal pain relief in patients with lumbar spinal stenosis (72). Friedly *et al* observed that epidural spinal injections of glucocorticoids in combination with lidocaine had minimal or short-term benefit in comparison with epidural injection of lidocaine alone (73). The combination of epidural steroid injections with physical therapy is not superior to epidural injections alone (74). The addition of calcitonin to epidural steroid and local anesthetic injections may reduce pain intensity and analgesics consumption in degenerative lumbar spinal stenosis (75). In terms of adverse events, there is evidence that steroid injections may cause cortisol suppression (76).

Neuromodulation: spinal cord stimulation is an invasive technique that involves epidural implantation of the electrodes, either percutaneously or through direct skin incision requiring a laminectomy. Electrodes must be placed at the exact spinal level, to cover the area of the reported pain (77). Spinal cord stimulation has been shown to be effective against leg pain in patients with lumbar spinal stenosis with a reported analgesic efficacy of 65% (78). The main proposed mechanisms are: (i) the suppression/regulation of abnormal activity of neurons at the posterior horn of the spinal cord, (ii) the normalization of neurons excitability and (iii) the postsynaptic suppression (78).

Bracing: braces and belts used for spinal stenosis aim to reduce lumbar lordosis, thus reducing the width of the spinal canal (79,80). Semi-rigid lumbosacral bracing and lumbosacral corsets have been found to potentially reduce pain (5,81). The proposed mechanism is that an anterior pelvic tilt may reduce the lumbar lordosis and therefore, the associated increase of the volume of lumbar spinal canal may result in improved blood flow to the spinal nerves. Moreover, lumbar braces reduce movement of the lumbar spine and provide additional mechanical support during walking, resulting in improved sense of stability and balance, walking confidence and pain decrease (79).

Acupuncture: it involves the placement of very fine needles on the body and face. Typically 10 to 20 needles are applied. Once the needle is inserted, the patient feels absolutely

no pain. A session usually lasts from 20 to 30 minutes. The needles are placed not only near the points of pain but also in other parts of the body that are associated with the overall improvement of health (82). For chronic low back pain, acupuncture is more effective for pain relief than no treatment at all, demonstrating short-term functional improvement (83). It has been shown that acupuncture has a significant short-term effect on pain and quality of life in patients with lumbar spinal stenosis (84-87). Oka et al have observed that as far as pain relief is concerned, acupuncture may be superior to physical therapy (88). According to a meta-analysis by Kim et al, pain intensity, functional outcome and quality of life related to lumbar spine stenosis, showed significantly favourable improvement in patients subjected to acupuncture compared with the control group, lasting for up to 6 months post-treatment (89). In patients who do not respond to conventional acupuncture, spinal nerve electroacupuncture may be an effective treatment (90, 91).

Failure of Conservative treatment

When conservative treatment is not effective and patients' quality of life is negatively affected, then surgical management is necessary. Predictive factors for surgical management are: (i) cauda equine symptoms, (ii) degenerative scoliosis or spondylolisthesis, and (iii) long disease duration with intolerable pain (92). Surgery is superior to continued conservative treatment. Delaying surgery for a period of conservative management does not affect surgical outcome (93). Moreover, it has been proved that the cost-effect of conservative management versus surgical treatment, for spinal stenosis, is unfavorable (94, 95).


The goal of surgical treatment is the decompression of the spinal canal without compromising spinal stability and the prevention of further structural deterioration. There are many different surgical options for indirect lateral and cen-

tral lumbar stenosis, including open, minimally invasive and endoscopic procedures. The purpose is the decompression of the compromised neural structures and the provision of pain relief. The gold standard is open posterior decompressive laminectomy, with or without spinal fusion, depending on the disease characteristics and surgeon preference (96).

Minimal invasive lumbar decompression (MILD) has been used for central stenosis direct decompression. Under fluoroscopic guidance, a cannula is inserted through a 6-gauge portal and tissue and bone sculptors are used to perform a minimal laminotomy and resection of the ligamentum flavum so that the affected dural sac or nerve roots are decompressed (57). The method has shown significant improvement in pain intensity and functional outcomes in comparison to control groups (97).

Percutaneous lumbar decompression is effective and safe especially in elderly patients with lumbar spinal stenosis (98). Minimally invasive discectomy may achieve decompression through nucleotomy and indirectly relieves pressure on the exiting nerve root, while minimally invasive transforaminal endoscopic decompression procedures may achieve spinal decompression through either a direct or an indirect approach (99). Radiofrequency ablation technique is a simple and safe alternative method to relieve pain of lumbar stenosis, especially in the elderly. It may reduce the soft tissue component of the stenosis and enlarges epidural space (100).

Conclusions

Pain management of patients with spinal stenosis is initially conservative, especially if the symptoms of spinal stenosis are simply numbness and pain. Conservative treatment includes analgesic drugs, physical therapy, steroid injections and acupuncture. However, there is little high quality evidence for the evaluation of non-operative treatment of pain due to spinal stenosis (101). When conservative management is inefficient, operative treatment demonstrates satisfactory results. 

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