



## Conservative Treatment and Percutaneous Pain Relief Techniques in Patients with Lumbar Spinal Stenosis: WFNS Spine Committee Recommendations

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■ **BACKGROUND:** Degenerative lumbar spinal stenosis (LSS) is a progressive disease with potentially dangerous consequences that affect quality of life. Despite the detailed literature, natural history is unpredictable. This uncertainty presents a challenge making the correct management decisions, especially in patients with mild to moderate symptoms, regarding conservative or surgical treatment. This article focused on conservative treatment for degenerative LSS.

■ **METHODS:** To standardize clinical practice worldwide as much as possible, the World Federation of Neurosurgical Societies Spine Committee held a consensus conference on conservative treatment for degenerative LSS. A team of experts in spinal disorders reviewed the literature on conservative treatment for degenerative LSS from 2008 to 2018 and drafted and voted on a number of statements.

■ **RESULTS:** During 2 consensus meetings, 14 statements were voted on. The Committee agreed on the use of physical therapy for up to 3 months in cases with no neurologic symptoms. Initial conservative treatment could be applied without major complications in these cases. In patients with moderate to severe symptoms or with acute radicular deficits, surgical treatment is indicated. The efficacy of epidural injections is still debated, as it shows only limited benefit in patients with degenerative LSS.

■ **CONCLUSIONS:** A conservative approach based on therapeutic exercise may be the first choice in patients with LSS except in the presence of significant neurologic deficits. Treatment with instrumental modalities or epidural injections is still debated. Further studies with standardization of outcome measures are needed to reach high-level evidence conclusions.

### INTRODUCTION

**D**egenerative lumbar spinal stenosis (LSS) is generally a progressive disease with potentially dangerous consequences causing alteration in walking capacity (neurogenic claudication) and consequently a reduction of quality of life because of the symptoms. However, the natural history of lumbar stenosis in a given patient is unpredictable. This uncertainty is a challenge particularly in making the correct management decisions, especially in patients with mild to moderate symptoms. Treatment may be surgical or conservative.

Regarding conservative treatment of degenerative LSS, many different approaches and techniques are described, and it is quite difficult to standardize which conservative treatment should be chosen as well as how to define its efficacy in respect to the natural history of the pathology. The World Federation of Neurosurgical Societies (WFNS) Spine Committee analyzed the different types of

### Key words

- Conservative treatment
- Follow-up of LSS
- Guidelines
- Lumbar spinal stenosis
- LSS
- Percutaneous pain relief techniques

### Abbreviations and Acronyms

- LBP:** Low back pain  
**LS:** Likert scale  
**LSS:** Lumbar spinal stenosis  
**PT:** Physical therapy  
**RCT:** Randomized controlled trial  
**WFNS:** World Federation of Neurosurgical Societies

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conservative approaches and their possible role for the treatment and follow-up of LSS. In particular, we analyzed the physical treatments (type of treatment and duration, bracing), percutaneous injections (both facet joint and epidural), and outcomes and complications of conservative treatment.

## MATERIALS AND METHODS

The WFNS Spine Committee formed a group of neurospinal experts to develop recommendations for treatment of LSS. The goal was to provide clinicians with evidence-based recommendations applicable across the globe for standardized care in patients with LSS. Each prioritized question was discussed using the modified Delphi method to establish consensus through voting.

The available literature on conservative treatment in managing LSS symptoms over the last 10 years was reviewed by 5 spinal experts (S.F., R.G., S.C.R., P.P., M.C.). The Agency for Healthcare Research and Quality criteria were used for quality assessment and clinical relevance of diagnostic studies and observational studies, and the Cochrane Musculoskeletal Review Group criteria were used for quality assessment and clinical relevance of randomized trials for interventional techniques. Level of evidence was defined as level I–IV based on the quality of evidence developed by the U.S. Preventive Services Task Force for therapeutic interventions. Strength of evidence rate was mild, moderate, or high. Data sources included relevant articles in the English language literature identified through searches of Ovid MEDLINE, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, National Guideline Clearinghouse, PubMed, and Embase for the years 2008–2018.

Answers to the following questions were sought:

1. What is the role of physical therapy (PT) in treatment of LSS?
2. Which type of PT is recommended and for how long?
3. Is there a role for bracing in conservative treatment of LSS?
4. Are there factors that can be used to recommend a conservative treatment, and which kind of conservative treatment is better?
5. Is there strong evidence to suggest conservative treatment for a certain period of time before surgery?
6. Do facet injections provide significant pain relief for treatment of low back pain (LBP)?
7. Do facet joint injections provide a useful diagnostic tool for LBP?
8. Should a facet/medial branch nerve ablation be performed when diagnostic facet joint injections are effective?
9. Is there a role for epidural injections in the treatment of LSS and, if so, which type are recommended?

Based on the most significant literature, 14 statements were drafted and presented for the first round in Milan, Italy, in November 2018 and then presented and voted on for the second round in Belgrade, Serbia, in March 2019. Methodology was described in the introductory article. This article presents our results in 2 sections: conservative treatment and percutaneous pain relief techniques.<sup>1</sup>

## RESULTS

### Conservative Treatment

**Value of PT, Exercise, and Brace.** The following key words were used as search items: “humans OR adults,” “lumbar stenosis OR spinal stenosis,” and “exercise OR rehabilitation.” The search was done for studies over the last 10 years in the English language. Only studies including conservative nonpharmacologic interventions were included. Titles and abstracts were screened by 2 authors (R.G. and S.F.) to identify relevant studies. The authors independently assessed the full text of the studies retained in the previous step, and in cases of discrepancies, their results were discussed to reach a consensus.

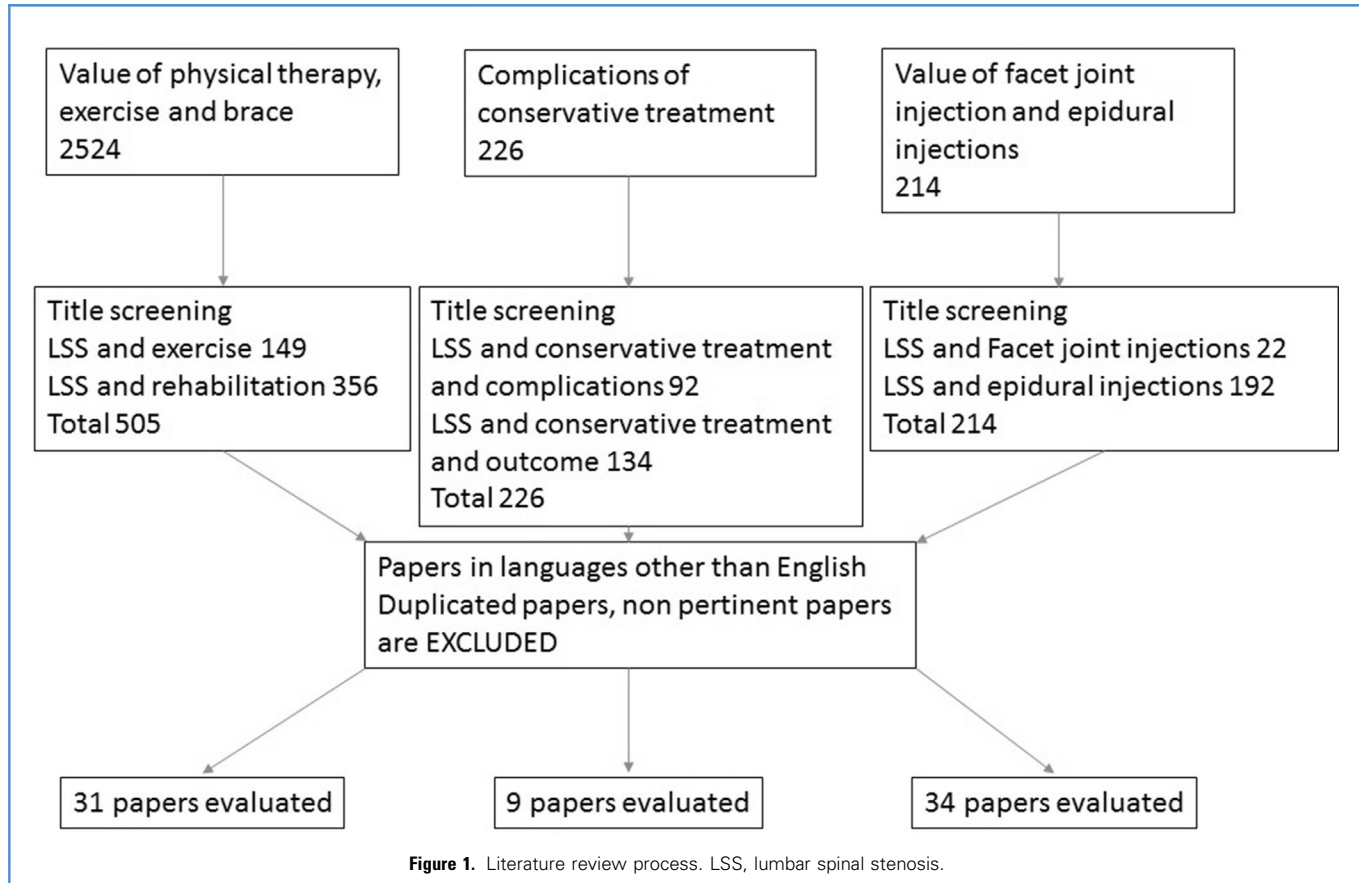
A total of 2524 articles were identified through database searching and manually searching reference lists. Duplicates were removed, and related articles were screened for title and abstract and then for full text. Finally, 31 articles were selected for the consensus conference. The literature review process is summarized in **Figure 1**.

To answer the question regarding the role of PT, the following articles were the most significant ones. Macebo et al.<sup>2</sup> stated that based on response to at least 3 weeks of the initial conservative approach, clinical assessment may suggest continuing with rehabilitation and, in this case, surgery should be considered only if the patient's clinical condition does not change in 3 months. This approach is particularly indicated for patients with spinal stenosis with mild symptoms. To reinforce this point, it should be noted that the rate of side effects in surgical cases is 10%–24%, whereas no side effects were reported for any conservative treatment, as reported by Zaina et al.<sup>3</sup>

Ammendolia et al.<sup>4</sup> analyzed the role of PT and which exercises are useful in the conservative treatment of LSS. They concluded that a multimodal approach is a good solution, mainly based on education and therapeutic exercise, eventually including manual therapy, whereas other approaches, such as aquatic therapy, acupuncture, psychosocial intervention, transcutaneous tibial nerve stimulation, and neural mobilization, did not reach a positive consensus because of the scarce evidence on their efficacy (**Table 1**). A comprehensive conservative program (including exercises) demonstrated superior, large, and sustained improvements in walking ability and can be a safe nonsurgical treatment option for patients with neurogenic claudication secondary to LSS.<sup>4</sup> Many other authors have reached similar conclusions.<sup>2,5–13</sup>

Adding manual therapy to flexion exercises and walking seemed to have a similar effect as flexion exercises and walking alone; therefore, Macedo et al.<sup>2</sup> and the North America Spine Society Guideline<sup>5</sup> stated that there is insufficient evidence to make recommendations for or against spinal manipulation. However, a conservative program based on body weight, sustained treadmill exercise, and manual therapy showed positive long-term results. Regarding devices, there is agreement in the literature that instrumental modalities, such as ultrasound, transcutaneous electrical nerve stimulation, heat pack, and others, add no additional effect to exercise.<sup>2,5,14</sup>

Furthermore, Fritz et al.<sup>15</sup> concluded that exercises in a PT program are addressed to reduce pain and maximize function by improving lumbar spine and lower extremity flexibility, muscular strength, and endurance and showed an association with



reduced likelihood of patients receiving surgery within 1 year (Figure 2). Kreiner et al.<sup>5</sup> concluded that the choice of an appropriate exercise is based on the characteristics of symptoms. Normally, it is possible to identify painful provocative or palliative conditions, depending on spine movement or posture. Provocative features include upright exercise such as walking or positionally induced neurogenic claudication, whereas palliative features commonly include symptomatic relief with forward flexion, sitting, or recumbency. Meanwhile, Schneider et al.<sup>16</sup> identified some factors, such as a

higher baseline score on the Swiss Spinal Stenosis Questionnaire or visual analog scale, high body mass index, presence of leg pain, and old age, that predict a less favorable response to conservative treatment.

As we stated previously, the best physical approach is a multimodal program, but which type of exercise is better? Backstrom et al.<sup>17</sup> found that exercises including spine and lower limb muscle stretching, spine and pelvis mobility, strength training, treadmill walking, and stationary cycling showed positive effects on subjects with LSS. Following the investigation by Comer et al.,<sup>18</sup>

**Table 1.** Multimodal Physical Therapy for Conservative Treatment of Lumbar Spinal Stenosis

Physical Therapy Modality	Examples
Exercises	Flexion-extension, walking, cycling
Manual therapy	Mobilization, manipulation, traction
Instrumental physical therapies	Ultrasound, TENS, heat pack
Other modalities	Acupuncture, aquatic therapy, psychosocial intervention, transcutaneous tibial nerve stimulation
Corset and braces	
Education and information	
TENS, transcutaneous electrical nerve stimulation.	



it is worth noting that although no particular exercise modality showed superiority regarding its efficacy, no literature data consider training based on lumbar spine extension, and consequently it would be reasonable to avoid this approach in a PT plan created for patients with LSS. However, physical therapists advise flexion and stabilization exercises.

The rationale for the use of a corset brace is to reduce the lumbar lordosis increasing the spine canal size, but despite its widespread clinical use, disagreement regarding its efficacy exists. However, the use of a lumbosacral corset brace is suggested to increase walking distance and decrease pain in patients with LSS and has been suggested by many authors.<sup>2,4,5</sup>

Some studies, such as the ones by Ammendolia et al.<sup>4</sup> and Bove et al.,<sup>19</sup> included psychosocial interventions. This intervention was included in some studies based on the patient's education level to obtain long-term engagement of the patient. However, none of the studies evaluated psychosocial interventions in conservative treatment alone.

According to these literature reviews, the WFNS Spine Committee proposed and voted on the statements as follows:

- Statement 1: In nonsevere clinical conditions, a conservative approach based on at least 3 weeks of therapeutic exercise may

be the first therapeutic choice. This statement reached a strong positive consensus (40% voted 5 on the Likert scale [LS], 20% voted 4 on LS, 30% voted 3 on LS, and 10% voted 2 on LS).

- Statement 2: Medical or interventional treatment should be preferred to surgical treatment in patients with spinal stenosis with mild symptoms. This statement reached a strong positive consensus (40% voted 5 on LS, 30% voted 4 on LS, 10% voted 3 on LS, and 20% voted grade 2 on LS).
- Statement 3: PT should consist of multimodal approaches. This statement reached a positive consensus (30% voted grade 5 on LS, 10% voted 4 on LS, 30% voted 3 on LS, and 30% voted grade 2 on LS).
- Statement 4: There is insufficient evidence to make a recommendation for the use of other PT interventions (aquatic therapy, acupuncture, psychosocial intervention, transcutaneous tibial nerve stimulation, neural mobilization). All expressed a positive vote with a strong positive consensus (80% voted grade 5 on LS and 20% voted grade 4 on LS).

**Complications of Conservative Treatment.** After searching with the key words “conservative treatment AND lumbar spinal stenosis,” “conservative treatment AND complications,” and “conservative

treatment AND outcome” between 2008 and 2018, 32 papers were found, of which 9 were considered pertinent to the question after a second review process. The literature review process is summarized in [Figure 1](#).

Most of the studies concluded that initial conservative treatment could be applied without major complications. This was not advisable in patients with a neurologic deficit at presentation.

In their meta-analysis, Zaina et al.<sup>3</sup> compared the outcome between conservative and surgical treatment with a follow-up period of 5 years. They analyzed pain, quality of life, disability, and complication rate. They found similar results between the 2 groups of patients. However, they reported that side effects were 10%–23% in surgical cases, whereas no side effects were reported for any conservative treatment. Considering the higher complication rate of surgery, they concluded that in the absence of strong evidence for the superiority of surgery, conservative treatment should be the first choice.

Zweig et al.<sup>20</sup> used the data from the Spine Tango registry to investigate if there was a relationship between the duration of conservative treatment and the outcome after surgical treatment. They listed 3478 patients stratified based on the duration of preoperative conservative treatment. They concluded that the duration of preoperative conservative treatment was not associated with differences in postoperative relief of leg pain, Core Outcome Measures Index score improvement, or surgical or general medical complication rates. Longer conservative treatment did not appear to influence the surgical outcome following lumbar spinal decompression. The only factor that was related to duration of symptoms was the duration of surgery, which was longer in patients with a longer history of symptoms, but this result has to be interpreted carefully.

Ma et al.<sup>21</sup> conducted a review of randomized controlled trials (RCTs) comparing surgical versus nonsurgical treatment. They identified 9 trials with a total of 1685 patients; 3 trials were of high quality (Spine Patient Outcomes Research Trial, MiDAS ENCORE, Investigational Device Exemption). Only 4 studies specifically analyzed complications in both conservative and surgical treatments, finding that the complication rate was lower in conservative treatment. Other significant studies compared surgical versus conservative treatment but did not mention the possible complications of prolonged conservative treatment.<sup>22–25</sup>

According to these literature reviews, the WFNS Spine Committee proposed and voted on the statements as follows:

- Statement 5: If conservative treatment is chosen, surgery should be considered if the clinical condition does not change in 3 months. This statement reached a strong positive consensus (70% voted grade 5 on LS, 10% voted grade 4 on LS, 10% voted grade 2 on LS, and 10% voted grade 1 on LS).
- Statement 6: There are some factors that can be used to recommend a conservative treatment and which kind of conservative treatment is better. This statement reached a strong negative consensus (50% voted grade 1 on LS, 37% voted grade 2 on LS, and 13% voted grade 5 on LS).
- Statement 7: There are some cases in which an immediate surgical treatment should be indicated. This statement reached

a positive consensus (45% voted grade 5 on LS, 11% voted grade 4 on LS, 22% voted grade 3 on LS, and 22% voted grade 1 on LS).

- Statement 8: There is strong evidence that  $\geq 3$  months of conservative treatment is indicated before surgery. This statement reached a strong negative consensus (50% voted grade 1 on LS, 37% voted grade 2 on LS, and 13% voted grade 3 on LS).

### Percutaneous Pain Relief Techniques

**Value of Facet Joint Injection.** We performed a full text review of studies on facet joint injections in adults for nonradicular LBP or LSS. These included intra-articular, extra-articular, and medial branch blocks. The primary outcome measure was pain relief with reduction of symptoms, with short-term relief defined as up to 6 months and long-term relief defined as 12 months. A total of articles were eventually selected for the review. The literature review process is summarized in [Figure 1](#).

The number of articles that specifically looked at facet joint injections in LSS was limited. Two articles were identified with level III evidence finding facet joint injections to be therapeutic in management of LSS. Most of the other studies looked at facet injections for management of LBP or diagnostic purposes. The level I evidence Facet Treatment Study determined that facet blocks were not therapeutic but might provide prognostic value before radiofrequency ablation.<sup>26–28</sup>

The evidence for diagnosis of lumbar facet joint pain with controlled local anesthetic blocks was level I, and evidence for therapeutic lumbar facet joint intervention was level II with lumbar facet joint nerve blocks.<sup>29,30</sup> The evidence also showed that local anesthetic with steroids and local anesthetic alone were equally effective except with disc herniation, where the superiority of local anesthetic with steroids was demonstrated over local anesthetic alone.

One systematic review proposed guidelines that intra-articular facet injections are not recommended as a treatment of facet mediated chronic LBP without radiculopathy and cases of degenerative disease of the lumbar spine based on a single level II study and a single level III study, respectively. Lumbar medial nerve blocks were suggested for short-term relief of facet mediated chronic LBP without radiculopathy in patients with degenerative disc disease of the lumbar spine based on a single level II study and single level III study. Lumbar medial nerve ablation was suggested for the short-term (3–6 months) relief of facet mediated pain in patients with chronic LBP without radiculopathy from degenerative disc disease of the lumbar spine, shown in 4 level II studies. The authors also concluded that there was no evidence to support the use of diagnostic facet blocks as a predictor of lumbar fusion outcome in patients with chronic LBP from degenerative lumbar disease.<sup>31</sup> An additional study found intra-articular facet joint injections for clinically diverse LBP that precluded any meta-analysis and suggested that there is a need for further high-quality work in this area.<sup>32</sup>

The Agency for Healthcare Research and Quality report and 2 other studies found no clear differences between various facet joint corticosteroid injections (intra-articular, extra-articular, or medial branch) and placebo interventions. Limited evidence

suggested that epidural corticosteroid injections were not effective for spinal stenosis or nonradicular back pain and that facet joint corticosteroid injections were not effective for presumed facet joint pain.<sup>33-35</sup>

Some studies found fair to good evidence for lumbar facet joint nerve blocks for treatment of chronic lumbar facet joint pain resulting in short-term and long-term pain relief and functional improvement.<sup>36-38</sup> These same studies showed limited evidence for intra-articular facet joint injection and pulsed radiofrequency thermoneurolysis. Additional systematic reviews found level II evidence for radiofrequency neurotomy in lumbar facet joint nerve blocks for long-term lumbar pain control, whereas evidence was level III for lumbosacral intra-articular injection.<sup>39-42</sup>

Facet injections for diagnostic value was limited by the high false-positive rates seen with single blocks. Controlled studies for lumbar facet injections have shown initial relief of symptoms for 1–4 weeks, while long-term relief at 3 months varied considerably. In conclusion, for intra-articular injection of local anesthetic and steroids, there is moderate evidence of short-term relief and limited evidence of long-term relief for chronic LBP.<sup>43-46</sup> The National Institute for Health and Care Excellence guidelines for managing LBP were recently updated and do not recommend intra-articular facet joint injections on the grounds of there being insufficient high-quality evidence to support their use, recommending targeting the nerve supply of the facet joints instead as the predominant pain generator source.<sup>47</sup>

According to these literature reviews, the WFNS Spine Committee proposed and voted on the statements as follows:

- Statement 9: Facet joint injections provide significant pain relief for treatment of LBP. This statement did not reach a consensus with 50% of agreement/disagreement (10% voted grade 5 on LS, 20% voted grade 4 on LS, 20% voted grade 3 on LS, 40% voted grade 2 on LS, and 10% grade 1 on LS).
- Statement 10: Facet joint injections provide a useful diagnostic tool for LBP. This statement reached a positive consensus (22% voted grade 5 on LS, 11% voted grade 4 on LS, 45% voted grade 3 on LS, 11% voted grade 2 on LS, and 11% voted grade 1 on LS).
- Statement 11: When facet joint injection is effective, facet/medial branch nerve ablation should be performed. This statement did not reach a consensus (10% voted grade 5 on LS, 40% voted grade 4 on LS, 10% voted grade 3 on LS, 30% voted grade 2 on LS, and 10% voted grade 1 on LS).

**Value of Epidural Injections.** The following search criteria were adopted: key words “epidural injections AND lumbar stenosis,” using as filters for systematic review, RCTs, consensus guidelines, full text, 2008–2018, humans. Articles referring only to disc herniation were excluded. The authors considered 12 papers for analysis and presentation, including 4 double-blind RCTs, 7 systematic reviews with or without meta-analysis, and 1 recently published consensus agreement.<sup>3,39,48-57</sup> The literature review process is summarized in **Figure 1**.

The leading journal to publish on this topic, with 6 of the 12 articles considered, was *Pain Physician*. Regarding the main cohorts compared in the studies, the most frequent analysis focused on

anesthetic versus anesthetic plus steroid. Only 1 study compared anesthetic with steroid, and 1 study compared surgery with steroid.

There are few high-quality study designs published in the literature regarding the use of epidural steroid injection for LSS, and most compared anesthetics with anesthetics plus steroids. Focusing on the research question proposed, there were no data comparing the use of steroid with placebo. The results of short- and long-term effectiveness had some variability, mainly on the use of anesthetics. However, when dissecting the methodology and level of evidence, some conclusions may be considered, given the available literature.

Besides the results of epidural injections, several other aspects were taken into account at oral presentation, such as the need for imaging guidance using fluoroscopy. The evidence supporting effectiveness of non-image-guided interlaminar epidural steroid injection for the reduction of pain and for improving function in patients with lumbar radicular pain and neurogenic claudication is very limited. Non-image-guided interlaminar epidural injections may be relatively safe, with the exception of patients with a history of previous surgery; however, they should be performed only in settings where fluoroscopy is not available.<sup>58</sup>

Complications associated with transforaminal and interlaminar epidural steroid injection, such as infection, bleeding, and spinal cord infarct, are very rare but should be taken into account. In a multi-institutional study including 14,956 transforaminal epidural steroid injections and 1682 interlaminar epidural steroid injections, the most common adverse event occurring in 2.6% of patients was a central steroid response, including sleeplessness, flushing, and nonpositional headache. Vasovagal reactions were reported in 1.2% of patients, and dural puncture was reported in only 0.06%. This study did not find any neurologic, bleeding, or infectious complications.<sup>59</sup>

The administration of steroids, even in the epidural space, may have an effect on cortisol suppression. A multicenter RCT comprising 400 patients reported a mean 14.4% reduction in cortisol levels 3 weeks after epidural steroid injection, and 20.3% of patients had a reduction in cortisol >50% of baseline. Suppression was more likely with methylprednisolone or triamcinolone than with betamethasone or dexamethasone.<sup>60</sup> A retrospective case-control database study using the U.S. Military Health System Data Repository database for the years 2009–2014 including 6535 patients who underwent single-level lumbar decompression, of which 847 had a preoperative epidural steroid injection, did not find any statistically significant differences between the control group and the injection group regarding postoperative infection rate.<sup>61</sup>

This review and expert panel discussion resulted in the following summary of statements voted and approved at the Consensus Conference “Lumbar Stenosis with and without Instability” regarding the topic “Value of Epidural Injections for Lumbar Spinal Stenosis”:

1. The literature supports a short- to intermediate-term benefit of epidural injections for the symptomatic treatment of LSS.
2. The inclusion of steroids does not seem to confer a benefit compared with local anesthetic alone in epidural injections for the symptomatic treatment of LSS.

**Table 2.** Literature Review on Percutaneous Pain Relief Techniques with Main Conclusions

Author, Year	Journal (JIF 2017)	Study Design	Included	Comparison/Analysis	Conclusions
Randomized Controlled Trials					
Manchikanti et al., 2012 <sup>48</sup>	<i>Pain Physician</i> (2.556)	Randomized, double-blind, active-controlled trial	100 patients	Caudal local anesthetic versus local anesthetic + steroid Average of 4 procedures	Both modalities provide relief in modest proportion of patients
Friedly et al., 2014 <sup>49</sup>	<i>The New England Journal of Medicine</i> (79.260)	Multicenter randomized, double-blind controlled trial	400 patients	Local anesthetic versus local anesthetic + steroid 1 or 2 procedures	No differences between groups. Adding a steroid to local anesthetic offered minimal or no short-term benefits
Manchikanti et al., 2015 <sup>41</sup>	<i>Pain Physician</i> (2.556)	Randomized, double-blind, active-controlled trial	120 patients	Local anesthetic versus local anesthetic + steroid Average of 5 to 6 procedures	No differences between groups. Relief in significant proportion of patients
Friedly et al., 2017 <sup>51</sup>	<i>Archives of Physical Medicine and Rehabilitation</i> (3.077)	Multicenter randomized, double-blind controlled trial	400 patients	Local anesthetic versus local anesthetic + steroid 12 weeks of treatment	No difference between groups. Repeated procedures offered no additional long-term benefit
Systematic Reviews with or without Meta-Analysis					
Manchikanti et al., 2013 <sup>39</sup>	<i>Pain Physician</i> (2.556)	Systematic review	2 RCTs +1 nonrandomized trial	Review of literature to provide guidelines for interventional techniques in chronic spinal pain	Evidence is considered fair for short- and long-term relief with local anesthetic and steroids in spinal stenosis
Liu et al., 2015 <sup>52</sup>	<i>Drug Design, Development and Therapy</i> (2.935)	Systematic review and meta-analysis	10 RCTs	Steroid injection for spinal stenosis	Epidural steroid injections provide limited short- and long-term benefits in LSS patients
Meng et al., 2015 <sup>53</sup>	<i>Drug Design, Development and Therapy</i> (2.935)	Systematic review and meta-analysis	13 RCTs	Local anesthetic versus anesthetic + steroids	Inclusion of steroids confers no advantage compared with local anesthetic alone. Both provide significant pain relief and functional improvement in chronic LBP
Manchikanti et al., 2015 <sup>54</sup>	<i>Anesthesiology and Pain Medicine</i> (—)	Systematic review	7 RCTs	Compare caudal versus interlaminar versus transforaminal epidural approaches for LSS	Epidural injections with local anesthetic alone or with local anesthetic with steroids offer short- and long-term relief of LBP and lower extremity pain for patients with lumbar central spinal stenosis. Interlaminar approach appears to be superior to caudal, and caudal approach appears to be superior to transforaminal
Kaye et al., 2015 <sup>55</sup>	<i>Pain Physician</i> (2.556)	Systematic review	7 trials for LSS	Efficacy of epidural injections in managing chronic spinal pain	Long-term effectiveness of caudal and interlaminar epidural injections and short-term effectiveness of transforaminal approach
Manchikanti et al., 2016 <sup>56</sup>	<i>Pain Physician</i> (2.556)	Systematic review and meta-analysis	39 RCTs for LSS and radiculopathy	Epidural injections for lumbar radiculopathy and spinal stenosis: saline with steroid versus local anesthetic versus anesthetic + steroid	Epidural corticosteroid injections for radiculopathy or spinal stenosis with sodium chloride solution or bupivacaine were shown to be ineffective. Lidocaine alone or lidocaine in conjunction with steroids was significantly effective
Zaina et al., 2016 <sup>3</sup>	<i>Cochrane Database of Systematic Reviews</i> (6.754)	Systematic review	5 RCTs	Surgery versus epidural steroid injection	Low-quality level of evidence. Minimally invasive surgical decompression provides better pain reduction and improves functional mobility versus epidural steroid injections
JIF, journal impact factor; RCT, randomized controlled trial; LSS, lumbar spinal stenosis; LBP, low back pain.					
					Continues

Table 2. Continued

Author, Year	Journal (JIF 2017)	Study Design	Included	Comparison/Analysis	Conclusions
Deer et al., 2019 <sup>57</sup>	<i>Pain Practice</i> (2.187)	Guidelines/consensus	—	Efficacy of injection therapy for symptomatic LSS	Short- to intermediate-term benefit of epidural injections for symptomatic treatment of LSS. Benefit of caudal and interlaminar injections (local anesthetic only and local anesthetic with steroid) and transforaminal injections of local anesthetic with or without steroid. Patients exhibiting shorter-term relief of <3 months should not proceed with further injection therapy but rather continue down treatment algorithm to a treatment option directed at decompression

JIF, journal impact factor; RCT, randomized controlled trial; LSS, lumbar spinal stenosis; LBP, low back pain.

3. For patients with symptomatic relief lasting <3 months after epidural injections, proceeding with further injections is not recommended. In addition, it is the Committee opinion that elderly patients represent an exception to this if they are not eligible for surgery. In this case, if the percutaneous procedures provide some benefits, they can be continued.

Table 2 summarizes the main characteristics and conclusions from each article analyzed for this consensus.

According to these literature reviews, the WFNS Spine Committee proposed and voted on the statements as follows:

- Statement 12: The literature supports the short- to intermediate-term benefits of the epidural injections for the symptomatic treatment of LSS. This statement reached a strong positive consensus (40% voted grade 5 on LS, 30% voted grade 4 on LS, 20% voted grade 3 on LS, and 10% voted grade 2 on LS).
- Statement 13: The inclusion of steroids does not confer a benefit compared with local anesthetic alone in epidural injections for the symptomatic treatment of LSS. This statement also reached a strong positive consensus (20% voted grade 5 on LS, 40% voted grade 4 on LS, 30% voted grade 3 on LS, and 10% voted grade 1 on LS).
- Statement 14: For patients with symptomatic relief lasting <3 months after epidural injections, proceeding with further injections is not recommended. All the participants expressed a positive vote for this statement (40% voted grade 5 on LS, 40% voted grade 4 on LS, and 20% voted grade 3 on LS).

**Table 3.** World Federation of Neurosurgical Societies Spine Committee Recommendations on Conservative Treatment and Percutaneous Pain Relief Technique

Recommendations for Conservative Treatment or Follow-Up for LSS
<ul style="list-style-type: none"> <li>● In nonsevere clinical conditions a conservative approach based on at least 3 weeks of therapeutic exercise may be the first therapeutic choice</li> <li>● Medical/interventional treatment should be preferred to surgical treatment in patients with spinal stenosis with mild symptoms</li> <li>● Physical therapy should consist of multimodal approaches</li> <li>● If conservative treatment is chosen, surgery should be considered in cases in which the clinical condition does not change in 3 months</li> <li>● There are some cases in which immediate surgical treatment can be indicated</li> </ul>
Recommendations for Percutaneous Pain Relief Techniques for LSS
<ul style="list-style-type: none"> <li>● Facet joint injections provide a useful diagnostic tool for LBP</li> <li>● The literature supports short- to intermediate-term benefits of epidural injections for symptomatic treatment of LSS</li> <li>● Inclusion of steroids does not confer a benefit compared with local anesthetic alone in epidural injections for symptomatic treatment of LSS</li> <li>● For patients with symptomatic relief lasting &lt;3 months after epidural injections, proceeding with further injections is not recommended</li> </ul>

LSS, lumbar spinal stenosis; LBP, low back pain.

## DISCUSSION AND CONCLUSIONS

This Consensus Conference, in accordance with literature review and the expertise of the Committee itself, stated that a conservative approach based on therapeutic exercise may be the first choice in patients with LSS except in the presence of clinical signs for which surgical treatment may be indicated. Congenital spinal stenosis cases should be excluded from these statements, as they have characteristics such as disease onset at a young age, more severe neurologic symptoms, and multiple-level disease. However, one of the main criticisms of using evidence-based medicine in degenerative LSS is represented by the heterogeneity of data regarding the grade of stenosis, number of levels involved, wide variety of symptoms, correlation with the severity of the symptoms, nonstandardized conservative treatment, and too many different surgical techniques.

Regarding conventional PT modalities, there is agreement in the literature that instrumental modalities, such as ultrasound, transcutaneous electrical nerve stimulation, heat pack, and others, have no additional effect on exercise and for this reason should not be considered. The Consensus Conference did not make any



specific statement about the use of a corset brace, including its use among the PT approaches. Moreover, there is insufficient evidence to make a recommendation for the use of other PT interventions (aquatic therapy, acupuncture, psychosocial intervention, transcutaneous tibial nerve stimulation, and neural mobilization).

Regarding the topic of conservative treatment in lumbar spinal stenosis, some considerations should be made with regard to the work of the consensus conference. First, the participants attending the meeting were for the most part surgeons who do not usually adopt conservative nonpharmacologic approaches. This could have conditioned the vote, with a natural trend toward increasing the importance of surgery versus the conservative approach.

Regarding the percutaneous pain relief techniques, we are not able to provide any recommendation owing to the broad variations among studies that limit the number that are comparable. In fact, the studies analyzed suggest that facet injections as well as epidural injections provide some short- to intermediate-term pain relief. It is our opinion that these represent a therapeutic option in elderly patients who are not eligible for surgery to control symptoms, but it should be clarified that these injections are only palliative therapies for symptoms such as radicular pain and do not provide any benefit for neurologic deficits.

The WFNS Spine Committee recommendations on conservative treatment and percutaneous pain relief techniques are summarized in **Table 3**.

#### DECLARATION OF COMPETING INTEREST

The authors declare that the article content was composed in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

#### CRediT AUTHORSHIP CONTRIBUTION STATEMENT

**Maurizio Fornari:** Conceptualization, Methodology, Writing - review & editing. **Scott C. Robertson:** Writing - original draft, Writing - review & editing. **Paulo Pereira:** Writing - original draft, Writing - review & editing. **Mehmet Zileli:** Writing - original draft, Writing - review & editing, Validation. **Carla D. Anania:** Writing - original draft, Writing - review & editing. **Ana Ferreira:** Data curation, Writing - original draft. **Silvano Ferrari:** Data curation, Writing - original draft. **Roberto Gatti:** Data curation, Writing - original draft. **Francesco Costa:** Conceptualization, Methodology, Formal analysis, Validation, Writing - review & editing.

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