Case report

Use of the short physical performance battery and step monitoring to evaluate improvements after epidural steroid injections in an elderly patient

Rene Przkora, MD PhD a, *, Steve R. Fisher, PT PhD b, Nicolas von der Hoeh, MD c, Christoph Eckhard Heyde, MD PhD c, Jesus David Dominguez, MS a, Marc O. Maybauer, MD PhD a, Elena Volpi, MD, PhD d

a Department of Anesthesiology, University of Texas Medical Branch, Galveston, TX, USA
b Department of Physical Therapy, University of Texas Medical Branch, Galveston, TX, USA
c Department of Orthopedic Surgery (Klinik und Poliklinik fuer Orthopaedie), University Medical Center Leipzig, Leipzig, Germany
d Department of Internal Medicine and Division of Geriatrics, University of Texas Medical Branch, Galveston, TX, USA

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A B S T R A C T

Treatment options for symptomatic lumbar spinal stenosis are limited in elderly patients. Injection therapies, such as lumbar epidural steroid injections, are one accepted alternative; however, objective evidence is usually not reported. We describe the use of the Short Physical Performance Battery (SPPB) and step count monitoring for the first time to demonstrate physical improvements in our patient with lumbar stenosis. The patient underwent two lumbar epidural steroid injections. Pain scores, the SPPB, and step count monitoring were measured at baseline and prior to and after each injection. Improvements were noted in the numerical pain score, the walk test, and the step count.

1. Introduction

Degenerative lumbar spine disease can present with low back pain and pain radiating unilaterally or bilaterally into the buttocks and legs secondary to inflammation, nerve compression, and possible ischemia. Changes in the lumbar spine, such as thickening of the ligamentum flavum, osteoarthritis of the facet joints, and disc degeneration, are considered the underlying pathology.1,2

Symptoms are exacerbated by activities such as walking and standing. These symptoms result in significant functional impairment, which, if left untreated, can lead to the risk of losing independence secondary to pain and loss of physical function. This disease process is most prominent in patients older than 60 years, a population that is expected to rise by 25% of the total population within the next 2 decades.1,2

Various treatment options have been postulated, including exercise, medication management, epidural steroid injections, and surgical decompression and fusion. The overall goal is to maintain the functional level of the patient.3,4 This case report describes the effects of a lumbar epidural steroid injection on lower extremity functioning and overall physical activity using the Short Physical Performance Battery (SPPB; timed walking measurement, chair rise test, standing balance) and accelerometer-derived step count monitoring. Numeric pain scores were also assessed.

2. Case report

2.1. Patient

The patient was a 72-year-old male with a body mass index of 35 presenting with symptomatic lumbar degenerative spine disease with lower back and leg pain. His past medical history was negative for spine surgery or interventions; his remaining history was noncontributory. He described his lower back pain as aching and the pain radiating into the posterior–lateral aspect of his right leg.
and his lateral foot as burning and shooting. Symptoms were aggravated with activity and slowly progressed over the previous 12 months. The diagnosis was confirmed clinically as well as with imaging studies. Lumbar magnetic imaging studies demonstrated multilevel degenerative changes most pronounced at the L4/S and L5/S1 levels, with canal and foraminal narrowing secondary to disc disease and facet, as well as flavum hypertrophy. The patient gave consent to publish this study. The outcome measures were also approved by the University of Texas Medical Branch (UTMB; Galveston, TX, USA) Institutional Review Board (Protocol 12-160).

2.2. Treatment

The patient was treated with hydrocodone/acetaminophen 10/325 mg (Norco, Watson Pharmaceuticals, Corona, CA, USA) twice daily and tramadol 50 mg (Ultram, Janssen Pharmaceuticals, Beerse, Belgium) every 6 hours by his referring physicians. He did not want to escalate his medication regimen and subsequently underwent two lumbar epidural steroid injections over the course of 3 months, as his symptoms returned after the first injection. The first lumbar epidural steroid injection was performed at the L4/5 level, and 10 mg of dexamethasone (Fresenius Kabi, Lake Zurich, Illinois, USA) was injected under fluoroscopic guidance and local anesthesia. The second injection was performed with a similar technique, except that a right transforaminal injection at the L5 foramen was performed and a total of 10 mg of dexamethasone was injected. Office visits with injections were 3 weeks apart during the study period.

2.3. Outcome measures

The SPPB,\(^5\) accelerometer-derived step counts (for 6 days), and self-reported pain scores (see descriptions below) were measured at baseline and prior to and after each injection. Percentage improvements pre- and post-interventions were calculated for each component of the SPPB, mean step counts, and the numeric pain score.

The SPPB includes three objective tests of lower body function: (1) a timed 4-meter walk; (2) five timed, repetitive chair stands; and (3) a hierarchical test of standing balance.\(^6\) The SPPB summary score is created by summing the three individual test items according to previously established criteria.\(^7\) There is a potential self-perceived questionnaires rather than objective measures, such as the Oswestry Disability Index and the self-reported pain scores (see descriptions below) were measured at baseline and prior to and after each injection. Percentage improvements pre- and post-interventions were calculated for each component of the SPPB, mean step counts, and the numeric pain score.

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The accelerometer used was a small (70 mm × 50 mm × 20 mm; 1.3 oz), dual axis, ankle-worn device attached loosely with a Velcro strap. It is programmed and read via a computer docking station, and is impervious to tampering. Step detection accuracy exceeds 96% even in clinical populations.\(^5\) The patient was instructed to wear the monitor during all waking hours. Mean step counts for 6 days improved 13% after the first injection and 48% after the second injection (Table 1 and Fig. 1).

His quantitative pain was recorded using the numerical pain score (from 0 = no pain to 10 = maximum pain). The improvement after his first injection was 40% and it increased to 43% after the second injection (Table 1).

During the course of the study, he was able to wean himself off the hydrocodone and was only taking tramadol 50 mg once, on occasion, twice daily.

3. Discussion

Symptom control is the treatment goal for painful degenerative lumbar spine disease. The injection of epidural steroids under fluoroscopic guidance is one accepted intervention.\(^4\) It is thought that the steroid injected into the epidural space will decrease the inflammation and nerve irritation caused by the degenerative changes.\(^4\) This intervention is usually tolerated well, can be performed in the ambulatory setting without general anesthesia, and has a very low complication rate with <1% having complications such as infection or neurological injury.\(^1\)

However, the injections do not provide a permanent “cure,” which has been criticized in studies.\(^1\)–\(^9\) Given that the underlying degenerative changes are usually not reversible, this is not surprising.\(^1\)–\(^9\) Therefore, epidural steroid injection for degenerative spine disease should be more regarded as a “maintenance therapy,” because it can be repeated based on symptomatology. Based on the amount of steroids injected, the injection could be repeated every 8–12 weeks to avoid adrenal suppression, although injections can be performed in a shorter time period if the injection therapy was just initiated.\(^6\)

The decision on whether or not the injection was successful is usually based on patient reports of pain scores and changes in the use of pain medications.\(^7\)–\(^9\) The impact on function is reported in self-perceived questionnaires rather than objective measurements.\(^10\) Because lumbar degenerative spine disease frequently impairs the function of the lower extremities, including walking, functional measures should be developed and used in clinical practice to address this lack of knowledge.\(^11\)

The team of Tomkins-Lane\(^1\) recently published a study measuring physical function with objective measures for research purposes. Seventeen patients undergoing a lumbar epidural steroid injection for lumbar spine stenosis were studied. A combination of subjective measures, such as the Oswestry Disability Index and the Swiss Spinal Stenosis Questionnaire, and physical performance measures, such as the Self-Paced Walking Test (SPWT), were used.\(^11\) Performance at home was measured with accelerometers for 7 days.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Prior to 1st injection</th>
<th>After 1st injection</th>
<th>Prior to 2nd injection</th>
<th>After 2nd injection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain score (0–10/10)</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>4</td>
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<tr>
<td>Pedometer steps (mean/6 days)</td>
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<td>4669</td>
<td>2872</td>
<td>4260</td>
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<td>4-meter walk test (s)</td>
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<td>4.3</td>
<td>6.5</td>
<td>4.1</td>
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<tr>
<td>Chair-rise test (s)</td>
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<td>15</td>
<td>13</td>
<td>12.3</td>
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<tr>
<td>Balance test (normal/impaired)</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
</tbody>
</table>
at a time. Baseline measures were compared to results taken 1 week after injection. The authors found significant improvements in self-report questionnaires including perceived physical function; however, findings on objectively measured performance tests (SPWT and accelerometer) demonstrated nonsignificant improvements. Tomkinc-Lane et al11 decided to use only one time point as follow up, and one can speculate if further follow-up examinations would have demonstrated a more dynamic response. Whereas the questionnaires and the accelerometer could be used in clinical practice, the SPWT involves a walking test of 4 meters, which is not feasible in most clinical settings. Nevertheless, this was one of the first studies using objective measures to access function.11

Although the combination of the SPPB and accelerometer has not been used in ambulatory pain patients undergoing injection therapy, both measures have been used for other clinical populations.5,6 The SPPB has been used to evaluate physical performance in acutely hospitalized patients and healthy, nonclinical populations. Guralnik et al5 described the use of the SPPB in >5000 older men and women living in the community. He found a strong correlation between SPPB score and the risk of death or nursing home admission within 5 years. Fisher et al12 used the SPPB in older hospitalized patients. Ninety patients aged 65 years and older were assessed within 24 hours of hospital admission. Age, comorbidities, length of stay, and cognition were significantly and inversely correlated with the SPPB score. Both studies demonstrated the feasibility of the SPPB in hospital and ambulatory settings.

The current case was conducted in the outpatient setting, and we can confirm the ease of administration of the SPPB in a busy clinic. Additionally, a one-point improvement in the SPPB summary score, as seen in our patient, has been shown to be clinically meaningful and correlated well with increases in overall activity.5

This case is also among the first to describe the combination of the SPPB, which provides one time point of physical performance with accelerometer to assess overall activity over an extended period of time. Improvements in pain scores, the SPPB, and step activity were seen in our patient after each injection. In addition, we found clinically useful information from the decrease in activity and performance with both instruments after the beneficial effect of the first epidural steroid injection faded.

We studied only one patient, which is a limitation of our investigation, however, this report is suitable to distribute the knowledge about the SPPB and accelerometer to a broader audience. The SPPB and accelerometer are specifically useful to study a disease process affecting mobility and balance of patients. Degenerative diseases of the musculoskeletal system such as lumbar spine disease or osteoarthritis of the major joints of the lower extremity are reasonable targets to study outcomes. Neurological diseases affecting locomotion and balance are additional attractive conditions to use the SPPB and accelerometer.

Based on these findings, we contend that the combination of the SPPB and step count monitoring may be useful in routine clinical settings, as well as research studies, to correlate the effects of an intervention.

Conflicts of interest

All authors declare no conflicts of interest.

Acknowledgments

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References