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ORIGINAL INVESTIGATION

Efficacy of ultrasound-guided infiltration with levobupivacaine and triamcinolone for myofascial pain syndrome of the quadratus lumborum: a retrospective observational study

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Abstract
Introduction and objectives: Myofascial Pain Syndrome (MPS) of the Quadratus Lumborum muscle (QL) is a frequent cause of chronic low back pain. With this study, we aimed to assess the efficacy of ultrasound-guided infiltration with 0.25% levobupivacaine and 40 mg triamcinolone for MPS of the QL.
Methods: Observational and retrospective study of participants submitted to ultrasound-guided infiltration of the QL muscle from January 1, 2015 to June 31, 2019. Pain intensity was assessed using the five-point pain Numeric Rating Scale (NRS): pre-intervention, at 72 hours, 1 month, 3 months and 6 months post-intervention. Additional data collected were demographic characteristics, opioid consumption, and adverse effects.
Results: We assessed 90 participants with mean age of 55.2 years. Sixty-eight percent of participants were female. Compared to the pre-intervention assessment, there was an improvement in pain at 72 hours (Mean Difference [MD = 3.085]; 95% CI: 2.200–3.970, $p < 0.05$), at the 1st month (MD = 2.644; 95% CI: 1.667–3.621, $p <$ 0.05), at the 3rdmonth (MD = 2.017; 95% CI: 0.202–2.729, $p < 0.05$) and at the 6th month (MD = 1.339; 95% CI 0.378–2.300, $p < 0.05$), post-intervention. No statistically significant differences in opioid consumption were observed. No adverse effects associated with the technique were reported.
Conclusions: Ultrasound-guided infiltration of the QL muscle is a safe and effective procedure for the treatment of pain in the QL MPS within 6 months post-intervention.

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Introduction

Chronic low back pain is one of the main causes of work absenteeism, incapacity for work and early retirement in developed countries, being responsible for an increase in health service utilization.[1,2] It is estimated that, in up to 80% of cases, Myofascial Pain Syndrome (MPS) is the cause of chronic low back pain and frequently its diagnosis is not established.[3,4] MPS is defined as subacute or chronic pain, with autonomic, sensory and motor symptoms, generated from active Trigger Points (TrPs). TrPs are firm and highly irritable muscle spots, located in a tight muscle band, that under external pressure elicit a painful response.[5] MPS originated at the QuadratL Muscle (QL) is a common cause of chronic low back pain and frequently observed in Chronic Pain Units (CPU). The QL is a posterior abdominal wall muscle that inserts inferiorly in the posteromedial iliac crest and superiorly in the inner border of the twelfth rib, as well as in the transverse processes of the four lumbar vertebrae.[6] The diagnosis of MPS of the QL is essentially clinical, based on careful history taking and physical examination. The pain is usually described as deep and persistent, and it can be sharp upon movement. Some patients describe irradiation to the groin. The greater trochanter can become sensitive to pressure in such a way that the patient cannot tolerate lying on the ipsilateral side. Thus, actions such as turning, getting out of bed, standing, and walking are described as very painful. Pain is elicited whenever TrPs are stimulated by pressure, heat, cold, or movements that stretch the structure that contains the TrPs. Palpation of the TrPs will mimic or accentuate the pain described by the patient, causing them to withdraw in a reaction known as jump sign.[7]

Currently, there are several therapeutic strategies comprising non-steroidal anti-inflammatory drugs, opioids, anticonvulsants, antidepressants, and muscle relaxants. Non-pharmacological strategies have also been used, such as physical exercise and physical therapy. More invasive treatment, for instance infiltration of the muscles involved, is recommended when the above-mentioned strategies fail. Infiltrations with local anesthetics and corticoids have been described as effective for MPS treatment and have been increasingly used in chronic pain clinics. A synergistic action has been suggested between the two drugs.[6] Corticoids are supposed to selectively block the transmission of nociceptive fibers, and local anesthetics relax the TrPs and interrupt the cycle of pain and contracture.[8] Several techniques are used to increase the safety and accuracy of the infiltration, comprising the use of fluoroscopy, CT scan, and ultrasound.[6] Recently, ultrasound has gained a prominent role as it is a noninvasive, not expensive, and effective technique.[9] However, there is not enough evidence supporting its broad recommendation due to the small number of participants and the quality of the studies published on ultrasound-guided Infiltration in the Quadratus Lumborum muscle (IQL) for patients presenting quadratus lumborum myofascial pain syndrome.

The primary objective of the study was to evaluate the efficacy and safety of triamcinolone and levobupivacaine in IQL.

Methods

Study design and participant selection

The study was observational, retrospective, and analytical. We selected patients seen at a Multidisciplinary Chronic Pain Unit for about 4 years (from January 1, 2015 to June 31, 2019), submitted to ultrasound-guided infiltration of the QL muscle for the management of myofascial pain refractory to conservative treatment. Each year, this unit performs roughly 130 invasive procedures, guided either by ultrasound, fluoroscopy, or CT scan.

The pain Numeric Rating Scale (NRS) was initially obtained. The diagnosis of QL MPS was established according to the concomitant presence of four of the following clinical criteria: pain on palpation below the 12th rib and 5 cm lateral to the transverse process of L1, with pain referred to the iliac crest; pain on palpation of TrPs in the quadratus lumborum muscle; low back pain when walking, sitting and squatting; pain exacerbation during posture change while lying down; lower back pain associated with muscle stretching; pain on palpation of TrPs located at the level of the L4 vertebral body, 1 to 2 cm above the iliac crest, with pain referred to the greater trochanter.[10]

Patients submitted to simultaneous injections at different sites were excluded, with a total of 90 participants included.

Participants were assessed at several moments: pre-intervention, at 72 hours post-intervention by telephone contact, and by evaluation of the records of the clinical process and telephone contact at the first, third- and sixth-month post-intervention.

Procedure protocol

The procedure was carried out after antisepsis and under sterile conditions. The technique was performed only by two anesthesiologists following the same protocol. With the participant in lateral decubitus a low-frequency curvilinear probe was placed parallel to the iliac crest, in the midaxillary line, and oriented posteriorly to obtain the Lateral Interfascial Triangle (LIFT) image. Using an in-plane approach, a 22G needle was oriented in the lateral-medial and posterior-anterior directions targeting the region between the erector spinae muscle and the posterior surface of the QL muscle (Fig. 1). Appropriate needle location was confirmed by hydro dissection with 2 to 3 mL of saline. A bolus injection of 40 mg triamcinolone diluted in 9 mL of 0.25% levobupivacaine was given, with 3 mL deposited intramuscular and 7 mL for the infiltration in the intermediate layer of the Thoracolumbar Fascia (TLF) adjacent to LIFT.

Data collection

Data was collected from patient charts, regarding age, gender, marital status, occupation, incapacity for work, previous spinal surgery, psychiatric pathology, fibromyalgia, pain in other locations, previous physical therapy, prescribed

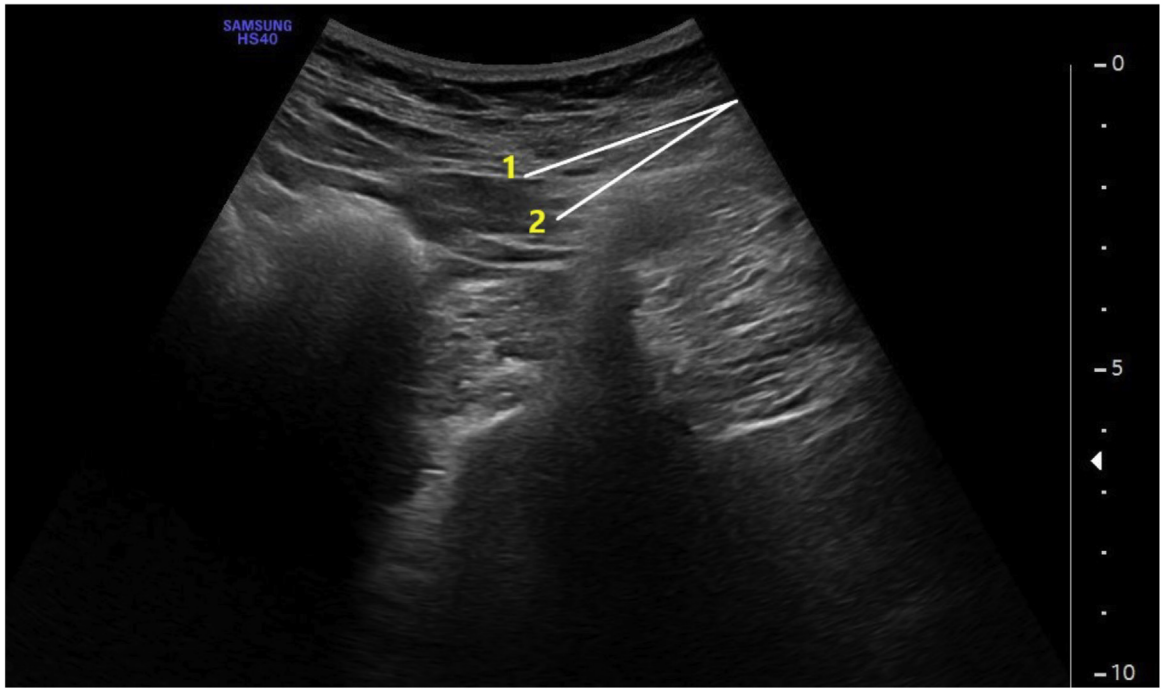

Figure 1 Ultrasound imaging of the quadratus lumbar muscle infiltration. (1) Intermediate layer of thoracolumbar fascia (posterior fascia quadratus lumbar muscle); (2) Intramuscular infiltration of the quadratus lumbar muscle.

analgesic drugs, pain characteristics, pain intensity assessed by NRS, complications and adverse effects resulting from the technique performed.

Bias

The main existing bias was information bias since the study has a retrospective design that is highly dependent on data acquired from the medical charts of participants.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences® 23 program (SPSS® Inc., Chicago, IL, USA). A $p < 0.05$ value, corrected by Bonferroni when indicated, was considered statistically significant. Data were depicted as absolute (n), relative (%), mean (standard deviation) or median (minimum and maximum values), when applicable. The normality of the data was verified by the Kolmogorov-Smirnov test. As pain intensity data represented by the NRS scores had a normal distribution during the various moments of assessment, parametric tests were used and the ANOVA test for repeated measures was applied. The model was adjusted to covariates that could interfere with NRS scores, so a mixed model for repeated measures was used to verify differences in NRS scores, using the number of drugs taken, psychiatric disorder and opioid consumption as factors. We used the Cochran's Q test, followed by three McNemar's tests with Bonferroni correction to compare opioid consumption between the three moments of evaluation, as the variables were qualitative dichotomous.

Ethics committee and informed consent

The study was approved by the Ethics Committee for Health of the institution where the study was carried out. Informed consent was obtained from all participants. Anonymity and confidentiality of all participants were safeguarded by all authors.

Conflicts of interest

The study was carried out with no commercial or monetary associated conflicts of interest.

Results

The study included 90 participants with a mean age of 55.2 years, and 61 participants (68%) were female. The social characteristics and medical history of the participants are shown in Table 1. Due to absence of records, NRS data was obtained only from 77. 78 and 71 participants, respectively, at 72 hours and first, third-, and sixth-month post-intervention.

Compared to the initial assessment, there was an improvement in the mean pain intensity, especially at 72 hours post-IQL (Table 2). Nevertheless, after performing the IQL we observed statistically significant improvement in pain 72 hours (MD = 3.085; 95% CI 2.200–3.970, $p < 0.05$), 1 month (MD = 2.644; 95% CI 1.667–3.621, $p < 0.05$), 3 months (MD = 2.017; 95% CI 1.120–2.914, $p < 0.05$) and 6 months (MD = 1.339; 95% CI 0.378–2.300, $p < 0.05$). Table 3 describes the differences registered between the other moments of the study. Reduction $\geq$ 30% for NRS was observed in 55.8%, 48.7% and 36.6% of participants in the first, third and sixth

Table 1 Sociodemographic and medical history of participants undergoing IQL.

	n = 90 (%)
Gender	
Female	61 (67.8%)
Male	29 (32.2%)
Profession	
Specialists in intellectual and scientific professions	2 (2.2%)
Sales and services workers	4 (4.4%)
Farmers and skilled workers in agriculture and fishery	5 (5.6%)
Workers, craftsmen, and similar jobs	16 (17.8%)
Plant and machine operators and line assembly workers	9 (10%)
Non-qualified workers	17 (18.9%)
Retired	16 (17.8%)
Unemployed	8 (8.9%)
Unknown	13 (14.4%)
Retirement due to incapacity	12 (13.3%)
Presenting a CIT at the day of the procedure	14 (15.6%)
Presenting a CIT 6 months after procedure	7 (9.7%)
Past lumbar spinal surgery	33 (36.7%)
Other specialties follow-up	
Orthopedic	25 (27.8%)
Neurosurgery	38 (42.2%)
Orthopedic and neurosurgery	11 (12.2%)
Past lumbar spinal surgery	33 (36.7%)
Pain characteristics	
Nociceptive	24 (26.7%)
Mix	66 (73.3%)
Presence of pain in other sites	42 (46.7%)
Fibromyalgia	2 (2.2%)
Psychiatric disorder	33 (36.7%)
Physical therapy before procedure	39 (43.3%)
Improvement after physical therapy	13 (33.3%)
Medications being taken at the day of the procedure	
Antidepressants	44 (48.9%)
Anticonvulsants	56 (62.2%)
Opioids	81 (90.0%)
Myorelaxants	34 (37.8%)
NSAIDs	16 (17.8%)

IQL, Ultrasound Guided infiltrations in quadratus Lumbar for myofascial pain syndrome; CIT, Certificate of Temporary Disability; NSAIDs, Non-Steroidal Anti-Inflammatory Drugs.

Table 2 Pain intensity over the various moments of assessment.

NRS before (n = 90) Mean (DP)	NRS 72 h (n = 77) Mean (DP)	NRS 1 month (n = 77) Mean (DP)	NRS 3 months (n = 78) Mean (DP)	NRS 6 months (n = 71) Mean (DP)
6.600 (0.1848)	3.69 (0.278)	4.23 (0.295)	4.65 (0.299)	5.24 (0.302)

NRS, Numerical Rating Scale; SD, Standard Deviation.

month (Table 4). After controlling for number of medications being taken, presence of psychiatric disorder, and consumption of opioids, we registered a statistically significant improvement for NRS scores at 72 hours (MD = 3.294; 95% CI 1.520–5.067, $p < 0.05$), 1 month (MD = 3.090; 95% CI 1.234–4.946, $p < 0.05$), 3 months (MD = 2.832; 95% CI 1.191–4.472, $p < 0.05$) and 6 months (MD = 3.111; 95% CI 1.376–4.845, $p < 0.05$) compared to the initial NRS score (Table 5).

Regarding treatment, we observed that 43.3% of participants underwent physical therapy prior to the technique, of which 33.3% reported pain improvement. At the time of the procedure, opioid was the drug class most used by the participants (90.0%), followed by anticonvulsants (62.2%) and antidepressants (48.9%) (Table 1). It is noteworthy that 36.7% of participants had a concomitant psychiatric disorder. At the first and third months after the technique, despite an apparent decrease in opioid consumption the difference was

Table 3 Comparison of NRS between different moments.

	MD	*p*-value	95% CI
Difference between NRS pre and:			
NRS 72 h (n = 58)	3.085	< 0.001	2.200–3.970
NRS 3 months (n = 58)	2.017	< 0.001	1.120–2.914
NRS 6 months (n = 58)	1.339	0.001	0.378–2.300
Difference between NRS 72 h and:			
NRS 1 month (n = 58)	-0.441	1.000	-1.270–0.389
NRS 3 months (n = 58)	-1.068	0.093	-2.227–0.091
NRS 6 months (n = 58)	-1.746	< 0.001	-2.812– -0.679
Difference between NRS 1 month and:			
NRS 3 months (n = 58)	-0.627	0.945	-1.946–1.612
NRS 6 months (n = 58)	-1.305	0.008	-2.387–0.223
Difference between NRS 3 months and:			
NRS 6 months (n = 58)	-1.083	0.330	-2.565–0.399

NRS, Numerical Rating Scale; MD, Mean Difference; CI, Confidence Interval.

Table 4 Efficacy of the IQL, considering an effective reduction in NRS $\geq$ 30%.

	1 month (n = 77) (%)	3 months (n = 78) (%)	6 months (n = 71) (%)
Efficient	43 (55.8%)	38 (48.72%)	26 (36.6%)
Not efficient	34 (44.2%)	40 (51.22%)	45 (63.4%)

IQL, Ultrasound–Guided Infiltrations in Quadratus Lumbar myofascial pain syndrome.

Table 5 Comparison of NRS between different moments, after controlling the number of drugs, existence of psychiatric disorder and opioid consumption.

	MD	*p*–value	95% CI
Difference between NRS pre and:			
NRS 72 h (n = 58)	3.294	< 0.001	1.520–5.067
NRS 1 month (n = 58)	3.090	< 0.001	1.234–4.946
NRS 3 months (n = 58)	2.832	< 0.001	1.191–4.472
NRS 6 months (n = 58)	3.111	< 0.001	1.376–4.845
Difference between NRS 72 h and:			
NRS 1 month (n = 58)	−0.203	1.000	−1.691–1.284
NRS 3 months (n = 58)	−0.462	1.000	−2.548–1.624
NRS 6 months (n = 58)	−0.183	1.000	−2.034–1.668
Difference between NRS 1 month and:			
NRS 3 months (n = 58)	−0.259	1.000	−2.138–1.621
NRS 6 months (n = 58)	0.020	1.000	−1.953–1.994
Difference between NRS 3 months and:			
NRS 6 months (n = 58)	−0.279	1.000	−1.566–2.125

NRS, Numerical Rating Scale; MD, Mean Difference; CI, Confidence Interval.

Table 6 Profile of opioid consumption at different times of assessment.

	1 month (n = 90)	3 months (n = 90)	6 months (n = 90)
Dosage increased	6 (6.7%)	5 (5.6%)	12 (13.3%)
Dosage decreased	5 (5.6%)	9 (10.0%)	1 (1.1%)
Opioid discontinued	6 (6.7%)	7 (7.8%)	7 (7.8%)
Opioid dose increment	2 (2.2%)	2 (2.2%)	9 (10.0%)
Dosage unchanged	65 (72.2%)	57 (63.3%)	53 (58.9%)
Total of participants consuming opioids	78 (86.7%)	73 (81.0%)	75 (83.3%)

not statistically significant. Table 6 shows that at 6 months there was an increase, although not statistically significant, in the number of participants requiring increase in dosage of opioids or their introduction. At the time of the procedure, 46.7% of participants complained of pain in at least one site, in addition to the lumbar spinal site. However, 6 months after the technique, no statistically significant association was revealed between presence or absence of pain in other locations and opioid dose increments (p = 0.129) and addition of opioid (p = 1.000).

It is worth mentioning that the largest proportion of participants submitted to the IQL were unskilled workers (22.1%).

No adverse effects associated with the technique were recorded in participants submitted to the technique.

Discussion

To the best of our knowledge, this is the first study to demonstrate the efficacy of ultrasound-guided infiltration with 0.25% levobupivacaine and 40 mg triamcinolone for chronic low back pain due to QL MPS over 6 months post-treatment. Pain management in chronic low back pain caused by QL MPS is usually unsatisfactory, often leading to gradual increment of opioid dosage[9] and superfluous diagnostic investigations. Although MPS pathophysiology[11] is not entirely clear, it is known that the affected muscles and those with TrPs cease to function efficiently. Therefore, to compensate for this weakness, other muscles of the functional muscle unit chronically contract, making them susceptible to developing TrPs. Therefore, once MPS is established in the lumbar spine muscles, a vicious cycle is elicited, perpetuating muscle dysfunction and pain.[12]

IQL is a recent anesthetic technique, first described in 2007[13] and extensively used for postoperative analgesia in patients to be submitted to abdominal and retroperitoneal surgeries.[14,15] The technique aims at injecting local anesthetic and/or corticosteroids in the site adjacent to the QL muscle.[16] Although not yet fully understood, it is believed that the TLF plays a central role in its mechanism of action.[17] The TLF is a fibrous tissue and component of the myofascial group that envelopes the lower trunk and plays an important role in posture, load transfer and lumbar spine stabilization.[6] It is assumed that the action of local anesthetics on the existing TLF mechanoreceptors cause the therapeutic response of IQL,[18] as well as the dispersion of the local anesthetics drug to the paravertebral space. Recently, several studies have revealed the effectiveness of IQL for postoperative analgesia in many surgical procedures. IQL action is well established for relieving acute postoperative pain, however, to date, there are no clinical studies showing its benefit for chronic pain management. There are studies assessing the efficacy of ultrasound-guided injections with local anesthetics and/or corticosteroids for treatment of chronic pain caused by MPS reporting controversial results.[19]

Gopinath Niraj[20] evaluated the effect of transmuscular infiltration with 10 mL of 0.5% levobupivacaine and 60 mg of methylprednisolone of the quadratus lumborum muscle for abdominal MPS and reported pain improvement in 36% of patients undergoing the procedure, and that the effect was maintained for 12 weeks. Agreeing with the results obtained by that author, the present study showed pain improvement at all evaluation times. Furthermore, approximately one-third of participants had a decrease of at least 30% of their initial pain when they were assessed at 6 months. It should be noted that the improvement reported at 6 months after treatment was not influenced by the number of drugs, the presence of psychiatric disorder or opioid consumption, which strengthens our conclusions.

Alternatively, the superiority of other treatments in relation to this technique has not been shown. Andrés et al.[21] concluded that botulinum toxin infiltration is not more effective in reducing NRS compared to 0.25% bupivacaine for treatment of MPS involving iliopsoas and/or QL muscles. Similarly, Levesque A. et al.[22] verified that there is no additional benefit with the infiltration of botulinum toxin combined with 0.2% ropivacaine compared to the isolated administration of 0.2% ropivacaine for pain relief in chronic pelvic MPS. They also concluded that both groups showed a decline in the analgesic effect 3 months after the intervention. However, Hong JO et al.[23] reported that when compared to ultrasound-guided injection of TrP, shock wave therapy showed better pain control for patients presenting QL MPS. The study did not use local anesthetic or corticosteroids, which are believed to play a role in sustained pain relief.

In the present study, about a third of participants had already undergone lumbar spine surgery, suggesting that QL MPS may play an important role in postoperative pain of lumbar spine surgery. On the other hand, QL MPS may mimic other conditions, and its precise diagnosis is crucial to avoid unnecessary surgical interventions.[24,25]

In this study, it is worth underscoring capacity/functionality improvement, revealed by the 50% reduction of participants with incapacity for work 6 months after performing the IQL, which suggests a significant clinical improvement associated with the technique. However, given the small sample size, further studies are required to validate these results.

Ninety percent of participants were under treatment with opioids and still presenting uncontrolled pain. Thus, these data indicate that ultrasound-guided infiltration with 0.25% levobupivacaine and 40 mg triamcinolone may be an effective alternative to conservative therapy.

Based on this study, it is not possible to infer a positive impact on opioid consumption related to the procedure, conversely to what has been observed in other studies.[26] Along the 6-month follow-up, we did not observe differences in opioid consumption. Our data reveal that 46.7% of participants had pain in at least one more site besides the lumbar spine, which may explain this finding. However, an association between opioid consumption and pain in another site has not been demonstrated.

The procedure is safe as there was no record of complications or adverse effects related to the technique, coinciding with previously published studies.

This study has some limitations. It was a retrospective study and, therefore, not controlled, and randomized. The sample size was relatively small, and the follow-up period short. It should also be noticed that it was not always possible to obtain the NRS records of the 90 participants assessed, reducing the number of participants with this variable studied. The diagnosis of QL MPS was presumptive, as it was

based on clinical criteria. Moreover, as the symptoms presented by the participants overlapped other musculoskeletal syndromes, false positives might have occurred. Since the follow-up was performed by telephone contact, we were unable to use scales other than NRS for pain scoring, as most of the scales are extensive or involve physical examination. In the future, it would be important to consider using other assessment tools, such as the Oswestry Disability Index. In this study, we only assessed pain at rest, so it would be important to understand the IQL impact on dynamic pain. In addition, the assessment of quality of life and symptoms of anxiety and depression should be considered.

Conclusion

QL MPS is a common and often overlooked disorder that significantly impacts quality of life. This study revealed the efficacy and safety of ultrasound-guided infiltration with levobupivacaine (0.25%) and 40 mg of triamcinolone for QL MPS along the 6-month post-intervention follow-up of patients with chronic low back pain refractory to conservative treatment, thus the technique can be considered as an alternative treatment. Prospective studies, with larger samples and standardized protocols, will be key to verify the results obtained in present study.

Conflicts of interest

The authors declare no conflicts of interest.

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