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ORIGINAL PAPERS

Chronic lumbar facet joint pain. Treatment results using percutaneous rhizolysis. Patient selection and surgical technique☆

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KEYWORDS
Lumbar pain;
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Abstract
Purpose: To evaluate the efficacy of percutaneous radiofrequency zygapophysial joint neurotomy (rhizotomy) to decrease pain and improve associated disability, in a group of patients suffering from low back pain from facet joint origin meticulously selected on the basis of a combination of clinical findings, physical examination, imaging tests and anaesthetic diagnostic blocks.
Materials and methods: Prospective study with 70 patients treated with rhizotomy for low back pain from facet joint origin longer than three months who did not improved after conservative treatment. Patients evaluated following the guidelines of the Spanish Society for the Study of the Spinal Diseases (GEER). Mean age was 49.52 years. Mean duration of pain: 6.86 years. Minimum follow-up: one year.
Results: Following percutaneous rhizotomy, mean low back pain as measured on the Visual Analogue Scale (VAS), decreased significantly ($p<0.05$). Likewise, there was a significant improvement in the values given for the Oswestry Disability Index (ODI) reflecting a notable improvement in terms of quality of life ($p<0.05$). Following rhizotomy 91.4% of patients reported significant pain relief, which was higher than or equal to six months in 61.4% of patients. At one year, 84.5% of patients stated that they would undergo the same treatment again, showing high satisfaction with the treatment received.
Conclusions: Percutaneous rhizotomy can be considered a valuable treatment for the symptomatic relief of chronic low back pain from facet joint origin. Meticulous patient selection by combining clinical and physical findings, imaging tests, and anaesthetic diagnostic blocks, provides significant and lasting pain relief, contributing to a reduction of the associated disability in patients suffering from chronic low back pain.

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PALABRAS CLAVE
Dolor lumbar;
Síndrome facetario;
Rizolisis;
Radiofrecuencia

Dolor lumbar crónico de origen facetario. Resultado del tratamiento mediante rizolisis percutánea. Selección de pacientes y técnica quirúrgica

Resumen
Objetivo: Evaluar la eficacia del tratamiento del dolor lumbar crónico de origen facetario mediante denervación percutánea facetaria por radiofrecuencia (rizolisis) para reducir el dolor y mejorar la discapacidad asociada en un grupo de pacientes meticulosamente seleccionados mediante combinación de la clínica, la exploración, las pruebas por imagen y el bloqueo anestésico facetario, y compararlo con la literatura médica previa.
Material y métodos: Estudio prospectivo de 70 pacientes con dolor lumbar crónico facetario de más de 3 meses de evolución, que no mejoraron con tratamiento conservador. Pacientes valorados clínicamente siguiendo indicaciones del Grupo para el Estudio de las Enfermedades del Raquis (GEER). Edad media: 49,52 años. Duración media del dolor: 6,86 años. Seguimiento mínimo: un año.
Resultados: Tras la rizolisis, el dolor lumbar medido mediante escala analógica visual (EAV) disminuye significativamente ($p<0,05$). Igualmente, mejoran de forma significativa los valores para el cuestionario Oswestry de discapacidad (ODI), reflejando una notable mejoría en su calidad de vida ($p<0,05$) al disminuir su incapacidad por el dolor lumbar. El 91,42% de los pacientes experimenta alivio significativo del dolor tras rizolisis, que llega a ser superior o igual a 6 meses en el 61,4%de los pacientes. Al año, el 84,5%de los pacientes afirma que volvería a recibir el mismo tratamiento.
Conclusiones: La rizolisis es una valiosa herramienta para el tratamiento sintomático del dolor lumbar crónico facetario. Una meticulosa selección de los pacientes mediante la combinación de la clínica, la exploración, las pruebas por imagen y el bloqueo anestésico facetario obtiene resultados duraderos en el tiempo ayudando a disminuir en estos pacientes su incapacidad por el dolor lumbar.

Introduction

Chronic lumbar pain may originate from different structures, such as intervertebral discs, ligaments, muscles, sacroiliac joints or the degeneration of facet joints.[1] Thanks to the classical schema of the lumbar column's degenerative process described by Mooney and Robertson,[2] we now know that degeneration begins at about 25 years of age, and a large number of chronic lumbar pain profiles originate from the degeneration of facet joints.[3]

In 1927, Goldwaith described a set of symptoms which he attributed to degeneration occurring in the interapophyseal joints of the lumbar column and referred to them collectively as "facet joint syndrome".[2,4-8] However, the clinical characteristics of lumbar pain of facet joint origin (table 1) are also common in lumbar pain from other causes, and most manoeuvres used for physical examination put stress on other structures adjacent to the facets simultaneously, especially discs, muscles and sacroiliac joints.[9-13]

Imaging studies (Rx, CAT, MRI or bone scans) are able to detect degenerative changes in discs or facet joints, but they often have scant clinical correlations, since many such changes appear in asymptomatic patients. This occurs to a greater extent and is more prevalent as patients age.[9,10,14-16]

Various authors have investigated the response to single or repeated facet nerve blocks and their relationship with lumbar pain.[10,11,17,18] If the facet joint block is delivered selectively, or a dorsal ramus block is used where this is not possible, the anaesthetic block will constitute the definitive diagnostic test for facet joint syndrome. However, diffusion of the anaesthetic through adjacent tissues may also block other structures that cause lumbar pain, thus causing false positives.[19] Recent studies by Kaplan and Dreyfuss[17] also warn of the high rate of false negatives, for which reason the absence of pain relief after a lumbar facet anaesthetic block does not necessarily exclude the presence of pain originating in the facet joints.[20]

The best marker[20-23] of lumbar pain originating with the facet joints may then be found by the proper combination of the clinical profile, exploratory findings, imaging tests and facet joint block, and by this method we can offer a higher probability of pain relief through percutaneous lumbar facet joint denervation by radiofrequency.

The purpose of this study is to provide a prospective evaluation of the effectiveness and duration of treatment for chronic lumbar pain of facet joint origin through percutaneous radiofrequency denervation in a patient group selected from the combination of clinical profile, exploratory findings, imaging tests and facet joint block results. We then compare the study with earlier medical literature.

Material and methods

This prospective study was carried out in accordance with applicable legislation on research, ethics and data protection,

Table 1 Clinical studies on clinical and diagnostic traits of facet joint syndrome

Helbig & Casey, 1998	Revel et al, 2004	Barriga et al, 2005
Lumbar pain + groin or thigh	Subjects older than 65	Pain with prolonged standing Pain with prolonged sitting
Pain upon paravertebral palpation Pain with extension-rotation	Pain does not increase with:	Pain increase with rotation Pain increase with flexion
Rx compatible	• coughing • hyperextension • standing alter lumbar flexion • flexion • extension-rotation	Pain improves upon standing and walking a little
	Pain decreases upon lying down	

with the consent and approval of the Clinical Research Ethics Committee and the Research Commission.

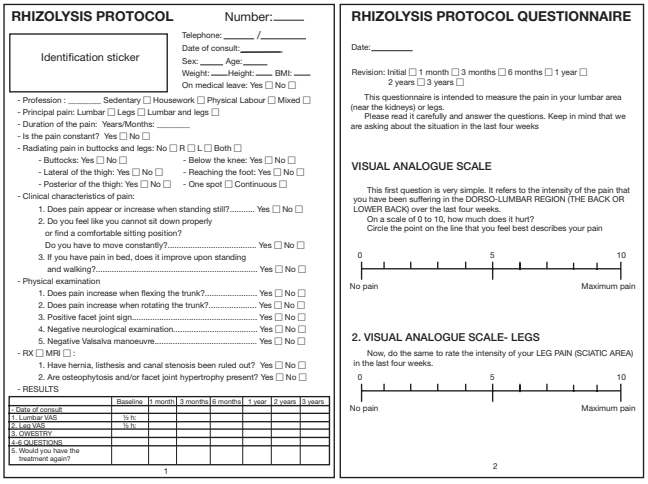
The study population consisted of patients chosen among those treated for lumbar pain in outpatient visits to Orthopaedic Surgery and Traumatology between June 2005 and February 2007.

Patients initially included in the study were those presenting lumbar pain or pain in the lower limbs with facet joint pain characteristics[18] lasting longer than three months. These patients had not seen an improvement with conservative treatment (lumbar pain appearing or increasing when standing or sitting for extended periods of time, pain lessened by standing or walking a little, pain increased by actively bending or rotating the spinal column); patients with signs or symptoms indicative of an origin other than a mechanical, degenerative cause were excluded. Patients younger than 18 and those who had undergone a previous lumbar surgery, had a neurological deficit, rheumatic disease or another specific prior diagnosis for the cause of lumbar pain (i.e. herniated disk, spondylosis or spondylolisthesis, canal stenosis, neoplastic disease, infection or trauma) were subsequently excluded.

All patients were evaluated according to indications by GEER (Spinal Pathology Study Group). All data for patient family history, sex, age, anthropometrics, profession, working status, pain characteristics and intensity, disability due to pain and affect of pain on quality of life were measured using the Visual Analogue Scale (VAS) and the Oswestry Disability Index (ODI) questionnaires. Satisfaction with treatment received was evaluated by elaborating a questionnaire called Rhizolysis protocol (fig. 1).

After a clinical and radiographic study using conventional radiography and an MRI, 82 patients underwent a lumbar block with image intensifier guidance and 90mm sterile 25 gauge spinal needles inserted in the direction of the dorsal ramus. As innervation of interapophyseal joints is related to at least two spinal segments, infiltrations were always performed on two levels (L4-L5 and L5-S1) and bilaterally.

The lumbar block gave a negative result in 12 patients. The 70 remaining patients were then admitted to the study, since their pain lessened by at least 50%of the VAS score 30 minutes after the infiltrations and after performing lumbar movements or exercises or reproducing the situations that typically caused or increased their normal lumbar pain.


RHIZOLYSIS PROTOCOL Number:_____

Identification sticker

Telephone: _____ /_____
Date of consult: _____
Sex: _____ Age: _____
Weight: ____Height: ____ BMI: ____
On medical leave: Yes ☐ No ☐

- Profession : _____ Sedentary ☐ Housework ☐ Physical Labour ☐ Mixed ☐
- Principal pain: Lumbar ☐ Legs ☐ Lumbar and legs ☐
- Duration of the pain: Years/Months: _____
- Is the pain constant? Yes ☐ No ☐
- Radiating pain in buttocks and legs: No ☐ R ☐ L ☐ Both ☐
  - Buttocks: Yes ☐ No ☐
  - Below the knee: Yes ☐ No ☐
  - Lateral of the thigh: Yes ☐ No ☐
  - Reaching the foot: Yes ☐ No ☐
  - Posterior of the thigh: Yes ☐ No ☐
  - One spot ☐ Continuous ☐
- Clinical characteristics of pain:
  1. Does pain appear or increase when standing still?..... Yes ☐ No ☐
  2. Do you feel like you cannot sit down properly or find a comfortable sitting position? Do you have to move constantly?..... Yes ☐ No ☐
  3. If you have pain in bed, does it improve upon standing and walking?..... Yes ☐ No ☐
- Physical examination
  1. Does pain increase when flexing the trunk?..... Yes ☐ No ☐
  2. Does pain increase when rotating the trunk?..... Yes ☐ No ☐
  3. Positive facet joint sign..... Yes ☐ No ☐
  4. Negative neurological examination..... Yes ☐ No ☐
  5. Negative Valsalva manoeuvre..... Yes ☐ No ☐
- RX ☐ MRI ☐ :
  1. Have hernia, listhesis and canal stenosis been ruled out? Yes ☐ No ☐
  2. Are osteophytosis and/or facet joint hypertrophy present? Yes ☐ No ☐
- RESULTS

	Baseline	1 month	3 months	6 months	1 year	2 years	3 years
- Date of consult							
1. Lumbar VAS	½ h:						
2. Leg VAS	½ h:						
3. OWESTRY							
4-6 QUESTIONS							
5. Would you have the treatment again?							

1

RHIZOLYSIS PROTOCOL QUESTIONNAIRE

Date:_____

Revision: Initial ☐ 1 month ☐ 3 months ☐ 6 months ☐ 1 year ☐ 2 years ☐ 3 years ☐

This questionnaire is intended to measure the pain in your lumbar area (near the kidneys) or legs.
Please read it carefully and answer the questions. Keep in mind that we are asking about the situation in the last four weeks

VISUAL ANALOGUE SCALE

This first question is very simple. It refers to the intensity of the pain that you have been suffering in the DORSO-LUMBAR REGION (THE BACK OR LOWER BACK) over the last four weeks.
On a scale of 0 to 10, how much does it hurt?
Circle the point on the line that you feel best describes your pain

0 5 10
No pain Maximum pain

2. VISUAL ANALOGUE SCALE- LEGS

Now, do the same to rate the intensity of your LEG PAIN (SCIATIC AREA) in the last four weeks.

0 5 10
No pain Maximum pain

2

Figure 1 Rhizolysis Protocol for gathering data regarding family history, sex, age, anthropometrics, profession, working status, pain characteristics by clinical and physical examination and pain measured by the visual analogue scale, Oswestry index of disability due to lumbar pain and patient satisfaction with the treatment received during follow-up, according to the indications of the Spinal Pathology Study Group.

Surgical interventions were performed in the Major Outpatient Surgery Unit by a surgical specialist in Orthopaedic Surgery and Traumatology with a preference for the spinal column and a 4th year resident surgeon in Orthopaedic Surgery and Traumatology with practical experience in spinal surgery and who had met the learning curve, under the surgeon's direct supervision. The patients who were to undergo interventions had them randomly assigned. The study lasted three years.

In subsequent clinical reviews carried out at the one-month, three-month, six-month and one-year marks, pain

intensity, disability and affect on quality of life were measured once more by repeating the VAS, ODI and treatment satisfaction questionnaires.

Percutaneous lumbar facet joint denervation using radiofrequency (rhizolysis)

At the start of the procedure, the patient is placed in prone decubitus upon the level operating table with a sterile lumbar area. The image intensifier is directed in a discrete oblique angle (10-20º) until we can clearly identify the junction of the upper edge of the spinous process and the lateral edge of the superior articulating process of L4 and L5, and the junction of the sacral ala and the sacral articulating process of S1. It is at these targets where the dorsal ramus medial rami in L3 and L4 and the dorsal ramus of L5 are then directed toward the base of the transversal process and the sacral ala, respectively.

To make the procedure more endurable for the patient, local anaesthesia is applied to the radiology target sites marked on the skin. Percutaneous placement of the 22 gauge 100mm cannulas with 5mm active tips (Radionics, Inc., Burlington, MA, USA.) was performed using image intensifier guidance at all times.[24] The cannulas were placed in contact with bone, parallel to the nervous branch. This is because if they are placed perpendicularly to the nerve, the nerve can escape thermocoagulation or undergo incomplete thermocoagulation (fig. 2).

The cannula stylus was then removed and replaced by a Radionics RFG-3C™ Plus Lesion Generator electrode (Radionics, Inc., Burlington, MA, USA.) Double motor and sensitive stimulation was performed before causing the lesion in order to verify proper electrode tip placement.

Following this verification, facet joint denervation was performed using thermocoagulation with the electrode at 80º C during 90 seconds, always performed bilaterally and in two levels of the lumbar column.

Statistical methods

A database was created using Excel for Windows in which we entered data from field work with patients. The analysis was carried out by an independent statistical team recruited for that purpose.

The comparison was made by obtaining a contingency table with the corresponding chi-square test for independence, and a contrast study of related or paired samples. The null hypothesis ("the variables are independent") was ruled out for P-values lower than 0.05. SPSS software was used for processing statistical data.

Results

The mean age for the population admitted to the study was 49.52 years (ranging from 18 to 80), with 33 women and 37 men. The mean pain duration was 6.86 years (ranging from 1 to 40 years). Physical characteristics of patients' professions or occupations were as follows: 33 engaged in physical labour (47.14%), 11 engaged in sedentary tasks (15.71%), 7 engaged in mixed tasks (10%) and 19 engaged in housework (27.14%). We found 13 patients on medical leave at the time treatment started.

Figure 2 Posteroanterior fluoroscope image during the procedure showing the position of the rhizolysis electrodes with respect to L5 and S1.

With respect to the analysis of lumbar and leg pain evolution (table 2 and fig. 3), values for mean VAS scores decreased significantly after rhizolysis ($p<0.05$), which demonstrates the validity of the treatment. However, during follow-up, pain increased significantly as time went on following the interventions. For 91.42% of the patients (n=64), there was significant pain relief following treatment with rhizolysis (decrease above or equal to 50% of pain score measured by VAS); in 61.4% of patients, pain relief lasted six months or more, and 40% of patients experienced pain relief during at least a year (fig. 4). It was shown that although rhizolysis treatment remains effective during follow-up, it loses its analgesic effect in a significant way over time.

ODI values decreased significantly after rhizolysis ($p<0.05$) and they reflected a notable decrease in disability due to lumbar pain. This improvement remained constant until the six-month mark, after which a decrease in quality of life was recorded. This shows that although rhizolysis treatment remains effective during the follow-up period, its effect decreases progressively over time.

Using a contrast study of related or paired samples, we observed that the difference between the initial VAS and ODI mean scores compared with values at the three, six and twelve-month marks were statistically significant ($p > 0.05$) and we observed that despite the progressively worsening condition, patients never reached the initial pre-rhizolysis pain and disability levels during the follow-up period.

In one month, 98.6% of the patients (all but one) repeated the same treatment (table 3). After one year, 84.5% of the patients expressed satisfaction with the treatment they had received and stated that they would undergo the same treatment again.

Table 2 Evolution of lumbar pain measured using the visual analogue scale and Oswestry's test for lower back pain disability before and after rhizolysis during follow-up

(Measurements)	Oswestry	Lumbar VAS	Leg VAS
Baseline	20.22	7.18	6.33
30 min	—	1.48	0.69
1 month	11.03	2.59	1.24
3 months	10.15	3.34	1.86
6 months	11.14	4.29	3.35
1 year	14.14	5.53	4.45

VAS: Visual Analogue Scale.

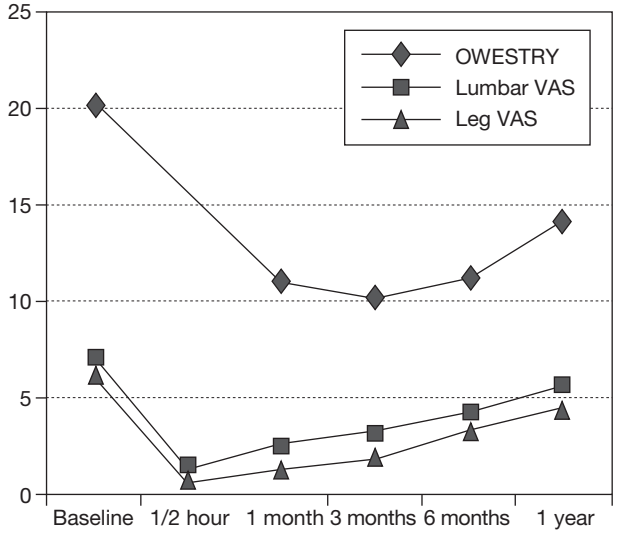


Figure 3 Evolution of lumbar pain measured using the visual analogue scale and Oswestry's index for lower back pain disability before and after rhizolysis during follow-up.

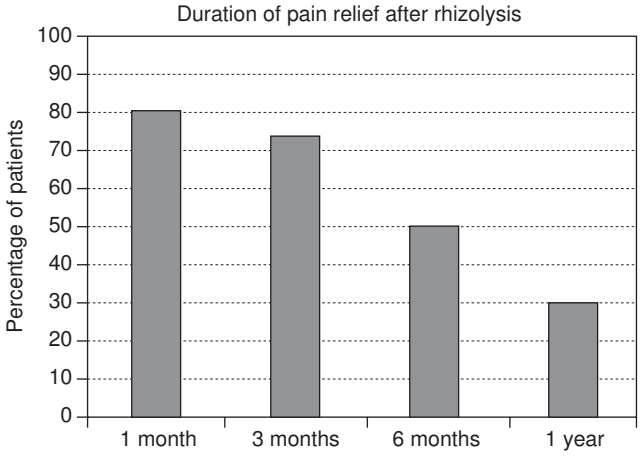


Figure 4 Duration of chronic lumbar pain relief following percutaneous rhizolysis.

Discussion

Percutaneous lumbar facet joint denervation by radiofrequency or rhizolysis was described in the 1970s for symptomatic treatment of chronic lumbar pain originating in the facet joints. Its principle is based on using controlled heat to damage nerve fibres that transmit pain signals. Heat generated by the radiofrequency is limited to the approximate volume of a sphere measuring between 0.5 and 1cm in diameter.[25] In the dorsal ramus, it causes a lesion that stops the transmission of pain originating in the innervation area.[16,20]

Percutaneous lumbar facet joint denervation is a minimally invasive technique that rapidly improves lumbar pain and allows patients to resume their daily activities quickly.[26-28] The procedure is minimally invasive and discomfort is minimal. It may be carried out in major outpatient surgery units, and the patient will be able to leave the hospital soon after the procedure.[27] None of our patients suffered any complications, and the procedure was well-tolerated.

The possibility of a relapse was related to reinnervation of the thermocoagulated area and the fact that the dorsal ramus is not the only structure innervating the facet joint. For this reason, lumbar facet joint denervation by radiofrequency should be accompanied by a treatment based on isometric exercises of the abdominal and spinal muscles,[28] a weight-loss programme, correcting poor posture and accelerating the patient's return to a normal life, including sports and physical exercise.

Rhizolysis can be repeated since it is a symptomatic treatment, as long as the same criteria are met. Both the duration of relief and the rate of good results remained constant for each of the repeated rhizolysis procedures.[29]

Response to percutaneous lumbar facet joint denervation

Published results of percutaneous lumbar facet joint denervation[1] are extremely disparate, varying from 9 to 83%. There are many reasons explaining the disparity of these results. There is a great deal of variation in study design, indications and method from author to author. In the first place, this is due to the difficulty of comparing different studies, particularly the oldest ones. In some cases, this is because of not having a clearly defined objective; in others, because of not mentioning the patient selection method, whether or not a previous diagnostic block was performed, or erroneous placement of the electrode a little to the side of the facet joint. In the study published by King and Lagger, the study population experienced radicular pain instead of lumbar pain, which is why its low rate of success, 27%,[1] is not surprising.

Despite the listed inconveniences, the more recent studies show a good results index of about 70 to 80% after patient selection, and symptomatic improvement is maintained in about 60 to 70% of patients during more than six months.[28,29] One common finding, however, is the decrease of the positive results over time and the reappearance of symptoms.

The main difficulty of assessing rhizolysis results accurately lies in patient selection. The characteristics of facet-joint related pain are also shared by other causes of lumbar pain. Radiology detects degenerative facet joint alterations, but

Table 3 Patient satisfaction questionnaire after percutaneous rhizolysis treatment to cure chronic lumbar pain of facet joint origin

Would you undergo the treatment again?	Follow-up			
	One month	3 months	6 months	One year
Yes	98.6%	86.3%	80.8%	84.9%
No	1.4%	9.6%	15.1%	11%
DK/NA	—	4.1%	4.1%	4.1%

correlation with clinical signs is often scarce.[9,10,14-16] Jackson et al. did not find any correlation between the presence of degenerative zygapophyseal changes detected by imaging and a positive response to facet joint block in his study of 390 patients. Schwarzer et al. did not find a correlation between the CAT findings and the positive response to facet joint block in 63 patients. SPECT (single photon emission computed tomography) requires a larger number of studies in order to demonstrate its effectiveness in diagnosing facet joint-related chronic lumbar pain.[24,30] The response to the single or repeated facet joint block with regard to lumbar pain produces a high rate of false positives and negatives.[10,11,17-20] Schwarzer et al[31] published a 38% rate of false-positive diagnoses of chronic lumbar pain originating in the facet joints based only on the response to the lumbar facet joint block. In a study of 18 asymptomatic volunteers, Kaplan et al[14] found that in 11%of the cases the facet joint block was not successful. Some of the reasons explaining the appearance of false negatives may be the presence of abnormal facet joint innervation or infusion of the anaesthetic in vessels adjacent to the dorsal ramus or facet joint.

The greatest limitation for a prospective study of patients with lumbar pain originating in the facet joints is the absence of a method to perform the definitive diagnosis. In our study, the final set of patients selected for rhizolysis treatment were those presenting chronic lumbar pain with a clinical profile and examination showing typical characteristics of facet joint pain based on a preliminary study by the authors.[18] Their imaging tests discarded all other possible origins of the pain and in the end, they responded favourably to the lumbar facet joint block. Therefore, a more meticulous patient selection based on the clinical profile, exploratory findings, imaging tests and facet joint block will provide better identification of the patient with facet joint lumbar pain and a higher probability of successful pain relief using rhizolysis.

In our opinion, rhizolysis can be considered a valid alternative for treating chronic lumbar pain in any specialised spinal pathology unit. Running randomised studies with stricter inclusion criteria, using a control group or developing a definitive diagnostic method are some suggestions based on our study's limitations which should be considered prior to undertaking future studies.

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Conflict of interest

The authors affirm that they have no conflicts of interest.

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