PREOPERATIVE MOTOR DEFICIT IN LUMBAR DISC HERNIATION AND ITS INFLUENCE ON QUALITY OF LIFE

DÉFICIT MOTOR PRÉ-OPERATÓRIO POR HÉRNIA DE DISCO LOMBAR E SUA INFLUÊNCIA NA QUALIDADE DE VIDA

DÉFICIT MOTOR PREOPERATORIO POR HERNIA DE DISCO LUMBAR Y SU INFLUENCIA EN LA CALIDAD DE VIDA

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ABSTRACT

Objective: Evaluate the impact of motor deficit (MD) on pain, disability, depression and quality of life measures of patients with LDH prior to a specific treatment. Methods: A total of 254 consecutively enrolled patients with LDH associated to neurological impairment and sciatica who have not responded to conservative treatment were evaluated. After reviewing the exclusion criteria, 168 were included. Validated instruments were used in the preoperative period to evaluate: pain, disability, quality of life, anxiety and depression. Results: Normal motor strength was observed in 57 (33.9%) patients and MD was observed in 111 (66.1%) cases. No statistically significant differences were observed between patients with and without MD regarding gender, age, level of herniation, lateralization and workers' compensation. Regarding quality of life, no difference was detected in the eight domains of SF36 and between the PCS and MCS groups. The only difference observed was a higher disability rate in the MD group, with the mean ODI difference being 7.84 (CI 95%: 1.82–13.87; p=0.011). Motor weakness was observed in 35.1% (n=39/111) of patients who had abnormal results at the motor evaluation, being related to severity (X^2: 46.058; p<0.0001). Conclusion: In patients with LDH without prior specific treatment, the presence of MD did not modify the pain, disability, depression measures and self-reported quality of life. The MD has no discriminative power for measures of quality of life in patients with LDH.

Keywords: Intervertebral disc displacement; Lumbar vertebrae; Quality of life.

RESUMO

Objetivo: Avaliar o impacto do déficit motor (DM) sobre dor, incapacidade, depressão e medidas de qualidade de vida em pacientes com HDL antes de tratamento específico. Métodos: Avaliou-se consecutivamente um total de 254 pacientes inscritos com HDL associado à lesão neurológica e ciática que não responderam ao tratamento conservador. Depois de analisar os critérios de exclusão, 168 foram incluídos. Instrumentos validados foram utilizados no período pré-operatório para avaliar: dor, incapacidade, qualidade de vida, ansiedade e depressão. Resultados: Verificou-se força motora normal em 57 (33,9%) pacientes e o DM foi observado em 111 (66,1%) casos. Não foram observadas diferenças estatisticamente significativas entre pacientes com e sem DM com relação a sexo, idade, nível de hérnia, lateralização e compensação trabalhista. Com relação à qualidade de vida, não foi detectada diferença nos oito domínios do SF-36 e entre os grupos PCS e MCS. A única diferença observada foi taxa de deficiência superior no grupo DM, sendo a diferença média do ODI de 7,84 (IC 95%: 1,82-13,87, p = 0,011) A fraqueza motora foi observada em 35,1% (n=39/111) dos pacientes que tiveram resultado anormal na avaliação motora e foi relacionada com a gravidade (X^2: 46,058, p<0,0001). Conclusão: Em pacientes com HDL sem tratamento específico prévio, a presença de DM não modificou as medidas de dor, incapacidade, depressão e a qualidade de vida autorrelatada. O DM não tem poder discriminativo para medidas de qualidade de vida em pacientes com HDL.

Descritores: Deslocamento do disco intervertebral; Vértebras lombares; Qualidade de vida.

RESUMEN

Objetivo: Evaluar el impacto del déficit motor (DM) en el dolor, la discapacidad, la depresión y de la medida de calidad de vida en pacientes con HDL antes de un tratamiento específico.Métodos: Ha sido evaluado consecutivamente un total de 254 pacientes inscritos con HDL asociado a lesión neurológica y ciática que no han respondido al tratamiento conservador. Después de analizar los criterios de exclusión, se incluyeron 168 pacientes. Se utilizaron instrumentos validados en el preoperatorio para evaluar: dolor, discapacidad, calidad de vida, ansiedad y depresión.Resultados: La fuerza motora normal se observó en 57 (33,9%) pacientes y DM se observó en 111 (66,1%) casos. No se observaron diferencias estadísticamente significativas entre los pacientes con y sin DM con respecto a sexo, edad, nivel de la hernia, lateralización y compensación laboral En cuanto a la calidad de vida no se detectaron diferencias en los ocho dominios del SF-36 y entre los grupos PCS y MCS. La única diferencia observada fue una tasa de deficiencia superior en el grupo DM, con la diferencia promedio del ODI de 7,84 (IC 95%: 1,82-13,87, p = 0,011). La debilidad motora observada fue del 35,1% (n=39/111) de los pacientes con resultados anormales en la evaluación motora, que estaba relacionada con la gravedad (X^2: 46,058, p<0,0001). Conclusión: En los pacientes con HDL sin tratamiento específico previo, la presencia de DM no modificó el dolor, la discapacidad, la depresión y las medidas de calidad de vida auto-declaradas. El DM no tiene poder discriminativo para las medidas de calidad de vida en pacientes con HDL.

Descriptores: Desplazamiento del disco intervertebral; Vértebras lumbares; Calidad de vida.

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Received on 08/01/2014, accepted on 09/10/2014.

http://dx.doi.org/10.1590/S1808-18512014130400473

INTRODUCTION

Compression of neural elements by the degenerative lumbar spine is usually caused by disc herniation, or bone or ligament entrapment, and is the main cause of disability.[1-4] Motor deficits (MD) or intractable pain are a major concern to physicians, and surgical treatment may be considered when conservative management fails to relieve the pain, or in the presence of progressive neurological deficit.[5,6]

Traditionally, MD in patients with lumbar disc herniation (LDH) was considered a sign of severity by spine surgeons. In these patients, the incidence of MD varies from 15% to 69% during the investigative or preoperative period.[1,7-11] These studies did not specify different degrees of MD, but only mentioned the prevalence of MD in the population studied, and compared it between different pathologies such as LDH and central spinal stenosis. Despite the high incidence, patients usually do not associate MD in the preoperative period as a factor that influences their general health.[8,11,12]

There seems to be no consensus regarding the precise importance of neurological impairment in determining the need for surgery and its impact on the patient's self-reported health-related quality of life (HRQoL).[13] The objective of this study was to evaluate the impact of MD on pain, disability, depression and HRQoL of patients with LDH prior to a specific treatment.

METHODS

Following Institutional Review Board approval (protocol # 33708), from 2006 to 2010, a total of 254 consecutively enrolled patients with LDH associated with neurological impairment and sciatica, without a response to conservative treatment, were evaluated for surgical treatment in the outpatient clinic. All the patients had persistent leg pain despite clinical treatment, and Magnetic Resonance Imaging Exams demonstrating an LDH that was in accordance with the symptoms and the neurological examination. After agreeing to participate in the study, the patients signed a consent form and answered validated questionnaires to assess pain, disability, quality of life and psychological disturbance. In order to reduce confounding factors in the analysis, patients with previous surgery (n=8), signs of segmental instability or stenosis (n=73), and multilevel LDH (n=5) were not included in this study. The study was performed on 168 patients who met the inclusion criteria.

The neurological examination was conducted by two spine surgeons participating in this study (AF, OR). Loss of muscle strength was evaluated according to the classification of the Medical Research Council (MRC), which grades muscle strength on a scale of 0 (paralysis) to 5 (normal strength).[14] Strength was assessed manually for all muscles.[15] Motor function was graded according to the MRC as "normal" for grade 5, "abnormal" for grades 1 – 4, or "absent" for grade 0. To assess the strength of the *extensor hallucis longus*, the examiner (right-handed) stood on the patient's right side, resisting foot dorsiflexion with the dorsum of his right hand, and tested extension of the big toe with his left middle finger, or both the index and middle finger placed at the level of the distal phalanx of the big toe. This maneuver allows the *extensor hallucis longus* to exert its maximal strength in isolation. The strength of the *tibialis anterior* was tested with the patient supine and the knee flexed at 30°. In this position the strength of dorsiflexion is less than with the knee extended, and muscle weakness is more easily detected and graded. The assessment in this position was confirmed by measuring the strength of dorsiflexion with the patient sitting on the edge of the bed. The *triceps surae* was tested manually, with the patient lying supine, assessing the strength of plantar flexion with the knee extended. The strength of the *quadriceps femoris* was assessed with the patient in the prone position. The examiner held down the patient's thigh with his left hand, and resisted knee extension with the right hand. The prone position was chosen because it was easier for the examiner and more sensitive than the other positions. When the patient was unable to lie prone because of leg pain, the test was carried out in the supine position with the affected knee flexed at 40°.

Patient Evaluation of Pain, Disability, Depression and Health-Related Quality of Life

Validated questionnaires in the preoperative period were used to evaluate HRQoL: pain, disability, quality of life, anxiety and depression. These included a Numerical Rating Scale of Pain (NRS), Oswestry Disability Index (ODI), Short-form 36 (SF-36), Beck Depression Inventory (BDI), Hospital Anxiety and Depression Scale (HADS) and fears and beliefs (FABq). The patients answered the questionnaires by themselves, using a computer questionnaire system, without any interference from a physician. The clinical and functional assessment methods used are described in detail elsewhere.[16]

Pain intensity was assessed by NRS.[17]

Disability was measured with the ODI.[18] This questionnaire was validated in Brazilian Portuguese in 2007.[19]

The SF-36 was used to evaluate the patient's healthcare-related quality of life.[20] This instrument was translated and validated in Brazilian Portuguese in 1999.[21]

The BDI is a self-report questionnaire widely used to screen for the presence of depression.[22] The HADS measures anxiety and depression not related to somatic or vegetative symptoms.[23] The BDI and the HADS were validated in Brazilian Portuguese in 1996 and 1995, respectively.[22,23]

The Fear and Beliefs Questionnaire is an instrument used to assess the influence of fears and beliefs on the level of patients' pain and disability.[24] This questionnaire was validated in Brazilian Portuguese in 2007.[25]

Statistical Analyses

All statistical analyses were conducted with SPSS 18.0 (SPSS, Chicago, IL). The categorical variables were presented as proportions. The continuous variables were submitted to the Kolmogorov-Smirnov test to verify normal distribution, and were presented as mean plus standard deviation. For comparisons between patients who had motor impairment and those who did not, we used the chi-square test for categorical variables and the Student's *t* test or Mann-Whitney test for continuous variables, as applicable. In order to verify the discrimination capacity of the HRQoL measurements in relation to MD, we calculated the area under the ROC (Receiver Operating Characteristic) curve. An area under the ROC curve higher than 0.80 or 0.90 indicates appropriate levels of discrimination in a clinical context; the closer the area is to 0.50, the higher the probability of random results in discrimination. Statistical significance was accepted at a level of $p < 0.05$.

RESULTS

A total of 254 consecutive patients with LDH associated with neurological impairment and sciatica were evaluated. Of these, 168 patients met the inclusion criteria and were enrolled.

The characteristics of the 168 patients are summarized in Table 1. Regarding the preoperative neurological findings, normal motor strength was observed in 57 (33.9%) patients and MD was observed in 111 (66.1%) cases.

Most of the patients had LDH at L4-L5 or L5-S1 (n = 101/168; 91%). No statistically significant differences were observed between patients with and without MD in terms of sex, age, level of herniation, lateralization and work compensation. There was a statistically non-significant tendency for patients with MD to present more acute symptoms, compared to patients with normal motor examination.

Table 2 summarizes the comparisons of HRQoL measurements in patients with and without MD. No correlation could be established between the groups when the intensity of leg or back pain, the Fear and Beliefs questionnaire, and the depressive or anxious symptoms were analyzed. Regarding quality of life, no difference was detected in the eight domains of SF36, or between the PCS and MCS groups. The only difference observed was a higher disability rate in the MD group, with the mean ODI difference being 7.84 (CI95%: 1.82 – 13.87; p = 0.011). (Figure 1) Analyses of each item of ODI demonstrate that MD patients complain more of dis-

Table 1.General features of the sample.

	Total (n = 168)	Motor deficit (n = 111)	Normal (n = 57)	P
Female[a]	46.4%	48.6%	42.1%	0.421
Age (in years)[b]	47.20 (±13.11)	47.64 (±13.95)	46.35 (±11.37)	0.548
Level of disc herniation[a]				0.380
L1-L2	-	-	-	
L2-L3	1.8%	0.9%	3.5%	
L3-L4	6.5%	8.1%	3.5%	
L4-L5	48.2%	49.5%	45.6%	
L5-S1	43.5%	41.4%	47.4%	
Side of pain[a]				0.352
Right	52.4%	45.0%	52.6%	
Left	47.6%	55.0%	47.4%	
Length of symptoms (in days)[c]	45 (30 – 90)	40 (25 – 90)	60 (30 – 90)	0.126
Work compensation[a]	13.1%	12.6%	14.0%	0.485

a=Chi-square; b=Student's *t*; c=Mann-Whitney.

Table 2. Clinical and functional assessments.

	Total (n = 168)	Motor deficit (n = 111)	Normal (n = 57)	P
Numerical rating scale of pain				
Leg	8.64 (±1.59)	8.74 (±1.46)	8.46 (±1.81)	0.267[a]
Lower back	3.33 (±2.55)	3.37 (±2.67)	3.25 (±2.32)	0.724[a]
Oswestry Disability Index	46.16 (±20.27)	48.82 (±21.25)	40.98 (±17.23)	0.011[b]
Quality of life (SF-36)				
Physical Functioning	33.27 (±21.75)	33.42 (±22.70)	32.98 (±19.97)	0.881[a]
Physical Role	11.16 (±24.88)	10.36 (±24.18)	12.71 (±26.35)	0.614[a]
Bodily Pain	24.32 (±15.81)	22.81 (±14.51)	27.26 (±17.85)	0.091[a]
General Heath	61.32 (±12.50)	61.72 (±12.48)	60.52 (±12.61)	0.383[a]
Vitality	45.11 (±20.06)	44.32 (±19.73)	46.66 (±20.79)	0.475[b]
Social Functioning	47.54 (±24.82)	45.38 (±24.88)	51.75 (±24.37)	0.113[a]
Emotional Role	35.11 (±40.33)	33.93 (±40.94)	37.42 (±39.37)	0.465[a]
Mental Health	55.23 (±22.49)	53.83 (±22.88)	57.96 (±21.64)	0.261[b]
SF36-Physical Component	30.88 (±6.65)	30.92 (±6.88)	30.80 (±6.22)	0.917[a]
SF36-Mental Component	38.44 (±13.95)	37.55 (±14.35)	40.16 (±13.08)	0.252[a]
Beck depression inventory	10.64 (±7.61)	10.75 (±7.84)	10.42 (±7.21)	0.682[a]
Hospital anxiety and depression scale	13.89 (±6.67)	14.00 (±7.00)	13.66 (±6.03)	0.754[b]
Fear Avoidance Beliefs (FABq)				
FABq-Work	24.05 (±12.51)	23.46 (±12.46)	25.69 (±12.69)	0.328[b]
FABq-Physical Activity	17.99 (±5.98)	18.14 (±5.72)	1.57 (±6.74)	0.964[a]

a=Mann-Whitney test; b=Student's t-test.

ability in relation to personal care (p = 0.050), walking (p = 0.051), standing (p = 0.021) and traveling (p = 0.043). (Table 3) Although statistically significant differences were found in disability between patients with and without MD, the area under the ROC curve of ODI for the presence of MD was 0.597 (CI95%: 0.510 – 0.684), indicating a low discrimination power of ODI to detect the presence of motor abnormalities in the current series. (Figure 2)

Most of the patients had grade 4 (70.1%, n = 80/111) or grade 3 (20.7%, n 23/111) strength. Only 6 patients (5.4%) were observed with grade 2 strength, and 2 patients had grade 1 (1.8%). No patient presented grade 0 muscle strength. Comparative analyses of HRQoL relative to the severity of MD did not reach statistical difference. Pearson's correlations between grade of motor strength and all the HRQoL measurements were not statistically significant. Also, comparative analyses of HRQoL among muscle strength groups (grade 1 or 2 X grade 3 X grade 4 X grade 5) did not show any differences in the Kruskal-Wallis test. Finally, post-hoc analyses using the Bonferroni method did not reach statistical difference between the subgroups.

Motor weakness was observed in 35.1% (n = 39/111) of patients with an abnormal motor examination, and was related to severity (X^2: 46.058; p < 0.0001), being observed by all patients with grade 1 or 2 strength, 78.3% with grade 3 (n = 18/23), and 16.3% with grade 4 (n = 13/80). The capacity to recognize, or not, the weakness in the patients was not related to the level of the disc herniation, sex, age, duration of symptoms, side of symptoms, and work compensation status. Also, it did not reach statistical difference in NRS, ODI, SF36, BDI, HADS and FABq. This means that the perception of weakness did not influence the HRQoL measurements.

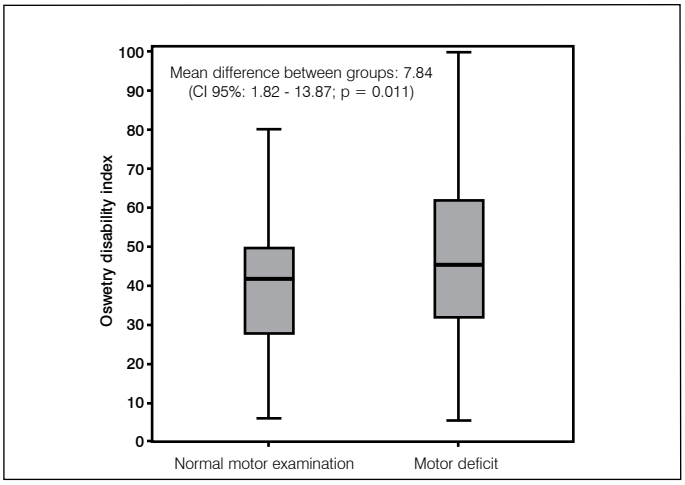

Figure 1. Comparison of Oswestry Disability Index between the groups.

Table 3. Individual items of the Oswestry Disability Index.

	Motor Deficit	Normal	P
Pain intensity	3.22 (±1.10)	2.88 (±1.21)	0.100
Personal care	1.99 (±1.37)	1.58 (±1.10)	0.050
Lifting	3.14 (±1.27)	2.79 (±1.26)	0.076
Walking	2.05 (±1.65)	1.53 (±1.59)	0.051
Sitting	2.37 (±1.60)	2.23 (±1.53)	0.653
Standing	2.60 (±1.56)	2.02 (±1.50)	0.021
Sleeping	1.86 (±1.57)	1.58 (±1.36)	0.329
Sex life	1.96 (±1.71)	1.44 (±1.42)	0.070
Social life	2.65 (±1.37)	2.51 (±1.10)	0.360
Traveling	2.57 (±1.65)	1.95 (±1.34)	0.043

Mann-Whitney.

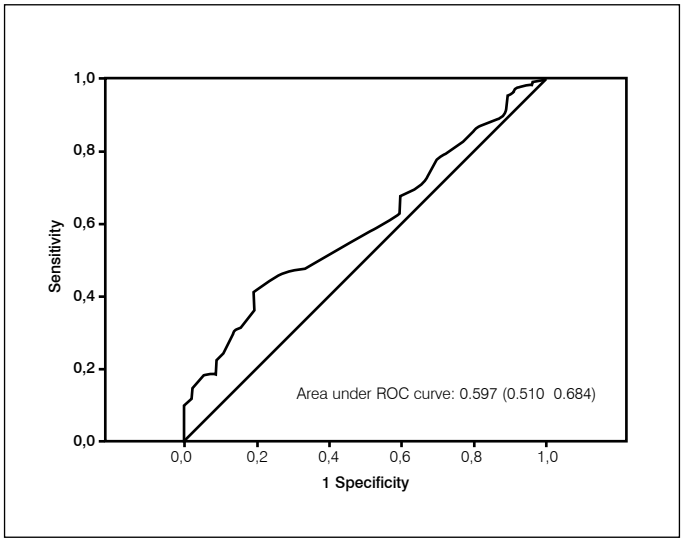

Figure 2. ROC Curve of Motor Deficit X Oswestry Disability Index.

DISCUSSION

Traditionally, MD is considered one of the most important signs of severity in spinal diseases, and except in severe cases of weakness, MD is not the main complaint of patients with disc disease.[8] Due to this lack of consonance between the patient's self-reported complaint and surgeon-perceived severity of disease, we designed a clinical study to investigate the association between MD and pain, disability, depression and patient self-reported quality of life in a selected group of patients with single-level LDH without any sign of instability.

In the presence of neurological impairment, the timing of surgical intervention seems to be pivotal in determining the final neurological outcome.[26] This is also found in clinical practice, where patients with symptoms lasting over 8 months should be advised of the possibility of prolonged or persistent neurological deficits after surgical decompression.[27] Once the MD has been recognized by the surgeon, there is concern regarding the progression of paralysis, or chronic nerve lesion limiting its recovery.

Leg pain, paresthesia and weakness are the symptoms found in patients with LDH, leg pain being the most bothersome.[7,13] Women reported a 10% higher score on the bothersomeness scale than men, and they also showed that emotional distress was associated with higher levels of leg pain and paresthesia.[8] In our series, there was no difference between patients with and without MD in relation to gender, age, level of herniation, lateralization and work compensation. There was a statistically non-significant tendency for patients with MD to present with more acute symptoms compared to patients with a normal motor examination.

The presence of MD in patients with LDH before any kind of treatment varies in the literature. Balagué *et al*.,[9] studied the evolution of MD in a sample of patients with acute sciatica treated conservatively, and found that the prevalence of MD before treatment was 15%.[9] In surgical cohorts, the MD was present in 15% to 69% of patients.[1,7-11] The incidence of MD in our study was 66.1% (n=111/168). The high incidence of MD is explained by the fact that a select group of patients, in whom conservative therapy failed to treat persistent leg pain or motor weakness, was studied. The reasons involved a lack of data on the presence and persistence of neurological impairment, as well as different methods of assessing muscle strength. Other reasons are that there is no description of the maneuvers used to perform the neurological examination, the terms paresis and paralysis are often used inadequately, and the symptoms are usually not recognized by the patient.[28]

Most patients do not recognize motor deficit as a symptom that can influence their daily routine or disturb their general health.[8] The impact of MD on HRQoL is poorly reported in the literature. Millisdotter *et al*.[29] studied muscle dysfunction in patients with L4-L5 or L5-S1 disc herniations pre- and postoperatively. Pain and Disability were assessed using the Visual Analogic Scale and Roland-Morris Questionnaire, respectively. They performed muscle tests to detect distal and proximal motor dysfunction in the pre and postoperative period in these patients. They report that patients with proximal MD are more likely to present higher levels of pain and disability in the preoperative period. Interestingly, the authors do not present information regarding preoperative distal MD with pain and disability. They only mention that preoperative distal MD was not related to postoperative pain and disability. The author's conclusions that patients with proximal MD have higher levels of disability should be interpreted with caution. According to the authors, several patients have increased pain while standing on the symptomatic leg, and it is possible that perceived disability is the result of a combination of pain with muscle weakness. In fact, we believe that proximal muscle impairment in patients with L5 or S1 root compression is more closely associated with fear of pain-related movement than with a muscle dysfunction itself. We reported a cohort of 150 patients with neurological dysfunction that were submitted to surgical treatment of LDH. The MD remained unchanged in 25% of patients 2 years after surgery, independently of any improvement in disability and pain.[10]

In our study, when the results of ODI were compared between the groups, we observed that patients with LDH presenting with MD have higher levels of disability compared with patients without MD. In the analyses of individual items of ODI, we observed that personal care, walking, standing and traveling were higher in patients with MD. However, these differences should be interpreted with caution for three reasons. Firstly, the ROC curve demonstrates that ODI has a low discrimination power in relation to motor function, indicating that disability measured by ODI is not specific or sensitive for MD in these patients. In other words, the correlation between motor signs and disability in a clinical setting is very low. Further, as demonstrated by various authors, a difference of 10 or more points in ODI is needed to be recognized by the patients as clinically significant.[30] Our analyses demonstrated a mean difference between patients with and without an MD of 7.84 points, indicating that possibly this statistical difference is not clinically significant (10 points). Finally, comparisons with others HRQoL measurements did not demonstrate any statistically significant difference between the groups.

In the present study the patients' capacity to recognize their weakness was related to the severity of the MD, which was observed in all patients with strength grades 1 or 2, 78.3% of cases with grade 3 and 16% of patients with grade 4. As the majority of the patients was grade 4 (70.1%), this leads to the conclusion that the MD diagnosis will be missed in approximately 2/3 of the patients if the physician does not perform a careful examination. This lack of perception of MD by the patients might be due the difficulty in distinguishing between numbness and weakness, and seems to be irrelevant from a patient perspective. Consequently, it should not have any clinical implications. Despite the perception or not of MD by the patients, the results of NRS, ODI, SF36, BDI, HADS and FABq were similar, which means that the perception of weakness did not influence HRQoL measurements.

In the current study, NRS, ODI, SF-36, IDB, HADS and FABq did not reliably and consistently reflect the presence of persistent MD. The use of these outcome measures did not allow differentiation between patients with and without persistent motor neurological deficits in lumbar disc herniation, suggesting that they should not be used as the sole tools to assess their outcome. For these reasons, it is important that the patient undergo an outcome evaluation that combines a neurological examination with other clinical outcome measurements.[6]

One of the limitations of our study was the small number of patients with grade 0, 1 and 2 motor strength (7.2%), which one would expect would lead to more pronounced disability in the

sample. Fortunately, this group represents the minority of patients with LDH. However, the absence of a statistically significant correlation between the severity of MD and HRQoL measurements may be related to the small sample size of the patients with severe motor weakness. The lack of impact of MD on HRQoL measurements could be interpreted as MD has a really low impact on HRQoL, the HRQoL measurement tools are inadequate to identify the MD as an important domain of QoL, and the small sample size of patients. More studies are needed to demonstrate this correlation. In order to reduce the confounding factors of a subgroup of patients with chronic low back pain and spinal instability, we only analyzed patients with sciatica that were submitted to lumbar discectomy. The purpose of this study was not to correlate the MD response after a specific treatment but to determine the preoperative impact of MD on patient self-reported HRQoL.

CONCLUSION

In patients with LDH without specific treatment, the presence of MD does not impair the pain, disability, depression and self-reported HRQoL. The MD has no discriminative power for HRQoL in patients with LDH. These findings support the need to combine neurological examination with protocols of pain, quality of life and disability, for the best evaluation of these patients.

ACKNOWLEDGMENTS

We thank AOSpine Latin America for financial support.

All authors declare no potential conflict of interest concerning this article.

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