SOCIEDADE BRASILEIRA DE REUMATOLOGIA

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Original article

A prospective study predicting the outcome of chronic low back pain and physical therapy: the role of fear-avoidance beliefs and extraspinal pain

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ARTICLE INFO

Article history:
Received 15 May 2015
Accepted 11 November 2015
Available online 22 March 2016

Keywords:
Fear-avoidance beliefs
Extraspinal pain
Therapeutic response
Chronic low back pain

ABSTRACT

Objective: To identify the prognostic factors for conventional physical therapy in patients with chronic low back pain (CLBP).
Methods: Prospective observational study.
Participants: One hundred thirteen patients with CLBP selected at the Spinal Disease Outpatient Clinic.
Main outcome measures: Pain intensity was scored using the Numeric Rating Scale (NRS), and function was measured using the Roland-Morris Disability Questionnaire (RMDQ).
Results: The Fear-Avoidance Beliefs Questionnaire work subscale results (FABQ-work; odds ratio [OR] = 0.27, 95% confidence interval [CI] 0.13–0.56, $p < 0.001$) and extraspinal pain (OR = 0.35, 95% CI 0.17–0.74, $p = 0.006$) were independently associated with a decreased response to conventional physical therapy for CLBP.
Conclusion: We identified high FABQ-work and extraspinal pain scores as key determinants of a worse response to physical therapy among CLBP patients, supporting the need for a special rehabilitation program for this subgroup.

Estudo prospectivo de fatores prognósticos em lombalgia crônica tratados com fisioterapia: papel do medo-evitação e dor extraespinal

Palavras-chave:
Crenças de evitação e medo
Dor extraespinal
Resposta terapêutica
Lombalgia crônica

RESUMO

Objetivo: Identificar os fatores prognósticos para a fisioterapia convencional em pacientes com lombalgia mecânica comum crônica (LMC).
Métodos: Estudo prospectivo observacional.
Participantes: Foram selecionados pelo Ambulatório de Doenças da Coluna Vertebral 113 pacientes com lombalgia mecânica comum crônica.
Medidas de desfecho principais: A intensidade da dor foi pontuada utilizando a Escala Numérica de Dor (END) e a função foi medida usando o Questionário Roland-Morris de Incapacidade (RMDQ).

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http://dx.doi.org/10.1016/j.rbre.2016.03.002

Resultados: Os resultados da subescala trabalho do Fear-Avoidance Beliefs Questionnaire (FABQ-trabalho; *odds ratio* [OR] = 0,27, intervalo de confiança de 95% [IC 95%] 0,13–0,56, $p < 0,001$) e da dor extraespinal (OR = 0,35, IC 0,17–0,74, $p = 0,006$) estiveram independentemente associados a uma diminuição na resposta à fisioterapia convencional para a lombalgia crônica.

Conclusão: Foram identificados escores elevados na FABQ-trabalho e dor extraespinal como determinantes-chave para uma pior resposta à fisioterapia em pacientes com LMC o que apoia a necessidade de um programa de reabilitação especial para este subgrupo.

Introduction

Chronic low back pain (CLBP) is one of the most common causes of musculoskeletal system-related disability, and it is associated with high levels of health care resource utilization.[1]

The impact of CLBP in Brazil is thought to parallel the situation in the Northern hemisphere, although accurate data are lacking. The number of Brazilians who are disabled by CLBP is very high; reports estimate that approximately 10 million people in Brazil are affected.[2] CLBP represents the main reason for disability benefit requests and is the third most common cause of disability-related retirement in Brazil.[3]

Treatment for CLBP is usually conservative. Scientific evidence consistently favors pharmacological agents and rehabilitation as the primary treatment options[4,5]; however, the response to physical therapy is rather variable and unpredictable.

Although studies have indicated the efficacy of rehabilitation compared with no treatment, few have demonstrated the superiority of any particular rehabilitation program for CLBP.[6–9] In addition, relapse rates after initial improvement from rehabilitation are high,[7] whereas the long-term cost-effectiveness of physical rehabilitation and its actual impact on recovery in terms of enabling patients to return to their normal activities remains unknown.[8]

Since the Quebec Task Force's report in 1987, many international guidelines have been published.[10–14] Although these guidelines were produced in different countries, most of the issues related to therapeutic intervention were similar.[13] Supervised exercise was generally recommended, although most guidelines did not propose a specific set of exercises. Physical therapists use a broad array of conservative, nonpharmacologic therapeutic interventions, few of which are consistently or widely recommended across various guidelines despite the strong evidence favoring the use of therapeutic exercises for chronic low back pain.

In 2006, the European guidelines for the management of chronic nonspecific low back pain were published. The goal of the COST B13 working group was to provide a set of recommendations that could support existing and future guidelines.[14] One of the major strengths of this guideline is its multinational and multidisciplinary nature. The authors proposed that chronic low back pain should not be considered a single clinical entity and emphasized the need to assess prognostic factors before treatment.

In 2007, the Multinational Musculoskeletal Inception Cohort Study (MMICS) published a list of factors that it deemed necessary to examine in future studies of prognostic indicators for chronicity in patients with CLBP.[9] The need to identify such factors is understandable because although only 5% of CLBP patients develop disabilities, 75% of all expenses related to low back pain are devoted to that population.[1] Consequently, most studies on identifying prognostic factors for chronicity and disability have focused on acute low back pain patients, and very few studies have focused on the prognostic factors for treatment response in patients with established CLBP.

The study hypothesis is that some baseline characteristics may identify subgroup of CLBP patients with distinct response rates to treatment. Therefore, we evaluated CLBP patients' clinical responses to a series of sessions of supervised physical activity and assessed various factors included in the MMICS recommendations to determine their ability to identify the prognostic factors for treatment response to conventional physical therapy.

Methods

Patients

Participants were recruited through advertisements designed by our press office. All potential participants were screened by the same rheumatologist (ASRH) between January and March 2009. Participants who were diagnosed with nonspecific CLBP and met the inclusion and exclusion criteria were recruited. The inclusion criteria were age between 18 and 80 years, pain between the last rib and the gluteal fold that persisted for more than three months, pain that was continuous or present most of the time and was patient's main pain-related complaint, and the provision of informed consent. The exclusion criteria were a diagnosis of systemic inflammatory disease, the presence of characteristic radicular pain, pain originating in the peripheral joints, osteoarticular deformities in the lower limbs, decompensated heart failure, neoplasia in the previous five years, previous lumbar spine surgery, systemic disease that might interfere with the interpretation of results based on medical opinion, an inability to understand questionnaires and explanations or to comply with the treatment, physical therapy for LBP that involved physical exercises in the previous five years, psychiatric disorders, and fibromyalgia or pain not located in the lumbar spine as the main pain-related complaint.

Our Spinal Diseases Outpatient Clinic is part of the Rheumatology Division of the university hospital. Patients are

referred to us from other departments within the hospital and from a network of primary or secondary care units linked to the hospital.

All of the participants signed an informed consent form, and the study was approved by the Research Ethics Committee.

This study complied with the ethical principles of the Declaration of Helsinki (2008) and the applicable local laws and regulations. This research was approved by the local ethics and research committee (Research Protocol 1110/07).

Physical therapy intervention

The treatment consisted of 10 individual sessions: two sessions per week for five weeks. Each session included core-strengthening exercises (i.e., exercises that involved the abdominal, pelvic floor, gluteal, diaphragmatic and pelvic girdle muscles), stretching exercises and postural orientation exercises. All assessments and physical therapy sessions were performed by the same physical therapist.

Assessments

The patients' responses to physical therapy were assessed in terms of changes in pain intensity using the Numeric Rating Scale (NRS), which has a range of 0–10, and in terms of CLBP-related disability using the Roland-Morris Disability Questionnaire (RMDQ), which has a range of 0–24. The participants were assessed upon inclusion in the study, immediately after the ten physical therapy sessions (first evaluation) and three months after the first evaluation (second evaluation).

For the responder analysis, the patients were divided into responder and nonresponder groups according to the individual changes in the pain intensity and disability measures at each evaluation. A patient was considered a responder if he/she showed a decrease of at least two points in the NRS score[15] or at least four points in the RMDQ score.[16] We also expressed the results as the percentage of change from the score obtained at baseline.

Socio-demographic data were collected, a complete physical examination was performed, and the duration of pain was assessed at baseline. In addition, all of the participants answered standardized questionnaires to assess the factors included in the MMICS guidelines (smoking, physical activity, occupational factors, depression, and catastrophic thinking) and completed the Fear-Avoidance Beliefs Questionnaire (FABQ). The FABQ contains two subscales that were separately evaluated: fear-avoidance beliefs related to work (FABQ-work) and physical activity (FABQ-physical). Fear avoidance related to physical activity was considered either present (score ≥15) or absent (<15), while fear avoidance related to work was considered present if the FABQ-work score was ≥34. The Brazilian versions of all of these questionnaires were previously validated.[17–20]

The patients were considered to have extraspinal pain if they had chronic pain complaints in addition to LBP but did not fulfill the criteria for fibromyalgia.

Table 1 – Demographic, anthropometric and clinical data.

Variables	All ($n = 113$)
Age, years	53.0 (12.2)[a]
Female, *n* (%)	81 (71.7)
BMI, kg/m^2	27.9 (5.1)[a]
Smoking, *n* (%)	16 (14.2)
Pain below the knee, *n* (%)	73 (64.6)
Physical activity, *n* (%)	90 (79.6)
Irritability, *n* (%)	13 (11.5)
Depression, *n* (%)	83 (73.5)
Catastrophic thinking, *n* (%)	35 (31.0)
FABQ-physical, *n* (%)	13 (11.5)
FABQ-work, *n* (%)	46 (36.3)
Extraspinal pain, *n* (%)	35 (31.0)

BMI, body mass index; FABQ-physical, fear-avoidance beliefs subscale for physical activity ≥15; FABQ-work, fear-avoidance beliefs subscale for work ≥34.

[a] Data are expressed as the mean (standard deviation).

Statistical analysis

The sample size followed the criteria for multiple logistic regression analysis with at least 5–12 patients in each of the 12 explanatory variables.

The normality of the data distribution was analyzed with the Kolmogorov–Smirnov test, and parametric tests were applied. Quantitative data were expressed as the mean (SD), whereas qualitative data were expressed in absolute numbers and relative frequency.

The combined influence of the variables and time of evaluation on the patient response was assessed with a fitted model that used generalized estimation equations (GEE) with a normal marginal distribution and an identity link function, assuming symmetric matrix component correlations between time points.

Only statistically significant variables were retained in the final models. The fit of each model was verified with residual analyses that used Cook's distance or deviance residuals. The significance level was set at 5%.

Table 2 – Response to physical therapy for chronic low back pain measured with the Numeric Rating Scale (NRS) and the Roland-Morris Disability Questionnaire (RMDQ) at each evaluation time.

	NRS			RMDQ		
	Nonresponse	Response	*p*	Nonresponse	Response	*p*
First, *n* (%)	29 (26)	84 (74)	0.03	23 (20)	90 (80)	0.87
Second, *n* (%)	44 (39)	69 (61)		24 (21)	89 (79)	

Table 3 – Prognostic factors for the response to physical therapy assessed with the Numeric Rating Scale (NRS) and the Roland-Morris Disability Questionnaire (RMDQ) at each evaluation time.

	NRS					RMDQ				
	First		Second		*p*	First		Second		*p*
	Non-responder *n* = 29	Responder *n* = 84	Non-responder *n* = 44	Responder *n* = 69		Non-responder *n* = 23	Responder *n* = 90	Non-responder *n* = 24	Responder *n* = 89	
Age, years[a]	53.9 (13.9)	52.7 (11.6)	53.3 (12.3)	52.8 (12.2)	0.71	53.5 (11.6)	52.8 (12.4)	54.1 (10.0)	52.7 (12.7)	0.65
Female	20 (68.9)	61 (72.6)	33 (75)	48 (69.5)	0.81	15 (65.2)	66 (66.7)	17 (70.8)	64 (71.9)	0.61
BMI, kg/m^2[a]	27.0 (5.0)	28.3 (5.1)	28.0 (5.5)	27.9 (4.8)	0.62	26.9 (5.3)	28.2 (5.0)	28.1 (5.9)	27.9 (4.8)	0.60
Smoking	5 (17.2)	11 (13.1)	7 (15.9)	9 (13)	0.58	5 (21.7)	11 (12.2)	4 (16.7)	12 (13.5)	0.36
Pain below the knee	20 (69.0)	53 (63.1)	33 (75.0)	40 (58.0)	0.13	17 (73.9)	56 (62.2)	17 (70.8)	56 (62.9)	0.30
Physical activity	21 (72.4)	69 (82.1)	34 (77.3)	56 (81.2)	0.37	18 (78.3)	72 (80.0)	19 (79.2)	71 (79.8)	0.88
Irritability	6 (20.6)	7 (8.3)	7 (15.9)	6 (8.7)	0.09	3 (13.0)	10 (11.1)	4 (16.7)	9 (10.1)	0.50
Depression	22 (75.9)	61 (72.6)	34 (77.3)	49 (71.0)	0.51	19 (82.6)	64 (71.1)	19 (79.2)	64 (71.9)	0.29
Catastrophic thinking	10 (34.5)	25 (29.8)	17 (38.6)	18 (26.1)	0.25	11 (47.8)	24 (26.7)	9 (37.5)	26 (29.2)	0.12
FABQ-physical	3 (10.3)	10 (11.9)	7 (15.9)	6 (8.7)	0.52	3 (13.0)	10 (11.1)	4 (16.7)	9 (10.1)	0.47
FABQ-work	16 (55.2)	25 (29.8)	26 (59.1)	15 (21.7)	**<0.001**	10 (43.5)	31 (34.4)	13 (54.2)	28 (31.5)	0.09
Extraspinal pain	14 (48.3)	21 (25.0)	21 (47.7)	14 (20.3)	**0.002**	12 (52.2)	23 (25.6)	9 (37.5)	26 (29.2)	0.06

BMI, body mass index; FABQ-physical, fear-avoidance beliefs questionnaire subscale for physical activity ≥15; FABQ-work, fear-avoidance beliefs questionnaire subscale for work ≥34.
$p < 0.05$ in bold.

[a] Data are expressed as the mean (standard deviation).

Results

From 217 inquiries, 130 people with CLBP were selected. Seventeen patients withdrew before the end of the scheduled consultations and were excluded. One hundred thirteen subjects completed the study. The main reason reported for withdrawal was difficulty commuting to the rehabilitation center as often as required.

The sample consisted of 81 women and 32 men between 21 and 80 years old. The cohort consisted of 40% housewives and pensioners, 16% cleaning personnel, 10% office employees and 31% other occupations. Only 3% were unemployed. The mean BMI value was 27.9 kg/m^2, ranging from 18 to 47. The duration of CLBP ranged from three months to 40 years (±0.76 years). Additional demographic, anthropometric and clinical characteristics of these patients are presented in Table 1.

The response to physical therapy as assessed with the NRS decreased from the first to the second evaluation (74% vs. 61%, $p = 0.03$). When assessed with the RMDQ, the frequency of response was similar for both evaluations (80% vs. 79%, $p = 0.87$; Table 2).

The participants with a high FABQ-work score had a poorer outcome at both evaluations based on the NRS results (55% nonresponders vs. 30% responders and 59% nonresponders vs. 22% responders, $p < 0.001$). The same results were observed for the patients with extraspinal pain (48% vs. 25% and 48% vs. 20%, $p = 0.002$; Table 3). The higher FABQ-work scores and the greater frequency of extraspinal pain according to the RMDQ did not reach statistical significance (Table 3).

In the final model analysis, the presence of work-related fear avoidance and extraspinal pain remained as independent factors associated with nonresponse (OR = 0.27, 95% CI = 0.13–0.56; $p < 0.001$ and OR = 0.35, 95% CI 0.17–0.74; $p = 0.006$, respectively; Table 4).

Table 4 – Final model of the prognostic factors for the response to conventional physical therapy assessed with the Numeric Rating Scale (NRS).

Variable	OR	(CI 95%)	p
Evaluation time			
First	1.00		
Second	0.49	(0.30–078)	0.003
FABQ-work			
No	1.00		
Yes	0.27	(0.13–0.56)	<0.001
Extraspinal pain			
No	1.00		
Yes	0.35	(0.17–0.74)	0.006

OR, odds ratio; CI, confidence interval; FABQ-work, fear-avoidance beliefs subscale for work ≥34.

In addition, we analyzed the result as the percentage of change in the response from baseline. Both the RMDQ and NRS response rates were negatively influenced by extraspinal pain and fear avoidance related to work (Table 5).

Discussion

This study is one of the few prospective studies to assess the prognostic factors related to physical therapy for patients with CLBP. We found that work-related fear avoidance and extraspinal pain negatively influenced the outcome.

Functional disability resulting from CLBP has increased despite new interventions. Comparisons among studies have been obstructed by the use of varied definitions and outcome measures.[21] In the same manner, there are no golden rules that predict the response to treatment for CLBP.[22] In this study, patients were considered responders if they showed a

Table 5 – Bivariate and multivariate analysis of the factors that influence the response to physical therapy, assessed with the Numeric Rating Scale (NRS) and the Roland-Morris Disability Questionnaire (RMDQ) and measured as the percentage of change from the baseline.

	NRS				RMDQ			
	Bivariate		Multivariate		Bivariate		Multivariate	
	Estimate (SE)	p	Estimate (SE)	p	Estimate (SE)	p	Estimate (SE)	p
Age, years	0.19 (0.27)	0.499			0.2 (0.22)	0.365		
Female	−7.9 (7.35)	0.282			−1.95 (5.94)	0.743		
BMI, kg/m^2	0.03 (0.66)	0.964			0.21 (0.53)	0.700		
Smoking	3.15 (9.53)	0.741			−2.63 (7.68)	0.732		
Pain below the knee	−10.44 (6.89)	0.130			−8.33 (5.55)	0.133		
Physical activity	4.15 (8.25)	0.615			7.18 (6.62)	0.278		
Irritability	−11.54 (10.37)	0.266			−12.68 (8.31)	0.127		
Depression	−8.48 (7.49)	0.257			−13.56 (5.93)	0.022		
Catastrophic thinking	−6.04 (7.17)	0.400			−7.84 (5.75)	0.173		
FABQ-physical	0.56 (10.43)	0.958			−2.97 (8.39)	0.723		
FABQ-work	−17.33 (6.72)	0.010	**−13.8 (6.53)**	**0.035**	−13.5 (5.42)	0.013	**−10.66 (5.27)**	**0.043**
Extraspinal pain	−23.92 (6.83)	<0.001	**−21.47 (6.79)**	**0.002**	−19.16 (5.5)	<0.001	**−17.26 (5.48)**	**0.002**

BMI, body mass index; FABQ-physical, fear-avoidance beliefs questionnaire subscale for physical activity ≥15; FABQ-work, fear-avoidance beliefs questionnaire subscale for work ≥34.
$p < 0.05$ in bold.

decrease of at least two points in the NRS score or four points in the RMDQ score. Alternatively, we evaluated the response as the % of change from baseline and found similar results. Nevertheless, we did not perform sensitivity analyses. Future studies should address this issue in more detail to support our conclusions.

FABQ-work scores emerged as an important variable despite the inclusion of a large proportion of housewives in the study population. Our findings support those of other studies with the suggestion that individualized physical therapy programs that focus on different occupational activities should be tested.[23,24]

In the last decade, it has been unclear whether psychological factors merited interventions to reduce the burden of chronic back pain.[25] When it was published in 2007, the MMICS suggested including fear avoidance and other psychological factors (catastrophizing and depression) in prospective investigations into the transition from acute to chronic back pain.[9] The factors that were incorporated largely reflected the opinion of experts and therefore were somewhat subjective despite representing a consensus. The impact of these components on the treatment strategy for chronic back pain (and not only in the early stages) is less well established. In our study, fear avoidance, but not other psychological factors, influenced the outcomes.

Extraspinal pain was another important factor that affected the treatment response. Patients with LBP as the main complaint did better when they had no other sites of pain. It has been already suggested that individuals with chronic pain often present with more than one painful condition,[26] but the importance of this observation to treatment and prognosis remains unclear.

In our study, most of the patients improved significantly with physical therapy. The protocol used consisted of a series of exercises that are commonly applied and that have a well-established level of efficacy in the literature.[27] It is worth mentioning that the response rate, as measured by the NRS, decreased after three months of treatment; however, this phenomenon was not observed for the RMDQ, which suggests that physical therapy had more lasting effects on function than on pain perception. Perhaps physical therapy programs affect patients' ability to cope with pain. This issue should be evaluated in future studies with longer follow-up periods.

Unfortunately, the sample used in this study included a large proportion of housewives, which prevents the extrapolation of these results to other populations. Although a large number of patients were assessed, CLBP is a very common condition; thus, even larger studies must be conducted in various employment and biopsychosocial contexts. It should be mentioned that the study lasted only three months; consequently, it did not address the need for re-treatment or the long-term duration of the response, nor was it designed to address the important question of patients' ability to return to work.

Epidemiological studies have shown that the spectrum of musculoskeletal disorders in developing countries is similar to that observed in industrialized countries, but the burden of disease tends to be higher because of delays in diagnosis or a lack of access to adequate health care facilities for effective treatment.[28] In Brazil, most patients with CLBP will receive a prescription for limited sessions of physical therapy in an almost universal manner; however, the results of our study suggest that physical therapy, such as other treatments for CLBP, should be individualized according to specific patient characteristics.

Fear avoidance could be a barrier to recovery from chronic back pain regardless of the treatment modality. We believe that fear avoidance should be routinely tested to help practitioners and researchers define better treatment strategies.

In conclusion, we identified fear-avoidance beliefs about work and the presence of extraspinal pain as characteristics of subgroups of patients who may require customized treatment protocols and special rehabilitation programs for CLBP.

Funding

Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) (ASAF).

Conflicts of interest

The authors declare no conflicts of interest.

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