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DAINA ŠMITE

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Summary of doctoral thesis

Speciality - Rehabilitation

RIGA, 2011

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The doctoral thesis is available at the library and home page (www.rsu.lv) of Riga Stradiņš University.

Secretary of the Promotion Council:

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INTRODUCTION

Chronic back pain is one of the most frequent and most costly chronic pain syndromes (*Nieuwenhuyse et al*, 2009; *Woolf and Pfleger*, 2003). Spine disease is one of the most common causes of disability and absence from work (13% of the total sick-leave time) and one of the most common reasons that people seek healthcare (10% of the number of all visits to doctor) (*Manek et al, 2005; Nachemson and Jonsson, 2000).*

Despite different treatment methods, for approximately 30% of patients acute back pain turns into chronic pain syndrome, that accompanied by disability creates remarkable material damages to patients itself, to health care and to society overall. Due to increase of chronic back pain and disability caused by it since 20 years it is called the social epidemic, the cause of which has been related to cultural and psychosocial factors, as no relevant biological pathology changes are observed (*Waddel*, 2004; *Keef*, 2004; *Linton*, 2005; *Freburger*, 2009; *Nachemson*, 2000).

Inclusion of psychosocial factors in an analysis of patients with chronic low back pain should expand our knowledge and help to provide new ways of dealing with the problem that ultimately will benefit individual patients. Emotional factors are currently viewed as important determinants in pain perception and behaviour. Psychological processes are not merely a reaction to pain, but they are an integral part of pain perception. *(Keef et al, 2004; Gatchel et al, 2001; Waddell, 2004,* Kroener-Herwig 2010)

The recent researches in psychoneuroimunology are promising way in understanding the complexity of pathogenesis of chronic low back pain syndrome. There is evidence about pathophysiologic role of cytokines both in chronic pain syndrome *(Watkins and Maier, 2000*) and emotional disturbances *(Dantzer, 2005; Beutler, 2004).* The results of research have showed that cytokine system also has direct influence to muscle function and radicular pain syndrome pathogenesis in patients with lumbar spine disc disease *(Miyamoto et al, 2000; Freemont et al, 2001).*

Widespread occurrence of chronic low back pain problem with further tendency to increase determines the relevance of deeper research and analysis and therefore justifies ***the topicality of the research work***.

The study results will contribute to more extended sense in biopsychosocial conception of chronic low back pain syndrome and wherewith will promote interdiciplinar approach in the health care of chronic back pain patients. The study results

will provide basis for evidence-based recommendations for clinical work with low back pain patients that will permit the improvement of quality of back pain patients treatment and rehabilitation.

OBJECTIVES

The aim

In the framework of biopsihosocial model to determine and analyse interaction between emotional distress and pain syndrome, its characteristic parameters and impact on the quality of life in patients with chronic low back pain.

The objectives

1. To evaluate and analyse emotional distress in chronic low back pain patients.
2. To evaluate and analyse pain syndrome and its interaction with emotional distress in chronic low back pain patients.
3. To evaluate and analyse physical state of chronic low back pain patients and its interaction with emotional distress.
4. To evaluate and analyse sense of emotional support, beliefs about pain and expression of avoidance behaviour, social situation in chronic low back pain patients and its interaction with emotional distress.
5. To evaluate and analyse chronic low back pain patients quality of life and its determinant factors, as well as influence of emotional distress upon strength of their impact.
6. To assess the level of cytokines in blood serum and analyse its relationships between emotional distress and sense of emotional support, pain syndrome, physical state and quality of life parameters in chronic low back pain patients.

METHODS

The materials

There were included all patients who were sent to rehabilitation (within the framework of State Compulsory Health Insurance Agency programme) and who during time period from 01.09.2006. till 01.09.2008. were admitted to rehabilitation centre „Ligatne" and corresponded to the study *inclusion criteria*: patients with clinical diagnosis of lumbar spine disk pathology with radiculopathy (after ICD -10 classification:

M 51.1.), who had radiological approved L4-L5 and/or L5-S1 intervertebral disc(s) herniation, and whose primary complaint was low back pain in duration more than 3 months, with or without irradiation un low back pain duration more than 3 months and whose age was from 18 to 60 years and who agrees to participate in the study. There were excluded those patients, who had some of the study *exclusion criteria*: muscle strength in lower extremities muscles less than 3 grades (after Kendall); additional disease and/or traumatic injury (unrelated to the spine), which causes a functional limitation; somatoform disorder (after ICD -10 classification: F 45) or another psychiatric additional disease; spinal pathology, which is connected with infectious process, autoimmune or metabolic disorder, traumatic injury, neoplastic process (primary tumour or metastases) or internal organ pathology; congenital spine disorders and spine development anomaly; *cauda equina* syndrome; spinal stenosis (clinical manifestation or radiological findings); previously carried out stabilising spine surgery or more than one level microdiscectomia; since microdiscectomia less than two months; pregnancy and less than 2 years after childbirth.

During the particular time period in the above mentioned rehabilitation centre in the pain programme were admitted overall 620 patients, of whom 207 corresponded to the study inclusion criteria, but based on the study's exclusion criteria, 97 patients were excluded.

As a result, in the study were enrolled a total of 110 patients, including 48 (43.6%) male and 62 (56.4%) female. The age of patients ranged from 24 to 60 years, mean age 44.2± 8, 0 years. The mean age of men were 43, 0 ± 7, 4 years, women - 45, 1 ± 8, 3 years. According to an independent sample t test there were no statistically significant difference between men and women mean age ($t = 1.337$, $p = 0.184$).

The procedure

Patients who were included in the study were referred to the rehabilitation within the framework of State Compulsory Health Insurance Agency programme, based on the regulations of Latvian Ministry of Health for financing of health care during the time period of the study. Patients' inclusion in the study (i.e., evaluation of inclusion and exclusion criteria) was conducted in collaboration with the rehabilitation centre doctors. Complex assessment was made to all included patients, by mean of the study assessment methods.

Patients who were enrolled in the study during time period from 10.09.2007. till 10.10.2007. and from 10.02.2008. till 10.03.2008. the complex assessment additionaly included the blood serum immunological analysis. Immunological studies and research were carried out in collaboration with the Institute of Experimental and Clinical Medicine (Latvian University) in the frameworks of the project: New approaches to the diagnostics of exogenous health risk factors induced disturbances (project leader: Pēteris Tretjakovs).

The complex assessment of included patients was done in first 48 hours after admission to the rehabilitation centre. The assessment results were documented in the evaluation protocol. All completely obtained assessment data was collected and processed by mathematical statistical methods.

The study was conducted in compliance with ethical principles (in accordance with the Helsinki Declaration). There is positive statement of Ethics Committee for the study.

The assessment methods

Structured interview

The structured interview included both closed and open questions. Interview had the following sections: current complaints (lower back pain syndrome, other complaints), additional diseases, previous history of trauma / surgery, previous and current treatment, addictions (smoking, alcohol), physical activities (what kind and how often), sport activities, family history: the current marital status, details of children, whereby living together, does disagreements in the family / with parents / friends reinforce the pain; work and social history (the actual place of residence, current employment situation, education, job risk factors, does the current work
satisfies, sick-leave and compensation).

Visual analogue scale

The visual analogue scale (VAS) was used to assess pain intensity. Methodology: a 10 cm long line where in the one end is marked for the strongest possible pain intensity, but in the second - if not painful at all. The patient was asked to point (a cross draw) how intensive is the current low back pain intensity. The result was obtained by measuring the distance (cm) on the line.

Lumbar spine and pelvic motor control tests

Active straight leg raising test (*Mens et al*, 2001)

Standardized functional test with proven reliability and sensitivity in patients with low back pain syndrome that assesses the ability of pelvis to transfer load from lumbar spine to legs, therefore it is indicative for active (partly also passive) stability of lumbar spine and pelvis.

Test procedure: patient is supine, legs about 20 cm in width in relaxed state of external rotation. Patient is asked to lift one straight leg about 5-10 cm from the base. After leg is lowered, and the same is done with other leg. Patient is asked to evaluate the effort and discomfort during movement. Tester observes patient, evaluating objective disturbances: the ability to move, leg tremor occurrence, and pelvis or trunk rotation.

Test results were interpreted by four-point scale for each leg: (0) has no special effort, and show no objective signs of disturbance, (1) is difficult, but show no objective signs of disturbance, (2) is difficult and observe objective signs of disturbance, (3) could not make / pain. For summarizing the results were used the overall results of both legs, which were obtained by summing the test results for right and left leg. Thus, the overall test result could be a range of 0 to 6 points; lower scores indicated a better lumbar spine and pelvic motor control.

Trendelenburg test (by Hardcastle et Nade, 1985)

This test was originally designed to evaluate hip function, but in recent years, the studies have shown that the test can assess motor control of pelvis and lumbar spine in weight-bearing position. The test has shown statistical significance.

Test procedure: The patient is upright. He/she is asked to raise one leg, bending the hip joint to approximately 30 degree angle and raise the same side (non-load) of pelvis above the horizontal level. In addition, patient is asked to hold the position for 30 seconds. After leg is lowered, and the test is repeated with other leg. Patient is asked to evaluate the effort and discomfort during movement. Tester observes the patient for evaluation of objective disturbances: the ability to move and hold the test position, change of breathing stereotype change, the shoulder girdle fixation or another.

Test results were interpreted by four-point scale for each leg: (0) has no special effort and show no objective signs of disturbance, (1) is difficult, but show no objective signs of disturbance, (2) is difficult and observe objective signs of disturbance, (3) could not make / pain. For summarizing the results were used the overall results of both legs,

which were obtained by summing the test result for right and left leg. Thus, the overall test result could be a range of 0 to 6 points; lower scores indicated a better lumbar spine and pelvic motor control.

Palpation test

To evaluate the muscle and ligament tension palpation test was used. There were palpated and assessed *m. erector spinae pars lumborum, pars thoracica* un *pars cervicalis* (paravertebral muscles), *m. quadratus lumborum*, postural muscles of pelvic girdle (*m. tensor fasciae latae* un *fascia lata*, *m.biceps femoris* un *m.semitendinosus, m.semimembranosus, m. ileopsoas*) and ligaments (*lig. sacrotuberale* and *ligg. sacroilica posterior*), postural muscles of shoulder girdle (*m. trapezius* upper part, *m. levator scapulae, m. pectoralis minor* and *m. sternocleidomastoideus*). Muscles and ligaments were palpated at both sides (left and right).

During palpation test was evaluated tension of muscle or ligament which was interpreted by grades from 0 to 3 where (0) is not excessive tension (strain), (1) mild, (2) moderate, (3) marked tension (strain). In the interpretation of palpation results were used methodology according to Vleeming (1996) long dorsal ligament palpation test.

Summarizing the results, were used the overall test results for both sides, which were obtained by summing the palpation test result from right and left side. Thus, the overall test result could be in range of 0 to 6 points, lower scores indicated a lower tension.

Body mass index

Body mass index (BMI) is a numerical value, calculated by taking into account the person's height and weight. BMI is used to assess the possible weight problems. BMI has proven reliability and correlation with direct measurements of body fat. BMI is calculated by the formula: weight (kg) / (height (m)) 2

Hospital Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HADS) assess the level of anxiety and depressive symptoms. The authors of questionnaire are Zigmond and Snaith, 1983. Questionnaire has been demonstrated statistical reliability; the questionnaire also demonstrated sensitivity in assessing patients with somatic diseases. In the study was used the Latvian version of the scale (the license and the translation from the National Foundation for Educational Research (nferNelson)); in the pilot study Latvian version of HADS had shown good internal consistency and reliability (Cronbach's alpha 0.892).

HADS is self-reported questionnaire. It consists of 14 statements (seven are related to the level of anxiety, but 7 to the symptoms of depression). Patient is asked to evaluate each of the statements by the way he (she) is felt over the last week. There are given four responses to choice for each statement.

The patient completed the questionnaire independently in a quiet and peaceful atmosphere Completion of questionnaires took an average of 2 to 5 minutes.

Responses to each statement have been interpreted from 0 to 3, and summarized in subscales of anxiety and depression. Both subscales have been analyzed separately. The results of subscales have been interpreted as follows: <7 normal, ≥ 7 elevated level of anxiety or depressive symptoms.

Fear Avoidance and Beliefs Questionnaire

Fear Avoidance and Beliefs Questionnaire (FABQ) assesses patient's attitudes and beliefs about influence of physical activities and work to their back pain, and analyse the desire to avoid physical activities and work. A questionnaire has been designed specifically for patients with low back pain. The authors of the FABQ are *Waddell et al* (1993). Questionnaire has been demonstrated statistical reliability and sensitivity. In the study was used Latvian version of FABQ; in the pilot study Latvian version of FABQ had shown good internal consistency and reliability (Cronbach's alpha 0.902).

FABQ is self-reported questionnaire, which consists of 17 statements. Patient is asked to evaluate each statement by a seven-point Likert scale (0 - completely disagree, 6 - completely agree). The questionnaire has two subscales: work subscale with seven statements (maximum score 42) and physical activity subscale with four points (maximum score 24). Higher scores indicate a stronger belief that physical activities and / or work causes pain and are possible aggravating factors and stronger desire to avoid.

Patient completed the questionnaire independently in a quiet and peaceful atmosphere. Completion of questionnaires took an average of ten minutes.

The results of FABQ have been calculated and analysed in both subscales separately.

Assessment of emotional support

Sense of emotional support was evaluated by assessment of perceived emotional support from seven emotional support achievement sources. In assessment was used self-reported scale, which consisted of seven statements. The patient was asked to evaluate each of them by a seven-point Likert scale (0 - completely disagree, 6 - completely agree). The scale includes four statements related to what degree the patient feels

emotional support from family / friends / work/ groups of social activities. But three issues are related to how much the patient feels emotional support from health care professionals (family doctor / other doctor/ other medical staff).

Patient completed the questionnaire independently in a quiet and peaceful atmosphere. Completion of questionnaires took an average of 2 to 5 minutes.

The questionnaire results were interpreted separately for each statement (the possible variation from 0 to 6), and calculated the total amount for health care professionals (potential variation from 0 to 18), and the total amount represented by the sense of support from family, friends, colleagues at work and social activity groups. Higher scores indicated a greater sense of social and emotional support.

The assessment of emotional support also included one open question: *if you would have to move to another country / city whereby you would like to live together?* This question enabled qualitative assessment of the close emotional contacts. To this question the patient responded in writing.

SF-36® Health Survey

SF-36 questionnaire assesses eight dimensions of quality of life. The authors of questionnaires are John E. Ware et al, Source - John E. Ware with KKSnow, M. Kosinski, B. Gandek SF-36 Health Survey. Manual and Interpretation Guide. QualityMetric, Inc.- Lincoln, Rhode Island, The Health Assessment Lab in Boston, Massachusetts, 1993, 2000.

SF-36 is a standardized, reliable self-reported questionnaire, which consists of 11 basic and 25 sub-questions, allowing the assessment of the eight indicators of quality of life. Questionnaires have been demonstrated as suitable and effective in analysis of patients with low back pain syndrome.

In our study was used Latvian version of the questionnaire (permission for use of the Latvian language translation from QualityMetric); in the pilot study Latvian version of SF-36 had shown good internal consistency and reliability (Cronbach's alpha 0.982).

The results of the questionnaire were calculated and converted to the standardized system for analyse each of the eight dimensions:
1) Physical Functioning (PF) – low score indicates limitation in physical activities (including a wash and dress) due to health problems, while high score indicates ability to carry different types of physical activity, including very difficult, without any restriction;
2) Role Physical (RF) – low score indicates limitation of participation in work and other

daily activities due to physical health problems;
3) Bodily Pain (BP) - low score indicates sever pain and restriction of activities due to pain;
4) General Health (GH) - low score suggest about poor self-esteem of health status;
5) Vitality (VT) - low scores indicates that the respondent most of the time feels tired and empty, but the high score indicates that the respondent feels most of the time full of energy;
6) Social Function (SF) - low score indicates limitation of participation in social activities (relations) due to emotional or physical problems;
7) Role Emotional (RE) - low score indicates limitations in participation due to psycho-emotional problems;
8) Mental Health (MH) - low score suggests that the respondent most of the time feels depressed, impetuous, but the high score indicates that the respondent feels calm and happy.

Patients completed the questionnaire independently in a quiet and peaceful atmosphere. Completion of SF-36 questionnaire took an average of 5 to 7 minutes

Immunological analysis of blood serum

Immunological analysis of blood serum was used to detect the level of cytokines. The blood tests were taken and then the taken blood samples were left for 30 minutes to coagulate, but after that the samples were centrifugated for 10 min. After centrifugation serum was filled in ependorf test-tube and frozen. The samples were stored at the same temperature (-80°C) until analysis were made. For detection of cytokines were used immunological analysis based upon xMAP technology using LUMINEX 200 system (USA) and LINKOplex cytokine's analysis kits (USA). In the result there were detected and analysed IL-2, IL-4, IL-6, and TNF-a, IL-8, IL-10, IL-1a, IL-1b, and INF-g levels in blood serum.

Statistical methods

Data processing was done using the computer program Microsoft Excel and SPSS. To analyze the general characteristics of the patients, there were used descriptive statistics (mean values, standard deviation, minimum and maximum values) and frequency analysis. For assessment of interaction and relationships correlation analysis were used by calculating Spearman correlation coefficients between the individual indicators. But in order to determine simultaneous impact of several factors to one dependent factor

multiple linear regression analysis were used. To assess the reliability of the average difference between two independent groups independent sample t test analysis were used. To assess the difference of the number of patients distribution in two different groups, Pearson chi-square analysis and analysis of the confidence interval were used. The statistical analysis rejected the null hypothesis and accepted the altemative hypothesis if the test of materiality levels were less than 5% ($p < 0.05$).

RESULTS

Based on literature data and empirical assumptions, in the process of result analysis two groups were set up:

Group 1: patients *without emotional distress* (depression and anxiety levels after HADS <7 points): 69 patients;

Group 2: patients *with emotional distress* (depression and/or anxiety levels after HADS ≥ 7 points): 41 patients.

Emotional distress *(Group 2)* in 35 (85%) patients were characterized by clinically significant depressive symptoms and elevated anxiety levels, while the remaining 6 (15%) patients were characterized by elevated anxiety levels, but did not detected clinically significant depressive symptoms (after HADS). HADS depression subscale scores in *Group 2* were in average 8.3 ± 2.5 (95% CI ofmean value from 7.5 to 9.1) points. HADS anxiety subscale scores in *Group 2:* 9.2 ± 2.4 (95% CI of mean value from 8.6 to 9.8) points.

Socio-demographic characteristics of patients

Patient proportion in the groups by *gender, mean age and marital status* showed no significant difference. ***(Table 1)***

Table 1 Characteristics of gender, age and marital status in the study groups

		Group 1 (n = 69)	*Group 2 (n = 41)*	*testing)*
Gender	female / male	*n* (%)	43 (62,9) / 26 (37,7)	20 (48,8) / 21 (51,2)	*No reliable difference* (x^2 = 1,528; df = 1; p = 0,216)
Age		*mean ± standard deviation*	43,1 ± 7,1	45,2 ± 9,0	*No reliable difference* (t = 2,054; P = 0,055)
Maritai status	married	*n (%)*	50 (72,5)	28 (68,3)	*No reliable difference* (overall distribution: x^2 = 6,886; df=3; p=0,076; CIA for single factors also did not revealed reliable difference
	divorced	n (%)	5 (7,3)	7 (17,1)	
	widow (-er)	*n (%)*	5 (7,3)	4 (9,8)	
Currently living with:	with husband/wife and kids	*n (%)*	46 (66,6)	19 (46,3)	***Reliable difference*** (difference 21,8% (95% CI from 3 to 39%))
	with husband/wife with partner	*n (%)*	12 (17,4)	8 (19,5)	*No reliable difference* (CIA for single factors did not revealed reliable difference)
	with parents	*n (%)*	5 (7,3)	6 (14,6)	
	alone	*n (%)*	6 (8,7)	8 (19,5)	

Patients more often reported that they *currently live with* one's husband or wife and children and there was found difference between groups: in Group 1 patients for in average 21,8% more than in Group 2 ***(Table 1).***

The results showed not reliable difference between groups according to *actual place of residence* (χ^2 = 2,067; df = 2; p = 0,559). (34 (31%) of all studied patients had an actual place of residence in Riga, while 55 (50%) - in another Latvian cities, while 21 (19%) of the patients were residents of one of the Latvian rural municipality).

As well patients in both groups did not show reliable difference according to their *education level and employment status.* 103 (93.6%) of all studied patients worked in paid employment, 4 (3.6%) patients were unemployed, 1 (0.9%) patient was retired, 1 (0.9%) patient was a housewife, but 1 (0.9%) of the patients studied (no reliable difference between groups: χ^2 = 6,633; df = 4; p = 0,157). 63 (57.3%) patients had higher education, while 8 (7.3%) - incomplete higher education, 36 (32.7%) - secondary education, but 3 (2.7%) - primary or incomplete secondary education (no reliable difference between groups: x^2 = 5,325; df = 3; p = 0,149).

Patients proportion distribution in both groups according to self-reported *workplace riskfactors* (analysed by single factor CIA and overall distribution by Pearson chi-square analysis) did not showed reliable (p<0,05) difference. Most often patients in both groups marked combination of prolonged static postures and psycho-emotional stress (in 1st group: 21 (30.4%) patients, 2nd group: 16 (23.2%) patients).

Prolonged static postures as risk factor reported 59 (85.5%) patients in Group 1 and 29 (70.7%) in Group 2, but the psycho-emotional stress: 56 (81.2%) in Group 1 and 28 (68.3%) patients in Group 2. While 29 (42%) patients in Group 1 and11 (26.8%) in Group 2 pointed heavy physical work as their workplace risk factor, which most often was in combination with psycho-emotional stress, prolonged static postures and meteorological factors.

Difference ($p<0,05$) between groups was found in patients responses about their *satisfaction with current work*: in Group 2 were more patients who were dissatisfied with their current work (difference 24.1% (95% CI from 7 to 41%), but in Group 1 (unlike Group 2) were patients who had no opinion about this question („don't know") (difference 15.9% (95% CI 5 to 23%).

There was not found reliable ($p<0,05$) difference between groups according *sick-leave status*: 56 (50.9%) of all studied patients (37 (53.6%) patients in Group 1, 19 (46.3%) in Group 2) sick-leave due to the current episode of pain, while the remaining 54 (49.1%) patients did not received sick-leave at the moment of assessment.

Previous and current treatment description

Current Treatment

There was found that currently 68 (61.8%) of all studied patients received pharmacotherapy for their low back pain treatment. From those patients 23 (20.9%) patients used medication regularly, while the remaining 45 (40.9%) patients applied the medication irregularly - at times of pain aggravation.

Comparative analysis of the groups had showed that in Group 2 were more patients who took medication irregularly (at episodes of pain exacerbations): difference 20.3% (95% CI from 38 to 1%). But there was not found significant difference between groups by proportion of patients who regularly used drugs.

It was found that the most commonly used group of medication was non-steroidal anti-inflammatory drugs (NSAIDs): 13 (11.8%) patients regularly (every day) used per oral NSAIDs at therapeutic doses, 12 (10.9%) patients used per oral NSAIDs irregularly (in average once a week), while 35 (31.8%) patients in moments of pain flare used topical NSAIDs (*Fastum gel, Olfen*). Other regularly used drugs were: tramadol 100 mg per day (3 (2.7%) patients), katadalon 100 mg per day (1 (0.9%)), midocalm (50-150 mg / day) (4 (3,6 %)), pregabalin 150 mg a day (8 (7.3%)), antidepressants (tricyclic antidepressants at therapeutic dose) (3 (2.7%)).

Additionally 11 (10%) patients regularly used medication for the treatment of underlying condition (antihypertensive therapy - eight patients, antiarrhythmics therapy - one patient, the gastro - intestinal diseases' therapy - four patients).

12 (10.9%) patients (Group 1: 5 (7.3%), 2 Group 2: 7 (17.1%); no reliable difference) reported that for pain relieve they try to use a variety of unconventional methods, the choice reposing on advertisement and friends' advices (most commonly different topical ointments/tincture were used, various types of magnetic belts and lumbar hot belts).

56 (50.9%) of the studied patients (Group 1: 42 (60.9%), Group 2: 14 (34.2%), difference 26.7% (95% CI from 43 to 7%)) used lumbar spine orthosis (corset).

20 (20.9%) patients (Group 1: 13 (18.8%), Group 2: 7 (17.1%); no reliable difference) reported that they regularly carry out specific exercises which were instructed by physiotherapist.

Previous treatment

The analysis of previous treatment for the *current episode of low back pain* showed that the majority of patients (74 (67.3%) patients (Group1 : 46 (66.7%), Group 2: 28 (68.3 %)) *started treatment* on their own (the most frequent forms of self-treatment: ointments, rest, some kind of stretching, pain medication, baths), 19 (17.3%) patients had begun treatment with advice from their family and/or friends (in most cases were used variety of ointments, pain medication, exercises, recommendations for a course of massage), 17 (15.5%) patients at the beginning visited the family doctor. Patient proportions in the groups by mode of starting treatment showed no reliable difference (χ^2 = 2,212; df =2; p = 0,331).

All studied patients in relation to the current episode of low back pain, had previously received conservative treatment and 28 (25.5%) had received also the surgical treatment. Conservative treatment was carried out both as outpatient treatment (under the guidance of family doctor and neurologist) and as inpatient treatment (in neurological unit). The conservative treatment usually had included pharmacotherapy, advice of bed rest and reduced activities, lumbar outhouses, massage, physical procedures and physical exercises (usually during inpatient treatment). Surgical treatment had included one level lumbar microdiscectomia operation.

Comparative analysis showed that patients in Group 2 more often had received repeated inpatient conservative treatment (difference 21.1% (95% CI from 4.5 to 34.7%). CIA did not showed reliable difference between patient proportions in the groups according the previous surgical treatment.

Characteristics of the patients' daily habits

Smoking and alcohol

The comparative analysis of the study groups showed that: in Group 1were 9 (13.0%) smokers, but in Group 2 - 16 (39.0%): difference 26% (95% CI from 42 to 9%).

Results revealed that in Group 2 was greater proportion of patients who reported that alcohol is used quite frequently (i.e., in average of 1-3 glasses per week): difference 20.5% (95% CI from 35 to 9%).

Daily physical activities

The analysis of physical activities (outside of work) and their frequency in everyday life, neither by analysis of the Pearson chi-square test (χ^2 = 2,497; df =4; p =0,645), nor by CIA of single statements, did not showed reliable difference between groups.

Chronic low back pain syndrome

Current low back pain episode

- Pain intensity

Patients in Group 2 demonstrated higher current low back pain intensity than patients in Group 1, the difference tested by t test for independent samples was statistically relevant (t=1,994; p=0,001). (***Table 2***)

Table 2 Current low back pain intensity in the study groups

Pain intensity characteristics	***Group 1 (n=69)***	***Group 2 (n=41)***
Mean	3,1	4,2
Standard deviation	1,2	1,8
*CI of mean value**	2,8–3,4	3,6–4,8

** calculated using the confidence interval analysis with $p < 0.05$*

7 (10%) patients from Group 1 and 14 (34%) patients from Group 2 their current low back pain intensity were marked with more than 5 points (after VAS), the proportion

difference tested by Pearson Chi square test presented relevant difference ($\chi 2$=9,592; df=1; p=0,002).

- Localisation

Patient proportion in the groups by current low back pain localisation (only in back, with irradiation to one leg or with irradiation to both legs) showed no significant difference ($\chi 2$ =7,266; df=2; p=0,262), most often mentioned pain localisation was in low back with irradiation to one leg: 53 (76,8%) patients in Group 1 and 24 (58,5%): Group 2 . Only 1 (1,4%) patient in Group 1 and 5 (12,2%) in Group 2 marked pain in low back that irradiate to both legs, but other patients - only in low back region.

- Nature

There was relevant (p<0,05) difference between the groups according to patients' description of their current low back pain nature: patients in Group 2 more often described their pain as continuous with episodes of exacerbation (difference 27,8% (95% CI from 43 to 9%). (***Table 3***)

Table 3 Current low back pain nature in the study groups

Pain nature	***Group 1 (n=69)***		***Group 2 (n=41)***	
	n	%	n	%
Continuous with episodes of exacerbation	33	47,8	31	75,6
Episodic	36	52,2	10	24,4

Patients in both groups as their *pain aggravating factor* most often mentioned long duration static loading (sitting, standing etc.). 14 (20,3%) patients in Group 1 and 19 (46,3%) in Group 2 as their pain aggravating factor marked psychological stress, as well patients in Group 2 more often marked that their pain aggravate both static loading and dynamic movements. There was relevant difference between groups according to pain aggravating ($\chi 2$=10,423; df=2; p=0,002).

Answers to the question: "*Do disagreements (disputes) in the family/ with parents / with friends aggravate your low back pain?"* given by the patients showed difference between the study groups. (***Table 4)*** The proportion presented relevant difference ($\chi 2$=12,95; df=2; p=0,001). Analysis of patients proportions after a single answer were found that patients from Group 2 more often marked that disagreements aggravates their pain (difference 34,1% (95% CI from 16 to 49%), but patients from Group 1 more often answered that they don't know (difference 18,3% (95% CI from 4,3 to 30%).

Table 4 Patients proportions in the study groups according to answers about disagreements

Do disagreements (disputes) in the family / with parents / with friends aggravate your low back pain?	***Group 1 (n=69)***		***Group 2 (n=41)***	
	N	*%*	*n*	*%*
Yes, aggravate	32	58,2	33	89,2
No, don't aggravate	21	30,4	6	14,6
I don't know	16	23,2	2	4,9

- Duration and onset

Duration of current low back pain episode in Group 1 was in average 8,5 (SD 5,4) months, in Group 2 - 9,2 (SD 6,3) month; neither CIA nor t test for independent samples did not confirm relevant difference between groups.

There was found relevant difference between groups after type of onset of current low back pain episode ($\chi 2$=18,009; df=1; p=0,0001) (***Table 4***). In Group 2 more often current low back pain had gradual onset (difference 39,4% (95% CI from 53 to 21%).

Table 5 Patients proportions in the study groups according to onset of current low back pain episode

Onset of current pain episode	***Group 1 (n=69)***		***Group 2 (n=41)***	
	N	*%*	*N*	*%*
Suddenly	39	56,5	7	17,1
Gradually	30	43,5	34	82,9

First low back pain episode

For all studied patients current low back pain episode was not their first low back pain episode. There was not found reliable (p<0,05) difference between the study groups according to duration of low back pain history (time of first low back pain episode): in Group 1 it was marked in average 7,6 ±8,3 years ago, but in Group 2: 9,9 ± 8,0) (t=1,389; p=0,168).

The analysis of results about settlement of first low back pain episode showed that patients from Group 2 more rarely (difference 39% (95% CI from 43 to 8%)) had remarked complete improvement (pain disappeared) and more often marked only partial improvement (difference 27,1% (95% CI from 44 to 8%)).

Other complaints and additional diseases/ injuries

Overall 62 (56.4%) of the studied patients (Group 1: 39 (56.5%) patients, Group 2: 23 (56.1%) patients; no reliable difference) at the time of evaluation had *complaints about sensory impairment.* 31 (28.2%) of patients noted an inconstant feeling of "tingling" in lower extremity, which was not specific to any zone of inervation by nerve root or periphery nerve, 27 (24.6%) of patients complained about impaired superficial sensation (the assessment of the patients confirmed reduced tactile skin sensation in the localisation of inervation of the corresponding nerve root), while the remaining 4 (3.6%) patients complained about hypersensitivity (tenderness) over the lateral surface of the thigh. There was not found difference between groups according to patients proportion by complaints about sensory impairment.

29 (26.4%) of the studied patients (Group 1: 21 (30.4%) patients, Group 2: 8 (19.5%): no reliable difference) noted the *complaints about movement restrictions.* 17 (15.5%) patients complained of limited motion at the low back (as the limiting factor was referred pain provocation or a feeling of stiffness, as the direction of movement was mentioned "all movements" or "bending and straightening"), whereas 11 (10%) patients complained of a feeling of instability in the leg (the same to which was pain irradiation) mainly in knee and ankle (lower extremity muscle strength was 4-5 points (after Kendall) and evaluation did not reveal any problems of passive stability in knee and/or ankle joint). Patients proportions in the study groups after complaint type did not show significant difference.

By analysis of complaints about *pain in other parts of the spine*, it was found that overall 76 (69.1%) of the studied patients complained of pain in upper part of spine: 58 (52.7%) complained of pain in neck, 6 (5.5%) – in thoracic spine, and 12 (10.9%) - both in neck and thoracic spine. But 34 (30.9%) of the studied patients did not complained of pain in other parts of the spine. The analysis of the study groups showed that in Group 1 a manifestation of pain in other parts of the spine was found in 53 (76.8%) patients, but in Group 2 in 23 (56.1%) patients (difference 20.7% (95% CI 3 to 38%)).

55 (50%) of the studied patients noted some additional disease, while 10 (9.1%) noted more than one additional disease. As the most common group of additional diseases was found cardiovascular diseases - in 24 (21.8%) patients (were reported such diseases as arterial hypertension, cardiac arrhythmias, ischemic heart disease). 17 (15.5%) patients noted some of the gastrointestinal diseases (most frequently mentioned were gastritis, gastric ulcer and disbacteriosis). There also were listed some endocrine (5 (4.5%) patients), lung (2 (1.8%) patients) and bone - joint (2 (1.8%) patients) diseases.

The analysis of occurrence of additional diseases among patients in both groups approved that in Group 1 more frequently patients noted presence of cardio-vascular diseases - 32 (46.4%) patients, but in Group 2 - 10 (24.4%) patients: difference of 22% (95% CI from 3 to 38%). While patients in Group 2 more frequently complained about some gastrointestinal disease - 12 (29.3%), but in Group 2 - 2 (2.9%): difference 26.4% (95% CI from 13 to 42%).

There were no significant differences between patients proportions in the groups by history of injuries and operations (not related to the spine).

Physical state

The analysis of mean values of *body mass index* revealed that in Group 1 BMI was 30.1 ± 8.6, but in Group 2: 26.8 ± 4.3. According to an independent sample t test there was found statistically significant difference between groups by mean BMI ($t = 1.982$, $p = 0.01$).

In Group 1 were 28 (40.5%) patients with normal weight, but in Group 2: 16 (39.0%). While increased body weight was in 21 (30.4%) patients from Group 1 and in 16 (39.0%) patients from Group 2. Obesity (according to BMI) was found in 20 (29.0%) patients from Group 1 and in 9 (22.0%) patients from Group 2. Patients proportions in the study groups after BMI interpretation did not show significant difference (($\chi^2 = 1,06$; df $= 2$; $p = 0,588$).

The results of the *lumbar spine and pelvic motor control* tests asserted that all analysed patients had motor control impairment in lumbar spine and pelvis. None of the patient neither in the active straight leg raising test (ASLR), nor in Trendelenburg test did not reach the normal motor control parameters, i.e., 0 points. (***Table 6***)

Analysis of study groups revealed reliable ($p<0,05$) difference between groups according ASLR test results (both tested by Pearson chi-square analysis of patients

distribution after tests result ((χ^2 = 13,56; df = 3; p = 0,004)and independent sample t test for mean value in groups (t = 3.511, p = 0.001)). Trendelenburg test results did not showed reliable difference.

Table 6. Results of ASLR test and Trendelenburg test in the study groups.

Results of tests		***1st group (n=69)***	***2nd group (n=41)***
ASLR test	*Mean*	4.4	4.9
	Standard deviation	0.6	0.7
	*Confidence interval of average result **	4.3–4.5	4.7–5.1
Trendelenburg test	*Mean*	4.5	4.5
	Standard deviation	1.0	1.0
	*Confidence interval of average result **	4.3–4.7	4.2–4.8

** calculated using the confidence interval analysis with p < 0.05*

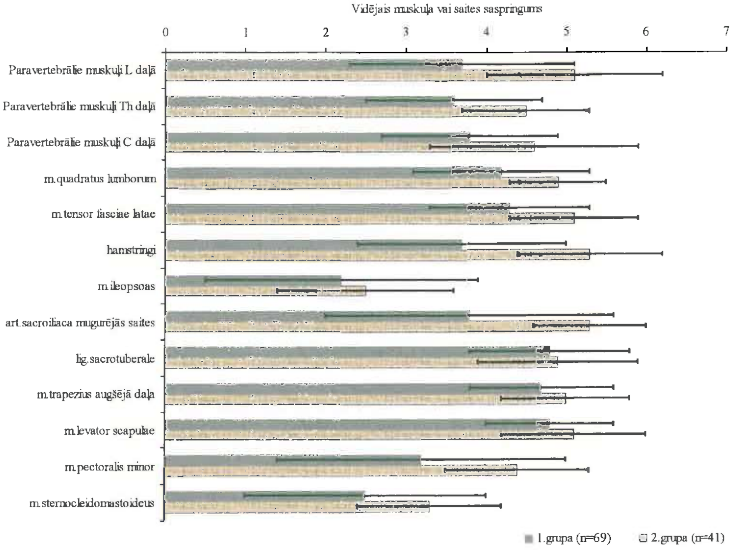
The results of *palpation tests* showed that the *muscle and ligament tension* in the various parts of the body is ranged from a normal tension (0 points) to very excessive tension (3 points).

The tension of paravertebral muscles (*m. erector spinae*) in the lumbar part ranged from mild symmetric tension (a total of 18 (16.4%) patients; 17 (24.6%) patients in Group 1; 1 (2.4 %) in Group 2) to very excessive symmetric (3 points on the right side and 3 points on the left) or asymmetric (3 points and 2 points) tension (total 50 (45.5%) patients; 25 (36,2%) in Group 1; 25 (61.0%) in Group 2).

As well tension of paravertebral muscles in the thoracic part ranged from mild to very excessive, and in Group 2 patients most frequently were found very excessive tension (Group 1: 17 (24.6%) patients, Group 2: 18 (43.9%)).

The analysis of muscle and ligament tension mean values and compartment between groups, according to an independent sample t test, there was found statistically reliable (p<0,05) difference between groups. Patients in Group 2 demonstrated more excessive muscle and ligament tension both in lumbar spine and pelvic girdle muscles and ligaments and in upper spine and shoulder girdle. (***Figure 1***)

Figure 1 Palpation test results (mean values and standard deviations) in the study groups



Patients' beliefs and manifestation of avoidance behaviour

FABQ physical activities subscale results in Group 1 were on average 14.2 ± 3.8 points, but in Group 2: 16.0 ± 5.7 points (t = 1.548, p = 0.126). However patients proportion in the groups according to the results of FABQ physical activities subscale showed reliable difference (χ^2 =13,13; df = 3; p = 0,004).

FABQ work subscale results in Group 1 were on average 19.3 ± 8.5, but in Group 2: 21.5 ± 11.3 points. According to an independent sample t test there was not found statistically significant difference (t = 0.672, p = 0.504). But patients proportion in the groups according to the results of FABQ work subscale showed significant difference (χ^2 = 12,37; df = 3; p = 0,006).

Sense of emotional support

Summarizing the results of evaluation for sense of emotional support from family, friends, colleagues at work and social activity groups, it was found that it ranged from 4 to 24 points, on average 17.9 ± 4.2. In Group 1: 19.6 ± 4.7, but in Group 2: 15.1 ± 5.0.

According to an independent sample t test difference is reliable (t = 4.546, p <0.0001). (***Table 7***)

Table 7 Sense of emotional support from different support groups in the study groups and t test results.

Emotional support group	***Group***	***Mean***	***Standard deviation***	***t***	***p***
Family	*Group 1*	5.1	1.6	4.491	0.001*
	Group 2	3.5	1.7		
Friends	*Group 1*	5.4	0.7	4.774	0.001*
	Group 2	4.4	1.4		
Work	*Group 1*	4.8	1.4	5.407	0.001*
	Group 2	3.1	1.7		
Social activities groups	*Group 1*	4.2	1.8	2.215	0.029*
	Group 2	3.4	1.8		

** average value difference in the t test is statistically significant*

Summarizing the results of rating for sense of support from health care professionals (family doctor, doctor - specialist, other health care provider) was found that totally it ranged from 0 to 18 points, on average 13.6 ± 4.8 points. In Group 1: 14.8 ± 4.8 points, but in Group 2: 11.3 ± 4.1 points. According to an independent sample t test difference was reliable (t = 3.887, p = 0.001).

There was also found reliable (p<0,05) difference between groups according to patients proportions in the groups by rating for sense of support from single support achievement source, that was approved by Pearson chi-square analysis.

Quality of life (results of SF-36 questionnaire)

The analysis of the study groups showed that patients in Group 2 in had relatively lower rates of physical functioning (PH) and physical health problems in greater extent affect participation in daily activities (RF) (***Table 8***).

Table 8. Results of PF and RF dimensions of SF-36 in the study groups and results of t test.

Parameter	*Group*	*Mean value*	*Standard deviation*	*t*	*P*
Physical Functioning (PF)	1st	73.8	14.5	3.813	0.001*
	2nd	62.2	17.0		
Role-Physical (RF)	1st	36.2	31.4	4.154	0.001*
	2nd	12.8	23.1		

** mean value difference according to t test is statistically reliable*

The rating of Bodily Pain (BP) dimension was estimated in the range from 0 to 74 points, on average 44.3 ± 13.4. In Group 1: on average of 49.5 ± 10.4, in Group 2: 34.9 ± 13.2.($t = 6.453$, $p = 0.0001$).

The scores of Role-Emotional (RE) were ranged from 0 to 100 points, on average 66.7 ± 34.9. In Group 1: 82.6 ± 24.0 points, in Group 2: 38.2 ± 33.8 ($t = 8.032$, $p = 0.001$). Also scores for mental health (MH) and vitality (VT) differed significantly between the groups (tested by t test): mental health (MH): Group 1: 67.2 ± 10.7, Group 2: on average 52.3 ± 14.5 ($t = 6.176$, $p = 0.001$), vitality (VT): Group 1: 68.1 ± 16.4, Group 2: 52.2 ± 11.1 ($t = 5.520$, $p = 0.001$).

The results of Social Function (SF) were estimated in the range of 25 to 100, on average 69.4 ± 15.3 points. Group 1: 77.2 ± 11.2, Group 2: 56.4 ± 11.9 ($t = 9.171$, $p = 0.0001$). General Health (GH) dimension ranged from 25 to 94, on average 60.1 ± 20.0 points. Group 1: 64.0 ± 19.9, Group 2: 48.4 ± 15.9 points ($t = 3.564$, $p = 0.001$).

Results of correlation analysis

The essential results of Spearman correlation analysis are demonstrated in ***Table 9***

Table 9 Results of Spearman correlations analyses in both groups

		Low back pain intensity (VAS)		*Duration of current pain episode*		*Anxiety level (HADS)*		*Depression symptoms (HADS)*	
		Group 1	***Group 2***	***Group 1***	***Group 2***	***Group 1***	***Group 2***	***Group 1***	***Group 2***
		R *p*	*R* *p*	*R* *p*	*R* *P*	*R* *p*	*R* *P*	*R* *p*	*R* *P*
Motor control	*ASLR test*	**0,482**** **0,001**	0,108 0,500	0,133 0,274	0,034 0,831	0,235 0,056	**0,363**** **0,002**	0,157 0,209	0,276 0,088
	Trendelenb. Test	**0,455*** **0,018**	**0,385**** **0,001**	**0,331**** **0,006**	**0,295*** **0,048**	0,010 0,934	**0,302**** **0,002**	0,049 0,697	0,021 0,901
BMI		-0,140 0,265	0,078 0,644	**0,745**** **0,000**	0,222 0,180	-0,174 0,173	-0,040 0,814	0,197 0,122	-0,136 0,422
Muscle tension in paravertebral muscles	*lumbar part*	**0,711**** **0,003**	**0,521**** **0,001**	**0,307*** **0,010**	-0,021 0,898	0,271 0,095	**0,452**** **0,001**	0,252 0,053	**0,458**** **0,000**
	thoracic part	-0,188 0,121	0,029 0,858	**0,381**** **0,001**	0,023 0,884	0,007 0,964	**0,311*** **0,011**	0,234 0,051	**0,299*** **0,015**
	cervical part	0,156 0,161	0,217 0,067	**0,325**** **0,006**	**0,559**** **0,001**	**-0,358*** **0,032**	0,116 0,356	**-0,267*** **0,041**	0,127 0,308
Anxiety level (HADS)		0,300 0,056	**0,543*** **0,021**	-0,182 0,052	**-0,552**** **0,001**	**1**	**1**		
Depression symptoms (HADS)		0,007 0,956	**0,525*** **0,013**	0,107 0,392	**-0,620**** **0,001**	0,042 0,804	0,221 0,056	**1**	**1**
Attitudes and avoidance behaviour (FABQ)	*physical activities*	**0,529**** **0,001**	0,312 0,208	0,167 0,184	-0,253 0,311	0,171 0,125	0,222 0,180	0,177 0,212	0,176 0,128
	Work	**0,431**** **0,001**	0,318 0,213	-0,145 0,256	0,160 0,539	0,087 0,964	-0,021 0,898	0,128 0,133	0,211 0,056
Sense of support	*family, friends, work and activities groups*	**0,314*** **0,019**	0,042 0,804	-0,126 0,315	0,069 0,684	0,131 0,161	0,243 0,061	**-0,245*** **0,044**	**-0,301*** **0,036**
	health care providers	**0,356**** **0,093**	0,134 0,429	**-0,382**** **0,002**	-0,023 0,891	-0,125 0,216	0,170 0,098	0,077 0,743	**-0,265*** **0,021**

Multiple linear regression analysis

In multiple linear regression analysis was found that in *Group 1 patients* there are reliable ($p<0,05$) and an equally strong impact on ***Physical Functioning (PF)*** both by lumbar spine and pelvic motor control (ATKP test: beta = -0.680, p = 0.028) and body mass (BMI: beta = -0.612, p = 0.002) ,and the patient's beliefs and avoidance behaviours (FABQ physical activities subscale) (beta = -0.661, p = 0.004). But relatively less impact demonstrate current pain intensity (beta = -0.253, p = 0.031) and duration of current pain episode (beta = -0.362, p = 0.035).

In *Group 2 patients*, the major impact on the Physical Functioning has current pain intensity (beta = -0.626, p = 0.020). Significant but in comparison with Group 1 less strong influence demonstrated the patient's beliefs and avoidance behaviours (FABQ physical activities subscale) (beta = -0.332, p = 0.032). Unlike the Group 1, in Group 2 PF are strongly affected by depression symptoms (HADS depression sub-scale: beta = -0.452, p = 0.011). Similar to Group 1 in Group 2 PF were found to be affected by lumbar spine and pelvic motor control (ATKP test: beta = -0.412, p = 0.021). Unlike the Group 1 there was not found significant influence neither of body weight, nor duration of the current pain episode.

It was found that in *Group 1 patients* ***participation due to physical health status (RP)*** is reliably ($p <0.05$) determined by motor control parameters (ASLR test: beta = -0.324, p = 0.034 and Trendelenburg test: beta = -0.232, p = 0.042) and by the patient's beliefs and avoidance behaviours (FABQ physical activities subscale: beta =- 0.233, p = 0.008), and pain intensity (VAS) (beta = 0.355, p = 0.001). But the strongest impact is from sense of emotional support received from family, friends, colleagues at work and interest groups (beta = 0.402, p = 0.012), as well as sense of support from health care providers (beta = 0.432, p = 0.032).

In *Group 2 patients* it was found that participation due to physical health status is reliably ($p <0.05$) and mostly influenced by current pain intensity (beta = -0.723, p = 0.001). Reliable, but less effect was from physical state variables (ASLR test: beta = -0.211, p = 0.010; Trendelenburg test: beta = -0.212, p = 0.035), psycho-emotional state variables (FABQ physical activities subscale: beta = -0.433, p = 0.02, HADS anxiety subscale: beta = -0.462, p = 0.025, HADS depression subscale: beta = -0.524, p = 0.035).

Significant, but relatively weaker impact was from pain duration (beta = -0.210, p = 0.033). Like in Group 1, patient participation due to physical health status was strongly affected by sense of support from family, friends, colleagues at work and interest groups (beta = 0.641, p = 0.001), as well as sense of support from health care providers (beta = 0.682, p = 0.001).

Pain syndrome and its impact on daily activities (BP) in *Group 1 patients* was determined both by motor control (ASLR test: beta = -0.478, p = 0.032; Trendelenburg test: beta = -0.366, p = 0.012) and the patient's beliefs and avoidance behaviours (FABQ physical activities subscale: beta = -0.432, p = 0.001 and FABQ work subscale (beta = -0.523, p = 0.001)). Reliable (p<0,05) effect was also from sense of support from family, friends, colleagues at work and the interest groups (beta = 0.441, p = 0.038), as well as from health care providers (beta = 0.487, p = 0.022).

In *Group 2 patients* pain syndrome and its impact on daily activities reliably (p <0.05), but in comparison with Group 1, less pronounced was found by motor control (ASLR test: beta = -0.214, p = 0.020; Trendelenburg test: beta = -0.218, p = 0.001). As well impact of patient beliefs and avoidance behaviours was found, but in comparison with Group 1 the influence was less (FABQ work subscale: beta = -0.213, p = 0.030; FABQ physical activity subscale: implications were not significant). Unlike Group 1, in Group 2 was found significant (p<0,05) impact of depressive symptoms (HADS depression subscale: beta = -0.642, p = 0.001) and anxiety level (HADS anxiety subscale: beta = -0.462, p = 0.001). Similar to Group 1, also in Group 2 strong influence was made by sense of support from family, friends, colleagues at work and interest groups (beta = 0.741, p = 0.008), as well as from health care providers (beta = 0.687, p = 0.001).

Correlation analyse of cytokines

The results of Spearman correlation analysis had showed statistically significant relationship between *pain intensity* and levels of such cytokines: IL-2 (R= -0, 32, p=0, 02), IL-1a (R=0, 33, p=0,002), IL-8 (R=0, 23, p=0, 04), IL-1b (R=0, 20, p=0, 04).

Correlation analysis pointed out that there is statistically significant moderate correlation between *current pain episode duration* and IL-6 (R=0, 33, p=0, 01) and IL-1a (R=0, 39, p=0, 02). Significant (p<0, 05), but not so strong correlation was found between

pain episode duration and IL-4 (R=0, 29), IL-2 (R= -0, 27), IL-1b (R= -0, 26), IL-10 (R= -0, 23), INF-g (R=0, 21).

Results showed that *depression* symptoms according to HADS score has moderate correlation with IL-6 (R=0, 40, p=0,003) IL-1a (R=0, 38, p=0, 01). Expression of depression symptoms had showed also significant (p<0, 05) relationship with INF-g (R=-0, 24), IL-10 (R=-0, 21), IL-4 (R=0, 26) and IL-1b (R=0, 20).

Level of *anxiety* according to HADS score correlated with IL-6 (R=0,41, p=0,01), IL-8 (R=0,39, p=0,01), IL-1a (R=0,31, p=0,03), IL-4 (R=0,30, p=0,03) and (R= -0,34, p=0,02).

Correlation analysis detected relationship between *sense of social support* and levels of cytokines: sense of support from family, friends, work and activities groups (total sum) correlated with IL-2 (R=0,25, p=0,01) un IL-6 (R= -0,20, p=0,03); sense of support from family correlated with IL-8 (R= -0,30, p=0,003), IL-1a (R= -0,23, p=0,03), TNF-a (R= -0,23, p=0,04), IL-10 (R=0,20, p=0,04); sense of support from work correlated with IL-2 (R=0,28, p=0,03) un IL-8 (R= - 0,23, p=0,04); but sense of support from health care professionals correlated with IL-2 (R=0,58, p=0,001), IL-4 (R= -0,55, p=0,004), IL-6 (R= -0,57, p=0,004), IL-8 (R= - 0,43, p=0,01).

Results of correlation analysis had showed that both of *motor control* test results correlated with some cytokines: IL-2 (ATKP: R=-0,41, p=0,02; Trendelenburg: R=-0,51, p=0,01), IL-10 (ATKP: R=-0,37, p=0,02; Trendelenburg: R=-0,41, p=0,02), INF-g (ATKP: R=-0,31, p=0,01; Trendelenburg: R=-0,41, p=0,01) un TNF-a (ATKP: R=0,36, p=0,03; Trendelenburg: R=0,35, p=0,01).

There was reliable (p<0,05) relationship between level of lumbar *muscle tension* and IL-8 (R=0, 25) and IL-6 (0, 28). *Body mass index* had showed significant (p<0, 05) correlation between IL-8 (R=0, 39), IL-1a (R=0, 30), IL-6 (0, 29) and IL-4 (R=0, 24).

Level of *physical functioning* according to SF-36 correlated with IL-2 (R=0.54, p=0.002), IL-10 (R=0.32, p=0.02), INF-g (R=0.32, p=0.02), IL-8 (R= -0.23, p=0.04), IL-1a (R= -0.23, p=0.03).

DISCUSSION

Chronic low back pain problem is a challenge for scientists as well for clinical practitioners. Still unanswered remains a question why on a background of overall increasing well-being and medical development number of patients suffering from low back pain is not decreasing but increases and becomes a main issue for economically active patients (from chronic low back pains suffers up to 45% of all adults). We tried to answer this question in this work.

Choosing criteria allowed us to form homogeny patients group suffering from chronic low back pain from point of view of clinical diagnosis and structural spine damage, e.g. all study subjects had a basic diagnosis of lumbar spine disc pathology with radiculopathy and all patients had radiological confirmed lumbar spine disc (-s) degeneration with impact on nerve root.

The results of clinical studies, performed during last 10 years have confirmed model of the polydimensional low back pain, integrating physical, emotional and social pathogenetic factors (*Freburger et al*, 2009; *Langworthy et al*, 2007; *Gunzman et al*, 2006; *Keef et al*, 2004; *Waddel*, 2004; *Linton*, 2005; *Nachemson*, 2000)

The results of our study indicate that chronic low back pain patients matched for socio-demographic features and structural spine damage reveal diversity by expression of emotional distress: 37,3% had emotional distress which was manifested with increased levels of anxiety and in association with clinically significant symptoms of depression. As important are our results on the clinical peculiarities that suggest about clinical subgroups of patients with chronic low back pain. In this respect, the assessment of emotional distress and its consequences deserves special attention in treatment of chronic low back patients.

Previous studies have confirmed higher prevalence of emotional distress in chronic low back pain patients in comparison to healthy controls (*Kim et al*, 2006; *Gatchel*, 2001), but results of our study show distinction in presence of emotional distress inside low back pain patients sample. Therefore factors that contribute to the development of emotional distress in patients with chronic low back pain should be investigated further to guide the development of effective therapeutic interventions.

The results of this study demonstrate that patients with emotional distress have particular clinical manifestation of pain syndrome. Considering that in this study emotional distress feature clinical symptoms of anxiety and depression we can discuss our finding in relation with results of other studies. Several studies have described and analysed pain syndrome as expression of anxiety and latent depression (*Linton*, 2005; *Haggman et al,* 2004; *Von Korff and Simon*, 1996; *Pennebaker,* 1982).

Relationship between anxiety and pain is clinically well known and scientifically well grounded. Anxiety might lower pain thresholds and result in physiological changes such as increase in muscle tension which in turn cause painful nociception. (*Linton*, 2005; *Gramling et al,* 1996; *Ohrback and McCall*, 1996) Equally there is evidence that also clinical symptoms of depression could lower the threshold and tolerance of pain (*Linton*, 2005; *Zelman et al*, 1991; *Pennebaker,* 1982).

It is important to remember that the pain promotes the development and remaining of negative emotions, thereby creating a vicious circle that in a case of long lasting pain syndrome involves also social and physical factors, hence jointly producing and maintaining complicated pathogenetic *circulus vitiosus* of pain syndrome. Therefore features of emotional distress should be appropriately noticed to provide better treatment for chronic low back pain patients.

In our study we have found that chronic low back pain patients with emotional distress present greater pain intensity. Previous studies (*Langworthy and Breen*, 2007; *Nachemson and Jonsson,* 2000; *Fisher and Johnston*, 1996) revealed similar feature.

As well we detected specific pain nature - gradual onset of pain and unremitting character of pain that can be aggravated both by physical overload and emotional problems. Such pain character seems interesting to discuss in connection with results of recent studies on neuropathic pain (*Turk et al,* 2010; Freynhagen et al, 2006) that emphasize psychosocial co-morbidities (anxiety, depression, sleep disorders) in neuropathic pain component and present evidence for psychosocial treatment approach in case of chronic neuropathic pain. Link between emotional distress features and neuropathic pain component of chronic low back pain need further research to improve both diagnostic and treatment approaches.

Results of this study show that from the first episode of low back pain fully recover 30,8% of patients with emotional distress (versus 57,4% of patients without emotional distress). It could be interpreted regarding results of recent studies about emotional distress as independent risk factor both in development of first pain episode

and chronic low back pain syndrome (*Shaw et al*, 2010; *Freburger et al*, 2009; *Linton*, 2000). Further longitudinal research is needed to inspect this presumption. While its stresses the essential role of early interventions and effective first time pain low back pain episode treatment.

Study results showed that patients with manifestation of emotional distress have more expressive musculoskeletal dysfunction (more affected lumbar spine motor control, more pronounced excessive muscle tension). Considering that all patients had similar structural spine damage, emotional disturbances (increased level of anxiety and clinical depression symptoms) have been considered as independent, concurrent pathogenetic factor in the development of musculoskeletal dysfunction in patients with chronic low back pain. There was found also correlation ($p<0,05$) between motor control test results and level of anxiety, that is clinically important relationship and has to be taken into account in physical state test's interpretation process. As well there was found correlation ($p<0,05$) between excessive muscle tension and anxiety level, and pain intensity that is frequently recognized in clinical praxis and described in literature. *(Ohrback and McCall, 1996)*

In compliance with the study results presence of high level anxiety and clinical depression symptoms are connected with worse health related quality of life that is characterised with more expressed disability. Similar finding have been described also by another authors (*Fisher and Johnson, 1996; Pincus et al, 2002*). Results showed that in patients with emotional distress there was more influence from pain syndrome to physical activities and participation in everyday life. This could be explained with altered pain perception, as well as with cognitive and behavioural manifestation of depression symptoms (as lack of interest, avoidance of social contacts etc).

We want to mark out the found fact that the participation in everyday activities (due to physical health, emotional disturbances, pain syndrome) was substantially affected by sense of support and the strength of this influence was more in the case of presence of emotional distress. This finding points out the importance of therapeutic relationships between patient and health care provider, supporting groups and psychotherapy in the treatment and rehabilitation of patients with chronic low back pain.

To understand complicated pathogenetic mechanisms in case of chronic pain (including lower back) integrating physical, emotional and social factors many

neiroimmunological studies are described during last few years (*Peng et al*, 2007; *Watkins et al, 2000)*, in which pathogenetic mechanisms are looked for in molecular level (cytokines). In accordance with recent scientific achievements immunological analysis to determine levels of cytokines in blood serum was included in our study that extend the understanding about bio-psycho-social aspects of chronic low back pain syndrome pathogenesis.

Indicators of several cytokines (TNF-a, IL-6, IL-8, IL-10, IL-2) showed reliable correlation with psychoemotional state (anxiety, depression, feeling of support) as well as with signs of physical state (motor control, muscle tension, body weight) and pain characteristics (intensity, duration) in patients with chronic low back pain. This finding reflects the unity of body and psyche, and complexity of pain syndrome. As two of the most characteristic cytokines appeared IL-10 and IL-8. It's interesting, that in literature are described studies that have approved a role of IL-10 in the pathogenesis of chronic, widespread pain syndrome, but for IL-8 has been showed its role in the pathogenesis of radicular pain syndrome in patients with lumbar spine disk pathology (*Seyler et al, 2006*; *Miyamoto et al, 2000*).

This study was designed as cross-sectional study to achieve the study aim – exploration and analysis of interaction and correlation. Inability to evaluate cause-sequence relation must be admitted as deficiency of this particular study design, but taking in account continuous and dynamic correlation of studied factors for the particular patient group, existence of precisely definable cause-sequence is questionable.

Selection of study subject (study group) was built using probability method and cluster selection example, it was satisfactory large and homogenous allowing processing and analysis of results. Basic selection was made independently from study performers, e.g., patients to rehabilitation were sent by general practitioners in accordance with acting legislature and regulations regulating availability of state financed rehabilitation.

Selection of participants for immunological analysis was made from basic group as secondary selection using randomization. Immunological analysis was allowed by homogeny structure of given selection – all patients were similar ($p<0,05$) by socio-demographical signs, emotional distress, manifestations of pain syndrome, by results of physical evaluation and quality of life with results of common group, as a result patient groups with emotional distress were formed (Group 2).

CONCLUSIONS

- Chronic low back pain patients matched for socio-demographic features and structural spine damage differ in expression of emotional distress and form clinical subgroups: patients with and without emotional distress.

- Interaction between emotional distress and pain syndrome leads to particular clinical features: explicit pain intensity, specific pain nature - gradual onset of pain and unremitting character of pain that can be aggravated both by physical overload and emotional problems, and marked pain impact to participation in daily activities.

- Musculoskeletal dysfunction – reduced lumbar spine and pelvic motor control and excessive muscle tension – for patients with chronic low back pain is connected both with physical ($p < 0,05$) and psycho-emotional ($p < 0,05$) factors. This finding has to be taken into account both in interpretation process of physical functional tests' results and during treatment process.

- Manifestation of emotional distress is connected with worse self-rated quality of life described with marked limitation in daily activities and participation determinate with direct and indirect impact of emotional distress features in patients with chronic low back pain.

- Quality of life in patients with chronic low back pain is substantially ($p<0,05$) affected by sense of emotional support and this influence intensify in the presence of emotional distress.

- Chronic low back pain syndrome complexity and biopsyhosocial factors interaction is illustrated by correlation of cytokines IL-10, IL-2, IL-6 and IL-8 level in blood serum and both pain intensity and duration, and characteristics of emotional and physical status, and level of physical activities.

PRACTICAL RECOMMENDATIONS

- There is essential need for appropriate assessment to notice clinical subgroups in expression of emotional distress to provide more successful treatment approach in chronic low back pain patients.

- It is necessary to take in mind that if there is manifestation of emotional distress (elevated anxiety level, clinically substantial symptoms of depression) this will affect both expression of pain syndrome and physical functional state in patients with chronic low back pain.

- Physical functional tests (such as, motor control tests, palpation tests etc.) in patients with chronic low back pain with manifestation of emotional distress is suitable to perform and evaluate not only in first consultation, but also after one or two treatment sessions, during which the level of anxiety and fear will be diminished.

- Taking into consideration, that feeling of emotional support, especially in case of emotional distress, substantially affects participation of patient in activities of everyday life and work, professionals, including physiotherapists, involved in treatment and rehabilitation of chronic low back pain patients, should be able to form professional therapeutic relations with patient, as well as should encourage formation of patients support groups.

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