Scandinavian Journal of Pain xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Scandinavian Journal of Pain

journal homepage: www.ScandinavianJournalPain.com

Clinical pain research

The cognitive impact of chronic low back pain: Positive effect of multidisciplinary pain therapy

Marcus Schiltenwolf[a], Michael Akbar[a], Eva Neubauer[a], Simone Gantz[a], Herta Flor[b], Andreas Hug[c,1], Haili Wang[a,*,1]

[a] Department of Orthopaedic Surgery and Traumatology, University Hospital of Heidelberg, Ruprecht-Karls-University of Heidelberg, Germany
[b] Department of Cognitive and Clinical Neuroscience, Central Institute of Mental Health, Medical Faculty Mannheim, Ruprecht-Karls-University of Heidelberg, Germany
[c] Spinal Cord Injury Center, University Hospital of Heidelberg, Ruprecht-Karls-University of Heidelberg, Germany

HIGHLIGHTS

- Chronic pain seems to impair both information processing and working memory.
- Attention and visual pattern recognition memory are not impaired in cLBP patients.
- There are interactions of cognitive function with pain, depression, anxiety, and medication.
- Multidisciplinary pain therapy may improve impaired cognitive function.

ARTICLE INFO

Article history:
Received 7 March 2017
Received in revised form 18 July 2017
Accepted 25 July 2017
Available online xxx

Keywords:
Chronic low back pain
Cognitive function
Multidisciplinary pain therapy

ABSTRACT

Objectives: Little is known about the affected cognitive problems in chronic low back pain patients. For this patient cohort research mostly focused on memory of pain, rather than cognitive difficulties related to pain. Chronic pain may be associated with specific (yet undefined) cognitive deficits that affect everyday behaviour. We set out to compare the cognitive function of patients with chronic low back pain (cLBP) in the course of multidisciplinary pain treatments before and after therapy.

Methods: Thirty-three patients with cLBP and 25 healthy controls between 20 and 70 years were recruited into the study. The inclusion criteria for patients were: (1) a history of at least 12 weeks of chronic myofascial low back pain without radicular pain sensation before enrolment; (2) grade II and higher chronicity according to von Korff; (3) no opioid medication. The patients recruited had a mean pain duration of 7.13 ± 7.16 years and reported a mean pain intensity of 6.62 ± 2.04 (visual analogue score, VAS). Their mean back function according to the Funktionsfragebogen Hannover (FFbH, a questionnaire comparable with the Health Assessment Questionnaire) was $52.39 \pm 20.23\%$.

At three time points (before therapy, 3 weeks and 6 months after therapy) the study subjects were assessed prospectively with a battery of visual memory tests from the Cambridge Neuropsychological Test Automated Battery (CANTAB). These included choice reaction time (CRT), pattern recognition memory (PRM) and spatial span (SSP). In parallel, the Trail-Making Test (TMT-A, TMT-B) and the Wechsler Adult Intelligence Scale (WAIS-III) were used to evaluate intelligence and cognitive flexibility.

Results: At the beginning of MDPT (T1), it took patients with cLBP significantly longer than HC to complete TMT-A (38.29 ± 19.99 s vs 30.25 ± 14.19 s, $p = 0.047$) and TMT-B (72.10 ± 26.98 s vs 55.99 ± 22.14 s, $p = 0.034$). There were no significant differences between patients and HC in CRT, PRM and SSP. Three weeks (T2) and 6 months (T3) after MDPT, TMT-A reaction time of patients significantly improved by 6.5 s and 8.1 ms (38.3 ± 19.9 s vs 31.8 ± 12.3 s, $p = 0.02$ and 31.8 ± 12.3 s vs 30.2 ± 8.9 s, $p = 0.021$, respectively). The patients' working memory was also better 6 months after MDPT ($48.8 \pm 11.1\%$ at T1, $51.2 \pm 11.9\%$ at T2, $57.1 \pm 10.9\%$ at T3, $p = 0.008$). Significant correlations among pain, depression/anxiety, medication and neuropsychological tests were found.

* Corresponding author at: Am Rebgarten 18, 69221 Dossenheim, Germany.
E-mail address: haili_wang2000@yahoo.de (H. Wang).
[1] These authors contributed equally to the work.

http://dx.doi.org/10.1016/j.sjpain.2017.07.019

Conclusions: These findings show that patients with cLBP have slowed speeds of information processing and working memory, but no alteration in attention and recognition memory. There are clearly interactions of cognitive function with pain, depression, anxiety, and medication. MDPT may improve the impaired cognitive function of patients with cLBP.
Implication: Health professionals should contemplate the results from this study when planning therapy strategies especially when prescribing pain medications such opioids to patients with chronic low back pain.

1. Introduction

Research conducted over the past 20 years has provided evidence of cognitive deficits in people with chronic pain [1–5]. Around 45–50% of these patients report cognitive deficits such as forgetfulness (23.4%), minor accidents (23.1%), difficulty finishing tasks (20.5%), and difficulty maintaining attention (18.7%) [6,7]. However, there are many discrepancies among results from different studies. The studies performed to date have several limitations: (1) data were obtained mostly from self-report measures and questionnaires. (2) Little work has focused directly on a group of patients with homogeneous diagnoses [8,9]. Cognitive impairment varies among different pain syndromes. This explains why contradictory findings have been noted for tests of for example verbal memory, with some studies [10–12], but not all [13,14], finding that chronic pain is associated with poorer performance. Similar inconsistencies are apparent for other cognitive domains. (3) The effects of psychotropic drugs on cognitive performance are contradictory [7].

Beside, little is known about the affected cognitive domains in chronic low back pain patients. For this patient cohort research mostly focused on memory of pain, rather than cognitive difficulties related to pain [9]. Apkarian [3] proposed that chronic pain may be associated with specific (yet undefined) cognitive deficits that affect everyday's behaviour. An association between slow reaction time and chronic low back pain has been observed [e.g. 15]. A further interventional study showed that an impaired psychomotor control in patients with chronic low back pain was reversible with successful rehabilitation [16] which suggests that the slower reaction time might be a consequence of chronic low back pain.

In the current study, we set out to measure the cognitive deficits in a homogeneous group of patients whose main complaint was chronic low back pain (cLBP) and to verify the effect of a multidisciplinary treatment on cognitive impairment in cLBP. We performed a comparative and longitudinal study to test the hypothesis that information processing function and working memory are impaired in patients with cLBP but are improved by multidisciplinary pain therapy incorporating a cognitive impairment component.

2. Patients and methods

2.1. Study subjects

Study subjects were recruited from the Department of Orthopaedic Surgery. Two groups of subjects were studied: patients with chronic low back pain (group 1, $n = 33$) and healthy controls with no pain (group 2, $n = 25$). All participants gave their written, informed consent to take part in the study and for their data to be published anonymously. The study was approved by the ethics committee of the University Hospital of Heidelberg, Germany and funded by the research fund of the Department of Orthopaedic Surgery and Traumatology of the University of Heidelberg.

The inclusion criteria for patients were: (1) age between 20 and 70 years; (2) a history of at least 12 weeks of chronic myofascial low back pain without radicular pain sensation before enrolment (grade II and higher chronicity according to Von Korff (Von Korff): grade I, low disability – low intensity; grade II, low disability – high intensity; grade III, high disability – moderately limiting; grade IV, high disability – severely limiting); (3) no opioid medication (non-opioid pain medication was allowed). Healthy controls had experienced no lower back pain and taken no pain medication in the past year. The patients recruited had a mean pain duration of 7.13 ± 7.16 years and reported a mean pain intensity of 6.62 ± 2.04 (visual analogue score, VAS). Their mean back function according to the Funktionsfragebogen Hannover (FFbH, German version; a questionnaire comparable with the Health Assessment Questionnaire) was 52.39 ± 20.23%. No significant differences of age, education level between both groups were found, but statistical significant difference of sex was determined. There were more female subjects in the patient group than in the healthy group (Table 1).

The exclusion criteria for both groups were: (1) gross brain damage, learning disability; (2) major mental disorder requiring recent hospitalisation, such as schizophrenia or psychosis.

2.2. Multidisciplinary pain therapy (MDPT)

Patients with cLBP underwent inpatient multidisciplinary therapy with medical, psychological, physical and social components: This comprised 6-h sessions on 5 days each week for 3 weeks, amounting to a total of 90 h. The goal of MDPT is to restore the patients' physical and psychosocial abilities, to expand their knowledge of back protection techniques and protective behaviour, to improve positive skills for individual coping and emotional control, and to increase the patients' activity levels on return to the workplace. It integrates physical exercises, ergonomic training, psychotherapy, patient education, behaviour therapy and workplace-based interventions in individual therapy and in-group sessions.

Table 1
Characteristics of study subjects.

	Group 1 ($n = 33$) cLBP Patients	Group 2 ($n = 25$) Healthy controls	p-value
Age (year)	49.82 ± 10.23 (28–71)	45.88 ± 9.24 (35–66)	ns
Female ♀	25 (75.8%)	10 (40.0%)	$p < 0.05$
Male ♂	8 (24.2%)	15 (60.0%)	
BMI	26.4 (18.5–35.4)	27.1 (18.7–47.8)	ns
High school (%)	88.57%	66.7%	ns
Higher education level (%)	11.42%	33.3%	ns
IQ (MWT-B)	27.00 ± 4.93	28.68 ± 6.28	ns
FFbH (%)	52.39 ± 20.23	96.0 ± 10.0	$p < 0.05$
Depression (HADS) (range 0–21)	9.24 ± 4.99	4.8 ± 3.7	ns
Anxiety (HADS) (range 0–21)	10.06 ± 4.44	4.4 ± 2.9 ♂ 5.2 ± 3.4 ♀	ns
Adjuvant	NSAIDs (5%) Antidepressant(6%)	0% 0%	

Please cite this article in press as: Schiltenwolf M, et al. The cognitive impact of chronic low back pain: Positive effect of multidisciplinary pain therapy. Scand J Pain (2017), http://dx.doi.org/10.1016/j.sjpain.2017.07.019