



Case report

Improvement in montreal cognitive assessment score following three-week pain rehabilitation program

Joann E. Bolton¹, Elke Lacayo², Svetlana Kurklinsky^{2,*} and Christopher D. Sletten²

¹ Department of Anesthesiology, Mayo Clinic Florida, 4500 San Pablo Road, Jacksonville, FL 32224, USA

² Department of Pain Medicines, Mayo Clinic Florida, 4500 San Pablo Road, Jacksonville, FL 32224, USA

* **Correspondence:** Email: kurklinsky.svetlana@mayo.edu; Tel: +9049532000; Fax: +9049561750.

Abstract: *Aim:* To demonstrate improvement in cognitive function following a 3-week Intensive Interdisciplinary Pain Rehabilitation Program. *Methods:* The Montreal Cognitive Assessment (MoCA) was performed at initial evaluation and on dismissal day of the program. *Results:* The patient had chronic, non-cancer lower back pain for over 15 years for which patient had myriad of treatments. Patient was directed to Intensive Interdisciplinary Pain Rehabilitation Program as a last resort treatment. The patient had moderate cognitive impairment when he joined the program (MoCA score of 17/30) that dramatically improved into the normal cognitive range by the end of the program (MoCA score of 26/30). *Conclusions:* Improvement in MoCA score was demonstrated after completion of the Intensive Interdisciplinary Pain Rehabilitation Program, which is the first demonstrated case.

Keywords: chronic pain; cognitive impairment; interdisciplinary pain rehabilitation; case report

1. Introduction

Chronic pain is a prevalent health problem in the United States [1] and Europe [2]. Unfortunately, current treatments for chronic pain are limited and may have significant side effects. Opioid prescriptions for chronic pain have been on a steady rise for the past 20 years. In 2006, 17.6 persons per 100 utilized opioids for greater than 30 days. This increased to 28.0 persons per 100 in 2012 [3]. Chronic use of opioid medications contribute to an increased use of opioids over time due to alteration

in pain pathways leading to opioid-induced hyperalgesia [4,5], addiction, and diversion [6,7]. Patients that have received long-term opioid treatments still had pain and had poor functional outcomes [8]. The number of fatal overdoses was greater than 350,000 people from 1999–2016 [9]. This led to a new Guideline for Prescribing Opioids for Chronic Pain by the CDC in 2016 [10].

Since the implementation of stricter guidelines for opioid prescriptions, there has been an increase in opioid overdose deaths [11] from July 2016 through September 2017 [11] and an increase in off-label use of non-opioids for pain [12]. This is due to a lack of new replacement therapies for chronic pain and lack of access to treatments that are shown to be effective like Interdisciplinary Rehabilitative Programs [13–15].

Interdisciplinary Pain Rehabilitative Programs (IPRPs) have been around for more than 40 years. However, due to the reluctance of third-party payers to compensate for this type of treatment, the number of programs has declined tenfold in the last two decades [14], thus limiting access of care to patients. IPRPs have high level of integration and harmonization of medicine, psychology, and rehabilitation services. In this model, the healthcare professionals work from the same facility, with daily meetings about the patients' progress, the same treatment vision is shared, and the same message is passed to the patients.

The team of IPRP consists of professionals such as, Physicians, Physician Assistants and Nurse Practitioners, Nurses, Psychologists, Physical therapists, Occupational therapists, Recreational therapists, Vocational counselors, Pharmacists, Nutritionists/dieticians, Social workers, Biofeedback Therapist, Chiropractors, Massage Therapist, Complementary and Alternative Medicine staff, Researchers, language interpretive services, substance abuse counseling, Support staff, and Volunteers. Intensive IPRPs consist of more than 100 hours of treatment, lasting 3 to 4 weeks.

Intuitively clinicians are aware that strong opioids can induce cognitive decline, however in the setting of chronic pain it can be difficult to delineate the role of opioids since chronic pain itself can contribute to cognitive deficits [16–19]. Studies regarding the influence of opioid consumption on cognitive abilities so far have had minimal to no effect [16,20] likely due to patients in the studies receiving relatively low doses of opioids. Currently there are no studies showing if cognitive decline due to chronic pain can be reduced with Intensive IPRPs.

2. Methods

Patient's medical history and medication use were obtained from the electronic medical record. Patients admitted to this program have chronic, non-cancer pain refractory to usual interventions and experience impairment in daily functioning. Patients with severe psychiatric impairment and/or cognitive impairment were excluded.

2.1. Pain scores, SF-36 general health perceptions, and the Pain Catastrophizing Scale

Pain scores, SF-36 general health perceptions, and the Pain Catastrophizing Scale were obtained from an internally stored computer-based questionnaire. The measures were collected on admission day of the PRC program in the manuscript referred to as "pre" value, and on dismissal day as "dismissal" value.

2.2. *The Montreal Cognitive Assessment (MoCA)*

MoCa was designed as a rapid screening instrument used to identify cognitive dysfunction in medical populations. It has been validated with different neurodegenerative diseases and substance use disorders [21]. The following cognitive domains are assessed: attention and concentration, executive functions, memory, language, visual-constructional skills, conceptual thinking, calculations and orientation. The time needed to administer the MoCA is approximately ten minutes. The total possible score is thirty points and a score of twenty-six or greater is considered normal. One point is added to the score for an educational level equal to or less than 12 years of formal education.

2.3. *Numeric Pain Rating Scale*

Pain scores were assessed via Numeric Pain Rating Scale (NPRS). The scale is 0 to 10 with 0 indicating no pain, 1–3 mild pain (interfering with activities of daily living (ADL)), 4–6 moderate pain (interferes significantly with ADL), and 7–10 severe pain (disabling, unable to perform ADL) [22]. The clinically significant change for the NPRS is a 2 point change, while a 1 point drop on the NPRS is seen as mild improvement [23].

2.4. *SF-36 general health perceptions (SF-36 GH)*

Reflect patient's physical and emotional health attributes for the last month [24]. The raw scores were converted to T scores with a normative from the general US population, using published age- and sex-specific mean scores and standard deviations [25]. SF-36 scoring is on a 0–100 scale where higher scores indicate better health [24–26].

2.5. *The Center for Epidemiologic Studies Depression Scale (CESD-R)*

Depression was measured with the CESD-R, a 20-item questionnaire with 0–3 points per question [27]. Total score ranges from 0 to 60, with a total score equal to or above 16 indicating a risk for clinical depression.

2.6. *The Pain Catastrophizing Scale (PCS)*

Pain catastrophizing has been described as an exaggerated negative mental set associated with actual or anticipated pain experiences [28]. The PCS comprises of 13 questions scored on a 5 point scale from 0 (not at all) to 4 (all the time). The score ranges from 0–52, with higher scores representing more pain catastrophizing. APCS of 20 is in the 50th percentile, while a score of 30 is in the 75th percentile [29,30].

2.7. *Canadian Occupational Performance Measure (COPM)*

The COPM is a quality of life measure designed to capture limitations in relation to activities of daily living and is administered by Occupational Therapists. Patients rate their performance and satisfaction in the five most important issues identified in the assessment in the areas of self-care,

leisure and productivity. The scale is 0–10 where 0 is the lowest score and 10 is the highest [31,32]. The average COPM performance for the geriatric rehabilitation population entering the program is 2.8 and average satisfaction is 2.3 [33]. A change of 2 or more points on any single item has been shown to be clinically significant [34].

2.8. 6-minute Walk Test (6mWT)

The 6mWT is a sub-maximal, performance-based measure of functional capacity and is performed by Physical Therapists. Patients are given instruction before the test begins to walk up and down the hallway safely, covering as much distance as possible in 6 minutes without running [35]. The average 6mWT for healthy elderly men is 400 m [36].

2.9. The Pain Rehabilitation Center (PRC)

Is a 3 week, intensive program consisting of treatments that incorporate physical reconditioning, occupational therapy with a focus on activity moderation, biofeedback, relaxation training, stress management, chemical health education, and behavioral interventions to reduce emotional distress [37,38] and treat pain related impairments in patients with chronic non-cancer pain. The goals of the PRC program include: consistent exercise targeting overall fitness, attention to stable and moderate levels of daily activity with graded exposure to activity, gradual reduction of fear-avoidance behaviors and incremental elimination of other pain behaviors. The interdisciplinary treatment approach focuses on moderation and balance of daily activity with modification as needed to increase functional independence and participation in life roles, while at the same time reducing and eliminating opioid analgesics, improving emotional status, and teaching maintenance strategies.

3. Case

An 82-year-old male was admitted to the PRC for the treatment of chronic low back pain. The patient's pain began prior to his first back surgery in 1997. At the time of admission, the patient had the following past medical history: degenerative joint disease of the lumbar spine, neck pain, sacroiliac pain, lumbar post-laminectomy syndrome, lumbosacral radiculopathy, lumbar spondylosis without myelopathy, left rotator cuff dysfunction and depressive disorder. The patient reported increased pain with movement and experienced relief with lying down. He reported a pain intensity score of 7/10. He also experienced bilateral lower extremity weakness requiring him to use a cane, walker or wheelchair. Previous therapies for pain included physical therapy, nerve block injections, facet joint injections, epidural injections, lumbar spine fusion, spinal cord stimulator, TENS unit, intrathecal pump trial and multiple medication trials. He denied numbness, tingling, or disturbances in sleep.

The patient was on several medications which can affect cognitive functioning, including opioid analgesic at a morphine oral equivalent of 120 mg per day. He was also using alprazolam 0.375 mg at bedtime. At his initial evaluation, he acknowledged a decrease in cognitive function.

Both he and his wife endorsed his increasing difficulty completing tasks, reading, and remembering recent events.

At the initial evaluation, the patient's MoCA score was 17/30 (Table 1). The patient's follow up MoCA assessment score on his dismissal day was 26/30 with an improvement in most categories with

the exception of the Naming section and Educational level where the patient had already obtained the maximum number of points (Table 1).

During the PRC program, the patient demonstrated an improvement in the quality of life measure-COPM (pre Performance was 3 and pre Satisfaction was 3; dismissal Performance was 8 and dismissal Satisfaction was 7), 6mWT (pre was 163.4 m and dismissal was 283.5 m), SF-36 GH (pre was 39.3 and dismissal was 51.5), and PCS score (pre was 43 and dismissal was 38, going from 95 to 90 percentile). Patient's pain score decreased from 7/10 to 6/10 on the NPRS. With a scheduled taper, he discontinued medications by day thirteen (Table 2).

Table 1. MoCA assessment before and after the PRC program. A normal score is 26 or greater. One point was added to the patient's score for an education level of less than or equal to 12 years. *Scoring: No points are given for Trials One and Two.

MoCA score breakdown	Patient's Initial Scores	Patient's Final Scores	Maximum possible points
Executive	3	4	5
Naming	3	3	3
Memory Recall*	0	0	0
Attention	3	5	6
Language	1	2	3
Abstraction	0	2	2
Delayed Recall	1	3	5
Orientation	5	6	6
+ 1 for education \leq 12 years	1	1	(not included)
Overall Score	17	26	30

Table 2. Patient's medications prior to admission to the PRC program. All of these medications were tapered and discontinued by day 13.

Medication	Frequency
oxycodone 20 mg extended release	1 tablet by mouth every 12 hours
oxycodone 40 mg extended release	1 tablet by mouth every morning
alprazolam 0.25 mg tablet	1.5 tablets each night

4. Discussion

While it has been shown that patients experience significant improvement in emotional and physical functioning following the PRC program [38], this is the first case where improvement of cognitive function has been demonstrated. This patient entered the program acknowledging a notable decline in cognitive functioning. This decline had led to decreased independence, the need for frequent cuing, and increased safety concerns. At the time of admission, it was not entirely clear what factors were responsible for this decline. Given his age, physical deconditioning, and medication use, his cognitive decline could have been due to early dementia, depression, and/or medication effects. He was safely tapered off all psychoactive medications. He demonstrated objectively on his initial MoCA that he was experiencing moderate to severe cognitive impairment. At the end of the program his MoCA score demonstrated normal cognitive function. Patient's physical functioning improved by 73.5%

(120.1 m) through the 6mWT measure, which is greater than 2 times the minimal clinically important difference of 50 m [39]. Patient's overall health improved from 39.3 at admission to 51.5 at dismissal using the SF-36 GH, with a change of 12.2 shown to be clinically significant [40]. Upon admission, patient was below the average SF-36 GH score for the 80–84 year old population which is 52.1 [41]. By the end of the program his SF-36 GH score was close to the average.

For the treatment of older adults with chronic pain, The American Geriatrics Society recommends interdisciplinary pain rehabilitation programs (AGS Panel, 2002). It has been demonstrated that patients on long-term opioid therapy who completed an interdisciplinary chronic pain program with opioid withdrawal experienced improvement in mood and functioning at the completion of the program and at six months post completion [42,43]. It has also been shown that, geriatric patients who exercise improve their MoCA score, but the change was much less substantial than what we saw in our patient.

5. Conclusions

This case exhibits a patient with chronic pain who experienced cognitive impairment that was likely secondary to opioid and benzodiazepine use. The PRC program provides a multimodal approach to chronic pain management that eliminates medications while improving overall physical, mental and cognitive functioning. Elderly patients are more prone to suffer from chronic pain and an average of 20% of this population are currently on opioid medications (Moriya & Miller 2018). A further research question is to investigate the prevalence of suspected dementia versus the effects of opioid use in the elderly population.

The limitation of our study is that it was done on one patients and we would like to have a larger study in the future where we would have patients with mild cognitive decline enrolled in our program to see their improvement.

Conflict of interest

The authors declare no conflict of interest.

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