

Catastrophizing and Fibromyalgia: A Mini-Review

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Abstract

Fibromyalgia is a syndrome characterized by widespread muscular-skeletal pain without any significant alterations upon physical examination and radiological tests. From an analysis of the literature, it appears that in subjects affected by FM there is a tendency to catastrophize pain (that is, a negative assessment of pain and its consequences) and that this, in turn, is associated with psychological stress (anxiety, depression), with the experience of the pain itself, and adjustment to the illness. The aim of this study is to provide a synthesis of the most recent studies that investigate the relationship between pain, catastrophizing of pain and emotional distress in subjects with fibromyalgia, highlighting also the neurobiological correlates of catastrophizing and the treatments considered efficacious for fibromyalgic patients. Studying the cognitive, affective and biological variables that influence pain in fibromyalgia may help us to set up treatments that are more specific and effective for this type of patient.

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Introduction

Fibromyalgia

Fibromyalgia is a chronic syndrome characterized by widespread muscular-skeletal pain that may not be attributed to any significant alterations resulting in the physical examinations. This painful symptomatology is accompanied by areas of tenderness to digital acupoint pressure, defined 'tender points', and to a series of symptoms including cognitive disorders, insomnia, fatigue and mood disorders [1].

The American College of Rheumatology (ACR) has proposed some criteria for the diagnosis of fibromyalgia: the presence of widespread muscular-skeletal pain for at least 3 months and tenderness to digital acupoint pressure in at least 11 tender points out of the 18 possible points considered [2]. In 2010 the ACR proposed new diagnostic criteria for FM which along with pain include common symptoms such as fatigue, sleep disturbances and cognitive problems [3].

Assessment of the patient should include consideration of symptoms such as chronic headache, irritable bowel and bladder, primary dysmenorrhea, restless legs syndrome, sicca or Sjögren syndrome and others. Some associated functional illnesses are,

in actual fact, more common in fibromyalgic patients than in the general population [4]. The aetiology of FM is still unknown to date, but it has been hypothesized that the etiopathogenesis is multifactorial and includes genetic factors, the immune system, the neuroendocrine system and environmental factors [1]. The WHO (World Health Organization) has estimated that the prevalence of FM in the world population varies between 3 and 6% (WHO, 2008). Fibromyalgia presents higher comorbidity rates in comparison with the general population of psychiatric disorders, in particular with anxiety and depression [5]. Some studies have shown a higher prevalence of personality disorders in fibromyalgic patients compared to the general population; specifically, obsessive-compulsive disorder, avoidant, borderline and passive-aggressive disorders of personality seem to be the ones most represented in this type of patient [5].

Catastrophizing of pain in fibromyalgia

One of the elements that is most involved in the chronicization of pain is a cognitive attitude denoted catastrophism; this construct has been widely studied in the literature on pain and is defined as the tendency to interpret the experiencing of pain in an excessively negative manner, amplifying the level of threat of the same [6]. Focusing on the study of the psychological variables

that influence chronic pain, research has demonstrated that the catastrophizing of pain is a significant predictor of emotional distress (anxiety and depression), of the severity of pain and of the adjustment to the illness and that it negatively influences treatment outcomes (Lami et al., Segal et al.). The subject who tends to catastrophize focuses on the pain stimulus and is unable to distract his attention from it, attributing more importance than is necessary also to stimuli that are not painful and thus amplifying the sensation [7]. Subjects may manifest attitudes of hypervigilance towards the onset of pain and avoidance of anything that may be the cause of it [8]. It has been observed that high levels of catastrophizing assessed in adults not suffering from pathologies correlated to pain may anticipate the future development of chronic pain and the use of the health services for treatment of the same [9,10]. Lami et al. have investigated the role of pain catastrophizing, acceptance of pain and coping strategies as predictors in adaptation to the experiencing of pain in a sample of fibromyalgic subjects. The study shows that pain catastrophizing is correlated with higher levels of pain, emotional distress and disability while, in contrast, pain acceptance (readiness to accept pain without trying to reduce, change or control it) was associated with lower levels of depression, anxiety and maladjustment. Pain catastrophizing emerged as the only significant mediator between pain and emotional distress (depression and anxiety); as such, the negative evaluation of pain as threatening/dangerous plays a more important role than the pain itself in determining the affective experiencing of anxiety and depression correlated with it. Also, in the study of Estevez-Lopez et al. the construct of catastrophizing takes on an important role in the adjustment to the illness in fibromyalgic subjects. The study shows that a high level of catastrophizing promotes a subjective sensation of reduced capacity to carry out significant everyday chores that persons with FM are objectively able to do. In a sample of women with FM, the subjective perception of their own physical functioning was as such more impaired in comparison with their objective functioning. Also, Segal et al. pointed out that catastrophizing is a significant predictor of the severity of pain, regardless of fatigue, age, depression or anxiety, in patients with Sjögren syndrome. Niedestrover et al. confirm the data in the literature with regard to the role of catastrophizing and the fear of pain that increase the risk of causing adverse outcomes related to pain; specifically, these variables independently predict the number of areas of pain in the 24 hours following the experimental induction of the pain itself.

In short, in fibromyalgic subjects, high levels of catastrophizing are associated with more severe and widespread forms of pain and with a greater frequency of emotional disturbance [11-13]. Furthermore, catastrophizing has revealed a positive association with the number of tender points found in a sample of subjects with fibromyalgia [14,15]. In women affected with fibromyalgia, catastrophizing has shown to be associated with a reduced pain threshold and tolerance to color [7]. Moreover, it has been shown to be correlated with negative affectivity [6].

Neurobiological correlates associated with pain catastrophizing

Exactly which are the neurobiological correlates of the tendency to catastrophize the experiencing of pain has been subject of investigation in the literature. In the study carried out by Lee et al. [16] the authors tried to understand which cerebral circuits are activated during pain catastrophizing. A functional MRI scan revealed that in fibromyalgic subjects, pain catastrophizing implicates the *Default mode network*, and in particular the posterior cingulate cortex. In fact, during the performance of tasks in which subjects were led to catastrophize reflecting on their pain, activation of the ventral posterior cingulate cortex was reported; in contrast, activation of the dorsal anterior cingulate cortex during performance of the same tasks was specifically associated with the severity of the clinical pain and the level of impairment it caused.

The study carried out by da Schreiber et al. [17] tried to shed light on the mechanism underlying the *painful after-sensation (PAS)*, that is the prolonging of the painful sensation usually present in fibromyalgic subjects, investigating whether this aspect may be associated with pain catastrophizing. The results showed that the severity of PAS does not seem to be correlated with trait and state catastrophizing. The severity of the prolonging of the painful sensation would rather seem to be associated with a reduced deactivation of the temporal medial lobe (amygdala, hippocampus, para hippocampal gyrus).

In their study in 2017, Lazaridou et al. [18] investigated the neural bases of the positive effects (reduction of hyperalgesia and pain catastrophization) found in fibromyalgic subjects after treatment with cognitive-behavioural therapy. The authors found that catastrophizing correlates with increased state of rest of the functional connectivity between the primary somato sensorial cortex (S1) and the anterior insula. Fibromyalgic patients treated with cognitive-behavioral therapy (CBT) showed a reduction of the connectivity at rest between S1 and medial/anterior insula, and this would appear to be associated with the decrease of pain catastrophizing linked to the treatment with CBT. The results have thus contributed to supporting the evidence in literature underpinning an association with the connectivity between S1 and insula, pain and catastrophizing, therefore suggesting that CBT could partially help to normalize the cerebral responses relating to fibromyalgic pain through the reduction of catastrophizing.

Kim and collaborators [19] compared the MRI scan images of fibromyalgic subjects with those of healthy controls, in phases of rest and during the administration of a painful stimulus. During the rest phase, the fibromyalgic subjects showed a decrease of connectivity between ipsilateral and transversal multiple S1 sub-regions, and this was correlated with the severity of pain. In comparison with the rest phase, the pain phase produced an increase of connectivity between S1 and anterior bilateral insula in fibromyalgic subjects, but not in the healthy controls. Moreover, in the fibromyalgic patients, this was correlated with the intensity and the catastrophizing of pain. The study carried

out by Ellingson et al. [20] with functional MRI scan showed that the ability to modulate pain during performance of a distracting task varies among fibromyalgic subjects and is associated with catastrophizing. A strong association was found between pain, catastrophizing and activation of the dorsolateral prefrontal cortex. Furthermore, there appeared to be no difference in the relation between catastrophizing and modulation of pain among fibromyalgic subjects and healthy controls. The study thus proves that the tendency of an FM patient to catastrophize pain influences his/her capacity to activate the central nervous system to inhibit pain during performance of a distracting task. Catastrophizing would thus seem to have a role in the maintenance of pain and associated symptoms in fibromyalgic subjects.

The study carried out by Loggia et al. pointed out the role of the lateral prefrontal cortex in the pathophysiology of fibromyalgia correlated to hyperalgesia. The authors demonstrated that in FM subjects, individual levels of catastrophizing were associated with a reduced anticipatory cerebral activity of pain and that this contributed to the hyperalgesic effect of the catastrophizing. Moreover, the anticipatory activity of the lateral prefrontal cortex mediated the association between scores obtained in measurement of the catastrophizing and the sensitivity to mechanical pain. The authors further demonstrated how catastrophizing was associated to reduced involvement of the descending pain control.

Treatment

As far as treatment of fibromyalgia is concerned, the literature reports heterogeneous approaches, in line with the heterogeneity of the symptoms of the illness. Martínez and colleagues [21] showed that cognitive-behavioural therapy significantly reduces fatigue, daily functioning and quality of sleep in many of its facets, in comparison with simple sleep education. Other studies [22] have underlined how CBT, with additions and adjustments for chronic pain, may significantly reduce the distress and fear linked with movement and thus improve disability in adolescents affected with FM. With regard to state-of-the-art therapies, Brooks and colleagues [23] analyzed the relation of mindfulness with some variables, including depression, catastrophizing, and perceived stress. This study has pointed out how mindfulness, that is the capacity to deliberately pay attention to the present moment, plays a fundamental role as protective factor with regard to the negative effects of a chronic pathology such as FM. These results would suggest mindfulness-based interventions (MBI) for treatment of stress and depressive symptoms in FM, in order to improve patients' quality of life and the symptomatology linked to these factors.

Some recent studies have shown how education both regarding neurosciences and the physiological part of pain, may positively influence the nociceptive sensation, state of health,

catastrophizing and disability deriving from the condition of chronic pain. Morris and colleagues [24] have illustrated a specific pattern of cerebral activation, elicited by *virtual reality exposure therapy*. Patients with FM who were subjected to treatment in fact demonstrated that stimulation modified the functioning of some areas (for example, *right posterior cerebellum, the right inferior frontal gyrus and the left thalamus*) which amongst other factors coincide with catastrophizing.

Van Oosterwijck and colleagues [25] addressed the issue of neuroscientific education of pain in their research, the aim of which was precisely to investigate the effect on FM patients of the study of written material on the subject of pain. Educational lessons on pain were administered to the patients, the effects of which, when measured, showed scarce improvement in the areas investigated. In justifying these results, the authors suggest human intervention associated with the education as a crucial factor for the reduction of pain and psychological symptomatology. In parallel, V. Oosterwijck and collaborators [25], conducted a study with the aim of testing education on pain; their hypothesis was to see whether intensive education regarding the neurophysiology of pain, carried out by expert physiologists, could in any way influence patients' psychological condition. The results of this study would appear to demonstrate how FM patients can benefit from being educated, limiting the tendency to worry and increasing functioning and general wellbeing. The study does not, however, show how educating patients about pain (and thus the increase in knowledge, compared to the functioning of the system itself) may specifically reduce catastrophizing, and other features such as hypervigilance.

Conclusion

From this analysis of the literature, it emerges that there is a certain tendency in FM subjects to catastrophize pain and that this, in turn, is associated with greater severity of pain perceived, with higher levels of psychological stress (anxiety and depression) and worse adjustment to the illness [26]. The relation between pain catastrophizing, psychological distress and disability has become of increasing interest to the scientific community. Detecting the psychological variables that influence the level of physical and psychological impairment in patients with FM has allowed to identify at an early stage those who could benefit from therapy targeted at reducing the mechanisms that maintain and aggravate the symptomatology, thus worsening patients' quality of life. There is scientific evidence of the involvement of specific cerebral areas, in particular, the dorsolateral prefrontal cortex, in pain catastrophizing. Some psychoeducational treatments regarding pain, especially those supported by the presence of a clinician who implements the therapy directly, have shown to be useful in improving quality of life in patients with FM and in influencing the mechanism of pain catastrophizing.

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