



Instructional Lecture

Association between brain and low back pain



Shin-ichi Konno*, Miho Sekiguchi

Department of Orthopaedic Surgery, Fukushima Medical University School of Medicine, Japan

ARTICLE INFO

Article history:

Received 30 August 2016

Received in revised form

24 August 2017

Accepted 2 October 2017

Available online 20 November 2017

ABSTRACT

Most chronic low back pain includes elements of nociceptive pain, neuropathic pain, and nonorganic pain. We conducted screening for nonorganic pain with use of the Brief Scale for Psychiatric Problems in Orthopaedic Patients (BS-POP), which is simple and can be used for multidimensional assessment. Research on pain areas using functional magnetic resonance imaging (fMRI) and positron emission tomography has shown that the dopamine system contributes to the pathology of chronic low back pain. Chronic low back pain patients show decreased activation of the anterior cingulate cortex, prefrontal cortex, and nucleus accumbens. Given that both the anterior cingulate cortex and prefrontal cortex belong to the descending inhibitory system, and that the nucleus accumbens, which is involved in the dopamine system, releases μ -opioids that act to relieve pain, decreased activation in these three brain regions may be related to decreased function of the descending inhibitory system. A pathological condition that can be explained at the molecular biological level clearly exists between chronic low back pain and psychosocial factors, and investigations of a pathological condition of chronic low back pain including brain function are needed.

© 2017 The Japanese Orthopaedic Association. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Orthopedists play a major role in dealing with the various diseases that cause chronic low back pain, but patient expectations cannot be said to be fully satisfied. One reason for this is the complexity of the mechanisms involved in chronic low back pain. Since social and psychological factors are involved in the pathogenesis of chronic low back pain, evaluating the condition of the patient is not a simple task. Restrictions in daily activities from pain affect not only the level of physical health, but also social participation and level of satisfaction with health [1]. Conversely, the existence of psychosocial factors is a factor in the occurrence of low pain and with disability, and contributes to chronicity [2–4]. In recent years, analysis of brain activity has become possible with functional brain imaging and other techniques, and the mechanisms underlying chronic low back pain are gradually being elucidated.

1.1. Evaluation for psychosocial factors underlying chronic low back pain

Pain is generally categorized into the three pathological conditions: nociceptive pain, neuropathic pain, and nonorganic pain. The

majority of cases of chronic low back pain are also thought to include these three elements of nociceptive pain, neuropathic pain, and nonorganic pain [5]. However, determining the degree to which nonorganic pain is involved in chronic low back pain is not easy. We use the Brief Scale for Psychiatric Problems in Orthopaedic Patients (BS-POP) (Tables 1a and 1b) (Japanese version [6], English version [7]). This tool is useful for orthopedic surgeons and primary-care physicians to assess the psychiatric problems of patients. The BS-POP has a physician version and a patient version. The physician version (Table 1a) consists of eight questions with total scores ranging from 8 to 24 points, with the physician answering each question based on their assessment of the patient. The patient version consists of ten questions with total scores ranging from 10 to 30 points, and is completed by the patient. According to the validity of the BS-POP compared with the Minnesota Multiphasic Personality Inventory (MMPI), the physician version of the BS-POP is correlated with the MMPI scale in hysteria ($\gamma = 0.49$) and hypochondriasis ($\gamma = 0.43$). While the patient version of the BS-POP is correlated with the scale in hysteria ($\gamma = 0.49$), hypochondriasis ($\gamma = 0.43$), and depression ($\gamma = 0.4$) [8]. Neither version of the BS-POP is influenced by age, sex, or degree of pain. A patient with a score ≥ 11 on the physician version, or ≥ 10 on the patient version and ≥ 15 on the patient version indicates the presence of psychiatric problems [8]. The BS-POP has shown reliability, validity, reproducibility, and responsibility [7,9]. The English version of the BS-POP has been back-translated and compared to

* Corresponding author. Department of Orthopaedic Surgery, Fukushima Medical University School of Medicine, 1-Hikarigaoka, Fukushima City, Fukushima, 960-1295, Japan. Fax: +81 24 548 5505.

E-mail address: sfortho@fmu.ac.jp (S.-i. Konno).

Table 1a
Questionnaire for Medical Personnel (for BS-POP physician use) English version.

Questions	Responses and scores		
1. The patient's pain appears uninterrupted.	1 That is not the case.	2 The pain is intermittent.	3 The patient appears almost always in pain.
2. The patient has a specific way of indicating the symptomatic area(s).	1 That is not the case.	2 They rub the symptomatic area(s).	3 Without instruction, they begin to remove their clothes and show the symptomatic area(s).
3. The patient appears to have pain over the whole symptomatic area.	1 That is not the case.	2 They sometimes do.	3 Almost all the time.
4. When examination or treatment is recommended, the patient becomes ill-tempered, easily angered, or argumentative.	1 That is not the case.	2 They show slight resistance.	3 They show significant resistance.
5. When having their senses assessed, the patient responds excessively to stimulation.	1 That is not the case.	2 Their response is slightly excessive.	3 Their response is quite excessive.
6. The patient repeatedly asks questions regarding their condition or surgery.	1 That is not the case.	2 They sometimes do.	3 Almost all the time.
7. The patient changes their attitude depending on the medical staff member.	1 That is not the case.	2 They somewhat do.	3 They significantly do.
8. The patient wishes their symptoms were gone, even with regard to slight symptoms.	1 That is not the case.	2 They somewhat do.	3 They significantly do.

Numbers indicate scores.

Table 1b
Questionnaire for Patients (for BS-POP patient use) English version.

Questions	Responses and scores		
1. Do you ever feel like crying, or do you cry?	1 No	2 Sometimes	3 Almost all the time
2. Do you always feel miserable and unhappy?	1 No	2 Sometimes	3 Almost all the time
3. Do you always feel nervous and irritated?	1 No	2 Sometimes	3 Almost all the time
4. Do you feel annoyed and aggravated over small things?	1 No	2 Sometimes	3 Almost all the time
5. Do you have a normal appetite?	3 No	2 I sometimes lose my appetite.	1 Yes
6. Are you in your best mood in the morning?	3 No	2 Sometimes	1 Almost all the time
7. Do you get somewhat tired?	1 No	2 Sometimes	3 Almost all the time
8. Are you able to put your usual effort into your work?	3 No	2 I sometimes can't.	1 Yes
9. Do you feel satisfied with the sleep you are getting?	3 No	2 I sometimes don't feel satisfied.	1 Yes
10. Do you have trouble falling asleep for any reason other than pain?	1 No	2 Sometimes	3 Almost all the time

Numbers next to responses indicate scores.

the original to ensure that the original intent is reflected [7]. The BS-POP will also prove useful in English-speaking countries. The BS-POP can evaluate psychological factors included personal disorder, sleep disorder, and depression but not fear avoidance factors. Therefore, pain catastrophizing and fear avoidance beliefs are also useful tool to evaluate patients' psychological factors.

1.2. Brain mechanism for chronic pain by brain imaging

Studies of pain areas using functional magnetic resonance imaging (fMRI) or positron emission tomography (PET) are steadily revealing aspects of pain where attention should be focused. One of these is the dopamine system [10–14]. Psychosocial factors such as stress and depression are clearly closely involved in chronic low back pain, but the mechanisms have yet to be clearly elucidated. However, the relationship between psychosocial factors and chronic pain is also being steadily uncovered by recent molecular biological studies. The mesolimbic dopamine system refers to the dopamine pathway with axons extending from the ventral tegmental area to the nucleus accumbens, ventral pallidum, frontal cortex, amygdala, and other areas. When painful stimuli are applied to the body, μ -opioids are produced mainly in the nucleus accumbens. Dopamine is involved in this μ -opioid production: when painful stimuli are applied, large amounts of dopamine are released from the ventral tegmental area. With the dopamine release, μ -opioids are produced in the nucleus accumbens, the descending pain inhibitory system is activated, and pain is inhibited [15]. The mesolimbic dopamine system functions involuntarily, but if it stops functioning for some reason, the individual becomes hypersensitive to pain. Stress, anxiety, and depression are thought to be causes of dopamine system dysfunction. Dopamine release occurs not just

with painful stimuli, but also with expectation of pleasure or reward. Scientific evidence for pleasure-related analgesia has also been obtained. Pain is inhibited by pleasurable sensations. Pleasant smells or images, favorite music, favorite foods and the like have shown clear efficacy in inhibiting pain. Interactions exist between pain and pleasure [16]. The introduction to medical practice of pleasant smells (aromatherapy), images (clean or fresh sensations, beautiful pictorial images), pleasant music and similar sensations are soothing for patients with chronic pain and can exert major effects on treatment effectiveness. In the presence of depression, anxiety, or stress, the dopamine response to painful stimuli is insufficient and as a result, μ -opioids are not produced and the mechanism of pain inhibition does not work.

Many reports have suggested dysfunction of central analgesic mechanisms in fibromyalgia patients [17,18]. Hamba integrated the findings of many studies on the dopamine system and hypothesized that dysfunction of the central analgesic mechanisms is involved in the pathology of nonorganic pain [15,17,18]. In this, she described a clinical study using PET that compared the relationship between dopamine metabolism in the brain and pain intensity between fibromyalgia patients and healthy individuals [12]. First, physiological saline and then hypertonic saline were injected into the tibialis anterior muscle of subjects. In healthy individuals, pain is not induced with physiological saline, but occurs with injection of hypertonic saline. The amount of dopamine in the striatum increases in proportion to the increase in pain intensity. An obvious positive correlation is seen between pain intensity and the amount of dopamine. Fibromyalgia patients, on the other hand, complain of pain even with the injection of physiological saline, and this pain intensifies with the injection of hypertonic saline. Increased amounts of dopamine are not seen in fibromyalgia patients as pain

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات