

How a Better Understanding of Spontaneous Mental Imagery Linked to Pain Could Enhance Imagery-Based Therapy in Chronic Pain

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Abstract

Therapy with mental images is prevalent in the field of chronic pain, and this has been the case for centuries. Yet few of the recent advances in the cognitive behavioural understanding of spontaneous (i.e. intrusive) mental imagery have been translated to this field. Such advances include imagery as a component of a psychopathological process, as an emotional amplifier and as a cognitive therapeutic target in its own right. Hence very little is known about the contents, prevalence and emotional impact of spontaneous mental imagery in the context of chronic pain. This article discusses the evidence in favour of spontaneous imagery being a potentially important part of patients' pain experience, and makes a case, based on neurophysiological findings, for imagery having an impact on pain perception. Furthermore, it presents how mental imagery has been used in the treatment of chronic pain. A case report illustrates further how spontaneous negative imagery linked to pain can be distressing, and how this might be addressed in therapy. Additionally, the case report demonstrates the spontaneous use of coping imagery, and raises a discussion of how this might be enhanced.

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Keywords: Mental imagery, chronic pain, guided imagery, coping imagery, suggestions, Cognitive Behavioural Therapy

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Introduction

Providing relief for patients suffering from chronic pain (pain persisting past the time of healing or caused by a chronic condition, lasting more than 3-6 months; Merksey & Bodgduk, 1994) is often difficult. Mental imagery-based therapy is frequently used in this context, and this has been the case for centuries (Pincus & Sheikh, 2009).

Mental images are cognitions, which take the form of sensory experiences (in any modality) in the absence of a direct percept. Images can be contrasted with verbal thoughts, i.e. cognitions in the form of words and verbal language. The difference between mental imagery and verbal thoughts has been a subject of theoretical debate in the basic psychology literature (Pylyshyn, 2003). However, from a perspective of clinical cognition it is widely assumed that verbal thoughts and mental images are indeed different phenomena (Hagenaars, Brewin, van Minnen, Holmes, & Hoogduin, 2010; Kosslyn, Ganis, & Thompson, 2001; Paivio & Begg, 1974), with the latter having tighter connections to emotions (Holmes & Mathews, 2010). Lately, cognitive psychology research has focused on *spontaneous mental imagery* (i.e. involuntary intrusions of often vivid mental images that spring to mind seemingly spontaneously and uninvited. Such images could be of sensory memories or constructed images, typically relating to emotional experiences). Such spontaneous mental imagery is now considered an important part of psychopathological processes across psychological disorders (Hackmann & Holmes, 2004), a potential emotional amplifier (Holmes, Geddes, Colom, & Goodwin, 2008) and a therapeutic target in its own right (Holmes, Arntz, & Smucker, 2007).

In the pain literature the term “imagery” is more frequently associated with a particular therapy technique rather than the spontaneous mental images described above. “*Guided imagery*” is a psychological treatment technique used for pain relief, in which a therapist suggests specific (positive) mental images that the patient should try to experience in their mind (Hart, 2008). Guided imagery is frequently used in clinical practice with some benefit for patients with chronic pain (Albright & Fischer, 1990; Baird, Murawski, & Wu, 2010; Brown, 1984; Fors & Gotestam, 2000; Fors, Sexton, & Gotestam, 2002; Kwekkeboom, Wanta, & Bumpus, 2008; Lewandowski, 2004; Lewandowski, Jacobson, Palmieri, Alexander, & Zeller, 2011; Mannix, Chandurkar, Rybicki, Tusek, & Solomon, 1999; Menzies, Taylor, & Bourguignon, 2006; Morone & Greco, 2007; Posadzki & Ernst, 2011; Raft, Smith, & Warren, 1986)

However, hitherto the link between “guided imagery” therapy on the one hand, and spontaneous mental imagery on the other, has been little explored. This means that few of the recent advances in the emerging research literature on the latter have been translated into clinically relevant explorations and interventions for patients with chronic pain.

In this article, we will present evidence in favour of spontaneous (i.e. intrusive) imagery being an important part of patients’ pain experience. Elements supporting a neurophysiological impact of mental imagery will be brought forward, thereby providing a link between these cognitions and pain perception. Finally, the current use of mental imagery in the treatment of chronic pain, which mostly relies on exogenously suggested images, will be discussed. To underline the therapeutic potential offered by exploring spontaneously occurring imagery, a clinical case will be described and discussed.

Spontaneous Imagery Linked To Pain: Images That Are Cognitions about Pain

Intrusive Negative Pain-Related Cognitions

Patients with chronic pain tend to experience negative thoughts about their pain, and it seems especially so if any psychiatric co-morbidity is present. These negative thoughts about pain have been mostly explored in the form of verbal thoughts (e.g. Eccleston, Crombez, Aldrich, & Stannard, 2001; Sullivan, Bishop, & Pivik, 1995). Populations with chronic pain have a high co-morbidity with anxiety disorders, post-traumatic stress disorder and depression (e.g. Asmundson & Hadjistavropoulos, 2006; Bair, Robinson, Katon, & Kroenke, 2003; Bair, Wu, Damush, Sutherland, & Kroenke, 2008). In these psychiatric conditions, intrusive negative mental imagery has been well described as a prevalent clinically-relevant form of cognition and as a potential therapeutic target (Arntz, Tiesema, & Kindt, 2007; Brewin, et al., 2009; Crane, Shah, Barnhofer, & Holmes, 2012; Day, Holmes, & Hackmann, 2004; Ehlers & Clark, 2000; Holmes, Arntz, et al., 2007; Holmes, Crane, Fennell, & Williams, 2007; Speckens, Hackmann, Ehlers, & Cuthbert, 2007; Wheatley, et al., 2007). The occurrence of negative intrusive images was also shown to be associated with distress and co-morbid mood disorders in populations suffering from cancer, and to be addressable through specific therapy (Brewin, Watson, McCarthy, Hyman, & Dayson, 1998; Whitaker, Brewin, & Watson, 2008, 2010). It therefore stands to reason that in chronic pain, especially with an associated psychiatric condition, it may be useful to know more about such imagery.

The interaction between chronic pain and mood disorder is not yet well understood. Potentially, mental imagery could be a common underlying mechanism to the pain-mood/anxiety interaction. Alternatively, mental imagery could enhance chronic pain patients’ distress in a similar way to psychiatric disorders. Despite a theoretically driven article proposing that mental imagery could be a form of catastrophizing, and could therefore participate in the vicious cycle of fear of pain and movement avoidance (Jamani & Clyde, 2008), to date, only few publications discuss the prevalence, contents and emotional impact of spontaneous negative mental images related to pain in patients suffering from chronic pain.

Carruthers and colleagues interviewed patients with irritable bowel syndrome before and after hypnotherapy, identifying any spontaneous pain related imagery (Carruthers et al., 2009). Out of 109 patients, 48.5% of patients did report a mental image associated with their pain before treatment. Interestingly, the report of an image was not linked to symptom severity, quality of life or depression. However, it was more common in anxious patients, and was a positive predictor of outcome following hypnotherapy. The treatment followed a standard hypnosis protocol (Whorwell, 2006), i.e. not using these specific images. Still, most responders reported new, positive or neutral images linked to their

disease after treatment (Carruthers, et al., 2009). This article only briefly summarized the image themes, and did not explore their meaning or associated affect. Further, our own exploratory research has collected more detailed accounts of spontaneous mental imagery associated to pain, using a cognitive framework, in a population of patients suffering from chronic pelvic pain. We described in detail ten patients' most significant image associated with their pain. All these images had a strong negative valence and meaning, and were associated with avoidance (Berna, et al., 2011). Interestingly, the attached negative emotions ranged from fear or anxiety, as proposed in the article by Jamani and Clyde (2008) to guilt, sadness, anger, disgust or helplessness (Berna, et al., 2011). Finally, among 59 patients suffering from pain interviewed in a rehabilitation setting, 78% reported spontaneous images linked to pain (Philips, 2011). Exposure during the interview to the most significant image led to increases in negative emotions and pain reports. The images were classified into different categories: negative self-appraisals, future catastrophe, past catastrophe (trauma/mishap), physical /anatomical details of pain/injury.

Are Images Linked To Pain Merely Metaphors That Describe Painful Sensations?

Many of the images reported in these interview studies represent the pain itself (Berna, et al., 2011; Carruthers, et al., 2009; Philips, 2011). Are these images merely voluntary descriptions meant for others to understand the patients' experience? We argue against this, as the patients clearly reported living with these cognitions well beyond an occasional explanation to their physicians or families, and described the intrusive or uncontrollable nature of these cognitions. Furthermore, many patients had never talked about these images with anyone before, and barely realised they were cognitions and not facts.

However, this does not exclude that metaphors are frequently used to describe pain. Pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (International Association for the Study of Pain). Metaphors can help patients to conceptualise or to discuss this sensory-emotional experience, and such voluntary mental depictions of the pain sensations have been discussed in a specific literature (e.g. Aldrich & Eccleston, 2000; De Souza & Frank, 2000; Schott, 2004; Semino, 2010; Sim & Madden, 2008; Soderberg & Norberg, 1995). Interestingly, next to simple verbal descriptors such as "boiling" or "gnawing", some of these descriptions are extremely vivid and elaborate, even allowing artists to create impressive representations of them (Carruthers, et al., 2009; Padfield, 2003; Padfield, Janmohamed, Zakrzewska, Pither, & Hurwitz, 2010; Pither, 2002). These more complex images could be spontaneous mental imagery, however in this context, no information was collected on the images' potential intrusiveness or the patients' control over them.

Given this, and the specific research on intrusive imagery in pain presented above (Berna, et al., 2011; Carruthers, et al., 2009; Philips, 2011), we argue that spontaneous imagery can incorporate symbolic or real elements of the patient's individual pain experience. These could conceptually be useful elements for the clinician to identify in order to aid pain modulation, as the meaning given to pain can have a powerful impact on its perception (Arntz & Claassens, 2004).

Coping Cognitions in the Form of Imagery

To our knowledge, no study has yet described in a systematic way the contents, characteristics and use of spontaneous coping images in chronic pain patients. Notably, the Coping Strategies Questionnaire (Rosenstiel & Keefe, 1983), a frequently used tool to assess coping strategies in the context of pain, does not make a distinction between verbal thoughts and mental images. Nevertheless, an earlier classification of coping strategies did propose images as a separate category (Fernandez, 1986) and

experimental data corroborates our clinical experience of mental imagery being a frequently used strategy. For example, when asked about their cognitions during acute dental pain, patients reported imagery both as a way of coping and of catastrophizing (Chaves & Brown, 1987). Moreover, participants in experimental pain studies used mental imagery before being instructed to do so, or were more compliant with instructions to use imagery, compared to using rational self-talk (Hackett & Horan, 1980; Worthington & Shumate, 1981). In other experimental pain paradigms, when instructed to use an imagery based coping strategy, many participants had their own images (Stevens, 1985; Stevens, Pfost, & Rapp, 1987). Our own research described the contents of spontaneous coping images reported by patients with chronic pain (an example can be read in the case presented below), proposing three categories that summarize them: allegoric treatment of an object symbolizing pain, imaginary treatment applied to the body, and supportive person (Berna, et al., 2011).

Physiological Impact of Mental Imagery

Interestingly, while holding a mental image might help to make sense of under-explained and distressing sensations, or express thoughts about a life-altering condition, it could also increase the patients' suffering.

Mental imagery in different modalities has been shown to activate cerebral areas involved in the actual sensory processing (e.g. Bensafi, et al., 2003; Halpern, Zatorre, Bouffard, & Johnson, 2004; Klein, Paradis, Poline, Kosslyn, & Le Bihan, 2000; Kosslyn, et al., 2001). Furthermore, motor imagery also results in activation in areas involved in movement planning or execution (e.g. Lacourse, Orr, Cramer, & Cohen, 2005). Comparable findings have been made for pain perception. Imagining other people's pain can evoke painful sensations, and involves some of the same neural areas to those recruited by pain processing, potentially underpinning empathy (Jackson, Brunet, Meltzoff, & Decety, 2006; Ochsner, et al., 2008; Osborn & Derbyshire, 2010; Singer, et al., 2004). Furthermore, imagery tasks involving pain-related words compared to non-pain-related controls activated the anterior cingulate cortex (Osaka, Osaka, Morishita, Kondo, & Fukuyama, 2004; Richter, Eck, Straube, Miltner, & Weiss, 2010), an area of the brain involved in pain processing and its regulation (Vogt, 2005). Hypnotic suggestion of painful heat perception was also able to recruit cerebral pain-processing areas (Derbyshire, Whalley, Stenger, & Oakley, 2004; Raij, Numminen, Narvanen, Hiltunen, & Hari, 2005). Finally, the retrieval of memories from previous painful experiences activated similar neural areas (Kelly, Lloyd, Nurmikko, & Roberts, 2007), and imagining that non-painful touch was unpleasant (allodynia) recruited pain processing areas, however only in participants who had experienced allodynia before (Krämer, et al., 2008). Therefore, holding an image of pain in our mind's eye might actually mean "rehearsing or simulating pain", in an analogy to the motor mental imagery literature, where mental imagery serves as practice to improve motor function, either to learn new skills or for rehabilitation (e.g. Avanzino, et al., 2009; Hall, 2002; Johnson-Frey, 2004; Sharma, Pomeroy, & Baron, 2006).

It has been shown that imagery of a head rotation can be translated into involuntary behaviour congruent with the real experience (Santarcangelo, et al., 2010). Hence, imagery linked to pain could lead to muscular tension or other unintentional bodily change, which might in turn increase pain perception. In fact, motor imagery can amplify the experience of pain in patients suffering from chronic pain, and increase activation in areas of central pain processing (Gustin, et al., 2008; Gustin, Wrigley, Henderson, & Siddall, 2010; Moseley, et al., 2008).

Finally, emotional imagery can alter physiological measures in a similar way to real emotional experiences (e.g. Cuthbert, et al., 2003; Lang, 1979; McNeil & Brunetti, 1992). Many functional imaging studies of emotion have used mental imagery techniques to induce a negative mood, and examine the

neural networks involved in emotional processing (e.g. Damasio, et al., 2000). Experimental pain perception can be enhanced by negative mood inductions, and this seems to rely on altered emotion regulation (Berna, et al., 2010). Emotional imagery can also modify the perception of experimental (Alden, Dale, & DeGood, 2001; Hertel & Hekmat, 1994) and clinical pain (Kirk & Jahoda, 2009).

Consequently, we propose that a spontaneous pain related image that has a strong negative emotional valence could hold clinical relevance by increasing negative mood, avoidance and/or muscular tensions and pain processing. On the other side of the spectrum, the physiological effect of imagery may underlie the beneficial effects of positive guided or coping imagery, by decreasing levels of anxiety, enabling muscular relaxation, or by recruiting cognitive pain-reducing strategies, such as distraction, reappraisal or acceptance.

Mental Imagery as a Treatment for Chronic Pain

Mental Imagery Techniques in the Context of Pain Relief

Many imagery techniques exist for pain relief, as illustrated in Pincus and Sheikh's book (2009), and these can also be employed as part of hypnotherapy (Patterson & Jensen, 2003). Only some of these approaches use the patients' own spontaneous imagery. These are occasionally described in case reports (e.g. Jamani & Clyde, 2008; Pincus & Sheikh, 2009; Winterowd, Beck, & Gruener, 2003), yet to our knowledge, have not to date been assessed by systematic trials. The most studied technique in the context of pain is "guided imagery", which suggests a standard positive image to patients (Albright & Fischer, 1990; Baird, et al., 2010; Brown, 1984; Fors & Gotestam, 2000; Fors, et al., 2002; Kwekkeboom, et al., 2008; Lewandowski, 2004; Lewandowski, et al., 2011.; Mannix, et al., 1999; Menzies, et al., 2006; Morone & Greco, 2007; Posadzki & Ernst, 2011; Raft, et al., 1986). While this research has provided important knowledge on the use of imagery for pain relief, it also has some shortcomings, as described below.

Factors Affecting the Response to Imagery in Therapy

The ability to respond to imaginative suggestions (i.e. to vividly imagine things suggested by someone) can be recruited by suggestions, independently of an hypnotic state (Kirsch & Braffman, 2001). Imaginative suggestibility is still a poorly understood personal trait (Kirsch & Braffman, 2001), that is currently known to be influenced by expectancy, motivation, absorption in the imagery and fantasy proneness (Braffman & Kirsch, 1999). It seems that patients' inter-individual differences in imaginative suggestibility explains a part of the variability in response to guided imagery treatments (e.g. Kwekkeboom, et al., 2008). However, we argue that the content of the suggested image is also important.

Are Some Images More Useful Than Others?

Only few studies have compared therapies using different guided images against each other in clinical pain. Most clinical imagery trials are script-based (imposed, standard image), which can be problematic. An often-suggested image like a beach might evoke negative emotions in many patients, from those who dislike heat to agoraphobics who dislike space. Furthermore, a suggested image could interact with spontaneous negative imagery. Such an interaction could explain a surprising finding: patients who practiced imagery of their pain regulatory system (picturing endorphins and inhibitory neurons) reported an increase in subjective fibromyalgia pain while a control group focusing on a pleasant scenery obtained the expected decrease in pain (Fors, et al., 2002). Given these elements, it might be better to

use patients' spontaneous coping imagery if they have developed any. Nonetheless, letting the patient choose an image without guidance might not be optimal either. The analgesic effects of a patient-selected image was less important than an image chosen by a therapist in acute clinical pain (yet no difference was shown for patients with chronic pain; Raft, et al., 1986). Hence simple positive guided imagery along a therapist-chosen theme (and not considering spontaneous imagery) does not offer insight into the patient's own experience. Consequently, we suggest that obtaining a better understanding of the patient's response to any deliberately constructed imagery designed to be 'positive' and in particular of the patient's own spontaneous, naturally occurring (negative and positive) imagery could be of use, as illustrated by the following example.

A Single Case Example of Spontaneous Negative and Coping Imagery in Chronic Pain¹

The patient was a single, nulliparous 47-year-old woman who had suffered from chronic pelvic pain for six years. Her symptoms started after a hysterectomy, which was performed to resect a benign uterine tumor. She described different types of pain: the scar was presented as being sensitive like a burn, as if it was on fire (mostly on touch); a deeper constant "hurt" pain was described in an area of the lower abdomen that felt as if it needed support; additionally, there was a constant and intense deep twisting pain, as if something wanted to straighten itself out.

Noticeably, during the first part of the interview, the patient described her most significant image as small fires on the abdomen (typical of the first type of pain). However, she also reported other images, corresponding to the other types of pains. One of them was:

"... that gaping hole inside of me. I visually see a hole in my body... black; visually it's big... but I know it's small. You know, if I had ovaries and a womb the size of my image, I would have "display organs" as in these models for educational purposes... But in fact I know... Logically... I know it's very small. But this gaping hole is so big..."

The interview was separated into two sessions. When the patient came back a week later, she mentioned this image again of her own accord:

"The main thing that probably... not shocked me.... but made me aware of myself, was my visual image of this gaping hole inside of me. I think having voiced it... I sort of... not accept it, but it's made sense. I suppose I never really thought about it, as in, I just accepted my visual image of it, I just accepted that's how I saw my body, I didn't think that there was anything wrong about that. I haven't spoken about it, and now I thought, that doesn't make sense. It doesn't change that I see it, but it has made me think: it doesn't make sense."

The image was then described in more detail:

"it's black, hollow, as in, oh this sounds stupid! (reassurance from interviewer)... It's hollow, it's resonant! ... I don't know what it's made of, well I know it's not made of anything! It's an image.... It's completely empty (starts with a very matter of fact tone), but it is this completely vacant, resonant (becomes troubled) ... and as I said, I have been thinking about it, it doesn't make sense, but that is what I see... or that I imagine or that I feel that it is. ... It doesn't let anything intrude into it, so nothing can break into that, but it's not solid, you think it's one of these strange sci-fi textures where things

¹ The detailed methods of the interview are described elsewhere (Berna, et al., 2011). The patient gave her written informed consent for this case example. Details of the case have been modified to protect the identity of the involved person.

cannot get beyond, but there is nothing solid there, that's how it is. "... later, after a discussion of the meaning... : "It still expects a part of me to come back, the rest of my body is not filling that space because it knows that it is coming back. I think, logically, my body HAS filled the space... That makes sense now."

The collaborative formulation of this image along a cognitive framework is illustrated in Figure 1. This Figure presents the meaning, emotions and avoidance patterns described by the patient in a model of imagery acting as an emotional amplifier. This hypothetical model (Berna, et al., 2011) proposes that negative imagery can amplify pain suffering: the image is raised by a trigger, such as pain; it is linked to negative emotions, a negative interpretation, and avoidance, leading therefore to a more negative experience of pain, and an increased likelihood of new occurrences of the image. A similar model has been proposed specifically for fear (Jamani & Clyde, 2008).

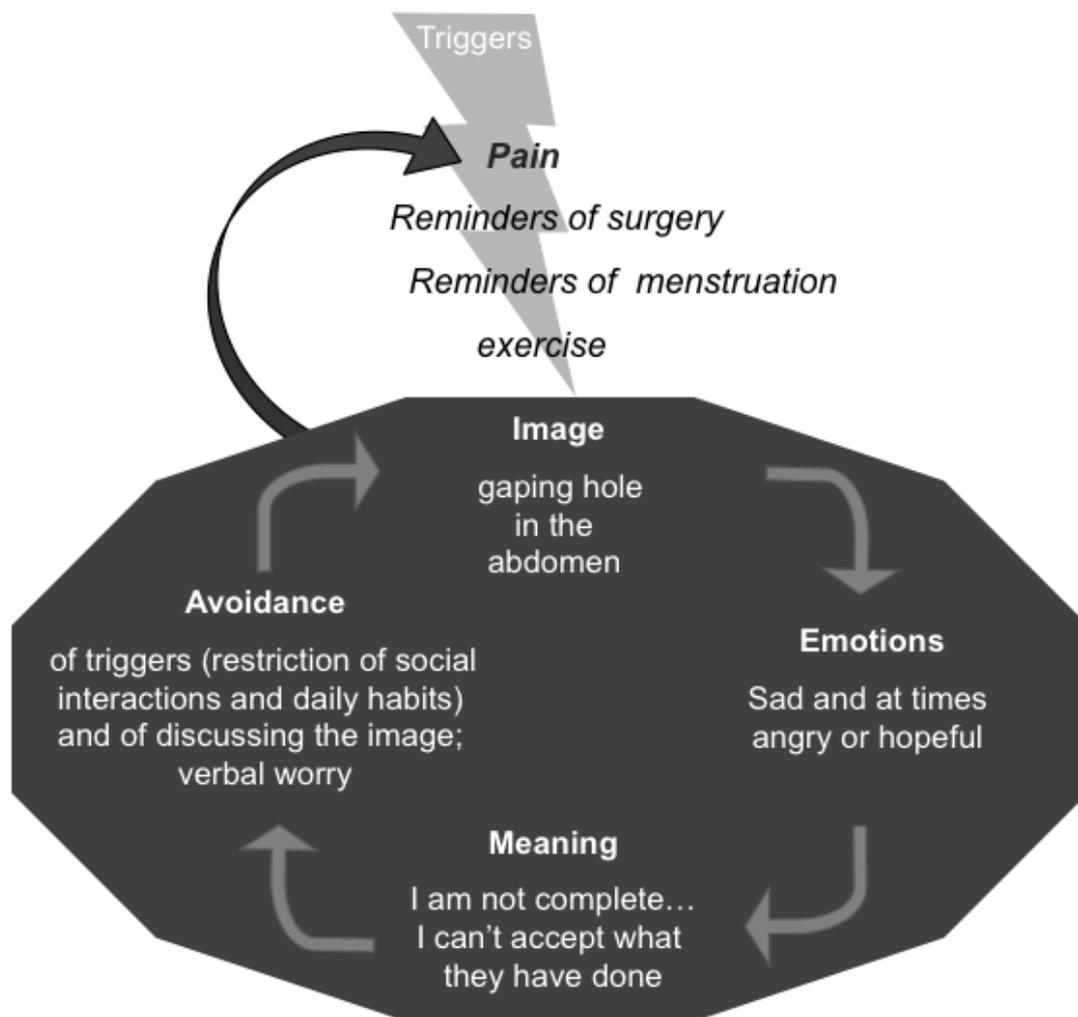


Figure 1: Case formulation along a cognitive behavioural therapy-based vicious cycle model of imagery as an emotional amplifiatory for pain. The patient's triggers elicit the intrusive image, which is connected to negative emotions and meaning, leading to avoidance, and new occurrences of the image (based on Berna, et al., 2011).

Regarding the link between the pain, the image and the emotions, the patient said:

"Nothing has changed pain wise... But I think I'm separating, you mentioned the pain and the emotions... I think before, one triggered the other and now, I'm thinking my feeling very much; there is this pain, yes; I'm angry, but I'm not linking it as much."

The patient was able to make sense of the image for herself and concluded:

“That rational side of me has the worry of the illogical thought. And on the other hand, I worry that the image will just go, and that I accept this. That scares me: if I just gave up the image, without finding acceptance. ... It’s a very strong image. And it’s real... it’s physically real, you know, it’s a structure. Rather than something soft, it’s strong. And I’m slightly scared of it going without me being ready for it. ... It’s become part of this journey.”

Interestingly, this patient also reported spontaneous coping imagery involving a hot water bottle that relieved her pain when applied physically to her abdomen:

“When I get pain and I can’t get a hot water bottle, then I will have this image of it, to get that soothing feeling... It’s the image of what I want... but I’m not that good at it... So if I can’t get the bottle, sometimes it’s detrimental, because I imagine it with the fact that I will not really get it, and that’s not good. If I manage to imagine it and I know I will get the bottle, then it helps me.”

Case Discussion

This case illustrates some interesting points. Patients with chronic pain can have different spontaneous images, linked to different types of pain. These images might express negative cognitions related to their condition. This patient reported that she had never discussed the image presented here with anyone, nor thought about it as a being a cognition per se (rather than reality). For her, it was a fact, slightly disgusting and shameful, although highly ambiguous, as it made her feel hopeful and sad in turns. Between the two parts of the interview, the patient had gathered that this image was actually a highly emotional cognition, containing some discrepancies with her own logical thinking.

The study, to which this patient had contributed, consisted of interviews that had no therapeutic aim (Berna, et al., 2011). However, by merely describing the image, this patient reported that she felt some benefit in being able to disentangle cognitions from reality, as suggested in Holmes & Mathews (2010). Further therapeutic discussions, as well as some behavioural experiments could help the patient to distinguish beliefs associated with the image from facts (Jamani & Clyde, 2008; Winterowd, et al., 2003). Further, the patient was able to clarify which emotions were attached to these images, and recognise they could interact with pain. Were future clinical work to be pursued, this image, and the residual distress attached to it could be addressed by a variety of techniques e.g. image rescripting (e.g. Holmes, Arntz, et al., 2007). Transforming the contents of the image to something less distressing, or learning to take control over it by for example fading it out could help to reduce its emotional impact (Holmes, Arntz, et al., 2007; Winterowd, et al., 2003).

Finally, this patient also reported the use of spontaneous coping imagery: she imagined that a hot water bottle was applied to her abdomen. However, this image only gave her relief when she believed she would soon be able to apply a real water bottle. This illustrates how motivation and expectation can modulate suggestibility and therefore the efficiency of positive guided imagery (Braffman & Kirsch, 1999). A therapeutic intervention could focus on giving the patient more confidence in the ability of a positive image to be helpful, and / or helping her to modify it in a way to make it more potent. Alternatively, an additional and different image might be developed with the patient (particularly since her current one seems associated with the anxiety of not getting treatment in time, which is inherently distressing) so that the positive meaning is disambiguated from any negative emotion. For a review of imagery techniques in cognitive therapy see Hackmann, Bennett-Levy and Holmes (2011).

Future Directions

Hitherto, many patients suffering from chronic pain cannot be offered adequate relief and those afflicted by a concurrent or secondary mood disorder are especially difficult to help. Therefore, new or enhanced therapies targeting these patients' distress would be extremely welcome. Additional studies on the presence, contents and outcomes of spontaneous imagery linked to pain will further our understanding of these cognitions. Specific tools might be developed to study spontaneous imagery, based upon those used up to now (Berna, et al., 2011; Carruthers, et al., 2009; Philips, 2011). Convergent, physiological measures should be used to clarify the interaction between pain-associated spontaneous negative images and nociception. Systematic treatment approaches targeting spontaneous negative pain related images could be studied in an area in need of treatment innovations.

In parallel, the spontaneous use of coping imagery could be further explored to determine its potential to improve guided imagery. In fact, a study analysing the neural correlates of a mental imagery technique in the setting of fibromyalgia pain has opened a new area of investigation (Derbyshire, Whalley, & Oakley, 2009). Additionally, imagery has been used as a bio-feedback strategy in the context of real-time functional magnetic resonance imagery, to teach patients with chronic pain to activate pain-inhibitory networks (deCharms, et al., 2005). Therefore, harnessing and combining cutting edge technological advances with systematic imagery description holds the promise of new clinically relevant therapeutic developments.

Conclusions

Spontaneous negative mental imagery linked to pain may have an impact on patients suffering from chronic pain. These images should be further explored in a systematic way, as this could lead to improved cognitive or even more novel technological treatments. While guided imagery has proven itself, working with the patient's own images might be even more powerful.

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