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Trauma in the Mind and Pain in the Body **Mind-Body Interactions in Psychogenic Pain**

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Abstract: Psychogenic pain is a kind of pain in which no organic or structural cause is found. The main mechanism proposed for the development of this condition is psychological trauma and suppression of painful emotions. Actually when a person encounters unacceptable and unbearable events, it evokes unpleasant emotions like anger and fear. If the person cannot accept and express these emotions, as a defensive mechanism, the memory of them becomes dissociated from mainstream consciousness and are suppressed in the person's unconscious. They are consolidated in the procedural memory and traumatize the person. Every physical, emotional and somatosensory stimulus that can remind the unconscious memory of the trauma will reactivate the pain experience. The most common locations of this pain are head, neck and vertebral column. From a neurophysiologic point of view, subconscious stimuli resulting from traumatization stimulate the locus cereleus and increase epinephrine release, which evokes the amygdala. The nociceptive area in the central nucleus of amygdala is involved in the production of pain. The most important implication for treatment is that the patient accepts the psychological origin of the pain. Different methods of treatment have been suggested for this condition, like tapping, psychotherapy, hypnosis and goal-directed healthcare. According to the high prevalence of this problem in the healthcare system, there is a need for a more comprehensive model that considers different dimensions in the diagnosis and treatment of this condition.

I. INTRODUCTION

Pain is a multidimensional, complex, and unpleasant experience with emotional, cognitive, affective, behavioural and sensory components (Manchikanti et al., 2002). The word 'pain' is rooted in the Latin word 'poena' which means penalty or punishment (Tyrrer, 2006). All people experience pain throughout their lives and more than 80% of patient visits to physicians are because of pain. Pain is defined as an "unpleasant sensory and emotional experi-

ence associated with actual or potential tissue damage, or described in terms of such damage" (Bob, 2008, p.355). The Joint Commission on Accreditation of Health Care Organizations (JCAHCO) declared that pain is a "fifth vital sign" in January 2001 and also the U.S. Congress has announced the last decade as the decade of "Pain Control and Research" (Rubin, 2005).

Pain is a challenging condition for the patient and the physician, and can make them helpless and flustered. It is a prevalent problem in which 38 percent of psychiatric inpatients and 18 percent of

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psychiatric outpatients suffer from chronic pain (Griffith, 2008). The sensation of pain is based on two components, sensory pathways and psychological factors (Sarafino, 2007). Many studies have been conducted to discover the mechanisms of pain, such as "gate-control theory" which was described by Ronald Melzack as one of the integrated models that is based on previous work in this field (Melzack, 1999). In this model, there are modulating gates in the dorsal horn of the spinal cord, which is composed of gray matter. These gates receive painful stimuli via pain fibres, and pass them to transmission cells. These cells conduct the pain signal to the brain and then the pain is sensed. The opening and closing of the gates is related to three factors. First, is the level of activity of fibres which conduct pain; this means that, when there is more painful stimulus, the pain fibres become more activated and the probability of the opening of the gates increases. Second, is the activity of other fibres that have a tendency to close the gates; there are some other fibres that conduct the signals of touching, gently scratching and rubbing that reduce the conduction of pain signals. This could be a good explanation for pain reduction strategies that involve using massage or heat therapy in the region of injury. Third, are descending messages that come from the cortex and brainstem to spinal cord. They can close or open the gates. For instance, different brain states related to different emotional states like anxiety or excitement have a general impact, i.e., they close or open all the gates for all inputs in the body but other brain processes may impact some inputs from special areas of the body. Conditions such as low level of physical activity, depression, and boredom can open the gates and circumstances like receiving massage, having positive emotions, and interest in life activities can close the gates. This influence of the brain on the gates can explain the lack of pain sensation in hypnosis or in

a condition in which a person is distracted by environmental stimuli (Sarafino, 2007). Pain is also modulated by cognition. The pain experience is influenced by attention, individual expectation, attitude, and emotions. Among these factors, emotions and attention are the most important factors affecting the quality of pain experience. Actually, attention alters the responsiveness of the neurons to painful or non-painful stimuli, and also it can select the pain stimulus and decide to bring painful events into consciousness (Bob, 2008).

Considering this physiological background, in clinical settings one method for the categorization of pain is based on its aetiology. In this manner, there are two main types of pain, organic and psychogenic pain. In organic pain the aetiology of pain is clearly tissue damage, but psychogenic pain lacks a clear physical root. Eighty five percent of patients with back pain lack any identifiable physical cause (Morrison & Bennett, 2006). This pain is the main cause of work absence and is the second most cited reason, after respiratory infection, to visit a doctor (Sarno, 1991). Different terms are proposed to describe this kind of pain. Walter (1961) calls this pain, which is without determined physical and peripheral origins, "psychogenic regional pain." Sarno (1991) described it as "tension myositis syndrome," Schechter and Smith (2005) called it "distraction pain syndrome" and Ruden (2008) uses "complex psychogenic pain" to describe this pain. Historically, from antiquity onward, hysteria and hypochondriasis were regarded as diseases that were without organic causes, with somatic and psychic symptoms. Hysteria was a condition in which patients showed different somatic symptoms like muscle paralysis, blindness, and pain, when there was no organic problem or tissue injury that could explain the symptoms in medical assessment. Freud and Bruer claimed that pain can be a manifestation of psychological

issues (Tyrer, 2006). From that time until now there have been controversies about the categorization of these kinds of diseases. In the case of psychogenic pain, psychiatrists classified it as a pain disorder which is one of the somatoform disorders subtypes (Sarafino, 2007).

Psychogenic pain is a very common problem. Eighty percent of the population of the world have a history of this kind of pain throughout their lives. Prevalent forms of Psychogenic Pain are migraine headache, neck, and upper back pain, low back pain and sciatica; this pain has a tendency to show itself in the axis of the spinal column (Sarno, 1991). Ruden (2008) categorized reflex sympathetic disorder, somatization disorder, phantom limb pain and radiculopathies in the group of complex psychogenic pain, and as Sarno (1991) states, low back pain is the most common form of these pains. It is usually associated with somatosensory, emotional, and psychological problems (Ruden, 2008; Sarno, 1991; Walter, 1961). Although it can start gradually or suddenly, usually there is no clear and determined onset. The duration of pain is variable from days to months. The pain is usually severe and disabling. The severity of pain can be the same throughout the day or different from time to time. Most often this pain tends to migrate to other parts of the body but sometimes it is constant in one location. There are different reports about the factors that alleviate or deteriorate the pain. For example, in some cases pain increases by walking and in some it decreases. Some patients have no pain in sleep but in others pain disturbs the sleep. Usually the pain is not relieved by analgesics and its sensation may vary by different moods. As long as an individual can generate emotions, she/he is vulnerable to psychogenic pain and it is not specific to a particular age group. Females have more susceptibility to demonstrate this pain (Lim, 1994; Sarno, 1991).

There is a tendency in patients and doctors to consider these pains as mechanical and organic; in this manner their approach is mechanistic and they usually use analgesics, surgery, and physical therapies that are not successful and the pain remains after these interventions (Smith & Friedemann, 1999). It has been estimated that 25 billion dollars are spent on this complex problem of medicine annually and 50 billion dollars is lost due to the disability. The main reason for this huge cost is the ambiguity of the aetiology of psychogenic pain. Clarification of the nature of this pain will lead to accurate diagnosis and successful treatment (Cherkin, Sherman, Deyo, & Shekelle, 2003; Sarno, 1999).

II. ETIOLOGICAL MODELS

The aetiology of psychogenic pain is very controversial and there are many debates about the origins and causes of this pain. Some authors consider a physical root for this kind of pain that has not been discovered yet and others believe that a physical cause of the pain is present but there is not a good diagnostic instrument to detect it and it might be detected by autopsy. In other words, this group believe that the cause of the pain is physical but we cannot find the cause because of imperfect knowledge and instruments (Angelova, Bora, Cuzman, Molina, & Silvestri, 2005). On the other hand, there are others who consider emotional and psychological roots for psychogenic pain. This group define different models to explain the development of this kind of pain. The most important models are the followings:

- 1) Personality and pain
- 2) Pain as a variance of depression
- 3) Behavioural model of pain
- 4) Biopsychosocial model of pain

A. Personality and Pain

Chronic pain patients often show abnormal personality profiles. Abnormal personality traits can be predisposing factors for the development of the pain. Engel (1959) proposed 'the pain-prone personality.' He believed that there is a specific personality for chronic pain patients. He has explained that inappropriate behaviour of parents with their children like punishment and traumatic childhood experiences like sexual abuse cause conflicts in the person. As a result of these childhood conflicts, the person prefers to show masochistic relations and uses the pain as a part of his/her psychological defence mechanism. The psychodynamic model of pain and personality was accepted then but the relationship between pain and personality needs more explanatory investigation. Studies demonstrate that there is no specific relationship between pain and a special kind of childhood trauma and abnormal childhood experiences. Also, there is no evidence to say that the pain patients have a specific form of personality, but the rate of personality disorder is higher in chronic pain patients (Birket-Smith, 2001).

B. Pain as a Variance of Depression

Depression is a very common problem in chronic pain patients. Thirty percent of these patients show depressive symptoms and one third of them have major depression. Some studies show that patients with depression have more severe pain compared to non-depressed patients. Previously, it was believed that chronic non-malignant pain is an affective spectrum. It has been proposed that this pain is an expression of a masked depression; hence antidepressants are effective in the treatment of chronic pain. Today this model has been challenged and studies demonstrate that depression can be a consequence

of pain but is not a risk factor for pain and there is no direct relationship between pain severity and depression. Although antidepressants are successful in the treatment of depressive mood, their effects on pain are transient and they cannot solve the problem completely. Eventually it has been shown that depressed mood is very prevalent in chronic pain patients and increases the pain intensity. Physicians should consider this problem in chronic pain patients and try to solve it to reduce the severity of pain and increase the quality of life for them (Birket-Smith, 2001; Magni, Moreschi, Rigatti-Luchini, & Merskey, 1994).

C. Behavioural Model of Pain

This model, proposed by Fordyce in 1976, is based on operant learning. In this model, chronic pain is an operant behaviour and the gain of the pain acts as the reinforcer. Different gains such as family attention, financial gain and avoidance of work reinforce the pain. There were many case reports of the effectiveness of this model in the management of pain for several years, but these results were not confirmed by systematic experimental studies which support the theoretical basis of the behavioural treatment. Also, there was no established evidence that showed the direct relationship between pain and secondary gain. This model plays an important role in understanding and treatment of chronic pain, but it lacks a comprehensive explanation of persistence and development of psychogenic pain in all patients (Birket-Smith, 2001).

D. Biopsychosocial Model of Pain

This model states that the diversity of pain perception and expression is related to the dynamic interrelationship between biological changes, psychological states, and social context of the individual. In this model it is emphasized that both the objec-

tive aspects like tissue damage and subjective issues like the meaning of the pain in the context of the patient's life are important in the management of the pain. The psychosocial factors which include emotion and cognition have an important role in the formation of this model. Based on this model each person has a unique perception of pain because of different emotional, cognitive, and sociocultural contexts in which the psychogenic pain is developed. According to this model, physiological, psychological and social aspects of an individual's life are involved in the formation and treatment of chronic pain. In this model the challenging issue of chronic and psychogenic pain is explained based on the effect of emotion, cognition and other external factors (Gatchel, Peng, Peters, Perry, & Dennis, 2007).

III. TRAUMA, MEMORY, AND PAIN

It has been proposed that suppressed emotions and psychological trauma have a critical role in the formation of pain (Lewis, 2007). Many patients attribute their pain to a physical activity that they had before the onset of pain. For example, they believe that the reason for their pain is carrying a heavy weight or doing a difficult physical activity and they tend to suppose a structural cause for their pain. However, this pain is almost always the result of emotional and psychological trauma (Sarno, 1991).

All people have some unpleasant and intolerable events and conflicts in their lives that can traumatize them and lead to some problems. People try to manage them in different ways but some of them cannot be solved, and as a defence mechanism, these conflicts become dissociated from the mainstream consciousness and become a part of the unconscious. This means that they exist in people's mind as conflicts, but people are not consciously aware of them

(Bateman, Brown, & Pedder, 2000). Charcot, Janet, Freud, and Breuer all believed that these psychological traumas are in the unconscious, which is dissociated from conscious awareness (Tallis, 2002). Actually, dissociation is the loss of normal integration of conscious functions, memories, and identity. Somatoform dissociation is "a lack of integration of somatoform components of experience, reactions and functions" (Bob, 2008, p.361), one that can cause different levels of pain perception, gastrointestinal symptoms, painful symptoms, motor inhibition, and so on. Dissociation at the level of the psyche can show itself as memory loss and fragmentation of knowledge of self and experience. In this state emotional and cognitive aspects of an experience are separated and the person tries to escape from aversive stimulus. Dissociative state of mind shows itself as a trance-like state and increases the suggestibility and hypnotisability of a person. Usually dissociation is the result of traumatic events like accidents and physical, emotional or sexual abuse. Traumatic or stressful conditions cause different clinical types of dissociation like emotional, perceptual, cognitive, or functional types and altered perception of time, place and sense of self. For example, the alteration of personal identity leads to depersonalization which is a dissociative experience or alteration of sensory perception which leads to different level of pain perception from analgesia to intolerable pain (Scaer, 2001). As it was mentioned above, fear and unacceptable memories cause the lack of cognitive integration in a person, leading to a dissociation state. In this manner, the lack of integration of emotional context, attentiveness, personal expectations and attitudes in stressful and bad situations, play important roles in pain experience (Bloom, 1999; Bob, 2008; Bob, 2009a). Indeed, dissociation between affect and cognition, and between feeling and thinking, is the base of somatic symptoms like psychogenic pain.

In other words, somatic and psychological processes have a very close relationship and the origin of somatic symptoms without any physical cause is the dissociation between affect and cognition or feeling and thinking. People dissociate from rage, fears and unpleasant emotions to tolerate them and this dissociation leads to somatic symptoms (Bromberg, 2003).

Scaer (2001) describes this pain as the result of a fearful condition from which the individual cannot escape. When people deal with a bad event which disturbs them and they feel helpless and powerless and cannot behaviourally express its emotional content, this can traumatize them and encode the psychogenic pain. This trauma is saved in the unconscious and the person is not aware of it because it is dissociated from consciousness. This means that negative charge events do not fit into current cognitive schemes and are split off from consciousness (Bob, 2009b).

Studies using hypnosis revealed an interesting fact about pain perception. In these experiments the pain was not sensed by the subject because of the hypnotists' suggestions. But later in another hypnosis session, the subject was able to remember the pain experience in a previous session. This means that, in the first session, the pain was registered in the brain while it was not consciously sensed. Given this result, researchers suggest that there are two dimensions to pain experience, suffering pain and sensory pain. Suffering pain is the conscious experience of pain and sensory pain is the informational dimension that is perceived unconsciously, its perceptual information registered in the brain without the awareness of the person (Bob, 2008). These two levels of pain perception are related to the mechanism involved in the formation of psychogenic pain. To explain this mechanism, first we should become familiar with the structure of memory.

In highly stressful situations in which a

person deals with events or emotions that are unacceptable, declarative memory is incapable of storing them and they will be stored in the procedural memory that is actually the unconscious mind of the person. Usually people tend to translate their sensory information in a narrative form, although they are not aware of the translation process; but in trauma, the process of translation of data into symbols fails and that special event cannot be categorized and become incorporated into other experiences. In this manner the painful experience becomes dissociated from other experiences of the person and is stored in the unconscious (Van der kolk, 1995). There are two kinds of memory, declarative (explicit) and procedural (implicit) memory. Declarative memory deals with facts and events. It is inaccurate and it is not durable and the memories stored in it are forgotten easily. It is conscious memory and the individual is aware of its content. It plays an essential role in recitation of trauma-related events. Procedural memory, in contrast, stores different motor skills, habits, reflexive actions, and conditioned sensorimotor responses. It has an important developmental role in emotional memory. It is very accurate and saves information in detail and also it is durable and resistant to decay, especially when it deals with highly emotional or threatening conditions (Scaer, 2001; Van der kolk, 1995).

How can unconscious stimuli produce a somatic symptom like pain? Although the unconscious state of mind is not accessible and cannot be mapped, it is possible to explore it. The behaviours and emotions of a person are good indicators of the unconscious content of the mind. Researchers have shown that unconscious stimuli can provoke physiological processes. As mentioned before, in a traumatic situation when a person encounters unacceptable emotions, one natural reaction is fear. The encoding of the pain is the result of fear and

defensive rage (Ruden, 2008).

In animal models it has been shown that if an animal senses the danger of a hunter, the first reaction is a "freeze response." The animal knows that any movement can draw the hunter's attention and in this manner freezing is a protective reaction. In this moment, the hunted animal's brain releases dopamine that leads to increased activity in the prefrontal cortex which results in more attention and high level of arousal state. In this state the presence of the hunter leads to fear or defensive rage in the hunted and the animal has to fight or take flight. At this level of fear the release of serotonin reduces the effect of dopamine. Simultaneously, catecholamines are released to prepare the animal for action. Actually, the increase of epinephrine and norepinephrine is necessary for encoding the event. In this situation, if the animal can escape and find a safe place or overcome the hunter in the flight, more serotonin will be released, which is essential to avoiding traumatization and activating gamma-aminobutyric acid (GABA) producing neurons (GABAergic neurons). These neurons inhibit the connection between amygdala and memory centres in the brain. If the animal cannot escape or be successful in flight, it will play the role of a dead animal by being in the state of tonic immobility which is called "fright" and increases the survival chance. Freezing, fear and defensive rage, fight or flight and fright are four special moments with different neurobiological states (Ruden, 2008; Scaer, 2001).

On the other hand, LeDuedx (as cited in Gottlieb, 2003) states that the activation of physiological concomitants of fear such as freezing and sympathetic symptoms (elevated blood pressure and increase in heart rate) does not need activity in the cerebral cortex and they are developed by the neural pathways that lie in the amygdala and limbic system. He believes that fearful situations may evoke fear in a

manner so that the frightened person is not conscious of what has caused it. In spite of the dominant belief that the person can consciously control his or her emotional response, the existence of these subcortical pathways shows that the role of consciousness in the emotional processes is less prominent than what was previously assumed. This means that it is not necessary to understand that the situation is frightening in order to be frightened. In other words, there is no need for registration, understanding and evaluation of the symbolic meaning of a traumatic stimulus by the individual's mind prior to the responses of the body. Here, the amygdala plays a basic role in the formation of the somatic symptoms of the trauma. For example, if a person has a vehicle accident, with a neutral stimulus such as the sound of a car horn, the amygdala associates it with the traumatic situation. After that time, whenever the person hears a car horn, he or she will reexperience the fear sensation and related somatic symptoms. In this reexperience the hippocampus is not involved. Sensory activation of the thalamus is transmitted to the amygdala and conscious recollection of the trauma by hippocampus and cerebral cortex is not needed (LeDoux, 1996).

Using the above explanation, Van der kolk (as cited in Gottlieb, 2003) suggested nonverbal therapies for these conditions because he believes that these kinds of therapies can bypass the mind. In these interventions factors such as body posture and movement are more important. Bucci (1997), who is a cognitive neuropsychologist, considers the issue from another perspective. Like Van der kolk, she believes that the treatment of somatisation and somatic symptoms due to psychological trauma is beyond the psychoanalytic and verbal therapies. The important difference in her approach is that in her view verbal treatment with focus on the details of somatic symptoms with the aim of estab-

lishing the lost higher-order symbolic connections might be a possible intervention. In other words she believes that psychotherapy will be useful for the victims of trauma only if it is done in a manner that helps the patient to verbalize the effects of trauma in his or her body. Using this method the therapist tries to connect the unconscious process of the trauma, which is developed through the amygdala, to the conscious processes like verbalization of the somatic symptoms of the trauma and cerebral cortex.

Ruden (2008) claimed that on the emotional level, fear and defensive rage provide the neurobiological context for encoding psychogenic pain. Fear and defensive rage at a physiological level result in some sympathetic signs like increased heart rate, piloerection, high level of blood flow in muscles, and vasoconstriction. Sarno (1991) believes that this vasoconstriction is one of the important causes of pain in muscles and also it can justify the difference of temperature in the region of pain in comparison to other parts of the body.

IV. BRAIN MECHANISMS

In the process of emotional traumatization and consolidation of its memory, two important components are involved. These are, first, amygdala-group of nuclei located in the medial temporal lobe, and second, catecholamine neurotransmitters, epinephrine and norepinephrine (Cahill & Alkire, 2003). Arousal-based input from sensory organs is conveyed to the thalamus and locus ceruleus. The locus ceruleus releases norepinephrine that starts the encoding of trauma by the effect on the lateral nucleus of amygdala (LA) which evaluates the emotional content of inputs. LA forwards a message to basolateral nucleus of amygdala (BLA), which has many connections with other areas and this

enables it to encode memory pathways and organize emotions, somatosensory processes, motor actions, and connects emotions and thoughts to the somatosensory aspect of events. BLA sends signals to central nucleus of amygdala (Ce) that produces fear and evokes sympathetic nervous system, the nucleus accumbens, the hippocampus, prefrontal cortex and the hypothalamic-pituitary axis. Sympathetic activation is responsible for fight or flight, danger evaluation is a duty of prefrontal cortex, and nucleus accumbens creates motivation to action (Ruden, 2008). The physiologic response to actual or potential tissue damage is called nociception and there is a region in Ce which is a nociceptive area and Ce based on its nociceptive area has an important role in the experience of psychogenic pain (Meeus & Nijs, 2007).

It has been shown that the brain regions that are responsible for aversive and unpleasant feelings of pain experience are the same in organic and psychogenic pain. In other words, they have the same affective quality but there is no sensory input in psychogenic pain because there is no tissue damage in the body (Bob, 2008). Prefrontal cortex (PFC) and anterior cingulate cortex (ACC) are modulators of Ce (Scaer, 2001). PFC organizes the brain's responses to threat. In the threatening situation, PFC inhibits emotional processing of the limbic system. As a result, the person acts in the best manner and gives the best response. But if the person cannot find a good opportunity to respond, it will traumatize the person (Lewis, 2007). In fact PFC has a controlling effect on nociceptive data, and is involved in solving conflict and ACC is able to detect the conflict (Bob, 2008). The theory that matches well to these explanations is kindling theory.

In the next section the origins of kindling theory and its relationship to psychogenic pain will be explained briefly.

Kindling Theory

The kindling phenomenon was originally described by Goddard and his colleagues in the development of seizure (Goddard, McIntyre, & Leech, 1969). They observed that repetitive low-level high-frequency electrical stimuli of the brain produce changes in its response and after a while, repeated stimulation causes increased alteration and neuronal excitability that will result in the seizures that can be self-perpetuating and ultimately result in a seizure disorder (Adamec, 1990; Cain, 1979; Worthman, Schechter, & Plotsky, 2010). In kindling, a group of stimuli via neuroplastic mechanisms alter the functions of the neuronal membrane, synaptic activities, intracellular messenger system, and the microscopic neuroanatomy of the CNS. There are three phases in the standard model of kindling. In the developmental phase, the subthreshold electrical stimulation of the amygdala leads to the focal neuronal activity and discharge. In the completed phase, any stimulation causes a reliable elicitation of seizure. In the spontaneous phase, seizure occurs in the absence of exogenous stimulation.

The limbic system is a part of the brain susceptible to kindling (Adamec, 1990; Worthman et al., 2010). In the early stages, kindling is limited to the stimulated region of the limbic system but in later phases it will be spread to other parts of limbic system and even other parts of the brain. After a while, the excitability of limbic structures increases, hence seizure will occur by an alternate nonelectrical stimulus. In this manner, the kindling phenomenon has been shown to occur by electrical, chemical and sociopsychological stimuli (Adamec, 1990).

Although this model was originally proposed for the explanation of the development of seizure, it has also been used to explain the formation of chronic psychogenic pain. Neuroplastic changes

that occur in the limbic system and other supraspinal parts of the CNS can develop chronic persistent pain (Rome & Rome, 2000). In traumatic events, there are some structural, chemical, and functional changes in amygdala that make the neuronal system more irritable and vulnerable to psychogenic symptoms. On the other hand, destructive experiences in traumatic situations lead to sensitization of brain stress response systems and failure to balance in regulatory systems in challenging situations. Inadequate outflow in the regulatory system of the brain causes the reduction of threshold for development of psychosomatic symptoms. Scaer (n.d.) explains that, there are three components involved in the formation of somatic symptoms that are the result of the trauma. These are centres of arousal, declarative memory, and the brain centres and pathways linked to neuromuscular procedural skill and conditioning memory. Kindling of the neural patterns in the mentioned centres is responsible for the formation of psychosomatic symptoms and psychogenic pain.

At the time of trauma, the memory of the body state of the person is stored in the procedural memory. Also, the facts and events of trauma are stored in the declarative memory and as these data signify a threat or emotionally unresolved conflict, amygdala and related centres responsible for the evaluation of emotional content will be aroused. After that, similar to what was described in the kindling model of seizure, in the early phases of formation of chronic psychogenic pain, each environmental trauma-related stimulus or recalling declarative memory of the trauma can arouse amygdala and the pathway involved in the formation of psychogenic pain which is described by Ruden (2008) and as discussed in the previous section. In this step the pain is not permanent and it depends on environmental stimuli and arousal of related centres. Like late phases of kindling process in seizure, this pathway

might become persistently active and there is no need for any stimulus. In this condition patients sense pain even when there is no stimulus in the environment. On the other hand, it has been shown that limbic seizure activity can produce dissociative symptoms also without neurological focal lesion (Bob, 2009b). Epileptic activity has been reported in dissociative experiences.

As mentioned above in a threatening and unacceptable situation, when escape is not possible and a person cannot accept and express the related emotion, the fear or defensive rage will be formed. In this condition, the person has a special body state that is linked to emotional states of the bad event that she/he experiences. This body state and also all stimuli associated with the event that the person is not aware of, are stored in procedural memory. After traumatisation, any physical, emotional or somatosensory stimulus that can remind these unconscious memories will reactivate the pain experience and via kindling, gradually the pain is sensed even without an external stimulus (Lewis, 2007; Ruden, 2007; Ruden, 2008; Scaer, 2001).

From the other perspective, being in the unacceptable and dangerous situation leads to negative feelings and fear that generate anxiety, and because of the unpleasant and embarrassing nature of these feelings and anxiety, the person does not like them and tries to suppress them. In this manner, they will be kept in the unconscious which is out of awareness (Bateman, Brown, & Pedder, 2000). This is also true of anger. All people have narcissism as a trait to some degree, and when it is powerful in a person, she/he will be more irritable. They usually are not satisfied with others and it makes them angry. Like anxiety, anger can be suppressed into the unconscious (Rashbaum & Sarno, 2003).

What was discussed above was the mechanisms of formation of psychogenic pain at the personal level, but it should be considered that there have been studies

which explore the process of the development of psychogenic pain at the level of interpersonal relationships which will be addressed briefly. Actually, a special form of family dynamics is related to the development of psychogenic pain. Problematic relationships in the family can become suppressed as conflicts. Also, it has been shown that psychogenic pain is more usual in families with history of pain in other members. There is a direct relationship between pain and history of depression in the family. It has been claimed that presence of a person with a psychiatric problem increases the incidence of pain in other members of the family. Also in families whose members do not have a good and close relationship, pain can be expressed to gain attention in the family (Snelling, 1990; Wirsching & Stierlin, 1985)

Another source of repressed emotions and unconscious conflicts is the sense of responsibility, especially to a close relative. Naturally a person loves his/her parents, children and spouse, and when they suffer or make him/her unhappy, it causes anger in the person. This anger is suppressed into the unconscious mind. In fact, people often learn to suppress their anger in a manner that remains unconscious to them in many situations; indeed, this suppressed anger plays a fundamental role in the presentation of physical symptoms (Fernandez & Turk, 1995).

People learn to suppress their emotions in different ways. One of them is the result of parental influence. They teach their children to suppress many of their feelings in order to be good children, and they do not know that this attitude can make psychological conflict in their adulthood (Sarno, 1991). The second reason is the tendency of a person to be loved and liked by others; in this manner the person tries to hide and suppress anger. Family, culture and society are strong motivators for a person to have logical, appropriate and lovable behaviour and to not show the problematic emotions.

Indeed, people are not aware of much of their anger; so, they are suppressed and stored in the unconscious as conflicts and consequently express themselves as physical symptoms (Wirsching & Stierlin, 1985).

Coen in a joint work with Sarno (1989) suggested that the pain and other psychogenic physical symptoms have a preventive role against suppressed emotions coming into the conscious level of the mind. In other words, somatic symptoms occur when the mind senses that the explosion of suppressed emotion is impending (Rashbaum & Sarno, 2003). Indeed, the pain here acts as a defensive mechanism to bring attention to the body instead of the mind and the awful, child-like, angry or selfish feelings that are in the unconscious mind. Schechter and Smith (2005) proposed the term "distraction pain syndrome" for psychogenic pain based on this explanation. They believe that psychogenic pain is a way to distract attention from the mind and the bad emotions like fear, rage and anger.

The physiological mechanism suggested for this pain is based on the activity of the autonomic system. As mentioned before, when a bad feeling is registered neurologically by the amygdala, the central nucleus evokes some systems. One of these is the autonomic system. When this system is activated, it makes different signs in the body. For example, increased heart rate, dilation of the pupils, decreased blood flow in many muscles to increases in blood flow in vital organs and parts of the body that may be involved in fight or flight (Ruden, 2008; Scaer, 2001). One of the important parts of the brain that is involved in the process of trauma and dissociation is hypothalamus-pituitary-adrenal axis (HPA) which is a self regulatory system. One of the first typical reactions to trauma and then dissociation is the disturbance of this system that results in hyperarousal, tachycardia and other autonomic nervous system instability symp-

toms. Studies show the close relationship of trauma and conflicts with the neuroendocrinological system, energetic metabolism, and hormone control activities of HPA system. Disturbances of these activities of HPA have a durable impact on behavioural, emotional, social, cognitive, and physiological functions of the person (Bob, 2009b).

As it was mentioned Sarno (1991) suggests that this blood flow reduction in the muscles leads to oxygen deprivation in muscles. This oxygen deprivation causes muscle spasm that is one of the main causes of pain in these muscles. Another cause of the pain is the chemical waste due to oxygen deprivation. In this situation muscles use lactic acid instead of oxygen to survive. The waste products which are the result of lactic acid metabolism can cause pain. This deprivation also affect nerves and tendons and in this manner these patients may show sensory abnormalities like numbness and tingling and tendon reflex changes. The fact that supports oxygen deprivation as a cause of pain is that when patients massage or warm the pain region, the pain diminishes. Indeed massaging and heating increase the blood flow in that location and reduce the pain (Sarno, 1991).

V. TREATMENT

The main goals in psychogenic pain treatment are pain relief, addressing the concomitant issues and managing the secondary effects of pain such as anxiety and sleep disturbance, and improving the patient's quality of life and functionality (Weil, n.d.). Physicians should consider the fact that different patients have different responses to chronic pain. As mentioned before, it is difficult for patients to accept that their pain is psychogenic and they may try to convince the physician to do more diagnostic tests. After the therapist has

diagnosed that pain is psychogenic in nature, the important point is that he/she should remain patient. Therapists should be empathic and friendly and reassure the patient that the pain is real and he/she can understand the patient's suffering. Explanations about the psychological roots of pain are helpful (Miller, 1993). Here some therapeutic approaches will be explained briefly. Despite medicine's many achievements in the control and treatment of pain, there are many patients who suffer from pain and need more help. Actually, there are no accurate statistics on the treatment of psychogenic pain in the literature. Based on the limited data that does exist, one third of chronic pain patients were reported to have been dissatisfied with their treatment because the pain had remained after treatment. Twenty eight percent of them believed that there are no effective treatments for their pain and more than half of them believe that their physicians do not understand how their pain makes them feel. These patients usually wander in the healthcare system and try different practitioners to get help (Mehendale, Patrick, & Goldman, 2004).

A. Psychoeducational Treatment

The therapist should consider some points in relation to the patient with psychogenic pain. One of them is the belief of the patient about the origin of the pain. Many of these patients consider the physical problem as the cause of their pain. Another point is the anxiety of the patient about his/her disability due to pain, because sometimes they cannot even do their routine work and this makes them more anxious. Also thinking about the future of their pain and imagining a whole life with pain makes them worried. Another point is that patients are worried about the recurrence of the pain. They avoid activity because they are afraid that it may worsen the pain (Sarno, 1991; Tyrer,

2006). All of these points and concerns in addition to the prolonged pain cause depression, which can worsen the pain sensation.

Actually, an essential part of the treatment is that patients accept that the pain is not organic or structural and the main cause of the pain is emotional and due to psychological disturbances. Accepting that their pain is a result of the interaction of mind and body has a therapeutic effect and decreases the pain and in some cases completely resolves the pain. Therapists should explain the mechanism and reassure the patients that it is not a dangerous situation and they can return to their usual life. Actually education about the pain is a basic component of this program. Patients can learn these concepts by attending educational classes or reading well-prepared therapeutic brochures. After these, the therapist should abandon physiotherapy and all physical treatment for the patient and replace it with exercise. The therapist should encourage them to be more active in life and start their previous activities. If these suggestions are not successful, psychotherapy will be suggested (Rashbaum & Sarno, 2003; Sarno, 1991; Schechter et al., 2007).

As Ruden (2007) explains, emotional states like fear and rage and their bodily states in inescapable and unpleasant situations are stored in procedural memory and encoded as the content of the unconscious mind. Simultaneously, there is an increase in epinephrine in the brain and because of the inability to find a safe emotional condition, there is no serotonin secretion. The lack of serotonin has the fundamental role in traumatisation and consolidation of events in the brain and after that each stimulus that is related to those events can reactivate the memory pathways and lead to pain. Now, if we can increase the serotonin level in the brain, the connection of LA and BLA will be interrupted. Actually, the relationship between event, emotion and pain

is the result of LA and BLA connection. Serotonin via GABAergic neurons leads to decrease in epinephrine secretion from locus coeruleus and therefore there is no signal in BLA to send to Ce and induce pain. Levine (1997) proposes that if we can imaginatively or physically replicate the traumatic event and its emotions and guide it to an imagined safe place, it can delink the LA and BLA connection. In this approach, the therapist helps the patient to find a good and suitable behavioural response to a traumatic event. Indeed, finding a good and appropriate response leads to serotonin secretion that disrupts the pathway of pain experience (Ruden, 2008; Ruden, n.d.).

B. Tapping

Another method of increasing serotonin is tapping of special parts of the body in certain points by specific sequence. This treatment was first explained by Callahan (2001) for phobia, PTSD, and psychological problems. He proposes that illness is a result of disturbance in the field of energy that surrounds the person and distressful thoughts are responsible for this disturbance. He believes that by tapping, these energy perturbations in the 'Thought Fields' resume normal functioning and healing occurs. He named his treatment, Callahan Techniques-Thought Field Therapy (CT-TFT). Based on Callahan's model, Ruden (2005) suggests psychosensory therapy in which the sensory input can alter mood, behaviour and thought. Indeed, the release of serotonin and disruption in the pathway of pain experience in amygdala is the basis of this treatment. Also there are many different treatment modalities like acupuncture, humming, mindfulness meditation, cognitive tasks, and eye movements that can increase serotonin level in the brain and have therapeutic effect especially on emotion-based problems.

C. Hypnosis

Montgomery (as cited in Bob, 2008) states that hypnosis in 75% of patients with different types of pain has a therapeutic effect and significantly diminishes their pain. When hypnotherapy is incorporated with other behavioural and psychological methods like Cognitive Behavioural Therapy (CBT) and biofeedback, pain management has been more successful. Hypnotic state and suggestion influence and change the emotion and somatosensory perception of the pain by cognitive modulation. As mentioned before, the sensory information of the pain is registered in the unconscious which is not accessible to the conscious, but its memory can be recalled during hypnosis. Hilgard (1992) called this unconscious level "the hidden observer." This hidden observer acts as a stream of consciousness that is dissociated from the person's mainstream consciousness and the person is not aware of it. The main activities of the hidden observer in the state of hypnosis are reprocessing the pain related emotions, changing the insight of the person toward the trauma, reframing the cognition (cognitive modulation) and recovering the memory of traumatic events. Indeed, hypnosis can uncover, reprocess and alleviate some of the emotional and cognitive factors that are hidden in the unconscious and constantly produce pain. Direct suggestion, hypnotic metaphor and cognitive reframing are some of the methods used in hypnotherapy (Bob, 2008; Bob, 2009a; Eimer, 2000).

D. Psychotherapy

Given the fact that psychogenic pain is a result of emotional and psychological problems, having the opportunity to discuss and speak about hidden emotions and thoughts is very useful and helps the patients to explore their inner world and gain insight into themselves. Psychother-

apy can reveal the suppressed emotions and helps patients to understand the nature of their pain. Identification, modulation and integration of the unpleasant emotions and dissociated affects can help relieve the pain (Bromberg, 2003). Therapists should encourage patients to change their lifestyle and take part in more healthy behaviours and encourage them to explore psychosocial issues with less attention to somatic symptom (pain). Indeed, healers should act in a supportive manner (Lim, 1994). Also group therapy can be effective for these patients; usually they learn some cognitive techniques and there is a good opportunity to discuss their beliefs, thoughts, and emotions (Levine, Brooks, Irving, & Fishman, 1993; Olbrisch, 1997). If the patient lives in a family in which there are relatives who complain of pain and other psychosomatic problems, it encourages the patient to complain more. In these cases family therapy can be more effective (Lim, 1994).

Ventegodt and his colleagues (2007) suggest Short Term Psychodynamic Psychotherapy (STPP). Actually, their approach is rooted in the way that Hypocrites visited his patients. In this approach, they believe that the physician should consider all aspects of the patient, i.e., his or her body, mind and spirit. Not only healing the illness but also improving the quality of life and functional ability are the goals of this approach. There are three main steps in clinical holistic medicine: feeling, understanding and letting go. Therapists with STPP encourage patients to verbalize their feelings and sensations, in this manner they gradually can discharge their suppressed emotions. The second step is helping the patient to understand the traumatic event that causes the pain. On this level, the healer uses different types of psychotherapy like existential therapy, cognitive therapy and thought field therapy to help the patient to modify and improve his/her perspective on life. In the third step, the patient can let go of the emotional and

physical tension. In this scenario the therapist acts as a coach and the patient must perform the prescribed activity. The patient should write about his/her life and its events and read something every day. This approach helps patients to get rid of physical symptoms, psychological conflicts and improve their worldview (Ventegodt, Morad, Andersen, & Merrick, 2004; Ventegodt et al., 2007).

E. Cognitive Behaviour Therapy (CBT)

The basic component of CBT is the notion that pain is influenced by the cognition, affect, and behaviour of the patient. Reaching a shared conceptualisation of pain with the patient and the need for the removal of the mistaken belief of the patient are essential components of CBT. Cognition influences the pain intensity report, patient's attempt to cope with pain, and mood and disabilities that are related to pain. Also patients' interpretations of pain are different and have different effects on its experience. For example, catastrophic interpretation of pain is associated with higher levels of depression, or when a pain is the indicator of more damage, patients tend to be more disabled and avoidant (Sharp, 2001).

In CBT patients understand the influence of cognition and behaviour on pain and the fact that they can control the pain. As mentioned before, altering cognition causes change in the neuronal plasticity. In the course of treatment, patients learn strategies to handle the pain and improve the quality of life, cope with the pain and think positively. Different relaxation skills are used which reduce the emotional and physical tension and also, patients learn how to divert attention from pain. Patients learn these issues by different educational methods like books, lectures, videotapes and individual sessions. In this process, they learn about the nature of the pain, anatomy of the pain location, suitable activ-

ities and in general a new perspective toward the concept of the pain is achieved. Different research efforts in this field have shown that CBT is effective in the treatment of psychogenic pain (Keefe, 1996; Lim, 1994; Moore, Von Korff, Cherkin, Saunders, & Lorig, 2000).

F. Complementary Alternative Medicine

Complementary Alternative Medicine is a heterogeneous spectrum of different ancient and new methods and techniques that are helpful in prevention and treatment of diseases (Borins, 2005). The treatment methods of CAM are not incorporated well into healthcare systems because research methods of modern western medicine cannot judge their efficacy. Different approaches of CAM can be used with conventional treatments or in some cases instead of them (Barnes, Bloom, & Nahin, 2008). Here there is a brief explanation of some of the therapeutic methods of CAM.

Acupuncture. Acupuncture has been accepted as an effective treatment of pain by National Health Institute (NHI). It is a technique of peripheral sensory stimulation. Needle insertion in the special points of skin activates the receptors and nerve fibres (Biella et al., 2001). From the biomedical point of view, it acts and affects on three levels. On the local level, the needle evokes the local motor points mechanically. On the level of spinal cord, the needle insertion leads to the release of neuropeptides into the spinal fluid and on the level of cortex, the needle insertion causes the release of endorphins and serotonin (Borins, 2005). One study examined the efficacy of acupuncture in 401 patients with headache. The group that was treated by acupuncture showed 34% pain reduction compared to the control group that showed 16% pain reduction (Vickers et al., 2004). In another study, researchers used acupuncture for

3093 patients with chronic low back pain. The results show that this method is more effective than routine care to control the pain (Witt et al., 2006). There are several studies that show acupuncture is superior to standard treatments in chronic pain management (Weidenhammer, Linde, Streng, Hoppe, & Melchart, 2007). This method is cost effective, does not have side effects for the patients, and can help them to manage and control their pain (Borins, 2005).

Meditation. Meditation is one of the mind-body therapy methods of CAM. It is an intentional self-regulation of the attention and monitoring of present experience in each moment. There are different types of meditation like yoga, transcendental meditation, relaxation and mindfulness. One of the most effective types of meditations in pain management is mindfulness which was developed by Jon Kabat-Zinn in the United States. In this method, patients learn to be aware of their moment to moment body states, thoughts and feelings non-judgmentally. The critical concept of this method is the elimination of struggling and the acceptance of the current condition without judgment in the present moment. There are several studies that demonstrate the effectiveness of mindfulness meditation in the chronic pain management. For example, in one study that compared massage therapy, mindfulness meditation and conventional care for chronic pain patients, results demonstrated that mindfulness is more effective especially in mental health status and mood improvement (Plews-Ogan, Owens, Goodman, Wolfe, & Schorling, 2005). In a randomized clinical trial study, mindfulness meditation was applied to adults with chronic low-back pain. The results demonstrated that this method is effective in pain reduction and pain acceptance. Also this method of meditation helps patients to improve their physical function (Morone, Greco, & Weiner, 2007).

Massage therapy. Massage therapy is

one of the ancient and popular techniques of CAM. Manipulating the muscles and soft tissues is associated with various effects. It causes relaxation in the mind and musculoskeletal system and reduction in the pain sensation. It also releases a number of neurochemicals including endorphins and oxytocin which has a cross-reaction with opioid receptors. Increase of the local blood flow is another consequence of this method that reduces the muscle spasm and clears the local pain mediators (Borins, 2005; Ernst, 1999). There are several bodies of evidence that support the effectiveness of massage for pain management. Cherkin and his colleagues (2001) examined massage, acupuncture and self-care education for pain in 262 patients with chronic low-back pain. Their results demonstrated that massage in comparison to acupuncture is more effective for the patient's function and in comparison to self-care education has more effect in symptom reduction and increase of the function of the patient. In one study it was shown that massage therapy is superior to muscle relaxation in chronic low-back pain patients in regard to pain, sleep, depression, and flexion. It is a safe and cost effective method of treatment (Cherkin et al., 2003).

Manipulation. Chiropractic manipulation is one of the CAM methods in which the manipulation of nerves has a therapeutic effect. This method of CAM is useful in the management of pain in different parts of the body, for example, migraine headache, back pain, and cervical pain. Psychogenic pain patients are good candidates for this method. Several studies show effectiveness of this method in the reduction of the frequency and intensity of episodes of migraine headache and low-back pain in comparison to conventional treatment (Borins, 2005; Meade, Dyer, Browne, Townsend, & Frank, 1990). In an observational study, 2870 patients with low-back pain received either chiropractic or conventional medical care with 48

months follow-up after treatment. Finally the patients who were under the chiropractic treatment showed better pain scores (Haas, Goldberg, Aickin, Ganger, & Attwood, 2004). Studies have also shown significant pain reduction in leg and cervical pain and tension headache (Hurwitz, Aker, Adams, Meeker, & Shekelle, 1996; Nelson et al., 1998).

G. Goal-Directed Health Care

Waters and Sierpina (2006) suggest goal-directed health care (G-DHC) as a new way for treatment of the chronic pain that involves psychogenic pain. Actually, it is a person-centered and relationship-centered therapeutic method. The patient has an active role and should be engaged in the treatment process actively and is not like the usual scenario in which the patient expects the doctor and the medication to cure him or her in expectation of treatment. Also the patient-doctor relationship plays a very important role here, because based on an empathic relationship between the healer and the patient, the treatment process can progress. In G-DHC, there are more important goals and values than merely pain reduction or elimination and in this manner, the healer and the patient interact with each other. In this mutual relationship the patient has a basic role and the physician act as a guide. The essential part of G-DHC is the recognition of patient's goals in life. The patient is directed to explore and reconsider his life goals beyond his illness and answer why he wants to recover his health again. Actually, the main goal of pain patients is pain elimination but the healer should guide the conversation and encourage the patient to consider more existential and essential goals in life. Questions like "what do you want to do that pain does not allow you to do?" or "What are your main concerns about not being able to do a task in the next 3-5 years?" When a patient thinks more

about these issues and clarifies his or her goals, the healer should connect these life goals to the health goals. When the goal is beyond the symptom relief, the patient can make suitable and conversant choices based on his essential desires in life. Indeed, this approach wants to change the patient's mind from "will/can the doctor cure me?" toward "can I change this condition and make my life more enjoyable?" In other words, this approach makes the patient more responsible and allows him/her to select and perform healthier behaviours by choice. Actually this way leads to the improvement of the patient's quality of life, enhancement of healing process and more satisfaction of patient and doctor.

H. Logotherapy and the Meaning of the Life

Bob (2009a) also has a different viewpoint about pain. He believes that although pain is not a pleasant experience, it can cause human growth and improve spirituality. Many investigations have shown that pain experience can reveal the meaning of life and the existential human purpose, and self-reflection which is a result of pain experience is a very basic component of learning and creative understanding. In other words, there can be many positive consequences and changes which are the result of pain experience such as improvement in patient relationships, worldview and spirituality. In this manner, in psychotherapy or G-DHC, the healer can prepare the space and encourage the patient to observe the pain from different perspectives. Logotherapy is one of the suggested treatments for chronic pain that was proposed by a neurologist and psychiatrist, Victor Frankl (as cited in Lantz, 1986). The main focus of this therapeutic method is on the person's will and meaning of life. He believes that life has meaning and each person should try to find it individually in all life circumstances. In addition to the

human biopsychosocial dimensions that were defined by Engel (1980), he believes that the human spiritual dimension is also very important and should be considered in understanding human behaviour. He believes that tension and suffering are natural parts of human existence. In his view there are two kinds of the unconscious, the instinctual and the spiritual unconscious. The instinctual unconscious is composed of suppressed emotions and aggressions but the spiritual unconscious is full of positive qualities such as love and transcendence which have been ignored and are not recognized by people. While Freudian therapists believe that free association is a way to access the instinctual unconscious, logotherapists try to use self-discovery discourse by asking existential questions to help patients to discover the spiritual unconscious (Lantz, 1986). As many chronic pain patients report a sense of existential meaninglessness and think that their pain is the punishment of God or they ask why life is unfair, logotherapy can help these patients. Clear purpose in life positively increases the self-efficacy of the patients and has a protective role against depression in chronic pain (Hutchinson, 2004).

VI. CONCLUSION

Given the fact that psychogenic pain is a prevalent clinical complaint that is not properly manageable using the biomedical approach, it has become one of the essential and chronic health problems that exhausts both doctors and patients. Therefore, it demands a comprehensive approach that is different from current biomedical approaches.

It has been demonstrated above that there are different psychological approaches which can be used as effective treatments for this kind of pain. Doctors should consider disease beyond its merely

biological aspects and should be trained in this regard. This means that in the management of complex problems like psychogenic pain, doctors should receive help from other specialists such as psychologists and physiotherapists and also should pay more attention to cognitive and emotional aspects of the problem. Also it is a duty of psychologists to teach people to consider their emotions seriously and note that there is an intimate interaction between their minds and their bodies. Given that neuropsychological origins of psychogenic pain have been revealed by studies in the field of neuroscience, new treatments may be developed based on these new achievements and further research in this field is needed.

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