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Neuropathic Pain: A Secondary Complication of Spinal Cord Injury

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Features of Neuropathic Pain

Defining and understanding pain has been considered a challenge among medical professionals because of the subjectivity and difficulty to assess pain experiences among patients. Literature associated with pain uses both a broad (i.e., referring to dysfunction) and narrow (i.e., referring to lesion) definition to describe neuropathic pain. The broad definition of pain includes various conditions, such as complex regional pain syndromes or even musculoskeletal disorders with signs of hypersensitivity which may be regarded as neuropathic pain (Cruccu et al., 2004). Traditionally, it was common to include other types of pain experiences within the description of "neuropathic" pain (Siddall & Cousins, 1998). The International Association for the Study of Pain (IASP) defined neuropathic pain as "pain initiated or caused by a primary lesion or dysfunction of the nervous system" (Merskey & Bogduk, 1994, p.212). A narrow and more specific definition of neuropathic pain notes that when the principal abrasion is located in the central nervous system, it is referred to as central neuropathic pain, and when the abrasion is located in the peripheral nervous system it is labeled as peripheral neuropathic pain (Siddall & Cousins, 1998). However, it is not uncommon for most conditions to become centralized. Other definitions that follow a narrow approach indicate: neuropathic pain is the result of an injury or condition affecting the somatosensory system (i.e., pain, temperature, touch, and proprioception) (Di Stefano et al., 2012); or, the result of abnormal processes of the nervous system and persists past the standard period of tissue healing (Eide, 1998; Mann, 2008).

Neuropathic pain is a persistent and distressing condition that drastically alters the physical and emotional well-being of individuals. Neuropathic pain accounts for frequent medical visits, high health care costs, loss of productivity, and poor quality of life (Mann, 2008). Many individuals with neuropathic pain often visit their general practitioner once a month for management. The relation among pathology, mechanisms and symptoms in neuropathic pain is multifaceted (Woolf & Mannion, 1999). For instance, not all mechanisms are present in every case, and similar symptoms reported by two individuals may have a different pathology. On the other hand, multiple mechanisms may exist in a single individual where the probability mechanisms will alter over time. Moreover, neuropathic pain is difficult to predict and at times complicated to diagnose. With a growing interest in neuropathic pain coupled with the prevalence expected to increase among this group, a consensus on accurate diagnosis and management is critical (Colombo, Annovazzi, & Comi, 2006). Consequently, it is the intention of this article to outline the features, pathology, symptoms, and prevalence/incidence studies associated with neuropathic pain, specifically regarding spinal

cord injury.

Pathology

The pathology, development, and maintenance of neuropathic pain have been extensively explored in past literature (Siddall & Cousins, 1998; Mann, 2008; Wolff & Mannion, 1999). Most theories have focused on examining the nervous system, inflammatory response, genetics and the immune system to determine their role in neuropathic pain (Mann, 2008). Early literature presented by Siddall and Cousins (1998) proposed impairment of the nervous system might be owed to injury, degeneration, inflammation or ischemia. They listed some of the common conditions responsible for these impairments when located in the peripheral nervous system. These common conditions include, but are not limited to: neuroma, nerve compression, nerve crush, and neuropathies, while lesions situated in the central nervous system include spinal cord injuries and brain stem trauma.

Woolf and Mannion (1999) offered the following explanations as the causes for peripheral neuropathic pain. One pain theory proposed by this study suggests injury to or alterations (i.e., inflammation) of sensory neurons elicit spontaneous pain independent of a stimulus where a healthy sensory neuron only elicits pain when evoked by a stimulus. Genetics was identified as a possible cause for peripheral neuropathic pain. A genetic component likely adds to the varied phenotype of persons with similar abrasions and explains, for instance, the various risks of developing post-herpetic neuralgia after an episode of shingles.

Symptomology

Symptoms vary exponentially among individuals with neuropathic pain. For instance, in reference to frequency of pain experience, the pain symptoms may be present on a constant, intermittent, or a combined basis. Neuropathic pain sensations are often characterized as burning, shooting, tingling, or electric (White, 2004). Other symptoms such as stabbing, erratic, and intense shock-like pain experiences have been reported among this population (Closs, Staples, Reid, Bennett, & Briggs, 2009).

Additional symptoms associated with sensory changes and abnormal pain perceptions have been documented, such as dysaesthesias (i.e., abnormal "burning" sensations), paraesthesisas (i.e., abnormal perception of a non-painful type, "pins and needles" sensation), allodynia (i.e., severe pain reaction to non-painful stimuli), and hyperalgesia (i.e., increased pain from stimuli that normally cause less pain such as by light touch or contact with a breeze/hypersensitivity) (Closs et al., 2009; Eide, 1998).

Neuropathic Pain Following Spinal Cord Injury

Individuals with spinal cord injury (SCI) endure various forms of pain; one of the most common types is neuropathic pain. Neuropathic pain is notably common in (SCI), with a prevalence ranging from 40% to 75% (Henwood, Ellis, Logan, Dubouloz, & D'Eon, 2012). Recent research suggests that the wide range is due to the inconsistency among definitions and taxonomies, though neuropathic pain is widely accepted and known as an enduring and complex problem in individuals with acquired SCI. Neuropathic pain experienced by persons with SCI report the pain often occurs below their level of the injury. Symptoms of neuropathic pain have been reported to last for years post-injury, even with the many pain interventions available (Cruz-Almeida, Martinez-Arizala, & Widerstrom-Noga, 2005). Neuropathic pain can have a significant impact on quality of life, sleep disturbance, and ability to complete activities of daily living (Felix, Cruz-Almeida, & Widerstrom-Noga, 2007).

Various studies have examined the onset and the gender differences of neuropathic pain

after SCI. Neuropathic pain is typically reported soon after the injury or within the first year following disability onset (Sang & Jenkins, 2006). Research has also found that there is not a difference among gender groups in regards to the onset of neuropathic pain (Celik, Erhan, & Lakse, 2012). According to Henwood et al. (2012), neuropathic pain has been regarded as one of the most disabling and difficult to treat sensory disturbances associated with SCI.

Clinical Characteristics

There are a number of documented indicators and symptoms which are suggestive of neuropathic pain following SCI; however, research suggests several of these symptoms are similar to those associated with neuropathic pain of other origin (Yezierski & Burchiel, 2002). Persons with SCI often describe the neuropathic pain symptoms as shooting, stabbing, burning, aching, and soreness; and, although the severity and frequency varies, symptoms can be intensified by physical movement and contact with cold temperature (Sang & Jenkins, 2006; Finnerup & Jensen, 2004; Yezierski & Burchiel, 2002). Neuropathic pain often varies in severity, frequency, and duration (Sang & Jenkins, 2006). Widerstrom-Noga et al. (2008) note this type of pain often becomes chronic and exacerbates periodically over time.

Neuropathic pain after SCI has been shown to interfere with activities of daily living and reduce quality of life (Celik et al., 2012; Henwood et al., 2008; Siddall, 2009). According to Werhagen, Budh, Hultling, & Molander (2004), SCI patients described pain as disruptive and Celik et al. (2012) found neuropathic pain affected SCI patients both emotionally and physically. Equally, neuropathic pain has been linked with higher intensity levels than musculoskeletal pains in patients with SCI (Siddall, McClelland, Rutkowski & Cousins, 2003).

Taxonomy

A number of sources have discussed taxonomies in regards to neuropathic pain after SCI to bring consensus among diagnosis and classifications (Felix et al., 2007; Eide, 1998; Siddall, 2009). The taxonomy for SCI pain is divided into three tiers as either neuropathic or nociceptive, and according to their location in relation to the level of injury. In the first tier, pain is divided into nociceptive pain (i.e. pain due to non-neurogenic tissue damage) and neuropathic pain (i.e. pain due to damage of peripheral and /or central nervous tissue). Neuropathic pain can be assigned to one of four following categories of pain specific to SCI. The first two types are nociceptive in nature (1) musculoskeletal pain and (2) visceral pain. In persons with SCI, peripheral nociceptive pain stimulation may be provoked by impairment of skeletal structures and ligaments in the spine and decubitus causing lesion of skin and muscles. The final two types are classified as neuropathic (3) at –level neuropathic pain (pain that occurs in a dermatomal or segmental distribution at the level of injury), and (4) below-level neuropathic pain (refers to neuropathic pain present in the region more than three dermatomes below the neurological level of injury). At-level neuropathic pain is generally described as burning, electric, or shooting; and changes such as allodynia or hyperalgesia within the pain distribution are often found (Widerstrom-Norga et al., 2008). Neuropathic pain at-level may be unilateral or bilateral. Below-level neuropathic pain is often described as burning, electric, or shooting and sensory alterations such as allodynia or hyperalgesia may occur (Widerstrom-Norga et al., 2008).

Prevalence of Neuropathic Pain in SCI Patients

The majority of individuals with SCI experience varying levels and types of pain as a secondary condition of their disability at some point in life. Pain has been shown to reduce rehabilitation outcomes and quality of life in individuals with SCI (Siddall, 2009). In addition,

neuropathic pain may impact an individual's ability to walk and decrease their sexual activity (Siddall et al., 2003). As a result, it is important for rehabilitation professionals to have a thorough understanding of the impact pain experiences may have on individuals.

Research has investigated the impact of age at onset of SCI has on the prevalence of neuropathic pain (Werhagen et al., 2004; Werhagen, Hultling, & Molander, 2007). Prevalence of neuropathic pain varies depending on whether the individual has traumatic or non-traumatic SCI (Werhagen et al., 2004; Werhagen et al., 2007). For instance, research indicates that there is a positive correlation between neuropathic pain and age at the onset of traumatic SCI (Werhagen et al., 2004). Individuals who are 39 years old or younger tend to have below-level of injury neuropathic pain, while many with SCI over age 40 report having at-level neuropathic pain (Werhagen et al., 2004). For individuals with non-traumatic SCI, there appears to be no consistent statistical significance between age at the onset of SCI and the prevalence of neuropathic pain (Werhagen et al., 2007).

Felix et al. (2007) evaluated 194 persons with SCI who were at least two years post injury and reported chronic pain complaints by using structured interview. The authors explored a neuropathic pain score which was calculated as the sum of the presence of pain descriptors (e.g., sharp, stabbing), and rated these on a visual analog scale from zero to 10 (10 representing the worst pain). Pain ratings were labeled as "most disturbing" and "least disturbing." Results indicated that 80.9% of participants reported having more than one type of pain, 36.1% reported having two pain areas, 23.7% reported three pain areas, and 21.1% reported four pain areas. The most disturbing pain was reported as being "sharp" of high intensity, high interference, high aggravation, and highly constant. Although most disturbing and least disturbing pain did not differ significantly regarding specific body location, 52% versus 39% of most disturbing as opposed to least disturbing pain was experienced at the level of injury. Turner and Cardenas (1999) reported similar overall chronic pain reports from their sample at 83.3%.

Similarly, Widerstrom-Noga, Cruz-Almeida, and Felix (2009) interviewed 182 participants who were categorized as "Dysfunctional, with higher pain severity (PS) and life interference (LI); Interpersonally Supported, with moderately high PS, high social support levels, and less LI; or Adaptive Coper, with lower PS and LI levels" (p. 43) using the SCI version of the Multidimensional Pain Inventory (MPI-SCI) (Kerns, Turk, & Rudy, 1985). The participants consisted of individuals who had acquired their traumatic SCI at least one year prior to the study, had experienced pain for at least six months, and who were 18 years or older. The authors examined the relationship between pain characteristics and specific adaptation patterns to pain after acquiring SCI. The authors used a structured interview format to assess pain intensity, constancy of pain, quality of pain, and pain aggravation. Participants were asked questions exploring whether they experienced pain that was different from other pain problems. If a participant reported that they experienced a distinctly different pain problem, they were then asked to identify the most disturbing pain problem. To assess pain intensity, participants were assessed using a numerical rating scale from zero to 10 (zero representing no pain and 10 being most pain imaginable). To assess constancy of pain, participants were asked two questions: (1) "How often do you have pain? (choice consisted of "no predictable pattern," "1 to 3 days per month," "1 to 2 days per week," "3 to 6 days per week," or "every day"); and (2) "Do you have breaks from pain?" (choices consisted of "no predictable pattern," "week-long breaks," "breaks of 1 day to several days," "breaks of several hours," "breaks of 5 minutes to 1 hour," "short breaks (<5 minutes)," or "no breaks"). To assess quality of pain, participants were given a list of 24 descriptors (i.e., aching, biting, burning, cold, cramping, crushing,

cutting, dull, electric, flashing, lacerating, lancinating, penetrating, pinching, pressing, pricking, pulsating, radiating, sharp, shocking, shooting, stabbing, stinging, and throbbing) to describe their most "disturbing" pain. To assess pain aggravation, participants were given a list of 27 factors and were asked to determine whether each factor "has no effect on the pain," "makes the pain worse," makes the pain considerably worse," or whether they "did not know." Results indicated that 78% of participants reported experiencing more than one pain. Out of the 182 participants that participated in the study, 463 pains were reported. From the 463 pains reported, 30.2% of pains were located in the back, 22.7% were located in the neck/shoulders, and 22.5% were located in the legs/feet. Pain intensities for the most "disturbing" pains fell in the severe range (i.e., 7.6 and 7.8). The most frequent pain descriptors chosen by participants were "sharp, burning, aching, stabbing, throbbing, penetrating, electric, stinging, shooting, and pinching" (Widerstrom-Noga et al., 2009, p. 48). In regards to pain aggravation, eight out of the 27 factors aggravated pain in more than 25% of the participant sample. The findings of this study support the bio-psychosocial model of pain that suggests there is reciprocation between biological, psychological, and social factors (Turk, 1996).

Ullrich, Jensen, Loeser, & Cardenas (2008) investigated the pain intensity of 238 individuals with SCI in relation to pain site. The authors utilized a postal survey consisting of measures of pain intensity, pain interference, as well as demographic and medical characteristics. The most common pain experienced was moderate and prevalent across the body. Although results indicated that there was a relationship between SCI and the presence of pain, there was no association between SCI with pain intensity or interference. The results indicated that individuals with higher level injuries reported upper extremity pain when compared to individuals with paraplegia. In addition, the authors found that the lower body contained the highest pain ratings. Furthermore, individuals with low cervical injuries were more likely to report having pain in their neck in comparison to individuals with high cervical injuries or paraplegia. Another significant finding was that individuals with paraplegia were less likely to report having pain in the shoulder, arms, or hands when compared to individuals with high cervical injuries. Approximately, 50-70% of participants reported having lower back pain. The findings of this study are supported in the literature. Although Curtis et al. (1999) found that individuals with tetraplegia were more likely to report having shoulder pain than individuals with paraplegia, shoulder pain intensity was also still highly prevalent among those with paraplegia.

At-level and below-level neuropathic pain are two of the four types of pain an individual with SCI may experience (Siddall et al., 2003). Siddall et al. (2003) conducted a longitudinal cohort study investigating the prevalence of pain experienced by individuals with traumatic SCI. Participants in the Siddall et al. (2003) were recruited from the sample population of the Siddall, Taylor, McClelland, Rutkowski, and Cousins (1999) study and were admitted into the Spinal Cord Unit of a University hospital with an acute SCI five years earlier. Siddall et al. (2003) conducted a five-year longitudinal study extending his 1999 study evaluating the prevalence of pain. Overall, the authors found that 65-85% of individuals who acquired SCI developed clinically significant pain. Out of a sample population of 73 individuals, 59% experienced musculoskeletal pain, 41% experienced at-level neuropathic pain, 34% experienced below-level neuropathic pain, and 5% experienced visceral pain. Individuals with below-level neuropathic pain reported experiencing severe or excruciating pain more than individuals with at-level neuropathic pain. For instance, 60% of individuals with below-level neuropathic pain experienced severe or excruciating pain, whereas only 48% of individuals with at-level neuropathic pain experienced severe or excruciating pain. In comparison with the

other two types of pain (visceral and musculoskeletal), 75% of individuals in the sample population with visceral pain experienced severe or excruciating pain and only 25% of individuals with musculoskeletal pain experienced this pain severity. Although chronic musculoskeletal pain is more common among individuals with SCI, the pain experienced is less severe and cannot be predicted within the first six months of injury. On the other hand, individuals who acquire neuropathic pain soon after their SCI are more likely to experience ongoing pain as well as experience severe pain symptoms (Siddall et al., 2003).

Past research has examined the prevalence of neuropathic pain as it relates to the level of SCI and injury completeness (Werhagen et al., 2004). From 1995-2000, Werhagen et al. (2004) assessed 402 patients seeking consultation at an outpatient clinic at the Karolinska Hospital in Stockholm, Sweden. The authors investigated at-level and below-level neuropathic pain as well as level of injury using the International Association for the Study of Pain (IASP) criteria. The authors also examined the patients' age at the time of injury, gender, and completeness of injury. Results indicated that 13% of individuals reported having at-level and 27% of individuals reported having below-level pain. Results yielded no significant difference between neuropathic pain and injury completeness. In addition, the authors found that there was no significant difference among individuals with paraplegia and quadriplegia and incidence of neuropathic pain. Siddall et al. (2003), on the other hand, found that 50% of individuals who reported having tetraplegia and 18% of individuals with paraplegia experienced below-level neuropathic pain. When individuals with below-level and at-level neuropathic pain were compared with individuals with complete and incomplete SCI, results indicated that there was no significant relationship. Nevertheless, research (Siddall et al., 2003; Werhagen et al., 2004) has highlighted the differences in prevalence rates of neuropathic pain among individuals with SCI depending on the level of SCI.

Researchers overall indicate that the prevalence of chronic pain among individuals with SCI is between 11-94% in which approximately 30% of this type of pain is expressed as neuropathic pain (Calmels, Mick, Perrouin-Verde, & Ventura, 2009; To et al., 2002; Budh et al., 2003). Celik et al. (2012) investigated 50 SCI patients experiencing at-level and below-level neuropathic pain. The authors obtained information pertaining to the individual's history, duration, localization, and characteristics of pain. Out of the 50 participants, 10 had tetraplegia and 40 had paraplegia. Twenty-eight participants reported having motor and sensory complete injuries while 22 participants reported having sensory incomplete injuries. Most of the participants described the neuropathic pain they were experiencing as "throbbing, tiring, hot and tingling" (Celik et al., 2012, p. 585). Results also indicated that 21 individuals reported having continuous neuropathic pain, 14 individuals had intermittent neuropathic pain, and 12 individuals had momentary neuropathic pain. A significant finding was that individuals experienced greater pain intensity at night than during the evening, noon, and morning. Celik et al. (2012) not only found that neuropathic pain is a serious condition experienced by individuals with SCI, but significantly impacts their quality of life. While nine individuals found pain relief through medicine and six found pain relief through physical activity, 23 individuals reported that nothing helped to alleviate the pain. Although the authors did not find a correlation between daily course of neuropathic pain severity and age, they did find that neuropathic pain was prevalent among individuals between the ages of 30 and 39. Ravenscroft and Ahmed (2000) also found that there was no association between chronic pain and age.

Management of Neuropathic Pain

There are numerous types of pain treatments that have been used to improve the quality

of life of the individual experiencing neuropathic pain (Cardenas & Jensen, 2005; Siddall & Loeser, 2001). The three major categories of pharmacological treatments used are anti-depressants, anticonvulsants, and analgesics. Individuals diagnosed with having neuropathic pain as a result of SCI are typically first prescribed tricyclic antidepressants (Cardenas & Jensen, 2005). A commonly used anticonvulsant is gabapentin. Gabapentin has been shown to reduce neuropathic pain by 50% (Finnerup, Sindrup, Bach, Ohannesen, & Jensen, 2002). Although analgesics such as non-steroidal anti-inflammatory drugs (NSAIDS), acetaminophen, and opioids have been used as pain medication for neuropathic pain, they are typically not effective in reducing pain. Analgesics have been found to be more effective when used to treat musculoskeletal pain (Cardenas & Jensen, 2005). An interesting finding is that the pain experienced by individuals with SCI tends to be refractory as a result of current pharmacological treatments (Baastrup & Finnerup, 2008; Siddall, 2009).

Cardenas and Jensen (2005) conducted a study to explore the various pain relief methods individuals with SCI were utilizing. The researchers surveyed 117 individuals with SCI to identify the different types of pain treatments that are being used by individuals and to examine their effectiveness in reducing pain. The majority (i.e., 71%) of individuals reported that they have taken NSAIDS for pain relief and of these individuals more than half of them continue to utilize this form of medication treatment. Furthermore, 59% of individuals stated that they have taken opioids in the past for pain and 21% were actively using the medication. On a scale from 0 to 10, 0 meaning "no relief" and 10 meaning "complete relief", individuals taking opioids average relief was 6.27. It is important to note that the majority of individuals participating in this study were predominately White (i.e., 89%) and male (i.e., 73%) and that the average age was 49. Although results indicated that opioids were most effective in reducing pain, 73% of participants reported using an alternative pain treatment. The most frequent type of alternative pain treatments used by the participants was massage, marijuana, and acupuncture. The authors found that individuals receiving massages and using marijuana experienced the most pain relief. An interesting finding was that medications only provided relief for only minutes to hours whereas alternative pain treatments, such as massage, acupuncture, and hypnosis provided pain relief for days in 25% to 33% of participants utilizing these methods.

Furthermore, Heutink, Post, Wollaars, and Van Asbeck (2011) examined the effectiveness of pharmacological and non-pharmacological treatment used for chronic spinal cord injury pain (CSCIP). The authors measured treatment effectiveness by using a Chronic Pain Grade questionnaire, obtaining a history of treatment modalities, and evaluating the participants' perceived effectiveness of the pain treatment they are currently using for pain. The participant sample consisted of 215 individuals with CSCIP. Results indicated that 62.8% had more than one pain type. The most frequently reported pain was neuropathic pain (i.e., 69.3%). Although 63.8% of participants were receiving some type of treatment, 52.8% of them still experienced high levels of pain. The types of treatment used by most participants were massage therapy/relaxation training, anticonvulsants, and non-steroidal anti-inflammatory drugs (NSAIDS).

Oxycodone has been shown to reduce neuropathic pain in individuals with SCI (Barrera-Chacon et al., 2011). Barrera-Chacon et al. (2011) examined the effectiveness of using oxycodone with anti-convulsants. Eighty-three percent of individuals used oxycodone in combination with anti-convulsants while 17% of individuals used only oxycodone. In this particular study, 51% of individuals had a dorsal lesion level and 50% had a complete lesion. Results indicated that 81% of individuals experienced an improvement in physical activity and

60% experienced better sleep.

Murphy and Reid (2001) found that an individual's impact of pain on life was important 57% of the time. As a result, the researchers suggest that professionals working with individuals with neuropathic pain obtain a comprehensive overview of the individual's pain needs. Murphy and Reid (2001) surveyed 88 individuals from the SCI registry of the Commonwealth of Virginia. Results of their study indicated that the majority of individuals receiving pain treatment were dissatisfied with their treatment. For this reason, rehabilitation professionals should explore all possible pain management options for the individual with SCI.

Norrbrink, Lindberg, Wahman, and Bjerkefors (2012) recruited 13 wheelchair users with a thoracic or lumbar SCI to participate in a 10-week training program held three times per week. The authors evaluated the effectiveness of the training program on the participants' upper-body strength, aerobic and mechanical power, and crossover effects on functional performance and cardiovascular risk factors. Participants were between the ages of 18 and 70 and did not have a history of cardiovascular, lung disease, or cognitive impairments. Of the 13 participants recruited for this study, eight individuals reported having pain. The authors explored the pain described by the participants by using the International SCI Basic Pain Data Set, the Wheelchair Users' Shoulder Pain Index, and International SCI Quality of Life Basic Data Set. Results indicated that four of the five participants experiencing musculoskeletal pain reported having no pain at the end of the 30 session treatment program. In addition, four out of seven participants experiencing neuropathic pain reported clinically significant decrease in intensity of pain.

Similarly, Mulroy et al. (2011) conducted a 12-week home-based program consisting of shoulder strengthening and stretching exercises. The purpose of the program was to investigate the strengthening and optimal movements for pain shoulders (STOMPS) in chronic SCI. The sample consisted of 80 participants who acquired paraplegia at 14 years of age or older and who have had SCI for at least 5 years. Participants also were between the ages of 19 and 75, had unilateral or bilateral shoulder pain, and have used a manual wheelchair for at least 50% of the time. During the program, participants were given recommendations on how to improve and optimize their physical ability for transfers, raises, and wheelchair propulsion. The outcome of this intervention group was compared to that of a control group who merely watched a 1-hour educational video. Participants who received the intervention decreased their pain levels by one third. Participants in the control group did not demonstrate any changes in pain levels. In addition, results indicated that participants in the intervention group experienced an improvement in their quality of life. All improvements experienced by the participants in the intervention group were maintained at the 4-week follow-up assessment.

Limited research has examined the use of psychological treatment to manage neuropathic pain in individuals with SCI (Heutink et al., 2010). Heutink et al. (2010) proposed a study protocol to investigate the effectiveness of using a cognitive behavioral approach to managing neuropathic pain. Heutink et al. (2010) organized Coping with Neuropathic Spinal Cord Injury Pain (CONECSI), a multidisciplinary cognitive behavioral program to assist individuals in coping with neuropathic pain. The researchers report that they will examine the effectiveness of the program on the intensity of pain and pain-related disability as well as mood, participation in activities, and life satisfaction. The researchers plan to obtain a sample of 60 participants with neuropathic SCI pain from four rehabilitation centers. Participants will be randomized into either a control group (i.e., waiting list) or treatment group (i.e., cognitive behavior intervention). Individuals in the treatment group will receive 11 treatment sessions consisting of an educational, cognitive, and behavioral component. Heutink et al. (2010)

expect that the findings of this proposed study will enhance rehabilitation treatment.

Depending on the individual's severity of neuropathic pain and the impact it has on their life (e.g., individual experiences psychological distress), psychological treatment may be beneficial to the individual in improving their psychological well-being (Siddall & Loeser, 2001). It is good practice to incorporate a psychological assessment into the individual's comprehensive evaluation of pain. Additionally, combining pain management with a cognitive behavioral therapy approach may result in improved mood, facilitate the adjustment process, and assist the individual in reaching his or her maximum functional ability (Craig, Hancock, & Dickson, 1999).

Conclusion

The findings presented in this literature review are aimed at providing rehabilitation professionals an overview of the research that is being conducted in neuropathic spinal cord pain. Research indicates that the prevalence of neuropathic pain differs depending on the individual's age of disability onset (Werhagen et al., 2004; Werhagen et al., 2007), gender (Werhagen et al., 2004), ethnicity (Ullrich et al., 2008), lesion level (Siddall et al., 2003), and injury completeness (Werhagen et al., 2004). As a result, it is important for rehabilitation professionals to have awareness of the prevalence, frequency, severity, and possible symptoms and implications associated with neuropathic pain in SCI (Samuel, Moses, North, Smith, & Thorne, 2007).

Life care planners can potentially have a myriad of consultation questions for treating neurosurgeons, pain specialists, and/or physiatrists with a pain background. From the review above, there appears to be a number of noninvasive and invasive treatments to manage pain. In addition, although some treatments work well for some, they appear to be largely ineffective for others. Although the prevalence rates vary widely depending on the sample being assessed, there appears to be a medical probability for most persons with SCI to need some form of treatment over their lifetime, whether that be temporary or permanent. Chronic reliance on typical pain medications may cause other long-term problems due to side effects as well as liver and kidney function. Indeed, some individuals with SCI would rather live with some degree of pain then to have to chronically rely on medications they believe may be harmful to them in the future.

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