Proposed physical therapy treatment for HIV/AIDS patients suffering from peripheral neuropathy pain

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Proposed Physical Therapy Treatment for HIV/AIDS Patients Suffering from Peripheral Neuropathy Pain

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In partial fulfillment of the requirements for the degree of Master of Science in Biomedical Sciences

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Proposed Physical Therapy treatment for HIV/AIDS patients suffering from peripheral neuropathy pain

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HIV/AIDS is an extremely prevalent health problem in the world today. Millions of individuals are directly affected by the Human Immunodeficiency virus. Billions of dollars are spent annually on HIV/AIDS related research and treatment/medical intervention. Many different health care professions are involved in the delivery of treatment interventions to patients living with HIV/AIDS. Despite all the research and all the treatment provided, HIV/AIDS patients continue to suffer from lack of adequate health care. The allied health professions have a lot to offer to HIV/AIDS treatment, especially with pain treatment interventions, adaptive equipment recommendations, and optimizing physical functioning. Physical therapists in particular can greatly help to improve the quality of life for patients living with HIV/AIDS. Unfortunately, HIV/AIDS education is not a large component of the physical therapy curriculum and HIV/AIDS specialization is not a common practice in the physical therapy professional realm of care.

The purpose of this research proposal is to provide a thorough overview of HIV/AIDS, the virus lifecycle, the disease course, the symptoms and the treatment interventions. The intention of this research is to inform health care professionals about how physical therapy can become an adjunctive treatment for patients living with HIV/AIDS, to encourage the integration of HIV/AIDS education into the existing physical therapy curriculums and to support HIV/AIDS treatment specialization in the physical therapy profession. Currently there is not much research regarding HIV/AIDS treatment and physical therapy. Hopefully this extensive research proposal will provide the ground work for future physical therapy involvement in the treatment and research of HIV/AIDS.
i) HIV/AIDS

(1) What is HIV and how is it transmitted

The Human Immunodeficiency virus (HIV) is a RNA retrovirus, which cannot survive outside of human cells. The virus is transmitted from one person to another by the transfer of body fluids (1). The virus can be spread through sexual contact with an infected person, by sharing needles (primarily for drug injection) with someone who is infected, or through blood transfusions (very rare in countries which screen blood for HIV antibodies). HIV infected mothers can also pass the virus to their children during childbirth or through breast-feeding after birth. Less commonly, HIV can be spread in the health care setting if workers are stuck with a needle containing HIV infected blood or infected blood gets into a workers open wound or in the mucous membrane (2).

(2) Prevalence:

According to the UNAIDS global summary of the AIDS epidemic December 2004, approximately 35.9-44.3 million people are living with HIV, 4.3-6.4 million people were newly infected with HIV and 2.8-3.5 million people died of AIDS in 2004 (3). According to the UNAIDS United States epidemiological data sheet 2004 update, in the United States of America in 2003 approximately 950,000 adults and children were living with HIV and 240,000 of these cases are women. Approximately 14,000 people died of AIDS in U.S.A. in 2003. The estimated number of diagnoses of AIDS among adults and adolescents according to exposure categories in the United States are: male-to-male sexual contact (420,790), injection drug use (240,268), heterosexual contact (135,628), male-to-male sexual contact and IDU (59,719), others, including hemophilia, blood transfusion, perinatal and risk not reported or identified (20,869). Among racial groups in the United States 58% of people with HIV and AIDS were non-Hispanic black or Hispanic, and 41% were white, non-Hispanic (4).

(3) Pathophysiology

(a) Effects on Body:

(i) The Immune System

In order to understand the effects the Human Immunodeficiency Virus has on the body, it is important to become familiar with the body’s immune system. The immune system is made up of cells and substances of the blood that are responsible for protection from infection. The immune system protects humans from a wide variety of infectious agents including: viruses, bacteria, protozoa, fungi, and multicellular parasites. The immune system also plays an important role in fighting cancer (5).

Cells of the immune system are divided into two classes: those that respond to a specific foreign agent or substance (lymphocytes) and those that are not specific for the foreign agent they attack (phagocytes, mast cells, eosinophils and natural killer cells). Phagocytes are cells that attack and eliminate foreign agents by engulfing them. Mast cells, basophils and eosinophils attack foreign agents that are too large to be engulfed by a single blood cell. Mast cells and eosinophils release toxic compounds upon contact with foreign agents in order to kill them (5).

Lymphocytes are cells that respond specifically to particular foreign agents or antigens. Lymphocytes are divided into two types: B-lymphocytes and T-lymphocytes. B-lymphocytes secrete antibodies into the circulatory system. These antibodies specifically recognizes and binds to one particular antigen then sends signals to other cells in the immune system to attack. T-lymphocytes, commonly known as T-cells, make proteins called receptors that are comparable to antibodies in that they recognize specific antigens. T-cells specifically recognize foreign antigens and bind to them. There are two types of T-lymphocytes, cytotoxic or killer T-cells and helper T-cells. Killer T-cells will directly bind to cells carrying a foreign antigen and attack and
kill those cells. Helper T-cells do not directly kill foreign antigens; instead they interact with Killer T-cells or B-lymphocytes and help them respond to antigens. Both Killer and helper T-cells have characteristic proteins on their surfaces: a CD8 protein is present on Killer T-cells and a CD4 protein is present on Helper T-cells (5).

(ii) Viruses and the Infection Cycle

In order to appreciate the effects HIV has on the body, it is first imperative to understand viruses and the infection cycle. Viruses are among the simplest forms of life. Viruses consist of genetic material, virus proteins, and a system for protecting the genetic material and introducing it into a cell. Viruses cannot replicate outside of cells. Viruses are dependent on cells for energy metabolism, protein synthesis and nucleic acid synthesis (5).

In order for a virus to infect an individual, it first must come into contact with a susceptible cell. Viruses may enter the body through several routes: the respiratory tract, the oral cavity and digestive tract, the anal/genital tract and breaks in the skin. Once the virus finds a route of entrance, then the virus binds to the cell via a virus receptor protein. Next the virus penetrates into the cell and begins uncoating the viral genetic material. After that, expression of the viral genetic material begins. First the infected cell becomes organized for virus expression, second the infected cell replicates the viral genetic material, third there is synthesis of proteins for virus particles and lastly virus particles are assembled and released from the cell. The fate of the infected cell depends on the virus. Lytic viruses kill the infected cell after replication. Nonlytic viruses do not kill the infected cell; instead the infected cell is left in a carrier state and continually produces virus particles. Latency viruses remain hidden in the cell, but does not produce virus until it becomes reactivated (5).
Once established, viruses are very difficult to treat. Since viruses rely on the cell to carry out most of their metabolic processes, it is difficult to find drugs similar to classical antibiotics that will block virus growth without killing the infected cell. Compounds that specifically inhibit a viral process have been identified; these are called antivirals and are promising for the future treatment of viral infections. Currently, the basic treatment for viral infection is to manage the symptoms and wait for the infection to run its course. The best approach to managing viral disease is to prevent the initial infection. Another approach is the use of vaccinations, however not all viruses have vaccines (5).

(iii) Retroviruses

The Human Immunodeficiency Virus is a retrovirus. Retroviruses genetic information is RNA, the RNA is covered with a viral protein coat and together they make a core particle. The core particle is then surrounded by a viral envelope. All retroviruses have three genes: gag genes, pol genes and env genes. Gag genes code for coat proteins that make up the inner virus core particle. Pol genes code for the enzyme reverse transcriptase, protease which is involved in maturation of viral proteins and integrase which is responsible for integration of the viral DNA into the cell’s chromosomal DNA. Env genes code for the proteins of the viral envelope, which are responsible for the binding of the virus to the cell receptor. Genetic information of retroviruses flow from DNA to RNA to proteins, which carry out most of the important functions for the cell (5).

The lifecycle of a retrovirus is as follows: The retrovirus binds to the surface of an uninfected cell by recognizing a cell receptor. Then the virus particle is brought into the cytoplasm of the cell and the viral envelope is removed, leaving the core particle. Next reverse transcriptase, a unique virus-specified enzyme, is activated. Reverse transcriptase reads the viral
RNA and makes viral DNA. The viral DNA then moves into the nucleus of the cell and is integrated into the host cell’s DNA in the chromosomes. Once integrated into the chromosome, the viral DNA resembles any other cell gene, thus normal cell machinery reads the integrated viral DNA to make more copies of viral RNA. The viral RNA is then used for two purposes: first some viral RNA moves to the cytoplasm and functions as viral messenger RNA to program the formation of viral proteins and second the rest of the viral RNA becomes new genetic material for new virus particles by combining with viral proteins in the cytoplasm. These virus particles leave the cell through budding. At initial budding virus particles are immature, viral enzyme proteases then convert immature virus particles into mature ones (5).

Retroviruses do not kill the infected cells. The viruses integrate their DNA into host chromosomes and establish a stable carrier state within the infected cell. Consequently, cells infected with retroviruses continually produce virus without dying. Some retroviruses go into a latent state initially and later become activated by some means and virus is then produced (5).

(iv) HIV Infection

Once in the body, HIV has a selective affinity for certain human cells and affects the immune system in several ways. The HIV infection begins by binding to the CD4 receptor on the host cell. CD4 is located on the surface of helper T lymphocytes, which play a critical role in the human immune system (6). HIV can also bind to CD4 receptors on macrophages and dendritic cells (5). After HIV enters into the cell, the genetic material of the virus, RNA, is released and undergoes reverse transcription into DNA. This viral DNA then enters into the host cell nucleus where it is incorporated into the genetic material of the cell (6). Contrary to most retroviral infections, when HIV infects Helper T-cells the result is death. As macrophages are
infected with HIV, the result is typical of most retroviral infections, macrophages are not killed. HIV infected macrophages then serve as important reservoirs of infection (5).

At initial infection of HIV, B cells are stimulated to produce antibodies that appear in circulation within weeks of exposure. Initially, persons infected with HIV may enter a latent phase and become asymptomatic for long periods of time (1). The virus still continues to replicate by transcription of viral DNA into messenger RNA, which is then translated into viral proteins. New viral RNA forms the genetic make up of the next generation of viruses. The viral RNA and viral proteins then assemble at the cell membrane into a new virus. One viral protein, HIV protease, helps process other HIV proteins into their functional form. And thus the virus is spread. Unless interrupted by treatment, the virus continues to spread throughout the body (6). HIV destroys the body’s CD4 cells and the symptoms begin to appear. Cell mediated and B-cell mediated immunity become depressed, therefore the HIV infected person cannot defend oneself from infection. Once the CD4 cell count falls below 200 or an HIV infected person gets an opportunistic infection, HIV then becomes AIDS, Acquired Immune Deficiency Syndrome. Fatality in HIV infection usually occurs due to overwhelming infection (1).
HIV Life Cycle [Link to image]

HIV Life Cycle [Link to image]
(b) Symptoms:

HIV infected persons are characterized into one of four groups. 1) Those with acute illness. 2) Those with asymptomatic infection. 3) Those with persistent, generalized lymphadenopathy. And, 4) those with other disease superimposed on the viral infection (1). Physical signs and symptoms of HIV infection are similar to flu-like symptoms. Common signs and symptoms that may be experienced are fever, adenopathy, pharyngitis, rash and myalgia or arthralgia. Other signs and symptoms may be fatigue, weight loss and headaches (7). The morphologic changes induced in humans by HIV are nonspecific. Changes vary over time, the extent of viremia, and the degree of immunosuppression. There are many pathologic changes associated with AIDS. Meningitis, encephalitis and AIDS dementia may affect the central nervous system. Herpes labialis and thrush may affect the mouth area. The lymph nodes may experience lymphadenopathy and lymphoma. Pneumonia could be present in the lung and AIDS nephropathy in the kidneys. There may be malabsorption within the small intestine and colitis and proctitis in the large intestine. The skin could have dermatitis, folliculitis, impetigo and Kaposi’s sarcoma (1).

(i) Initial Infection

The progression of symptoms in AIDS may vary depending on the individual affected. At initial infection with HIV some may experience acute symptoms that last several days then disappear. There are two types of acute symptoms that may occur: mononucleosis-like illness and brain infection (encephalopathy). The most common early symptoms seen with HIV infection are similar to symptoms of mononucleosis. Prominent symptoms may be swollen lymph glands, sore throat, fever and skin rash. HIV infection of the brain can also occur at initial infection, this will lead to inflammation of the brain. Symptoms caused by encephalopathy
include headache, fever, and difficulty concentrating, remembering or solving problems. Personality changes may also be present. Significant levels of circulating infectious HIV are usually detectable in the blood during the acute phase of HIV infection (5).

(ii) Asymptomatic Period

During the asymptomatic period, levels of the infections HIV in the blood are decreased and often undetectable. HIV infected individuals usually feel well during this phase. The asymptomatic period may last less than one year or over ten years; it is not known why there is such variability. Within the asymptomatic period a balance is established between HIV infection and the immune system, these changes often allow the HIV infection to escape from control and lead to disease (5).

(iii) Initial Disease Symptoms

Initial disease symptoms fall into three major classes: wasting syndrome, lymphadenopathy syndrome, and neurological disease.

Major symptoms seen with wasting syndrome are sudden and otherwise unexplained loss in body weight (>10% of total body weight) and fevers (usually at night that cause night sweats). The weight loss experienced is usually progressive and leads to wasting away of infected persons. Fevers experienced lead to dangerously high temperatures (106-107° Fahrenheit) that can lead to brain damage. Night sweats occur because the body is trying to lower the high internal temperature experienced with fever (5).

During lymphadenopathy syndrome, lymph gland enlargement is present and persistent. Lymph glands swollen include lymph glands in the head and neck, the armpits, and the groin. Pain is seldom experienced with swollen glands. HIV infected individuals may also experience wasting syndrome along with lymphadenopathy syndrome (5).
About 33% of all AIDS patients experience neurological disease. HIV infection can spread to the brain and nervous system and cause damage. Neurological symptoms, which may be experienced, include dementia (usually progressive), spinal cord damage (myelopathy), and peripheral nerve damage (neuropathy) (5).

(iv) Early Immune Failure

During HIV infection the immune system is severely damaged. Immunological damage can lead to the occurrence of opportunistic infections and the development of cancers. Common opportunistic infections that occur during early immune failure are Candida, shingles (varicella), and hairy leukoplasia (Epstein-Barr virus) (5).

Candida is a yeast infection that can be found on the skin and mucosal surfaces of an individual. Candida often affects the mouth in AIDS patients causing thrush. In thrush, the Candida forms white, furry plaques in the mouth. HIV infected individuals who develop thrush have a high probability of progressing to full-blown AIDS. Thrush can also spread down the esophagus (esophagitis) causing painful burning sensations upon eating. Women infected with HIV may experience vaginal Candida infections; this is an important symptom to recognize. Overall, about on half of AIDS patients will experience a Candida infection (5).

Shingles is a painful rash condition affecting the skin, often of the torso. Shingles is caused by the reactivation of Varicella zoster, a member of the Herpes family. Varicella zoster is the virus responsible for causing chicken pox during childhood. This virus often remains dormant and can become reactivated when the immune system is compromised or stressed. Shingles is more severe in HIV infected individuals than non-HIV infected individuals (5).

Hairy Leukoplasia is an abnormal condition of the mouth, which causes white plaques to appear on the surface of the tongue. The plaques are not caused by overgrowth of fungus or
bacteria; rather they are an abnormal growth of the papillae cells of the tongue. These plaques cannot be scraped off. The overgrown cells appear to result from an infection with Epstein-Barr virus. Hairy Leukoplakia is a condition exclusive to AIDS patients (5).

(v) Full-blown AIDS

Most HIV infected individuals will develop symptoms associated with AIDS within eight to ten years after initial infection in the absence of antiviral treatments. There are many infections and cancers that can be seen in AIDS patients that indicate that the immune system has undergone a disastrous failure and can no longer prevent life-threatening infections or cancers. Opportunistic infections and cancers seen in AIDS patients may vary some include: fungal infections (pneumocystis carinii pneumonia and systemic mycosis), protozoal infections (cryptosporidium gastroenteritis and toxoplasmosis), bacterial infections (mycobacterium), viral infections (cytomegalovirus), and cancers (Kaposi’s sarcoma, lymphomas, and cervical cancer) (5).

Fungal Infections: Pneumocystis carinii pneumonia (PCP) is an illness, which results from inflammation of the lungs. In AIDS patients the infection is often dangerous and patients may be unaware of the seriousness of the illness. Common symptoms are a dry cough and shortness of breath. PCP is a leading cause of death in AIDS patients. Systemic mycosis is the presence of three common types of soil fungi, which can cause generalized infections in AIDS patients. These fungi can cause devastating systemic infections affecting the brain, skin, bone, liver, and lymphatic tissue. Systemic mycosis infections typically lead to death in AIDS patients (5).

Protozoal Infections: Cryptosporidium gastroenteritis is a disease caused by infection of the linings of the intestinal tract and causes diarrhea. In AIDS patient’s diarrhea experienced is
prolonged and severe. AIDS patients may have 20-50 watery stools per day accompanied by profound weight loss and abdominal cramps. Infected AIDS patients experience a serious loss of fluid and electrolytes. Toxoplasmosis is a disease in which an intracellular parasite invades numerous organs of infected individuals. The brain is often infected in AIDS patients causing symptoms such as convulsions, disorientation and dementia (5).

Bacterial Infections: Mycobacterium: A form of tuberculosis bacterium, mycobacterium aviumintracellulare does not normally cause disease in healthy individuals; however in AIDS patients it may cause a tuberculosis-like disease in the lungs. The infection may also involve bone marrow. AIDS patients with mycobacterium aviumintracellulare will have fevers and low numbers of white blood cells. Standard tuberculosis (mycobacterium tuberculosis) has recently become a common infection in AIDS patients (5).

Viral Infections: Cytomegalovirus (CMV) is a member of the Herpes virus family. Cytomegalovirus often mimics a mononucleosis-like illness. In AIDS patients CMV tends to infect the retinas of the eyes, causing blindness. CMV also infects the adrenal gland, leading to hormonal imbalance. CMV infection can also lead to pneumonia, fever, rash, and gastroenteritis (5).

Cancers: Kaposi’s sarcoma is tumors of the blood vessels. Initially, tumors may appear as pink, purple, or brown skin lesions, often located on the extremities. Tumors spread and eventually involve most of the linings of the body. AIDS patients with Kaposi’s sarcoma frequently have high levels of opportunistic infections. Lymphomas occurring in AIDS patients are cancers derived from the B-cells of the immune system. Lymphomas can spread to the brain. Female AIDS patients frequently develop cervical cancer (5).
Currently, AIDS is an incurable disease. However, AIDS is considered as a chronic manageable disease. Symptoms may be treated with vigorous treatment of opportunistic infections and general support of viral functions (1). With current anti-viral medications (e.g. reverse transcriptase inhibitors and protease inhibitors) HIV infection can be contained (6). There is no cure for or vaccination against HIV thus far (1).

ii) Pain management for HIV/AIDS patients

Chronic and acute pains are common complications of HIV. Pain may have specific or nonspecific causes. Pain in HIV patients is underreported and under-treated. Pain adversely affects the quality of life in HIV patients (7). The prevalence of pain in AIDS increases with advanced disease and is associated with psychological distress and functional impairment (8). Persistent pain of moderate intensity seems to be present in approximately 40-60% of HIV/AIDS patients (9). Effective pain management in HIV/AIDS patients is limited. Clinicians believe certain barriers such as fear of chemical dependency, health care accessibility and knowledge may affect pain management (10).

(1) Localization of pain

In diagnosing pain in HIV/AIDS patients, it is important to determine the location of the nervous system damage and the etiology of the pain (8). Pain syndromes common in HIV/AIDS patients include peripheral neuropathy in 30% of patients, abdominal pain, headache and rheumatologic conditions (9). The most commonly reported pain syndromes in HIV/AIDS patients include painful peripheral sensory neuropathy, pain due to extensive Kaposi’s sarcoma, headache, pharyngeal and abdominal pain, arthralgias and myalgias, and some dermatologic conditions (11).
(2) Pain associated cellular damage

HIV does not directly infect neurons. Instead, it damages the cells the surround nerves, unraveling the neural insulation and slowing or stopping the transmission of information to and from the brain. Abnormal macrophage activation is associated with the pathology. Drugs that are used to treat HIV or associated opportunistic infections may also damage the axons of the neurons (12).

(3) Treatment of HIV/AIDS-related Pain

Treatment of HIV/AIDS-related pain must be individualized, and active participation from patients should be encouraged. The least-invasive and least-disruptive effective treatment intervention should be implemented at the beginning of the pain management program. Effectiveness of treatment must be closely monitored using standard outcome measures. Both pain and the impact of pain, such as physical dysfunction, should be measured (11).

(4) Medial/pharmaceutical Therapy

The World Health Organization provides recommendations for pharmaceutical management of HIV/AIDS related pain: Mild pain requires non-opiod drug, ± adjuvant. Moderate pain requires weak opiod drug, ± non-opiod, ± adjuvant. Severe pain requires strong opiod drug, ± non-opiod, ± adjuvant. Non-opiod drugs include acetaminophen, aspirin and NSAIDS (13). Adjuvant analgesic drugs include antidepressants, anticonvulsants, corticosteroids and oral anesthetics. Adjuvant analgesic drugs are used to enhance analgesic efficacy of opiods, to treat concurrent symptoms that exacerbate pain, and to provide independent analgesia. Weak opiod drugs include oxycodone, hydrocodone and codeine. Strong opiod drugs include hydromorphone, methadone, levorphanol and fentanyl (14). Intermittent pain requires short-acting analgesics (13). Short acting opiods include morphine, codeine,
oxycodone, meperidine, hydrocodone and hydromorphone (14). Chronic/persistent pain requires around-the-clock administration of long-acting opioids (13). Long acting opioids include methadone, sustained release morphine and transdermal fentanyl (14).

(5) Alternate Therapies

Alternate approaches to pain management in HIV/ADIS patients include psychotherapies, cognitive behavioral therapy, rehabilitation, neurosurgical approaches and neurostimulation. HIV/AIDS patients experiencing pain often have psychosocial factors, which affect and/or contribute to pain. The use of psychotherapies such as psychiatrists, psychologists and counselors can help treat psychosocial factors therefore aiding in the management of pain syndromes experienced by HIV/AIDS patients. Cognitive behavioral therapy for pain management includes the use of relaxation and distraction techniques. Relaxation techniques include breathing exercises and muscle relaxation exercises. Distraction techniques include focusing and specific mental imagery. Combinations of relaxation and distraction techniques include meditation, hypnosis, biofeedback and systemic desensitization. Rehabilitation techniques for pain management include physical therapy treatment. Physical modalities used to treat HIV/AIDS related pain include heat/cold, massage, exercise, joint mobilization, stretching, electrical stimulation, whirlpool, and ultrasound. Other rehab techniques for pain management include acupuncture. Neurosurgical approaches to pain management in HIV/AIDS patients include epidural delivery of analgesics, nerve blocks and cordotomy (14).

iii) Peripheral Neuropathies

A peripheral neuropathy is damage to the peripheral nervous system, the network which transmits information from the central nervous system (CNS, the brain and the spinal cord) to all other parts of the body. The peripheral nervous system also sends sensory information back to
the CNS. Damage to the peripheral nervous system interrupts messages being sent from the CNS to the body and messages being sent from the body to the CNS. Due to the highly specialized function of peripheral nerves in specific body parts, damage to peripheral nerves can result in a wide array of symptoms (16).

There are more than 100 types of peripheral neuropathy, each having its own characteristic set of symptoms, pattern of development, and prognosis. Symptoms and impaired function depends on the type of peripheral nerves damaged: motor, sensory or autonomic. Motor nerves control conscious movement of muscles. Sensory nerves transmit information about sensory experiences, such as pain or feeling light touch. Autonomic nerves help regulate biological activities in which we do not have conscious control, such as breathing and digestion. Neuropathy can affect any or all of the types of peripheral nerves (16).

Some common symptoms of neuropathy include: Motor neuropathy: muscle weakness, muscle loss, muscle cramping and fasciculation’s, and bone degeneration. Sensory neuropathy: Symptoms depend on the type of sensory fiber damaged. Damage to large sensory fibers decreases the ability to feel touch and vibrations, resulting in a general sense of numbness, especially in the hands and feet. Proprioception may also be affected, making coordination and balance difficult. Damage to small sensory fibers affects the ability to feel pain or changes in temperature. One may fail to sense pain or oppositely become oversensitive to pain, experiencing extreme pain from stimuli which are normally painless. Autonomic neuropathy: Symptoms are diverse and depend on which organs or glands are being affected. Autonomic nerve dysfunction can become life-threatening, especially when the cardiopulmonary systems are involved. Some common symptoms of autonomic nerve dysfunction include the inability to sweat normally, loss of bladder control, and an inability to regulate blood pressure (16).
Peripheral neuropathies may be acquired or inherited. Acquired peripheral neuropathies are grouped into three categories: those caused by systemic disease, those caused by trauma from external agents, and those caused by infections or autoimmune disorders affecting nerve tissue. Physical damage/trauma is the most common injury to a nerve. Injury/trauma resulting from motor vehicle accidents, falls or sports-related injuries can cause nerves to become partially or completely severed, crushed, compressed or stretched. Systemic diseases (disorders which affect the entire body) such as metabolic and endocrine disorders often cause peripheral neuropathy. Nerve tissues are very vulnerable to damage from diseases which impair the body’s ability to transform nutrients into energy, process waste products, or manufacture substances that make up living tissue. Systemic diseases can include: kidney disorders, hormonal imbalances, vitamin deficiencies and alcoholism, vascular damage and blood diseases, connective tissue disorders and chronic inflammation, cancers and benign tumors, repetitive stress and toxins. Infections and autoimmune disorders that can cause peripheral neuropathy may include: shingles, Epstein-Barr virus, cytomegalovirus, herpes virus, Lyme disease, diphtheria, leprosy, and HIV/AIDS. Inherited forms of peripheral neuropathy are caused by inborn mistakes in the genetic code or genetic mutation. Charcot-Marie-Tooth disease is the most common inherited neuropathy (16).

Peripheral neuropathy is difficult to diagnose due to the variability of symptoms. A thorough neurological examination, a physical examination, patient history taking, and a battery of tests are commonly used to help in the diagnosis of peripheral neuropathy. Testing may include, blood work labs, muscle testing, cerebrospinal fluid testing, sensory testing, computed tomography (CT) scans, magnetic resonance imaging (MRI), electromyography (EMG), nerve conduction velocity (NCV), nerve biopsy, and skin biopsy (16).
Once a diagnosis is made, treatment is often difficult. There is no cure for inherited peripheral neuropathy; however, symptoms may be controlled. Treatment of acquired peripheral neuropathy varies. In general, maintaining a healthy lifestyle with regular exercise and appropriate nutritional habits can help reduce the physical and emotional effects of peripheral neuropathy. There are more specific treatments for each individual type peripheral neuropathy (16).

Controlling peripheral neuropathy related pain is difficult. Mild pain is seemingly helped by over the counter analgesics. More severe and chronic neuropathic pain is helped by drugs such as mexiletine, antiepileptic drugs, and antidepressants. Injections of local anesthetics may also help reduce neuropathic pain. Mechanical aids such as hand and foot braces can help relieve pain and lessen the impact of physical disability associated with peripheral neuropathy. Surgical interventions may also be used to help treat neuropathic pain (16).

(1) Prevalence in HIV/AIDS Patients

Neuropathy occurs in 30-50% of HIV/AIDS patients. According to neuropathy expert, Justin McArthur, MBBS, MPH, of Johns Hopkins University, the single most important predictive risk factor for developing HIV/AIDS-related sensory neuropathy is viral load “set point”, the viral load level before antiretroviral treatment is started. The higher the “set point”, the greater the risk of developing peripheral neuropathy. Lower CD4 cell counts, increased age and the presence of wasting syndrome are also associated with an increased risk of developing peripheral neuropathy in HIV/AIDS patients. Peripheral neuropathy occurs at the same rates in both men and women infected with HIV (15).

Peripheral neuropathies associated with the HIV disease are distal painful neuropathy, neuropathy due to nutritional deficiencies, neuropathy due to antiretroviral or chemotherapy
drugs, neuropathy due to toxins, diabetic neuropathy, Guillain-Barre syndrome, and chronic inflammatory demyelinating polyradiculopathy, multiple mononeuropathies and acute lumbosacral polyradiculopathy (12). Neuropathic pain may be frustrating for both patients and medical personnel because it seems to have no cause, responds poorly to standard pain therapies, can last indefinitely, can escalate over time and often results in severe disability. Neuropathic pain can be characterized by a shooting, stabbing, lancinating, burning and or searing description. Neuropathic pain is often worse at night, which helps distinguish it from many other types of pain. It is theorized that the pain is worse at night due to lack of competing stimuli which can help heighten neuropathic pain and circadian rhythms which are known to affect pain thresholds (17).

The most common form of neuropathy in HIV patients is distal symmetric peripheral neuropathy (DSPN). DSPN is diagnosed by history and physical examination. Symptoms are usually symmetrical in the feet but may be pronounced more on one side. Symptoms can also occur in the hands as well. Symptoms usually progress from distal to proximal. Signs and symptoms may include burning, paresthesia, allodynia or dysesthesia, hyperesthesia, painful numbness, decreased temperature and vibratory sensation in a stocking or glove distribution, areflexia at the ankles, trophic changes, mild weakness of the intrinsic musculature of the feet and gait abnormalities (4).

(2) Treatment/pain Management

Medical management of peripheral neuropathy is limited (2). There are pharmacological measures that can be taken to help manage pain; however chemical dependency becomes an issue. Other non-pharmacological therapies may also be used to help manage neuropathic pain. These include stimulation-based therapies such as transcutaneous electrical nerve stimulation
(TENS), acupuncture, spinal stimulation and massage; however they may aggravate symptoms especially with alldynia present. Physical rehab techniques such as splinting and bracing affected extremities may also help ease symptoms (17). Biofeedback, a technique in which patients are trained to control their own physiological responses using signals from their own bodies, and nutritional strategies have also been implemented in some treatment of peripheral neuropathy. Supportive measures can also play a role in reducing the severity of peripheral neuropathy symptoms. Some supportive measures are avoiding tight socks, stockings, shoes and gloves. It is also important to maintain a comfortable temperature in the extremities, so people should wear warm footwear when it is cold and sandals when it is warm. Peripheral neuropathy pain experienced at night may be relieved by keeping feet uncovered propping sheets up with a “tent” to avoid the pressure caused by bed linens. Walking can help improve blood flow to the feet and may improve other symptoms. Some may find that soaking their feet in cold water helps relieve neuropathic pain and others find warm baths helpful. However, there is no scientific research to back up these supportive measures (15).

iv) Physical Therapy Involvement in HIV/AIDS Treatment

Physical therapy can serve as an adjunctive therapy to support medical and educational interventions in the treatment of HIV and AIDS. Initially, physical therapy was viewed as a way to maintain function and help alleviate pain and distress at the end of life. Currently, with HIV being regarded as a chronic disease, quality of life for HIV patients has become a concern. Physical therapy can plan an integral role in improving function and quality of life in HIV and AIDS patients (11).

The goals of physical therapy interventions for HIV and AIDS patients are to minimize pain and body cell mass loss and to improve function and quality of life. It is important for
physical therapy treatment plans to deal with patient’s problems in a comprehensive manner. It is necessary to adequately manage patient’s pain in order to assist with participation in exercise interventions aimed at improving function and preventing body cell mass loss. Physical therapy can help improve body cell mass by the use of resistive exercises (11). Physical therapists can help optimize physical functioning by supplying patients with the appropriate assistive equipment and training patients how to use equipment efficiently and effectively. Physical therapists can also help patients restore physical function by teaching different transfer and mobility techniques (18).

Physical therapy treatment of pain in patients with HIV and AIDS includes the use of multiple-modality interventions such as transcutaneous electrical nerve stimulation (TENS), ultrasound, hydrotherapy, electrical stimulation, laser, microamperage (a low-powered stimulation designed to provide an electrical stimulus without overpowering the action potential due to the presence of voltage-sensitive channels), and biofeedback. Physical therapy also focuses on posture and body awareness in the management of pain. This can help reduce pain associated with the rapid musculoskeletal changes observed in many HIV and AIDS patients. Physical therapy use of low-energy laser systems can help stimulate wound and fracture healing as well as obtaining analgesic effects (18).

Physical therapy can also help in the treatment of peripheral neuropathies experienced by HIV and AIDS patients. Physical therapists can help in obtaining comfort measures to reduce the painful side effects of peripheral neuropathy, for example prescribing specialized shoes with foam inserts and Velcro closures in order to accommodate for symptoms experienced in the feet. The use of TENS at specific acupuncture points may help decrease the pain associated with
peripheral neuropathies. The use of light ankle weights may improve coordination in patients suffering from peripheral neuropathies by providing increased proprioceptive feedback (18).

v) Summary of Studies

(1) Clinicians perceptions of barriers to pain management in AIDS

There has not been much research done regarding pain treatment in HIV/AIDS patients. In fact, there is widespread under treatment of pain in HIV/AIDS patients. One study completed by Breitbart et al focused on health care providers’ attitudes towards pain management and their perceptions of the barriers to adequate pain management. The most frequently cited barrier to pain management in patients with HIV/AIDS was lack of knowledge about pain management or access to pain management experts. Other barriers mentioned were concern for substance abuse of pain medication. This study only focused on health care providers perceived barriers to pain management; however data suggested that clinician experience, knowledge and attitudes towards pain management may have considerable impact on the interventions offered (10).

(2) Neuropathic pain in cancer and AIDS

“Neuropathic Pain in Cancer and AIDS”, a journal article review, summarizes treatment strategies for neuropathic pain. Neuropathic pain is treated with oral analgesics, opioids, topical analgesics, spinal analgesics, neurolytic blocks and neurosurgical procedures. The most appropriate pain treatment strategy in HIV/AIDS patient management has not been determined. Oral analgesics, Tricyclic Antidepressants or Gabapentin, are most commonly used in pain management. Those HIV/AIDS patients not responding to non-opiod analgesics may respond better to oral opioids; however the effects are not known (8).
(3) Physiotherapy Intervention in two people with HIV or AIDS related peripheral neuropathy

A study found in Physiotherapy Research International identifies physiotherapy interventions used in treating two patients with HIV or AIDS-related peripheral neuropathy. A combination of joint mobilization, soft tissue mobilization, microcurrent, stretching and instruction in home program showed favorable results in treating the patients. Joint mobilization was used to help promote more normal gait and decrease pain related to stiffness. Soft tissue mobilization was used to help decrease sensitivity, improve soft tissue pliability and promote circulation. Stretching was used to help regain mobility in the joint of the feet. And, microcurrent was used to help decrease pain. Both patients’ outcomes improved. Patient function increased and pain decreased. Pain medication usage also decreased or was discontinued. However, further research is needed to demonstrate the long-term effectiveness of physiotherapy management of HIV/AIDS related peripheral neuropathy (2).

vi) Therapeutic uses for heat and cold

(1) Physiologic effects of heat and cold

Heat and cold modalities can also be used to decrease pain, however their effects on peripheral neuropathy pain in HIV/AIDS patients is currently unknown. Much of pain control through heat and cold modalities is associated with the Gate Control Theory. With the Gate Control Theory, an increase in A-beta inputs stimulates the substantia gelatinosa, which inhibits the flow of afferent input to sensory centers, therefore blocking pain perception. The analgesic effects of cold create colds greatest benefits. Cold bombards central pain receptor areas with so many cold impulses that pain impulses are lost through the Gate Control Theory of pain modulation. Cold also decreases nerve conduction velocity, which helps decrease transmission of input along nociceptive pathways, therefore decreasing pain. Cold can depress the excitability
of free nerve endings and peripheral nerve fibers as well, thus increasing pain threshold. The analgesic effects of heat are not well understood, but are related to Gate Control. Heat can also provide comfort, which helps with pain tolerance (19).

It is known that controlling peripheral neuropathy related pain is difficult. Mild pain may be helped by over the counter drugs and more severe pain may be helped by prescription drugs. However, not all individuals suffering from neuropathic pain receive relief from medication. Not to mention the fact that sometimes the cost of medication becomes too much and even if it were to help neuropathic pain, not all sufferers may be able to afford the specific medications. It would be helpful to have an alternate treatment option for peripheral neuropathy related pain sufferers. Heat and cold modalities have been shown to provide comfort as well as help decreased pain. The effects of heat and cold modalities on peripheral neuropathy related pain is currently unknown, but perhaps if researched could provide an alternative treatment option for relief of neuropathic pain. The physical therapy profession could help aid in this research and physical therapists could become a highly sought health care provider for peripheral neuropathy related pain sufferers.

vii) Importance of HIV/AIDS research

More research is needed regarding treatment options for HIV/AIDS patients suffering from pain, especially peripheral neuropathy pain. Physical therapy plays a significant role in pain management with the use of modalities and therapeutic exercise. There is not enough information within the literature to prove whether or not physical therapy can be effective in HIV/AIDS patient’s peripheral neuropathy pain management. Physical therapists use both heat and cold modalities on a daily basis to help with pain management in order to progress treatment. The effect of hot and cold packs on peripheral neuropathy pain associated
with HIV/AIDS is currently unknown. A research study, which focuses on the use of hot or cold pack treatment of peripheral neuropathy pain in HIV/AIDS patient’s, would greatly help in determining alternate treatment interventions for peripheral neuropathy pain. Therapeutic use of hot and cold packs could prove useful and provide HIV/AIDS patients suffering from peripheral neuropathy pain an alternate treatment option therefore improving quality of life. Physical therapists could end up playing a large role HIV/AIDS pain management once more research is completed.

HIV/AIDS is a prevalent health problem within the United States. Currently there is no cure for the disease, however HIV/AIDS can be treated and contained. With better treatment of the disease HIV/AIDS infected individuals are living longer life’s which creates the possibility of further complications. The prevalence of pain in HIV/AIDS increases with advanced disease (8). Pain related to HIV/AIDS is associated with increased psychological distress and functional impairment. HIV/AIDS patients experiencing pain also report being less satisfied with their physical health, sexual life, work, and family and social relationships. Pain can significantly reduce quality of life (9). The physical therapy profession focuses on maximizing function and quality of life. The physical therapy profession has a lot of treatment interventions that would benefit pain sufferers. Hopefully, through education and research, physical therapy will become a common form of treatment for HIV/AIDS patients, thereby helping to reduce pain and improve quality of life for individuals living with HIV/AIDS.
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