



# World News of Natural Sciences

An International Scientific Journal

WNOFNS 20 (2018) 238-247

EISSN 2543-5426

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## Physiotherapeutic Management of People Living with HIV/AIDS

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### ABSTRACT

The Human immunodeficiency virus (HIV) is a lentivirus that causes HIV infection, and over time, Acquired Immunodeficiency Syndrome (AIDS). HIV infection (simply called HIV at its early stage and AIDS at its later stage) is a very prevalent global disease condition affecting about 36.7 million people, both young and old. Sadly, HIV/AIDS affects almost all the systems in the body (particularly the neurological and musculoskeletal systems), which may result into physical disability. Physiotherapists are known to play important roles in the management of physical disability. In this paper, the authors provide information on the clinical and epidemiological features of HIV/AIDS, as well as the treatment modalities for the neurological and musculoskeletal problems experienced by people living with HIV/AIDS.

**Keywords:** HIV, AIDS, management, patient, physiotherapy

### 1. INTRODUCTION

The Human immunodeficiency virus (HIV) is a lentivirus (a subgroup of retrovirus) that causes HIV infection and over time Acquired immunodeficiency syndrome (AIDS) (Weiss,

1993; Doeuk et al, 2009). Lentiviruses have many morphological properties in common and are commonly responsible for long duration illnesses with a long incubation period (Levy, 1993). Human immunodeficiency virus is believed to have originated in non-human primates in West-central Africa, and transferred to humans in the early 20th century (Sharp & Hahn 2011; Faria et al, 2014). Acquired immunodeficiency syndrome is the last stage of an HIV infection (Mayo Clinic, 2015); it is characterized by the occurrence of any of the more than 20 opportunistic infections or HIV-related cancers (WHO, 2016).

The Centers for Disease Control and Prevention (CDC) revised the definition of AIDS in 1993 to include those who have HIV with a CD4 count below 200cells/ $\mu$ L or one of the defining illness or certain cancers. According to the American Physical Therapy Association (2016), Physiotherapy is a dynamic profession with an established theoretical and scientific base and widespread clinical applications in the restoration, maintenance, and promotion of optimal physical function. In a study by Anadan et al (2006), 80% of some surveyed people living with HIV/AIDS (PLWHA) experienced impairment (such as pain and muscle weakness), activity limitation (such as inability to walk) or participation restriction (such as inability to work), all attributed to their HIV status. A 2004 British Columbia study also found that: over 90% of people living with HIV experience one or more impairments; 80% experience one or more activity limitation; and over 90% experience one or more participation restrictions. Based on the recorded rate of impairments, activity limitations and participation restrictions experienced among PLWHA, physiotherapists can also be involved in their management (Harris-Love M et al, 2004; Worthington et al, 2005; Tenia et al, 2015). Physiotherapists can also manage complications or other disease conditions that set in or are worsened due to their HIV status. Physiotherapy rehabilitation is increasingly important in the continuum of HIV/AIDS care and can slow deterioration of the individual's condition and enable the person to achieve and maintain independence.

## **2. EPIDEMIOLOGY**

**Table 1.** Regional prevalence of HIV.

Region	People Living with HIV(2016)
Eastern and South Africa	19.4 million (17.8 million- 21.1 million)
Asia and the Pacific	5.1 million (3.9 million – 7.2 million)
Western and Central Africa	6.1 million (4.9 million – 7.6 million)
Latin America	1.8 million (1.4 million – 2.1 million)
The Carribean	310,000 (280,000 – 350,000)
Middle East and North Africa	230,000 (160,000 – 380,000)
Eastern Europe and Central Asia	2.1 million (1.4 million – 1.7 million)

(Source: UNAIDS, 2017)

HIV is a very prevalent condition affecting about 36.7 million globally (30.8 million – 42.9 million) (UNAIDS, 2017). See table 1 for more information.

About 3.2 million individuals (2.3 million to 4.3 million) in Nigeria are suffering from HIV (Nigeria Health Blog, 2016). As HIV infection now increasingly presents, there is also a subsequent increase in the prevalence and impact of disability (Anadan et al 2006). Consequently the rehabilitation of PLWHA needs to include the management of impairment, activity limitations and participation restrictions.

### **3. AETIOLOGY**

The HIV and AIDS diseased condition are caused by the human immunodeficiency virus (called HIV at early stage; while AIDS at later stage). The virus is spread through sexual contact, transfusion of infected blood or blood products, perinatal transmission from infected birthing, breastfeeding a child from an infected mother etc. HIV is not transmitted through casual contact such as the shared use of utensils (CDC, 2014).

The transmission of HIV always involves exposure to some body fluid from an infected individual. It happens in individuals partaking in high risk behaviors which include: unprotected vaginal, anal, or oral sex; having 6 or more sexual partners in the past year; and sexual activity with someone known to carry HIV. Population groups at the greatest risk are: commercial sex workers (prostitutes) and their clients; homosexual men; injection drug users; etc (Mayo Clinic, 2014).

### **4. PATHOPHYSIOLOGY**

Infection with HIV occurs by the transfer of bodily fluids in which it is present as both free virus particles and virus within infected immune cells. After the virus enters the body there is a period of rapid viral replication, leading to an abundance of virus in the peripheral blood (Piaiak et al, 1993). HIV infects vital cells in the human immune system such as helper T cells (specifically CD4+ T cells), leading to a marked drop in the numbers of circulating CD4+ T cells, macrophages, and dendritic cells (Cunningham et al, 2010). It also affects monocytes, certain endothelial cells, microglia of the nervous system, astrocytes, oligodendrocytes and neurons- indirectly by the action of cytokines and the gp-120 (Harsh, 2010).

When CD4+ T cell numbers decline below a critical level, cell-mediated immunity is lost, and the body becomes progressively more susceptible to opportunistic infections. CD4 T-cell depletion and chronic inflammation are the two events that drive HIV pathogenesis and progression to AIDS (Vidya et al, 2017). Infection of the cells of the CNS will cause vacuolar myelopathy, acute encephalitis and peripheral neuropathy. (Ungvarski & Trzcianowska, 2000) Later it leads to even AIDS dementia complex. The CD<sub>4</sub>-gp120 interaction is permissive to other viruses like Cytomegalovirus, Hepatitis virus, Herpes simplex virus, etc. (Capobianchi et al, 1997)

## 5. CLASSIFICATION

HIV has been classified into two major classes: HIV-1 and HIV-2. HIV-1 was initially termed both LAV (Lymphadenopathy-associated Virus) and HTLV-III (Human T-lymphotrophic Virus). It is more virulent, more infective and is the cause of the majority of HIV infections globally (Gilbert et al, 2008). HIV-2 has a longer asymptomatic stage, lower infectivity, lower plasma viral loads, and lower mortality rate and is largely confined to West Africa, because of its relatively poor capacity for transmission (Reeves & Doms, 2002) (see table 2).

**Table 2.** Comparison of HIV Species

Species	Virulence	Infectivity	Prevalence	Inferred origin
HIV-1	High	High	Global	Common chimpanzee
HIV-2	Lower	Lower	West Africa	Sooty mangabey

(Source: Wikipedia)

## 6. CLINICAL FEATURES

The clinical features of HIV/AIDS based on systemic classification are:

- 1) Integumentary system and neoplasms: The neoplastic conditions in HIV/AIDS are Kaposi's sarcoma, Non-Hodgkin's lymphoma, cervical cancer, etc. Kaposi's sarcoma presents in the integumentary system as cutaneous purple nodular lesions. Other integumentary presentations are dry skin, skin rashes, etc (Witte, 1993; Nunley , 2000).
- 2) Musculoskeletal system: They are not as common as other systems and tend to occur at the advanced stage of HIV infection. The primary musculoskeletal abnormalities are osseous and soft tissue infections, polymyositis, myopathy and arthritis. The secondary abnormalities are often due to the various compensatory patterns of gait as a result of HIV-infected peripheral neuropathy or the change in the biomechanics of the foot and ankle from Kaposi's sarcoma. Myopathy in HIV-infected persons present with proximal muscle weakness, Arthritis range from arthralgia's to severe joint disability (Galantino, 1998).
- 3) Cardiopulmonary system: Pulmonary diseases are important causes of deaths in PLWHA. Sinusitis and bronchitis occur frequently in HIV-infected population; mycobacterium infections present as Mycobacterium avium complex (MAC) and tuberculosis. Others are dyspnea, syncope, chest pain, non-productive cough (Palella et al, 1998).
- 4) Gastrointestinal System: Gastrointestinal complaints include change in bowel and bladder function, especially diarrhea (U.S. Department of Health and Human Services, 2017)
- 5) Neurological System: They are numerous and involve the autonomic nervous system, central nervous system and peripheral nervous system:

- a) Autonomic nervous System: They include dementia, variations in heart rate, abnormal blood pressure (Freeman et al, 1990).
- b) Central Nervous system (CNS): The initial CNS invasion by HIV is asymptomatic in most individuals, affective and cognitive deficits may develop. They include: HIV myelitis, opportunistic infections, lymphomas and vacuolar myelopathy (Ungvarski & Trzcianowska, 2000).
- c) Peripheral Nervous System: They include distal polyneuropathy, Guillain-Barre Syndrome, Sensory peripheral neuropathy, and mononeuropathy (McReynolds & Garske, 2001).

Other clinical features not based on systemic classification include:

1. Pain: It is one of the most prominent and distressing symptoms on patients with HIV and has a significant effect on quality of life. It is the result of complex process that involve psychological and neurophysiological mechanisms (Simpson, Tagilati & Grinell, 1994).
2. Psychopathology: The psychiatric complications include disturbances in sleep and appetite pattern, diminished memory and energy, psychomotor retardation, withdrawal, anxiety disorders, adjustment reactions, etc ( Ostrow, 1990; Jacobsberg, 1992; Fernandez, 1990).
3. Opportunistic Infection: They include pneumocystis carinii, pneumonia, lymphoma, thrush, herpes 1 and 2, toxoplasmosis, coccidioidomycosis, cryptococcosis, invasive cervical cancer, cytomegalovirus disease, candidiasis of the bronchi, trachea, esophagus, or lungs, histoplasmosis, isosporiasis, Kaposi's sarcoma, MAC, progressive multifocal leukoencephalopathy, toxoplasmosis of the brain and Wasting syndrome (CDC, 1993).

## **7. DIAGNOSIS**

The 2014 CDC guidelines for HIV diagnostic testing involve initial HIV testing using an HIV-1/HIV-2 antigen/antibody combination immunoassay and subsequent testing using an HIV-1/HIV-2 antibody differentiation immunoassay if the HIV-1/-2 screen result is reactive. The Multispot HIV-1/HIV-2 Rapid Test (Bio-Rad Laboratories) is used for differentiating HIV-1 from HIV-2 infection. All initially positive supplemental or confirmatory test results should be verified by submitting a second serum specimen for repeat testing after four to six weeks (Timothy, 2016).

### **7. 1. Diagnostic Criteria**

AIDS can be diagnosed using the CDC criteria (CDC, 1993). The presence of HIV infection is shown by a positive HIV antibody test with the presence of at least one of the following:

- 1) A CD4+ T-cell count below 200 cells/ $\mu$ L
- 2) One of the defining illnesses
- 3) Certain Cancers such as: Lymphoma, CNS Lymphoma, Kaposi's sarcoma, Anal Cancer, and Invasive Cervical Cancer (CDC, 1993).

## **8. PHYSIOTHERAPEUTIC MANAGEMENT**

Physiotherapists play important roles in the treatment of conditions that limit the patient's movement and function such as HIV/AIDS. Goals will be set to improve quality of life and keep the patient active in both his/her life and in the community. A plan of care to help the HIV/AIDS patient improve his/her ability to do daily activities, improve balance, reduce pain, and maintain a healthy body weight will be developed. In addition, a proper home exercise programme will be prescribed to achieve goals set by such patient and his/her physiotherapist (American Physical Therapy Association, 2014).

### **8. 1. Indications for Physiotherapeutic Management**

Below are highlighted indications for physiotherapeutic management (Galantino, 1998; McReynolds & Garske, 2001; Gale, 2003; Harris-Love & Shrader, 2004; Ownby, 2006):

- a) Atrophy
- b) Muscle weakness
- c) Arthritis
- d) Myelopathy
- e) Pain
- f) Lymphedema (secondary to invasive Kaposi's sarcoma)
- g) Polymyositis,
- h) Peripheral neuropathy
- i) Guillain-Barre Syndrome
- j) Swelling etc.

### **8. 2. Treatment Modalities**

Below are the various treatment modalities that can be adopted for the physiotherapeutic management of a patient living with HIV/AIDS:

- a) Exercise therapy: It is used in diverse forms (aerobic, resistance, progressive resistance and therapeutic exercise) and has been found from literature to be very effective. It is indicated for atrophy, muscle weakness, etc. Exercise therapy, according to literatures, has the following effects in the rehabilitation of PLWHA: reduction in body fat and increase in lean body mass (through the combination of aerobic training and resisted exercise, which is more effective than aerobic exercise alone) (Malita et al, 2005); reduced HIV symptoms (through therapeutic exercises) (Taylor et al, 2007); and improvement in self-efficacy and cardiovascular fitness (through the use of supervised aerobic and resistance exercise program) (Fillipas et al, 2006).
- b) Manual therapy: Manual therapy techniques such as massage, joint and soft tissue mobilization can also be used. It is indicated for pain, lymphedema, swelling, etc. It has the following effects: reduction in neuropathic pain (through use of ice massage and dry towel massage) (Ownby, 2006); relief of pain; and improved function and quality of life (through the application of soft tissue and joint mobilization) (Gale, 2003).

- c) Compression bandaging and pressure garments: This is indicated for pain and swelling in rehabilitating PLWHA (Harris-Love & Shrader, 2004).
- d) Gait training: Use of orthotic sandals in gait training leads to improvement in mobility in physiotherapy management of PLWHA (Harris-Love & Shrader, 2004).
- e) Chest physiotherapy: Positive expiratory pressure (PEP) mask can be used in the management of for recurrent pulmonary infections (Plebani et al, 1997).
- f) Counseling and health education: Counseling and health education is also another role performed by physiotherapists in management of PLWHA (Useh, Akinpelu and Makinde, 2003).

### **8. 3. Outcome Measure**

Measures of outcome are used in assessing end result of care. Outcome measures specific to HIV/AIDS include: AIDS Specific Functional Assessment (ASFA) for functional ability. General outcome measures can also used e.g. Palliative Outcome Scales for pain.

### **8. 4. Precautions**

As HIV/AIDS is transmitted by contact with body fluids and PLWHA have myriad of diseases, physiotherapists have to take the following precautions during their management:

- a) Use of protective barriers (gloves) when handling patient
- b) Don't treat a patient with HIV/AIDS if you have open wounds or skin lesions until the lesions have healed
- c) Careful monitoring of exercise
- d) Precautions based on other presenting diseases etc

### **8. 5. Ethics**

Physiotherapists have responsibility to treat their patient without any form of stigmatization. According to Voors (2000), based on the ethical principles of beneficence, non-maleficence and justice, physiotherapists do not have the right to refuse to treat PLWHA.

## **9. CONCLUSION**

HIV/AIDS is a very prevalent condition which presents with impairment, activity limitation and participation restriction which physiotherapists manage. Physical therapy has different techniques which have been shown in literatures to be effective in the rehabilitation of PLWHA. Care must be taken when handling patients without any form of stigmatization.

### **Acknowledgement**

Authors they declare that they have no competing interest. This study was self-funded.

## References

- [1] Anaan N, Braveman B, Kielhofner G and Forsyth K (2006). Impairments and perceived competence persons living with HIV/AIDS. *Work* 27(3):255-266.
- [2] Bell J (1998). The neuropathy of adult HIV disease. *Revue Neurologique* 154: 816- 829.
- [3] Capboblanchi MR, Barresi C, Gessani S, Fantuzzi L, Ameglio F, Belardelli F et al (1997) Human immunodeficiency type 1 gp120 stimulates cytomegalovirus replication in monocytes: possible role of endogenous interleukin-8. *Journal of Virology* 71(2): 1591-1597
- [4] Cunningham A, Donaghy H, Harman A, Kim M, Turville S (2010). Manipulation of dendritic cell function by viruses. *Current Opinion in Microbiology* 13 (4): 524–529.
- [5] Doitsh G, Galloway NL, Geng X, Yang Z; Monroe KM, Zepeda O et al (2014). Cell death by pyroptosis drives CD4 T-cell depletion in HIV-1 infection. *Nature* 505 (7484): 509–514.
- [6] Douek DC, Roederer M and Koup RA. Emerging Concepts in the Immunopathogenesis of AIDS. *Annual Review of Medicine* 60 (2009) 471–84.
- [7] Faria NR, Rambaut A, Suchard MA, Baele G, Bedford T , Ward MJ et al (2014). The early spread and epidemic ignition of HIV-1 in human populations. *Science* 346 (6205): 56–61
- [8] Phillipas S, Oldmeadow L, Bailey M , and Cherry C. (2006). A six month, supervised, aerobic and resistance exercise programme improves self-efficacy in people with human immunodeficiency virus: A randomized controlled trial. *Australian Journal of Physiotherapy* 52, 185-190.
- [9] Freeman R, Roberts M and Freidman (1990). Autonomic function and human immunodeficiency virus. *Neurology* 50: 575-580.
- [10] Fernandez F (1990). Neuropsychiatric syndromes and their treatment in HIV infection, In a psychiatric's guide to HIV and AIDS disease. American Pscyhiatric Association.
- [11] Gale, J. (2003). Physiotherapy intervention in two people with HIV or AIDS-related peripheral neuropathy. *Physiotherapy Research International* 8 (4), 200-207.
- [12] Galantine M, Jermyn R and Tursi F (1998). Physical therapy management for the patient with HIV: lower extremities. *Clinics in Podiatric Medicine and Surgery* 15: 329-346.
- [13] Garg H, Mohl J and Joshi A (2012). HIV-1 induced bystander apoptosis. *Viruses* 4 (11): 3020–43.
- [14] Gilbert B, McKeague W, Eisen G, Mullins C, Guéye-NDiaye A, Mboup S and Kanki PJ (2003). Comparison of HIV-1 and HIV-2 infectivity from a prospective cohort study in Senegal. *Statistics in Medicine* 22(4): 573–593.
- [15] Hand G, Phillips K, Dudgeon W, Lyerly G, Durstine J and Burgess S.(2008). Moderate intensity exercise training reverses functional aerobic impairment in HIV-infected individuals. *AIDS Care* 20 (9): 1066-1074.



- [16] Harris-Love, M. O, and Shrader J A. (2004). Physiotherapy management of patients with HIV-associated Kaposi's sarcoma. *Physiotherapy Research International* (4), 174-181.
- [17] HIV/AIDS. Mayo Clinic. <http://www.mayoclinic.org/diseases-conditions/hiv/aids/basics/symptoms/con-20013732>. Accessed October 22 2017.
- [18] HIV/AIDS. Center for Disease Control and Prevention. <http://www.cdc.gov/hiv/default.html>. Accessed October 22, 2017.
- [19] Kumar, Vinay (2012). Robbins Basic Pathology (9<sup>th</sup> ed.). p. 147. ISBN 9781455737871.
- [20] Levy JA (1993). HIV pathogenesis and long-term survival. *AIDS Science* 7 (11): 1401–1410.
- [21] Malita F M, Karelis A D, Toma E, and Rabassa-Lhoret, R. (2005). Effect of different types of exercise on body composition and fat distribution in HIV-infected patients. *Canadian Journal of Applied Physiology* 30 (2): 233-245.
- [22] McReynolds C and Garske G (2001). Current issues in HIV disease and AIDS; Implications for health and rehabilitation professionals, *Work*. 17: 117-124.
- [23] Miller, T (2007). Hospital-Based exercise Program to improve Body composition, strength and abdominal adiposity in 2 HIV-infected children. *The AIDS Reader* 17 (9): 450.
- [24] Mutimura E, Stewart A, Crowther NJ, Yarasheski KE and Cade WT. (2008) The effects of exercise training on quality of life in HAART-related HIV-positive Rwandan subjects with body fat distribution. *Quality of Life Research* (17) 377-385.
- [25] New CDC Recommendations for HIV Testing in Laboratories. (<https://www.cdc.gov/nchstp/newsroom/docs/2014/HIV-testing-Labs-Flowchart.pdf>) (PDF).cdc.gov. Centers for Disease Control and Prevention. Accessed October, 22, 2017.
- [26] Nunley J (2000). Cutaneous manifestations of HIV and HCV. *Dermatology Nursing* (12): 163-169.
- [27] Palella F, Moorman A and Delancy K (1998). Dramatically declining morbidity and mortality in an ambulatory HIV-infected population. In Abstracts of the 5<sup>th</sup> Conference on Retroviruses and Opportunistic Infections, Chicago, February 1-5, 199
- [28] Physical Therapist's Guide to HIV Disease and AIDS. American Physical Therapy Association. <http://www.moveforwardpt.com/symptomsconditionsdetail.aspx?cid=931ce05b-4b22-49529b18-34af9e201f8d#.UzGRfNnOTp> , Accessed October 22, 2017.
- [29] Plebani A, Pinzani R, Startari R, Brusa D. and Padoan R. (1997), Usefulness of chest physiotherapy with Positive Expiratory Pressure (PEP)-mask in HIV-infected children with recurrent pulmonary infections. *Acta Paediatrica* 86: 1195–1197
- [30] O'Brien K, Nixon S, Glazier, R and Tinan (2004). Progressive resistive exercise interventions for the adults living with HIV/AIDS. *Cochrane Database of systematic Reviews*, 18 (4).

- [31] O'Brien K, Tynan A, Nixon S and Glazier R. (2008). Effects of progressive resistive exercise in adults living with HIV/AIDS: systematic review and meta-analysis of randomized trials. *AIDS Care* 20: 631-653. Accessed October 22, 2017.
- [32] Reeves J and Doms R (2002). Human Immunodeficiency Virus Type 2. *Journal of General Virology* 83 (6):1253–65.
- [33] Sharp PM and Hahn BH (2011). Origins of HIV and the AIDS Pandemic. *Cold Spring Harbor perspectives in medicine* 1 (1), doi: 10.1101/cshperspect.a006841
- [34] Simpson DM, Tagilati M and Grinell J (1994). Electrophysiological findings in HIV infection: association with distal symmetrical polyneuropathy and CD4+. *Muscle Nerve* 17: 1113.
- [35] Steinbach L, Tehranzadah J and Fleckenstein J (1993). Musculoskeletal manifestations of human immunodeficiency virus (HIV) infection. *Radiology* 186: 833-838
- [36] Taylor NF, Dodds KJ, Shields N and Bruder A (2007). Therapeutic exercise in physiotherapy practice is beneficial: a summary of systematic reviews 2002-2005. *Australian Journal of Physiotherapy* 53: 7-16.
- [37] Harsh Mohan, (2010) Textbook of Pathology by 6<sup>th</sup> Ed. Jaypee Brothers, New Delhi Brothers.
- [38] Ungvarski P and Trzcianowska H (2000). Neurocognitive disorders seen in HIV disease. *Issues Ment Health Nursing* 21: 51-77.
- [39] U.S. Department of Health and Human Services. HIV/AIDS Basics. AIDS.gov. <http://aids.gov/hiv-aids-basics>. Accessed November 1, 2017
- [40] Useh U, Akinpelu AO and Makinde GB (2003). HIV/AIDS pandemic comparative knowledge and roles of physiotherapists in two African countries. *Physiotherapy*, 89 (12): 20-727.
- [41] Vidya VK, Karthigeyan KP, Tripathi SP and Hanna LE (2017). Pathophysiology of CD4+ T-Cell Depletion in HIV-1 and HIV-2 infections. *Frontiers in Immunology* (8): 580
- [42] Voors M (2000). Ethics and HIV/AIDS. *Physiotherapy* 86(12): 640-644
- [43] Weiss RA (1993). How does HIV cause AIDS? *Science* 260 (5112).
- [44] Witte M, Witte C and Way M (1990). AIDS. Kaposi sarcoma and the lymphatic: update and reflections. *Lymphology* 23: 73-80.
- [45] Worthington C, Myers T, O'Brien K, Nixon S, Cockeril R and Bereket, T. (2005). Rehabilitation professionals and human immunodeficiency virus care: Results of a Canadian survey. *Archives of Physical Medicine and Rehabilitation* (89). 105-113.