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THE HIV PANDEMIC APPERARS TO HAVE PRESENTED SCIENCE AND MEDICINE WITH MORE OBSTACLES THAN ANY OTHER SINGLE DISEASE.

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Abstract: Acquired immunodeficiency syndrome (AIDS) of humans is caused by two lentiviruses, human immunodeficiency viruses' types 1 and 2 (HIV-1 and HIV-2). Here, we describe the origins and evolution of these viruses, and the circumstances that led to the AIDS pandemic. Both HIVs are the result of multiple cross-species transmissions of simian immunodeficiency viruses (SIVs) naturally infecting African primates. Most of these transfers resulted in viruses that spread in humans to only a limited extent. However, one transmission event, involving SIV cpz from chimpanzees in south-eastern Cameroon, gave rise to HIV-1 group M—the principal cause of the AIDS pandemic. We discuss how host restriction factors have shaped the emergence of new SIV zoonoses by imposing adaptive hurdles to cross-species transmission and/or secondary spread. We also show that AIDS has likely afflicted chimpanzees long before the emergence of HIV. Tracing the genetic changes that occurred as SIVs crossed from monkeys to apes and from apes to humans provides a new framework to examine the requirements of successful host switches and to gauge future zoonotic risk Chimpanzees were most likely infected with AIDS long before HIV was discovered. Tracing the genomic changes that happened as SIVs transferred from monkeys to apes and then from apes to humans gives a novel paradigm for investigating the criteria for successful host shifts and predicting future zoonotic risk.

INTRODUCTION

The virus has caused huge human misery and has had a catastrophic socio-economic impact on healthcare around the world, with third-world countries facing perhaps more substantial issues than industrialized countries.

- **Epidemiology**

HIV is often regarded as one of, if not the most, serious and devastating diseases of the contemporary era. HIV has taken the globe by storm since its initial diagnosis in 1981. HIV infection is a global epidemic, according to UNAIDS, with 33.3 million (31.4 million–35.3 million) persons living with HIV at the end of 2009 and an estimated 2.6 million people newly infected with HIV worldwide. However, annual AIDS-related deaths are steadily declining, from a high of 2.1 million (1.9 million–2.3 million) in 2004 to an estimated 1.8 million (1.6 million–2.1 million) in 2009. The decrease reflects people's increasing access to antiretroviral medicine, as well as care and support, living with HIV, especially in low- and middle-income countries It is also due to a decrease in occurrence beginning in the late 1990s.

In 2009, an estimated 4.9 million (4.5 million–5.5 million) Asians were infected with HIV. The majority of country HIV epidemics appear to have peaked. In Asia, there were 360 000 (300 000–430 000) new HIV infections in 2009. The overall trends in this region conceal significant heterogeneity in epidemics, both within and between nations. The epidemics appear to be stable in the majority of them. National epidemics are concentrated in a small number of provinces in many of the region's countries. Asia's epidemics continue to be concentrated primarily among drug users, sex workers and their clients, and men who have sex with males.

In large countries like India, incidence patterns might vary greatly. About 90% of new HIV infections in India are thought to have occurred through unprotected intercourse, although the common use of contaminated injecting equipment by two or more people on the same occasion is the predominant mechanism of HIV transmission in the country's north-eastern states.

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- **Quality of Life (QoL) and HIV:**

The association between HIV and disability is acknowledged in a policy brief paper published by UNAIDS, the World Health Organization (WHO), and the Office of the High Commissioner for Human Rights (OHCHR). This work recognizes that people living with HIV are at risk of developing impairments and disabilities as a result of the disease itself as well as the side effects of various treatment regimens. Many HIV/AIDS-related impairments and disabilities have the potential to have a devastating impact on the quality of life of persons living with HIV/AIDS. Biomedical, psychological, spiritual, and emotional well-being are examples. WHO defines quality of life as an individual's perspective of their situation in life; this perception is within the realm of possibility it relates to their aims, expectations, standards, and concerns in the context of culture and the value system in which they live. One of the major impairments and impacts of HIV on the human body is auditory system abnormalities, which result in hearing loss. Hearing loss is well documented to reduce quality of life, which can have far-reaching consequences. The severity of hearing loss has been demonstrated to have a direct impact on the extent of its consequences on quality of life.

Poor communication, social isolation, and retreat, depression, dementia, frustration, diminished functional status, and maladaptive behavior are all possible consequences of hearing loss.

Frustration caused by hearing loss affects not only the affected person but also family members. The magnitude of the impacts of hearing loss on quality of life underlines the need of early treatment by health care professionals in order to avoid and minimize these effects while also positively impacting the QoL of HIV-positive people and their families.

- **Hearing loss and HIV:**

In the past several years, however, otologic disorders increasingly have been reported in individuals with human immunodeficiency virus (HIV), as well as in retrospective studies of such patients. Numerous clinical and mostly medically oriented studies have demonstrated the occurrence of hearing loss and other auditory manifestations in HIV/AIDS. As many as 75% of the PLHIV are reported to experience, at some point in time, auditory dysfunction secondary to HIV infection and also auditory abnormalities associated with HIV/AIDS and its treatments have been reported in persons with varying degrees of HIV infection, in both symptomatic and asymptomatic patients, as well as in patients on antiretroviral treatment. However, the otologic data appears quite variable. The reported prevalence of ENT, head and neck manifestations of HIV/AIDS worldwide varies from 41 to 80%. The exact prevalence and mechanism of the auditory dysfunction remains unclear to date and poses challenges in the assessment, treatment and monitoring of these individuals

- **People Living with HIV/AIDS Rehabilitation:**

According to the Disability and HIV Policy Brief, rehabilitation specialists should play a role in identifying and resolving the multiple impairments that HIV-infected individual's encounter. More information on the prevalence of auditory impairment in these patients is required for hearing care practitioners to screen, treat, manage, and monitor these patients appropriately. HIV-infected people, as well as health care providers, should be taught about the aural manifestations of HIV/AIDS on the auditory system. This awareness may lead to early discovery of auditory impairment, resulting in more suitable treatment and better treatment outcomes.

- **BERA (Brainstem Evoked Response Audiometry) in HIV:**

The human body is a field of ongoing electrical activity which includes muscle contractions, sensory end organ responses and neural events from the central and peripheral nervous system. It is difficult to measure the Auditory Evoked Potentials (AEPs) because they are small in amplitude and buried in a background of electrical noise. Added to these problems are the electrically insulative characteristics of the skin, particularly of the stratum corneum.

Applying an electrode to the skin constitutes a barrier over which there can be no net charge transfer. Electrode impedance is a product of the electrode material and surface area of the skin, muscle or mucosa to which it is interfaced and anything in between (e.g., oil, dirt, fluid etc). Silver, gold and platinum have lower impedances. Methodology 41 Silver if plated with salt forming a silver-silver chloride (Ag-AgCl) electrode has an even lower impedance (as used in our laboratory). Good electrical contact was achieved using surface electrodes after cleansing the skin thoroughly and applying electrolyte gel, paste or cream on it, which not only improved conductivity but also gave contact stability and effectively increased electrode surface area. The identification of the response from the background noise was made possible by the use of averaging computer technique.

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Filtering was done to remove background noise. This was done before and/or after signal averaging. High-pass filter was used to eliminate low frequency (of EMG or EEG) and dc potentials. Low pass filter was used because high frequency noise can be superimposed on the tracing and can obscure identification of peaks of evoked potentials. Some high frequency noise, which was likely to remain even with low-pass filtering, was treated by post-filtering smoothing, which is a form of lowpass filtering. To minimize electrical artifacts, proper electrical wiring of the sound production and response recording systems was done. Because testing is usually done under electromagnetically shielded earphones, the study was done in a quiet room as is also suggested by American Speech-LanguageHearing Association. Interference from 60 Hz noise was minimized by choosing a suitable stimulus rate (11.1/sec here). Methodology 42 Recommended stimulus rate (no. of clicks presented to the ear per second) is 10-40 clicks/sec but usually it is 11.1/sec. Very high stimulus rate increases the latency and decreases the amplitude.

Stimulus polarity affects the amplitude, latency and even morphology of the short latency potentials of BERA. Monaural stimulation was i.e one ear at a time was tested. Contralateral masking with white noise (20-30 dB below the stimulus) is required whenever the monaural stimuli are sufficiently intense as to produce crossover response via bones. Masking of the contralateral ear has been shown to have no or little effect on the ipsilateral response. Usually, stimulus intensity is kept at 60 dB (50) and normal audible speech has an intensity of about 65 dB. Therefore, in this study, all the parameters have been compared at 60 dBnHL stimulus intensity.

- **Obtaining the graph**

Peaks of wave I, III and V were marked manually after proper identification and amplitudes of wave I and V were marked from crest of the wave to the next trough. The absolute latencies of the waves I, III and V, the latencies of the inter-wave intervals and the amplitudes of the waves I and V at a sensitivity of 0.2µV/div. were obtained automatically by means of a computer program.

Data of the individual ears rather than the mean of the two ears were used to analyse because BERA is usually evaluated in terms of the individual ears, instead of the mean of the two ears. The I-V IPL is considered a reliable measure of the function of the auditory pathway from the cochlear nerve to the mesencephalon (96). This parameter was used in the present study because it is insensitive to irrelevant factors such as peripheral hearing.

- **Normal values:**

The values of the parameters are dependent upon the characters of the sound stimulus used for eliciting the BERA response (90). However, if the recommended procedure or using a 60dB suprathreshold stimulus, at a stimulus rate of 10-20 Hz, and a rarefaction stimulus polarity is used for the recording of the BERA in subjects between the age 2 to 60 years, then the range of accepted normal values for the commonly used parameters are (90):

SR. NO	Parameters Measured	Normal Values (in ms)
1	APL-I	1.65-1.7
2	APL-III	3.8 – 4.1
3	APL-V	5.8 – 6.5
4	IPL I-III	2.0 - 2.4
5	IPL III-V	2.0 - 2.4
6	IPL I-V	4.0 - 4.4
7	Interaural latency difference of wave V	> 0.3

Normal values of latencies at 60dB in a subject between the age 2 to 60 years

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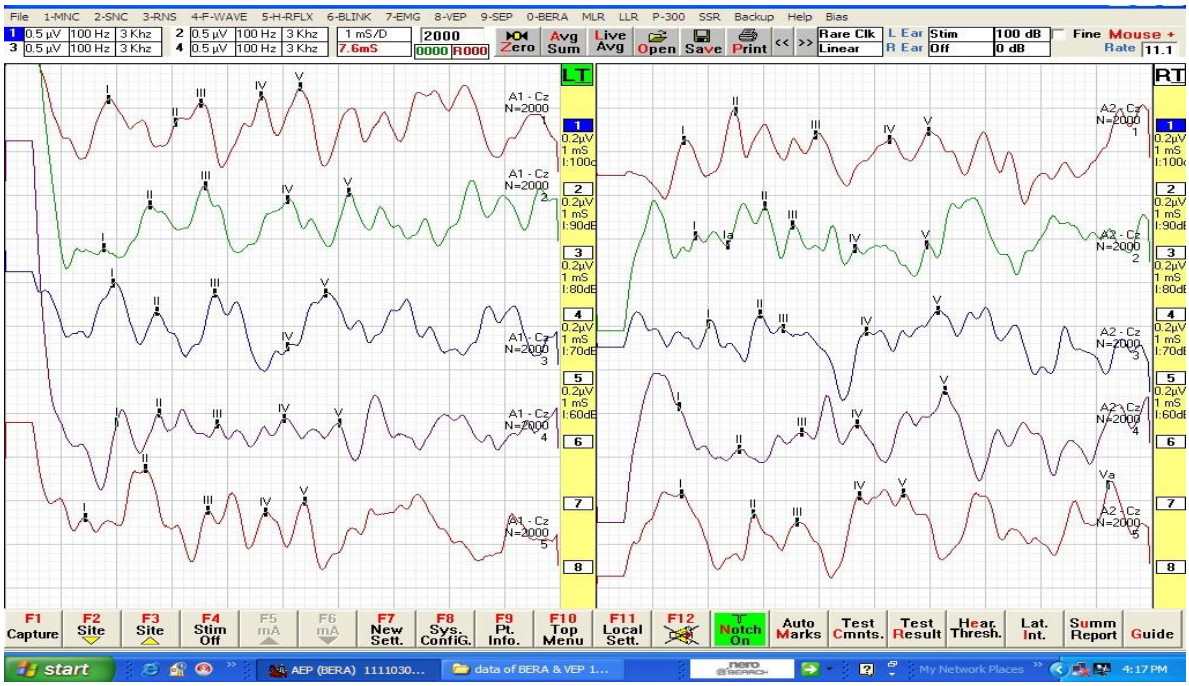

Figure3: Graph of BERA by RMS Polyrite

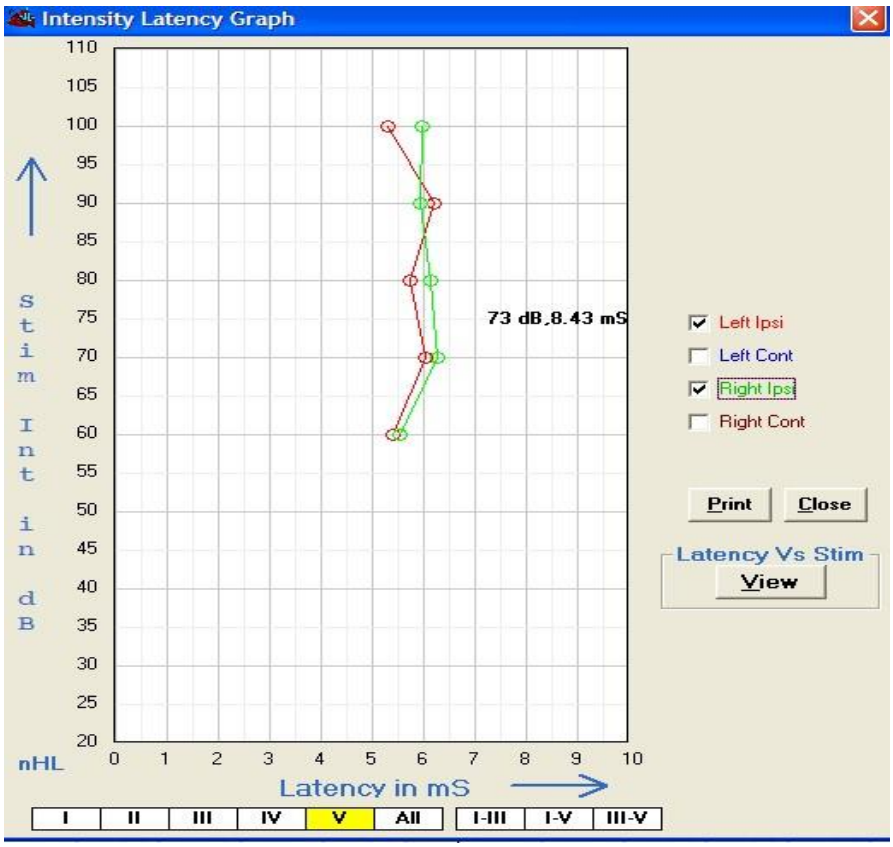

Figure 4: Intensity Latency Graph of wave V

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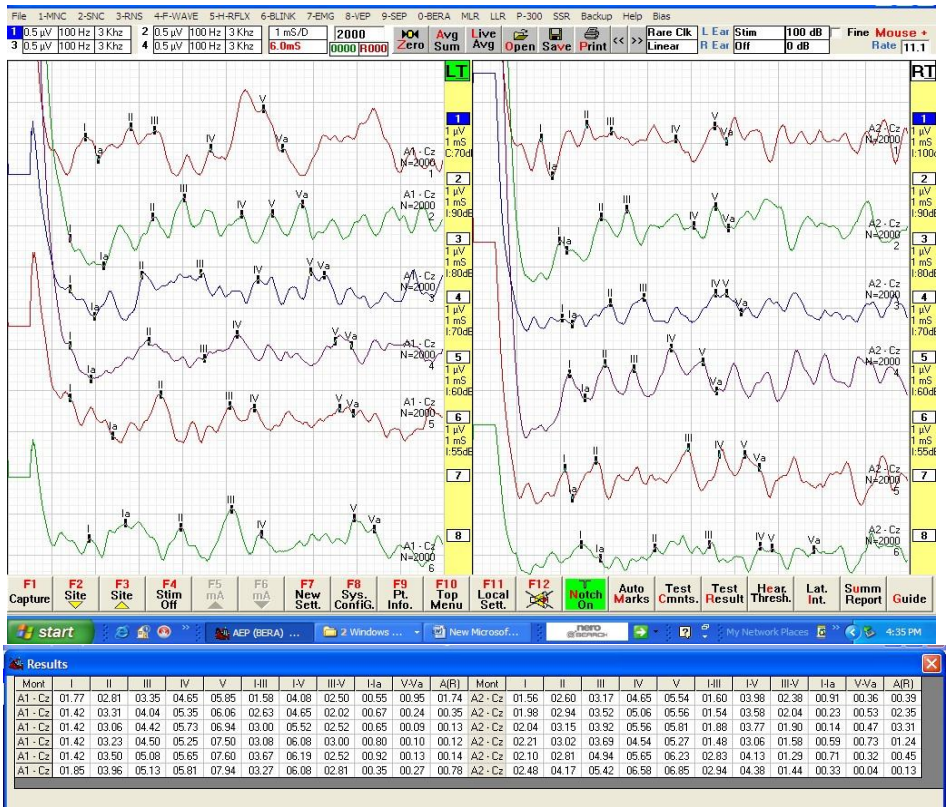

Figure 5: BERA in a 30-year-old female HIV participant shows increased absolute peak latencies of wave III and V and increased inter-peak latencies I-III, III-V and I-V in left ear. The right ear shows normal absolute peak latencies and inter-peak latencies. The interaural latency difference of wave V is >0.3.

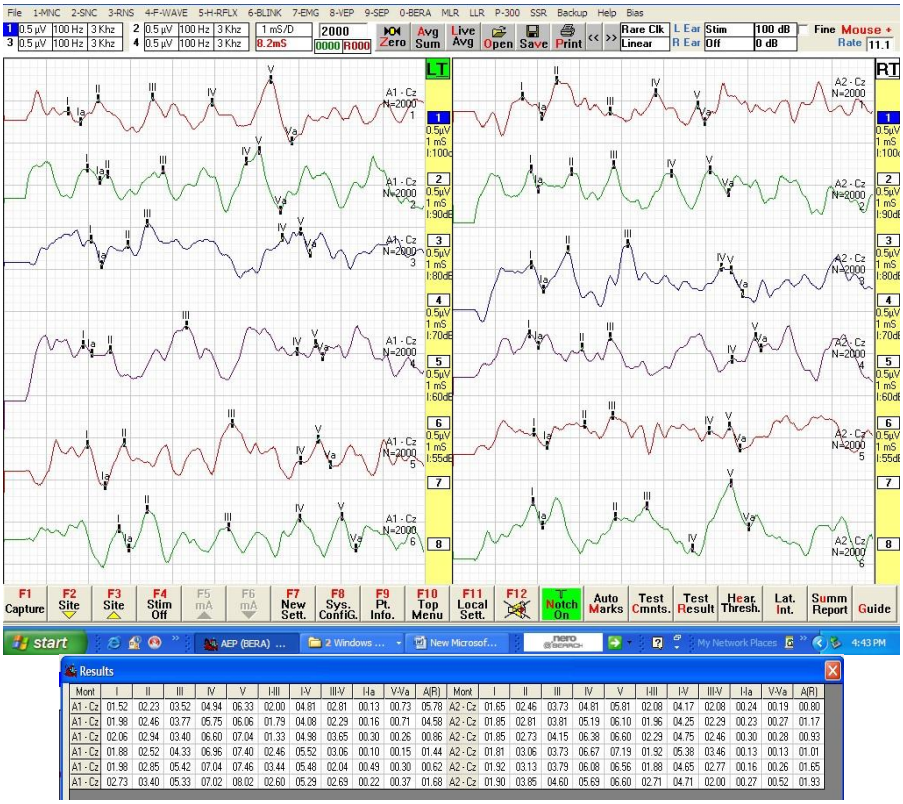

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Figure 6: BERA in a 50-year-old participant shows increased APL of wave V and increased IPL of III-V and I-V in both the ears. The interaural latency difference of wave V is <0.3.

- **Operational definitions:**

1) **Brainstem auditory disorders:** were considered when the ABR results revealed either a delay in the absolute latencies of waves III and V, with an increase in IIII and I-V inter-peaks (indicating a low brainstem auditory disorder), or a delay in the absolute latency of wave V, with an increase in III-V and I-V inter-peaks (indicating a high brainstem auditory disorder) (suggesting high brainstem auditory disorders). (97)

2) **Sensorineural hearing loss:** was diagnosed when participants' absolute latencies of waves I, III, and V were normal and inter-peaks I-III, I-V, and III-V were increased on BERA measurements. (97)

3) **Conductive hearing loss:** Participants were judged to have conductive hearing loss if there was a delay in the absolute latency of waves I, III, and V and inter-peaks I-III, I-V, and III-V were normal (97).

4) **Mixed hearing loss:** was defined as the presence of both peripheral and brainstem auditory problems, as well as conductive hearing loss with a delay in the absolute latency of waves I, III, and V and sensorineural hearing loss with increased I-III, I-V, and/or III-V interpeak latencies (97).

5) **Mild hearing loss:** Hearing impairment at 26-40 dBHL

6) **Moderate hearing loss:** Hearing impairment at 41-60 dBHL

7) **Severe hearing loss:** Hearing impairment at 41-60 dBHL

- **Conclusion:**

HIV infection is no longer merely a life-threatening condition, but has evolved into a chronic, manageable sickness that presents a number of issues in terms of the quality of life of infected individuals who now have a longer life expectancy. Although evidence suggests that manifestations of this on the auditory system are significant, there is limited heterogenic literature on its precise form.

Individuals with HIV/AIDS have BERA anomalies, indicating deficits in neural impulse generation and transmission along the auditory pathway in the brainstem. These people also have AMLR and P300 abnormalities, indicating deficits in the auditory subcortical and cortical regions.

Hearing problems are not uncommon in HIV/AIDS patients. However, little study has been conducted to investigate the association and impact of HIV/AIDS on hearing loss. Several HIV/AIDS-related issues impair communication abilities. These risks include infection-related CNS disorders, opportunistic infection, and therapeutic effects. To the best of their ability, health care practitioners should distinguish between symptoms associated with the HIV disease process and side effects of antiretroviral drugs. Auditory deficiency assessments should be conducted as needed to provide quality care to those living with HIV/AIDS and to maintain the quality of life that effective communication affords.

In conclusion, more than four-fifths of the individuals had ENT manifestations of HIV. The health care provider who detects HIV infection should be on the lookout for atypical symptoms and presentations. As more people seek voluntary HIV counselling and testing, it is critical for health care practitioners to be aware of its manifestations so that, in addition to adequate antiretroviral medication, early diagnosis and immediate intervention may be implemented to enhance survival rates.

Finally, the current study's results can be converted into recommendations for the clinical assessment and care of HIV/AIDS patients, team member education, policy formulation, and future research.

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