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Issues in Developing HIV/AIDS Diagnostic Tools in the Resource-Scarce Setting of Zambia

With the prevalence of HIV/AIDS in Zambia increasing at a harrowing rate, the development of more cost-efficient, effective medicines is undeniably important. Yet paralleling the need for such development is an urgent need for cheaper and more reliable diagnostic methods. Analyzing factors such as viral load and CD4 count are crucial in delivering effective treatments to those suffering from HIV/AIDS. However, the scarcity of laboratory resources, as well as funds, in Zambia complicates the use of Western diagnostic techniques in the impoverished country.

This paper presents a very superficial overview of factors that must be considered when looking at the role of diagnostics in solving the HIV/AIDS problem of Zambia.

Background

Typically, methods used to diagnose and manage HIV/AIDS detect three types of markers in blood samples: viral RNA, p24 antigen, and antibodies to HIV antigens.[1]

Within the first 2 weeks of infection, both viral RNA and p24 antigen levels increase significantly. With regard to viral RNA, this increase results in viraemia, and assays that detect viral loads are useful in observing the onset of viraemia soon after infection. Eventually, the body's immune system responds to the increased presence of virus, resulting in a decrease in viral load. Yet as the immune system weakens with the progression of the disease, the body is unable to maintain its attack against the virus; thus, viral load begins to increase exponentially again, which usually accompanies the transition into AIDS.

Additionally, the p24 antigen increase parallels that of viral load. Due to less sensitive detection methods, however, the rise in p24 antigen levels is unable to be detected until approximately 1 month after infection.

[1] Constantine NT, Zink H. "HIV testing technologies after two decades of evolution." *Indian J Med Res*, 2005 Apr; 121(4):519-38.

Lastly, three to four weeks after infection, antibodies to the HIV antigens can be detected in the blood. While this time period may vary amongst people, it is rare that these antibodies go undetected for more than two months after infection.

Current Developments and Necessary Considerations

Most of the diagnostic techniques currently being used and further developed are those that detect absolute CD4 counts or viral loads.[2] A plethora of manufacturers have produced relatively cheap diagnostic kits, which are listed in a document recently prepared by the World Health Organization.[3]

Such developments have allowed for the testing of not only absolute CD4 cell counts, but also CD4 percentage counts. These percentage counts are important in the diagnosis of HIV in children, as absolute CD4 counts can vary dramatically in the early years of life. Further developments in the diagnosis of HIV could include detection p24 antigen levels, which would be remarkably beneficial in infant diagnoses.

More recent developments have included a microchip CD4 counter that requires a minute volume of blood and provides an accurate and quick measurement of both absolute and relative CD4 counts.[4] The application of new technology, such as microchip production, to the field of diagnostics is crucial to coming up with more cost-efficient and reliable techniques.

Conclusion

While much work has been done in trying to deliver more efficient diagnostic methods to African countries like Zambia, there is still a lot of room for further development. In the process of evaluating and producing new methods, the factor of sustainability must be kept in mind, as well as the immense value of a point-of-care diagnostic method.

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[2] "Transfer of HIV Monitoring Technologies Into Resource-Poor Settings: Moving the Field Forward." Report of a Forum for Collaborative HIV Research Workshop. February 26, 2006; Washington, D.C.

[3] "Sources and prices of selected medicines and diagnostics for people living with HIV/AIDS." UNICEF, UNAIDS, WHO, MSF. June 2005

[4] Rodriguez WR, et al. "A Microchip CD4 Counting Method for HIV Monitoring in Resource-Poor Settings. *PLoS Med*, 2(7). July 2005.

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