APPLICATION OF RAMANUJAN'S FORMULA FOR THE STUDY OF THE HIV SECTION AND THE PROLIFERATION DYNAMICS OF ACQUIRED IMMUNO-DEFICIENCY SYNDROME

DR. V.P. SINGH

Associate Professor

D.J. College Baraut Dist Baghpat U.P. 250611

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The present paper examines the cross-sectional slices of HIV, where the deadly components exist. The present study develops the mathematical background needed for drug designing. This work also examines the principles by which the virus could be annihilated. This study deals with the theoretical aspects of HIV non-functionality in the human body. By calculating the rate of infection with HIV and its incubation period, it is shown that the precisional aspects of the molecular mathematics of HIV help is in developing an experimental design for the therapautical management of AIDS.

Key Words: HIV, Ramanujan's formulae, AIDS proliferation dynamics, virus annihilation, mathematics, therapeutical management.

INTRODUCTION :

The study of HIV has become extremely important view of the alarming global situation created by the explosion of AIDS. Several facets of HIV have already been studied and established by earlier workers, including biophysicists, biochemists and virologists. Mainly these studies have been confined to the integrated aspects related to the anatomy and physiology of HIV. To the best of our knowledge, no attempt has been made so far reveal the differential aspects of this fragile but deadly virus.

By differential analysis, we mean the study of the infinite sections or slices of the virus in the overall configuration and the role played by each slice in the proliferation dynamics of AIDS.

MATHEMATICAL DETAILS AND PRINCIPLES OF TOMOGRAPHICAL ANALYSIS :

In order to examine the finest quantitative aspects of HIV. It is imperative to study the computer assisted tomographical details using the most powerful mathematical tools provided to us by the extensive work of S. Ramanujan during the first two decades of the present century.

Suppose c_i and d_i are the circumference and diameter of the i^{th} circular section of the HIV. Than

$$\frac{C_i}{d_i} = \pi \ = \sum_{i=1}^{\infty} T_i = T_1 + T_2 + T_3 \ldots . to \ \infty \tag{2.1}$$

$$C_i \ = d_i \sum_{i=1}^{\infty} T_i \tag{2.2}$$

The expansion of π by Ramanujan's expression[1-67] has been found to be correct up to 17 million places of decimal by modern computers. Therefore it is possible to study the infinite circular sections of HIV. All these sections are approximately circular, because HIV has been shown to be almost spherical in shape.

THERETICAL FORMULATION

If we cut the spherical HIV (I,II,III), we shall get circular sections. The circumference of a circular section is $2\pi r$. Ramanujan's gave a mysterious formula for π. A computer scientist used a various of Ramanujan's formula to calculate the value of π upto 17 million places. The formula is

$$\pi = \frac{1}{2\sqrt{2}} \sum_{n=0}^{\infty} \left[\frac{(1)_n (1)_n ni}{(1/4)_n (1/2)_n (3/4)_n} (1103 + 26390n)^{-1} \frac{1}{\left[\frac{1}{99}\right]^{4n+2}} \right]$$

If l_c is the length of the circular section, then by putting this value of l_c, we get

$$l_c = \frac{2}{2\sqrt{2}} \sum_{n=0}^{\infty} \left[\frac{(1)_n (1)_n n^1}{(1/4)_n (1/2)_n (3/4)_n} (1103 + 26390n) \left(\frac{1}{99}\right)^{4n+2} \right]$$

$$= \frac{r}{\sqrt{2}} \sum_{n=0}^{\infty} \left[\frac{(1)_n (1)_n n^1}{(1/4)_n (1/2)_n (3/4)_n} (1103 + 26390n) \left[\frac{1}{99}\right]^{4n+2} \right]$$

When n=o,

$$l_c = \frac{r}{\sqrt{2}} \sum_{n=0}^{\infty} \left\{ \frac{(1)_0 (1)_0}{(1/4)_0 (1/2)_0 (3/4)_0 (1103 + 0)} \left[\frac{1}{99}\right]^2 \right\}$$

When n=1,

$$l_c = \frac{r}{\sqrt{2}} \sum_{n=0}^{\infty} \left\{ \frac{(1)_1 (1)_1}{(1/4)_1 (1/2)_1 (3/4)_1 (1103 + 0)} \left[\frac{1}{99}\right]^6 \right\}$$

When n=2,

$$l_c = \frac{r}{\sqrt{2}} \sum_{n=0}^{\infty} \left\{ \frac{(1)_2 .2}{(1/4)_2 (1/2)_2 (3/4)_2 (1103 + 26390 \times 2)} \left[\frac{1}{99}\right]^{10} \right\}$$

In early 1983, the team of Montagnier identified and isolated a virus from a man suffering from lymphadenopathy syndrome, a condition which often precedes fully-blown AIDS. They named it lymphadenopathy-associated virus (LAV). Later in 1983, the same

group of workers isolated viruses from full-blown AIDS, and called these viruses IDAV (immune deficiency associated viruses). After comparing IDAV with LAV, the team observed they were the same virus, nd so they named all viral isolates LAV., which now means lymphadenopathy AIDS virus. In May, 1986, the International Committee on the Taxonomy of Viruses agreed to call the virus HIV (Human Immune Deficiency Syndrome). Researchers now believe that the AIDS virus in humans had a common ancestor with the virus that is found in several African monkeys. The origins of the virus are shrouded in tropical darkness, but it seems likely that virus jumped the species barrier.

THE STRUCTURE OF HIV

The size of the virus bears no relation to the havoc it has wreaked upon human health. The diameter of HIV is about 0.1 micrometers. Research of Gelderlom and colleagues suggests that the distribution of proleins of the viral surface is very much like a soccer ball made of 12 pentagons and 20 hexagons "stitched" together to make a sphere (Fig. 4.1).

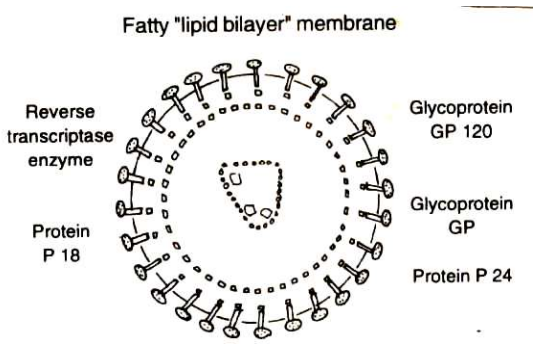

Fig. 4.1. The Basic structure of HIV

A molecule of GP 120 protein appears as a knob at the corners of the hexagons, with an extra molecule of the protein in the center of hexagons. Thus the total number of GP 120 molecules comes to 80.

Immediately the outer envelope of HIV, there is a core shell of protein surrounding the center of the core, which appears as a dense mass. The envelope of HIV also contains other proteins, known as HLA (human-leucocyte-associated) antigens. These are believed to be derived from the membranes of human cells that the virus takes some of the HLA antigens with it. These HLA protein do not appear to from any set pattern in the geometry of the envelope. It may be that the distribution of these HLA antigens in the envelope confers individuality to the viruses (Fig. 4.2).

Fig. 4.2. The basic structure of HIV.

Preston Max and Robert Mum proposed that the core cell was in fact a complicated shape called a deltacosehedron. This is a polygonalstructure composed of 60 triangular elements forming a mix of alternating hexagonal and pentagonal structures, which partly penetrate each other. The central cone is hollow and open at the narrow end, the "top". The other end appears to have a dimple-like indentation, rather like the bottom at a champagne bottle, which could be there for the same effect, to give the hollow cone strength. Alternatively, the indentation could be there to pack more protein into a given space (Fig. 4.3).

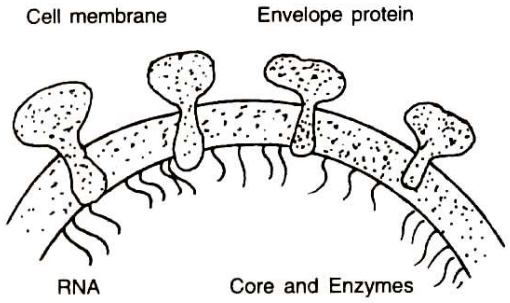

Fig. 4.3. Positions of protease in HIV.

Researchers have not yet-uncovered the structure of the RNA (Ribonucleic acid) and the reverse transcriptase, enzyme, lurking inside the cone-the two elements that give the virus its deadly signature. Retroviruses are responsible for AIDS and some types of cancer. They are unique in that an enzyme in the retrovirus, copies the viral genome into DNA, (deoxyribonucleic acid) which is then integrated into the genome of infected cells. This gives retroviruses the opportunity to change the genetic material of cells.

A retrovirus is a chemical package containing the viral RNA, along with a few molecules of the enzyme reverse transcriptase, which copies the viral RNA into DNA as soon as the virus infects the new cell. The DNA then integrates into cellular DNA from where it orchestrates production of both the messenger RNA (mRNA), that codes for viral proteins, and new copies of the viral genome. Finally newly formed viral genomes and proteins are assembled into new viruses, which escape from the cell.

Sometime, however cellular mRNAs, copied from genes belonging to the cell, are packaged into the virus. We have to study, whether the mRNAs can be copied into DNA and then inserted into the cell genome of the next host cell in the way that viral RNA is. Linial obtained good evidence that retroviruses may transport cellular mRNA from one cell to another, and then deposit a DNA copy of that RNA into the genome of an infected cell. It seems that retrovirus may be able to transfer genes indirectly between different cells and different organisms. This transfer process is called "retrofection".

Retroviruses are nothing, if not versatile in addition to "living their own lives", they can cause devastating disease. They might also be important "mechanisms of the genome", shuffling genetic material between organism to make a major contribution to the continual evolution of the genetic material of all life. The human immune system consists of many different types of white blood corpuscles (WBC),which circulate throughout the body in the blood and lymph. Some of these WBCs produce "antibodies", which are proteins that can bind to and eliminate incredible array of different foreign substances (antigens), carried by all types

of infectious organisms. Other WBCs interact with the infected or diseased cells of the body and kill them. Some WBCs act as "helper" cells supporting the other cells of the immune system in their defensive efforts. They may release proteins that activate and control the other cells of the immune system. Yet other kinds of WBCs act as "suppressors", damping down the immune response when it has done its job. The most important type of WBC infected by HIV and T-4 lymphocytes forms a crucial part of the human immune system. The T-4 cells infected by HIV are "helper" cells. When a particular antigen activates a T-4 cell, that is infected with HIV, it also activates the latent viral genes. Suddenly, the cell begins to make copies of the viral genes in the form of mRNA. This travels out of the nucleus and goes into the cytoplasm. The mRNA then stats off the production of the viral proteins, which the virus sheds, when it moves into the nucleus. It also makes copies of the strand of viral RNA that will serve as the genetic "hearts" of new virus particles.

Within these activated cells the viral proteins and RNAs begin to assemble into virus particles. These are almost complete but lack the outside fatty membranes. The new viruses begin to "bud-out" from beneath the membranes of the infected cells. As they come out, they become surrounded by sits of the cell's membrane and break free as complete viruses.

The original HIV that infected the T-4 cells and inserted its genes into DNA of the cell has now spawned a new generation of viruses. The raw materials needed to make the new viruses have been taken from the supplies in the cells. The HIV then spreads to other T-4 cells, various other types of cells throughout the body including brain cells. There it can cause damaging changes. The most circular effect of HIV infection however, is that it eventually kills the T-4 lymphocytes, selectively damages immune defenses, leaving the body vulnerable to opportunistic infections. We have yet to know what kinds of body defenses may operate against HIV.

It has been observed that 60% of patients with AIDS are estimated to be the likely sufferer of dementia before their death, they will have problems with memory, thinking and behavior. These neurological problems in the patients are the result of the direct attack by HIV on the brain. When the patients die, their brains reveal shrinkage, small groups of inflammatory cells, and spaces in the white matter. Babies born to mothers with HIV infection show shrunken brain with many diseased cells. We have now come to know that people with AIDS who are losing their mental faculties almost invariably have the virus in their brains. But yet it has to be discovered how it gets there, what types of cell it invades or by what mechanisms it destroys the brain tissues.

Every one who is infected with HIV does not react in the same way. Some people have a brief illness similar to influenza or glandular fever at around the time that antibodies develop against the virus between 4 weeks and 4 months from the time of infection. Even so, some people will remain symptomless for several years, other will be unfortunate. Estimates very, but probable 60.7% of the infected people will have some symptoms by the time that 3 years are up. About 30.40% people infected people for 3years will develop mild symptoms such as fever, sweats, aches, fatigue, unexplained loss of weight, sickness and diarrhea. There may also be shingles and herpes. The term AIDS-related complex (ARC) is used to describe this set of symptoms.

People with antibodies to HIV may also suffer swollen lymph glands in the neck and the arm-pits, for example. The medical term for this condition is "persistent general

lymphadenopathy (PGL)". Out of a group, of patients who had infection for 3 years, 15-20% will develop the syndrome of severe infections and symptoms categorized as AIDS. These conditions include lung disease, the skin tumors called Kaposi's sarcoma, severe fungal infection of the oesophagus and severe diarrhea. People with the kinds of lung infection common in AIDS suffer progressive shortness of breath, a dry cough and fevers. Kaposi's sarcoma appears as a purplish mark similar to a bruise.

Result & discussion

(1) The present work shows how the thin slices of HIV can be studied. This kind of study helps is in location the area where glycoproteins (GP 45etc.) are most effective and also provide a clue to the mechanism of operation of these glysoproteins and their affected individual.

(2) The diverse behaviour of HIV and its destructive consequences are associated with the life cycle of the virus and the tiny package of genetic instructions, which control it. The genetic blueprint for the structure and life cycle of HIV is about 100, 000 times smaller than the genetic information of a human cell, a mere 9,749 nucleotides (the units) kthat encode information along the genetic material. A few years back, when HIV became available in a workable from, the full power of contemporary molecular biology and genetic analysis has been focused in this scrap of genetic information.

(3) *The transmission dynamics of HIV.* In the classical models for sexually transmitted diseases we implicitly assume that all contacts with the same partner are concentrated in one instant. Dietz model takes into account the duration of a partnership and the number of partners during a life time which is necessary to maintain the infection at an endemic level.

Conclusions

1. The HIV section shows where the deadly components exist.
2. This study is expected to be of great significance in drug designing.
3. This study is expected to be of great significance in developing principles of destroying the virus.
4. This study can be used in making HIV non-functional in the human body.
5. By calculating the rate of infection with HIV and its incubation period, it is shown that the precisional aspects of the molecular mathematics of HIV help us in developing an experimental design for the therapeutical management of AIDS.

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