Correlation Between Viral Load And Immunity Of HIV Carriers - An Experimental Study

P Devi, N Parameswari, S Murugan

INTRODUCTION

AIDS (Acquired Immunodeficiency Syndrome) is a particularly unpleasant fatal disease caused by infection with the human immunodeficiency virus (HIV). The major feature of the disease is the destruction of the immune system which is normally the body’s way of fighting disease. HIV is actively wiped out the cells that form the body’s immune system, resulting in the disease known as AIDS.

There are currently two types of HIV: HIV-1 and HIV-2. Worldwide, the predominant virus is HIV-1, and generally when people refer to HIV without specifying the type of virus they will be referring to HIV-1. However, HIV-2 is less easily transmitted, and the period between initial infection and illness is longer in the case of HIV-2. Both HIV-1 and HIV-2 appear to cause clinically indistinguishable AIDS. HIV-1 strains can be classified into two groups, group M and group O and Group M consists of at least ten genetically distinct subtypes A to J. A declining titer of IgA antibodies against gp160, gp120 and p24 antigens may be associated with disease progression. Serum IgA (SIgA) may play a role in the in vitro neutralization of HIV-2.

The HIV-positive subjects had HIV-specific serum IgG and IgA; the sero negative persons had HIV-specific serum IgA in the absence of IgG. Testing of the sero negative persons one year after the interruption of sex with HIV patients showed that no IgG seroconversion had occurred and that HIV-specific IgA serum concentrations had declined. The immunologic picture for resistance to HIV infection should include HIV-specific cell-mediated immunity as well as HIV-specific IgA-mediated mucosal and systemic immunity.

About 25% of the children of untreated HIV-infected mothers are later determined to be HIV-infected. At birth, all of the children of HIV-infected mothers have HIV-IgG antibody, which is transferred transplacentally from the mothers to their children, and infected children produced HIV-IgG antibody in response to their infection. Most infected children have detectable HIV-IgA by 3 months of age. The presence of IgG, serum IgA and secretory IgA antibodies capable of mediating antibody dependent cellular cytotoxicity may be critical in maintaining a functional immune response in all stages of HIV infection.

HIV-1 infection induces the expression of high level of gm2 ganglioside on infected cells and IgM antibody (Ab) against GM2 can cause complement mediated cytolysis of HIV-1 infected cells. There is a positive correlation between the anti-GM2 IgM antibody Ab titer and CD4+ cell count but a negative correlation between the anti-GM2 IgM Ab titer and HIV RNA load. Therefore, the amount of IgM Ab against GM2 may be related to the prognosis of HIV-1 infected patients.

The in vivo IgM to IgG isotype switch and affinity maturation may be important for protection and long-term survival in certain HIV-1 infected individuals. So the present study was carried to assess the viral load in the blood, estimate the immunoglobulins IgG, IgA and IgM and...
correlate the viral load and immunity of HIV carriers

**MATERIALS AND METHODS**

Forty HIV carriers of both sexes and age from 26 to 45 years who came to Kovai Medical Centre and Hospital (KMCH), Coimbatore, Tamil Nadu for regular checkup were selected for this study. Forty healthy subjects of both sexes and corresponding age group free from HIV infection were chosen as controls. 15ml of Heparinised blood and stored in a vacutainer blood collection tube also 5ml of blood is collected from the HIV carriers and serum is separated and stored in a vial. The viral load was estimated by Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) aimed at amplifying the RNA of the virus. The quantification of viral load was done at Specialty Ranbaxy Limited, a clinical reference laboratory in Mumbai, India.

Pathogen diagnosis by the polymerase chain reaction (PCR) is based on the amplification of specific regions of the pathogen genome. In real-time PCR, amplified product is detected via fluorescent dyes. These are usually linked to oligonucleotide probes which bind specifically to the amplified product. Monitoring the fluorescent intensities during the PCR run (i.e. in real time) allows the detection and quantification of the accumulating product without having to re-open the reaction tube after the PCR run.

The determination of human IgG, IgA and IgM are based on the specific reaction between antigen and corresponding antibody. IgG, IgM are based on the specific reaction between antigen and corresponding antibody. IgG, IgA and IgM in the serum were determined by Radical immunodiffusion test as described by Fahey and Muckelvey and Mancini et al. The levels of significance in the variation of above biochemical parameters in blood among HIV patients were determined by performing student’s ‘t’ test.

**RESULTS AND DISCUSSION**

The mean HIV load was increased in the HIV carriers when compared to the control. The mean HIV load was 30788.70 ± 22811.43 copies/ml in the HIV carriers and 0 copies/ml in the control. Increase in the mean IgG level was statistically significant at 1 percent level. Similar observation was made by Lawoko et al. that there is an increased IgG binding in HIV-1 infected individuals.

When the mean viral load 30788.70 ± 022811.43 copies/ml was increased, the mean IgG level 2325.25 ± 394.4mg/dl was also increased. But this elevation is not useful in the prevention of disease progression. This statement is supported by Daniel et al. and Olivos et al. Oliva et al reported that following primary infection with HIV – 1, antibodies against HIV – 1 auto antibodies, also arise. Such auto antibodies have an important role in the pathogenesis of HIV – 1 infection.

![Figure 1](image)

**Table 1:** The values of various parameters in the blood of HIV carriers

<table>
<thead>
<tr>
<th>S.No</th>
<th>Parameters</th>
<th>Units</th>
<th>Mean ±SD</th>
<th>Groups compared</th>
<th>'t' value</th>
<th>indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Viral load</td>
<td>Copies/ml</td>
<td>640</td>
<td>A vs B</td>
<td>4.2555</td>
<td>Increased</td>
</tr>
<tr>
<td>2</td>
<td>IgG</td>
<td>mg/dl</td>
<td>1112.38</td>
<td>219.45</td>
<td>9.3222</td>
<td>Increased</td>
</tr>
<tr>
<td>3</td>
<td>IgM</td>
<td>mg/dl</td>
<td>186.37</td>
<td>63.84</td>
<td>0.9598</td>
<td>Normal</td>
</tr>
<tr>
<td>4</td>
<td>IgA</td>
<td>mg/dl</td>
<td>241.87</td>
<td>148.73</td>
<td>0.3555</td>
<td>NS</td>
</tr>
</tbody>
</table>

The mean IgG level was normal when compared to the control. The mean IgM level was 241.87± 148.73 mg/dl in the HIV carriers and 224.9± 43.12 mg/dl in the control.

When the mean viral load 30788.70±28811.43 copies/ml were increased, the mean IgA level 241.87 ± 148.73 mg/dl were not increased. Koziowski and Jackson stated that IgA level is increase in early in infection and remained elevated throughout disease progression. But the present study contradicted the statement of Koziowski and Jackson that the IgA was not increased.

The mean IgM level was normal when compared to the control. The mean IgM level was 186.37 ± 43.84 mg/dl in the HIV carriers and 192.65 ±49.70 mg/dl in the control.

When the mean viral load 30788.70 ± 28811.43 copies/ml were increased, the mean IgA level 241.87 ±148.73 mg/dl were not increased. Koziowski and Jackson reported that the IgA level was increased early in infection and remained elevated throughout disease progression. But the present study contradicted the statement of Koziowski and Jackson that the IgA was not increased.

The mean IgM level was normal when compared to the control. The mean IgM level was 186.37 ±43.84 mg/dl in the HIV carriers and 192.65 ±49.70 mg/dl in the control.

There was no significant variation in the mean IgM level in
the HIV carriers. Wu et al. reported that HIV – 1 infection induces the expression of high level of IgM antibody. But the current study was contradictory to the statement of Wu et al." When the mean viral load 30788.70 ± 22811.13 copies/ml was increased, the mean IgM level 186.37 ±43.84 mg / dl was not increased. The above statement is supported by Toran et al. and Daniel et al.15.

Any immune stimulation may increase the viral load, and specific immunization may lead to enhancement of infection. High mutation rate and high turnover rate, which are the characteristics of the virus explains in part why the immune response alone is unable to control the infection.

**CONCLUSION**

The current study was done in HIV carriers who were healthy and who did not turned to full blown AIDS. Their results showed that an increase in the level of immunoglobulin IgA and viral load and normal levels of IgA and IgM. Though there is an increase in viral load, the immunoglobulin IgA and IgM level were found to be normal in HIV carriers. Due to chronic infection of HIV, IgG level was found to be increased. The current study indicated that even though there was an increase in the viral load, there was no decrease in the levels of immunoglobulins IgG, IgA and IgM. A study might be needed with large sample size concentrating on the IgA anti HIV antibodies binding to envelope glycoproteins of HIV in carriers. Since the non-specific IgA in plasma are involved in every stages of HIV infection, but the mechanism is not known so far. The polymeric nature of the IgA antibodies against env glycoproteins might be studied promptly by analyzing the same in carriers as well as AIDS patients which may help us to assess the role of the antibody in every stages of the disease. Since elevated levels of GM2 ganglioside on infected cells producing IgM antibody against the same have correlation with CD4 + cell count and HIV RNA load and these may be related to the prognosis of HIV – 1 infected patient. They might be correlated with the other T cells also. These studies might be needed for the enhancement of immune response against those viruses to prolong the life of the infected persons.

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