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(REVIEW ARTICLE)

HIV infection and vaccinations

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Abstract

Introduction: Vaccination is mentioned as a most successful way of intervention in public health. Vaccination against other diseases is usually recommended for people with Human Immunodeficiency Virus (HIV/AIDS) infection.

Purpose: To identify the correlation of vaccines and vaccination in patients suffering from HIV/AIDS infection.

Methodology: This narrative review was based on the bibliographic search of reviews and research studies drawn from the international databases. The exclusion criterion of the articles was the language other than English and Greek.

Results: HIV infection is characterized by severe immunodeficiency, which is the result of a decrease in the number of CD4+ T – lymphocytes. The right time to vaccinate a HIV patient is not precisely determined, but it is recommended for those with low CD4 values. All HIV patients are recommended to be vaccinated the annual vaccination of Influenza virus vaccination. It also is recommended to be vaccinated with the vaccination against human papillomavirus (HPV), the vaccination against hepatitis A virus (HAV) and hepatitis B virus (HBV), the vaccination against herpes zoster or shingles and the vaccination against COVID-19 infection.

Conclusion: People with HIV/AIDS are more vulnerable to infections from various diseases. Therefore, it is necessary patients with HIV infection be vaccinated against life-threatening diseases.

Keywords: Vaccines; Vaccination; HIV/AIDS infection; Medicine; Prevention

1 Introduction

Vaccination is mentioned as a most successful way of intervention in public health, not only for citizens' health but also for the economy of a country [1]. Vaccination saves millions of lives every year. In addition, it is an important tool regarding the control and prevention of epidemics that can take on pandemic ramifications with significant impacts on global health and the global economy [2].

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Medicine, pharmacology, new technologies through rapid evolution during the last century and health emergencies such as the recent pandemic of the new coronavirus SARS-CoV-2, have proven that they can offer humanity safe, quality, and effective vaccines aimed at preserving and protecting public health [1].

During the COVID-19 pandemic caused by the new coronavirus SARS-CoV-2, other types of vaccines have become known; viral vector vaccines as well as vaccines whose immune response responds to the administration of mRNA and / or DNA [3].

Vaccination against other diseases is usually recommended for people with HIV/AIDS infection. Vaccination against seasonal influenza, pneumococcus, human papillomavirus (HPV), hepatitis A virus (HAV) and hepatitis B virus (HBV), herpes zoster or shingles, and the latest SARS-CoV-2 infection, is recommended or even imposed on people with HIV infection [4, 5]

It is vital specific assessments be required based on strict scientific criteria such as the prevalence of the disease, as well as the examination of possible complications by age group or based on underlying diseases, before any vaccine being widely used in humans [6].

The purpose of this narrative review is to identify the correlation of vaccines and vaccination in patients suffering from HIV/AIDS infection.

2 Methodology

The methodology followed was based on the bibliographic search of reviews and research studies drawn from the international databases Medline, Pubmed, Cinahl and from the Greek database Iatrotek. The keywords used were vaccines, vaccination, and HIV/AIDS infection. The exclusion criterion of the articles was the language other than English and Greek.

3 Talking about Vaccines

Vaccines consist of parts of a microbe that have been neutralized or weakened, or even parts of some toxins produced by the microbe, or some protein found on its surface. When this part of the microbe enters the body, the body's defense mechanisms are mobilized to neutralize it and acquire adaptive immunity. As a result, the next time, when the pathogen enters the body, the latter will be able to neutralize it faster and more easily [1].

The function of vaccines is characterized by the stimulation of the human immune system, aiming at producing memory cells and antibodies against some specific antigens. Immunization of the organism can be achieved in two ways [7]:

- Through natural active immunization and artificial active immunization (vaccination),
- Through passive immunization, administering ready-made antibodies, which have already developed in the body of another organism, either human or animal.

Vaccines are classified into two main categories [6, 7]:

- Vaccines consisting of live-attenuated vectors characterized by their ability to multiply while achieving immune response in the body without the person being infected.
- Inactivated vaccines, which consist of either completely inactivated viruses, bacteria or their internal components, such as polysaccharides and proteins.

Vaccines can be administered through almost all routes (intramuscular, intradermal, subcutaneous, intranasal, oral) [1, 7]

Vaccines are also distinguished according to how many types of microbes, or their products are used for their manufacture, i.e., monovalent vaccines, created with one strain or component of a microorganism, and in pluripotent vaccines for which many types of microorganisms or their products are used [8].

The implementation of vaccination programs is a public health measure that can offer many benefits both individuals' health, whether children or adults, and the economy of a country or community [9].

For this reason, many economists are in favor of implementing vaccination programs because health gains will increase due to lower health care costs and population productivity will increase in the long term due to their good health [10].

4 Talking about HIV Infection

AIDS is defined as Acquired Immune Deficiency Syndrome. AIDS is due to disturbances in cellular and humoral immunity caused by the Human Immune Deficiency Virus (HIV) [11]. The virus causes damage to the immune system, attacking T-lymphocytes, thus making the sufferer's body susceptible to many infections [12].

HIV infection is characterized by severe immunodeficiency, which is the result of a decrease in the number of CD4+ T – lymphocytes. The reduction of CD4+ increases the risk of contracting various opportunistic infections (Ois) as well as the development of neoplasms [13].

HIV infection develops chronicity, which is characterized by the multiplication of the virus, as well as a period that will take until clinical signs of the disease appear (this period can last up to 10 years) [14]. The virus, even in its clinically latent period (CDC stage A), continues to reproduce [15]. In untreated HIV infection, there is, usually, a slow progression of the disease that progresses nonlinearly to severe immunosuppression [12].

However, disease progression varies considerably amongst people with HIV infection. Within 10 years of infection, if untreated, about 50% of people will develop AIDS syndrome; 30% of them will experience milder symptoms, while fewer than 20% of them will remain completely asymptomatic [15]. It is estimated that progression of AIDS infection is much slower in children and adolescents than in adults. Moreover, after 10 years from the time of infection, and if they do not receive treatment, a percentage of 30% will develop AIDS [16].

In fact, the route of transmission of HIV infection affects neither the speed with which the disease will progress, nor gender. Nevertheless, it is observed that the disease with lower plasma levels of the virus seems to develop faster in women [17].

In 1993, the Center for Disease Control (CDC) in the USA, issued the guidelines according to which HIV infection is still staged nowadays. Staging is derived from the combination of clinical and laboratory findings and involves nine stages. These stages result from the combination of the number of CD4+ and the three major stages of HIV infection [18].

A patient is considered to be suffering from AIDS when, in the table, he is classified in one of the stages A3, B3, C1, C2 or C3. (Table 1). If the patient is classified once in one of these categories, regardless of any improvement in his clinical or laboratory image, he remains in this category [19].

Table 1 Classification of HIV infection by CD^{4+} number and clinical picture

		Clinical		**Categories**
	Categories of CD4+ lymphocytes	A	B	C
1	CD4 > 500/μL	A1	B1	C1
2	CD4 200 - 499 /μL	A2	B2	C2
3	CD4 < 200/μL	A3	B3	C3

Disease progression varies considerably amongst people with HIV infection. Within 10 years of infection, about 50% of untreated people will develop AIDS syndrome, 30% of them will develop milder symptoms, while fewer than 20% will remain completely asymptomatic [15].

5 Vaccinations and HIV Infection

The right time to vaccinate a HIV patient is not precisely determined, but it is recommended for those with low CD4 values. In patients with CD4 <200mm3 it is not recommended to administer live vaccines [20].

5.1 Influenza virus vaccination

Complications of the influenza virus make the need for the annual vaccination of people living with HIV/AIDS imperative, and these complications are accompanied by high rates of morbidity and mortality [4].

5.2 Vaccination against pneumococcus

All HIV patients are recommended to be vaccinated with a dose of Prevenar13 (PCV14) and after at least eight weeks, with a dose of Pneumovax (PPV23). If someone has firstly been vaccinated with PPV23 then, at least one year after vaccination, they should also receive a dose of PCV13. It is recommended they be administered the second dose five years after the initial one [21].

5.3 Vaccination against human papillomavirus (HPV)

According to the CDC, vaccination against HPV is recommended for all girls and boys over 11 years of age regardless of whether or not they have HIV infection, for men who have sex with men (MSM), for immunocompromised patients up to 26 years of age (including HIV patients), if they are not previously vaccinated [21].

5.4 Vaccination against hepatitis A virus (HAV) and hepatitis B virus (HBV)

Serological testing for HAV and HBV is recommended in patients with HIV infection. Those who are not immunized to HBV should be vaccinated [21].

5.5 Vaccination against herpes zoster or shingles

A major cause of morbidity among HIV patients is varicella virus infection, which results in shingles. The herpes zoster vaccine consists of live-attenuated vaccine vectors, and although the testing phase has not revealed any additional risk for seropositive patients, the FDA has not issued a final decision yet. Consequently, they are not currently indicated for HIV patients [21].

5.6 Vaccination against COVID-19 infection

According to the most recent research data, vaccination against COVID-19 infection is recommended for all immunocompromised people, regardless of CD4 number [22, 23] However, their immune response may not reach satisfactory levels, so despite vaccination they must continue to adhere to all preventive measures for exposure to SARS-CoV-2, while it may be necessary people with whom they are in direct contact be vaccinated [22, 5]

5.7 Vaccination against HIV infection

Despite four decades of research, scientists have not developed a vaccine so far that protects against the virus that causes AIDS, which is responsible for the deaths of hundreds of thousands of people annually. HIV-1 infection is characterized by the tremendous growth of genetic diversity in the viral population and its continuous evolution and adaptation [24].

Most HIV proteins cause an immunobiological response, but intense antibody production reactions are caused by gp120 and gp41 glycoproteins and the key matrix proteins p24 and P17. The importance of activating the immunobiological system against P17 has been highlighted over time and has been cross-referenced by clinical studies showing that the presence of antibodies against of P17 correlates with non-progression of AIDS [25].

The goal now is to create a single system to block the biological activities of P17s for the development of an effective anti-HIV-1 therapeutic vaccine [26].

6 Conclusion

Many diseases are controlled through vaccines while vaccination is the most successful intervention as regards both health management and health promotion for these patients.

People with HIV/AIDS are more vulnerable to infections from various diseases, often making comorbidity dangerous even for their own lives.

Therefore, it is necessary patients with HIV infection be vaccinated against life-threatening diseases. Furthermore, a vaccine that will provide preventive protection against HIV/AIDS is the big issue in research on the disease from the very first years of the onset of the disease. [27]

Compliance with ethical standards

Disclosure of conflict of interest

There are no conflicts of interest.

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