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INFLUENZA VACCINATION. ADVANTAGES AND DISADVANTAGES

Review
Article

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Abstract

Influenza vaccination is very important not only for elderly and children that don't have enough autoantibodies that can fight against different viruses. Individuals who receive influenza vaccination have to be precautious because this immunization can determine allergic reactions for people that are sensitive to the yolk sac of the egg. The doctor has to know the allergies of the patients before vaccination. This review informs about randomized controlled studies for improving influenza. But despite all these, for receiving the flu-shot, all the patients need precautions before and after vaccination because they can develop allergies.

INTRODUCTION

If we were to go back to the famous X-Files movie, we agree that “viruses are not gifts for people from aliens” (Sompayrac, 2002). But surely it is the fact that they have appeared with the advent of life on earth, they have evolved, but no one can certify exactly their evolution. The fact is that since the beginnings, they remained unsigned, and by the beginning of the twentieth century, people still talked about those “imaginary beings”, without them being known. Wikipedia presents a definition that explains a clear image of a virus „, a virus is a microbial pathogen, invisible to the optic microscope, which has no capacity for self-production, but is multiplied by the parasitic cell” (Wikipedia, 2019) causing various infectious diseases called virosis. They have known adaptations and mutations as all, like other organisms that use a genetic code which is required for survival. The use of these “jumping genes” made it possible for completing the functional genetic units to be combined to produce proteins that were multifunctional, and for parts of different genes to be spliced together in order to create proteins that could perform brand new interactions (Adogu, Achebe and Ubajaka, 2014).

According to the estimation, more than 30% of all human genes bear the traces of the transposition of such a string of events.

This gene shuffling greatly accelerated the evolutionary process, but it also provided a mechanism for creating viruses; after this process, the transposition took place. Genetic information existed free in the cell, unattached to any chromosome.

And since viruses are nothing more than parts of RNA or DNA enclosed in a protective coat, some of this mobile cellular genetic information could be used by “wannabe” viruses to construct their genomes (defined as the sum total of a virus genetic information) (Sompayrac, 2002).

A defining characteristic of viruses makes them able to pass through filters that retain or trap most known bacteria (Teri, 2013). This important feature was revealed by Pasteur after all his attempts to highlight the rabies agents that seemed to be in vain (because these microorganisms were invisible under a microscope).

Typically, bacteria range from 1 to 10 micrometers (μM) in length, whereas a virus would fall in the range of 0.03 to 0.1 μM in length (or 30–90 nanometers). Of course there are always some exceptions: some viruses, such as poxviruses, can be 200 to 400 nanometers (nm) in length and some viruses (such as Ebola) can be up to 1000 nm in length (Teri, 2013).

It is important to understand that viral evasion of host defenses need not be complete. In fact, if a virus were to completely evade host defenses and

reproduce unchecked, the virus would probably kill its host before it could spread to another human. What a virus has to do is to evade these defenses long enough either to spread to another host, or to establish a latent or chronic infection within the original most front which the virus can spread at a later time.

Of course, the solutions to these three problems of reproduction, spread, and evasion must be consistent.

BENEFITS OF VACCINATION, LITERATURE REVIEW

Vaccines are biological preparations endowed with antigenic properties, which trigger the appearance of the immune response to the organisms subjected to vaccination. In principle, vaccines, regardless of the strategy they rely on to combat the effects of the pathogen, aim at obtaining an immune response in the body by producing specific antibodies. Immunological protection is established after varying inoculation time (weeks, months), depending on the vaccine, and provides long lasting protection (years). In most cases, viral infection provides protection against further infections.

Influenza vaccine is divided into some categories; according to the mechanism of action: vaccines acting by activating the mechanisms of humoral immunity, vaccines that act by activating cellular immunity mechanisms; by biological content: vaccines containing live attenuated microorganisms, vaccines containing purified microbial components, protein or protein-conjugated polysaccharides, vaccines containing recombinant proteins and vaccines contain anatoxins.

Advantages and disadvantages of passive immunization

Flu vaccination is based on a number of variables that depend on three hypotheses:

1. Target of the intervention (e.g. patients, providers, or systems).
2. The type of intervention (e.g. education, reminders, feedback).
3. The social theory (e.g. social influence, marketing) that underpins the intervention (Gillam & Siriwardena, 2014).

The hypotheses from above, have as results the individuals who need to be vaccinated. In order to reach their acceptance, a number of operations are needed to overcome the reticence of human behavior. One way to explain this behavior concerns the needs and motives.

If people consider the needs relatively unimportant, they cannot affect their behaviour at any given time, instead, if people become convinced of their importance, they will act accordingly. And because it addresses to people, they must be persuaded, and

the most common method is based on marketing policies.

In marketing, two important ways explain the motivation:

- By examining consumers, forming their own opinions.
- Taking into account the types of needs.

Maslow's hierarchy of needs suggests that people primarily have in mind satisfying the physiological needs, and only after that they will take into account the safety, social elements, esteem, and will self-update the secondary needs only after basic (primary) needs are at least partially fulfilled.

As seen, the safety of the person occupies a second place in the hierarchy of needs, and for a successful campaign in defeating human beliefs, there are ways and methods of positive influence, such as:

1. The social group.
2. Social class and the reference groups.
3. Family and culture.

One of the most important environmental influences is the social group. Social groups influence a person's needs, motives, perceptions and attitudes. The group's influence on an individual depends on the status and role of the individual in a group. Group influence shows high values for products that are easily identifiable.

Social class and reference groups are other types of group influence. The social class is determined by occupation, source of income, education, family environment and living area. Reference groups are those persons with whom a person identifies and directs his/her behaviour. Family and culture are two other sources of external influence on human behaviour (Pauna, 2016). Changes in the family lead to adjustments in the behaviour of an individual.

Any vaccination campaign should be focused on these elements in order to present a real success. Having reviewed the main ways of persuading the population for the vaccination process, the vaccine development has a series of barriers that require special attention. In this case the authors distinguish active immunization and passive immunization, and which is the most optimal of these two. If the authors refer to active immunization, it persists much more time than the passive one, sometimes even the whole life. Inducing active immunity is more desirable than passive immunity, because this form of immunity is a long-term one.

Passive immunization has an advantage in that it is quick acting, producing an immune response within hours or days, faster than a vaccine. Additionally, passive immunization can override a deficient immune system, which is especially helpful in an individual who does not respond to immunization. (Passive Immunization, Centers for Disease Control and Prevention, 2019). Regardless of which of the two forms of immunization are being discussed, the base is the antibody production. Artificially forming active immunity is a very complicated process.

Introducing foreign antibodies into the body, even controlled, can be dangerous for some individuals, so it also clearly shows disadvantages. Although new techniques produce antibodies in the laboratory, in most cases antibodies to infectious diseases must be harvested from the blood of hundreds or thousands of human donors. Or, they must be obtained from the blood of immune animals (such as antibodies that neutralize snake venoms). In the case of antibodies harvested from animals, serious allergic reactions can develop in the recipient. Another disadvantage is that many antibody treatments must be given via intravenous injection, which is a more time-consuming and potentially complicated procedure than the injection of a vaccine (Passive Immunization, Centers for Disease Control and Prevention, 2019).

In accordance with the great changes in the modern medicine, vaccine immunization has become an innovative science for millions of lives to be saved daily. The introduction of new vaccine preparations poses a challenge for both medical research and practice, but also for countries where the population is exposed to the risk of diseases and death.

Influenza vaccine

Influenza virus causes a contagious respiratory infection. At European level, influenza occurs regularly in annual epidemics, in winter months. Usually the winter epidemic flu affects every country for one or two months and lasts, at the level of the European continent, for almost four months. Sporadic infections may also occur outside the flu season, with a very small incidence in the warm months of summer. This decline in antibodies and the need to vary the composition of the vaccine depending on the subtypes prevalent each year are the reasons for annual revaccination. Apart from these killed or inactivated vaccines, live vaccines have been trialed but are unlicensed. The recent flu vaccine is quadrivalent and is available only in the developed countries (Siriwardena, 2003).

Not all those who are infected by influenza virus get sick, but those who have clinical manifestations of the disease, present common symptoms, such as: fever, cough, sore throat, muscle and joint pain, headaches, malaise and fatigue. A countermeasure of these symptoms is the prevention by receiving the flu shot, which provides protection against influenza. A new variant of the influenza vaccine is developed twice a year, because the strain of the virus changes rapidly. In their vast majority they offer medium to high protection against influenza virus, but this varies every year. The vaccines are usually trivalent, containing two subtypes of influenza A and one of influenza B and produce a rapid antibody response that lasts three to six months (Siriwardena, 2003).

The World Health Organization, but also the centers for Disease Control and Prevention, recommends

vaccination of all people over the age of six months annually (World Health Organization (WHO), The Regional Office for Europe of the Regional Office for Europe, 2018). Vaccines are generally safe. In children, an adverse reaction can be the occurrence of fever (between five and 10%), as well as muscle aches or fatigue. One in a million doses can cause Guillain-Barre syndrome in people with advanced age. The vaccine should not be given to people with severe allergies to older versions of the vaccine. These vaccines may contain inactive or attenuated viral forms of the virus. The inactive form of the vaccine is usually administered to pregnant women as an intramuscular injection or sprayed into the nasal cavity.

Effectiveness of influenza vaccination

The evidence for effectiveness of influenza vaccination comes largely from systematic reviews and meta-analyses in adults and elderly people. More recent evidence from observational studies also suggests greater effectiveness of repeated influenza vaccination (Siriwardena, 2003).

In general, studies of the effectiveness of influenza vaccines are based on disseminated statistical data from a series of observations, or simply from data transmitted. In case of Romania, that happens through the National Vaccination Programme, by Family Doctors that receive free doses of the vaccine for people over 65 years or for children. Another method is based on the number of doses sold in pharmacies, centralized at the level of Public Health Directions at National Level. Whether the vaccines are effective or not and whether there are major adverse reactions, it is something that can be seen in the number of hospitalized people. The number of patients, the side effects and the days of hospitalization are reported to the same county institutions.

Severe allergic reactions to vaccines are rare and difficult to predict. An allergic reaction may be defined as an idiosyncratic reaction that is caused by an immunologic mechanism (Siriwardena, 2003).

An analysis of adverse reactions at European Level is managed by (EFA) European Federation of Allergy and Airways Diseases Patients' Associations, and worldwide by (WAO) World Allergy Organization. Both organizations' analyses, in the case of influenza vaccine reaction, rely on the immunological reactions to drugs (including vaccines), based upon the timing of the appearance of symptoms (Revised nomenclature for allergy for global use; Report of the Nomenclature Review Committee of the World Allergy Organization, 2003).

Allergic reactions need to be distinguished from clinical manifestations that occur coincidental to vaccination (e.g. becoming anxious), vasovagal responses, local injection-site reactions (either

immediate or delayed), and the oculo-respiratory syndrome (ORS) (Dreskin et al., 2016).

In Romania, post-vaccination adverse reactions are registered based on a supervisory methodology included in a governmental decision (HG 589/2007). This methodology deals with the reporting of the undesirable post-vaccination adverse reactions (RAPI) which are immediately reported by telephone, as well as with the "unique record of transmissible disease" issued within five days after detecting the suspect/confirmed case. One of its main purposes is to increase the adhesion and understanding of the Romanian population towards the National Vaccination Programme.

Undesirable post-vaccination (RAPI) reaction is an unwanted/adverse medical event (unexpected manifestations, abnormal laboratory results, symptoms or exacerbations) which occurs in the first 30 days after vaccination, depending on the type of adverse reaction and which does not necessarily have a causal relationship with the administration of the vaccine. Depending on the effects that may cause post vaccination adverse reactions, according to the Council of International Medical Sciences Organizations (CIOMS, 2018), there are the following categories:

1. Reaction associated with the composition of the vaccine.
2. Reaction associated with vaccine quality.
3. Reaction associated with errors of vaccination (programmatic errors).
4. Reaction associated with anxiety due to vaccination.
5. Coincident post-vaccination reactions according to the cause, the severity and frequency are divided into two categories:

1. Reaction associated with the composition of the vaccine: are due to the intrinsic properties of the vaccine, taking into account the production of the vaccine, its transport, storage and administration. The post-vaccination reaction in such situations may be due to an idiosyncratic adverse reaction (e.g. anaphylactic shock) or due to the replication of the microbial agent associated with the vaccine (post-vaccination Polio after administration of live attenuated VPO containing virus).

2. The reaction associated with the defects of quality production of the vaccine is due to the production of the vaccine or of the vaccine administration device that may have an impact on the individual post-vaccination response which may lead to an increased risk.

Literature defines two general types of reactions: immediate and delayed (Kelso, 2019).

- Immediate reactions begin within one hour after administration or they may begin within minutes. IgE-mediated reactions are most likely to present within this time period.

- Delayed reactions appear several hours or days after administration. These reactions may be caused by several different mechanisms, but they are rarely IgE-mediated.

Very rarely, allergic reactions to vaccines occur, and can be life threatening. Estimates of allergic reactions to vaccines including immediate hypersensitivity reactions, range from 1 in 50,000 to 1 in 1,000,000 doses (Dreskin et al., 2016).

The most common symptoms encountered in the adverse reactions of the influenza vaccine range from the minor cutaneous signs and symptoms (erythema and itching), up to the multisystem effects (anaphylaxis) that can include the cutaneous, respiratory, gastrointestinal, and/or cardiovascular systems (Dreskin et al., 2016).

The main side effects of flu vaccination are: encephalopathy, seizures, transverse myelitis, optic neuritis and Guillain-Barre syndrome (Stratton, Ford, Rusch and Clayton, 2011).

Patients may have clinical complaints that occur immediately subsequent to administration of a vaccine that may or may not be compatible with an allergic reaction, but nonetheless have a significant impact on the patients' perception of vaccines and their willingness to undergo further vaccination (Dreskin et al., 2016).

In this context, the authors can disassociate the above mentioned adverse reactions from the symptoms due to anxiety or acceptance/non-acceptance of vaccination. Most influenza vaccines marketed currently are produced in embryonated chicken eggs, and therefore contain small amounts of egg proteins, most notably ovalbumin, the amounts of which may vary by vaccine manufacturer and vaccine lot (Harding and Heaton, 2018).

A severe allergic reaction to influenza vaccine, regardless of the component suspected of being responsible for the reaction, requires evaluation before future receipt of the vaccine in question or an alternative vaccine (Dreskin et al., 2016).

CONCLUSIONS

The safety and efficacy of influenza vaccines are two of the characteristics located in the first place. Although even if the protection against influenza varies, there are numerous reasons for annual vaccination. The most relevant reasons are:

- Protection against influenza.
- It reduces the risk of hospitalization associated with influenza, among children and adults; (A study from 2014 showed that influenza vaccine reduced the risk of hospitalizations in intensive care units among children by 74% during influenza seasons 2010-2012. Another study in 2016 showed that the vaccine reduced by 57% the number of hospitalizations among people over 50 years of age).

- Flu vaccination prevents exacerbations among people with chronic conditions.
- It protects pregnant women during pregnancy and during the period after giving birth.
- It protects the child during pregnancy and several months after childbirth.
- It relieves the symptoms of the disease among those who have the flu, shortening the period of the disease.
- Vaccination protects the people around individuals who get sick. In the last two years, important steps have been taken in Romania to improve the vaccination activity. Vaccination and information campaigns were based on the "door-to-door" communication for both anti-measles and anti-flu vaccination, which led to an increased number of vaccinated children from disadvantaged areas, but not only.

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