Directions and opportunities for immunoprophylaxis development among Polish Army soldiers sent to foreign missions

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Summary

The Polish Army is engaged in stabilization activities and peace missions in countries often characterized by completely different customs, culture and religion, as well as different bacterial and viral flora. It might be expected that foreign military operations will be more and more important, as the number of local conflicts is escalating. The safety and health of our citizens in these circumstances is the absolute priority. This article is dedicated to the safety of soldiers in the context of the risks associated with infectious diseases that can be prevented by vaccination. The main goal of this study is to verify the model and condition of immunization in the Polish Army in the context of foreign contingents, as well as presentation of the possibilities to optimize solutions in this field.

key words: vaccines • typhoid fever • tetanus • diphtheria • poliomyelitis

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**BACKGROUND**

The Republic of Poland and its armed forces have gained much experience in the difficult, endless task of peace-keeping around the world. The Polish army has been actively taking part in peace and stabilization missions (carried out by UNO, OSCE and NATO) since 1953, and consequently has been sending soldiers to the most important trouble spots in the world. It is a vital element of the Polish participation in international policy, as well as an important part of foreign policy [1]. At the same time, taking part in international peace missions is a great opportunity for Polish soldiers to gain valuable experience. Our country benefits from participation in international peace missions. This has been clearly visible in the past, when both NATO and EU had difficulties in gathering sufficient number of soldiers to carry out their operations (eg, in Chad and Afghanistan). Poland was an exception in both of these operations – its contribution in each was essential and highly visible. Thanks to the participation of nearly 84,000 Polish soldiers and military employees in more than 71 operations, the Polish Armed Forces have gained huge experience, which stimulated modification and modernization of training; and above all, creating a professional army. However, these operations also showed how much has to be done in the field of training, equipment, and protecting the health and lives of Polish soldiers. Participation in the mission in Iraq proved that soldiers of the modern battlefield must be considered comprehensively: it is necessary to provide them not only with the right weaponry and training, but also comfortable uniforms and shoes suitable to the difficult conditions of the desert. Also important are the health care system, as well as legal and social systems, necessary to assure a sense of security and high morale in soldiers, and as a result, to assure their maximum performance [1].

Foreign military operations will become increasingly important, as the number of local conflicts is escalating [1,2]. Clearly, it is not possible to participate in such missions without a modern army. In the previous years the gap between the Polish army and the armies of its allies has decreased considerably; still, much remains to be achieved. Our officers, non-commissioned officers, soldiers and military employees very often carry out military service in difficult geographical and climatic conditions, far away from their homes and relatives, in countries often characterized by completely different customs, culture, religion, but also bacterial and viral flora, where danger lurks at any moment and in almost any place [1].

The safety and health of our citizens in these circumstances is the absolute priority [3]. It is not possible to avoid every kind of danger mentioned above, but at least some of them can be controlled. A special threat is infectious diseases, especially those endemic for a particular place, but exotic in relation to Poland [4]. Many of these diseases can be prevented through vaccination, which is the focus of this study, whose aim is to verify the model and condition of immunization in the Polish Army in the context of foreign contingents, as well as presentation of the possibilities to optimize solutions in this field.

**DESTINATIONS OF POLISH ARMY FOREIGN MISSIONS**

The Polish Army is engaged in stabilization activities and peace missions abroad. The tradition of participation in such operations dates back to 1953 [5,6]. Since then, Polish soldiers have supported international organizations with their knowledge and experience, in various, sometimes very remote, regions of the world. Polish contingents have been stationed in Europe, Asia and Africa. Close to 84,000 Polish troops have served abroad [5].

The Poles have participated in military actions within NATO, EUFOR, OSCE and UNO [5].

Initially, Polish contingents specialized in logistic tasks. The first of these was UNEF II (United Nations Emergency Force) stationed in the Sinai Peninsula from November 1973 to January 1980, consisting of 822 to 1026 soldiers (Figure 1) [6]. The contingent was assuring widespread logistic support. The Polish Field Hospitals & Clinics unit was responsible for medical protection. The Logistics unit assured supply of drinking water and food to all other contingents, and a smaller engineering unit dealt with clearing the field of explosives [6].

The participation in the peace-making mission in the former Yugoslavia brought about a new stage of Polish engagement in UNO peace operations. It was the first time when Polish soldiers took part in operational tasks (patrolling supervised areas, protecting important installations, escorting humanitarian aid convoys, etc.) [6].

The mission took place from April 1992 until May 1995 – the Polish battalion was engaged in the mission within UNPROFOR operation and then UNCRP operation for three years. After that, it became a part of the Nordic-Polish Brigade of IFOR forces. More recently, Polish contingents participated in missions in Africa, the Middle East and Europe (Figure 1) [6].

**DESCRIPTIONS OF DISEASES AND RISK ARISING FROM THEM**

Places where soldiers and army civilian employees participating in foreign missions are required to stay often have a different climate from Poland, as well as specific bacterial and viral flora and related epidemiological threats. Those that can be prevented by vaccination are listed below [7–9].

**Diphtheria**

**Symptoms**

Following a one- to five-day incubation period, diphtheria typically presents as pharyngitis with pseudomembranes that can spread, obstruct the airways and eventually lead to death by asphyxia. Complications of diphtheria include potentially fatal heart and neurological disorders. Diphtheria-related mortality remains high (10%) even during recent outbreaks. Diphtheria must be treated as an emergency in order to reduce the risk of complications and death. Treatment relies mainly on the administration of diphtheria antitoxin by the intramuscular or intravenous route. Antibiotics are also used to contain bacterial growth, but they have no effect whatsoever on toxin-induced symptoms [7].

**Epidemiology and vaccination**

Humans are the only natural reservoir of *Corynebacterium diphtheriae*. Transmission occurs through respiratory droplets...
and close physical contact. Before vaccination against diphtheria became readily available in the 1980s, it was estimated that approximately 1 million cases occurred in the developing countries of Eastern Europe each year [8]. Diphtheria is still present in many countries, and epidemics have broken out during the 1990’s in Eastern Europe (Figure 2) [4]. Diphtheria vaccines are produced from diphtheria toxoid, a non-toxic form of the toxin [9].

**Tetanus**

**Symptoms**
The bacterium penetrates the body through lesions (eg, soiled wounds, open fractures, chronic ulcers) or as a result of medical acts performed under insufficient aseptic precautions. Following an incubation period of four to 21 days, tetanus most often presents as a generalized spastic disease. Contractions of the jaw muscle (or trismus) are a characteristic feature and are followed by spasms of the back muscles (opisthotonos) and sudden generalized convulsions. In the absence of treatment, the outcome is almost always fatal, particularly in the very young or the elderly. Even after appropriate treatment, tetanus-related mortality remains high [7].

**Epidemiology and vaccination**
Tetanus bacillus is ubiquitous and present in the soil in the form of highly resistant spores. Its reservoir can thus not be eliminated, but vaccination is a very effective weapon in the prevention of the disease. In 2002, over 200,000 tetanus-related deaths were estimated to occur worldwide, of which approximately 180,000 were due to neonatal tetanus (Figure 2) [4]. Tetanus vaccines are based on tetanus toxoid, and are usually combined with other valences (eg, diphtheria, pertussis, polio, Hib [haemophilus influenza type B]) [9].

**Poliomyelitis**

**Symptoms**
In most cases, the infected patient will remain asymptomatic or present only a flu-like syndrome similar to that observed with other benign viral infections. In less than 1% of cases, however, and after an incubation period ranging from six to 20 days, incapacitating paralysis develop, resulting in sequelae of various intensity and sometimes death. No specific antiviral treatment is available [7].

**Epidemiology and vaccination**
Transmission is strictly human-to-human, and mainly fecal-oral. Whether symptomatic or not, an infected individual will transmit the virus to close contacts. Polio still causes epidemic outbreaks in some countries in Sub-Saharan Africa, India, and the Middle East (Figure 2). Two types of vaccine are being used to eradicate the disease: injectable inactivated polio vaccine (IPV), and live attenuated oral polio vaccine (OPV). After smallpox, poliomyelitis is projected to become the second infectious disease to be eradicated from the surface of the earth (the first was smallpox) [9].

**Hepatitis A**

**Symptoms**
Hepatitis A is often asymptomatic in young children, and more severe in adults. After an incubation period of 15 to 50 days, the onset of the disease is marked by a sensation of generalized malaise including, fever, headache, muscle soreness, fatigue, and gastrointestinal disorders. It is often accompanied by jaundice, particularly in adults. The condition may be long-lasting, with an acute phase of approximately one month and a convalescence phase of up to six months. No specific treatment is available [7].

**Epidemiology and vaccination**
Hepatitis A is a strictly human disease. Transmission occurs through the fecal-oral route, from person to person, or by ingestion of contaminated food or drinking water. Approximately 1.4 million cases are reported each year. Hepatitis A is most common in urban areas, but the incidence rates differ according to geographical regions and socio-economic levels (Figure 3) [10]. Hepatitis A vaccines are available [8,9].

**Hepatitis B**

**Symptoms**
After an incubation period of three to four months, acute hepatitis B is usually associated with a loss of appetite,
weakness, nausea, abdominal pain, jaundice, skin rash, and joint pain that last several weeks. One to two percent of subjects develop fulminant hepatitis B, a total acute necrosis of the liver, for which mortality rate is extremely high. Following HBV infection, 10% of patients will develop chronic hepatitis (ie, persistence of HBV in the body) with the potential risk of developing cirrhosis and liver cancer. The risk of transition to a chronic state is particularly high among immunodepressed individuals and newborns [7].

**Epidemiology and vaccination**

HBV is transmitted primarily through blood and to a lesser extent by other body fluids. WHO estimates that about two billion people worldwide have been infected with the virus. An estimated 600,000 persons die each year due to the acute or chronic consequences of hepatitis B [9].

**Influenza**

**Symptoms**

After an incubation period of one to four days, the first symptoms begin to appear, with the abrupt onset of fever accompanied by malaise, headaches, muscle pain, sore throat and non-productive cough. Infection usually lasts one week. Pneumonia is the most common complication and mostly occurs among young children, the elderly, and people with chronic diseases. Complications may lead to death, particularly among the most vulnerable groups. Antiviral treatments are available and are effective in reducing both the intensity and duration of symptoms, provided they are administered early in the course of the disease [7].

**Epidemiology and vaccination**

The infectious period is from the day before symptoms begin through approximately five days after illness onset. Children can be infectious for more than 10 days after the onset of symptoms. Seventy-two percent of the passengers became ill after travelling with one infected passenger, the apparent index case, on an airplane. Influenza is a highly contagious disease. Influenza viruses are transmitted from one person to another through the inhalation of respiratory droplets or contact with respiratory secretions. According to WHO estimates, the number of influenza-related deaths ranges between 250,000 and 500,000 annually [9]. The composition of influenza vaccines is adapted each year according to the dominant strains in circulation.

**Japanese encephalitis**

**Symptoms**

Encephalitis is the major form of the disease, although other, less severe forms, such as aseptic meningitis or simple
febrile syndromes accompanied by headache, are also frequent. After an incubation period of five to 15 days, the disease is characterized by the abrupt onset of high fever accompanied by headaches and behavioral changes, as well as speech and motor disorders (paralyses). The evolution of the disease is marked by the gradual onset of consciousness disorders that can evolve to coma. The mortality rate of Japanese encephalitis is high and sequelae are common, especially among children (up to 50%). There is no specific treatment for the disease [7].

Epidemiology and vaccination

Japanese encephalitis is mostly seen in rural areas (where humans are in the close vicinity of swine and birds – the main reservoir of the virus), and more particularly in rice fields, an environment favorable to the development of mosquitoes. Infection usually occurs between April and December, with peaks during the monsoon season. Prevention is possible through the use of inactivated vaccines [7].

Meningococcal infections

Symptoms

Meningococcal meningitis usually occurs during infancy, adolescence and early adulthood and is characterized by an infectious syndrome (fever, severe headaches, vomiting) with meningismus (stiffness of the neck, lethargy, consciousness disorder, and even coma). *Purpura fulminans* (or fulminating meningococcal septicemia) is seen in 10% to 20% of patients. It is characterized by infectious shock and extensive, often ecchymotic, purpura. The mortality rate is high and the sequelae drastic.

Epidemiology and vaccination

Although invasive meningococcal infections mostly appear in the form of sporadic cases or minor epidemics, unpredictable and devastating epidemics do occur in certain geographical areas, such as the African “meningitis belt” (Figure 4) [4]. Transmission of meningococci occurs via airborne respiratory droplets expelled by infected patients or healthy carriers. Several types of meningococcal vaccines are available.

Rabies

Symptoms

Following infection, the virus replicates within muscle cells surrounding the wound. It then reaches the central nervous system and eventually spreads through the entire body. The mean incubation period is two to three months, but may range from several days to years. The first signs of the disease include pain or an abnormal sensation at or around the wound, followed by other nonspecific symptoms such as fever, anorexia, nausea, vomiting, headaches, malaise, and lethargy. In the acute stage, rabies symptoms mimic encephalitis. The disease may evolve as one of two clinical forms: furious rabies, or paralytic (dumb) rabies. In both cases, the outcome is coma followed by death within a few days [7].

Epidemiology and vaccination

Rabies is usually transmitted through a rabid animal’s saliva by a bite, scratch, or licking of damaged skin or mucosa. To date, vaccination remains the only effective treatment against rabies and acts by neutralizing the virus before it actually reaches the central nervous system [7]. Once the nervous system is infected, the disease is inevitably fatal (Figure 5) [4].

Typhoid fever

Symptoms

Following a seven- to 14-day incubation period, typical signs, including diffuse abdominal pain, possibly high fever, anorexia, and very often diarrhea, progressively appear. Daytime drowsiness and nighttime insomnia are characteristic signs. Possible complications include gastrointestinal hemorrhage and perforation, heart failure, and encephalitis. Effective antibiotics are available, and the prognosis in patients under treatment is usually favorable. Nevertheless, recovery may be followed by chronic carriage during several months. Moreover, the emergence of drug-resistant strains makes the treatment more complex [7].

Epidemiology and vaccination

The reservoir of the pathogen is strictly human. Transmission usually occurs through the fecal-oral route by ingestion of
contaminated food or water (Figure 6) [11]. Prevention relies on good hygiene and vaccination. Several vaccines against typhoid fever are available [9].

**Yellow fever**

**Symptoms**

Following an incubation period of one week, the first signs of the disease typically include fever, chills, muscle pain, and headaches, suggestive of flu, dengue or malaria. In the most severe forms of the disease, a transient remission period occurs after three days, and is followed by the onset of a hemorrhagic syndrome associated with vomiting of black blood, jaundice (hence the name of the disease), and renal failure. The outcome is fatal in 20% to 50% of cases. All curable forms of the disease confer lifelong immunity to the patients. No specific antiviral treatment is available against yellow fever.
Epidemiology and vaccination

WHO estimates that a total of 200,000 cases of yellow fever occur each year, with about 30,000 deaths. Yellow fever is a threat for over three million travelers visiting endemic regions each year. Although the usefulness of vaccination campaigns have been demonstrated to be beneficial over the past 60 years, yellow fever still remains a major concern in tropical regions in both Africa and South America (Figure 7) [11]. In countries at risk for yellow fever, vaccination is recommended in order to prevent and fight epidemics. It is also recommended for travelers visiting endemic regions.

Vaccinations for the Military

Prevention of infectious diseases is one of the most important functions of the military health system [2,3]. A key element of infectious diseases prophylaxis vaccination is vaccination [12,13]. Currently there are a number of vaccines available that can be used for military personnel in order to control the vaccine-preventable infectious diseases. Some of the vaccines are used routinely and others are used for specific deployments [14].

Vaccines used routinely

Most of the young people entering the army have received routine childhood immunizations; hence the routinely used vaccinations are mostly booster doses. If there is no reliable history of prior immunization, the basic vaccination schedule has to be used according to national recommendations [12,13].

Tetanus and Diphtheria

In order to boost immunity in previously vaccinated individuals, the monovalent tetanus vaccine (T) or combined tetanus and diphtheria vaccine (Td) is used. The booster should be given every 10 years. These vaccines include tetanus or tetanus-diphtheria toxoids. Since in the last decade an increasing number of pertussis cases has been reported in adults, in some armies the vaccines including tetanus-diphtheria toxoids and acellular pertussis antigens (Tdap) are preferred in order to sustain pertussis immunity [14,15]. The available Tdap vaccines are Adacel (Sanofi Pasteur) and Boostrix (GSK). The available vaccines containing tetanus or tetanus-diphtheria toxoids are “Szczepionka przeciwtęczow” (Biomed Kraków) and “Szczepionka durnowo-tęczowa” TyT (Biomed Kraków). Additionally, there is a vaccine containing tetanus, diphtheria toxoids and inactivated polio viruses – Dultavax (Sanofi Pasteur). This vaccine is indicated as a booster dose for simultaneous prevention of diphtheria, tetanus and poliomyelitis.

Hepatitis A

The vaccine against Hepatitis A is an inactivated vaccine containing killed virus. Anti-HAV antibodies are detectable two weeks after the first dose of vaccine. The second dose should be given at least six months after the first. Booster doses are not recommended [14,15]. The available vaccines against Hepatitis A are Avaxim 160U (Sanofi Pasteur) and Havrix 1440 (GSK).

Hepatitis B

Vaccination against Hepatitis B in most cases has been completed during childhood. If not, three doses of the vaccine should be administered at 0, 1, and 6 months. Booster doses are recommended. The vaccine against Hepatitis B is a recombinant subunit vaccine [14,15]. The available vaccines against Hepatitis B are Euvax B (LG Life Science), Engerix B (GSK), and Heptavax-Gene (Biomed).

Influenza

Since influenza is a highly infectious disease and can cause epidemics, the influenza vaccine should be given every year to all military personnel. The influenza vaccine contains three strains of the influenza viruses recommended by WHO for each year [15]. The protective antibodies appear two weeks after vaccination. The available vaccines against influenza are Vaxigrip, IDflu 9 mcg, IDflu 15 mcg (Sanofi Pasteur), Influvac (Abbott), Fluarix (GSK), and Agrippal (Novartis).

Meningococcal disease

Vaccines against meningococcal disease are recommended according to the epidemiological needs. Military personnel living in crowding conditions are at risk for meningococcal infections. Currently the quadrivalent conjugated vaccine containing the Neisseria meningitidis serogroups A, C, W-135 and Y is recommended (Menveo form Novartis, Menactra from Sanofi Pasteur). One dose of the vaccine ensures protection. Additionally, the meningococcal conjugated vaccine containing the serogroup C is available (Neissvac C from Baxter) as well as the polysaccharide vaccine containing serotypes A+C (Meningo A+C from Sanofi Pasteur). The conjugated vaccine should be administered once, and for the polysaccharide vaccine one priming dose and a booster dose after two to four years is recommended. Vaccination against meningococcal disease is also recommended for military personnel deployed to areas where outbreaks of meningococcal disease occur [14,15].

Vaccines used for specific deployments

Some of the vaccine-preventable diseases are prevalent or endemic in selected world regions and require individualized immunization of military personnel deployed to high-risk countries [16].

Yellow fever

Yellow fever vaccine must be given to military personnel traveling to yellow fever endemic countries in order to prevent the disease. Vaccination against yellow fever is obligatory for all travelers to endemic areas. The yellow fever vaccine is a live attenuated vaccine containing the 17-D strain of yellow fever virus. One priming dose must be administered. Protective immunity appears 10 days after vaccination. Revaccination every 10 years is required [14,15]. The only available yellow fever vaccine is Stamaril (Sanofi Pasteur).

Typhoid fever

In order to prevent typhoid fever a vaccine must be administered to all military personnel before the deployment to typhoid fever endemic areas. Currently there are two vaccines against typhoid fever – inactivated parenteral polysaccharide vaccine containing antigen Vi from Ty2 strain and live oral
Ty21a vaccine [14,15]. These two vaccines should now replace the old inactivated whole-cell vaccine. The oral Typhim vaccine is not available in Poland. The only available vaccine against typhoid fever is Typhim Vi (Sanofi Pasteur). A single dose of this vaccine ensures protection. Immunity appears about two weeks after vaccination. Revaccination every three years is required.

Poliomyelitis

Although there has been significant progress in poliomyelitis eradication, some regions are still poliomyelitis-endemic. The military personnel deploying to high-risk areas should be vaccinated against poliomyelitis. Taking into consideration the high level of childhood immunization against this disease, one booster dose of inactivated polio vaccine should be given [14]. The available vaccines are Imovax Polio (Sanofi Pasteur) and Poliorix (GSK). In order to prevent poliomyelitis, Dultavax (Sanofi Pasteur) can also be used. This vaccine simultaneously protects against tetanus, diphtheria and poliomyelitis.

Rabies

Pre-exposure immunization against rabies is recommended for military personnel deployed to rabies-endemic regions. The currently used anti-rabies vaccines are cell-cultured or embryonated egg-based. Two vaccines are available in Poland – Verorab (Sanofi Pasteur) produced on Vero cells, and Rabipur (Novartis) produced on purified chick embryo cells. Both vaccines should be administered according to the schedule: D0, D7, and D28 or D21. Booster doses are required and should be given according to the manufacturers’ recommendations. For all military personnel the post-exposure vaccination is recommended. The post-exposure vaccination schedule depends on the previous vaccination and on the severity of the injuries [15].

Japanese encephalitis

Vaccine against Japanese encephalitis should be given to military personnel deployed to the endemic areas in Asia. The available vaccine is inactivated Vero cell culture-derived vaccine Ixiaro (Intercell Biomedical). The primary immunization schedule includes two doses given on days 0 and 28. The second dose must be given at least one week before travel. The duration of protection and the need for booster doses are not known [15].

Immunization Orogram for the Polish Armed Forces

The current “program of immunization for the Polish Armed Forces” is defined by the order of the Ministry of Defense of April 30, 2010, on the program of immunization for professional soldiers [17]. It includes both the needs of soldiers stationed within the territory of Poland and those on duty abroad, especially in the Middle East, Africa or South America, where they are exposed to the threat of completely different diseases than the ones existing in their native climatic zone (Table 1). An example of such exotic disease included in the program of immunization is Japanese encephalitis, a disease occurring extremely rarely, the presence of which is limited only to Asiatic countries; the vaccine protecting against Japanese encephalitis is not available in our country for “common” citizens.

Another such example is including in the program of immunization the vaccination against infections caused by bacteria Neisseria meningitidis group A,C, W-135 and Y; the vaccination is made with Menveo product, which appeared on the polish market in the beginning of 2011. The risk of infection caused by these serotypes of meningococcus occurs mainly in a few countries of Central Africa (the “meningitidis belt”) and Saudi Arabia.

| Diseases                  | Name of vaccine | Manufacturer       | Vaccination schedule | Protection |
|---------------------------|-----------------|--------------------|----------------------|------------|
| Tetanus                   | TT              | Biomed Kraków     | 3 doses (0,1,6 m)    | 10 years   |
|                           | TyT             | Biomed Kraków     | 3 doses (0,1,12 m)   | 3–5 years  |
| Diphtheria                | d               | Biomed             | 3 doses (0,1,6 m)    | 10 years   |
| Typhoid fever             | Ty              | Biomed             | 3 doses (0,1,12 m)   | 3–5 years  |
|                           | TyT             | Biomed Kraków     | 3 doses (0,1,12 m)   | 3–5 years  |
| Poliomyelitis             | Imovax Polio   | Sanofi Pasteur     | 1 dose               | 10 years   |
| Hepatitis A               | Avaxim 160U    | Sanofi Pasteur     | 2 doses (0,6–12 m)   |            |
| Hepatitis B               | Hepavax-Gene   | Biomed             | 3 doses (0,1,6 m)    |            |
| Influenza                 | IDflu 9 µg     | Sanofi Pasteur     | 1 dose               | 1 year     |
| Yellow fever              | Stamaril        | Sanofi Pasteur     | 1 dose               | 10 years   |
| Rabies                    | Rabipur         | Novartis           | 3 doses (0,7,21(28)d) + 1 dose (1y) | 5 years |
| Meningococcal meningitidis| Menveo (A,C,Y, W135) | Novartis | 1 dose |            |
|                          | MeningiteC© | Pfizer             | 1 dose               |            |
| Japanese encephalitis     | Ixiaro          | Intercel Biomedical Inc. | 2 doses (0,28 d) |            |

Table 1. Vaccines currently used by the Polish Army in the immunization of soldiers leaving for foreign missions [19].

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### Table 2. Proposals for modification of entries in the military immunization programme for expanding the capabilities in the protection against typhoid, diphtheria, tetanus and poliomyelitis.

| Type of vaccination | Professional soldiers subject to vaccination: | Remarks |
|---------------------|-----------------------------------------------|---------|
| Against TYPHOID FEVER: | – according to individual orders, professional soldiers exposed to the risk of contracting typhoid fever | |
| Monovalent typhoid vaccine (Ty); | – professional soldiers dealing with waste or sewage disposal or conservation of devices used in the disposal of waste or sewage | |
| Combined typhoid-tetanus vaccine | – according to epidemiological situation, | |
| Polysaccharide vaccine | – professional soldiers connected with diagnostics of typhoid fever, | |
| | – professional soldiers going to the typhoid fever endemic regions | |
| Against POLIOMYELITIS: | – professional soldiers going to the Poliomyelitis endemic regions | – booster vaccination with an inactivated (IPV) polyvalent vaccine – one-time administration |
| | | – booster vaccination with a combined dT-IPV vaccine – one-time administration, in case there is the need to administer booster doses against diphtheria and tetanus, among soldiers vaccinated within basic scheme, over the age of 19 years |

Also, influenza vaccination of Polish soldiers uses the most modern solution available on the Polish market, the influenza vaccine for intradermal administration IDflu 9 μg.

The examples listed above show clearly that the “military vaccination calendar” is adapted to the various needs of soldiers on duty in foreign countries, and is adaptable to changes in the market, in order to provide soldiers with the best possible prophylaxis. In order to make another step in the process of improving the immunization program for professional soldiers, it is necessary to observe the new products offered on the market as well as to take into consideration new trends appearing in the armies of other European countries.

The problem that should be carefully examined is typhoid fever, no longer occurring only on a local scale, and connected with activities such as waste and sewage disposal or epidemiological threats caused floods, etc. Typhoid fever is also a problem of soldiers stationed abroad, especially in the southern hemisphere, where the risk of disease occurrence is considered to be high. Currently it is estimated that in such countries as India and its neighbors, the risk is several times higher than in the rest of the world [19].

Referring to the content and structure of the immunization program for soldiers, emphasis should be on military employees transferred to parts of world in which there is a high risk of contracting typhoid fever.

Another important issue is the choice of vaccines against typhoid fever. Up to now the prophylaxis used by the Polish Army included only whole-cell vaccines which, on one hand, assure unquestionable effectiveness, but on the other hand are connected with the inconvenience of a 3-dose vaccination scheme, age restrictions for the use, as well as occurrence of post-vaccination adverse reactions. Since 2002, a polysaccharide vaccine – Typhim Vi [20], produced by Sanofi Pasteur – is available on the Polish market. It is successfully applied in the prophylaxis of typhoid fever among people planning departure to high-risk regions. Typhim Vi contains purified Vi capsular polysaccharide of Salmonella typhi (Ty 2 strain) and it is intended for adults and children aged two years and over. The Typhim Vi vaccination scheme includes a single-dose injection; booster vaccination should be given every 3 years (on condition that patient is still exposed to the risk of infection). Immunity appears as soon as seven days after vaccination.

Introducing this modern vaccine into the vaccination calendar for the Polish Army is further justified by the fact that this vaccine is listed in the official WHO and CDC recommendations as the basic form of prophylaxis for people exposed to the risk of contact with typhoid fever. Moreover, polysaccharide vaccine is included in the “military vaccination calendar” of other countries (eg, Czech Republic) were the prophylaxis against typhoid fever among soldiers transferred to the endemic regions is based uniquely on the use of vaccine for parenteral administration, containing Vi capsular polysaccharide [21].

While reviewing the vaccines available on the Polish market, it is worth focusing on the growing interest in combined vaccines, assuring protection against a few diseases simultaneously. Their main advantage is greater convenience, both for
the patient as well as the person administering the vaccine. Regarding the immunization needs of professional soldiers, Dultavax should receive attention [22] – the vaccine was introduced to the Polish market in 2010, assuring immunity against three diseases with only one injection. Dultavax is the vaccine against diphtheria, tetanus and poliomyelitis (inactivated) adsorbed, containing reduced quantities of diphtheria antigens (diphtheria toxoid), for adults aged 19 years and over. Vaccination scheme includes one booster dose for people previously vaccinated against diphtheria, tetanus and poliomyelitis. In case of adults vaccinated more than 10 years earlier, or not sure if they were vaccinated at all, administering the second dose one month later should be considered, especially if there is a risk of contracting diphtheria. Protection lasts for 10 years. Immunity appears as soon as one month after vaccination [22].

Taking into account the fact that the immunization program for soldiers includes vaccines against diphtheria, tetanus and poliomyelitis, completing it with a combined vaccine Dultavax (3 in 1) is worth considering as a good alternative.

Suggested modifications in the immunization program for 2012 include (Table 2):
1. Paying special attention to the soldiers going to typhoid fever endemic regions.
2. Completing the range of vaccines against typhoid fever with a polysaccharide vaccine, with a simplified administration scheme and better tolerance.
3. Completing the range of vaccines against diphtheria, tetanus and poliomyelitis with a combined vaccine against all three diseases.

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