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POLIOMYELITIS (HEINE-MEDIN DISEASE), STILL A CURRENT THREAT TO PUBLIC HEALTH, DESPITE THE DETERMINATION TO IMPLEMENT THE GLOBAL PROGRAM TO ERADICATE THE DISEASE IN THE WORLD

Konecka-Szydełko B.

UMB v Banskej Bistricy: Department of International Relations, Banska Bistrica, Slovakia

Provincial Sanitary and Epidemiological Station in Rzeszow, Rzeszow, Poland

Abstract. After more than 30 years of campaigning, the Global Polio Eradication Initiative (GPEI) has been repeatedly criticized for failing to eradicate polio. Some critics have even called for a return to polio control strategies. However, control does not appear to be a sufficient solution as long as the disease remains endemic in any country.

Currently, countries classified as endemic to poliomyelitis still include, inter alia, Afghanistan and Pakistan. In addition, apart from the presence of wild polio strain (WPV1), cases of paralytic poliomyelitis caused by reverted strains (WPV1, VDPV2, VDPV3) are also reported or these strains are detected in environmental surveillance in Asia and Africa.

The purpose of these considerations is to show that despite compulsory vaccinations and significant successes in this field, there are still new cases of disease. The return of large-scale polio is still real, and not in the long run - Due to the COVID-19 pandemic, programs related to the fight against Heine-Medin disease have been suspended in many countries, including those where the disease has taken the greatest toll so far.

***Key words**: poliomyelitis, polio eradication program, elimination.*

Introduction. Currently, countries classified as endemic to poliomyelitis still include, inter alia, Afghanistan and Pakistan. Moreover, in addition to the presence of wild polio strain (WPV1), cases of paralytic poliomyelitis caused by reverted strains (WPV1, VDPV2, VDPV3) are also reported or these strains are detected in environmental surveillance in Asia and Africa [1].

Poliomyelitis is a viral disease that affects the roots of the motor nerves and causes flaccid paralysis, mainly in children under 15 years of age.

Since 1988, the World Health Organization, along with many partners from around the world, has been running a global program of eradication of poliomyelitis. This program consists of inoculating each child against poliomyelitis, virological examination of any case with symptoms of flaccid paralysis (including meningitis in some countries) and the destruction of any materials that may contain the virus (e.g. stool samples or sewage samples collected from at the time when the disease occurred in humans) [2].

The criteria for eradicating the transmission of poliovirus, established by the World Health Organization, include not only the failure to identify diseases caused by "wild" virus, but also require

confirmation that other non-polyomyelitic diseases that occur with acute flaccid paralysis are not caused by "wild" polio virus.

The etiological factor of Heine-Medin disease is "wild" or attenuated (attenuated) polio virus derived from the vaccine virus. Infection gives a variety of clinical pictures, from symptomatic infections to severe paralytic forms, which leave permanent disability.

The condition for obtaining the appropriate certificate of uprooting is:

- no disease (also sporadic) caused by any polio virus,

- maintaining a high percentage of preventive vaccinations (over 95-97% of the child population) in each administrative unit of the country,

- conducting ongoing active monitoring of acute flaccid paralysis, combined with laboratory diagnostics of detected cases. The measure of a well-conducted monitoring is the achievement of a high paralysis detection rate - 1/100,000 children under the age of 14.

In the past, polio was the source of epidemics around the world, but since the invention of the vaccine, the number of cases has been significantly reduced. Numerous global organizations continue to fight for the total eradication of polio in the world [3].

Purpose. The purpose of these considerations is to show that despite compulsory vaccinations and significant successes in this field, there are still new cases of disease. Worse still, a large-scale return of polio is real, and not in the long run - Due to the COVID-19 pandemic, programs related to the fight against Heine-Medin disease have been suspended in many countries, including those where the disease has taken the greatest toll so far.

Results and discussion.

Poliomyelitis (Heine-Medin disease). Poliomyelitis is a devastating disease that results from infection with one of the three related types of poliovirus (referred to as P1, P2 and P3 types) [4-6] members of the enterovirus (picornavirus) family. The greatest infectivity occurs in the period immediately before the onset of symptoms (transmission is possible, however, 7–10 days before the onset of the disease) and 1–2 weeks after their onset. Polio virus replication takes quite a long time, so it can be excreted in the faeces for 3-6 weeks and in saliva for 2 weeks. Hence, the infectious period may be 4-8 weeks.

The incubation period from infection to onset of symptoms usually lasts 3–6 days, and from infection to infection, it usually takes 7–21 days (range 3–35 days).

The risk of infection by the fecal-oral route of a susceptible (unvaccinated) person at home is up to 90%. According to serological studies conducted prior to the initiation of mass vaccination, paralytic disease occurred in 1 in 200 (0.5%) children exposed to the poliovirus.

The polio virus is passed from person to person through oral contact with secretions or feces from an infected person. After the virus multiplies on the surface of the nasopharyngeal mucosa, the

poliovirus can multiply in specialized cells in the intestines and enter the bloodstream, attacking the central nervous system [7], where it spreads along the nerve fibers. When it multiplies in the nervous system, the virus can destroy the nerve cells (motor neurons) that activate skeletal muscles. These nerve cells cannot regenerate, and the affected muscles lose their function due to a lack of nervous weakness - a condition known as acute flaccid paralysis (AFP). Without respiratory support, bulbar polio can kill. It can strike at any age, but it mainly affects children under three (over 50% of all cases).

The process of eradication (eradication, elimination of an infectious disease). Infectious diseases are governed by general biological laws. For most infectious diseases, their development can be traced historically - their emergence, the period in which their importance increased, in terms of both the number of cases and the severity of the disease, to their peak, followed by resolution or even disappearance. These processes can take place with different intensity and speed - depending on the etiological factor, the way it spreads, the sources of infection and their activity, the resistance of the population and its natural and artificial formation and development. After carrying out the above information, systematizing and compiling it, man has learned to gradually influence the development of infectious diseases by shortening, less often lengthening, some development phases.

The elimination of an infectious disease is a situation where there are only sporadic diseases, between which the chain of infections cannot be traced. The pathogen is not found in material collected from healthy people. You can show its presence in material taken from the environment. There are virtually no deaths.

Such a state can be achieved by acting on all three elements of the epidemiological process, i.e. by:

a) immunizing the population, especially those susceptible to the infection, by carrying out mass vaccination. It is an action aimed at the third element of the epidemiological process which has proved to be most effective in preventing infectious diseases.

b) intersecting the paths of spreading infections, and by eliminating the carriers (e.g. lice, mosquitoes, bedbugs) and improving the sanitary condition, especially in terms of providing sanitary water for drinking and economic purposes, as well as food and proper waste disposal.

c) neutralizing the sources of infection (proper disposal of infectious material), isolation of infectious diseases, quarantine of people from contact. Effective causal treatment of infected people also contributes to this. It is an action aimed at the primary element of the epidemiological process. The eradication process is activities leading to a situation when there are no cases of falling ill with a specific disease, when no germ is found in the material taken from people, as well as in the material taken from the environment. In principle, eradication should be referred to when there has been liquidation worldwide. In the case of eradicating the disease in one country or even a continent, one

should take into account the possibility of importing the infection from the area where the disease still occurs [8].

Poliomyelitis is an acute viral disease with asymmetric paresis or flaccid paralysis of the skeletal muscles as a result of paralysis of the anterior horn motoneurons of the spinal cord. The history of polio begins around 1500 B.C. The first scientific descriptions of the disease were made by Michael Underwood. In 1840, the German doctor Jakob Heine gave a detailed description of the disease.

Less than fifty years later, the Swedish doctor Karl Oskar Medin re-analyzes the etiology and course of the disease. This was due to the spread of the polio virus epidemic in Sweden in 1885 and 1887. Medina's contribution to the study of the disease was enormous, as it is believed that both epidemics were the primary outbreaks of the spread of the disease to other European countries, and - thanks to emigration - to the territories of North America.

Out of seven global attempts to eradicate human infectious diseases, only one has been successful so far - the eradication of smallpox. Earlier attempts to eradicate malaria, yellow fever, raspberry and ankylostomatosis have been unsuccessful [9]. Two other programs on eradication of Heine-Medin disease and Dracunculosis are underway, both very close and still so uncertain of success [10], causing an avalanche of discussions as to whether eradication of polio makes sense at all and whether it will ever be possible. At the same time, technological progress and the experience gained provide many arguments for extending eradication programs to other infectious diseases.

In 1997, the Dahlem Workshop on the Eradication of Infectious Diseases was held in Dahlem, during which five possible ways of combating infectious diseases were described: control, elimination, elimination of infections, eradication and extinction. During the symposium, the above-mentioned terms were defined as follows:

Control - reduction of the incidence, incidence, mortality and mortality rate for a given infectious disease to the level recognized locally as acceptable as a result of deliberate actions; Continuous interventions are required to maintain the reduction (example: infectious diarrhea).

Elimination - reduction to zero the incidence of a given disease in a specific geographical area as a result of deliberate actions; continuous interventions are essential (example: neonatal tetanus).

Eliminate infections - reduce the incidence of infections caused by a specific infectious agent in a specific geographic area to zero as a result of deliberate actions; Continuous interventions are needed to prevent relapse transmission of infections (examples: measles and poliomyelitis).

Eradication - permanent, global reduction to zero of cases of infections caused by a specific infectious agent as a result of deliberate actions; then intervention measures are no longer needed (example: smallpox) Extinction (extinction-extinction) - a specific infectious agent ceases to exist both in nature and in the laboratory (no examples) [11]. As the above definition shows,

eradication of infections is a more difficult target achievement than control over them, however, has a far greater advantage over control. Firstly, it removes the obligation of continuous interventions, such as costly vaccinations. Second, it is a stronger incentive for developed countries to financially support medical activities in developing countries than just infection control [12].

A disease-free world is, for obvious reasons, a better situation than the fear of being constantly threatened by the disease we are trying to control.

In theory, all infectious diseases could be eradicated if only the resources were available. In fact, there are many biologicals and technical obstacles that make eradication more or less possible. These obstacles change over time as we have more and more knowledge and technology from year to year, so barriers that are now considered insurmountable in the future may not be a big deal. In 1989, ITFDE (International Task Force for Disease Eradication), a body established in 1988; A team of 12 experts from various related institutions with health protection, incl. World Health Organization, UNICEF, World Bank, CDC) developed criteria that allow to assess the chances of eradication of selected infectious diseases.

They are: a) biological criteria: epidemiological sensitivity (this is, among others, the existence of a reservoir - multiplication outside the human body, easy spread of infection, easy diagnosis of infections), availability of appropriate means that would allow the transmission of infections to be interrupted, documented possibility of elimination (elimination of the infectious agent from a given geographical region, e.g. an island) [13].

The availability of appropriate resources is confirmed by eliminating the disease, but this does not make the eliminated disease an immediate candidate for eradication - e.g. the level of medical services and the availability of sanitary facilities may make elimination possible in one geographic region but not necessarily in others [14].

b) socio-political criteria: the effects of the disease on society (e.g. morbidity, mortality, importance of the problem for both rich and poor countries), the expected cost of eradication (especially compared to the perceived effects of the disease), synergy of eradication with other interventions undertaken- m in health, and the need for eradication has a clear advantage over control.

For the first time in history, the ITFDE criteria put political factors on an equal footing and economical with biological agents.

Worldwide poliomyelitis eradication program. The global eradication initiative is both about stopping new cases of polio caused by polio virus worldwide and implementing mechanisms to prevent its re-introduction.

The main goal of eradication of poliomyelitis from the population was to eliminate the source of the infection and the intersection of infection pathways and the acquisition of immunity in the susceptible population.

Obtaining a sufficient degree of immunization was the most important element in getting rid of epidemic outbreaks. This was possible thanks to the creation in 1950 by the Polish virologist Hilary Koprowski, the first vaccine containing attenuated (live weakened) polioviruses. However, the development of research and new laboratory techniques resulted in the development of an inactivated (killed) polio virus vaccine in 1955. It was the work of the American virologist Jonas Salk [15].

Salk vaccine contained three types of virus, inactivated with formalin. The launch of the mass childhood immunization program has led to a 90% drop in the number of registered cases of poliomyelitis.

Albert Sabin developed an attentive oral vaccine that further increased its availability. Mass vaccination has strengthened the eradication process in developing countries In May 1988, at the annual meeting in Geneva, the World Health Assembly, the governing body of the World Health Organization (WHO), decided to eradicate polio from the world, commemorating the launch of the Global Polio Eradication Initiative, led by national governments, WHO, Rotary International, American Control Centers and Disease Prevention (CDC), UNICEF, and later joined the Bill & Melinda Gates Foundation and Gavi, Vaccine Alliance.

A resolution on the eradication of Heine-Medina disease was adopted at the 41st World Health Assembly on May 13, 1988 [16]. To this day, it is the largest ever health initiative coordinated by international institutions (GPEI - Global Polio Eradication Initiative). GPEI is a public-private partnership led by the World Health Organization, CDC, UNICEF, Rotary International and Member State governments, the latter both owning and beneficiaries of the GPEI [17].

At the time of the 1988 resolution, more than 125 countries of the world were still infected with wild-type polio, and more than 350,000 children were affected each year with disabilities caused by the disease. Although GPEI was established in 1988, most of the polio endemic countries did not start implementing an eradication program until the mid-1990s. The last two countries to join the program - the Democratic Republic of Congo and Sierra Leone - did so because of internal conflicts. it was not until 2000, the year the GPEI adopted as the starting date for global polio eradication. A number of factors contributed to the delays in implementing the program, including a lack of adequate financial resources and a lack of commitment from political authorities and health institutions in some parts of the world. Additionally, the system of compulsory preventive vaccinations, so crucial for the eradication program, has failed. This was one of the main reasons for opting for additional immunization with oral vaccines (OPVs) during supplementary immunization activities (SIAs) specially organized for this purpose. These are campaigns carried out in a given country for a short period of time (days, weeks), during which a single dose of OPV is given to all children under the age of five, regardless of previous immunization history. They can be carried out throughout the country (so-called national vaccination days) or only in selected regions [18].

Wild poliovirus cases have decreased by more than 99% since 1988, from around 350,000 in more than 125 endemic countries to 175 reported in 2019. Out of the 3 wild-type polio strains (type 1, type 2, and type 3) wild-type Type 2 polio virus was eradicated in 1999 and no case of wild type 3 polio virus has been found since the last reported case in Nigeria in November 2012. Both strains have been officially certified as globally eliminated. As of 2020, wild type 1 polio virus affects two countries: Pakistan and Afghanistan. Polio control strategies work when they are fully implemented. This is evident in India's success in polio containment in January 2011, possibly the most technically challenging place, and in the March 2014 WHO certification of the entire Southeast Asia region as polio-free.

Polio virus surveillance WPV and cVDPV transmissions are detected primarily through the observation of acute flaccid paralysis (AFP) in children <15 years of age with stool sample testing in one of 145 WHO-accredited Global Polio Laboratory Network laboratories [19]. In the period January-September 2020, the number of AFP cases reported decreased by 33% compared to the same period in 2019 [20]. Environmental surveillance (wastewater testing for polio virus) can complement AFP surveillance; however, environmental sampling also decreased somewhat over this period. Current data indicate that the COVID-19 pandemic continues to reduce the sensitivity of AFP surveillance.

Continuous strengthening of both surveillance systems, especially in priority countries, is key to tracking progress and documenting the absence of polio transmission.

Polio eradication - implementation and prospects. In 1988, when the Global Polio Eradication Initiative (GPEI) was launched, polio became a disability cause for over 350,000 children in 125 countries around the world. Since then, two types of wild poliovirus [WPV] have been eradicated - type 2 in 2015 and type 3 in 2019. Type 1 (WPV-1) transmission is still found in two countries - Afghanistan and Pakistan.

In August 2020, the African Region Polio Eradication Certification Commission announced that the continent is free from WPV polio (the condition of at least 3 years of no WPV transmission has been met). Currently, 5 out of 6 regions of the World Health Organization (WHO), covering more than 90% of the world's population, are free from WPV-related diseases.

The journal "Morbidity and Mortality Weekly Report" published a report summarizing the activities carried out in the period from January 2019 to June 2021 aimed at the total eradication of polio.

In 2016, the use of the "live" oral 3-valent vaccine containing types 1, 2 and 3 polio virus (tOPV) was discontinued and replaced with inactivated vaccine (IPV) or additionally with 2-valent OPV (bOPV) containing types 1 and 3 virus (in polio prevalent countries). This decision was based on an analysis of the epidemiological situation of polio. In 2015, WPV-2 was considered eradicated

worldwide (no cases of polio caused by this type of virus have been reported since 1999), and the majority of polio caused by circulating vaccine-derived polyovirus (cVDPV) was Type 2 polio virus is derived precisely from OPV. The use of monovalent polio virus type 2 (mOPV2) vaccine is reserved solely for the control of cVDPV type 2 (cVDPV2) outbreaks.

The report notes that in recent years GPEI has focused on eliminating the last endemic reservoirs of WPV, while in a dozen or so countries, in populations with low vaccination coverage, outbreaks of polio caused by cVDPV, mainly type 2, have appeared in the period from January 2019 to June 2021. 32 countries reported cVDPV outbreaks, including 26 cVDPV2 countries, 4 type 1 (cVDPV1) countries, and 2 countries of both types of vaccine virus. In 2020, 308 cases of cVDPV2 were reported in Afghanistan, while in 2019 none were reported, while in Pakistan, 135 cases were reported, i.e. 5 times more than in 2019. Between January and June 2021, 195 cVDPV2 cases were registered worldwide, including 43 in Afghanistan and 5 in Pakistan.

In November 2020, WHO added a new OPV containing genetically engineered polio virus type 2 (nOPV2) to the list of products approved for use in emergency situations (EUL), which is characterized by a much lower risk of developing a mutant vaccine virus. The new polio GPEI eradication strategy for 2022–2026 provides for the extended use of nOPV2, which will reduce the emergence of new cVDPV2 outbreaks. Currently, WPV (only type 1) cases are found in two countries, Afghanistan and Pakistan. In 2020, 140 cases of WPV-1 polio were registered, including 56 in Afghanistan (93% more than in 2019) and 84 in Pakistan (43% less than in 2019).

In 2020, 83% of infants worldwide received 3 doses of the polio vaccine up to the age of 1 year. However, the vaccination coverage varied significantly between WHO regions, countries and their regions. In Afghanistan and Pakistan - two countries that still transmit WPV-1 - the proportion of infants vaccinated was 75% and 83%, respectively. In 2020, approximately 696 million doses of bOPV, 6 million IPV, 4 million mOPV and 228 million mOPV2 were administered in 33 countries worldwide in 2020 as part of the GPEI-supported vaccination programs. In 2021, over 136 million doses of nOPV2 were administered in 8 countries (Benin, Chad, Congo, Liberia, Niger, Nigeria, Sierra Leone, and Tajikistan) in order to reduce the emergence of new cVDPV2 outbreaks. The GPEI also allowed tOPV to be reused in Afghanistan and Pakistan, where both WPV1 and cVDPV2 were found to be broadcast.

The authors of the report noted that the COVID-19 pandemic had a negative impact on the implementation of polio vaccination programs and the quality of epidemiological surveillance in countries with persistent transmission of WPV or cVDPV. A challenge for the coming years will also be the fight against disinformation about vaccinations, disseminated mainly in social media, which also affected these countries.

Summary. After more than 30 years of campaigning, the Global Polio Eradication Initiative (GPEI) has been repeatedly criticized for failing to eradicate polio. Some critics have even called for a return to polio control strategies. However, control does not appear to be a sufficient solution as long as the disease remains endemic in any country.

An eradication failure would again lead to tens of thousands of new cases of flaccid paralysis over the next few years. Victory, on the other hand, would result in the permanent elimination of a disease that would otherwise have disabled thousands of children. The possibility of dragging the infection even at long distances from areas where transmission of wild poliovirus strains is still present, with current means of transport - possible and highly probable. An example is the case in Ukraine, which was recorded in the Rivne region at the beginning of October this year in a one and a half year old child. The Ukrainian health ministry informed then that the parents had consciously refrained from vaccinating their child against this disease. As a result of the infection, the child suffered paralysis of the lower limbs.

On November 3 this year, the Ukrainian editorial office of the BBC announced that further infections had been registered in five children in Ukrainian Transcarpathia. Four of them became infected through contact with an infected child from the region of Tychy. None of the sick children were vaccinated, the BBC added. Across the region, only half of the children received polio treatment as a result of increasing religious refusals to vaccinate them. Taking the above into account, it should be concluded that the risk of international spread of the polio virus remains a public health emergency of international concern. Many countries have weak vaccination systems that can be affected by a variety of humanitarian situations, including COVID-19, and the number of countries where vaccination systems have been weakened or disrupted by conflict and complex emergencies poses an increasing risk, leaving populations in these fragile conditions prone to outbreaks of polio.

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ПОЛІОМІЄЛІТ (ХВОРОБА ГЕЙНЕ-МЕДІНА), ЗАЛИШАЄТЬСЯ АКТУАЛЬНОЮ ЗАГРОЗОЮ ДЛЯ ЗДОРОВ'Я НАСЕЛЕННЯ, НЕЗВАЖАЮЧИ НА РІШУЧІСТЬ РЕАЛІЗУВАТИ ГЛОБАЛЬНУ ПРОГРАМУ З ЛІКВІДАЦІЇ ЦІЄЇ ХВОРОБИ У СВІТІ

Конецька-Шиделько Б.

Анотація. Після більш ніж 30 років кампанії, Глобальну ініціативу з ліквідації поліомієліту (GPEI) неодноразово критикували за те, що вона не змогла викорінити поліомієліт. Деякі критики навіть закликали до повернення стратегій боротьби з поліомієлітом. Однак контроль не є достатнім рішенням, поки хвороба залишається ендемічною в будь-якій країні.

В даний час до країн, які класифікуються як ендемічні щодо поліомієліту, все ще входять, серед інших, Афганістан і Пакистан. Крім того, окрім наявності дикого штаму поліомієліту (WPV1), також повідомляють про випадки паралітичного поліомієліту, спричиненого ревертованими штамами (WPV1, VDPV2, VDPV3), ці штами виявляють під час екологічного нагляду в Азії та Африці.

Метою цього повідомлення є показати, що, незважаючи на обов'язкові щеплення та значні успіхи в цій галузі, все ще є нові випадки захворювання. Повернення широкомасштабного поліомієліту все ще реальне і не в довгостроковій перспективі. У зв'язку з пандемією COVID-19 програми, пов'язані з боротьбою з хворобою Гейне-Медіна, були призупинені в багатьох країнах, у тому числі в тих, де хвороба завдала найбільших наслідків.

Ключові слова: *поліомієліт, програма ліквідації поліомієліту, елімінація.*

Konecka-Szydełko Bożena ORCID ID: 0000-0001-8018-6973,
bozena.konecka@wsse.rzeszow.pl