

ECOLOGICAL ASPECTS OF VIRUS INFECTION SIGNS IN THE NATIVES AND ALIENS OF EXTREME TERRITORIES

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This work represents comparative analysis for the peculiarities of epidemic process and severity of epidemic roseola (measles) clinical course in aliens and natives of the Extreme North, tropics and subtropics in the succession of generations. We revealed considerable distinctions in the functioning of macroorganism (human subject) – microorganism (measles virus) system under extremely low and high temperatures. It was shown that in the succession of generations the selection of highly virulent virus populations happens in subjects, living in air high temperature areas and naturally weakened under low temperatures.

Background

At present time measles ranks first in some countries among common children infection morbidity and mortality indices. According to WHO data, up to 20 mln measles cases are being registered annually in the world. Over 500 000 of them are lethal cases (873 000 lethal cases were registered in 1999, 530 000 in 2003) [1]. The analysis of measles lethality clarifies that the diseased subjects were registered not only among aliens but among natives as well. This was marked first of all in Tropical and Subtropical Zones of Africa and Asia. Among lethal cases the share of Africa, i.e. higher temperature areas, is 60%, Southern-Eastern Asia 30%, Eastern Mediterranean 10%. Despite over 1.5 reduction of annual lethality resulted from vaccine prophylaxis in 1999 – 2003 the ratio recovery/ lethal cases in unvaccinated group did not change.

We analyzed the severity of measles clinical signs in the natives and aliens of the Extreme North for the last 55 years. Before the seventies of the XX century the measles morbidity reached over 4 000 as per 100 000 population in the Siberia Extreme North and the Far East [2, 3]. Before vaccination period, measles morbidity in the natives and aliens of Extreme North was not lower and even higher than in tropics and subtropics [1, 4]. But during this period in the second half of the XX century during mass vaccination since the seventies of the last century and during the first 8 years of the XXI century

there were no lethal cases of measles registered in the Extreme North. The disease proceeded mildly with full recovery. As the course of the disease was mild we offered to the session of Soviet Union Academy of Medical Sciences the discussion on advisability of vaccine prophylaxis among native and alien children and adults in the Extreme North [5]. The necessity of children immunization and adult revaccination was predominantly caused by the possibility of virus distribution from the Extreme North to other Russian territories and abroad.

The researchers of tropical and subtropical climate associate measles morbidity and lethality with low living standards of population, starvation, high level of bacterial and virus infections [6]. But in the Extreme North and hot climate subsistence the minimum of subsistence in between the inhabitants is different. There is native and alien population in the survey territory. In tropical and subtropical countries measles mortality is equally high among both groups of population. Life span in Northern people is 10 years shorter than in Russia on average [7]. Children of Polar regions suffer from acute respiratory virus infections, pneumonia and other infections very often. High prevalence of intercurrent infections and their severe course contribute to considerable weighting of measles with lethal cases [8]. It was marked that 80 – 100% of native and alien children tolerate the disease being vaccinated before 1 to 2 months and during the first month after.

In the period before vaccination 85-96% of population in different countries had measles in childhood. In middle ages when great cohorts of population moved from Europe, they brought the infection agent to

America, which lead to its contagion to aboriginal children and adults. Measles in isolated and relatively isolated populations amazed with its scope and consequences (Table 1).

Table 1. Measles in isolated and relatively isolated populations in the period before vaccination

№	Location	Year	The Cohort of the Subjects	The diseased	Lethality
1	Faeroes	1846	Isolated Population	70 %	high
2	Fiji	1875	Isolated Population	100 %	20 – 25 %
3	Africa and Eastern Mediterranean	1912 - 1914	French Army Soldiers	Is unknown	1 740 people died
4	Tahiti	1929	Population	100 %	No data to work on
		1951		96 %	
		1960		67 %	
5	Greenland	1951	Population	90 %	No data
6	New Guinea	1944	Population	80 %	No data
7	Australia	1944	Population	50 – 80 %	No data
8	Russian Polar regions	XIX век	Population	96 – 100 %	50 – 70 %
9		1948	Relatively isolated populations	19 %	3 – 9 %
10		1960 - 1968	Native and alien population	2 000 to 4 000 per 100 000 of the population	0 %

P.Panum in 1846 observed measles in natives of Faeroes Islands in its absence during 65 years. 6 000 inhabitants of 7 782 were taken ill and the majority died. Those who survived after the previous epidemic of 1781 didn't fell ill for the second time. Glycerill Corney described the epidemic in Fiji islands in 1875 when nearly 20 000 people died, which made 20 - 25% of the population. It is evident from measles morbidity analysis in Tahiti that intensification of contagion of the agent lead to the lowering of the morbidity as a result of pro-epidemising. It was marked that in small native populations the measles agent is preserved for limited time, eliminating fast. For instance, in Tahiti island in 1929 all the population suffered from measles, in 1951 only 96% of the inhabitants and in 1960 the number was 67 %.

76 000 soldiers from France were positioned into Africa and Eastern Mediterranean. The number of the diseased with mea-

sles is not known but the number of lethal cases was 1 470, so measles mortality was 2%.

Data on the dynamics in world morbidity during many centuries in the natives of the Extreme North is very few. There is data on the contagion of measles agent to Yakutia and Kolyma in the XIX century when 96 - 100% of all the inhabitants were ill with 50 - 70% lethality cases. In the middle of the XX century the lethality was lowered and during the last 55 years no death caused by measles was revealed. At the same time common morbidity in the Extreme North exceeded the morbidity in middle latitudes 5 to 10 times [5, 9 - 12]. As a result of planned mass vaccination in the Extreme North there were only single cases of measles since 1990.

So, despite the influence of extreme factors on native and alien population in the Extreme North during the last 100 years, considerable lowering in severity of illness

and outcome took place. In the XIX century as a result of measles contagion to isolated and relatively isolated native populations the single breakouts of very severe measles happened in children and adults. But since the middle of the XX century and before mass vaccine prophylaxis, the children fell ill with clinical signs being mild and without lethal cases. Measles epidemic took place in native and alien population simultaneously.

So, in Siberia Extreme North before the XX century the measles epidemics developed as a result of bringing an agent into isolated or relatively isolated native populations of the Extreme North. The same situation took place in islands, far away from continents (Faeroes Islands, Fiji, Tahiti). In scanty territories with small population groups epidemics resulted in pro-epidemic of children and grown ups with further elimination of an agent. The subsequent measles epidemics developed mostly after repeated contagion of the virus into the population of non-immune people. Technical progress influenced transport systems. Especially since the XX century the exploitation of natural resources of the Extreme North favored the intensive migration of people from middle latitudes to the Extreme North. New towns appeared. Contacts of native and alien population intensified, the population size increased considerably. These factors lead to the preservation of measles agent in population after epidemic outbreaks with disease periodicity, typical for middle latitudes.

However, it should be explained why in the Extreme North measles appreciably evolved during the last 100 years from the severe disease with mostly lethal cases into the infection with rather mild clinical course followed by recovery. At the same time in tropical and subtropical areas lethality is still high in native and alien people. Social factor (starvation of the natives in tropical and subtropical area, other infectious diseases, etc.) hardly explain this situation, because children of both poorest and socially well provided population as well as the aliens of middle latitudes equally suffer from the most

severe measles with lethal cases. Migration of the population is substantially increased both southwards and northwards – to the extreme southern areas and Extreme North. Measles virus was imported into isolated populations mainly from middle latitudes of Eurasia continent [13, 14].

It should be mentioned that genetic typing of measles virus was started in the period of mass vaccine prophylaxis at the end of XX century. The data was obtained and they testified on importing the viruses into the countries and territories with different climatic ecological conditions [12, 13, 15, 16]. At present two genotypes are the most prevalent. Δ_4 was revealed in the middle latitudes of Russia in the hotbeds with evidently milder clinical course of measles. The lethality was lower than in the countries with tropical and subtropical climate, but it had more severe course than in the Extreme North. Δ_6 is circulating in Euro-Asian, American and African continents (Table 2).

Gene typing for measles virus was not carried out for Russia Extreme North, USA and Canada because the disease was almost absolutely eliminated in these territories as a result of mass vaccine prophylaxis. Different course of measles in different territories requires the explanation (Table 3).

Extreme North, tropics and subtropics are extreme areas with low life span for both alien and native population. Any virus infection including measles is developing as a result of interconnection inside the system “macroorganism – virus”. In hotbeds of different types the system is influenced by ecological factors, including extreme ones. However, neither lowered immune reactivity in natives and aliens in the Extreme North, nor going through different infections or low life standards, can provoke measles severe clinical forms with high lethality [3, 8].

It is reasonable to analyze the influence of special ecological factor of the Extreme North and extreme territories of the South, namely, temperatures, under which the “macroorganism – virus” system is functioning. As measles virus is air-

communicable, we implemented thermo – reographic parallels analysis in diagnosis and clinics of inflammatory diseases in perirhinal sinuses in subjects of Extreme North and Siberia [17]. We found “northern” variation of the “norm” of thermal picture of a face. Under Extreme North conditions local temperature on the face is 3°C lower on average as compared to the middle latitudes of Siberia.

On the background of the lower temperature of a face the higher frequency of latent infections became typical. In the Extreme North inhabitants latent antritis is met 2 times more often than in Siberia middle latitudes (22.2% and 13.3 % correspondingly). To our regret we failed to find available data on the results of the same research in tropical and subtropical areas.

Table 2. Geographic prevalence of measles virus genotypes

Genotype	Countries with genotypes, which are endemic there or countries identified as the source of measles viruses imported to other countries (1995 - 2001)
A (A ₂₀ , A ₂₂ , A ₂₃)	Russia (Siberia)
B ₁	Cameroon
B ₂	Gabon
B ₃	Congo, Gambia, Ghana, Kenya, Nigeria, Sudan
C ₂	Czech Republic, Denmark, Germany, Luxemburg, Morocco, Spain
D ₂	Spain, Southern Africa, Zambia
D ₃	Japan, the Philippines
D ₄	Ethiopia, India, Iran, Kenya, Namibia, Pakistan, Russia, Southern Africa, Zimbabwe
D ₅	Japan, Namibia, Thailand
D ₆	Argentina, Brazil, Bolivia, Dominican Republic, Germany, Italy, Luxemburg, Poland, Russia, Spain, Turkey
D ₇	Germany, Spain,
D ₈	Ethiopia, India, Nepal
J ₂	Indonesia, Malaysia
J ₃	East Timor
H ₁	China, Korea, Russia (Siberia)
H ₂	Viet-Nam

Table 3. The types of measles hotbeds in the period before vaccination in the 2-nd half of the XX century

№	Characteristics of hotbeds	Territory
1.	With high morbidity and lethality	Africa, South-East Asia, Eastern Mediterranean
2.	With high morbidity and mild clinical course	Russian polar regions
3.	Clinical course is milder than in № 1, but more severe than in № 2, low lethality	Middle latitudes of Euro Asia continent, American and Australian continent

Wild strains of viruses, including measles agents, consist of mixed populations on different stage of pathogenicity. After the experiments for tissue cultures we found that virulence of the viruses of measles, rubeola, parotitis, poliomyelitis and others correlates

with their ability to reproduce themselves under different temperatures (rct sign). Under higher temperatures reproduction activity is depressed in naturally weakened virions in virus populations and under low temperatures in virulent virions. It is evident that as a re-

sult of natural selection in the Extreme North the naturally weakened agents of infectious diseases prevail. Measles is one them and they lead to the development of the infection with mild enough clinical course [9]. Most probably, in tropical and subtropical area high temperatures influence the selection of highly virulent populations of the virus.

Conclusion

Under various ecological geographical conditions a distinctive ecological homeorhesis is being formed, i.e. homeostasis systems go into conformity with ecological factors on population, species and interspecies level. The basis of its formation is adaptation, natural or artificial selection, geno- phenotype modifications [18]. When measles virus is brought into isolated and partly isolated human populations, the whole population or the majority is affected by the agent as a result of the absence or low level of specific immunity. At the same time the diseases were very severe under different ecological geographical conditions not only in tropics and subtropics but in the natives of the Extreme North as well. Virus elimination in the isolated populations stopped epidemic and interrupted the epidemic chain of ecological homeorhesis formation in the succession of generations. The increase of population size and the development of transport connections strengthened the importing of virus between different ecological geographical areas. Its ongoing circulation started in the Extreme North. The selection of naturally weakened virus populations in the ecological system "human organism – virus" happened under the influence of low temperatures of the North. Clinics of the disease evolved to the development of mild obliterated forms of the infection. However the morbidity in the Extreme North before the introduction of vaccine prophylaxis was as high as under extreme conditions in tropics and subtropics. This is explained by intensive circulation of naturally weakened populations of the virus in the Extreme North under lowered immune response to specific anti measles antigen in the inhabitants [8, 19].

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