DOUBLE-BARRIER STRATEGY AGAINST FOOT-AND-MOUTH DISEASE PANZOOTIC WAVE SUCCESSFULLY APPLIED UNDER MONGOLIAN CONDITIONS

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Abstract

The paper describes successful application of a new original method against foot-and-mouth disease panzootic wave based on extensive and very long double-barrier combining belt without susceptible species animals with vaccinated zone under vast desert and steppe conditions. In 1964 Mongolian economy suffered catastrophic losses due to foot-and-mouth disease rapidly spreading from eastern towards central territories affecting about 2 million animals in a territory of about 300,000 km^2. All the measures, such as aphtization (1.5 million animals), territorial isolations and quarantines were unable to stop this wave. On Mongolian request it was sent a Czechoslovak veterinary expedition which elaborated a strategy, agreed and implemented by Mongolian authorities, of a double-barrier going from Chinese to Soviet borders. For the vaccination it was used Czechoslovak vaccine which proved to be compatible with local virus strain. The width of strictly controlled belt without susceptible species animals was up to 80 km and the vaccination belt width was of 100-300 km. Double-barrier of more than one thousand km length was adjusted to epizootiological situation. The aphtization was stopped and replaced by the vaccination. From 790,000 vaccinated animals 448,000 were vaccinated by the expedition itself. After creating the barrier the disease wave was stopped and the foot-and-mouth disease eradicated during several months.

Key words: anti-FMD measures, anti-FMD strategy, anti-FMD vaccination, anti-FMD barrier, aphtization, FMD panzootie, foot-and-mouth disease, Gobi desert, veterinary expedition

INTRODUCTION

At the end of 1963 foot-and-mouth disease (FMD) was discovered in eastern part of Mongolia rapidly spreading to the west. Enormous losses due to the FMD in cattle, sheep, goats and camels having catastrophic impact on Mongolian economy were multiplied by another natural disaster caused by extraordinary amount of snow covering the grazing land and thus preventing animals from access to only source of feed. The FMD penetrated from Chinese Dalaj-Nur lake area into Mongolian eastern ajmaks (provinces) – Eastern ajmak and Suchebator ajmak - through immense herds of antelopes, including also FMD virus carriers and clinically sick animals. These herds were moving westward due to organized hunting during October and November 1963 and extraordinary snowstorms in December 1963. That time there were set up high level anti-FMD commissions at ministerial level and in all ajmaks and somons as well as a central commission of FMD specialists. In February 1964 the FMD spread to the west deep into Chentej ajmak and also into East-Gobi ajmak, i.e. affecting already all four eastern provinces. The size of FMD territory reached more than 300,000 km^2.

FMD spreading was facilitated by: late discovery and reporting new cases, late application of anti-FMD measures, impossibility to isolate effectively diseased animals, not disposing dead animals, uncontrolled movement of persons, nomadic type of livestock husbandry in permanent movement in the open air, contacts of domestic with wild animals on pastures and at water pools, long distance movement of antelopes, wolfs and vultures, strong winds, sand storms, etc.

Aphtization (artificial infection) of cattle, sheep, goats and camels was carried out in all somons (districts) where the FMD appeared. For the aphtization fresh saliva of 2-3 days sick animals was diluted in 1:10 and 1:20. To reduce the losses of young animals serum or citrated blood of recovered animals were used. The blood was collected in big amount and distributed to distant somons and other ajmaks. The convalescent serum doses were for calves 1-3 ml per kg of live weight and citrate blood doses were 2-4 ml per kg of live weight and for adult animals 500-1000 ml.

There were established disinfection centres, mainly at the borders of affected somons and ajmaks as well as at airports and main routes. It was used paraformaldehyde vapour (produced in DUK camions) for gas disinfection and formalin, eventually caustic soda, for liquid disinfection. The disinfection of persons was usually carried out in specially adjusted yurts, for disinfection of clothing and different articles there were used camions with paraformaldehyde boxroom. There were constructed simple provisional big field impermeable rooms for gas disinfection of cars and camions.

Unfortunately, all the anti-FMD measures were unable to stop the huge FMD panzootic wave penetrating rapidly into other Mongolian territories.

In March 1964, when rapidly increasing number of new natural FMD cases reached about 600,000, Mongolian government asked Czechoslovak government for help. It was sent without any delay an anti-FMD veterinary expedition with the task to assist in stopping FMD panzootic wave penetrating toward central Mongolian territories and in eradicating existing outbreaks. *)

*)The expedition (12 veterinarians with FMD experience and 4 supporting technicians), led by Dr Václav Kouba, Czechoslovak Chief Epizootiologist and Vice-Director, State Veterinary Service, arrived in Ulan-Bator on 13 April 1964. All expedition expenses were paid by Czechoslovak government.

MATERIAL AND METHODS

The paper is based on the report of Czechoslovak veterinary anti-FMD expedition sent to Mongolia (FMD Expedition, 1964), information provided by Mongolian veterinary service (Sugaradza, 1964), publications of expedition participants (Kouba, 1964, 1965 and 1994; Pospíchal, 1965 and 1994; Ševčík, 1964 and 1965) and on personal experience of the author who was the leader of the expedition.

The expedition was fully equipped for harsh Mongolian desert and steppe conditions *) to can work as independent unit. It was provided by two thousand litres of bivalent A+O anti-FMD vaccine (later it was imported other two thousand litres to meet increasing needs to cover all the buffer territories and intrafocal applications) **), necessary equipment for vaccination including automatic syringes, transport means (six cross-country vehicles - GAZ and one 6-ton camion), accommodation facilities (8 tents), facilities for food preparation, non-perishable foodstuffs, clothes including protective ones and footwear, medicaments (including antisera against Mongolian venomous snakes), sanitary facilities, cleansing and disinfection means, maintenance material, hunting and fishing equipment, mobile diagnostic laboratory, etc..

*) During vaccination starting day on 24 April 1964 in Erdene Somon, Gobi desert, the midday temperature reached 45° C (many of expedition members suffered by second grade of burns – vesicles on auricle tips) and in the night – 8 ° C, i.e. requiring particular protection of the vaccine against freeze).

**) Czechoslovak anti-FMD vaccine was produced in Bioveta Terezin (Klobouk, 1951; Dombek, 1955) according to Waldmann method (Waldmann and Zimmermann, 1955). Doses of the vaccine were as follows: adult cattle – 10 ml, calf – 5 ml, adult sheep – 3 ml, lamb – 2 ml, adult goat – 3 ml, kid – 2 ml, camel – 15 ml.

After analysing epizootiological situation in FMD ajmaks and territories under risk and considering measures already applied by Mongolian authorities, the Czechoslovak expedition chairmanship elaborated new strategy. Its principle was to combine wide protective zone without susceptible species animals with mass vaccination of all cattle, sheep, goats and camels in threatened territories from southern to northern country borders, i.e. from Chinese to Soviet frontiers. The objective was to create wide double-barrier adjusted to local epizootiological and ecological conditions, to avoid further propagation of the FMD toward to central and western ajmaks.

The leader of the expedition presented to Mongolian authorities a proposal for FMD eradication based on new original concept consisting in complex protection of FMD-free territories mainly through the vaccination of susceptible animals and thus to create wide protective zones. Czechoslovak concept was based also on immediate and uncompromising isolation of infected territories and outbreak areas, consistent complex intrafocal measures, rigorous epizootiological surveillance, immediate diagnosis of suspect cases (including virus typing), prevention of threatened territories creating wide (50-80 km) belts without FMD susceptible species animals combined with mass vaccination in threatened zones. Other requirement was immediate stopping of the aphtization.

This plan was pushed through only after successful application of Czechoslovak vaccine under field conditions and after its experimental testing. Initially, two members of the expedition were testing the compatibility of Czechoslovak anti-FMD vaccine with local Mongolian FMD field strain provided by Mongolian biofactory in Sangino. The experiment confirmed required efficacy and safety. Czechoslovak vaccine against FMD proved to be very effective, even inside of FMD outbreaks replacing traditional aphtization. The concept was accepted and widely applied by Mongolian government. The aphtization was stopped.

Expedition members participated in FMD diagnosis, organizing anti-FMD measures at national, ajmak and somon levels as well as inside of the outbreaks. The main activity consisted in the realization of Czechoslovak plan to create vaccinated buffer zone along affected territory. The vaccination started at Chinese borders in Erdene somon, Gobi desert, and continued northward up to Soviet borders. The vaccination was organized in groups working separately in several herds of different localities. The groups were composed from 2-3 expedition veterinarians supported by technicians and Mongolian counterpart.

Existing anti-FMD measures and their control were significantly strengthened and complemented. There were created much more consistent isolation of FMD somons and FMD ajmaks applying usually three belts of sentinels (two belts of civil guards and central belt secured by national army posts). There were expanded "anti-FMD belts without susceptible species animals" up to 80 km width. From this territory domestic animals were driven away and wild animals susceptible to FMD were chased and hunted. Nomadic territorial movement in affected and threatened territories was stopped. For the control of quarantine measures there were established sentinels composed by civil persons in somons and military or combined at the borders of FMD zones. The borders between affected and non-

affected ajmaks were closed and controlled by army units. Government mobilized also national army providing staff and equipment (military camions, airplanes, helicopters, disinfection units, etc.).

RESULTS

With 4,000 litres of Czechoslovak anti-FMD vaccine there were vaccinated about 790,000 animals. Czechoslovak expedition itself vaccinated from April to October 1964 448,000 animals (147,000 in East-Gobi ajmak and 301,000 in Chentej ajmak). The expedition vaccinated 12,029 camels, 59,683 cattle, 334,192 sheep, 41,571 goats and 305 pigs. See Table 1. The percentages of young animals from total vaccinated ones were as follows: in camels – 12.84 %, in cattle – 17.41 %, in sheep – 24.28 % and in goats – 19.87 %.

It was created 100 – 300 km wide vaccination barrier along up to 80 km wide belt without FMD susceptible species animals of more than one thousand km length going from Chinese to Soviet borders. This double-barrier the FMD could not cross. The FMD panzootic wave was stopped and gradually liquidated combining classical anti-FMD protection and intrafocal measures replacing aphtization by using vaccination.

It was proved full feasibility and very high biological and economic effectivity of new original double-barrier anti-FMD strategy and measures tested under specific Mongolian desert and steppe conditions, i.e. in a developing country with enormous number of domestic animals spread widely in the least populated grand territory with prevailing nomadic system.

Double-barrier anti-FMD strategy applied practically and effectively under desert and steppe conditions proved to be suitable system for controlling and stopping FMD panzootic wave in the future in any other territory with similar epizootiological and ecological conditions.

FMD panzootic wave was stopped and existing outbreaks eradicated during several months. Mongolian livestock husbandry was saved from further losses and future consequences caused by the most dangerous animal disease such as FMD.

DISCUSSION AND CONCLUSION

Double-barrier strategy to stop panzootic FMD wave under desert and steppe condition was implemented for the first time in FMD history and therefore, there were not available any publications on this subject for the comparison. No any international organization documents have touched this kind of anti-FMD strategy under similar conditions.

According to data provided by Mongolian government veterinary service (Sugaradza, 1964), the comparison of animal mortality due to natural and aphtization infection by FMD virus carried out in Eastern Mongolia (reported 1,232,562 diseased animals) showed that the ratio of mortality caused by natural to artificial FMD infection was 1.64 : 1. Registered absolute number of animals diseased due to the aphtization was ten times higher than the number of naturally diseased animals. Tab. 2.

Mass application of the aphtization in Mongolia had many disadvantages: it caused artificial reproduction of FMD virus in huge amount and thus from small outbreaks there were created great ones very difficult to cope with when using only quarantine measures; instead of healthy animals' protection it caused FMD disease of hundreds of thousands of animals with all negative consequences, mainly deaths and reduced performance; in some cases, even several months after the aphtization, the FMD broke out again; extraordinary high morbidity facilitated FMD penetration among wild animals and thus the risk of crossing quarantine zones became higher; artificial infection represented the passages of the virus in great number of susceptible animals, which could cause increase of virus virulence and eventually virus mutation.

The use of radical "stamping out" method was under existing conditions unrealistic and therefore, Mongolian authorities initially applied only general protective measures and the mass aphtization in spite of knowing its negative consequences. Only after the availability of a suitable anti-FMD vaccine the aphtization could be stopped and the double-barrier anti-FMD strategy could be implemented.

This case reconfirmed the fact that not all FMD field virus strains are suitable for production of the vaccine against the same local strain (vaccines produced from local source virus were in this case ineffective) and that on the contrary some foreign virus strains from very distant country can be immunogenetically compatible with local virus serotype.

The task of the expedition to help in stopping FMD panzootic wave and in eradicating existing outbreaks was accomplished in full spectrum of its responsibility. The expedition work and results were highly appreciated by Mongolian Government.

The success of the expedition double-barrier strategy was made possible only thanks to perfect cooperation with Mongolian counterpart, intensive and devoted work of strong, well organized and competent Mongolian public veterinary service, support and effective participation of herdsmen and public, full understandings and involvement of Mongolian national and local authorities with the aim to save livestock population and production as the backbone of national economy.

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Tab. 1: Number of animals vaccinated against foot-and-mouth disease by Czechoslovak veterinary expedition, Mongolia, 1964

Somon	camels	cattle	sheep	Goats	Pigs	Total
East-Gobi Ajmak:						
Erdene	1,335	377	10,486	2,617	-	14,815
Organ	25	311	8,019	1,776		10,131
Delgerech	4,443	3,988	54,498	5,455		68,384
Altansirce	140	1,601	18,183	1,897		21,821
Ichet	2,667	688	26,017	2,467		31,839
Subtotal	8,610	6,965	117,203	14,212		146,990
Chentej Ajmak:						
Onderchan	319	1,986	61,298	115		63,718
Bajanadraga	712	13,177	48,281	6,570		68,740
Binder	838	21,570	53,230	11,282	305	87,225
Omnedelger	1,550	15,985	54,180	9,392		81,107
Subtotal	3,419	52,718	216,989	27,359	305	300,790
Grand Total	12,029	59,683	334,192	41,571	305	447,780

Tab. 2. : Comparison of animal mortality due to natural and artificial infection by foot-and-mouth disease virus, Eastern Mongolia, 1964 (data provided by Mongolian government veterinary service)

Species	Number of diseased naturally	artificially	Number of deaths due to infection natural	%	artificial	%
cattle	18,547	104,033	1,003	5.41	2,618	2.52
sheep	83,056	884,470	760	0.92	6,705	0.76
goats	9,295	108,890	58	0.62	1,953	1.79
camels	1,535	21,341	1	0.07	127	0.59
pigs	221	174	30	13.57	24	13.79
Total	112,654	1,119,908	1,858	1.64	11,427	1.02

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