

Control of foot and mouth disease: the experience of the Americas

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Summary

Foot and mouth disease (FMD) was first recognised in South America in 1870, almost simultaneously in the province of Buenos Aires (Argentina), in the central region of Chile, in Uruguay, in southern Brazil and coincidentally, on the north-eastern coast of the United States of America. The epidemiology of the disease was unknown and no government action was taken following the initial outbreaks. This resulted in the disease spreading to other areas of Chile, as well as to Peru, Bolivia and Paraguay, reaching Venezuela and Colombia in the 1950s, and Ecuador in 1961.

The entire continent was affected in the 1960s when national FMD control programmes were initiated, with the exception of Guyana, Surinam, French Guiana and Patagonia. In the 1970s, steps were taken to implement a regional control and eradication strategy in view of the impact of production and trade on the persistence of the virus. The *Plan Hemisférico de Erradicación de la Fiebre Aftosa* (PHEFA: Hemispheric FMD Eradication Plan), public- and private-sector policies, new diagnostic tools, the oil-adjuvanted FMD vaccine and regional strategies played a part in improving the epidemiological situation during the 1990s.

A setback was encountered in 2000 and 2001, with outbreaks due to virus types A and O recorded in Argentina, Uruguay and Brazil.

Keywords

Americas – Community participation – Epidemics – Foot and mouth disease – Hemispheric plan – Prevention – Surveillance.

Introduction

When Europeans colonised the Americas, they introduced foot and mouth disease (FMD) viruses with their livestock. Although the introduction of cattle into South America dates back to the very early days of colonisation, the trade monopoly enjoyed by Spain and Portugal served as a protective factor, since those countries were not affected by FMD until the late 19th Century.

Livestock production for non-local consumption was first established in the great plains of Argentina, southern Brazil and Uruguay, using the abundant local cattle for the production of tallow, leather and salted meats. However, the advent of industrial cold storage brought the time factor and the efficiency of food conversion to the fore, prompting the

importation of breeding stock in order to acquire adequate genetic material (5). The virus is thought to have reached South America via British breeds imported into the Rio de la Plata region (2).

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Whilst the United States of America (1921), Mexico (1947-1954) and Canada (1952) conducted successful eradication campaigns, the countries of South America did not act effectively to prevent the entry and spread of FMD (8). The closing of the North American markets after World War II and the above-mentioned introduction of FMD into Venezuela and Colombia in 1950, may be considered the main reasons behind the decision to wage an organised, continent-wide battle against the disease. On the initiative of the countries concerned, through the Organization of American States (OAS), the Pan American Foot-and-Mouth Disease Center (PANAFTOSA) was created in Rio de Janeiro in 1951. The Center first operated as a special OAS programme, eventually becoming a regular programme of the Pan American Health Organization (PAHO) (4).

The founding of PANAFTOSA gave rise to an ongoing process of interaction between research, planning and evaluation of health strategies in a self-sustaining effort which has proven to be a useful tool in the control and eventual eradication of FMD, expected by the year 2010.

Initial programmes

At the outset, special attention was devoted to research in improving FMD diagnostic methods and to their adoption in the various countries concerned, as well as to training personnel in numbers sufficient to make a qualitative difference. This groundwork began to yield results in the 1960s. In 1961, Argentina set up a specific agency for the control and eradication of FMD, Brazil began disease-control activities in Rio Grande do Sul in 1965, Paraguay and Uruguay initiated similar programmes in 1967, Chile in 1970 and Colombia in 1972, with financial support from the Inter-American Development Bank (IDB) in most cases, and technical support from the PAHO via PANAFTOSA (4, 6).

At the time, the entire continent was affected. With the exception of Guyana, Surinam, French Guiana and Argentinean Patagonia, high-intensity epidemics due to different viral strains occurred periodically. Due to the above-mentioned control programmes, the percentage of cattle herds under control increased from 30% in the 1960s to 40% in the early 1970s. At the same time, those involved became aware of the need for regional co-ordination to fight a virus that knows no borders.

This concept was at the origin of the creation, in 1972, of the South American FMD Commission, as an arena for regional co-ordination, promotion and evaluation, harmonisation of health standards and discussion of bilateral and multilateral agreements on FMD control. This effort led to a 90% coverage rate in 1981, when Chile became the first country in South America to eradicate FMD and gain recognition as an FMD-free country.

The control strategy at the time did not take into account geographical variations in FMD epidemiology due to differing ecological conditions or predominant types of livestock, but set forth homogeneous control measures for the entire continent. Research was directed at the development of new vaccines and, most importantly, new structures were created to help fill in knowledge gaps regarding FMD epidemiology (8).

New vaccines

For the control strategy to be effective, two practical problems had to be overcome. Firstly, vaccines had to provide higher levels of immunity for longer periods of time and, secondly, vaccinal inactivation had to be made more reliable, as certain failures had generated epidemics in Peru and Uruguay.

Due to an integrated research approach involving laboratory and field work, a new production method for oil-adjuvant vaccines was developed, and techniques for producing antigens in suspension for industrial use were standardised. The new vaccine which provided for longer intervals between applications and was thus easier to use, also incorporated top-quality inactivants, which resulted in enhanced product safety.

Within the same series of technological measures, PANAFTOSA developed reference methods and procedures to help all countries establish comparable quality standards for vaccines.

Continental information and surveillance systems

Efforts to rationalise disease control activities brought to light the need for adequate and relevant information. To this end, PANAFTOSA designed and, in late 1971, initiated a pilot epidemiological information system in the state of Rio Grande do Sul, Brazil, which was rapidly adopted in Paraguay and Uruguay as well. This process culminated in the establishment of information and surveillance systems in all countries of South America and in the creation of a Vesicular Disease Epidemiological Information and Surveillance System for the Americas.

The system, using spatial and temporal criteria and a set of geographical coordinates, provided timely, reliable access to information regarding the vesicular disease epidemiological situation (1). The analysis of this information showed that there was an intimate link between the behaviour of FMD in South America and the dominant forms of livestock production in a given area or region.

This meant that FMD control programmes were unlikely to be successful unless they were co-ordinated at a regional level with common sanitary measures and that blanket application of identical strategies in all places would increasingly serve to hamper progress in programme implementation.

A socio-economic analysis of the livestock structures helped identify the different production and marketing systems, making it possible to establish a geographical delineation and risk classification of these systems (3). The findings of this study, together with the experience gained in programme implementation over the previous period, led to the identification of operational alternatives. These were based on the possibility of interrupting the FMD epidemiological chain, the relative risk of the various factors and the probability of their modification and comprised selective regional strategies, adapted to each FMD ecosystem, involving local livestock communities and other sectors in the framework of a decentralisation policy. The new approach was embodied in the Hemispheric FMD Eradication Plan (PHEFA).

The Hemispheric Eradication Plan

Several factors contributed to the creation of a social, political and economic framework conducive to the implementation of an eradication plan. Experience had shown how costly living with FMD could be. Decreasing the number of outbreaks and thus the direct economic losses suffered, especially by major exporting countries, was considered strategically important and discussions on non-tariff barriers to world trade in meat and derivative products in the framework of the GATT (General Agreement on Tariffs and Trade) Uruguay Round were a further incentive.

The underlying premise of the Plan was that upholding animal health was the response of society to the need to protect and promote productivity and trade in animals, animal products and by-products, in the context of economic and livestock development policies, social needs, and requirements of the domestic and international markets (7). The veterinary model is thus exemplary of a broader concept of social organisation in which a society generates the service facilities deemed most appropriate. The general objectives of the Plan are as follows:

- to improve availability of meat and milk for the inhabitants of the regions
- to enhance the socio-economic efficiency of livestock farming through lower opportunity costs for public investment in animal health and private investment in livestock activities, while respecting the overriding principle of sustainable, environment-friendly development
- to eliminate major limiting factors for technological investment (in genetics, feeding, handling)
- to strengthen the negotiating power of breeders in the world market.

The more specific objectives of the Plan are as follows:

- to eradicate FMD in South America

- to prevent introduction of FMD into disease-free areas
- to prevent the introduction of sources of FMD virus and other exogenous pathogens into new breeding areas, especially the Amazon sub-region, while respecting the ecological integrity of such areas.

For the purposes of FMD control, the Americas are divided into regions which take into account ecological, productive and socio-economic disparities, as well as the existence, prior to the implementation of the Hemispheric Plan, of two major areas, i.e. one with and one without FMD. On this basis, areas of primary prevention include the countries of Central and North America and the Caribbean, and an area of eradication comprises all of South America, which in turn is divided into three major systems on the basis of FMD behaviour and the relation of the disease to livestock production, i.e. the Southern Cone and Plata river basin; the region of the Andes; and the Amazon and non-Amazonian Brazil.

Programme management

The national and regional programmes adopted new administrative structures based on the following principles:

- internal and external regionalisation: each regional structure pursues specific activities and covers territories of two or more countries, providing technical and administrative co-ordination
- involvement and active participation of broad sectors of the livestock community, especially the breeders, promoting processes of joint public-private management
- planning, implementation and evaluation of control activities at the local level so that decisions are taken where the problems occur
- promotion of inter-sectoral co-operation, with emphasis on participation of sectors such as universities, other scientific-technical bodies and all those with similar activities to those of the programmes
- differentiation between breeders in order to conduct specialised actions to meet the specific health needs of subsistence, family or small farms, in areas where those types predominate
- effective communication with all sectors on the social importance of FMD eradication and on the need to adopt new attitudes toward eradication.

As a result of these changes, the situation improved considerably. In 1996, Uruguay was the second country in South America to be recognised as FMD-free without vaccination, followed by Argentina and a zone in northern Colombia in 1997. Paraguay (1997) and extensive zones in southern (1998) and central (2000, 2001) Brazil were classified FMD-free with vaccination (dates in brackets) and the sanitary situation in the rest of Colombia, Venezuela and Peru is very promising, with a marked decrease in FMD incidence rates.

New diagnostic tools

The new epidemiological situation raised new problems for research, as techniques needed to be developed to identify areas of residual viral activity and distinguish vaccinated animals from those infected naturally. Work on non-capsidal antibodies created such a possibility, enabling epidemiological diagnosis on the basis of extensive serological samplings.

Likewise, pathogens need to be characterised with greater precision to monitor their phylogenetic evolution. The PANAFTOSA has begun working on the identification of the gene sequence in order to establish a map of the FMD viruses active in South America.

Current situation and conclusions

The improved situation suffered a major setback in 2000, when outbreaks caused by virus types A and O occurred and in 2001, much of Argentina, all of Uruguay, and parts of southern Brazil were affected.

The conditions that made the epidemic possible were essentially created by changes in livestock movements, brought about by the very establishment of FMD-free areas. Areas where exports were authorised enjoyed greater trading potential than those where output was restricted to the domestic market, which generated price differentials, especially for replacement and fattening cattle. This made it profitable to move livestock over distances that were formerly economically unviable.

Veterinary Authorities in South America did not prove sufficiently swift or flexible in adapting their strategies to this new situation or in maintaining the participation of the farmers

in this new phase and the veterinary structures suffered as a result.

Nonetheless, the governments and livestock communities of South America have shown their commitment to the objectives set forth in the PHEFA and to the eradication of FMD as soon as possible. Progress made to date has demonstrated the concrete benefits that can be derived from increased productivity and international trade, and official veterinarians and technicians have acquired experience in varied sanitary situations, making them much better equipped to face the challenges of the future.

The involvement and active participation of different sectors of the livestock community has had a significant impact on planning, organisation and implementation and, above all, an extremely sound and critical dialogue has been created within the framework of control programmes, proving the strong commitment of those involved.

The regional integration strategy has demonstrated promising results and must be pursued in order to overcome the problems encountered in the Southern Cone in 2001 and to maintain the progress made by Brazil and the Andean countries. An analysis of the productive and commercial factors that led to the recent outbreaks, and, above all, of the changes that occur as the result of eradication, will help set a more solid foundation for continued progress.

In this context, the technical co-operation provided by PANAFTOSA aims at securing the full participation of various sectors of the community by strengthening the mechanisms for mobilising resources, to continue implementing the objectives of the PHEFA and the strategic orientations of the PAHO.

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