CONCEPTS AND OPPORTUNITIES FOR THE CONTROL OF FOOT AND MOUTH DISEASE IN INDIA

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SUMMARY

Foot-and-mouth disease (FMD) is endemic in India and occurs round the year with higher incidences being recorded in the winter months and early monsoon. About 4000-5000 outbreaks are reported every year, which is an underestimate. Serotypes, O, A and Asia 1 are responsible for the outbreaks and add to the already complicated disease situation due to free movement of animals within the country. The economic losses caused by the disease are huge and according to some studies, the direct losses alone could be more than 2 billion US dollars per year. Agriculture, which was major contributor to the Gross Domestic Product (GDP) in the fifties, occupies a less dominant position now, due to the increased growth of industrial and service sectors. At the same time, contribution of livestock sector to the total GDP has remained steady and its contribution to the agriculture GDP has gone up from 13.8 % in 1981 to 23.8% in 2002-2003 and thus has potential for further growth. In order to realize this potential, India needs to conquer many infectious diseases of livestock including FMD. Results of the pilot scale control programme involving 54 districts initiated in the 10th plan period (2002-2007) showed a lower incidence of FMD in the areas where it was operational. Though desirable, taking up country wide FMD control programme may not be feasible at the moment due to many constraints; however, there exists a prospect to launch it in a phased manner. This paper discusses those constraints and opportunities for the control of FMD in India.

1. INTRODUCTION

Foot-and-mouth disease (FMD) is a major concern to both FMD-free countries as well as to countries not free from it. Apart from its impact on animal health, FMD has been described as the most important constraint to international trade in animals and animal products, which restricts trade in a south-to-north direction (1). These authors have shown that the world distribution of this one disease is almost a mirror image of the world-wide global economic structure with the high-income, industrialised countries being generally free from FMD, while the disease is persistently endemic in low-income countries suffering from food deficits. A recent Department for International Development (DFID)-ILRI study has ranked FMD as the disease that most affects livestock productivity of small-scale farmers, especially in Asia (2) while a consultative document by the FAO has identified FMD as one of the key impediments to the access of poor livestock farmers to formal markets (3).

In India, FMD is endemic and occurs round the year with higher incidences being recorded in the winter months and early monsoon. About 4000-5000 outbreaks are reported every year, which could be an underestimate. Serotypes, O, A and Asia 1 are responsible for the outbreaks and add to the already complicated disease situation due to free movement of animals within the country. The economic losses caused by the disease are huge and according to some studies, the direct losses alone could be more than 2 billion US dollars per year. Agriculture, which was major contributor to the Gross Domestic Product (GDP) in the fifties, occupies a less dominant position now, due to the increased growth of industrial and service sectors. At the same time, contribution of livestock sector to the total GDP has been increasing and its contribution to the agriculture GDP has gone up from 13.8 % in 1981 to 23.8% in 2002-2003 (source: CSO, MoSPI, GOI) and thus has potential for further growth. In order to realize this potential, India needs to conquer many infectious diseases of livestock including FMD. Results of the pilot scale control programme involving 54 districts initiated in the 10th plan period (2002-2007) showed a lower incidence of FMD...
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2. OPPORTUNITIES

2.1 Availability of large network of laboratories
Project Directorate on FMD, which lends technical support to Government of India in decision and policy making, has a network of laboratories spread across India. These laboratories totalling 23, located in almost every state, are primarily involved in collection of epidemiological data, clinical samples and laboratory diagnosis besides advising on the control measures to be undertaken. Availability of such laboratories is a boon considering that any suspected outbreaks can be attended and reported to as quickly as possible and control measures can be put in place. Fig 1 shows the location and distribution of network of FMD laboratories in India.

2.2 Large peninsular region
India has the advantage of being a large peninsula and it is worth mentioning that India's coast is 7,517 kilometres (4,671 miles) long; of this distance, 5,423 kilometres (3,370 mi) belong to peninsular India. Considering that FMD is trans-boundary in nature, Southern India (Deccan Peninsula), covered by sea/ocean in all directions except north, is an ideal geographical region to initiate the control programme.

2.3 Availability of large base line data
The Project Directorate on FMD, which was set up in 1968, as All India Co-ordinated Research Project for FMD virus serotyping, has over the years generated a large pool of data on disease prevalence and distribution of serotypes etc. This information along with antigenic, genetic and vaccine matching analysis has added to our knowledge on the antigenic and genetic spectrum/nature of the circulating field strains and the suitability/relevance of the current vaccine strains.

2.4 One country, one strain
Currently, trivalent vaccine consisting of serotypes O, A and Asia 1 is manufactured in the country. Molecular epidemiology studies carried out at PD-FMD indicates that field strains (within each serotype) belonging to a single genotype are circulating in the recent years. Interestingly, co-circulation of two different genotypes, particularly in serotype A, which was a common feature just a few years ago, has been not observed in the past 4-5 years. Antigenic analysis shows that, barring in type A, most of the field strains are related to the vaccine strains. In serotype A, a change of vaccine strain has been recommended recently and will replace the old strain in any vaccine batch prepared from December 2008. Use of single strain per serotype is advantageous as it helps in cutting down the cost of the vaccine as well as the dose volume. Further it saves labour on the production of vaccine containing different strains for different regions.

2.5 Availability of companion diagnostic tests
When it comes to diagnosing the disease, foot-and-mouth disease in large animals, seldom poses confusion in the minds of veterinary clinicians in India. However, clinical diagnosis in sheep and goats is difficult because of the transient appearance of lesions and their similarity to those caused by other common diseases of small ruminants. In this context, one has to rely on laboratory diagnosis. Recently, one step pen-side diagnostic test has been developed and validated with some success during the 2007 outbreak in UK. A similar test is under development at PD-FMD besides a sandwich ELISA that is routinely used for serotyping (4). Availability of molecular diagnostics such as PCR could be useful in situations where the clinical material is insufficient or the amount of antigen present is not sufficient to be detectable by routine tests such as ELISA. Recently a multiplex PCR (5) for the serotyping of Indian FMDV strains has been developed and is being used as a back up test for ELISA. Seromonitoring of the vaccinated animals is done by indigenously developed liquid phase blocking ELISA (LPBE). Differentiating infected from vaccinated animals becomes imminent once the disease incidence comes down. Options in this area include detecting antibodies to non structural proteins, particularly 3ABC and 2C. An indirect ELISA and electro immuno transfer blot (EITB) are being used world over for the detection NSP antibodies, and at PD-FMD, an indirect ELISA employing recombinant 3AB3 is being validated for the said purpose. Besides vaccine matching exercises are routinely carried out at PD-FMD in order to assess the relevance of the vaccine strains to the field situation.
2.6 Large pool of qualified manpower
Veterinary services in India are primarily state funded and there are about 9000 veterinary hospitals/polyclinics and 18000 veterinary dispensaries with more than 43,000 veterinarians and other supporting workers who provide the Veterinary services to the huge livestock population of the country (6). The field level veterinarians are responsible for the reporting of the diseases, collection of samples, data and executing the required control measures. Besides there are mobile disease surveillance/investigation teams established under veterinary colleges/state agricultural universities and also PD-FMD trained-manpower to undertake laboratory diagnosis.

2.7 Fairly strong political will
As seen from the European and South American experience control of foot-and-mouth disease leading to ultimate eradication is a long drawn process with huge investments. Obviously a political will to sustain and support a control programme is a must for the fruitful outcome. In these lines, to prevent economic losses due to FMD and to build herd immunity in large ruminants, foot-and-mouth disease control programme (FMD-CP) was initiated in 54 specified districts of the country in the tenth five year plan by Government of India (GOI). The programme involved 100% central funding towards the cost of vaccine, maintenance of cold chain and other logistic support to undertake vaccination. The State Governments provided other infrastructure and manpower. Encouraged by the results of this pilot scale programme, GOI is planning to expand this activity in a phase wise manner in the upcoming five year plans.

3. CONSTRAINTS

3.1 Lack of public awareness
Though farmers in India recognize FMD quiet easily, the disease has never been taken seriously by them. The reason being FMD being non fatal and has not much perceivable impact on the milk production in low milk producing animals. Besides illiteracy and poverty make the situation much more complicated. Further, the inability of FMD vaccines to produce sterilizing immunity adds up the pressure on any vaccination programme being taken up, as the vets needs to answer some difficult questions.

3.2 Less than required quantity of vaccine production
At present, India has three commercial producers of foot-and-mouth disease vaccine, namely, Indian Immunologicals Ltd., Intervet India Ltd. and Indian Veterinary Research Institute, Bengaluru. Products of M/S Brilliant Industries and Biovet Pvt. Ltd. are in the process of entering the market. Indian Immunologicals are the biggest producer of FMD vaccine in India and they produce about 120-150 million trivalent doses annually. Intervet and Indian Veterinary Research Institute together produce about 60-70 million trivalent doses. In all, there is about 180-220 million trivalent doses of FMD vaccine produced. This is less considering that the country has about 483 millions of FMD susceptible livestock population and the animals have to be vaccinated two times a year. In India, large ruminants (cattle and buffaloes) constitute nearly half of the total domestic livestock population and FMD is recorded mostly in these two species. Obviously, the present control strategy in the country has involved vaccinating these two species with the hopes to bring down disease incidences in small ruminants automatically.

3.3 Lack of strong legislation for animal movements and disease reporting
For any disease control programme to be successful, movement of animals within and at the international borders needs to be strictly monitored and controlled. Although check posts exist at state borders in most of the states in India, they need to be strengthened with man power and quarantine facilities. Then a strong legislation requiring any animal entering the state to have vaccination certificates as well as to undergo quarantine may help restricting the disease at the entry level. The legislation should also encourage farming community report the disease immediately to the veterinary authorities, who in turn may be responsible for ordering movement restrictions to prevent further spread of the disease, quarantine, cordonning, disinfecting, ring vaccination and informing neighbouring districts and provinces immediately. It may be recalled that a farmer was convicted of failing to inform the authorities of a notifiable disease, and later of feeding his pigs "untreated waste" during 2001 UK outbreak. In a country like India, reporting can be encouraged by offering incentives rather than penalising. Recently, Government of Kerala has issued a notification amending the Kerala prevention and control of animal diseases rules 1968 providing compulsory vaccination against FMD and identification of vaccinated animals by ear tagging on cost basis (GO No.176/04/AD dt.24/8/2004). Further, the state also has issued the
orders to strengthen surveillance and checking FMD at State borders (GO (MS) No. 36/2004/AD dated 19/3/2004) and compulsory disease reporting. (Source: www.ahd.kerala.gov.in)

3.4 Ban on cow slaughter
Although FMD has been controlled in many countries in Europe and South America by systematic and repeated rounds of vaccinations, none have been successful in eradicating the disease without a stamping out policy, particularly when re-introductions occurred. This is mainly because, international trade regulation impose a heavy penalty on the use of vaccine against FMD in the form of import/export restrictions of animals and animal products and by practicing stamping out policy, one can hope to regain disease free status quickly, there by reducing the trade and other direct losses due to the disease. It can be recalled that in 1981, Chile was the first country in South America to be declared officially free of FMD. The eradication strategy was based on the gradual elimination of the disease working in a south-to-north direction; applying quarantine measures across different regions of the country and following a vaccination campaign using aqueous vaccines of guaranteed quality, mainly produced in Uruguay. The country suffered two re-introductions of FMD caused by illegal animal movements: one in March 1984 and the second one in March 1987. Both episodes were eradicated by stamping-out and quarantine measures. Chile has been recognized by OIE as free of FMD since 1988 (7). In India, at present, Kerala, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland and Tripura are the only states that permit cow slaughter. This is due to the fact that cow is considered sacred in Hinduism and worshipped for the various graces she bestows on humanity. Although, not very pertinent at the present day FMD situation in India, ban on cow slaughter may become an issue, once the disease incidence comes down to zero level.

3.5 Porous international borders
Illegal trafficking of livestock and livestock products has been the biggest threat for maintaining a disease free status. Similarly, 2001 FMD outbreak in UK has been attributed to feeding of infected swill. Chile suffered two re-introductions of FMD caused by illegal animal movements: one in March 1984 and the second one in March 1987(7). There was one outbreak in Botswana in 2002 in cattle in a communal area near Francistown in the east of the country, apparently resulting from the illegal movement of carrier or subclinically infected cattle from Zimbabwe. Similarly, illegal trafficking of livestock and livestock products along India’s international borders takes place and may pose a serious threat in the years to come. In view of the above and considering that FMD is transboundary in nature concerted efforts by all the neighbouring countries may be required to attain full freedom from the disease.

4. CONCLUSIONS
Foot-and-mouth disease is endemic in India and despite some constraints, efforts are being made to control this dreaded disease in a phased manner. However, it would be ideal if the countries within the Indian sub-continent take up the FMD control programme in unison to attain full freedom from the disease.

5. ACKNOWLEDGMENTS
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6. REFERENCES


Fig 1. India Map showing the locations of network regional laboratories under Project Directorate on FMD