AN APPROACH TO DEVELOPING COORDINATED AND HARMONISED ACTIONS FOR THE CONTROL OF BRUCELLOSIS

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Summary: Brucellosis in humans and animals is a worldwide problem and its control still remains a goal for Veterinary and Health Authorities in several countries. The choice of a control strategy depends on a number of factors such as animal husbandry practices, social customs, infrastructure and the epidemiological pattern of the disease as well as organisation of veterinary services, economy and political commitment. Several possible strategies may be applied, ranging from the elimination of infected animals to vaccination of all (adult and young) susceptible animals or young animals only. Often a long-term planning is necessary to decide the steps of brucellosis control and the transition between strategies for the achievement of the final goal. In any case a thorough understanding of local and regional and local conditions are mandatory to decide on the best strategy and practices to be applied.

Key words: brucellosis – surveillance – control – eradication

Introduction

Brucellosis in humans and animals is a worldwide problem and one of the most important zoonoses in the Mediterranean and Middle East regions. Although continuous progress has been achieved in its control, brucellosis still remains a major public health hazard as well as a disease of great economic importance.

Brucellosis is readily transmissible to humans, causing acute febrile illness —undulant fever— which may progress to a more chronic form and can also produce serious complications affecting the musculoskeletal, cardiovascular, and central nervous systems [6]. According to data on human cases of zoonoses notified to the World Organisation for Animal Health (OIE), more than 22,000 human cases of brucellosis have been detected in the Mediterranean and Middle-Eastern countries. The national incidence rate in humans ranges from 0.2 per 100,000 in France and Italy to 196 per 100,000 in Algeria and the Palestinian Autonomous Territories. In 8 out of 27 countries considered in this statistic, brucellosis ranks first in the list of the main zoonoses in humans.

The worldwide decrease of financial resources available for health services has induced considerable changes in the management of health systems and programmes. The optimisation of resource use must be based on a accurate planning of activity, a continuous evaluation of the actions implemented and of the effective achievements as well as a thorough reporting of the resources employed to decision makers. The latter is particularly important in the case of zoonoses, where the advantages of control activities may be less evident than in the case of other animal diseases whose occurrence is characterised by heavy direct losses.

The implementation of effective surveillance systems, therefore, and the definition of the strategic objectives of the control programme are the prerequisites for a successful action against this disease.

The choice of a control strategy

The establishment of the strategic objective consists in the choice of one of the possible general strategies against a disease condition. In particular, regarding zoonoses the most common strategies are focused on the prevention of human infection and on either the control of the disease or the eradication of the infection in the animal populations. In fact, strategies against brucellosis may be aimed either to control or to eradicate the disease in susceptible animal populations. The main goal of a control programme is to reduce the impact of a disease on human health and economy of a region, whereas the eradication of an infection implies the disappearance of the infectious agent from a given territory.

The choice of a control strategy depends on a number of factors such as epidemiology, economy and organisation (organisation of veterinary services, animal husbandry practices, etc.). It is of crucial importance

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that the control strategy be based on a thorough understanding of local and regional animal husbandry practices, social customs, infrastructure, and the epidemiological pattern of the disease. Under no circumstances should the control be based on blueprints derived from situations different from those demonstrated to be prevalent in the specific area of intervention.

The prerequisite for the choice and planning of the strategy is the assessment of:

- existing veterinary and public health legislation and regulation;

- laboratory infrastructure;

- human and technological resources in the Veterinary Services and the Public Health Departments;

- other ongoing control programmes for possible integration into the objective of the brucellosis programme;

- the effective long-term availability of the financial resources necessary for the successful implementation of the programme;

- farmers and other stakeholders commitment;

- availability of possible additional national and international resources.

Whatever the strategy adopted, a proper surveillance system should be established to monitor [5]:

- the prevalence and incidence of infection at individual and herd level through a screening survey or the exhaustive testing of the population (assessment of the achievement of the planned objectives of the programme);

- the incidence of human infection (assessment of the impact of the programme on human health);

- the performance of the Veterinary Services (assessment of the critical factors and efficiency of the programme).

All antigens, reagents and diagnostic tests used in the framework of the programme should comply with the OIE standards [7]. The antigens and reagents should also be subjected to the quality control regimen defined by the OIE standards. Furthermore, the laboratories involved in the programme should regularly participate to inter-laboratory proficiency testing.

Main brucellosis control strategies

Control measures for animal brucellosis are based on the elimination of infected animals and/or the vaccination of susceptible domestic animal species. However, further actions, such as control of animal movements and epidemiological investigations, are needed to achieve the strategic objectives.

A brief summary of the advantages and disadvantages of the main strategies is reported below:

1) Elimination of infected animals

Advantages: Elimination of the source of infection for other animals and for humans.

Disadvantages: The highest cost in the short term; need for efficient veterinary services (movement control, epidemiological investigation capabilities); need for acceptance by the animal owners of harsh veterinary measures; need for high amount of economic resources on a short time basis; need for advanced technological infrastructure (individual animal identification, laboratory support, epidemiological support tools).

2) Vaccination of young animals

a. Vaccination of young animals and elimination of infected animals:

Advantages: Abortion is minimised; the herd immunity reduces the incidence of infection; serological tests are able to differentiate infected/vaccinated animals; basic technological infrastructures are needed.

Disadvantages: The whole herd immunity is slowly established; there is a need for very efficient veterinary services (frequent access into the herd to vaccinate animals before puberty) and a need for good technological infrastructure (individual identification, laboratory support, competent laboratory that can differentiate whether reactors are vaccinated or infected animals).

> b. Vaccination of young animals only:
>
> Advantages: Abortion is minimised; lower cost; no need for technological infrastructures.
>
> Disadvantages: The whole herd immunity is slowly established; there is a need for efficient veterinary services.

3) <u>Mass vaccination (young and adult animals)</u>

Advantages: Lower economic cost, herd immunity quickly established.

Disadvantages: Vaccine can induce abortions and excretion of vaccine strain in the milk (public health risk); persistence of infected animals in herds; there is a need for efficient planning of the campaign to achieve the objectives of vaccination coverage.

4) <u>Heat treatment of milk (without any action in animal populations)</u>

Advantages: The lowest economic cost; no need for efficient veterinary services; only basic technology required.

Disadvantages: Unable to prevent infection in workers at risk and economic losses due to brucellosis in animals; human infection persists when raw milk and raw milk products are consumed.

Where brucellosis is present at high rates, or when animals are managed under extensive transhumant or nomadic systems, any strategy to control brucellosis can take a great advantage from a preliminary vaccination programme aimed at reducing the incidence and the prevalence of the infection. When a significant reduction in flock prevalence has been accomplished, the control programme should be reviewed and alternative strategies may be considered [5].

Epidemiological factors suggesting the change from one strategy to another may be more complex than usually appears. For example, prevalence of infection, if considered alone, not in relation to incidence, may be misleading. In fact, when the high prevalence rate is associated to a high incidence rate due to the active spread of infection among herds, the vaccination may be the best choice for reducing the number of new infected herds. On the other hand, when the infection is clustered in a restricted number of infected herds and spreads little out of these herds, the vaccination of the whole population is useless and would divert resources from more relevant activities, such as the identification of those risk factors (e.g. delays in re-testing the infected flocks, delays in the culling of infected animals, husbandry conditions impairing disinfections, lack of movement control) specifically linked to this group of herds.

In relation to vaccine strains, live *Brucella melitensis* strain Rev. 1 is the reference vaccine to immunise sheep and goats at risk of infection by any species of *Brucella* (*B. melitensis* or *B. abortus*). When properly used, Rev. 1 vaccine confers a long-lasting protection against field infections.

There are two possibilities for Rev. 1 vaccination: subcutaneous vaccination at $1\text{-}2\text{x}10^9$ CFU/dose or conjunctival vaccination at $1\text{-}2\text{x}10^9$ CFU/dose. The advantage of the subcutaneous vaccination route is the life-long immunity but the possibility exists of residual antibody titre due to vaccination in younger animals. The conjunctival route of vaccination shows a very quick disappearance of residual antibody titre and a long-lasting immunity but older animals may possibly recover susceptibility [8].

S19 or RB51 vaccines are used to immunise cattle against *B. abortus*. The control activity is best carried out by a decentralised organisation able to be constantly in contact with herds and animal owners and have a full knowledge of local practices and customs as well as people and disease epidemiology. A central co-ordination structure, however, is always needed to co-ordinate the vaccination campaigns and the follow-up activities, surveillance, evaluation of data and re-planning of the programme on a nationwide level. A long-term planning is always necessary to decide the steps of brucellosis control and the transition between strategies for the achievement of the final goal. The management of such a long-term control campaign usually needs the improvement of the veterinary information and reporting systems, often including an efficient animal identification system, which is the keystone for the success of any strategy.

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