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Risk Management of *Mycobacterium bovis*-Infected Cattle in Herds in High Risk Areas

J. D. Collins

Introduction
Further progress with the eradication of tuberculosis from the national herd is achievable. There are impediments to be addressed, the single most important of which is the tuberculous badger. Otherwise, the main factors involved are the efficient identification of infected cattle and their early disposal, the control of cattle movement out of known infected herds, the protection of contiguous herds and an undertaking by the herdowner to make management decisions that reduce the risk of exposure of his/her herd to the disease on a daily basis. The successful implementation of each of these measures is fundamental to the success of the programme. Meanwhile, effective central and local administrative structures, along with compensation measures that protect herdowners against unavoidable loss, are required in order to support the overall effort and remain essential components of the eradication programme.

Two components of the programme require to be developed and managed in parallel in order to address the current situation, *viz.*
- an eradication component, i.e. the main programme based on the surveillance of currently non-restricted herds throughout the State using a tuberculin testing programme that is scheduled in such a way as to optimise the efficiency of control in the event of breakdowns being disclosed in herds on an area by area basis, and
- a control component targeted on areas of high incidence where there are known to be infected herds or clusters of infected herds, with the specific purpose of removing all sources of infection from such herds and preventing the exit of infected cattle from such herds other than for direct slaughter.

Each of these components calls for different strategies that are at the same time complementary to each other. Both require specific resource allocations at local and central level. Measurement of progress in both cases requires to be based on parameters other than the number of tuberculin reactor animals per 1,000 tuberculin tests per year (APT), or other current methods. In the case of the control component, the nature of the episode, that is, the pattern and extent of disclosure of reactors throughout the episode from the index test to the six-month check test, is the preferred measure.

The distribution of tuberculosis-restricted herds
The distribution of confirmed infected herds in the State has followed a constant if not predictable pattern from year to year over the past decade, with foci of infection being repeatedly identified in specific areas (Hammond, 2000). In the first instance, movement of cattle out of herds in these areas requires to be controlled on the basis of more severe criteria than those currently used. This applies to all herds in designated high-risk areas, as the contribution of the contiguity factor is central to our understanding of the mode of maintenance of infection in a locality. In this latter context the role of infected wildlife, and in particular the tuberculous badger, is paramount, as the movement of infected...
wildlife from herd to herd is likely to account directly for at least 17% of all restrictions and 34% of breakdowns involving more than one tuberculous bovine animal (O'Keeffe and O'Driscoll, 1997).

**A strategic approach to the prevention of transmission of M. bovis from infected wildlife to cattle in high risk areas**

Implementation of a strategic approach to the control of the tuberculous badger as a confirmed source of infection in designated high-risk areas is now required as a matter of priority.

Each year some 1,000 herds or more are the subject of confirmed outbreaks of tuberculosis as a recurring problem. Many of these herds are located in the high risk areas. Some of these herds acquire and re-acquire infection from already infected neighbouring herds, either directly or indirectly via infected badgers and deer. Meanwhile, up to 24% of multiple reactor breakdowns such as these are attributable to difficulties associated with the diagnosis of tuberculosis in infected cattle at different stages of the disease (O'Keeffe and O'Driscoll, 1997). This is not unexpected and has been a problem in eradication programmes in other countries, due to the fact that the tuberculin test, however well performed, is not capable of detecting up to one in three infected animals in heavily infected herds (Monaghan et al., 1997). This accounts for the persistence of infection in a proportion of herds with a recurring problem, as failure to identify infected cattle in the early stages of the disease may lead to within-herd transfer of infection over the time it takes for the infected animal to become responsive to bovine tuberculin.

This shortcoming is of particular relevance to the overall programme when one considers that there is now an additional and significant source of infection, in the form of the tuberculous badger, for herds that have hitherto been protected against acquiring infection directly from infected cattle. The hazard posed by tuberculous badgers is all the greater because in many cases there is nothing in the herd's history to indicate that the herd is at risk until after the event. Failure of the tuberculin test to identify, at an early stage, cattle that become infected as a result of contact with tuberculous badgers may have accounted for the increase in the numbers of tuberculin reactors and lesion-positive attested cattle disclosed at routine slaughter, in recent years. For this reason it is now imperative that the eradication of tuberculosis in the badger, preferably by means of a vaccination programme in that species (Gormley and Collins, 2000), be addressed as a priority, both as a badger health, as well as a cattle health, issue.

The potential exposure of cattle to tuberculosis from two main sources, namely, tuberculous badgers and other infected cattle, represents a cumulative risk over and above that posed by an infected cattle population alone. The early detection of cattle infected from either of these sources is paramount since the potential rate of exposure is now greater than it has been at any time in the past twenty years, due to the increase in the number of tuberculous badgers over that period (Collins, 2001).

The current programme of intensive eradication is focussed on areas in which badger-borne infection is identified as the most likely source of infection for new breakdowns, based upon epidemiological evidence provided by herd analysis and ER76-based investigation (O'Keeffe, 2000). This programme provides a unique opportunity to further assess ways of enhancing the identification of early cases of tuberculosis in high-risk herds.
Strategic use of ancillary tests in the early detection of M. bovis-infected cattle

A serious problem of detection arises in chronically affected herds because sole reliance upon the tuberculin test as the means of identifying Mycobacterium bovis-infected cattle does not take full account of the limits of sensitivity of this test in detecting animals in the early stages of infection (Monaghan et al., 1994). Consequently, infection may be present in exposed herds which (a) have had no history of the disease, (b) may not have purchased animals and (c) have contracted such infection from other sources such as infectious wildlife, until the infection is well established in the herd. Late detection of infected animals in these herds directly impedes the effectiveness of the current programme.

Ancillary diagnostic tests, such as the interferon-γ assay, which can detect many of the earlier cases, provides a means of addressing this problem effectively. This has already been demonstrated, based on the results of some 25,000 tests conducted on cattle in problem herds (Collins et al., 2000). The use of ancillary tests in known infected herds has been under consideration by the CEC Standing Veterinary Committee since November, 1999.

The strategic use of interferon-γ assay and other tests in herds in high risk areas would go some way to reducing the pool of infection for the entire State.

Animal identification and animal movement control

Animal identification and animal movement are issues that are of major concern for reasons other than tuberculosis at present. The CMMS requires to be evaluated against the current background. In this context, the efficiency with which the herd of origin, as well as the herds most recently visited, of the 2,500 non-reactor cattle that annually are found to have confirmed tuberculous lesions at slaughter can be identified provides a practical means of conducting such an assessment. Meanwhile, the within-herd movement of cattle between parcels of land in different DVO districts, without movement control, is still a matter of concern, as these movements are unlikely to be recorded.

The local availability of computerised facilities at District Veterinary Offices to identify contiguous herds, as successfully applied in the recent foot and mouth disease emergency, now provides a means of addressing some aspects of this problem (McGrath and White, 2002).

The role of the herdowner

The importance of the role played by the herdowner, on the one hand in preventing the spread of tuberculosis and on the other, in containing and controlling infection in his/her herd, cannot be overstated. Somehow, the fact that tuberculosis is an infectious disease is hardly appreciated by herdowners, nor is it emphasised sufficiently by farmers’ advisers. The lessons about the importance of biosecurity learned from the recent foot and mouth disease episode apply in equal measure to the prevention and control of tuberculosis in every farmer’s herd, on a herd by herd basis. If these lessons are allowed to be ignored, then tuberculosis will only be identified after it has become well established in the herd. At that stage the herdowner is already losing income. Each herdowner is his/her last line of defence: not to be properly informed, and not to act to protect the herd, would be a self-imposed mistake in almost every case.

Buying in policy including post-movement tuberculin tests in the case of replacement stock in dairy herds, culling policy during or after a breakdown, farm hygiene and sound stockmanship, peripheral
stock-proof fencing and reasoned precautions against avoidable contact with tuberculous wildlife - these are the points of emphasis for the managers of the programme and for the farming organisations, if the full benefits of efficient agriculture are to be attained.

Conclusion

The approach identified here, namely, a programme that consists of an eradication component run in parallel with a disease control component that includes a rational approach to the control of tuberculous badgers and the strategic use of ancillary diagnostic tests in infected herds, can form the basis for an acceleration of the eradication programme. The current research programme provides evidence that strongly supports this approach. The badger vaccination project currently in progress (Gormley and Costello, 2002) addresses this key issue in as direct a manner as possible. With the right encouragement and self-help on the part of herdowners, based on the self-confidence gained during the foot and mouth disease crisis, worthwhile progress is attainable. A number of these issues are already being addressed by the Veterinary Epidemiology and Tuberculosis Investigation Unit. This approach affords a reliable basis for risk analysis including risk management that is based on direct action aimed at reducing the impact of the disease both at herd and district level (Martin et al., 2000). The level of competence required is now available at DVO level to operate both components of the programme successfully.

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