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Tuberculosis in Cattle: A Case Study

Margaret Good

Introduction
In the course of the Bovine Tuberculosis Eradication Scheme the majority of the herd breakdowns which occur are resolved within the minimum period and the breakdown is controlled following the identification and removal of the source of infection for the herd. However, in minority of cases the breakdown is characterised by the periodic disclosure of one or more reactors over a prolonged period. This leads to considerable disruption for the herdowner and seriously compromises the status of contiguous herds over the period of restriction. In such cases the origin of the infection may be difficult to identify and, as a result, the momentum of the overall programme, at local level, may appear to falter.

This paper describes an investigation of such an outbreak and explores the nature of the infective process associated with *Mycobacterium bovis* at the herd level.

Case Study
The herd was primarily a dairy herd. All stock including males were kept for slaughter. Herd size varied between 400 - 600 animals. The only cattle bought into the herd were bulls which were purchased as required.

The dairy herd provided the calves for the dairy replacements and the beef enterprise which were managed apart.

Both the herd and the surrounding area had a good profile as regards tuberculosis until June, 1987, when this herd, followed by two contiguous herds, were restricted with minor breakdowns.

No source of infection was identified on any of the farms. The wildlife population was not sampled.

The index case in this herd was a 6-month old Friesian heifer calf which was part of the "dairy replacement" group. She was identified, initially, as an inconclusive reactor in June, 1987, and as a standard tuberculin reactor two months later. The presence of tuberculosis was confirmed at slaughter. Following a series of reactor retests the herd was de-restricted. At the end of October, 1988 a routine herd test was clear. Then in April, 1989, 20 reactors were disclosed in the group comprising first calvers and adult springing cows managed together in the periparturient period. Seventeen of these were first calvers and were companions of the index case; nine of these disclosed lesions of tuberculosis at slaughter. The remaining three reactors consisted of dry cows which were removed as in-contacts; none of these showed lesions at slaughter.

Two months later, in June, 1989, a further eleven cattle were removed following a reactor retest. One of these, a companion of the index case, was a standard inconclusive reactor and disclosed lesions at slaughter. The other ten cattle consisted of a further companion of the index case and nine older cows which were identified for removal on epidemiological grounds; the latter group were removed because it was considered, at the time, that an older infected but anergic animal might have been the focus of infection for the herd. None of these ten animals disclosed lesions at slaughter.

In August, 1989 another companion animal was removed as a severe inconclusive reactor; tuberculosis was confirmed in this animal following slaughter. Four older cows were removed at this time; none of these showed lesions.

A survey of the holding was carried out during
1989 in order to determine whether or not tuberculous badgers might be involved in the breakdown. Some setts were discovered and despite a snaring programme, operated under licence, no badgers were captured. It was concluded that badger activity on the holding, if present, was at a low level at the time.

No further evidence of tuberculosis in the herd was disclosed until June, 1990 when yet another companion of the index case, now a mature cow, was identified as a standard inconclusive reactor and was slaughtered. Tuberculous lesions were found at slaughter. In April 1991, a cow which as a calf had been a companion of the index case was sent for slaughter and was found to be tuberculous on post-mortem examination. This animal had earlier been identified as a severe inconclusive reactor but had not been removed at the time. In July, 1992, in what was considered to be a separate incident confined solely to beef animals kept on an outfarm, a number of bullocks were found to be reactors. These, along with all their in-contacts, were slaughtered by the end of that year.

A further companion to the index case was disclosed as a standard inconclusive reactor in November, 1992 and was found to have tuberculous lesions at slaughter.

No further reactors have been disclosed to-date and the herd currently has a clear status. As far as can be ascertained no companion animals to the index case now remain in the herd.

**Observations**

A feature of the outbreak was the fact that the only cattle found to have tuberculous lesions at slaughter all came from the initial group of calves associated with the index case in 1987. These animals had remained in the herd over a period of five years during which other cattle including older cows with which they were in contact were removed for slaughter, on epidemiological grounds. Also routine culling occurred in the herd without any evidence of transmission. In all a total of thirteen cattle directly associated with the index case during calfhood showed evidence of tuberculosis at slaughter during the period, 1987 - 1992.

No obvious source of infection was identified for the 1989 outbreak. It had arisen among the "first calvers", reactors being disclosed from this segment both before and after they joined the main body of the cow herd. No spread of infection outside this group or within other groupings was apparent. This was the same group of animals that had revealed exposure to infection in 1987. Did all infected animals acquire infection in 1987, and was its presence only revealed when the stress of gestation/pregnancy weakened their immune defence? Did one animal, perhaps due to calving stress, spread infection within the group just to the companions of the index case but not to others? Was the same group exposed again to infection during winter 1988/89?

It would appear probable that exposure of all cases which were subsequently confirmed on post-mortem occurred in 1987.

It was a notable feature during this outbreak that the lesioned animals had a very poor tuberculin response profile. Only two animals failed the standard interpretation Single Intradermal Comparative Tuberculin Test, with 9mm and 5mm bovine/avian differentials respectively; seven others showed standard interpretation inconclusive readings.

**Discussion**

This case study illustrates the importance of herd records in the elucidation of the nature of an outbreak of tuberculosis in a herd of cattle. Reference to the animal identification tag numbers and also farmer identification and records confirmed the relationship between the affected animals in this largely self-contained herd. Whatever the primary source of infection for the index case and its companions was, this herd breakdown illustrates some of the difficulties associated with the eradication of tuberculosis from infected herds. In particular it highlights the importance of establishing the relationship and level of exposure to infection of
animals other than those already identified as reactors in the herd and of instigating measures for the segregation of animals thus exposed.

The breakdown also raises questions regarding the nature of the infectivity of *Mycobacterium bovis* among groups of cattle under farm conditions, and in particular, the susceptibility of cattle of different age groups to exposure under farm conditions. As already mentioned, the only animals found to have tuberculous lesions over the period of the breakdown came from the group of calves in which the first case was originally identified in 1987. Sixteen other cattle from different age groups within the herd which had been kept in close proximity with the affected cattle and had been removed as a result of a tuberculin test (one standard interpretation inconclusive animal and 9 severe interpretation inconclusive animals) or on epidemiological grounds, failed to disclose lesions at slaughter.

A number of outbreaks reported each year have profiles similar to the above case. For this reason it is necessary to establish whether or not differences exist in regard to the susceptibility of discrete groups of cattle to *M. bovis* infection, depending upon e.g. age, stage of reproduction in the case of heifers and cows, and stress-related factors associated with production. Also, the extent, if any, to which a variation in the responsiveness to tuberculin(s) of cattle infected with *M. bovis* may occur, thereby delaying their identification and removal from the herd, requires further investigation.

It has been the experience in other countries that herds in which a major exposure to infection has occurred, will inevitably experience further breakdowns over time. For this reason, in the later stages of eradication, depopulation has tended to be the preferred option in such herds. At our stage of eradication it may not be possible to do this routinely, but we must take great care in dealing with groups of animals where we know that such exposure has taken place.

**Acknowledgements**

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