THE ERADICATION OF BOVINE TUBERCULOSIS IN GREAT BRITAIN

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Introduction

The Royal Commission on Tuberculosis (1907) established the common identity of the disease in man and cattle.

In spite of the obvious public health implications, no action was taken until 1913 when a Tuberculosis Order was introduced to deal with "open" cases of the disease in cattle. The Order was replaced by another in July, 1914, but the latter was suspended following the outbreak of war and it was not until 1925 that another Order of this kind came into force.

The categories coming within the scope of the Tuberculosis Order of 1925 - later replaced by the Tuberculosis Order of 1938 - were: "tuberculosis of the udder"; "giving tuberculous milk"; "tuberculosis with emaciation"; and "chronic cough with definite clinical signs of tuberculosis". To these another was added, viz "excreting or discharging tuberculous material" in the Tuberculosis Order (Amendment) of 1946.

The Tuberculosis Order was a measure of public health only and had little or no effect on the incidence of the disease in cattle - or of bovine infection in humans - as in most cases the affected animal was infective for some time before it was notified or could be detected clinically. Nevertheless, the Order was of some value in that it allowed a health authority to slaughter an "openly" affected animal instead of merely requiring its removal from the herd under Milk and Dairies legislation.

In 1929, 15,532 cattle were slaughtered under the Tuberculosis Order; of the 14,858 cows and heifers found to be affected at post mortem examination, 2,692 i.e. 18.1 per cent were affected with tuberculosis of the udder or giving tuberculous milk.

In 1932 the Cattle Diseases Committee of the Economic Advisory Council was appointed to consider measures to reduce disease among milk cattle with particular reference to tuberculosis and improvement of the milk supply. In the report (ref. i), the Committee accepted the widely held view (based mainly on the findings in abattoirs and the results of exploratory tests in 144 herds) that at least 40 per cent of cows in dairy herds were infected with tuberculosis to some
extent and that, on the evidence available, at least 40 per cent of cows yielded tuberculous milk. It was also stated that bovine tuberculosis was responsible for over 2,500 deaths and for a still larger amount of illness annually among the human population.

While the overall incidence of infection in cows was accepted as being about 30 per cent, it was realized that there was a great deal of variation among herds even within small areas, ranging from complete freedom to 100 per cent infection. The distribution of cases of clinical disease coming within the scope of the Tuberculosis Order showed that the heaviest infection was in herds situated in or near industrial areas. Many of these herds consisted entirely of cows which spent their milking lives in the confinement of badly ventilated cow sheds. There was little information on which to base an estimate of the overall incidence of infection in cattle but it was thought to be in the region of 15-20 per cent.

The Cattle Diseases Committee concluded that the total eradication of bovine tuberculosis was the only complete solution of the problem of tuberculous milk but that the progressive formation of clean areas, based on compulsion at the outset, could not then be undertaken.

The Attested Herds Scheme

The Milk Act of 1934 gave effect to the conclusions of the Cattle Diseases Committee by making provision for the expenditure of £750,000 over a period of four years to improve the milk supply. As it was obviously impracticable at the time to slaughter reactors as soon as they were identified, the only alternative was to free as many herds as possible under a voluntary scheme so that, at a later date, when the overall incidence of infection had been reduced to manageable proportions it would be possible to introduce radical measures to get rid of the remainder.

The first Attested Herds Schemes were introduced in 1935. One applied to England and Wales and was administered by the Ministry of Agriculture and Fisheries; the other applied to Scotland and was administered by the Department of Agriculture for Scotland. The Schemes were similar and although modified from time to time, to allow of changes in bonus payments, remained essentially the same throughout.

Under these Schemes, herds which were free from tuberculosis, as judged by their having passed three consecutive tuberculin tests - the last of which was an official test - at minimum intervals of 60 days; or herds which had been entirely constituted with attested cattle could be registered as attested herds. Before the official test was carried out, the farm was approved as suitable for the maintenance of an attested herd and the owner was required to give an undertaking to observe a number of rules designed to prevent, as far as possible, the chance of re-introduction of infection into the herd. A bonus of one penny per gallon was paid on milk from an attested herd sold through a Milk Marketing Board.
The herd was tested at intervals to see that freedom from tuberculosis was maintained. Reactors disclosed at any tuberculin test were required to be isolated at once and removed from the premises within a stipulated time, otherwise the registration of the herd, as attested, was cancelled.

For a time progress was slow and the Scheme largely attracted owners whose herds were already licensed to produce "Tuberculin-Tested" (T.T.) milk under the Milk (Special Designations) Orders or those who were already taking measures to free their herds on their own account. At the end of 1936, there were only 414 attested herds and during the same year 23,716 cattle were slaughtered under the Tuberculosis Order, the largest number recorded in a single year. This increase over the number dealt with under the Tuberculosis Order in 1929 does not necessarily mean that the incidence of clinical tuberculosis rose between these years. It is more likely to have been the result of the increased number of clinical examinations of herds carried out following the expansion of veterinary services of local authorities during this period (ref. 3).

At the same time it was clear that progress could not be made without adequate marketing facilities for attested stock and, as the need arose, markets were approved for the holding of sales of attested cattle.

In 1937, a very important step was taken when the Agriculture Act of that year empowered the Minister of Agriculture and Fisheries to expend money on the eradication of bovine tuberculosis and other diseases of animals and to declare eradication areas for that purpose. This meant that eradication measures could now be applied to bovine tuberculosis, as a disease of animals as well as a safeguard to public health.

In 1938 the Attested Herds Schemes of 1935 were replaced by a single scheme applicable to the whole country and administered by the Ministry of Agriculture and Fisheries. The new Scheme made provision for the payment of a bonus of £1 per animal per year for a period of three years as an alternative to one penny per gallon of milk for the same period.

At the end of 1938, the number of attested herds had risen to 5,353 and during the year the number of animals slaughtered under the Tuberculosis Order had fallen to 19,910.

During the period August 1938 to September 1939 a tuberculin test survey was carried out in 12,300 self-contained herds containing 364,286 cattle and the incidence of reactors was found to be 13 per cent; 6,971 herds (127,141 cattle) showed no reactors; of the herds with reactors, 2,897 (114,701 cattle) had less than 10 per cent and 2,432 (122,444 cattle) showed more than 10 per cent. The reactor incidence (13 per cent) cannot be taken as a true indication of the position at this time as the herds in the survey were selected on the basis that they were self-contained with little or no history of clinical tuberculosis.

The outbreak of war in 1939 undoubtedly hampered progress as it was found necessary, for the main period, to restrict attestation to herds which were licensed to produce "T.T." milk. On the other hand it is possible that, as a result of shortage of foodstuffs during the same period, many animals, unthrifty as a result of tuberculosis, were disposed of for slaughter and so reduced the overall weight of infection to some extent.
In October, 1943, the Ministry of Food made payable a premium of four pence per gallon on milk from license "T.T." herds and many herds which qualified for "T.T." licences became attested in due course.

The Attested Herds Scheme was fully re-opened in July, 1944, but, since no corresponding bonus was payable to non-dairy herds, it was inevitable that attestation should progress largely in areas in which dairy farming was the main agricultural activity.

Ritchie (1946) estimated that the incidence of tuberculosis in all cattle in Great Britain was 17.5 to 18 per cent (England 20 per cent; Wales 7.5 per cent and Scotland 14 per cent) and in cows 30-35 percent (ref. 6). Francis (1958), commenting on this, states that, taken with the fact that as about 40 per cent of cows slaughtered in abattoirs are tuberculous, the estimate of 17-18 per cent for all cattle fits very well on the age-incidence curve (ref. 2).

At the end of 1947, 1,200,000 cattle, i.e. about 14 per cent of the total population, were in attested herds - (Scotland 32 per cent; Wales 26 per "cent and England 8 per cent). During that year the number of cattle slaughtered under the Tuberculosis Order fell to 6,543. The proportion of those animals affected with tuberculosis of the udder or giving tuberculous milk, remained fairly constant at 30 per cent during the 10-year period 1938-47 (ref 4).

Area eradication plan

In October 1950 it was decided to introduce a plan of area-eradication which had been under consideration during the post-war period. The necessary legislative measures - Tuberculosis (Area Eradication) Order; Tuberculosis (Slaughter of Reactors) Order and the Tuberculosis (Compensation) Order - were taken under the provisions of the relevant sections of the Agriculture Act of 1937. which by now had been incorporated in the Diseases of Animals Act, 1950.

The conception of the plan was to select areas in which the percentage of attested cattle under the voluntary schemes was already substantially high, and which were reasonably self sufficient as regards stock replacements and marketing facilities. After consultation with local interests, notice would be given that, on a determined date, the area concerned would be declared to be an eradication area. All herds in an eradication area, not subject to the rules of the Attested Herds Scheme on the date of declaration, would be placed under movement restrictions and tuberculin tested, compulsorily if necessary, with immediate slaughter of reactors and payment of compensation. When all such herds had been tested twice and reactors disposed of, the area would be declared to be an attested area. During the period of notice of intention to declare an eradication area - in practice the period was two years - the State would pay the cost of tuberculin testing of herds not already attested, to bring them up to that standard, provided the owner carried out the Ministry's requirements regarding disposal of reactors. Each year in succession, further areas, in which voluntary attestation of herds showed the highest rate of progress, would be selected for eradication and in
turn dealt with, in the same way, until eventually the whole country became one large attested area.

In October, 1950, the Attested Herds Scheme was modified to provide for payment to attested herd owners of a bonus of twopence per gallon of milk for a period of four years and one penny per gallon respectively. At the same time the first areas, one in south-west Scotland and one in south ~Wales, were select-.d for eradication in 1952. At the end of 1951, there were about 74,000 ~ attested herds containing nearly three million cattle or 31 per cent of the population. The number of cases dealt with under the Tuberculosis Order during the year was 3,771.

In the Isles of Scilly, Arran. Cumbrae and Shetland, voluntary attestation had already progressed so far that is was possible, without an intervening eradication stage, to declare them “attested areas” on 1st February, 1951, the first in Great Britain. Each year new areas were selected according to the plan so that from 1952 onwards, eradication areas were declared every year with the exceptions of 1953 and 1956. Scotland and Wales became attested areas in October, 1959.

At the end of 1959, 95 per cent of animals were found to come within the scope of the Tuberculosis Order – in 1960 to date the respective figures are 97-98 per cent and 18.

On 1st March, 1960, the last eradication areas comprising counties in the Midlands and in the north and east of England were declared. These areas are due to become attested towards the end 1960 (possibly 1st October) when the whole of Great Britain will be one attested area. [Great Britain did, in effect, become one attested area on 1st October, 1960].

The Plan went smoothly from the beginning; no serious difficulties were encountered and the great majority of owners co-operated in the carrying out of tuberculin tests. In all, 9,695 herds (174,607 cattle), not subject to the Rules of the Attested Herds Scheme when eradication areas were declared, were included in the first round of compulsory tests under the plan; about 50 per cent of these herds showed no reactors. In herds showing reactors the incidence ranged from 0.5 to 30.5 per cent; the incidence of reactors in cattle tested was 17.5 per cent which tends to confirm the earlier estimates of the overall incidence in non-attested cattle.

The map shows the different eradication areas numbered to show the sequence and dates on which they became attested. In a few instances one part of a county became attested before the other.

Reactors in attested herds

The fact that the whole country will soon become one attested area does not mean that bovine tuberculosis has been eradicated in a literal sense. It is doubtful, in the present knowledge, whether such a goal can ever be quite attained. Experience as s own that an incidence of 20 per cent of rectors in an area can quickly be reduced to about 0.5 per cent by repeated tuberculin testing with rapid removal of reactors and disinfection, but any appreciable lessening of
the latter figure may take a considerable time; thus, for example, between 1941 and 1951 the incidence in attested herds fell only from 0.41 per cent to 0.37 per cent, but between 1952 and 1959 it fell from 0.32 per cent to 0.16 per cent corresponding with the great increase in numbers of attested cattle during the period. Perhaps the most that can be expected in the foreseeable future is to reach and maintain an overall incidence of 0.05 per cent which already exists in some of the older attested areas.

There are a number of reasons for a continuing incidence of reactors.

1. **Residual infection on farms**
   Many farms do not lend themselves readily to adequate disinfection, except at heavy expense, and the organism may survive long enough in a suitable environment to infect one or more members of a herd.

2. **Failure of the tuberculin test to disclose infected animals**
   The margin of error in this direction is extremely important but very difficult to determine. An earlier speaker (ref. 5) referred to a total error of 18 per cent in a group of 160 cattle of unknown origin (Paterson et al. 1958). Approximately half of these cattle gave negative reactions to the single intradermal comparative test and of these approximately 14 per cent were found to be infected at autopsy. In practice the error is unlikely to be so high, since the result of the test of the herd as a whole is first assessed and other factors such as the herd history and the co-existence of reactors are taken into account in considering the result in individual animals. Nevertheless, an animal with a slight non-progressive infection and in which tuberculin reactivity has largely or completely disappeared is of great danger in a herd if, under conditions of stress, reactivation of the earlier infection takes place followed by generalization. When this happens, a large number of reactors (breakdown) may be expected among animals in contact. Herd "breakdown" is uncommon in relation to the number of herds and even allowing for it, the average number of reactors in herds, where reactors are found, is 2.2.

Non-specific reactions

Approximately 70 per cent of reactors from attested herds examined post mortem during the past seven years showed lesions of tuberculosis. During the earlier part of this period (1953-55) 75 per cent were found to be affected and it appears therefore that, as intensive measures of eradication take their effect, the percentage of reactors showing no-visible-lesion (N.V.L.) is on the increase. Post mortem examinations are carried out in abattoirs under unfavourable conditions for the detection of early or slight infections and if such examinations were made under laboratory conditions more "N.V.L." reactors would be found to be affected. Nevertheless, reactors occur in which, even after examination at the laboratory, no lesion can be found nor can the organism be recovered from the usual sites; apart from the condition known as "Skin Tuberculosis" which appears to
sensitize non-tuberculous cattle to tuberculin little is known at present of the cause(s) of tuberculin reactivity in such animals.

Reservoirs of infection in other species

Infection from goats and swine: progressive tuberculosis in goats and swine is usually due to a bovine strain of the organism, probably acquired from cattle. In goats the disease is very uncommon, but on one occasion a goat kept in a cowshed and which died from generalized tuberculosis appeared to have been responsible for infecting the herd of cattle. The disease is much more common in swine but as the incidence in cattle has declined there has been a corresponding decrease of incidence in swine. This decrease seems likely to continue and with the increased application of the tuberculin test as well as the removal of the common bovine source, bovine tuberculosis in these species may largely disappear. Since tuberculosis in goats and swine is not subject to the measures of eradication which apply to cattle, owners of attested herds may be required to keep goats and swine on the same farms segregated from cattle.

Infection from human beings

Infection from human beings: the human strain of the organism has a very low pathogenicity for cattle and infections with this strain in cattle, while they do occur occasionally, are more of a nuisance than anything else in that they cause tuberculin reactivity, and there is no satisfactory means of differentiation from reactions due to bovine infection. Much more important are cases where cattle owners or attendants are infected with the bovine strain - already in several instances there is strong circumstantial evidence that infection with the bovine strain was passed from humans to attested cattle under their charge; in other instances, although a human source of infection in cattle was suspected, it was not possible to obtain particulars of the strain of organism involved in the human subject. It is of course most likely that human pulmonary tuberculosis due to the bovine strain was originally acquired from cattle but although infection of this kind among farm workers may be uncommon it must remain, when it occurs, a potential danger to cattle.

Infection from horses, dogs and cats is so unlikely that it may be disregarded.

Eradication and the future

Bovine tuberculosis is now at least under satisfactory control in Great Britain. The task -has taken 25 years - the cost, about £130 million, most of which was expended in payments of bonuses and compensation for reactors. It has been carried out without upset to the agricultural economy or to the national food supply and has been of great benefit to both. During the next few years, a good deal of effort will be necessary to consolidate and improve the position by eradicating infection whenever it is disclosed. To this end, in addition to the tracing of contacts to any known infection, tuberculin testing of all herds will be continued at appropriate intervals; already the interval has been successfully extended from one to two years in some of the older attested areas. This has been
effected by testing one half of the cattle in a district every second year and after a period it should be possible to do the same throughout the country. As the various sources of re-infection become fewer it may be possible to extend the testing interval progressively further in the same way, but that is very much a matter for the future.

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REFERENCES


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