ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD (ACMSF)

Mycobacterium bovis

Introduction

1. The purpose of this paper is to

   - provide members with an update on the current incidence of and trends in *Mycobacterium bovis* infection in cattle and man
   - review measures in place to protect the food chain from risks associated with this organism
   - seek the views of members on the level of protection afforded by current regulations relating to meat from animals with evidence of infection
   - propose the establishment of an ACMSF subgroup to advise the Agency further

The current situation in cattle and man

Mycobacterium bovis infection in cattle

2. A compulsory eradication programme for TB in cattle began in the UK in 1950. The mainstay of control is the routine free tuberculin skin testing of animals carried out by the Ministry of Agriculture, Fisheries and Food (MAFF) and removal of those with positive skin reactions for slaughter and further examination. By 1960 the whole of the UK had been declared 'attested' (two successive tests on all animals in a herd showing herds to be TB free). However, the disease had not been eradicated : one in 50 herds was still infected. One factor affecting the assessment is that tuberculin skin testing in cattle only has a sensitivity of about 85%.

3. Since the early 1980s, the number of herds with TB reported each year ('new confirmed herd incidents') has steadily increased. Over the last ten years it has risen six fold, from 122 in 1988 to over 700 in 1998. At first this increase mainly affected the south-west of England, which has long had problems with tuberculosis in cattle, but more recently it has appeared in parts of South Wales and in the West Midlands, and it is continuing to spread.

4. MAFF is undertaking an extensive programme of studies to increase understanding of local factors associated with tuberculosis in cattle and to develop a long term sustainable policy of disease control. The programme includes studies of the risk factors for infection and the role of wildlife species, particularly the badger (see below), in maintaining a reservoir of infection. A substantial research programme

has been established, including research towards the development of a vaccine for cattle.

M. bovis infection in other animals

5. *M. bovis* has also been found in Great Britain in farmed deer, goats, llamas, dogs and cats. In rare instances, infected farmed deer have been the source of human tuberculosis[1]. There is no compulsory tuberculosis testing regimen for farmed deer, although, as for cattle, tuberculosis is a notifiable disease in deer (farmed, park and wild).

6. Transmission of *M. bovis* between badgers and cattle is poorly understood. As part of its programme of studies, MAFF has begun a trial in high incidence areas to assess the role of badgers in the transmission of infection, and the effect on transmission of culling badgers.

Human *M. bovis* infection

7. Most human tuberculosis in the UK is due to *Mycobacterium tuberculosis* rather than *M. bovis*. In recent years, an average of only 42 cases a year out of approximately 3,600 bacteriologically proven cases of tuberculosis (1.1-1.3%) have been identified as due to *M. bovis*. These *M. bovis* infections are predominantly in older, white people in whom they are thought to represent reactivation of infection originally acquired when human *M. bovis* infection was more common in the UK.

8. While the evidence so far, both from national tuberculosis surveillance data and from investigations of human contacts of infected herds, is that the risk to public health from bovine tuberculosis in cattle is very small, there are provisos:

    i. The organism *M. bovis* is difficult, and slow, to grow in the laboratory, and it is possible that some cases are missed due to failure to culture the organism, or failure to undertake the further tests necessary to differentiate it from *M. tuberculosis.* All medical microbiology laboratories should use media that will isolate both *M. tuberculosis* and *M. bovis*. In practice this means two types of solid media. Molecular amplification systems, which may be used by local laboratories for TB diagnosis in primary specimens, do not usually differentiate *M. tuberculosis* from *M. bovis.* This highlights the importance of referral of isolates from all cases of human tuberculosis to a Reference Laboratory for identification.

    ii. Many years may elapse between acquisition of *M. bovis* infection and progression to clinical disease, so that the full impact, should an increase in recent infections have occurred, may not yet be apparent. Against this is the lack of tuberculin skin test, or other, evidence of recent infection among close human (including child) contacts who have been investigated during contact tracing exercises following herd breakdowns.

Control measures to prevent transmission of *M. bovis* in milk and dairy products

9. Historically, the main route of transmission of *M. bovis* infection from cattle to man was via infected milk. The main measure to prevent this is pasteurisation of milk. Milk becomes contaminated mainly from tuberculous udder lesions, which are usually the consequence of chronic secondary spread of disease. Low numbers of organisms may occur in the absence of udder lesions or due to faecal contamination.

10. Herds are routinely tested at a frequency of 1-4 years, depending on the local incidence of TB. Additionally, some individual herds which are perceived to have a higher public or animal health risk may be tested more frequently than the background interval for their geographic location. Regular removal of tuberculin reactors from dairy herds before they have developed overt disease means that udder lesions are now rare. However, there remains a risk from unpasteurised milk or dairy products derived from animals which become infected and develop lesions between the routine tuberculin tests.

11. The Dairy Products (Hygiene) Regulations (DPHRs) 1995 require that raw cows' milk shall come from animals belonging to a herd which is officially tuberculosis free (OTF), otherwise milk must be heat treated. For many years, MAFF has tested herds from which raw drinking milk is retailed on an annual basis.

12. When veterinary staff become aware of a TB reactor or suspicious lesions at routine slaughter in a *dairy herd*, the OTF status is suspended and a herd movement restriction is served with a covering letter. The veterinary staff will notify the food authorities (the CEHO) so that action can be taken under the Dairy Product Hygiene Regulations. The CEHO undertakes rapid investigation to ensure that milk from the herd is heat treated, and a statutory heat treatment notice is served where appropriate.

13. Where a food authority becomes aware of raw milk or unpasteurised dairy products made from a herd where the OTF status has been lost, an assessment of the risks of the food to human health should be carried out locally (in liaison with the CCDC) and appropriate action taken. Enforcement Officers should inform the Department of Health, as necessary, in accordance with Code of Practice No 16 on the Food Hazard Warning System.

14. Advice on the investigation and management of potential human contacts is included in recent guidance issued to CCDCs and CEHOs by the Department of Health. Screening of those who may have consumed unpasteurised milk or dairy products from affected animals is generally recommended only in the case of reactor cattle with proven or possible udder infection.

Control measures to prevent transmission of *M. bovis* in meat

15. There is no evidence that contaminated meat has resulted in human cases. However, if transmission were a rare event, it is unlikely that surveillance systems would be capable of detecting it. Evidence regarding the infectious dose by the oral route is patchy, but it is generally accepted that the infectious dose is high. In 1997, the Krebs Committee, which contained a veterinary pathologist and medical microbiologist, concluded that:

> "The risk of transmission of bovine TB from contaminated meat is extremely small. *M. bovis* does not actively multiply in meat (in contrast to common food pathogens such as *Salmonella*). Raw beef is rarely consumed in this country and cooking readily kills M. bovis"[2].

16. Detailed rules on post-mortem procedures and judgements to be made are laid down in the Fresh Meat Directive 64/433/EEC. All carcases and offal must undergo a post-mortem health inspection, under veterinary supervision, before they can be stamped as fit for human consumption. The Directive requires the total condemnation of all carcases with generalised TB. In the case of reactors and inconclusive reactors the directive requires the following action:

    a) no visible lesions: pass fit for human consumption;
    b) lesions restricted to the lymph nodes of one organ or the lymph nodes of one part of a carcase: that organ or part of the carcase condemned;
    c) lesions other than (b) above: carcase and offal totally condemned.

17. Many cattle found to be reactors on tuberculin screening show no visible lesions at post-mortem. A rough breakdown of the 1997 data shows that about 30% of all cattle slaughtered as a result of tuberculin tests were confirmed to be infected with bovine TB on the basis of post-mortem lesions. Regardless of the presence or absence of lesions, material from all epidemiologically significant reactors is sent for mycobacterial culture. In a further 8%, *M. bovis* was recovered on culture of the commonly affected lymph nodes.

18. The Fresh Meat Directive is implemented in GB by the Fresh Meat (Hygiene and Inspection) Regulations 1995 (as amended). These repeat the Directive's requirements for post-mortem inspection. They also define generalised TB and set out in detail those situations in which partial condemnation is allowed. In accordance with the Directive, they allow partial salvage of carcases and offal from TB reactors, inconclusive reactors and slaughterhouse cases with lesions restricted to the lymph nodes of one organ or the lymph nodes of one part of a carcase. However, they also allow partial salvage of carcases in which lesions are not confined to lymph nodes of a single organ or part of a carcase i.e. where some dissemination of disease has occurred. In most cases, however, this is believed to be confined to lymph nodes associated with the site of entry in non-edible tissues (head, respiratory tract and alimentary tract), although recent data on the distribution of lesions found in reactors, inconclusive reactors and slaughterhouse cases is not currently available.

19. On confirmation of TB lesions or a positive mycobacterial culture in an animal *in any bovine herd*, veterinary staff will notify the CCDC and/or the CEHO of the relevant

local authority according to the locally agreed arrangements. The notification upon confirmation of *M. bovis* in cattle will indicate the number of animals infected and the location and type of lesions observed at post-mortem examination. When animals with lesions suspicious of tuberculosis are detected at routine meat inspection in the abattoir, the animal will be traced back to the farm it came from and similar arrangements apply.

Views on the level of protection afforded by current regulations relating to meat from animals with evidence of infection

20. There are two aspects to this question:

- the adequacy of the protection afforded by the Directive as currently implemented in the UK;

- the adequacy of the protection afforded by the Directive if fully implemented.

21. Our knowledge of tuberculosis in cattle, although extensive, is largely based on work carried out before the recent increase in incidence. Experts have raised the possibility that microfoci of viable organisms might be present in edible tissues in the absence of visible lesions, both in animals with disease which appears to be localised to non-edible tissues and in reactor cattle with no obvious active tuberculous lesions. MAFF's Animal Health and Veterinary Group is therefore funding work to investigate the pathogenesis, diagnosis and mathematical modelling of tuberculosis in cattle. In particular, they are going to fund a study of the distribution of lesions in reactor cattle. The Food Standards Agency is also considering funding work to enumerate *M. bovis* in the tissues of reactor cattle and cattle with evidence of active infection, both localised and generalised.

22. The question of an assessment of the risk associated with eating meat from the partially-salvaged carcase of an animal with localised disease, or from a reactor animal with no evidence of disease, was under consideration by MAFF prior to the establishment of the Food Standards Agency. Responsibility for this has now transferred to the Agency. The FSA's Chairman has considered the question and has requested that the Agency commission a small, short enquiry through a sub-group of the ACMSF.

Proposed ACMSF subgroup

23. It is hoped that draft terms of reference, suggested membership and a timetable will be available to be tabled at the meeting. In order to progress this matter without further delay members are asked to agree in principle to the setting up of a working group with terms of reference along the following lines:

> "To review the possible health risks associated with consumption of meat from animals with evidence of *M. bovis* infection, including reactor animals with no post-mortem evidence of active disease, and to advise on the adequacy of current control measures."

REFERENCES

1. The zoonotic importance of *Mycobacterium bovis*. Tubercle and Lung Disease 1996;**77**:103-8.

2. Bovine tuberculosis in cattle and badgers. Report to the Rt Hon Dr Jack Cunningham MP by Professor John R Krebs and the Independent Scientific Review Group. MAFF, 1997.