Surveillance of contagious bovine pleuropneumonia in Switzerland

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Summary: An active surveillance system for contagious bovine pleuropneumonia (CBPP) has been established in Switzerland. The system is based on the detection of typical gross pathological lesions in the lungs of slaughtered cattle, followed by microbiological analysis of the sampled organs and sero-epidemiological investigation of the herd of origin for each suspect case. The programme was tested over six months. The prevalence of lung lesions detected in carcasses during this period in the 108 participating abattoirs was 0.04%, but *Mycoplasma mycoides* subsp. *mycoides* SC was not isolated from any of these organs. On the basis of the results presented, there is no evidence of CBPP in Switzerland. The surveillance programme will continue, however, in order to document the situation and eventually obtain a disease-free status in accordance with international standards.


INTRODUCTION

Contagious bovine pleuropneumonia (CBPP) is a highly contagious disease, caused by *Mycoplasma mycoides* subsp. *mycoides* SC, which affects the lungs of adult cattle (*Bos taurus*), domestic buffalo (*Bubalus bubalis*) and zebu (*Bos indicus*) (17). The causative agent is a member of the so-called *mycoides* cluster, a group of six *Mycoplasma* species showing serological and genetic similarity (9, 11, 15, 18). The common cross-reactions between these species complicate serological diagnosis. For the description of clinical and pathological signs, readers are referred to recent reviews (16, 19).
CBPP was eradicated from Europe by the end of the 19th century, but since 1980 new outbreaks have been reported from France, Portugal, Spain and Italy (19). Chronic forms predominate in these countries. This seems to be typical for endemic situations, and may be due to favourable housing and climatic conditions, as well as the use of antimicrobial and anti-inflammatory drugs, which can mask the clinical signs. Outbreaks of CBPP were also reported from numerous African countries in 1993 (4).

In Switzerland, the last case of CBPP was confirmed in 1895. Since then, no classical signs of the disease have been observed by the national Veterinary Services, although CBPP has always been listed as a notifiable disease in the Swiss animal health regulations (1). In view of this situation, Switzerland has been considered free from CBPP. In 1992, however, several Swiss cattle exported to Italy were tested for anti-CBPP antibodies on arrival and were found to have positive titres. This incident raised the question of the health status of Swiss cattle and led to a reactivation of the surveillance system. A study was initiated with the aim of developing a more active approach to CBPP reporting, in order to provide documentation of the disease-free status of the country (20).

MATERIAL AND METHODS

Principles of the Office International des Epizooties with regard to disease-free status

The Office International des Epizooties (OIE) first published guidelines for the declaration of freedom from a disease in the context of rinderpest (2). In 1993, an OIE ad hoc expert group suggested a similar procedure for CBPP (5). The basic principle is a step-by-step approach, consisting of different levels of freedom which can be obtained when certain criteria and time limits have been met. Only provisional freedom from disease may be declared by the applying country itself, as the subsequent stages need to be officially declared by the OIE before they are accepted internationally. A central element in this procedure is the operation of an active surveillance system, in addition to routine reporting of clinical cases. In view of the diagnostic problems described above with regard to chronic cases in endemic situations, it has been suggested that effective meat inspection procedures would be the most reliable way to detect CBPP occurrence. All suspect cases must be carefully investigated and documented. This data will form the basis for the eventual declaration of disease-free status by the OIE.

Sampling and analyses

More than 1,500 abattoirs are registered in Switzerland, and not all of these could be included in the study due to organisational difficulties. The decision was taken to select only enterprises where at least 300 cattle are slaughtered per year. With the aid of the annual federal statistics (3), 131 such slaughterhouses were identified. These enterprises accounted for over 87% of all slaughtered cattle. The responsible veterinarians at these abattoirs were contacted and asked to participate in the study. On their agreement, these veterinarians were invited to attend a seminar where they were provided with illustrated documentation and instructed how to check – during routine meat inspection – for typical CBPP lesions in the lungs of cattle older than six months.

Suspect organs were submitted for intensive microbiological investigation, including complete bacteriological examination, using the protocol recommended by the OIE (13); macroscopic and histological descriptions of the lesions were also made. Additional
sero-epidemiological investigations were performed in selected cases when one of the following criteria was fulfilled:

- isolation of any *Mycoplasma* spp.
- typical histological lesions with sterile bacteriology
- extraordinarily suspect gross pathological lesions.

In these cases, the carcass was traced back to its herd of origin and serum samples were taken from all adult cattle in the respective herd. These sera were analysed using a slightly modified complement fixation test (13). Briefly, a 3% suspension of red blood cells and five units of complement titrated at 50% haemolysis were used. The results were interpreted as suggested by Campbell and Turner (8). Reactions of 1/10+ and 1/10++ were considered ‘doubtful positives’, and reactions of 1/10+++ and higher were considered positive. The validity of the serological results was verified using reference sera and by repeat analysis in the OIE Reference Laboratory for CBPP (at CNEVA: Centre national d'études vétérinaires et alimentaires [French National Centre for Veterinary and Food Studies]).

In addition, a number of lungs without apparent lesions were collected using systematic random sampling in seven abattoirs, and samples from these lungs were used for control tests. Lymph nodes and blood samples were also collected for use as controls. These samples were treated in the same way as the suspect lungs identified during routine meat inspection.

**RESULTS**

Of the 131 abattoirs contacted, 108 (82%) agreed to participate in the study. From 1 June to 30 November 1993, 84 suspect lungs were submitted for further examination. During this period, approximately 200,000 adult cattle were slaughtered at the participating abattoirs. Thus, the prevalence of suspect lungs was 0.04%. The geographical origin of cattle with typical lung lesions showed no clustering. The distribution correlated with the density of cattle in each canton (Fig. 1).

All 84 suspect lungs submitted showed gross pathological lesions as described to the meat inspectors. *M. mycoides* subsp. *mycoides* SC could not be isolated from any of these organs, however, while other *Mycoplasma* spp. and bacteria were regularly found (Table I and Fig. 2). The presence of antibiotics was evident in thirteen lungs, but these showed no lesions which were macroscopically or histologically characteristic. In six cases, additional sero-epidemiological investigations were performed in the herds of origin. Of the 124 blood samples collected, 98% yielded negative reactions. Two sera were doubtful and had titres of 1/10++ and 1/10++++, respectively. None of the animals in these herds showed clinical signs of pulmonary disease.

None of the 72 lungs collected randomly as controls harboured *M. mycoides* subsp. *mycoides* SC, while six were contaminated with *Streptococcus viridans*, *E. coli* or mixed flora; the rest were sterile. Only one of the 67 blood serum samples from these carcasses yielded a positive anti-CBPP antibody titre (1/20++).
Origin of cattle with lung lesions suspected of being caused by contagious bovine pleuropneumonia
Figures indicate the number of suspected cattle in each canton

TABLE I

Bacteriological diagnosis of suspect lungs

<table>
<thead>
<tr>
<th>Bacteriological diagnosis</th>
<th>Isolations</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actinomyces pyogenes, Fusobacterium necrophorum and/or mixed anaerobic flora</td>
<td></td>
<td>43</td>
<td>45.2</td>
</tr>
<tr>
<td>Pasteurella haemolytica</td>
<td></td>
<td>6</td>
<td>6.3</td>
</tr>
<tr>
<td>Mycoplasma bovis</td>
<td></td>
<td>7</td>
<td>7.4</td>
</tr>
<tr>
<td>Other mycoplasmas *</td>
<td></td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>Other bacteria</td>
<td></td>
<td>10</td>
<td>10.5</td>
</tr>
<tr>
<td>Sterile or negative</td>
<td></td>
<td>24</td>
<td>25.3</td>
</tr>
</tbody>
</table>
| **Total**                                                     |            | 95  | **

* Mycoplasma bovirhinis (4) and Mycoplasma arginini (1)
** more than one diagnosis in 22 cases (n = 84)
In accordance with the recommendations of the OIE (5), Switzerland has been operating an active surveillance system to document freedom from CBPP in this country. The system was designed to have a high probability of detecting CBPP if the disease was present.

Recent CBPP outbreaks in Europe have been characterised by low morbidity, very low mortality and only rare clinical signs (1). In view of the difficulties of diagnosis under such circumstances, the detection of pathological indicators at slaughter was considered to be the most sensitive approach. Every animal slaughtered in Switzerland is subjected to routine meat inspection by veterinarians or other trained personnel. The procedure includes palpation and section of the lungs and bronchial lymph nodes. Furthermore, all meat inspectors are legally obliged to report and investigate all carcasses suspected of infection with OIE List A diseases (1). The infrastructure necessary for an intensified search for typical CBPP lesions was therefore already in place.

**FIg. 2**

Lesions in cattle lung, similar to contagious bovine pleuropneumonia lesions, but found to be caused by bacteria other than *Mycoplasma mycoides* subsp. *mycoides*

**DISCUSSION**

(a) *Pasteurella haemolytica*
(b) *Haemophilus somnis*
(c) *Mycoplasma bovis*
(d) *Fusobacterium necrophorum*

and other anaerobic bacteria
This study concentrated on the larger abattoirs, representing more than 87% of cattle slaughtered in Switzerland. The response rate from abattoirs invited to participate in the study was 82%. This sample was considered to be representative of the total number of slaughtered cattle. The overall prevalence of suspect lungs from these abattoirs was very low (0.04%). Most of the submitted organ samples showed lesions similar to those typical for CBPP as shown and described to the meat inspectors during an information meeting and through an instruction leaflet. *M. mycoides* subsp. *mycoides* SC could not be isolated from these lungs, however, although a number of cultures showed the presence of various other *Mycoplasma* spp. The isolation of *Mycoplasma bovis* in seven cases was particularly surprising. In recent years, *M. bovis* has been isolated increasingly often, but this was the first recorded isolation of this organism from lung tissue (12). In view of the high pathogenity of *M. bovis*, this situation must be closely monitored in the future.

The results of serological analysis were negative in over 98% of cases. The percentage of positive results obtained (2%) was well within the range of uncertainty of the complement fixation test. Other sero-epidemiological investigations in Switzerland, however, showed that up to 3.5% of blood samples taken from clinically healthy cattle may react positively for CBPP (1). These positive results were generally at low titres and, as the same samples yielded negative results when re-tested some weeks later, the results were probably due to non-specific cross-reactions with other *Mycoplasma* spp. from the *mycoides* cluster. This phenomenon is known from other studies and has been described in the literature (10, 14, 17). The probable low prevalence of genuine reactors and the possibility of non-specific reactions, which both contribute to a low positive predictive value of the diagnostic test, constitute the major factors impeding the efficiency of any large-scale serological screening programme.

Summarising the results from the first round of surveillance, there is no evidence of CBPP in Switzerland. The gross pathological signs which occur in CBPP cases are far from pathognomonic. Similar lesions (especially ‘marble lung’) may be caused by other agents. Nevertheless, these altered lungs can still be considered as high-risk indicators. Random sampling of non-suspect lungs provided no additional information and, in any event, this would not be practicable within the routine slaughter process.

Active surveillance of CBPP will be continued in all Swiss abattoirs with the aim of obtaining CBPP-free status as recognised by the OIE. The results of the study and all details of the future surveillance procedure have been communicated to all meat inspectors (6). A reference laboratory has been designated (Institute of Veterinary Bacteriology, University of Berne) and a standard protocol has been established for the investigation of suspect cases; this protocol includes epidemiological examination of the herd of origin, and will be integrated into the future version of the animal health ordinance (7). To maintain vigilance, however, it will be vital to continue providing information and reminding inspectors that careful CBPP surveillance is extremely important. Experience has shown that diseases with very low prevalence tend to be forgotten after a while.

**CONCLUSION**

The CBPP surveillance system applied in Switzerland, based on slaughterhouse observations and subsequent case investigations – as recommended by the OIE *ad hoc*
expert group – is considered to be a practical and reliable solution for countries without clinical CBPP cases. The programme will be continued in Switzerland and can be recommended to other countries lacking documentation of their CBPP-free status.

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Résumé : La Suisse s’est dotée d’un système de surveillance active de la péripneumonie contagieuse bovine, fondé sur la recherche des lésions macroscopiques caractéristiques dans les poumons des bovins après abattage, sur l’analyse microbiologique des prélèvements et sur la réalisation d’une enquête séro-épidémiologique dans le troupeau d’origine de chaque animal suspect. Le programme a été testé pendant six mois. La prévalence des lésions pulmonaires décelées sur les animaux abattus, pendant cette période, dans les 108 abattoirs associés au programme, était de 0,04 %, mais Mycoplasma mycoides subsp. mycoides SC n’a été isolé sur aucun de ces organes. D’après les résultats obtenus, il n’y a aucune preuve de l’existence de la péripneumonie contagieuse bovine en Suisse. Le programme d’épidémiosurveillance sera néanmoins maintenu pour permettre à la Suisse, résultats à l’appui, d’obtenir le statut de pays indemne de la maladie conformément aux normes internationales.


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Resumen: En Suiza se ha implantado un sistema de vigilancia activa contra la pleuroneumonía contagiosa bovina. Este sistema está basado en la detección de las lesiones pulmonares características que presentan las reses sacrificadas, seguida del análisis microbiológico de las muestras de órganos y del examen sero-epidemiológico del rebaño de origen de todos los casos sospechosos. El programa fue sometido a prueba a lo largo de seis meses. Durante dicho
periodo, la prevalencia de lesiones pulmonares detectadas en canales de los 108 mataderos participantes fue del 0.04%, pero en ninguno de los casos se aisló Mycoplasma mycoides subsp. mycoides SC. Sobre la base de los resultados descritos, no existe prueba alguna de la presencia de pleuroneumonía contagiosa bovina en Suiza. No obstante, va a darse continuidad al programa de vigilancia, con el fin de documentar la situación y de obtener en último término el estatuto de país libre de la enfermedad conforme a las normas internacionales.


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REFERENCES


