SURVEILLANCE OF INFECTIOUS DISEASES IN ANIMALS AND HUMANS IN SWEDEN 2020

Chapter excerpt -

Paratuberculosis

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Cover: Juvenile mink in hand. Photo: Elina Kähkönen

Reporting guidelines: Reporting guidelines were introduced in 2018 for those chapters related to purely animal pathogens. The guidelines build on experiences from several EU projects, and have been validated by a team of international experts in animal health surveillance. The aim is to develop these guidelines further in collaboration within the global surveillance community and they have therefore been made available in the form of a wiki on the collaborative platform GitHub (https://github.com/SVA-SE/AHSURED/wiki). Feel free to contribute!

Layout: The production of this report continues to be accomplished using a primarily open-source toolset. The method allows the source text, produced by authors, to be edited independently of the template for the layout which can be modified and reused for future reports. Specifically, the chapter texts, tables and captions are authored in Microsoft Word and then converted using pandoc and R to the LaTeX typesetting language. Most figures and maps are produced using the R software for statistical computing and the LaTeX library pgfplots. Development for 2020 has further improved the importing of content from Excel files to automatically build figures in the pgfplots LaTeX library. The tool is available as an R-package on GitHub (https://github.com/SVA-SE/mill/). The report generation R-package and process was designed by Thomas Rosendal, Wiktor Gustafsson and Stefan Widgren. In 2020, final typsetting was done primarily by Wiktor Gustafsson with contributions from the report authors.

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Paratuberculosis

The voluntary surveillance programme for paratuberculosis includes all main beef breeding herds in Sweden. Photo: Bengt Ekberg/SVA.

BACKGROUND

Paratuberculosis, caused by *Mycobacterium avium* subsp. *paratuberculosis* (MAP), is a common disease of ruminants in most parts of the world. Throughout the 20th and 21st century, detection of cases in Sweden has been followed by whole herd stamping-out, tracing and sanitation measures, with the goal of eradicating the disease and to prevent spread of infection, should it be introduced.

Previous cases of MAP in Sweden have all been directly or indirectly linked to imported beef cattle. The latest case of MAP was detected in 2005, in an imported beef bull. Paratuberculosis has never been detected in dairy cattle, other ruminant species or wildlife in Sweden.

Previous active surveillance

Several screenings in cattle were initiated after detection of a positive beef cow in 1993:

- Screening of 200 dairy herds in the years of 2000, 2003 and 2005.
- Screening of sheep herds during the years 1993–2011, first with serology, then with faecal culture.
- In 2007–2009 faecal culture screening of beef herds with animals imported during 1990–2005. In 2012, another screening of beef herds with animals imported during 2005–2011 was conducted.
- Risk-based screening of older cows at abattoirs in 2009–2010, including cows older than six years with signs of weight loss, resulted in 1211 sampled cows.
- In 2012–2013, bovine practitioners were encouraged to look for and sample cows with low bodyweight, with or without diarrhoea and 258 samples were analysed by faecal PCR.

DISEASE

Paratuberculosis, also known as Johne's disease, causes chronic diarrhoea and emaciation, resulting in suffering and death. If present, the disease causes great economic losses due to reduced milk production, reproductive losses and increased replacements of affected animals.

The incubation period ranges from months to several years. In areas with endemic infection, clinical disease is most commonly seen at the age of 2–5 years. The bacteria are excreted in the faeces of an infected animal and the normal transmission route is faecal to oral. There is no reliable method to detect the infection in the individual animal during the incubation period.

The zoonotic potential of MAP is a recurring question and there are ongoing discussions about MAP as a possible contributing factor to the development of Crohn's disease in humans.

LEGISLATION

Paratuberculosis has been included in the Swedish Act of Epizootic diseases since 1952 (SFS 1999:657 with amendments). Vaccination is prohibited by law and notification of the infection is mandatory on clinical suspicion. The Swedish Board of Agriculture decides on actions when MAP is detected in a herd. Quarantine and testing at trade and import is mandatory as regulated in SJVFS 1998:70 (amended by SJVFS 2018:29).

SURVEILLANCE

The overall purpose of the surveillance is to document freedom from bovine paratuberculosis and to allow for early detection of the infection and prevent possible spread by early detection of the infection.

Passive surveillance

Notification, sampling and diagnostic testing are mandatory in animals of any ruminant species exhibiting clinical signs that lead to suspicion of paratuberculosis. Sampling includes faecal samples from live animals and post mortem samples from dead or culled animals. The latter consists of samples from the ileal wall, ileal contents and ileocaecal lymph nodes as well as any macroscopic lesions in the intestines. Wildlife is sampled when paratuberculosis is suspected at postmortem.

Post mortem examinations

Since 2004 sampling is performed on all ruminants above one year of age submitted for post mortem examinations as part of the enhanced passive surveillance for MAP. Samples are taken from the ileal wall, ileal contents and ileocaecal lymph nodes and submitted to the National Veterinary Institute. The average number of animals examined per year has been around 370, most of them being cattle, the others being predominantly sheep but also a few goats and exotic ruminants like bison and camelids.

Active surveillance

Programme for targeted surveillance in beef cattle

In the voluntary programme, the target population is beef herds that sell animals for breeding. The programme is managed by Farm & Animal Health and financed by the Swedish Board of Agriculture. In total, at the end of 2020, the voluntary programme for bovine paratuberculosis encompassed 451 herds, of which 426 were of the highest status within the programme. The voluntary targeted surveillance programme includes all main beef breeding herds and a smaller number of dairy herds selling calves to beef herds within the programme.

In affiliated herds, individual faecal samples are collected annually for three consecutive years from all cattle over two years of age. While most of these samples are analysed individually, pooling of samples three and three or five and five, is occasionally done at the lab. Herds affiliated with the programme are only allowed to trade with herds of the same status or higher to maintain their level within the programme. After three years of negative test results, the faecal sampling is replaced by postmortem of all deceased or euthanised cattle on the premises where paratuberculosis cannot be excluded as a cause of culling. In the case affiliated beef herds have sheep in contact with the cattle, the sheep are sampled as well.

Bulk milk testing

To improve the surveillance in the dairy cattle population, bulk milk testing was recently added. The aim was to sample all dairy herds in Sweden and milk samples were originally collected during 2019 and analysed during 2020.

Abattoir testing

To increase the surveillance in beef cattle herds not affiliated to the voluntary surveillance programme, testing of slaughterhouse serum samples from non-dairy cattle was implemented in 2020.

Health controls for export reasons

Testing for MAP is performed for export reasons when requested. The choice of analysis depends on the recipient country.

Diagnostic tests

Samples collected from clinical suspicions and individual faecal samples from the voluntary beef herd control programme are analysed with direct PCR. Samples are pretreated by homogenization in lysis buffer and subsequently DNA is recovered by a robotic extraction system. Real-time PCR is performed using a commercial kit.

Blood and bulk milk samples are analysed with the commercial indirect ELISA kit *ID Screen Paratuberculosis Indirect* on an automated ELISA system (Tecan). Positive reactions in the screening test are manually confirmed using the *IDEXX Paratuberculosis Verification Ab Test*, also an indirect commercial ELISA kit but with improved specificity by using individual negative control samples. Any positive serological reactions are always followed up with stool samples for antigen detection and/or extensive serological retesting in the herd.

Cultures are pre-treated with HPC (an antibiotic to inactivate other bacteria but mycobacteria) and double incubation. Samples are subsequently cultured on modified Löwenstein-Jensen medium supplemented with mycobactin and on Herrolds Egg Yolk medium for up to 4 months. Faecal samples from sheep are cultured for up to 6 months on modified L-J with mycobactin. Direct PCR on a new preparation from the stored samples are performed on cultures with mould overgrowth.

All diagnostic analyses are performed at the National Veterinary Institute.

RESULTS

In 2020, two suspicions of paratuberculosis in cattle, one in moose (*Alces alces*) and one in addax antelopes (*Addax nasomaculatus*) (all wild species from a Swedish zoo) were raised due to clinical signs of the disease. All suspected cases tested negative for MAP with PCR and the suspicions were ruled out.

Bulk milk samples from 3303 dairy herds have been tested, all with negative results except one herd. The test positive herd was followed up by additional bulk milk testing and serological testing of all cows in the herd. All follow-up samples were test negative and MAP was excluded.

In the abattoir serum sampling, 4252 analyses of samples from 2250 herds have been conducted. Three samples had a positive test result, and the source herds are currently under investigation to rule out paratuberculosis.

Moreover, 1170 samples, corresponding to approximately 1377 cattle (there is an uncertainty of 10 animals due to the pooling of samples) from 38 herds, and 25 sampled sheep from 4 herds, were analysed and tested negative within the programme in beef herds. For export reasons, four cattle were tested with serology. Two hundred and seventy-one animals were sampled at post mortem examination; 188 cattle, 69 sheep, 10 goats, 1 bison (*Bison bison*), 2 alpaca and 1 camel (*Camelus bactrianus*). No cases of MAP were detected in the examinations completed in 2020 (Tables 13, 14 and 15).

Table 13: Cattle sampled for paratuberculosis in 2020.

Surveillance in cattle	No. of sampled animals	No. of herds
Beef herd surveillance programme	1377	38
Cattle sampled at post mortem examinations	188	138
Cattle sampled for export	4	2

Table 14: Exotic ruminants sampled for paratuberculosis in 2020.

Surveillance in exotic ruminants	No. of sampled animals	No. of herds
Exotic and wild kept ruminants sampled at post mortem examination[A]	4	4
Exotic and wild kept ruminants sampled for export	0	0

[A] 1 bison, 2 alpaca, 1 camel.

Table 15: Sheep and goats sampled for paratuberculosis in 2020.

Surveillance in sheep and goats	No. of sampled animals	No. of herds
Sheep sampled in cattle herds within the beef herd surveillance programme	25	4
Sheep sampled at post mortem examinations	69	56
Goats sampled at post mortem examinations	10	7

DISCUSSION

If present at all, the prevalence of MAP in Swedish ruminants remains at a very low level. The risk of introduction of paratuberculosis to Swedish herds is assessed to be very low, due to the existing legislation and the low number of animals brought in from other countries.

The screenings of beef herds with cattle imported from 1990–2011 was targeting the highest risk group of animals for MAP in Sweden; MAP has never been detected in any other breeds or species than beef cattle and all cases have been traced back to imported animals with the latest case in 2005.

Fallen stock is considered a risk category for paratuberculosis and therefore all ruminants older than one year of age, submitted for post mortem examination, are sampled for MAP and examined by culture. All herds affiliated to the voluntary programme must send fallen stock for post mortem examination if paratuberculosis cannot be ruled out as a cause for death or culling. The post mortem sampling also includes other susceptible species, like sheep, goats and exotic ruminants. The exotic ruminants are sometimes imported or kept in herds with other exotic ruminants imported from countries where MAP is prevalent.

A previous update of the evaluation of the paratuberculosis surveillance programme indicated that the surveillance sensitivity in the last years has decreased. Testing of bulk milk samples and slaughterhouse serum samples to increase the surveillance in the dairy cattle population and beef cattle herds not affiliated to the voluntary programme is currently being done, to improve the surveillance sensitivity.

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