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Mycotic Abortions in Bovine: A Review

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Abstract

Mycotic abortion is an important reproductive problem of cattle all over the world. It is caused by a number of different species of fungi and yeasts. These usually occur during the winter and spring months, since this is when cows are often kept in total confinement and can be exposed to moldy hay or silage. The epizootiology of the disease is not clearly understood but it is assumed that mouldy hay, straw and feeding stuffs are the most probable transmitting agents. The mold spores are thought to reach the placenta and fetus through the blood supply of the cow, although the way that they gain access to the circulatory system is not well understood. Mycotic abortion in cattle have been recorded usually after first 6 months of gestation. Aborted animals usually suffer from retention of placenta. Fungal abortions tend to occur sporadically although on some occasions a significant percentage (10–20%) of the pregnant animals in a herd may be affected. No treatment has yet been evolved for such abortions.

Keywords: Mycotic abortion; Bovine; Epizootiology; Fungal abortions.

Introduction

Abortion in cattle is a serious problem everywhere in the world where these animals are reared. The implication of fungi in abortion in cattle has received increasing attention during recent years and it is now recognized that mycotic infection contributes significantly to the annual losses from abortion.

Mycotic abortion can cause great economic loss to the stockholders and also a loss of animal proteins to human population which is already facing a very serious problem of shortage of animal proteins. The first record of a fungus isolated from bovine foetal membranes was of *Mucor rhizopodiformis (Rhizopus cohnii)* found growing in a gravid uterus by Theobald Smith (1920).

Mycotic abortion, also known as fungal abortion or mycotic placentitis, is caused by different species of fungi and yeasts. About 35 different species of fungi have been known to cause abortion, *Aspergillus fumigatus* being the most commonly diagnosed casual organism (Jenson et al., 1993).

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This form of abortion occurs sporadically and its prevalence may be influenced by poor quality contaminated fodder harvested in wet seasons. *Aspergillus fumigatus* can proliferate in damp hay, in poor quality silage and in brewers grains. Infection, which reaches the uterus haematogenously, causes placentitis leading to abortion late in gestation. Affected cows usually show no signs of systemic illness. Intercotyledonary areas of the placenta are thickened and leathery and the cotyledons are necrotic. Aborted foetuses may have raised cutaneous plaques, resembling ringworm lesions.

The prevalence of mycotic abortion in cattle is influenced by climatic and other environmental factors. Reports from some regions suggest that fungi may be involved in 7% of bovine abortions (Knudtson and Kirkbride, 1992). Although Aspergillus species account for the majority of cases in many countries, *M. Wolfi, Absidia species, Mucor species and Rhizopus species have also been implicated* and, in some regions, may predominate. Abortion which occurs late in gestation, is often linked to the feeding of mouldy hay or silage. The location of lesions on cotyledons suggest haematogenous infection of the uterus, possibly from a pulmonary or enteric source. The cotyledons are enlarged and necrotic, and the intercotyledonary placental tissue is thickened and leathery. Vasculitis, associated with hyphal invasion, is demonstrable in sections of affcetd cotyledons. Occasionally lesions may be observed grossly on the skin of aborted foetuses.

Abortion due to *M. Wolfi,* an important cause of mycotic abortion may be followed within days by an acute fibrinonecrotic fungal pneumonia (Carter et al., 1973). Because of the difficulty in isolating *M. Wolfi* from autolysed tissues, abortion caused by this organism may be under- diagnosed (MacDonald and Corbel, 1981).

Previous reports indicated that > 60% of cases are caused by uncomplicated infection with *Aspergillus fumigatus;* zygomycetes *(Absidia, Mortierella, Rhizomucor, Rhizopus)* accounted for about 20% of cases, and the remaining 20% were caused by a wide range of opportunistic filamentous fungi and yeasts.

Some of possible pathogens of mycotic abortion include:

Mucor rhizopodiformis,

Absidia corymbifera, Absidia ramosa,

A. flavus, A. fumigates, A. nidulans, A. terreus, A. niger, A. versicolnr

Rhizopus pusillus, Rhizomucor pusillus

Rhizopus arrhizus, Rhizopus boyinus,

Kontospora lanuginose,

Mortierella polycephala,

Polystictus versicolor,

Mucordisperses

Mortierella zychae, Mortirella wolfii,

Candida tropiculis,

Nicardia asterodies, Mortirellla wolfii.

Mycotic Placentitis

The chief fungus associated with mycotic abortion is *Aspergillus fumigatus*, which has been recorded from over 60% of cases. *Absidia ramosa* and *Absidia corymbifera* are also frequent isolates, but the remaining species are rarely reported. Fungi have been recovered from the placenta, amniotic fluid, foetal stomach contents and skin lesions. Very rarely have isolations been made from other organs of aborted foetus (Figs. 1 and 2).

Fig. 1: Mycotic abortion—Portion of bovine placenta with thickened cotyledons infected with Aspergillus fumigatus.

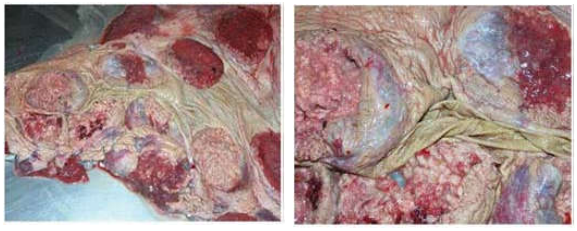

Fig. 2: Mycotic Placentitis.

Epizootiology

Geographical distribution and transmission

The disease has been reported from Europe, North America, South Africa, Australia and parts of Asia. The exact mode of transmission of mycotic abortion is not fully understood and route and source of infection remain unknown. There are

indications that infection is originally derived from the spores of fungi present in large number in the mouldy hay, straw and feeding stuffs and hence in the air of cowsheds (Ainsworth and Austwick, 1959). However, there is no evidence of animal to animal transmission of the disease. The disease is sporadic and rarely affects more than 1 or 2 animals in a herd.

Susceptible hosts include: Cattle, Sheep and Mares.

In the Northern Hemisphere, the incidence of mycotic abortion is highest between November and April, which corresponds to the approximate time when gravid cows are housed indoors and fed hay and/or ensilage. The disease can also occur in beef cattle confined to pens and fed hay as well as those on pasture. Furthermore, cows confined to sheds and fed in cubicals are at greater risk than those fed loose hay in an "open"barn.

Factors influencing susceptibility

- It is assumed that housing of animals in relatively confined spaces predisposes them to infection due to the presence of higher concentrations of fungal spores in the air of cowsheds than that of its surroundings (Turner, 1965).
- Pregnancy in a cow with metabolic derangements from stress may predispose the pregnant cow to fungal infection (Dalling, 1966).
- The incidence of the condition is high in late summer or early autumn, due to the presence of large number of fungal spores in pastures during this period (Stableforth and Galloway, 1959). There is also evidence of a winter rise of disease incidence.

Pathogenesis

- Principal entry of fungi is via the respiratory tract and the route of infection is via the blood stream in the lungs.
- Granulomatous lesions in the lungs could break down under stress, leading to invasion of blood vessels with hyphae.
- Small ulcers in the forestomach and abomasum in the cattle are well known and these may become invaded by the fungi.
- Spread of infection to the blood stream from such ulcers leads to either pneumonia or placentitis (Roberts, 1971).

Symptomatology

- In the experimental disease, a period of about one month lapses between intravenous inoculation of fungal spores and abortion, but natural incubation period is unknown.
- No noticeable symptoms have been recorded in the dam either before or after explusion of dead foetus.
- A tentative clinical diagnosis can be made on the pathological appearance of placenta and particularly the cotyledons and also on the presence of foetal skin lesions.

Lesions

- The placenta shows characteristic changes. The placental lesions are chiefly concerned with the adherence of maternal part of cotyledon to the chorionic part so that these organs appear as raised, solid, yellowish, cushion-like structures, often with a raised and thickened margin.
- Occasionally, the foetus shows skin lesions in the form of diffused white hair on the flanks, neck, axilla and inside the backs.
- Histological examination of the affected cotyledons shows extensive hyperaemia and haemorrhages in the early infection with scattered infiltration of polymorphonuclear leukocytes and eosinophils.

Diagnosis

Criteria for diagnosis

- A diagnosis of mycotic abortion was made when mycotic elements were seen associated with placentitis, fetal dermatitis, or pneumonia.
- Also, morphologic and pigmentation characteristics of hyphae seen in tissues had to be compatible with cultured isolates.
- A provisional field diagnosis can be made by the sporadic nature of the disease, with appearance of placental and foetal skin lesions.
- Abortions usually occur late in pregnancy and the palcenta is usually retained.
- Confirmation of mycotic abortion is made by microscopical and cultural examination.
- Hyphae may be detected by direct examination of wet preparations of affected

cotyledons and abomasal contents.

- The fungi are isolated from abomasal contents and cotyledons.
- Foetal stomach contents provide more useful material for culture and produce a pure growth of causative organisms.

Specimens

In some instances, fetal placenta and abomasal content but no other fetal tissues were available. Occasionally, formalin-preserved fetal and placental tissues along with abomasal content or only formalin-fixed tissues were examined.

Gross examination

For the diagnosis of mycotic infection, a sterile disposable syringe was used to aseptically collect l–3 ml of abomasal content. In addition, a piece of placenta with 2 or 3 cotyledons was placed in a sterile plastic bag, and depending on the availability of fetal tissues, portions of lung, eyelid, and skin (if there was evidence of dermatitis)were collected.

Mycological examination.

- Portions of placenta containing 2 or 3 cotyledons were placed in a beaker, washed in running tap water l–3 min to remove extraneous debris, then blotted with sterile paper towels.
- A sterile scalpel was used to scrape a small amount of material from the cut surface of all cotyledons, caruncles, and any fetal skin that had gross lesions.
- This material fetal lung that had been macerated with a sterile mortar and pestle, and 0.2 ml of fetal abomasal content were separately spread onto the surface of plates of Sabouraud Dextrose Agar (SDA) containing 1000 units/ml of Penicillin-G. Solid media were incubated at both room temperature and 37°C.
- Thereafter, primary isolation was performed only at 37°C. Plates were examined daily for the first week and twice each week for the next 2 weeks.
- Portions of detectable mycotic growth were transferred to Potato Dextrose Agar (PDA) and SDA plates and slants.
- PDA was used as a growth medium for slide cultures, which were incubated 3–7 days and then stained with lactophenol cotton blue.
- Identification of filamentous isolates was made from gross and microscopic characteristics.
- Yeasts were identified from carbohydrate assimilation patterns.

Direct microscopic examination

A small portion of each placental tissue, fetal skin with gross lesions, or abomasal content was placed on a glass slide with a drop of 10% potassium hydroxide, heated slightly over an open flame, and examined for mycotic elements by light microscopy.

Histologic examinations

Portions of placental cotyledons, intracotyledonary tissue with gross lesions, caruncle, fetal eyelid, skin with gross changes, and parenchymatous organs were fixed in 10% phosphate-buffered formalin, pH 7.0. Tissues were embedded in paraffin, sectioned 7 μm thick, and stained with hematoxylin and eosin. Gomori methenamine silver and periodic acid (Schiff's) stains were used to stain mycelial elements in tissue sections.

Isolation and Identification

A. fumigatus isolation is carried out on Sabourauds dextrose agar without cyclohexamide. The cultures are incubated aerobically at 37^0C for upto 5 days. A.fumigatus colonies rapidly become velvety and granular and bluish green with narrow white pheriperes. Older colonies are slate-grey.

Absidia, Mucor and Rhizopus

Growth of Absidia, Mucor and Rhizopus species is rapid, filling the petridish with greyish or brownish - grey fluffy colonies within a few days.

Absidia corymbifera: Rapid growth, wooly and white becoming olive grey. Fills petridish like Rhizopus. It is thermotolerant and grows at 45°C.

Mucor: Colonies spread right across petridish but growth is low. Pale grey or yellowish brown at 37°C

Rhizopus: Coarse, rampant growth. Petridish is filled in 5 days with dense, wooly mycelium. White at first, becoming greyish and surmounted by black pin-head-sized sporangia.

Rhizomucor pusillus: Rapidly growing, cottony colonies. White but surrounded by brown

sporangia. Thermophilic with growth at 50°C–60°C.

Mortierella wolfi: M. Wolfi has characteristic white velvety colonies with lobulated outlines giving a rosette appearance colonies are about 5 cm in diameter after incubation for 4 days.

C. albicans: Isolation out on Sabourauds dextrose agar with cyclohexamide. Colonies are whitish, shiny and convex 4 to 5 mm in diameter after incubation for 3 days at 37°C

Differential diagnosis

Diagnosis of mycotic abortion presents great difficulties because a number of infectious and non-infectious agents are known to cause abortion in cattle. Abortion resulting from various infectious causes must be differentiated from mycotic abortion. Confirmation lies in the isolation of specific etiologic agent.

Prognosis

There is conflicting evidence regarding the effect of uterine fungal infection on the subsequent breeding performance of the cow. Resumption of regular breeding is certainly not ruled out by mycotic abortion, but there is not sufficient information to estimate the future performance of an affected cow.

Treatment

No clinical symptoms have been observed in the dam either before or after abortion and no treatment has ever been given to the affected animals.

Control

- Since the epizootiology of mycotic abortion is obscure, evidence on the methods of control is speculative.
- If mouldy hay and straw are assumed to be the commonest source of infection, a careful watch on the quality of these materials is essential, so that any sample that appears excessively dusty may be rejected.
- Dust has been shown to consist chiefly of fungal spores of various types, but more especially the spores of mycotic abortion.
- Treatment of hay with some suitable fungicide during haymaking should be done in order to reduce subsequent mould growth.
- Housing of animals in relatively confined spaces should also be avoided because some evidence indicates that air of over-crowded cowsheds is rich in spores of fungi and can cause abortion.

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