BOVINE EURYTREMATOSIS: Life Cycle, Pathologic Manifestations and Public Health Considerations[1]

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ABSTRACT: This article describes the life cycle, pathologic manifestations and aspects of public health relative to infection of *Eurytrema sp.* in beef cattle and offers concise information to assist those involved in meat inspection. *Eurytrema* sp. produces interstitial pancreatitis with subsequent ductal obstruction and is being considered as the principal cause of rejection of pancreas in some Brazilian states. Methods to identify and diagnose gross alterations of infection by *Eurytrema* sp. in beef cattle as well as aspects related to this disease are also discussed.

Index terms: *Eurytrema* sp., pancreas, meat inspection, bovines.

EUTREMATOSE BOVINA: Ciclo Biológico, Manifestações Patológicas e Considerações de Saúde Pública

RESUMO: Este artigo descreve o ciclo biológico, as manifestações patológicas e os aspectos de saúde pública relacionadas com infecções por *Eurytrema* sp. em bovinos de corte e fornece informações para ajudar os profissionais envolvidos na inspeção de carne. Infecções por *Eurytrema* sp. induz pancreatite intersticial com obstrução ductal subseqüente, sendo considerada como a principal causa de rejeição de pâncreas em alguns estados brasileiros. São discutidos os métodos de identificação e de diagnóstico das alterações macroscópicas induzidas por *Eurytrema* sp. em bovinos de corte bem como os aspectos relacionados à sua infecção.

Descritores: *Eurytrema* sp., pâncreas, inspeção de carne, bovinos.

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Introduction

Bovine eurytrematosis is caused by three trematodes, *Eurytrema coelomaticum, Eurytrema pancreticum,* and *Eurytrema fostosunm* of the family *Dicrocolidae* (SOULBSY, 1982). These trematodes live in the pancreatic duct and occasionally in the bile ducts of ruminants (SOULSBY, 1982; MATTOS JUNIOR & VIANNA, 1987; JUBB, 1993). A similar fluke, *E. procyonis*, has been described in the pancreatic ducts of small carnivores (FOX; MOSLEY; VOGLER; AUSTIN & REBER, 1981; JUBB, 1993). Infection by these flukes induces interstitial pancreatitis with subsequent ductal obstruction. Chronic pancreatitis induced by *Eurytrema* sp. may turn the pancreas unsuitable for commercialisation (MATTOS JÚNIOR & VIANNA, 1987), as well as insulin production (FOX, MOSLEY, VOGLER, AUSTIN, REBER, 1981; GRAYDON; CARMICHAEL; SANCHEZ; WEIDOSARI & WIDJAYANTI, 1992). These lesions have also been related to reduced milk and meat production (MATTOS JÚNIOR & VIANNA, 1987).

Infection by *Eurytrema* sp. has already been described in Asia, Brazil, China, Europe, India, Indonesia, Japan, the islands of Madagascar and Mauritania, and Oriental Russia (BASCH, 1966; CORREIA, CORREIA, FERREIRA, PAES, 1984; MATTOS JÚNIOR & VIANNA, 1987). In Brazil, descriptions have been made in the states of Minas Gerais, Rio de Janeiro, Rio Grande do Sul, and Santa Catarina (BRANT, 1962).

Pancreatitis by *E. pancreaticum* has been described in bovine, bubaline, camelid, caprine, cervine, lagomorphus, ovine, and swine (BASCH, 1966; SOULSBY, 1982; CORREIA et al, 1984; MATTOS JÚNIOR & VIANNA, 1987;), and was also observed in human beings (MATTOS JÚNIOR & VIANNA, 1982). *E. coelomaticum* has already been found in bovine (SOULBSY, 1982; MATTOS JÚNIOR & VIANNA, 1987), caprine, ovine, camelid, and bubaline species (MATTOS JÚINOR & VIANNA, 1987).

The present article describes the life cycle, pathologic manifestations and public health aspects of infections caused by *Eurytrema* sp. so as to provide concise understanding of these processes and clarify doubts relating to pathologic manifestations. This article serves as a guide for veterinary practitioners involved in federal meat inspection so that they could be correctly oriented. The fact that the frequency of bovine eurytrematosis is increasing while relative documented information is scarce also supports the relevance and importance of this article.

Life Cycle

Eggs are passed in the faeces and are ingested by land snails, *Bradybaena similaris,* which in Brazil has been demonstrated to be the first intermediate host (MATTOS JÚNIOR & VIANNA, 1987). This host must eat the eggs of the trematode before hatching occurs (BASCH, 1966). After ingestion, the eggs are deposited in the digestive tract of the mollusc giving rise to the miracidium, who then penetrates the digestive tube of the host, growing until she has been transferred into the mother-sporocycst (BASCH, 1966). At this stage the mother-sporocyst resembles a rounded mass and is found fixed to the external surface of the intestinal wall of the mollusc. Laden with daugther-sporocysts, development of the mother-sporocycst continues, until completion of the post-infection phase, which occurs within 90 days at a temperature of 26°C. When environmental conditions are favourable, this period could be extended to 250 - 350 days (MATTOS JÚNIOR & VIANNA, 1987).

The daugther-sporocyst leaves the mother-sporocyts by migrating on the external surface of the digestive tract until she has reached the opening of the respiratory aperture (BASCH, 1966; MATTOS JÚNIOR & VIANNA, 1987). The daugther-sporocyst is eliminated externally after which she has to be ingested by another intermediate host to continue the cycle (BASCH, 1966). The second intermediate hosts of *E. coelomaticum* and *E. pancreaticum* are various species of grasshoppers, *Conocephlaus maculatus, C. chimensis, C. melas*, and *C. gladiator* from the *Tettigoniidae* family (MATTOS JÚNIOR & VIANNA, 1987).

In this intermediate host, the cercaria perforates the intestinal wall producing a cyst within the hemocoelic cavity (BASCH, 1966; MATTOS JÚNIOR & VIANNA, 1987). Birth of the metacercaria occurs within three weeks (BASCH, 1966). Maturation of the cercaria into metacercara is temperature influenced; an increase in temperature directly increases the maturation rate, permitting maturation in 15 days at 30ºC (MATTOS JÚNIOR & VIANNA, 1987).

The definite hosts (cattle) are normally infected during accidental ingestion of infected grasshoppers along with forage. Metacercariae are encysted in the duodenum, migrate via the accessory pancreatic ducts and are distributed throughout the tributary pancreatic ducts (BASCH, 1966). However, in rare cases the bile duct can also be infected (KING & LEE, 1983; JUBB, 1993). Egg production has been estimated to begin within seven weeks in goats and cattle (BASCH, 1966). The entire transmission of this trematode is passive, i.e., each phase must be ingested by the following host so that there is continued growth of this parasite (BASCH, 1966; MATTOS JÚNIOR & VIANNA, 1987). The pre-patent period is between 90 to 100 days, while the patent period could be extended between one to two years (MATTOS JÚNIOR & VIANNA, 1987).

The Importance Of Meat Inspection

E. coelomaticium is of great importance in meat inspection because of the increasing frequency with

which it has been observed in beef cattle slaughter-houses within several Brazilian states (SANTOS, 1986; MATTOS JÚNIOR & VIANNA, 1987). Additionally, *E. pancreaticum* is probably the trematode that occurs more frequently within the State of São Paulo, Brazil, where an infection rate of 42.7% was observed in cattle originating from the municipality of São Manoel (SANTOS, 1986),

Animals infected by *Eurytrema* sp. are frequently found in poor body conditions (MATTOS JÚNIOR & VIANNA,1987), and should be separated for observations. However, manifestations of this infection is normally passed unnoticed, so therefore adequate *post mortem* inspections is of utmost importance to determine the presence of these parasites (MATTOS JÚNIOR & VIANNA,1987).

The importance of adequate meat inspection procedures has also been stressed by SANTOS (1986). This author has indicated that due to the anatomic location of the pancreas, a thorough inspection of the pancreas adhered to the intestine, as well as to the liver, must be done after the evisceration of the abdomen. Further, the operator must be cautious to prevent contamination via perforation of the intestines.

To obtain adequate results on examining portions of the pancreas stuck to the intestine, inspection should be done by sight and palpation, and additionally two incisions should de done in direction of the pancreatic ducts. Federal Meat Inspectors should always be cautious to observe the presence of darkened points and cords contrasting the normal yellowish-red colour of the pancreatic parenchyma. When such an area has been located, an incision should be made to verify trematodes (SANTOS, 1986). Additionally, according to this author, Meat Inspectors should cut and scrape the pancreas to remove any blood that might have remained after the evisceration of the intestines, which could have made the identification of the these flukes or, the possible indication of their presence, difficult.

During Federal Meat Inspection, it is important to identify these parasites in an attempt to prevent the approval of contaminated beef. More information relating to the occurrence of these trematodes in slaughtered cattle is needed, since the parasite has already been described in humans (MATTOS JÚNIOR & VIANNA, 1987), and as such, could possibly have unknown zoonotic properties.

Criterion For Judgement

Article Nº 192 of the Regulation for Industrial Inspection of Products of Animal Origin - RIISPOA (1952), recommends the condemnation of pancreas infected by *E. coelomaticium*, but does not provide any information relative to the inspection of the pancreas. Therefore, pancreatic lesion induced by *Eurytrema* sp. infection would not be easily recognised by meat inspectors. Consequently, pancreas visibly infected by this fluke would be rejected, while pancreas infected but without external lesion (SANTOS, 1986), would be approved at inspection.

Pathologic Manifestations

There exist an interesting theory that relates the weight of infected and uninfected bovine pancreas to the number of trematodes, where the increasing weight is directly proportional to the number of trematodes within an infected pancreas (MATTOS & VIANNA, 1987). However, more detailed experimental studies must be realised to determine the efficiency of this relationship.

The size of the adult fluke is inversely proportional to the intensity of pancreatic destruction (BASCH, 1966), reflecting an absence of fluke nutrition due to tissue destruction. In those pancreases with minimal tissue destruction, adult flukes are large, active and restricted to larger ducts, while in severely damaged pancreases, flukes are stunted or shrunken and are found within tiny ducts (BASCH, 1966).

Gross identification of infection by *Eurytrema* sp. in pancreas is facilitated by darkened spots and cord-like formations contrasting the creamish-red colour of the normal parenchyma (SANTOS, 1986). In some cases, pancreatic hypertrophy and atrophy have been associated with infection by *Eurytrema* sp. (GRAYDON, CARMICHAEL, SANCHEZ, WEIDOSARI, WIDJAYANTI, 1992; SANTOS, 1986). In chronic infection the pancreas has been described as firm and fibrinotic, or fatty and flaccid (BASCH, 1966)

Microscopically, lesions are inconsistent. Varying from the presence of the parasites in the pancreatic ducts associated to minimal tecidual response (BASCH, 1966; GRAYDON et al., 1992), destruction of the superficial pancreatic epithelium (BASCH, 1966), granuloma formation, substitution of exocrine pancreatic cells by fibrous tissue, and central lobular necrosis in chronic cases (GRAYDON et al., 1992). Cases of central lobular necrosis have been associated with glucosuria in sheep (GRAYDON et al., 1992). In most cases the adult trematode and eggs are found in the lumen of the pancreatic duct where there is diffuse cellular proliferation at the sites of penetration by the flukes (BASCH, 1966; GRAYDON et al., 1992).

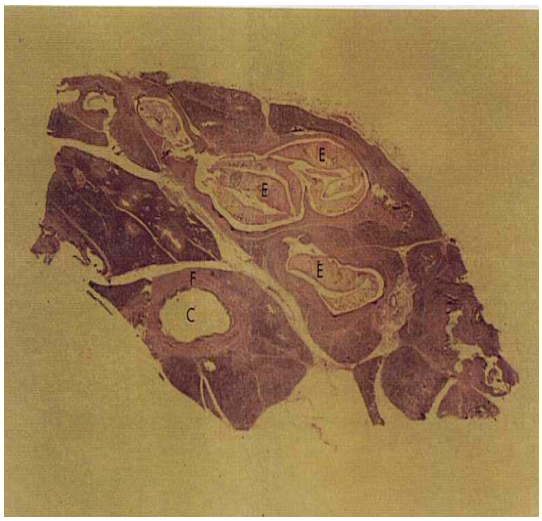

Figura:

Microscopic investigation realised at the Veterinary Pathology Unit, Universidade Federall de Santa Maria, suggests that not only the ducts, where these parasites are housed are damaged. Occasionally the entire acinar tissue of the pancreatic tract is also damaged, this being substituted by fibrous tissue (Fig. 01). Proliferation of the connective tissue induces destruction of the glandular acinus, conserving the Islets of Langerhans and the lymphatic infiltrate, this being evident around the points where trematodes are found. This chronic infection is associated with secondary atrophy of the parenchyma, obliteration and obstruction of the pancreatic ducts, with accumulation of eggs within these ducts. In advanced stages, a pronounced lymphatic infiltration with discrete fibrosis could be observed (MATTOS JÚNIOR & VIANNA, 1987). Flukes of the genus *Eurytrema* sp. adopt the pancreatic duct as their primary habitat, although they may, simultaneously, infect the biliary tract. Infection within the pancreatic duct leads to chronic interstitial pancreatitis (JUBB,1993), and may inhibit the secretion of pancreatic enzymes making enteric digestion difficult (MATTOS JÚNIOR & VIANNA, 1987; GRAYDON et al.,1992).

Conclusions

Infectious chronic pancreatitis by *E. pancreaticum* and *E. coelomaticium* are the principal causes of rejection of pancreas in some Brazilian states. These parasites habit the pancreatic duct producing interstitial pancreatitis and subsequent ductal obstruction. Pancreatic lesions are associated with the presence of the adult fluke as well as the eggs of the parasite.

Although there are descriptions of hypertrophy and atrophy (SANTOS, 1986), of the pancreas relative to infection by the fluke, both alterations described are in fact atrophy. This is because in the hypertrophic form of infection induced by the fluke there is an increase in the size of the organ due to fibrous proliferation without a corresponding increase of the parenchyma.

Even though there are reports of digestive disturbances induced by the impediment of the liberation of pancreatic enzymes to the intestine (FOX et al., 1966; MATTOS JÚNIOR & VIANNA, 1987; GRAYDON et al, 1992), in most cases there are no corresponding clinical signs. There are not sufficient documented literature to support the theory that *Eurytrema* sp. induces diabetes in animals by reducing the liberation of insulin (FOX et al., 1966). Insulin is produced within the endocrine section (islets) of the pancreas and is not eliminated by the ducts. Further, it has been confirmed that the islets are less attacked, and that the regions frequently attacked in eurytrematosis are the pancreatic ducts and the acinar (exocrine) parenchyma (JUBB, 1993).

The fact that *E. pancreaticum* has already been identified in human beings (MATTOS JÚNIOR & VIANNA, 1987), should not be ignored. However, more epidemiological data must be obtained and analysed to establish the frequency as well as the form of transmission to human beings, thereby discovering the potential of this fluke as a threat to human health.

Finally, it is important that the Meat Inspectors of the Federal Inspection Service obtain more training in the identification of the gross lesions of bovine eurytrematosis and the methods of verification, principally when these gross lesions are not pronounced, thereby preventing the non-detection of contaminated carcasses.

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