

YERSINIOSIS IN CAPTIVE CAPYBARAS (*HYDROCHAERIS HYDROCHAERIS*)

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Summary: Four young female capybaras (*Hydrochaeris hydrochaeris*), three to four months old, died in the late autumn of year 2001 in the Ljubljana Zoo. Three of them were submitted for dissection. Granulomatous lesions in small intestine and mesenteric lymph nodes with severe haemorrhagic enteritis and ascites were found in all capybaras. Microscopically pyogranulomatous enteritis, lymphadenitis, hepatitis, splenitis, and pneumonia were diagnosed in two capybaras and pyogranulomatous enteritis, lymphadenitis, hepatitis, splenitis and diffuse fibrinopurulent pneumonia in one. *Yersinia pseudotuberculosis* was isolated from small intestine, liver, lung and spleen from all dissected capybaras.

Key words : Capybara (*Hydrochaeris hydrochaeris*); pathology; pyogranulomatous lesions, *Yersinia pseudotuberculosis*

Introduction

Yersiniosis is an infectious bacterial disease caused by *Yersinia pseudotuberculosis*, a small, gram negative, aerobic, pleomorphic coccobacillus, which causes disease in rodents, lagomorphs, nonhuman primates (1, 2), birds, carnivores, ungulates, reptiles and many other animal species (3, 4, 5, 6, 7, 8) including humans (9, 10, 11). Among free-living animals yersiniosis appears to be an important disease of hares (12) and doves (13), but the most affected seem to be animals from the Zoos and wildlife parks (3, 4, 5, 8, 14).

Infection with *Y. pseudotuberculosis* is usually acquired orally, while feeding with food, contaminated with feces of carriers, mostly rodents and birds (5, 13, 15).

We described pathomorphological lesions in naturally occurring yersiniosis in three capybaras (*Hydrochaeris hydrochaeris*) from Ljubljana Zoo. Capybaras belong to the order Rodentia, which is very susceptible for yersiniosis although to date only a few cases were reported but not described in this animal species (4, 16).

Materials and methods

Capybaras were dissected at the Institute of Pathology, Forensic and Administrative Veterinary Medicine of Veterinary Faculty in Ljubljana. Representative specimens of spleen, liver, mesenteric lymph nodes, small intestine, lungs, kidneys and myocardium were fixed in 10% neutral buffered formalin for 24 hours, routinely embedded in paraffin, sectioned at 4 µm and stained with hematoxylin and eosin (HE).

Samples of spleen, liver, mesenteric lymph nodes, small intestine, lungs and kidneys were inoculated on blood agar (nutrient agar Oxoid, Unipath Ltd., Basingstoke, UK, supplemented with 5% of ovine blood) and Drigalski agar. Inoculated plates were incubated at 37° C for 48 hours, even though the colonies were visible after 24 hours of incubation. Subcultures for *Y. pseudotuberculosis* identification were also prepared on blood agar. Bacteria that had grown on culture media were Gram stained (Gram Stain Kits and Reagents, Becton Dickinson and Company, USA), and tested for catalase and oxidase activity (Difco-BBL). The strain was biochemically characterised by using commercial system API 20 E (API bioMerieux, Marcy l'Etoile, France). Enzyme reactions were read after 24 hours of incubation at

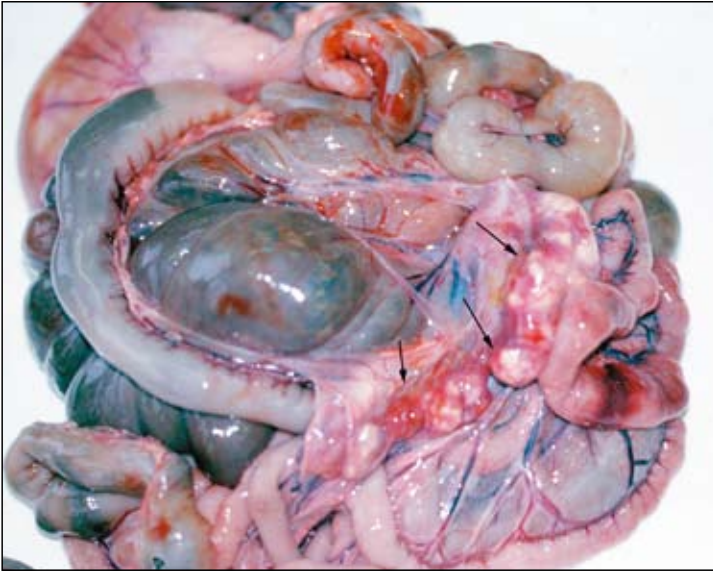


Figure 1: Intestine with mesenteric lymph nodes. Pyogranulomatous lymphadenitis caused by *Yersinia pseudotuberculosis*

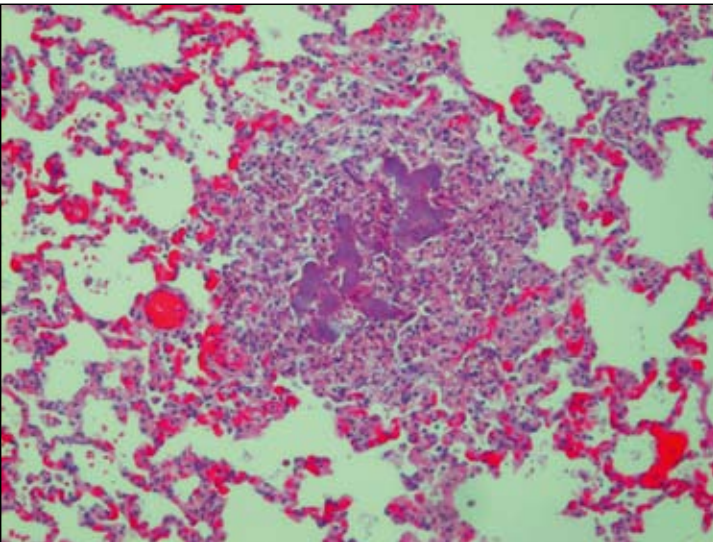


Figure 2: Lung. Pyogranuloma with *Yersinia pseudotuberculosis* colonies in the centre. HE staining, x 200

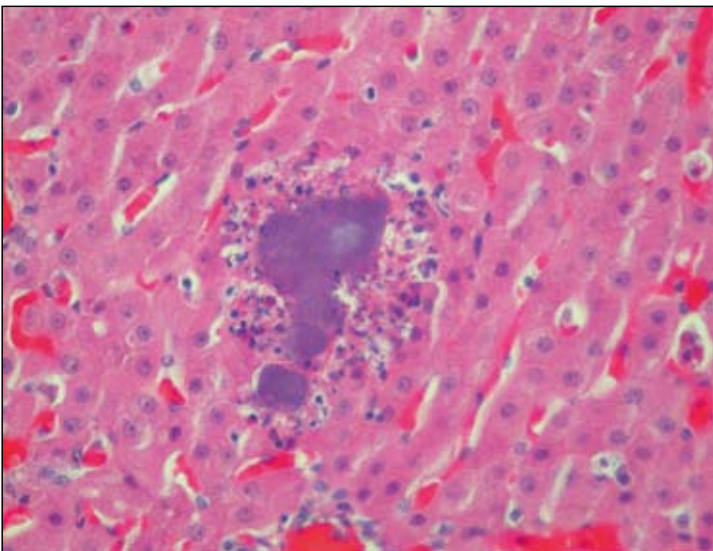


Figure 3: Liver. Necrotic focus with large *Yersinia pseudotuberculosis* colonies in the centre. HE staining, x 400

37° C according to the analytical profile index. Additional test for aesculin hydrolysis was performed classically. In vitro susceptibility of the bacterium to antimicrobial drugs by the agar disc-diffusion method (Kirby-Bauer) was performed.

Strain of *Y. pseudotuberculosis*, isolated from samples obtained from inter-laboratory control scheme (QA), was used as reference strain for media growth control.

Results

Anamnesis

Four young female capybaras from a family, composed of two parents and a litter of five offspring, which lived in an enclosure near the fish pond and were feed predominantly with vegetables, died in the Ljubljana Zoo in November and December 2001 during one month period. Three of them were submitted for dissection. Two capybaras were three months old and they died suddenly, one was four months old and was anorectic and depressed with fever and severe diarrhea two days prior to death. We don't have information about clinical signs and status of the fourth capybara, which derived from the same litter, but was not submitted for the necropsy.

Necropsy

All capybaras were in good condition. Gross lesions were similar in all animals: the peritoneal cavity contained one liter of transudate and the peritoneal surface was translucent and smooth. The small intestine and enlarged mesenteric lymph nodes, with diameter up to three cm, were scattered with numerous nodular, grey-whitish necrotic lesions, from few millimeters to one cm in diameter (Figure 1). The small intestine was severely inflamed and lumen was filled with dense, bloodstained content. The large intestine exhibited catarrhal inflammation and contained brown, dense feces. The spleen, liver, lungs and kidneys were hyperemic.

Histopathology

Microscopic examination revealed some differences in a form and a degree of pathological lesions among three dissected capybaras.

Widely extended areas of necrosis and hemorrhages, with numerous bacterial colonies in the very centre, densely infiltrated with necrotic mixed

inflammatory cells, heterophils and macrophages were found in the small intestine's mucosa, edematous and hemorrhagic submucosa, lungs and spleen in the first capybara (Figure 2). Necrotic foci, with one or several large bacterial colonies in the centre, surrounded by necrotic mixed inflammatory cells and some heterophils were scattered also throughout the muscular layer of the small intestine, mesenteric lymph nodes and liver (Figure 3). Several small bacterial colonies were noticed also in the renal glomeruli.

The pathological lesions in the small intestine of the second capybara were similar to those described in the first one, with some differences in location of the lesions: several segments had lesions only in mucosa; in others all intestinal layers were affected. Widely extended necrotic and hemorrhagic areas, with numerous bacterial colonies, densely infiltrated with remnants of mixed inflammatory cells and surrounded by heterophils and macrophages were noticed in mesenteric lymph nodes. Only few necrotic foci, with some necrotic mixed inflammatory cells, heterophils and rare macrophages were found in lungs, liver and the spleen, and only those in lungs contained bacterial colonies.

The small intestine mucosa and submucosa of the third capybara were also scattered with multifocal necrotic areas, in which remnants of mixed inflammatory cells and heterophils were noticed, surrounded by thin fibrous capsule, infiltrated with macrophages and lymphocytes. Rare bacterial colonies were located at the periphery of described lesions. Similar lesions were more frequent and confluent in mesenteric lymph nodes and less frequent in spleen and liver, where there were no bacterial colonies. In lungs, extended areas of fibrinopurulent pneumonia with necrotic foci, containing heterophils and small bacterial colonies, were found.

Described lesions were evaluated as acute pyogranulomatous enteritis, lymphadenitis, hepatitis, splenitis and pneumonia in the first two capybaras and subacute pyogranulomatous enteritis, lymphadenitis, hepatitis and splenitis with diffuse fibrinopurulent pneumonia in the last one.

No patohistological lesions were found in the myocardium of dissected capybaras.

Bacteriological culture

Bacteriological culture of mesenteric lymph nodes yielded abundant growth of small colonies, non-hemolytic, grayish, shiny and similar to those

of the *Enterobacteriaceae*. Colonies on Drigalski agar were blue-green color due to their inability to ferment lactose. Colonies on blood agar and Drigalski agar as well were smaller than those of the other members of *Enterobacteriaceae* after 24 hours of incubation. The same type of less numerous colonies were also isolated from almost all the other examined tissue (liver, spleen, lung, intestine), but not from kidney. Gram stain of culture demonstrated Gram-negative rod-shaped bacteria. On the basis of the cellular morphology and biochemical profiling the isolate was identified as *Y. pseudotuberculosis*. Isolated strain was susceptible to amoxicillin/clavulanic acid and enrofloxacin, but resistant to neomycin and trimethoprim/sulphamethoxazole.

From intestine, non-hemolytic *Escherichia coli* and alpha-hemolytic streptococci were also isolated.

Discussion

Zoo animals are very susceptible for yersiniosis, especially birds, primates, ungulates and rodents (1, 3, 4, 5, 13), but in the literature we found only descriptions about one case of yersiniosis in capybara from Bristol Zoo (4) and seven from Berne Zoo (16). In the Ljubljana Zoo there was one outbreak of yersiniosis, in which only capybaras were affected.

All capybaras died in the late autumn, which was cold and rainy in 2001. Several authors described yersiniosis as a seasonal disease with outbreaks occurring mostly in the late autumn and winter, from November to April (1, 3, 5, 8, 14). Unfavorable weather conditions, i.e., cold, rainy weather and floods, increase animals susceptibility (1, 8, 17).

All capybaras were young females, at the age of three to four months. There were no information about capybaras with yersiniosis from Bristol Zoo (4) and Berne Zoo (16), but we think that young animals are more susceptible for infection due to immature immune system. In the literature there are no data concerning sex predisposition for yersiniosis and we also don't know the gender of survived offspring from Ljubljana Zoo.

Several authors think that food, contaminated with feces of rodents and birds, the well-known carriers of bacteria *Y. pseudotuberculosis*, is the most possible source of the infection (5, 13, 15). In the Ljubljana Zoo, capybaras' habitat is located near the artificial pond, where the concentration of rats is the highest. Taking in consideration the results of others we can summarize that the infection in the Ljubljana Zoo was probably transmitted by rodents.

In Ljubljana Zoo the first two capybaras died without clinical signs and only in the third one diarrhea, anorexia, emaciation and fever were noticed two days prior to death. Data about clinical signs are not known for the fourth capybara, which was not submitted for the necropsy. All three dissected capybaras were in good condition. There are no pathognomonic clinical manifestations of yersiniosis (3). Infected animals may die suddenly, without any clinical signs (8, 14), although fever, diarrhea, anorexia, depression and emaciation were often reported in animals, infected with *Y. pseudotuberculosis* (1, 3, 5, 8).

At necropsy nodular lesions were found only in the small intestine and mesenteric lymph nodes in all capybaras. Similar nodular lesions were often found also in liver, spleen, lungs and kidney in different animal species (3, 4, 5) and in the myocardium of a guinea pig (1). Distribution, expansion and number of lesions depend primarily on the animal species (13) and probably also on the length of survival time of the infected animal. Unfortunately there were no data about the pathological lesions in yersiniosis in capybaras from Bristol Zoo (4) and Berne Zoo (16).

Histopathological lesions, described in the first two capybaras, show an acute form of yersiniosis, which was described in primates (2) and ungulates (8, 13). In the third capybara the pathological lesions were surrounded by thin fibrous capsule and were evaluated as subacute. The subacute form of yersiniosis was reported in birds and several mammals (8, 13). In chronic form of the disease, described in some rodents, mainly in rats, granulomas in liver, lungs, kidneys and lymph nodes, but not in the intestine were diagnosed (8, 13). We believe that yersiniosis in capybaras probably started in small intestine and spread through the mesenteric lymph nodes to lungs, liver and the spleen. Capybaras probably died of septicemia.

Y. pseudotuberculosis was isolated from intestine, liver, lungs and spleen of all capybaras. Bacterial colonies on the blood agar were small, round and grayish. Colonies, described in literature, were also round, grayish, with opaque center (8).

Treatment of yersiniosis is due to late onset of clinical signs or their absence often unsuccessful (5). It was ascertained that some isolates were susceptible to several antibiotics, including penicillin, streptomycin, gentamicin, sulphadimethoxin, neomycin and trimethoprim/sulphadiazine (14). *Y. pseudotuberculosis* is also susceptible to tetracyclines

(13). Prophylaxis with sulphonamides (1) and tetracyclines (8, 14) is recommended. Several authors believe that adequate feed and drinking water hygiene with preventive measures towards birds and rodents are of great importance in the prevention of yersiniosis (1, 5, 8, 14). In our study was established that isolated strain of *Y. pseudotuberculosis* was susceptible to amoxicillin/clavulanic acid and enrofloxacin, but resistant to neomycin and trimethoprim/sulphamethoxazol. Enrofloxacin was immediately applied to all survived capybaras and a deratization was carried out in the whole Zoo. Till date no outbreaks of yersiniosis in capybaras or in any other animal species in the Ljubljana Zoo were diagnosed.

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JERSINIOZA PRI KAPIBARAH (*HYDROCHAERIS HYDROCHAERIS*) IZ ŽIVALSKEGA VRTA

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Povzetek: V Ljubljanskem živalskem vrtu so jeseni 2001 poginili štiri mladiči kapibar (*Hydrochaeris hydrochaeris*) ženskega spola, stari od tri do štiri mesece. Tri od njih smo prejeli v raztelesbo, pri tem pa smo ugotovili granulomatozne spremembe v tankem črevesu in mezenterialnih bezgavkah kakor tudi hemoragično vnetje črevesa in ascites pri vseh raztelešenih kapibarah. S patohistološko preiskavo smo pri dveh kapibarah diagnosticirali piogranulomatozno vnetje črevesa, bezgavk, jeter, vranice in pljuč ter piogranulomatozno vnetje črevesa, bezgavk, jeter, vranice in difuzno fibrinopululentno vnetje pljuč pri eni od kapibar. Z bakteriološko preiskavo je bila iz tankega črevesa, jeter, pljuč in vranice vseh kapibar izolirana bakterija *Yersinia pseudotuberculosis*.

Ključne besede: *Hydrochaeris hydrochaeris*; patologija; piogranulomatozno vnetje; *Yersinia pseudotuberculosis*