

Septicemia and Multiple Abscesses Associated with *Pantoea agglomerans* in a Dog

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Abstract

A 2-year-old Anatolian Shepherd Dog was presented with lethargy and small abrasion wound on the left paw. The patient was diagnosed with phlegmon in his left arm and treatment was started. However, septicemia occurred and the dog died after fourteen days. At necropsy multiple white-colored foci was seen on the liver, lungs, kidney and heart. In these organs, abscesses formations with large areas of necrosis were seen in histopathologic examination. In samples taken from organs with abscess, the bacteria were identified morphologically and biochemically by Vitek II and *Pantoea agglomerans* was confirmed by PCR. *Pantoea agglomerans* has been previously isolated from humans and animals. However, the bacteria is rarely isolated from septicemia associated lesions in animals. In the presented report, *Pantoea agglomerans* was identified in a dog with septicemia and clinical, postmortal and histopathological findings caused by the bacteria were reported.

Keywords: Bacteria, Dog, *Pantoea agglomerans*, Septicemia

Bir Köpekte *Pantoea agglomerans* İle İlişkili Septisemi ve Multiple Apse Olgusu

Öz

İki yaşlı Anadolu çoban köpeği halsizlik ve sol patide küçük abrazyon yarası şikayetiyle getirildi. Hastanın sol ön kolunda bulanık yaraya flegmon tanısı konuldu ve tedaviye başlandı. Ancak septisemi meydana geldi ve tedavinin 14. gününde hasta öldü. Nekropside, karaciğer, akciğer, böbrek ve kalpte çok sayıda beyaz renkli odak görüldü. Bu organların histopatolojik incelemesinde, apse yapıları ile geniş nekroz alanları belirlendi. Organlardaki apselerden alınan örneklerde, bakteri morfolojik olarak ve Vitek II ile biyokimyasal olarak tanımlandı. PCR ile etkenin *Pantoea agglomerans* olduğu doğrulandı. *Pantoea agglomerans* daha önce insanlarda ve hayvanlarda izole edilmiştir. Bununla birlikte bu bakteri, hayvanlarda nadiren septisemi ile ilişkili lezyonlardan izole edilmiştir. Bu olgu sunumunda, septisemili bir köpekte tanımlanan *Pantoea agglomerans*'in neden olduğu klinik, postmortal ve histopatolojik bulgular bildirilmiştir.

Anahtar sözcükler: Bakteri, Köpek, *Pantoea agglomerans*, Septisemi

INTRODUCTION

Pantoea agglomerans is a gram-negative opportunistic bacterium, belonging to the family *Enterobacteriaceae*. The bacterium was called *Enterobacter agglomerans* or *Erwinia herbicola*. It was isolated from plant surfaces, seeds, water and humans ^[1]. *Pantoea agglomerans* is commonly known

as nosocomial infection in human medicine. However, the bacteria is rarely isolated from clinical problems in animals ^[2].

Clinical outcomes of infection by *Pantoea agglomerans* in animals include fibrinonecrotic placentitis, equine abortion ^[3], and allergic lung disease in cows ^[4]. Also,

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Pantoea agglomerans related with pneumonia in a cat was reported [5]. The bacteria was isolated in fishes such as Brown Trout and Rainbow Trout [6,7]. *Klebsiella pneumoniae* is a gram-negative opportunistic bacterium. *Klebsiella* is known to cause enteritis, pneumonia and urinary tract infection in dogs [8].

In this case report, we aimed to present a case of *Pantoea agglomerans* related septicemia, and its postmortal and histopathological findings in a dog.

CASE HISTORY

The patient was a 2-year-old Anatolian Shepherd Dog weighing 45 kg that was brought to Animal Hospital of Ondokuz Mayıs University due to lethargy and loss of appetite. Initial clinical examination revealed 4% dehydration, an increased white blood cell count ($24.52 \times 10^9/L$) and mild anemia as well as a small abrasion wound on the left paw, about 1 cm in diameter. An intravenous catheter was introduced to the left cephalic vein in order to administer fluid therapy. On the following day, a fluctuating swelling formed in the arm and the patient was referred to the surgery department on day 3.

The patient was hospitalized due to his deteriorating condition. The hair over the swollen area which started from the cranial surface of the paw and extends over the scapula, some of the lateral thorax as well as, up to and including the 4th rib line was clipped. The skin over the swollen area was felt warm when touching and fluctuation was evident in the entire area. Antibiotic treatment with cefazolin-Na (Cezol® 20 mg/kg IV every 8 h, Deva, Istanbul, Turkey) and fomentation therapy was initiated along with daily IV fluid administration.

A pustule was opened at the mid-level of scapula at the 4th day and purulent content of the cavity was drained and irrigated using copious amounts of saline. After this, a drain was placed through the cavity, from the natural opening on the scapula, to an incision made laterally to the elbow. The drain was kept in place for 3 days, during this time, a wet to dry wound dressing was applied daily and a local antibiotic was rifamycin (Rif® 250 mg, Koçak Farma, Istanbul, Turkey) administered locally at each dressing change. The drain was changed once in 3 days.

Despite continuous antibiotic treatment, the WBC count ($35.14 \times 10^9/L$) and the patient's condition has deteriorated. On day 10, hematuria was seen and the collected urine sample was evaluated under light microscope and calcium oxalate crystals were seen. Ceftriaxon (Novosef® 25 mg/kg IV, every 12 h, Zentiva, Prague, Czech) and metronidazole (Flagyl®, 10 mg/kg slow IV infusion, once a day, Eczacıbaşı, Istanbul,

Turkey) was initiated at this point in favor of the other antibiotic treatment. In addition, vitamin K (Konakion® 2 mg/kg IV, single dose, Roche, Basel, Switzerland), vitamin C (Zinco-C® 750 mg PO, once a day, Berko ilaç, Istanbul, Turkey) supplements were administered and meloxicam (Maxicam® 0.2 mg/kg, SC inj, once a day for 3 days, Sanovel, Istanbul, Turkey) and ranitidine (Ranitab® 2mg/kg IV, twice a day, Istanbul, Turkey) was started. By this time the swelling has subsided, and only the drain's entry and egress wound openings were present, a dry-to-dry wound dressing was applied over them.

The dog started exhibiting respiratory distress on day 11, wheezing and wet sounds were heard during auscultation and a chest radiogram was taken and radiopaque areas were seen, confirming an empyema diagnosis (Fig. 1). The patient's condition continued to deteriorate and he died at the 14th day. Informed consent form was obtained from the owner for the procedures to be applied to this case.

At gross examination, total of 5-6 perforated areas of 1-2 cm in diameter were determined on the left skin of the left forefoot (Fig. 2-A). A yellow colored fluid was seen when the lesions were cut. In the liver, yellowish-white abscesses 2-5 cm in size were seen especially in lateral and medial lobules (Fig. 2-B). It was seen that there were white colored foci of 2-3 cm diameter in the cortex of the cross-sectional area of the kidneys. In all lobules of the lungs, large and small yellowish-white diffuse foci ranging between 1-5 cm in diameter were found (Fig. 2-C). A hemorrhagic fluid at a small amount was detected in the pericardium. The heart was seen to have a rounded shape, and the micro-abscesses were noticed on it. Left ventricular wall of the heart was thickened and the right ventricle was dilated. A white colored focus 2-3 cm in diameter attracted attention in the aorta exit of the heart (Fig. 2-D). Tissue samples which

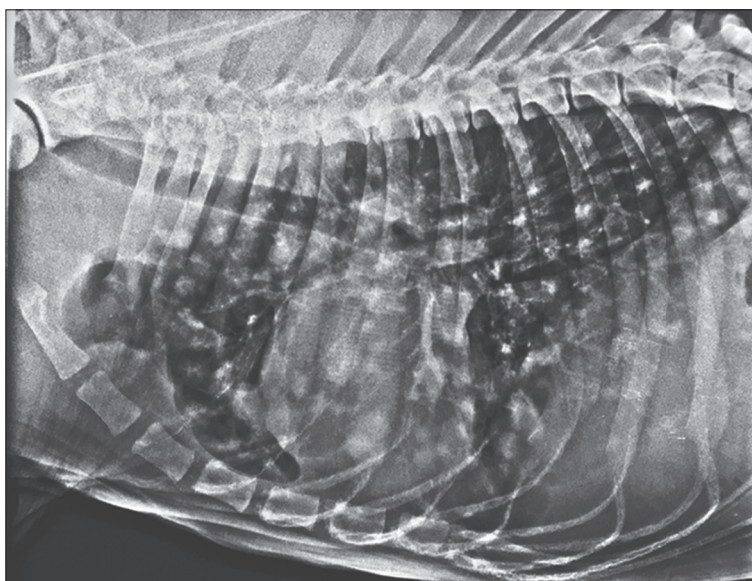


Fig 1. Diffuse nodular interstitial sign in the lateral radiograph of the dog

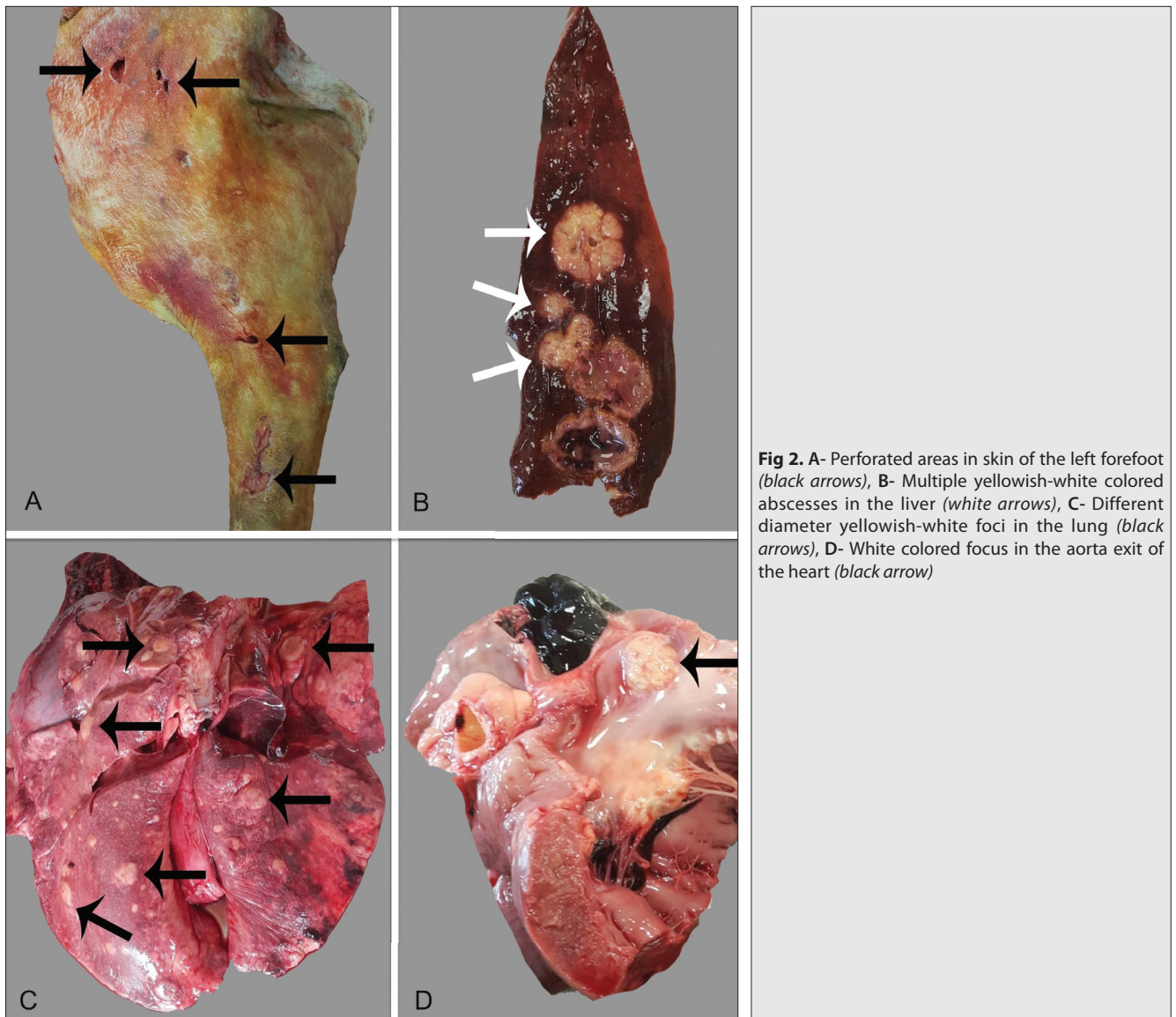


Fig 2. A- Perforated areas in skin of the left forefoot (black arrows), B- Multiple yellowish-white colored abscesses in the liver (white arrows), C- Different diameter yellowish-white foci in the lung (black arrows), D- White colored focus in the aorta exit of the heart (black arrow)

were taken during necropsy were fixed in 10% formalin. Formalin fixed tissue samples were processed via paraffin embedding technique and sections were cut at 5 μ m and stained with hematoxylin-eosine.

Microscopically, vacuolar and hydropic degeneration were detected in the hepatocytes together with congestion and edema in the liver. There were large abscesses with large areas of necrosis that were surrounded by connective tissue including macrophages and lymphocytes (Fig. 3-A). Multifocal abscesses were observed with varying size and malacia areas in the brain. Meninges of the cerebellum was hyperemic and there were also diffuse cell infiltrations most of which were formed by polymorphic nuclear leukocytes, and the meninges were thickened (Fig. 3-B). There was thickening and fibrotic areas in the kidney capsule. It was also noticed that the mesangial regions were enlarged in the renal glomeruli. Non-suppurative glomerulitis and periglomerulitis were seen in the kidney (Fig. 3-C). Significant edema was observed in alveolar

lumens in the lung. Many alveolar macrophages filled in the alveolar lumens with neutrophils (Fig. 3-D). Widespread necrotic areas were seen in the stroma. Abscess formations separated to the septum by connective tissue was noticed in the heart (Fig. 3-E). Mucoïd degeneration was seen in the heart valves. Large necrotic areas were detected in pancreatic acini. Hypocellularity was also seen together with edema in the lymph follicles. Disseminated inflammatory changes, bleeding and necrosis were seen in subcutaneous tissues (Fig. 3-F).

The lymph nodes, lung, liver of dog taken after necropsy for microbiological examination. The samples were inoculated into 5% sheep blood agar. The plate was incubated for 24 h at 37°C in aerobic conditions. After incubation period, the gram stained colonies of bacteria were shown microscopically as Gram negative rods. The bacteria were identified morphologically and biochemically by Vitek II with gram negative card as *Pantoea agglomerans*. *Pantoea agglomerans* was confirmed by PCR as described by

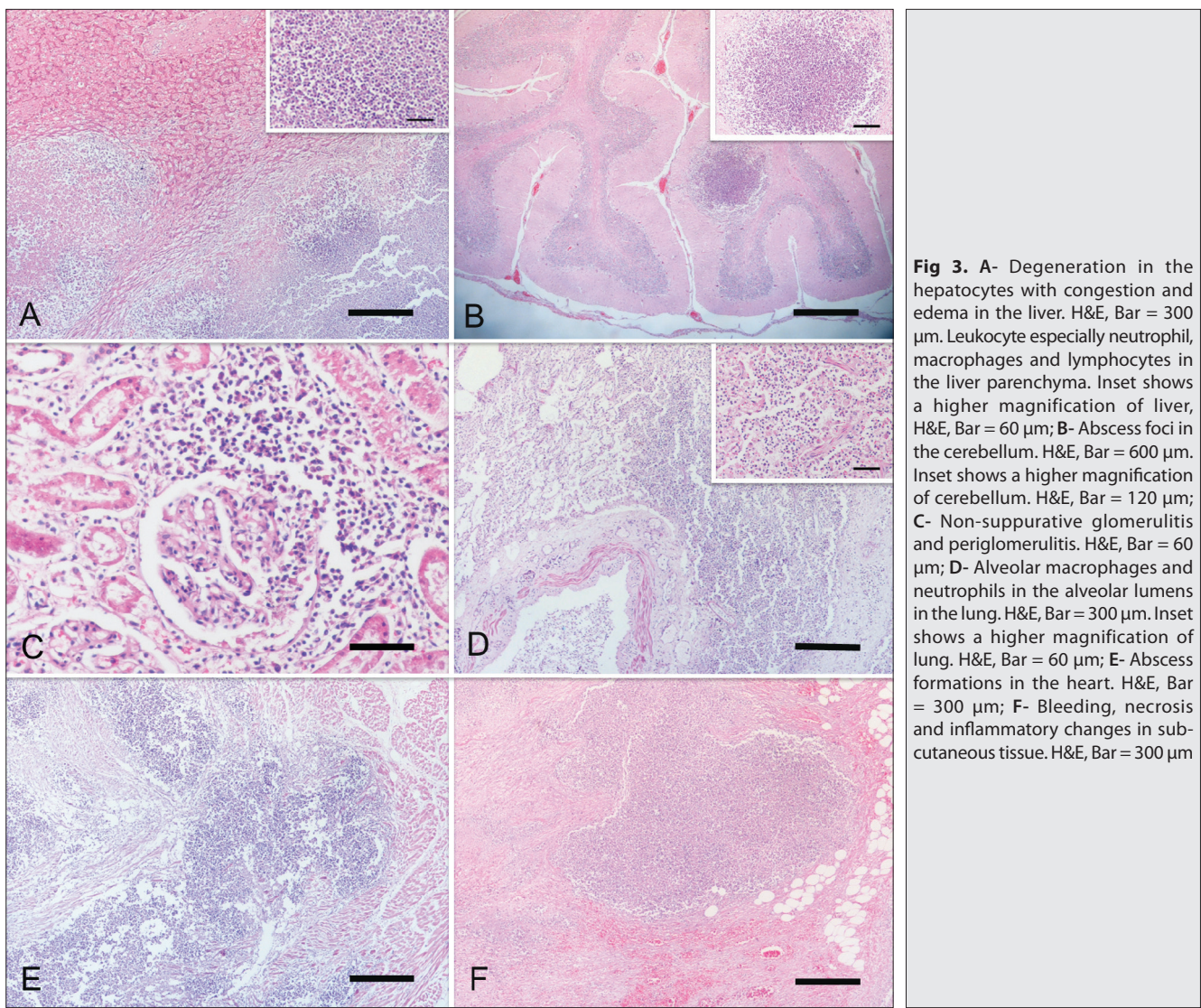


Fig 3. A- Degeneration in the hepatocytes with congestion and edema in the liver. H&E, Bar = 300 µm. Leukocyte especially neutrophil, macrophages and lymphocytes in the liver parenchyma. Inset shows a higher magnification of liver, H&E, Bar = 60 µm; B- Abscess foci in the cerebellum. H&E, Bar = 600 µm. Inset shows a higher magnification of cerebellum. H&E, Bar = 120 µm; C- Non-suppurative glomerulitis and periglomerulitis. H&E, Bar = 60 µm; D- Alveolar macrophages and neutrophils in the alveolar lumens in the lung. H&E, Bar = 300 µm. Inset shows a higher magnification of lung. H&E, Bar = 60 µm; E- Abscess formations in the heart. H&E, Bar = 300 µm; F- Bleeding, necrosis and inflammatory changes in sub-cutaneous tissue. H&E, Bar = 300 µm

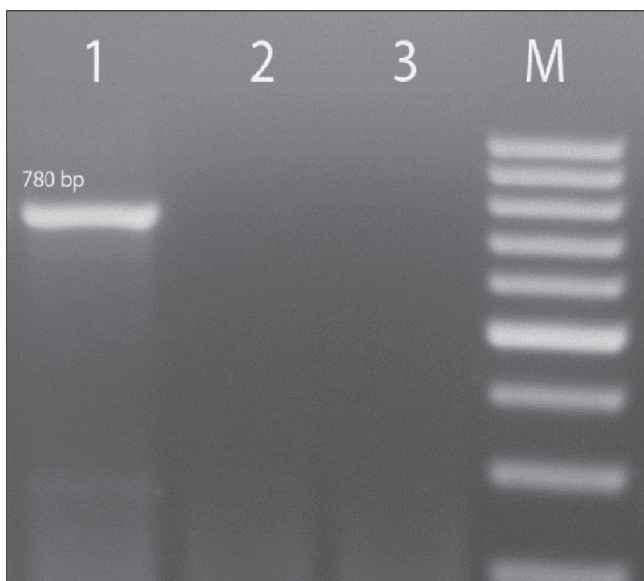


Fig 4. The PCR result of *Pantoea agglomerans*. M: marker (100-1000 bp); 1: *Pantoea agglomerans*; 2: *Escherichia coli*; 3: *Salmonella* spp.

previous study [9]. For this purpose, rep-F 5-TTGTGGGG GACATAAATTAACC-3 and rep-R5-AGGGCCATAGTGAGGA-AGGT-3 primer sets were used. In PCR, the band of 780 bp for rep gene were detected and the identification was confirmed as *Pantoea agglomerans* (Fig. 4).

DISCUSSION

Pantoea agglomerans is an opportunistic pathogen, and it has been reported especially in immunosuppressive patients. Infection are usually caused by infected plant parts that has penetrated the skin [2]. Septic arthritis [10], and muscle lesions [11], caused by plant thorn injury was reported in human medicine due to the bacteria that is found in plant surface. Reported diseases other than wound infection in humans include endophthalmitis [12], endocarditis [13] and osteomyelitis [14].

Infection caused by *Pantoea agglomerans* was infrequently reported in animals. In veterinary literature, abort, fibrinonecrotic placentitis in a mare [3], and pneumonia in a

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cat were reported [5]. Also this agent was isolated in Brown Trout and Rainbow Trout [6,7].

In our case, *Pantoea agglomerans* was isolated in liver, subcutaneous tissues and lymph nodes and also *Klebsiella pneumoniae* was isolated in lung on microbiological examination. Both *Klebsiella pneumoniae* and *Pantoea agglomerans* bacteria are opportunistic pathogens. The presence of both bacteria in the dog may explain the increase in inflammatory activity, in particular neutrophils.

Abscesses have been identified in the liver, lung, heart, brain, cerebellum and subcutaneous tissues on macroscopic and microscopic examination in this case. In addition to this, widespread necrosis was observed, especially in the liver, lung, pancreas, heart and subcutaneous tissues.

Foreign body granuloma with giant cells that related with *Pantoea agglomerans* was reported in a human case. The authors were noticed that probable reason of these granuloma was penetration of plant thorn in to the muscle [11]. In our case, neutrophil infiltration and necrosis were the most prominent. Giant cells were not detected due to there have no foreign body penetration in the case history. Histopathological changes have been described in foetal lungs after equine abortion associated with *Pantoea agglomerans*. Interstitial inflammatory infiltrate of lymphocytes, macrophages, and neutrophils was seen in the lungs [3]. Similar histopathological changes were observed in our case.

Although *Pantoea agglomerans* mostly associated with infection in human medicine, the infection caused by this bacterium was uncommonly reported in animals. In this case report, a large number of abscesses included central nervous system and heart in a dog has been reported. Authors believe that these data would contribute to the veterinary literature.

CONFLICT OF INTEREST

The authors declared that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

TG, Sİ and NK evaluated postmortal and microscopic examinations and wrote the manuscript. EB and KŞİ are played role in the clinical examination and management of case. AF and MGS did phenotyping and molecular identification.

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