NOTE *Pathology*

Pyelonephritis Associated with *Staphylococcus intermedius* in a Siberian Tiger (*Panthera tigris altaica*)

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ABSTRACT. Pyelonephritis, in which *Staphylococcus intermedius* was isolated, was diagnosed in a 4-year-old female Siberian tiger (*Panthera tigris altaica*). At necropsy, the renal pelvis was dilated with a large amount of purulent exudates. Microscopically, the lesions of renal pelvis and medulla consisted of necrotic foci intermingled primarily with numerous degenerative neutrophils and a few lymphocytes, plasma cells and macrophages. Bacteriology showed the presence of *S. intermedius*. This is the first report on pyelonephritis associated with *S. intermedius* in wild *felidae*.

KEY WORDS: *Panthera tigris altaica*, pyelonephritis, *Staphylococcus intermedius*.

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Staphylococcus intermedius is a gram-positive, non-motile, non-spore forming, facultative anaerobic coccus [3], which is part of the normal microflora of the skin and mucosal surfaces of the upper respiratory tract of dogs, horses, cats, and minks [1, 7]. This bacterium has also been isolated from the anterior nares of dogs and pigeons [4], and from infected dog bite wounds in humans [10]. *S. intermedius* may cause cutaneous, urinary tract, bone, and central nervous system infections in several animal species [1, 7].

In dogs, *S. intermedius* is one of the leading pus-forming bacteria and causes infections such as pyoderma and otitis externa [3, 8]. *Staphylococcus* spp. does not generally appear to cause any major disease in cats [5], but cases of superficial dermatitis, bacterial folliculitis, and superficial pyoderma caused by *S. intermedius* have been reported [9]. About 10% (9/93) of Staphylococci obtained from feline clinical specimens were *S. intermedius* [3, 5].

Diseases associated with *S. intermedius* have not been reported in wild *felidae*. Here we describe an episode of a Siberian tiger (*Panthera tigris altaica*) kept at the Korea National Arboretum with pyelonephritis caused by *S. intermedius*.

The four-year-old female Siberian tiger had been donated from China for breeding and was raised for four months alongside a male Siberian tiger at the Korea National Arboretum. After showing depression and anorexia over several days, the female tiger suddenly died. A postmortem examination was performed immediately.

At necropsy, the dead Siberian tiger was thin and emaciated. No wounds or disease conditions were observed in the external body surfaces and orifices, and the tiger was not pregnant. Both kidneys were congested, and the pelvis of the left kidney was markedly dilated and filled with a large amount of inspissated purulent exudates (Fig. 1). No purulent exudates or any significant gross abnormalities were found in the urinary bladder and ureter. Representative samples from major parenchymal tissues, including the heart, lungs, liver, spleen, kidneys, small and large intestines, urinary bladder, ovaries and uterus, were fixed in 10% neutral phosphate-buffered formalin, routinely processed, embedded in paraffin, and stained with hematoxylin and eosin (HE) for histopathologic examinations. The normal histologic architecture of the renal pelvis and deep medulla was obscured by necrosis as well as by infiltration of numerous degenerative neutrophils and a few lymphocytes, plasma cells, and macrophages (Fig. 2). The renal tubules were dilated due to much amount of proteinaceous materials and sloughed-off necrotic epithelia with and without mineralization. The interstitium was multifocally thickened due to mild infiltration of mainly lymphocytes and plasma cells with a few macrophages and mild fibrosis. No other significant microscopic abnormalities were found.

A portion of the renal parenchyma as well as pelvic purulent exudates were collected aseptically and inoculated onto blood agar plates. The plates were cultured at 37°C under 5% CO_2 atmosphere, and colonies were selected based on characteristics such as size, morphology, pigmentation or hemolysis. The selected colonies were identified using a Vitek automatic bacterial isolation system (bioMeriex UK Ltd., Basingstoke, UK) after basic biochemical tests. Identification of the isolate was further confirmed by Voges-Proskauer (VP) tests [7]. Both Vitek system and VP test identified β-hemolytic *S. intermedius* in the kidneys. Based on the gross lesions, histopathological findings, and bacterial characterization, we concluded that *S. intermedius* was the causative agent of pyelonephritis in this animal.

Transmission of *Staphylococcus* spp. is usually endogenous, with predisposing factors, including maceration of the skin, age, any complicating debilitating disease, and trauma, being critical in pathogenesis [3]. Destruction of the normal

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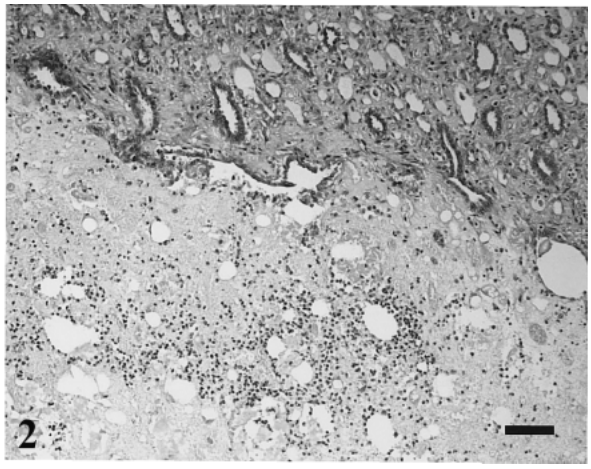

Fig. 1. Kidney. The four-year-old female Siberian tiger. Note abscess in the renal pelvis.
Fig. 2. Kidney. Note necrosis and infiltration of numerous degenerative neutrophils and a few lymphocytes, and plasma cells in the deep medulla. H&E. Bar = 50 μm.

bacterial flora can predispose dogs and cats to pyoderma [6]. Ascending infection from the urinary bladder is the most common cause of pyelonephritis in animals. Necropsy and histopathology, however, showed no evidence of lower urinary tract infection, including cystitis. The reproductive tract infection experienced by this tiger during the breeding process three months prior to its death could be counted in the cause of the renal infection. When the tiger was donated, it was clinically healthy. Prior to its sudden death, no evident clinical signs were observed. Several possible predisposing factors may have contributed to its disease and death. The renal pelvis and medulla region is highly susceptible to bacterial infection because of limited blood flow and high concentrations of ammonia. Stress related to the animal's transfer from China and adaptation to a new environment should also be considered.

Transmissible plasmids in the human strain of *S. aureus* are common and carry genes for virulence factors and antimicrobial resistance. In addition, genes from human strains of *S. aureus* may be transferred to animal strains of *S. intermedius* [3]. A sec_{canine}-positive human *S. intermedius* isolate has been found to contaminate food products during handling and processing via animal-human contacts [2], and *S. intermedius* has been isolated from infected dog bite wounds in humans, representing a newly recognized zoonotic pathogen [10]. Thus, although it is likely that disease in this animal was due to the endogenous factors, additional causes could not be ruled out.

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