pISSN 1598-298X / eISSN 2384-0749
J Vet Clin 33(5) : 313-315 (2016)
http://dx.doi.org/10.17555/jvc.2016.10.33.5.313

Journal of Veterinary Clinics
www.ksvc.or.kr

Nephrolithiasis in an Aged Snow Leopard

Kyung-Yeon Eo, Hyun-Ho Lee, Young-Mok Jung and Oh-Deog Kwon*[1]

Conservation and Health Center, Seoul Zoo, Gwacheon, Gyonggido 13829, Korea
**College of Veterinary Medicine, Kyungpook National University, Daegu 41566, Korea*

(Received: September 20, 2016 / Accepted: October 13, 2016)

Abstract : An aged (14 years old) female snow leopard exhibited renal calculi and pyelonephritis at necropsy. The animal experienced appetite loss, mild diarrhea, polydipsia, and difficulty breathing, and was curled up and staggering on its hind legs 2 days before death. Large calculi were found obstructing both sides of the renal pelvis. The left-side calculus was larger than that of the right side. These calculi had rough surfaces and were 15 × 21 mm and 9 × 14 mm, respectively. The bladder was filled with dark, cloudy urine. Multiple ulcerous lesions were found in the inner layer of the bladder. *Enterococcus faecalis* and *Proteus mirabili* were identified via microbiological examination of the urine. Under microscopic examination, urine struvites were observed in the pyuria sediment in the bladder. To our knowledge, this is the first documented case of nephrolithiasis in a captive snow leopard.

Key words **:** *Panthera uncia*, nephroliths, renal calculi, snow leopard.

Introduction

The snow leopard (*Panthera uncia*) is a large cat native to the mountain ranges of Central and South Asia, ranging throughout Afghanistan, Bhutan, China, India, Mongolia, Nepal, Pakistan, and Russia (5,18). It is listed as endangered on the IUCN Red List of Threatened Species because, as of 2003, the size of the global population was estimated at only 4,080-6,590 adults, of which fewer than 2,500 individuals may reproduce in the wild (24). Numerous agencies are working to conserve the snow leopard and its threatened mountain habitat. These include the Snow Leopard Trust, the Snow Leopard Conservancy, the Snow Leopard Network, the Cat Specialist Group, and the Panthera Corporation.

Nephroliths may obstruct the renal pelvis or ureter, predispose an individual to pyelonephritis, or result in compressive injury of the renal parenchyma in turn leading to progressive chronic kidney disease (1,22,23). Occasionally, nephroliths pass from the kidney and become ureteroliths. Clinical signs of nephroliths and ureteroliths depend on the size, number and location of the stone, and presence or absence of urinary obstruction and urinary tract infection (9). Although nephrolithiasis and urolithiasis may cause signs of hematuria, flank pain, azotemia, pollakiuria or stranguria, some patients with nephroliths show no clinical signs (9).

Nephrolithiasis and urolithiasis have been frequently reported in a variety of domestic species (1,14,17). However, few cases of renal calculi have been described in wildlife species (4,6,7). We diagnosed renal calculi in an aged captive snow leopard during its necropsy at Seoul Zoo. To our knowledge, there is no previous report of nephrolithiasis in a snow leopard in Korea. We report this case to provide information regarding the risk of renal calculi in captive snow leopards in zoos.

[1]Corresponding author.
E-mail : odkwon@knu.ac.kr

Case

A 14-year-old, 33 kg female snow leopard (International Studbook No. 2324) was found dead on February 12, 2016 at Seoul Zoo. The animal had been exhibited in an 84 m^2 outdoor enclosure with a male cage mate. It gave a birth twice, in May 2012 and May 2013, but the cubs died within 2 days of birth. We could not collect the dead cubs because they were consumed by the mother snow leopard; thus, their causes of death were not identified. The animal was fed a diet of chicken meat with bones and beef every day except Friday, which was a fasting day. In addition, every Wednesday a live rabbit was provided. The snow leopard was born at Tierpark Berlin, Germany on June 28, 2002 (offspring of International Studbook No. 2127 and International Studbook No. 1963). At the age of about 1 year, in May 2003, it was transferred to Seoul Zoo. It was vaccinated using standard protocols for domestic cats (Felocell CVR, Pfizer Animal Health; feline rhinotracheitis, calici, panleukopenia vaccine modified live virus).

The leopard experienced sudden appetite loss, mild diarrhea, polydipsia, difficulty breathing, curling up, and staggering of the hind legs 2 days before its death. Serum biochemical analysis revealed severe azotemia [blood urea nitrogen (BUN) 140 mg/dL, reference range 17-35 mg/dL; and creatinine 24.0 mg/dL, reference range 1.2-2.6 mg/dL]. As an allopathic remedy, 100 mg marbofloxacin (Marbostar® 10% injection; Komipharm International Co., Ltd., Gyeonggi-Do, Korea) and 20 mg meloxicam (Metacam® 2% injection; Boehringer Ingelheim, Korea) were administered intramuscularly for 2 days.

Fig 1. Renal calculi observed in both kidneys in an aged snow leopard. (A) The renal pelvis was filled with rough-surfaced calculi 15 × 21 mm and 9 × 14 mm in size (left and right side, respectively; white arrows). Numerous small calculi were present in the medulla of both kidneys. (B) Magnified photo of the calculus in the left kidney. The surface was uneven and rough.

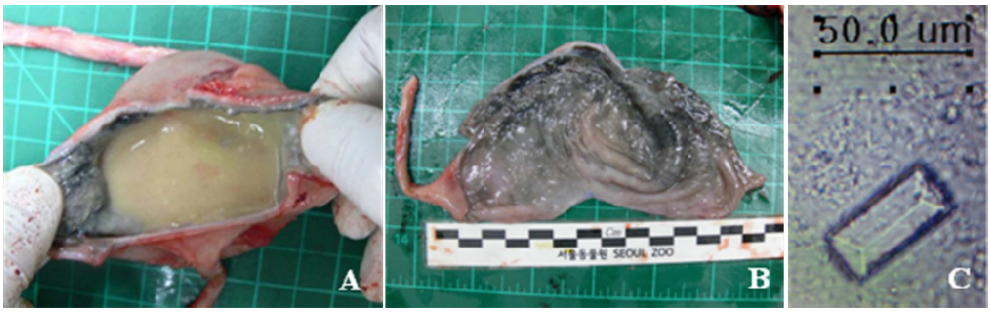

Fig 2. The urinary bladder was filled with dark, cloudy urine. (A) The pyuria residue in the bladder was very different from normal urine. Urinary levels of white blood cells, glucose, protein, and red blood cells were considerably high. (B) Gross inspection of the bladder showed that the bladder wall had thickened and was black in color. (C) Struvites were observed on microscopic examination of the urine.

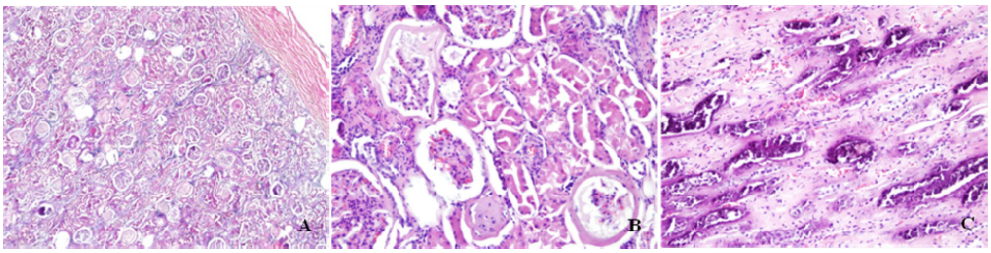

Fig 3. Histopathological examination of the kidney. (A) In cortex, several Bowman's capsules contain the eosinophilic materials or empty space (H&E, × 40). (B) In high magnification of A, the renal corpuscles have contracted glomeruli with thickened Bowman's capsules, and the urinary spaces contain protein-containing fluid with cell debris (H&E, × 200). (C) Calcification with fibrosis was observed in the renal tubules in medulla (H&E, × 100).

The animal died 2 days after initial treatment. The necropsy was performed at the Animal Health Center of the zoo to identify the cause of death. At necropsy, renal calculi, 15 × 21 mm and 9 × 14 mm in size, were found obstructing both sides of the renal pelvis. The surface of these calculi was not smooth, but rough. Dark cloudy urine was observed in the bladder (Fig 1). Multiple ulcerous lesions were found in the inner layer of the bladder. Struvites were observed during microscopic examination of the urine (Fig 2). Microbiological examination identified *Enterococcus faecalis* and *Proteus mirabili* in the urine. The levels of red blood cells, white blood cells, glucose, and protein in the urine were all higher than normal values. However, the nitrite, ketone, and urobilinogen levels were within the normal range. Samples of the kidney lesions were fixed in 4% neutral buffered formalin and processed routinely. Tissue sections were stained with hematoxylin and eosin for light microscopy examination. During histopathological examination of the kidneys, remarkable findings, such as thickened Bowman's capsules, protein-containing fluid with cell debris, and calcification with fibrosis in the renal tubules were observed (Fig 3).

Discussion

Calculi of the ureter or kidney is considered to be among the most serious urinary tract problems in domesticated and

wildlife animals (3,16,20). The incidence of nephroliths and ureteroliths has increased not only in the human population, but also in many other animals, including farm animals and companion animals (21). Although urolithiasis is a major disease of domestic cats (10), it has rarely been reported in large feline species (3). In domestic cats (19), lions (3) and cheetahs (25), the most common types are struvite and calcium oxalate uroliths. These reports are consistent with the struvite found in the urine of the snow leopard we examined.

Many factors have been discussed in terms of actual or potential etiological involvement in urolithiasis in cats (3,8, 16). Urinary tract infection by bacteria that hydrolyze urea (e.g., *Staphylococcus*, *Proteus*) is the most common cause of struvite urolithiasis (2). Urinary tract infection also may occur secondary to urolithiasis that initially developed in the absence of infection (2). Nephroliths often may serve as a nidus for bacterial infection (15). Other factors, such as certain metabolic abnormalities, and a reduction or absence of specific intrinsic inhibitors of crystallization, may also play a part in calculus formation (11). Urinary bacterial infections are clearly associated with urolithiasis in domestic cats (13). In the case of the snow leopard we examined, *Proteus mirabili* and *Enterococcus faecalis* were identified in the urine, and are thought to have contributed to the formation of struvite calculi.

Struvite nephroliths are associated with pyelonephritis (15). Infected kidney stones, composed of struvite or calcium carbonate apatite, can refer to stones that form because of urinary tract infections with urease-producing bacteria, secondarily infected stones of any composition, or stones obstructing the urinary tract leading to pyelonephritis (12). In the present case, renal calculi were found to be obstructing both renal pelvises, and the surface of the calculi was rough. *Proteus mirabili*, a urease-producing bacteria species, was identified in the urine. The pyelonephritis identified in the snow leopard may have been associated with the renal calculi. Based on the findings described in this report, although renal insufficiency could have been the major cause of death due to nephrolithiasis, further study is required to effectively diagnose and elucidate renal calculi in snow leopards.

References

1. Adams LG. Nephroliths and ureteroliths: a new stone age. N Z Vet J 2013; 61: 212-216.
2. Birchard SJ, Sherding RG. Disease of the kidney and ureter. In: Saunders manual of small animal practice, 2nd ed. Philadelphia: WB Saunders Company. 2000: 913-937.
3. Corpa JM, Marín S, Bolea R, Ortega J, Peris B, Pérez V. Urolithiosis in two lions. Vet Rec 2003; 153: 786-787.
4. Dennison S, Gulland F, Haulena M, De Morais H, Colegrove K. Urate nephrolithiasis in a northern elephant seal (Mirounga angustirostris) and a California sea lion (Zalophus californianus). J Zoo Wildl Med 2007; 38: 114-120.
5. Fox JL. A Review of the Status and Ecology of the Snow Leopard (Panthera uncia). International Snow Leopard Trust, Seattle, Washington. 1989.
6. Harms CA, Piccolo RL, Rotstein DS, Hohn AA. Struvite penile urethrolithiasis in a pygmy sperm whale (Kogia breviceps). J Wildl Dis 2004; 40: 588-593.
7. Hattel AL, Shaw DP, Love BC, Wagner DC, Drake TR and Brooks JW. A retrospective study of mortality in Pennsylvania captive white-tailed deer (Odocoileus virginianus): 2000-2003. J Vet Diagn Invest 2004; 16: 515-521.
8. Lawler DF, Evans RH. Urinary tract disease in cats. Water balance studies, urolith and crystal analyses, and necropsy findings. Vet Clin North Am Small Anim Pract 1984; 14: 537-553.
9. Leib MS, Monroe WE. Diseases of the kidney and ureter. In: Practical small animal internal medicine. Philadelphia: WB Saunders Company. 1997: 283-331.
10. Lewis LD, Morris ML Jr. Treatment and prevention of feline struvite urolithiasis. Vet Clin North Am Small Anim Pract 1984; 14: 649-660.
11. Ling GV, Ruby AL, Johnson DL, Thurmond M, Franti CE. Renal calculi in dogs and cats: prevalence, mineral type, breed, age, and gender interrelationships (1981-1993). J Vet Intern Med 1998; 12: 11-21.
12. Marien T, Miller NL. Treatment of the Infected Stone. Urol Clin North Am 2015; 42: 459-472.
13. McGavin MD, Carlton WW, Zachary JF. The urinary system. In: Thomson's special veterinary pathology, 3rd ed. St Louis: Mosby. 2001: 235-278.
14. Miranda M, Rigueira L, Suárez ML, Carbajales P, Moure P, Fidalgo LE, Failde D, Vázquez S. Xanthine nephrolithiasis in a galician blond beef calf. J Vet Med Sci. 2010; 72: 921-923.
15. Morgan RV. Diseases of the kidney. In: Handbook of small animal practice, 3rd ed. Churchill Livingstone: WB Saunders Company. 1997: 497-524.
16. Newman SJ, Confer AW, Panciera RJ. Urinary system. In: Pathologic Basis of Veterinary Disease, 4th ed. St Louis: Mosby. 2007: 613-691.
17. Novak JM, Craig LE. Pathology in practice. Hydronephrosis and intrapelvic blood nephroliths with acute tubular degeneration and end-stage nephropathy. J Am Vet Med Assoc 2011; 238: 863-865.
18. Nyhus PJ, McCarthy T, Mallon D. Snow leopards. Biodiversity of the World: Conservation from Genes to Landscapes. 1st ed. London: Elsevier. 2016: 409-531.
19. Osborne CA, Lulich JP, Thumchai R, Ulrich LK, Koehler LA, Bird KA, Bartges JW. Feline urolithiasis. Etiology and pathophysiology. Vet Clin North Am Small Anim Pract 1996; 26: 217-232.
20. Radostits OM, Gay CC, Hinchcliff KW, Constable PD. Diseases of the urinary system. In: Veterinary medicine. A textbook of the diseases of cattle, horses, sheep, pigs and goats. 10th ed. Philadelphia: Saunders Elsevier. 2007: 543-573.
21. Robinson MR, Norris RD, Sur RL, Preminger GM. Urolithiasis: not just a 2-legged animal disease. J Urol 2008; 179: 46-52.
22. Ross SJ, Osborne CA, Lekcharoensuk C, Koehler LA, Polzin DJ. A case-control study of the effects of nephrolithiasis in cats with chronic kidney disease. J Am Vet Med Assoc 2007; 230: 1854-1859.
23. Rubin SI. Chronic renal failure and its management and nephrolithiasis. Vet Clin North Am Small Anim Pract 1997; 27: 1331-1354.
24. The IUCN Red List of Threatened Species Web site. Panthera uncia. Available at: http://www.iucnredlist.org/details/22732/0. Accessed Sep 19, 2016.
25. Weber WJ, Raphael BL, Boothe HW Jr. Struvite uroliths in a cheetah. J Am Vet Med Assoc 1984; 185: 1389-1390.