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Polycystic Kidney Disease in the Adult Female Pygmy Hippopotamus (*Choeropsis liberiensis*)

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Abstract : Polycystic kidney disease (PKD) is characterized by multiple cysts within the renal parenchyma and is a common heritable disease in humans, dogs, and cats. However, a few cases of PKD have been described in captive pygmy hippopotamuses. Bilateral PKD was observed in a 33-year-old, 198-kg female pygmy hippopotamus during its necropsy in Seoul Zoo on 15 January 2013. The diagnosis of PKD was confirmed by gross findings and histopathological examination. One kidney was slightly enlarged, and the lower portion of other kidney contained a large cyst filled with light yellow, watery fluid. Both kidneys had numerous, variably sized fluid-filled cysts of 2 to 20 mm in diameter. Considerable portions of the renal cortex and medulla were replaced by cysts. Microscopic inspection showed that the cysts were lined with low cuboidal to flat epithelial cells. The present case report of PKD in a pygmy hippopotamus is the first in Korea.

Key words **:** Polycystic kidney disease, pygmy hippopotamus, *Choeropsis liberiensis.*

Introduction

The pygmy hippopotamus (*Choeropsis liberiensis*) is found in western Africa, mainly in Liberia but also in Sierra Leone, Guinea, and the Ivory Coast (8). It is classified as endangered by the IUCN Red List (19), is listed on Appendix II of CITES, and faces more immediate danger as evidenced by the fact that there are an estimated 2,000 to 3,000 individuals remaining in the wild (18).

Polycystic kidney disease (PKD) is characterized by multiple cysts within the renal parenchyma (15) and is an important contributor to renal and systemic morbidity (2). Although PKD is considered to be heritable in humans, dogs, and cats (3-5,11), the exact mechanisms of PKD remain unclear (2,17). PKD has been frequently reported in a variety of domestic, nondomestic, and wildlife species (1,7,14). However, a few cases of PKD have been described in captive pygmy hippopotamuses (6,13). The authors diagnosed PKD in an aged captive pygmy hippopotamus during its necropsy in Seoul Zoo. To our knowledge, there are no previous reports of PKD in captive pygmy hippopotamuses in Korea. We report this case to provide information regarding the risk of PKD in captive pygmy hippopotamuses in zoos in Korea.

Case

A 33-year-old, 198-kg female pygmy hippopotamus (International Studbook No. 568) was found dead on 15 January 2013 in Seoul Zoo. There were no previous clinical signs before its death. It had been exhibited in a 519-m^2 outdoor enclosure with a 132-m^2 pool and a 15-m^2 wallow area with a male hippopotamus since 1984, when the zoo was opened. The two animals were housed in an indoor exhibition room together during winter. There were freshwater pools without sand filters both the outdoor enclosure and indoor room. The water was supplied from a dam constructed in the upper valley of the zoo. The hippopotamuses were fed twice per day on a diet of hay, pelleted feed for calves, cabbage, Chinese cabbage, carrots, apples, potatoes, and sweet potatoes.

The female hippopotamus was born in the Tierpark Berlin, Germany (International Studbook No. 568), on 22 May 1980 (sire, International Studbook No. 286; dam, International Studbook No. 287). At the age of 4 years, in May 1984, it was transferred to Seoul Zoo. Its male hippopotamus cage mate (International Studbook No. 466, born in Amsterdam Zoo on 10 March 1977) was transferred from Amsterdam, Netherlands in May 1984. The female hippopotamus gave birth to a calf in April 2002; however, the calf died of severe stress due to breech presentation. The calf was pulled out by hand-assisted breech delivery. It died 2 days later, and the female hippopotamus gave birth to no additional calves thereafter. This pair of hippopotamuses was the only pygmy hippopotamus pair in Korea.

A necropsy was performed at the Animal Health Center of the zoo to identify the cause of sudden death of the adult female pygmy hippopotamus. Tissue samples of the lesions were fixed in 10% neutral buffered formalin and processed

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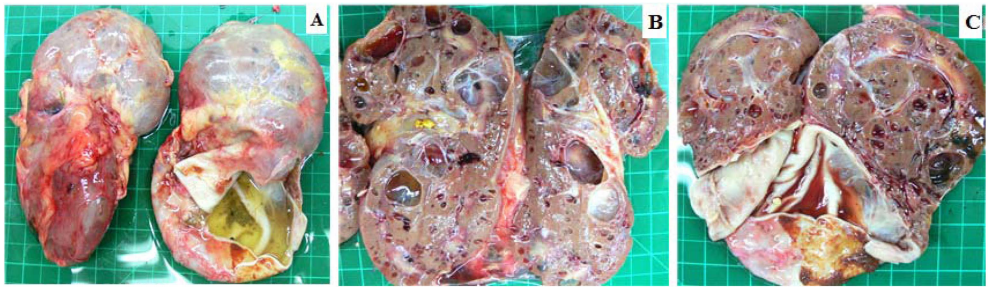

Fig 1. Polycystic kidney disease (PKD) occurred bilaterally in an adult female pygmy hippopotamus. (A) One kidney was slightly enlarged. The lower part of the other kidney had a large cyst filled with light yellow-colored watery fluid. (B, C) Numerous fluid-filled cysts of 2 to 20 mm in diameter were present in the cortex and medulla of the dorsal aspects of both kidneys.

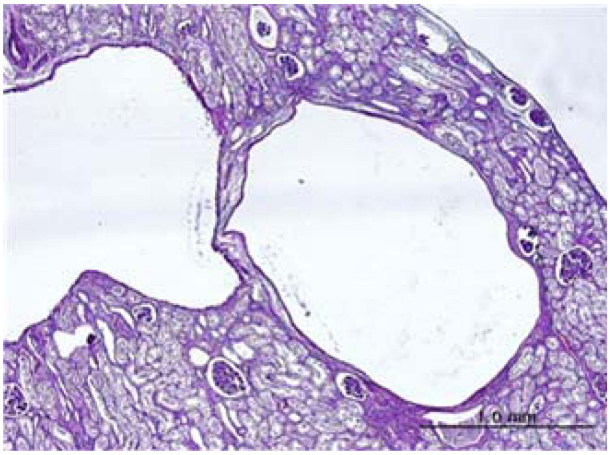

Fig 2. Photomicrograph of the polycystic kidney in the female pygmy hippopotamus stained with hematoxylin and eosin. Approximately 2-mm-diameter cysts were observed in the renal cortex. The cysts were lined with a single layer of low cuboidal to flat epithelial cells.

routinely. Tissue sections were stained with hematoxylin and eosin for light microscopy examination. The diagnosis of PKD was confirmed by gross findings and histopathological examination. On necropsy, one kidney was slightly enlarged (Fig 1A). The lower part of the other kidney contained a large cyst filled with light yellow-colored watery fluid without renal parenchymal tissue (Fig 1A and C). Both kidneys had numerous variably sized fluid-filled cysts of 2 to 20 mm in diameter. A considerable portion of the renal cortex and medulla was replaced by cysts (Fig 1B and C). On microscopic inspection of the kidney, the cysts were lined with low cuboidal to flat epithelial cells (Fig 2).

Blood-stained peritoneal fluid was observed upon opening the abdominal cavity (Fig 3A). Widespread hematomas and congestion were present in the mesentery of the intestine (Fig 3B). Mesenteric torsion was also observed (Fig 3C). There were no specific lesions in other organs, such as the liver, pancreas, heart, or stomach.

Discussion

Various PKDs have been described in humans (15) and many domestic animal species including lambs (7), rabbits (10) and cats (5). However, a few cases of PKD have been reported in exotic or wildlife species, including sturgeons (17), pandas (9), deer (1), and raccoons (4). The authors encountered PKD in a captive pygmy hippopotamus during its necropsy in Seoul Zoo.

Nees *et al.* (11) described the occurrence of PKD in 13 aged female hippopotamuses. The present case also involved a female aged pygmy hippopotamus. Raymond *et al.* (13) reported that the clinical signs prior to death of pygmy hippopotamuses with PKD were anorexia, lethargy, weight loss, polydipsia, and polyuria. Although the clinical signs shown by affected pygmy hippopotamuses with PKD are nonspecific, they may include those suggestive of renal disease (11). In the present case, there were no clinical signs before death.

Kidneys with PKD in pygmy hippopotamuses contain numerous, variably sized fluid-filled cyst that partially and completely efface the cortices and medullae (13). Multifocal fluid-filled cysts may be present within the parenchyma and under the capsule of the liver as well as in the mucosa of the proximal duodenum (11). In the present case, both kidneys

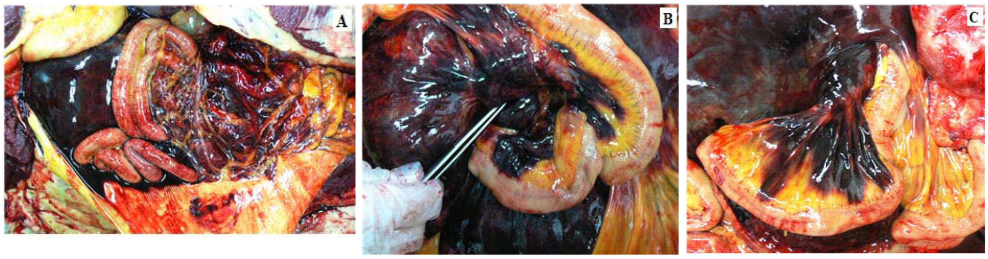

Fig 3. Blood-stained peritoneal fluid and mesenteric hematomas and congestion were observed. (A) Large hematoma caused by leakage of blood into the space between the two serosal layers of the mesentery. Dark red-colored, blood-stained peritoneal fluid was found. (B, C) Mesenteric torsion and severe hematoma were observed. Grossly, the small intestine was normal, with the exception of the mesenteric hematomas.

exhibited numerous variably sized fluid-filled cysts 2 to 20 mm in diameter. One kidney was almost half the size of the other. The cause of these size discrepancy, whether a congenital defect or secondary to PKD, is uncertain.

Nees *et al.* (11) reported that histologically, the renal cysts in PKD are lined by cuboidal to squamous epithelium surrounded by fibrous connective tissue of variable thickness. The kidneys in the present case contained cysts lined with low cuboidal to flat epithelial cells. On the other hand, Sanna-Cherchi (16) reported that renal dysplasia or hypoplasia is another congenital kidney disease in humans. The present case exhibited renal defects in one kidney. The relationship between the renal defects and PKD is unclear.

Although the natural course of PKD is not well characterized (12), it seems to be a multifactorial disease with a complex pathogenesis. Additionally, there is some indication that in genetically susceptible individuals, environmental factors may trigger the initiation and perhaps the progression of PKD (11). Although the cause of cystic disorders has not been determined, some factors may have contributed to the death of this pygmy hippopotamus. This report is the first case of PKD in a pygmy hippopotamus in Korea, and further study is needed to elucidate the pattern of occurrence of PKD in pygmy hippopotamuses.

References

1. Blutke A, März K, Matenaers C, Oswald K, Hermanns W, Wanke R. Polycystic kidney disease in a European roe deer (Capreolus capreolus). J Zoo Wildl Med 2013; 44: 487-490.
2. Czarnecki PG, Steinman TI. Polycystic kidney disease: new horizons and therapeutic frontiers. Minerva Urol Nefrol 2013; 65: 61-68.
3. Goilav B. Apoptosis in polycystic kidney disease. Biochim Biophys Acta 2011; 1812: 1272-1280.
4. Hamir AN, Klein L. Polycystic kidney disease in a raccoon (Procyon lotor). J Wildl Dis 1996; 32: 674-677.
5. Helps C, Tasker S, Harley R. Correlation of the feline PKD1 genetic mutation with cases of PKD diagnosed by pathological examination. Exp Mol Pathol 2007; 83: 264-268.
6. Jarofke D, Klös HG. Immobilisation and diseases of pygmy hippopotamus. VerhBer Erkr Zootiere 1982; 24: 361-374.
7. Johnstone AC, Davidson BI, Roe AR, Eccles MR, Jolly RD. Congenital polycystic kidney disease in lambs. N Z Vet J 2005; 53: 307-314.
8. Kleiman DG, Geist V, McDade MC. Grzimek's animal life encyclopedia. vol 15, 2nd ed. 2004: 301-312.
9. Makungu M, du Plessis WM, Barrows M, Koeppel KN, Groenewald HB. Polycystic kidneys in the red panda (Ailurus fulgens). J Zoo Wildl Med 2013; 44: 777-780.
10. Maurer KJ, Marini RP, Fox JG, Rogers AB. Polycystic kidney syndrome in New Zealand White rabbits resembling human polycystic kidney disease. Kidney Int 2004; 65: 482-489.
11. Nees S, Schade B, Clauss M, Steinmetz HW, Ehrensperger F, Steck B, Hatt JM. Polycystic kidney disease in the pygmy hippopotamus (Hexaprotodon liberiensis). J Zoo Wildl Med 2009; 40: 529-535.
12. Parfrey PS, Bear JC, Morgan J, Cramer BC, McManamon PJ, Gault MH, Churchill DN, Singh M, Hewitt R, Somlo S, Reeders ST. The diagnosis and prognosis of autosomal dominant polycystic kidney disease. N Engl J Med 1990; 323: 1085-1090.
13. Raymond JT, Eaton KA, Monyali RJ. A disease in captive pygmy hippopotamuses (Choeropsis liberiensis) anatomically resembling polycystic kidney disease. Proc Amer Assoc Zoo Vet 2000; 302.
14. Roher DP, Nielsen SW. Polycystic kidneys in a western coyote. J Am Vet Med Assoc 1983; 183: 1276-1277.
15. Rowe I, Boletta A. Defective metabolism in polycystic kidney disease: potential for therapy and open questions. Nephrol Dial Transplant 2014; 29: 1480-1486.
16. Sanna-Cherchi S, Caridi G, Weng PL, Scolari F, Perfumo F, Gharavi AG, Ghiggeri GM. Genetic approaches to human renal agenesis/hypoplasia and dysplasia. Pediatr Nephrol 2007; 22: 1675-1684.
17. Taylor P, Smith CE, Blair MJ. Polycystic lesions in the liver of the white sturgeon. J Aquat Anim Health 2009; 21: 57-59.
18. The Convention on International Trade in Endangered Species of Wild Fauna and Flora. <http://www.cites.org>. Downloaded on 29 July 2014.
19. The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on 29 July 2014.

꼬마하마(*Choeropsis liberiensis*)에서 확인된 다낭신장병

어경연 · 이명희 · 정영목 · 여용구 · 이현호 · 문경철* · 권오덕[1]**

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요 약 : 다낭신장병은 신장실질에 다수의 낭포가 형성되는 것을 특징으로 하는 사람, 개, 고양이에서 흔히 있는 유전성 질환으로서, 사육상태의 꼬마하마(pygmy hippopotamus)에서도 몇 몇 증례가 보고되고 있다. 2013년 1월 15일 체중 198킬로그램, 33년령 암컷 꼬마하마의 부검과정 중에 양쪽 신장에서 다낭신장병이 관찰되었다. 한 쪽 신장은 약간 종대된 반면 다른 쪽 신장의 아랫부분은 옅은 황색의 수양성 액체로 채워진 한 개의 큰 낭포가 있었다. 양측 신장 모두 직경 2 mm에서 20 mm의 다양한 크기의 액체가 함유된 다수의 낭포들이 관찰되었다. 상당한 부분의 신장 피질과 수질부가 낭포들로 대체되어 있었다. 현미경 검사에서 낭포들의 안쪽은 낮은 입방세포에서부터 편평상피세포들로 구성되어 있었다. 육안적인 소견과 조직병리학적인 검사로 다낭신장병으로 진단하였다. 본 증례보고는 한국에서 최초로 꼬마하마에서 다낭신장병이 확인된 것이다.

주요어 : 다낭신장병, 꼬마하마, *Choeropsis liberiensis*