Case Report

Spontaneous Pancreatic Islet Amyloidosis in a Greater White-nosed Guenon (*Ceropithecus nictitans*)

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Abstract: Pancreatic islet amyloidosis from a 15-year-old female greater white-nosed guenon is described. The monkey had been kept in an indoor exhibition facility at the Seoul Grand Park, Korea, and died 2 days after development of anorexia and lethargy. Histologically, amorphous homogeneous eosinophilic, hyalinized material was found deposited in the pancreatic islets and was positive for Congo red stain. The deposits were positive to amyloid A protein and P component by immunohistochemistry. Additionally, glucosuria and ketonuria were detected. (J Toxicol Pathol 2005; 18: 61–63)

Key words: amyloidosis, pancreas, monkey

Pancreatic islet amyloidosis has been reported in humans and in non-human primates with type 2 diabetes mellitus^{1,2}. In non-human primates, islet amyloidosis has been reported in chimpanzees (*Pan troglodytes*)³, Celebes crested macaques (*Macaca nigra*)⁴, rhesus monkeys (*Macaca mulatta*)⁵, cynomolgus monkeys (*Macaca fascicularis*)^{1,6}, pigtailed macaques (*Macaca nemestrina*)⁷, and baboons (*Papio* species)⁸. In this report, we describe a case of spontaneous pancreatic islet amyloidosis in a greater white-nosed guenon (*Ceropithecus nictitans*).

Primary amyloidosis is generally associated with plasma cell dyscrasias and is the most common type of amyloidosis in humans. Secondary amyloidosis is associated with chronic inflammatory disease and is the most common form in animals^{3,9}. Amyloid fibril protein makes up about 95% of amyloid and the other 5% is the P component, which is a glycoprotein. In humans as well as in non-human primates with type 2 diabetes mellitus, the major pancreatic lesion is islet amyloidosis; pancreatic amyloidosis has been found in over 90% of humans with type 2 diabetes mellitus and in 100% of spontaneously diabetic cynomolgus macaques^{1,2,10}.

In our case, the monkey was a 15-year-old female greater white-nosed guenon that had been kept in an indoor

exhibition facility at the Seoul Grand Park, Korea. The guenon died 2 days after the initiation of clinical signs of anorexia and lethargy. Before death, urinalysis was performed using a uropaper strip (Eiken Chemical, Japan). The urinary glucose level was 4+ (> 1,000 mg/dl) and the urinary ketone level was +3 (> 40 mg/dl). The postmortem examination was performed immediately after death.

Representative tissue specimens were fixed with 10% phosphate-buffered formalin, routinely processed, and stained with hematoxylin and eosin (HE) and Congo red. Immunohistochemical identification of amyloid A protein and P component was performed in the pancreas. Sections were placed on Probe-On slides (Fisher Scientific, Pittsburgh, PA, U.S.A.), and unlabelled antibody directed against human amyloid A protein (mouse monoclonal, DAKO Corporation, Carpinteria, CA, U.S.A.) and human P component (DAKO Corporation), at dilutions of 1:50 and 1:100, respectively, were used as primary antibodies. The standard avidin-biotin complex (ABC) method was used according to the manufacturer's protocol (Vectastain kit, Vector Laboratories, Burlingame, CA, U.S.A.) to demonstrate antigen, using 3'3'-diaminobenzidine as the chromogen. To enhance the immunoreactivity, sections in a plastic jar containing 0.01 M sodium citrate (pH 6.0) were heated in a microwave oven for 10 min.

On light microscopic examination, significant change was limited to the pancreas. Microscopically, an amorphous homogeneous eosinophilic, hyalinized material was deposited in the pancreatic islets (Fig. 1A). The degree of deposit ranged from mild, multifocal deposits without loss

Fig. 1. Histopathology of the pancreas. Note amyloid deposits in pancreatic islets. HE (A). Congo red (B). Bar = 100 μ m. Amyloid deposits are positive for amyloid A (C) and P component (D) by immunohistochemistry, ABC. Bar = 50 μ m.

of islet cells to marked diffuse deposits with severe atrophy and loss of islet cells. The eosinophilic material deposited in the islets was positive for Congo red stain (Fig. 1B) and was birefringent under polarizing light microscopy. There was minimal amount of amyloid deposit in the spleen, liver, and kidney (data not shown). The islet amyloid deposits were also strongly positive for amyloid A (Fig. 1C) and the P component (Fig. 1D). Previously, Hubbard et al. reported that immunohistochemical staining for amyloid A and P component had been very effective in identifying amyloid in pancreatic islets⁸. It is unlikely that the amyloid A immunostaining of amyloid deposits was a cross-reaction with the P component because the tissue localizations of the immunoreactive materials of amyloid A and P components were different from each other.

Elevated blood glucose levels may be one of the best indications of pancreatic islet amyloidosis^{1,2,8}. Pancreatic islet amyloid deposits are seen in more than 90% of humans with type 2 diabetes mellitus^{2,10}. The chronic stages of type 2 diabetes mellitus are associated with the replacement of islet tissue by amyloid, with up to 50% loss of the pancreatic beta cells¹⁰. Based on the pancreatic islet change and urinary analysis data, the present case was diagnosed as pancreatic amyloidosis with type 2 diabetes mellitus although no blood

glucose data was available. This is the first report of islet amyloidosis with amyloid A and P components in a greater white-nosed guenon with type 2 diabetes mellitus.

Acknowledgments: This case report was supported by a grant from KRIBB Research Initiative Program and Brain Korea 21 Project.

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