NOTE *Pathology*

Hepatic Myelolipoma with Systemic Amyloidosis in a Goose (*Anser cygnoides domesticus*)

Takayuki SUZUKI[1)], Kouji UETSUKA[1)], Kouichi KUSANAGI[1)], Takuya HIRAI[2)], Tetsuo NUNOYA[1)] and Kunio DOI[1)]

[1)]Nippon Institute for Biological Science, 9–2221–1 Shinmachi, Ome, Tokyo 198–0024 and [2)]Department of Veterinary Pathology, Faculty of Agriculture, Miyazaki University, Miyazaki 889–2155, Japan

(Received 15 October 2009/Accepted 3 January 2010/Published online in J-STAGE 22 January 2010)

ABSTRACT. We report here a case of hepatic myelolipoma with systemic amyloidosis in a goose (*Anser cygnoides domesticus*), which died suddenly following the short history of weakness and greenish diarrhea. At necropsy, multiple yellowish-white foci were observed on the surface of the prominently enlarged liver. Histologically, there were multiple foci of adipose tissue admixed with myeloid elements in various proportions in the liver as well as amyloid deposition in several organs including the liver, intestine, spleen, kidney, and ovary. Ultrastructurally, erythroblast-like cells and myelocytes, which showed various stages of differentiation, were observed in the foci of the liver. These findings shared characteristics of hepatic myelolipoma which is very rare in birds.
KEY WORDS: amyloidosis, goose, myelolipoma.

J. Vet. Med. Sci. 72(5): 669–671, 2010

Myelolipoma is a benign extramedullary tumor that is composed of mature adipose tissue and myeloid tissue in various proportions [5]. The tumor is often found in humans, and most of them are located in the adrenal glands [4, 6, 12, 14, 16, 19, 21, 22]. On the other hand, the tumor is infrequent and mostly located in the liver or spleen in domestic animals [1, 7, 8, 13, 15, 23]. In birds, the tumor is extremely rare, and there are only a few reports in pet and exotic birds [2, 11, 17]. This paper describes histologic and ultrastructural characteristics of the first case of hepatic myelolipoma with systemic amyloidosis in a goose (*Anser cygnoides domesticus*).

A young female goose (age unknown) that has been kept in a breeding cage for collecting blood samples suddenly died following a short history of weakness and greenish diarrhea. At necropsy, there were swelling of plantar digital pads with a small browned area of the skin surface and multiple yellowish-white foci ranging from 1 to 3 mm in diameter on the surface of the prominently swollen liver as well as on the serosal surface of both the small intestine and the ovary. No abnormalities were observed in the other organs. Tissues were fixed in 4% phosphate-buffered paraformaldehyde solution, embedded in paraffin, sectioned at 4 μm, and stained with hematoxylin and eosin (HE) for histological examination. Some sections were stained by periodic acid-Schiff (PAS) reaction, Congo red staining or Schmorl method.

For electron microscopic analysis, small pieces of the paraformaldehyde-fixed liver were refixed in 1% osmium tetroxide and embedded in epoxy resin. Ultrathin sections were double-stained with uranyl acetate and lead citrate and were examined using a transmission electron microscope (H600, Hitachi, Tokyo, Japan).

* CORRESPONDENCE TO: SUZUKI, T., Nippon Institute for Biological Science, 9–2221–1 Shinmachi, Ome, Tokyo 198–0024, Japan.
e-mail: takayuki.s@nibs.or.jp

In the liver, there were multiple foci of adipose tissues admixed with myeloid elements in various proportions (Fig. 1A). The myeloid elements were composed of erythrocytic and granulocytic series at various stages of differentiation (Fig. 1B). Bony spicules were observed in some areas of adipose tissue (Fig. 2). In the sinusoid or peri-sinusoidal space, there was an accumulation of eosinophilic homogeneous and amorphous material (Fig. 3). Deposition of similar material was also found in several tissues, including lamina propria in the intestine, sheathed arteries in the spleen, basement membrane of the renal tubules, and cortex in the ovary. The material showed a positive stainability for Congo red, and the degree of stainability was reduced after potassium permanganate processing. The material also showed apple-green birefringence under polarized light. Ultrastructurally, erythroblast-like round to oval cells with scattered free ribosomes throughout the cytoplasm (Fig. 4A) and myelocytes at various stages of differentiation were observed within the myeloid elements in the liver (Fig. 4B , C). The extracellular deposits in the peri-sinusoidal space consisted of 8 to 10 nm non-branching filaments (Fig. 4D).

On the HE-stained section, yellowish-orange granules were found in the cytoplasm around the nucleus of neurons in the central nervous system. These granules were positively stained by PAS reaction and Schmorl method. Judging from the above-mentioned results, the present case was diagnosed as hepatic myelolipoma with systemic amyloidosis and neuronal pigmentation in the central nervous system.

The differential diagnosis of myelolipoma includes extramedullary hematopoiesis, osseous metaplasia, angiomyelolipoma, and angiomyomyelolipoma [5, 11]. Extramedullary hematopoiesis is characterized by densely packed hematopoietic cells and usually lacks adipose tissue while myeloliopoma always contains both hematopoietic and fatty components. On the other hand, osseous metaplasia usually contains bony spicules while bony spicules are

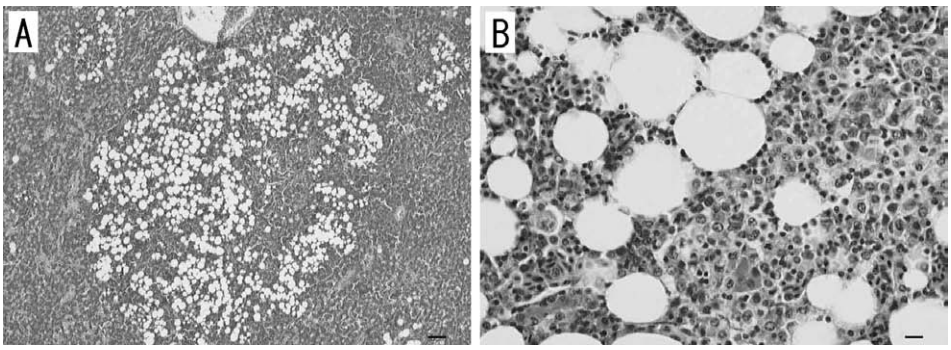

Fig . 1. Micrographs of the liver. (A) Multiple foci of adipose tissue admixed with myeloid elements in various proportions. HE. Bar=100 μm. (B) A focus of various hematopoietic cells and adipocytes. HE. Bar=10 μm.

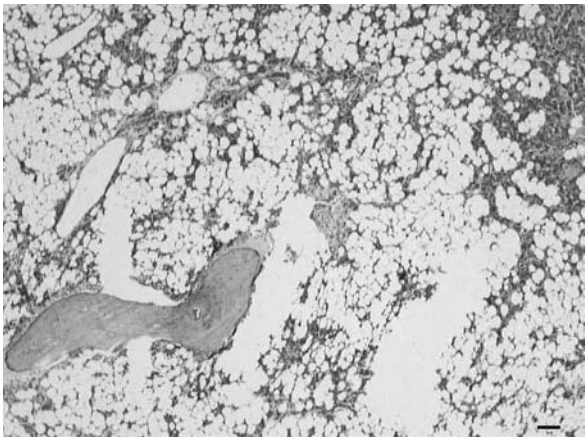

Fig. 2. Bony spicules in adipose tissues in the liver. HE. Bar=100 μm.

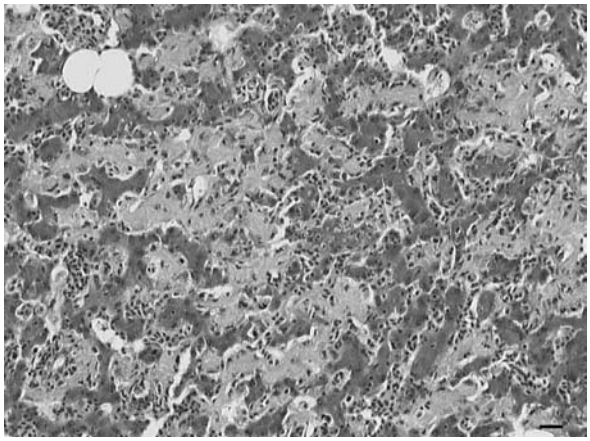

Fig 3. Eosinophilic homogeneous and amorphous material in the sinusoid or peri-sinusoidal space of the liver. HE. Bar=20 μm.

not common in myelolipomas. Myelolipoma can be differentiated from angiomyelolipoma and angiomyomyelolipoma, which have the proliferative areas of vascular elements and/or smooth muscle cells, respectively. In the present case, fatty components were more prominent than hematopoietic components, and bony spicules were observed only in the limited areas of tumor tissue as previously reported in hepatic myelolipoma [13, 21, 22]. To date, six cases of myelolipoma have been reported in birds; four occurring in the cutaneous tissue, one in the abdomen, and one in the liver [2, 11, 17].

Although the exact pathogenesis of myelolipoma is still unclear, there are several hypotheses [2, 4, 6, 11–13]. The first hypothesis is that myelolipoma formed in the adrenal gland may arise from uncommitted adrenocortical mesenchymal cells. In humans, the occurrence of adrenal myelolipoma is frequently associated with endocrinological disorders or chronic debilitating diseases. These conditions are thought to stimulate uncommitted adrenocortical mesenchymal cells to differentiate into myeloid or lipid cells. The second one is that myelolipoma may originate from congenitally misplaced hematopoietic stem cells or from direct extension of bone marrow from the adjacent interosseous bone. In this hypothesis, prolonged hematopoietic stimuli, such as anemia and hypoxia, may be important as an activating factor. Thus, myelolipoma is considered to represent choristomas or metaplastic lesions rather than true neoplasms [2, 4, 6, 11–13].

The amyloid which deposited in various organs in the present case was suspected as AA amyloid based on the results of Congo Red staining with potassium permanganate processing. There are a number of reports of amyloidosis in birds especially in waterfowl [23, 24]. In addition, it is noted that the occurrence of AA amyloidosis in waterfowl increases under stressful environmental conditions or chronic inflammatory disease such as bumblefoot [23, 24], and AA amyloidosis in the present case might be also induced by lesions in the plantar digital pads or stressful conditions such as breeding in a cage and repeated blood collection.

The granules which deposited in neurons in the central nervous system were suspected as lipofuscin or ceroid based on the results of histochemical staining. The deposition of ceroid or lipofuscin is induced by aging, dystrophy, wasting diseases, and so on [8, 11]. In the present case, there is a

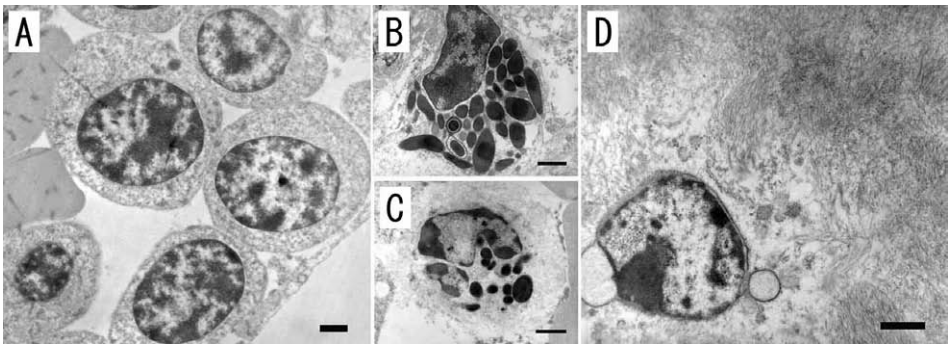

Fig 4. Electron micrographs of the liver. Bar=1 μm. (A) Cluster of erythroblast-like cells in the myeloid element. (B) Immature heterophil with non-lobulated nucleus and a number of oval granules in the myeloid element. (C) Eosinophil with bi-lobed nucleus and a small number of round granules in the myeloid element. (D) The non-branching filaments in the peri-sinusoid of the liver.

possibility that such wasting conditions as hepatic myelolipoma and systemic amyloidosis contributed to the pigmentation.

ACKNOWLEDGEMENT. We thank Ms. H. Tomioka for her excellent technical assistance.

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