Case Report

Cardiac Rhabdomyoma in a Beagle Dog

Kazuo Kizawa¹, Shinichi Furubo¹, Takahiro Sanzen¹, Yasuhide Kawamura¹, and Isao Narama²

¹Drug Safety Research Laboratory, Toyama Chemical Co., Ltd., 2–4–1, Shimookui, Toyama 930–8508, Japan
²Research Institute of Drug Safety, Setsunan University, 45–1 Nagaotohge-cho, Hirakata, Osaka 573–0101, Japan

Abstract: Cardiac rhabdomyoma was found as an incidental finding in a 6-month-old male beagle dog on microscopic examination. The lesions took a spongy appearance and were located in the subepicardial area of the junction of the left ventricular wall and the interventricular septum. The cells comprising the lesions had a large vacuole surrounded by a narrow rim of cytoplasm. The cytoplasm of these cells was positive for periodic acid-Schiff's reaction, but negative after digestion with diastase. Cross-striation was seen in the cytoplasm by phosphotungstic acid hematoxylin staining. No abnormalities were detected by clinical examination, including blood chemistry and electrocardiography. This case might be the first reported cardiac rhabdomyoma in laboratory beagle dogs. (J Toxicol Pathol 2002; 15: 69–72)

Key words: rhabdomyoma, glycogen, myocardium, beagle dog

Cardiac rhabdomyoma is a lesion characterized by large vacuolated myocardial cells containing glycogen, and synonymously “rhabdomyomatosis”, “congenital glycogenic tumor”, “circumscribed glycogenic storage disease”, “nodular glycogenic degeneration”, “nodular glycogenosis”, and “nodular glycogenic infiltration” are used for the lesion¹–³. This lesion has often been reported in pigs and guinea pigs¹–⁷, but there were only two cases in dogs⁸,⁹. In laboratory beagle dogs, myocarditis, fibrosis, calcification, granuloma, and pericarditis are common as spontaneous lesions in the heart¹⁰, but there have been very few reports of cardiac rhabdomyoma. This report describes a case of cardiac rhabdomyoma in a laboratory beagle dog. A 6-month-old male beagle dog was purchased from CSK Research Park Co., Ltd. (Nagano, Japan), and assigned to a dosing group in a repeated dose toxicity study. The dog was infused with a test article via the cephalic vein once a day for 2 weeks. Before euthanasia, serum biochemical analyses, including lactate dehydrogenase (LDH), aspartate aminotransferase (AST), alanine aminotransferase (ALT), creatine phosphokinase (CPK), triglyceride (TG), and glucose, were conducted. On electrocardiography, the dog was laid on the right side, and the standard limb leads I, II, and III were recorded. At the end of the dosing period, the dog was euthanized under deep pentobarbital anesthesia by exsanguination from the axillary artery. At necropsy, the heart weighed 86.7 g and had no gross abnormalities. The following tissue samples from the heart fixed in 10% formalin solution were prepared as paraffin-embedded sections, stained with hematoxylin and eosin (H & E), and examined microscopically; interventricular septum, bilateral ventricular walls, and apex. Special staining included periodic acid-Schiff’s reaction (PAS) with and without diastase digestion, and phosphotungstic acid hematoxylin (PTAH).

Microscopically, three small oval foci were located in the subepicardial area of the junction of the left ventricular wall and the interventricular septum; they varied in size from 810 × 280 µm for the largest one to 300 × 140 µm for the smallest one. The individual foci were sharply circumscribed, but neither encapsulated nor compressing adjacent myocardial tissues, and had a spongy appearance. The lesions were almost composed of enlarged cells containing a single large vacuole surrounded by a narrow rim of cytoplasm (Fig. 1). Cross-striation was noted in the cytoplasm (Fig. 2). Nuclei of the affected cells were enlarged. Typical “spider cells” that have been described in human cardiac rhabdomyoma¹¹ were not observed. Stromal collagen was scant, and no mitotic figures were observed. The cytoplasm of the affected cells was positive for PAS, but negative after diastase digestion (Fig. 3). The liver, kidneys, esophagus, and skeletal muscle showed no histopathological changes. Neither congenital malformations nor neoplasms were observed in any organs. No abnormalities were detected on blood chemistry; the serum levels for LDH, AST, ALT, CPK, TG, and glucose were 74 IU/L, 28 IU/L, 24 IU/L, 186 IU/L, 38 mg/dL and 102 mg/dL, respectively.

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Mailing address: Kazuo Kizawa, Drug Safety Research Laboratory, Toyama Chemical Co., Ltd., 2–4–1, Shimookui, Toyama 930–8508, Japan
TEL: 81-76-431-8275 FAX: 81-76-431-8208
E-mail: kazuo_kizawa@toyama-chemical.co.jp
Fig. 1. Three spongy foci (arrows) are observed in the myocardial tissue under the epicardium (*) (A). H & E stain, original magnification × 60. The foci are circumscribed without compression to adjacent tissue, and are composed of enlarged cells with cytoplasmic large vacuoles (B). H & E stain, original magnification × 130.

Fig. 2. Cross striation is identified in cytoplasm of the affected cells in the foci (arrows). PTAH stain, original magnification × 800.
On electrocardiography, the waveform was normal, and the interval, including P wave, PQ, QRS, QT, and RR, and potential of each wave showed no abnormalities. Similar lesions were not observed in other dogs assigned to the same dosing group.

The etiology and pathogenesis of cardiac rhabdomyoma are still uncertain. In human clinicopathology, most investigators have proposed that cardiac rhabdomyoma is a hamartomatous change rather than a true neoplasm, because this lesion has been observed chiefly in infants, and has frequently been associated with tuberous sclerosis, other congenital malformations, and neoplasms. Some morphological and immunohistochemical evidences confirm this proposition\(^{11,12}\). On the other hand, some investigators have considered cardiac rhabdomyoma to be a degenerative change in myocardial cells with glycogen accumulation or a congenital dysplasia of the perinatal cardiac tissues with myofibrillar degeneration\(^{5,13}\). Recently, Vaughan and colleagues\(^{14}\) reported that human cardiac rhabdomyomas were caused by mutation in the TSC1 and TSC2 genes.

Cardiac rhabdomyoma should be distinguished from glycogen storage disease. This disease, so-called glycogenosis, is characterized by glycogen accumulation in the heart, skeletal muscles, liver, kidneys, or muscular layer of esophagus\(^{15}\). In this case, these organs and tissues showed no abnormalities, and the lesion involved only one part of the heart, thus the authors consider this case to be cardiac rhabdomyoma. It has been pointed out that the glycogen in rhabdomyoma cells is more soluble in ordinary fixatives than that in the myocardial cells in glycogen storage disease\(^4\); the solubility of glycogen in aqueous fixatives is dependent on the degree of polymerization\(^7\). The authors could not demonstrate the presence of glycogen in vacuoles; this is perhaps because the tissue samples were fixed in 10% formalin solution.

There are few reports on the findings of clinical examinations including blood chemistry and electrocardiography in animals with cardiac rhabdomyoma. In this case, serum levels for LDH, AST, ALT, CPK, TG, and glucose, some of which are useful indices for myocardial disorders, were within normal limits. Electrocardiogram was normal. These findings together suggest that no clinical features were observed in this case of small cardiac rhabdomyoma.

To the best of our knowledge, this case is the first report of cardiac rhabdomyoma in laboratory beagle dogs.
References