Short Communication

Granulomatous Gastritis and Natural Infection with Spirilla in Beagle Dogs

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Abstract: Since granulomatous gastritis and infection with spirilla were observed in most of the Beagle dogs sacrificed for a certain toxicity study, we investigated the stomach histopathologically. The lesions were characterized by degeneration and erosion in the mucosal and crypt epithelium, diffuse and focal infiltration of inflammatory cells containing foreign body giant cells in the lamina propria and hyperplasia of lymphoid follicles in the submucosa. Spirilla were adhered to the epithelium and seen in the crypt lacunae without invading into the tissues. However, they invaded into the cytoplasm of the parietal cells and induced mild degeneration and necrosis. The granulomatous lesions and spirilla were more markedly observed in the pylorus than in the fundus. There was no clear relationship between granuloma and spirilla, but granulomas were considered to be formed by foreign materials invading from the gastric lumen through the destroyed epithelium. (J Toxicol Pathol 1998; 11: 69~71)

Key words: Granuloma, Gastritis, Spirilla, Beagle dogs

Introduction

Gastric spirilla, particularly *Helicobacter pylori*, has been much reported in connection with gastritis and stomach ulcer in man.

Recently, *Gastrospirillum hominis* or *H. heilmani* which are slightly larger spirilla than *H. pylori* have been given attention due to having pseudo-positive reaction by urease activation like *H. pylori* and due to the occurrence of mild gastritis in children^{1,2}. Kasai (1919), who has been successful in intragastric infection with spirilla in mice and rats, described that gastric spirilla in dogs had been reported by several investigators in the latter half of the 19th century³. While the spirilla were considered not to be pathogenic in normal dogs^{4,5}, spirilla are reported to be related to gastric lesions^{6,7}. Furthermore, granulomatous gastritis has been reported in man infected with spirilla^{5,8}. The spirilla which were seen in dogs and cats are also observed in man, and the evidence shows that the infection is probably derived from these animal pets. Therefore, we believe that the study of spirilla and gastritis is of special significance.

This paper describes the histopathological features of the gastritis with granuloma and natural infection with spirilla in Beagle dogs.

Materials and Methods

Twenty-three male and female Beagle dogs aged 8 months were examined. Pyloric and fundic regions of the stomach were fixed in 10% buffered formalin and stained with hematoxylin and eosin (HE). Other sections were stained

with silver of Wathin-Stary, Giemsa, Toluidine blue or Periodic Acid-Schiff (PAS).

Results

Macroscopically, no significant changes were observed except for slight hemorrhage on the mucosal surface in the pylorus.

Microscopically, gastric lesions were more conspicuous in the pylorus than in the fundus (Table 1). In the pylorus, small granulomas were observed near the mucosal and crypt epithelium, and inflammatory cells were diffusely infiltrated in the lamina propria. The granuloma consisted of foreign body giant cells and a small number of histiocytes and occasionally showed indistinct nodular appearance (Fig. 1). The causes of granuloma were not clarified in the present study. However, the foreign materials phagocytosed by giant cells were characterized by the following: The foreign materials were irregular in shape, invisible with HE and PAS stain, reddish purple with Giemsa stain and metachromasia with Toluidine blue stain. The characteristic stainability was similar to that of the mucosal mast cells proliferated in the lamina propria.

The mucosal epithelium covered with villi was often degenerated and necrotized, showing nuclear pyknosis and was eosinophilic in the cytoplasm. Moreover, desquamation and erosion were occasionally observed in the epithelium and were also observed in the crypt (Fig. 2). As other changes in the pylorus, small foci of eosinophiles and neutrophils were infrequently observed at the subepithelium of the crypt, and lymphoid follicles were hyperplastic.

On the other hand, spirilla, about 3 to 7 μ m in length, were recognized in the mucosal epithelium and in crypt lacunae, but they did not invade into the epithelium or lamina propria. In the fundus spirilla often invaded into the cytoplasm of the parietal cells, but most of the invaded cells

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Table 1. The Incidence of Gastric Lesions in Beagle Dogs

Main Lesions	Pylorus (20*)				Fundus (21)			
	—	+	⦿	⦿	—	+	⦿	⦿
Spirilla	6 (30)**	10 (50)	3 (15)	1 (5)	0 (0)	21 (100)	0 (0)	0 (0)
Granuloma (giant cell)	1 (5)	15 (75)	4 (20)	0 (0)	15 (71)	6 (29)	0 (0)	0 (0)
Degeneration and erosion	0 (0)	19 (95)	1 (5)	0 (0)	1 (5)	20 (95)	0 (0)	0 (0)
Inflammatory cell	1 (5)	13 (65)	6 (30)	0 (0)	13 (62)	8 (38)	0 (0)	0 (0)
Lymphoid follicle	4 (20)	12 (60)	4 (20)	0 (0)	10 (48)	7 (33)	3 (14)	1 (5)

* : Number of animals examined

** : The incidence lesions (%)

Fig. 1. Note the granulomatous lesions characterized by foreign body giant cells in pylorus. (A) A granuloma is seen just under the villous epithelium (arrow). HE. $\times 200$. (B) Spirilla adhere to the epithelium but do not invade. Arrows show foreign body giant cells. HE. $\times 400$.

Fig. 2. Note degeneration and erosion of crypt epithelium in pylorus, and spirilla are seen in the lacuna. CE : Cryptal epithelium. Toluidine blue. $\times 400$.

Fig. 3. Note the spirilla in the parietal cells in fundus (arrow). spirilla (large arrow) occasionally cause degeneration and necrosis of parietal cells. Toluidine blue. $\times 400$.

were not affected and mild degenerative and necrotic changes were merely observed (Fig. 3). Although the spirilla were found in all cases, there was no correlation between severity of gastric lesions and quantity of the spirilla.

Discussion

Granuloma of the stomach may be uncommon and be accidentally developed by infection with microorganisms and foreign bodies in dogs and man^{4,8}. In the present study, granulomatous gastritis was observed in numerous Beagle dogs sacrificed during a certain toxicity study, but it was clarified from the findings observed in the control animals that gastric lesions are not caused by the test substance. The histological changes were similar to those in granulomatous gastritis with spirilla in man⁸. That is to say, granuloma consisting of giant cells and a small number of histiocytes was small and was sporadically observed on the surface of the lamina propria. Simultaneously, a variety of inflammatory cells containing mast cells were diffusely infiltrated and lymphoid follicles were observed in many cases.

Granuloma was usually found in the subepithelium covered with villi and pits, and the epithelium occasionally showed degeneration, necrosis, and erosion. From these findings, it was suggested that granuloma might be formed by invasion of foreign materials from the gastric lumen. Ectors⁸ has also discussed that foreign materials originate from gastric contents such as mucus. On the other hand, the spirilla usually adhered to the columnar mucous cells of the villi and were present in the lumen of the pits. The spirilla did not invade into the epithelium of villi and pits, and could not be recognized within granuloma. However, the spirilla tend to invade the parietal cells only, and as a result, they showed mild injury such as degeneration and necrosis. The invasion into the parietal cells has been observed in animals infected with *G. hominis*⁵. Pathogenicity of the spirilla like the *G. hominis* has not been clarified yet, but was reported to be related to granulomatous gastritis⁵ and chronic gastritis² in man, and lymphoid follicle hyperplasia and degeneration of the parietal cells in dogs^{6,7}. To be early clarified the pathogenicity will be expected. It was of interest for us that foreign materials phagocytosed by giant cells occasionally have the same stainability as the mast cells. The mucosal mast cells, which have some characteristics different from that

of the other regions such as connective tissues, are useful for the protection of foreign antigens, and are present in the lamina propria of the gastrointestinal tract⁹. We could not sufficiently investigate the mucosal mast cells because materials examined were fixed in formalin solution. However, since the mast cells stained with Giemsa and Toluidine blue, were proliferated in the lamina propria, they were considered to have an important role in foreign materials and spirilla. Gastric lesions were more conspicuous in the pylorus than in the fundus. These findings show that gastric lesions must be examined not only in the fundus but also in the pylorus in toxicity studies.

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