

## Brief Reports

# Three-dimensional structure of lymphatics in rabbit stomach<sup>\*</sup>

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## INTRODUCTION

Recently, the stomach lymphatics have been studied, but there are different opinions on the lymphatic distribution of the stomach layers<sup>[1-6]</sup>. There has been no reported in China. Describing the three-dimensional organization of the stomach lymphatics and revealing the correlation of the three-dimensional and the two-dimensional and organization.

In our study in the rabbit with the lymphatic corrosion cast with Mercor and semithin section methods we investigated the relationship of the three-dimensional organization with the drainage of the stomach lymphatics, which may provide the evidences of lymphology, pathology and the clinical medicine.

## MATERIALS AND METHOD

Twelve rabbits of both sexes were used, two of them, undergone the procession of the semithin section of electron microscopy, were observed under light microscopy. The other ten were used for the lymphatic corrosion casts.

The Mercor (CL-2B-5, Japan Velene Hospital, Tokyo,) diluted to 25%-30% (V/V) with methyl methacrylate monomer was injected in and around the mucosal submucosal, layers of the stomach. Shortly before the injection, a curing agent (MA, Japan Velene Hospital Tokyo) was added to the injection medium to give a concentration of 1% (W/V). The injected parts of the stomach were

removed and placed in a hot water bath (60°C) for 3hrs. They were put in concentrated NaOH (15%-20%) at about 60°C until tissue elements were completely corroded away. The lymphatic corrosion casts were cut into blocks and observed under a SEM (S-520) (with an accelerating voltage of 10-15kv).

## RESULTS AND DISCUSSION

### *The lymphatic of mucosal and submucosal layers*

The samples filled with resin which were in the mucosal and the submucosal layers clearly showed the three-dimensional organization of the lymphatic capillaries and the lymphatics. There was a layer of the lymphatic capillary network in the deep layer of the tunica mucosa between the bottoms of gastric gland and the muscularis mucosa. The networks extended short tube with blind ends into gastric glands. The tubers were called intergland circular cones. which were 20µm-30µm in diameters. The cones were round, hook, V and finger in shap. In the cardia and the fundus of the stomach the cones were sparse and connected to the lymphatic capillary networks of the tunica mucosa. In the body of the stomach 2 or 3 circular cones were connected in one group. The roots of the circular cones were connected to the sinus (50µm-60µm in diameters), then drained to the lymphatic capillary networks of the tunica mucosa (Figure 1).

Donini has observed the lymphatic capillary networks of the subepithelium were in the stomach pylorus. We observed the lymphatic capillaries between the bottoms of the tunica mucosa gland and the muscularis mucosa, but did not observe the lymphatic capillaries were in the subepithelium. Our observations were similar to Han's studies<sup>[5]</sup>. We found the lymphatic capillaries were in the tunica mucoa, but no thick lymphatics. A large number of lymphatic capillaries and lymphatics were found in the tela submucosa. The lymphatic capillaries formed a coarse network. The lymphatics (vessels) also formed a coarse plexus. The corrosion casts of the lymphatic clearly showed the three-dimensional organization of the lymphatics. The diameter of the lymphatic capillary was 10 µm - 30 µm, but the lymphatic vessel's diameter was 30 µm - 100 µm.

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The size of the meshes of the lymphatic vessels were varied and interconnected, triangular, oval and polygon in shape. The semithin sections also showed rich lymphatic capillaries and lymphatic vessels in the stomach tela submucosa. On the surface of the lymphatic casts, we found marked constrictions characteristic of bicuspid valves (Figure 2).

#### *The lymphatics of the tunica muscularis*

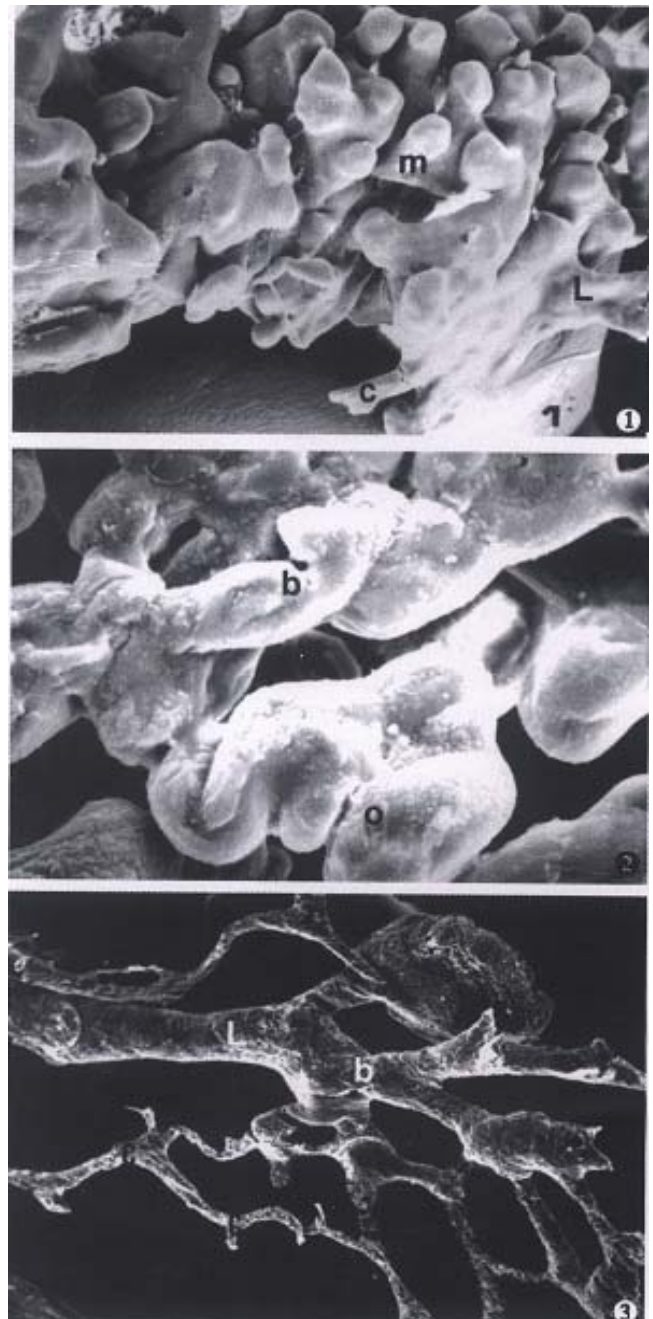
A rich lymphatic capillaries and lymphatics were found in the stomach tunic muscularis. Some the lymphatic capillaries of 7 $\mu$ m-30 $\mu$ m in diameter extended the short branches with blind ends. The diameter of the lymphatic was 30  $\mu$ m - 80  $\mu$ m. Between three muscular layers there were lymphatic capillaries and the lymphatic vessels. The lymphatics were string of beads in shape and interconnected to plexus. There were break ends of the anastomotic channels to the superficial and the deep part from the lymphatics of the tunic muscularis. It suggested that the lymphatics of the tunica muscularis were interconnected with both the lymphatics of the tela submucosa and the lymphatics of the tunica serosa. The surface of the lymphatic casts in the tunica muscularis there were folds which run pallelled to the lymphatic major axis. The imprints of endothelial nuclei were denser than other layers. On the surface, we could see the transverse imprints which were induced by the smooth muscle contraction. Between the lymphatic capillaries and lymphatic vessels of the tunica muscularis there were anastomotic channels which existed in each layer of perimysium. The lymphatics and the lymphatic capillaries of the tunica muscularis were seen in the histological sections.

Octrovekhev thought that there was not any lymphatic capillary. But Nariadchikova pointed out that the lymphatic vessels and the lymphatic capillaries of the tunica muscularis only existed among the three layer's muscularis but not in each muscular layer. Our experiment proved that in the connective tissue there were both lymphatic capillaries and lymphatic vessels in each smooth muscularis layer. We also observed the lymphatic capillaries among perifascicular parts of each muscular layer.

#### *The lymphatics of the tunica serosa*

There were both the lymphatic capillaries and the lymphatic vessels in a deep part of the tunica serosa (Figure 3). The meshes of the lymphatic capillary network and the lymphatic plexus in the layer were larger than those of the tela submucosa and the tunic muscularis. The meshes presented in willow leaf, oval or triangular shape. The lymphatic

capillaries and the lymphatic vessels were also observed in the semithin sections of the layers under the light microscopy.



**Figure 1** The intergland circular cones of tunica mucosa (m) the lymphatic capillaries (c) and the lymphatics (L) of the tela submucosa. SEM $\times$ 150

**Figure 2** The lymphatic networks of the tela submucosa. The constriction (b) of the cast surface presenting the bicuspid valves; the ovoid or fusiform indentations (o) presenting the endothelial nuclei of the lymphatic. SEM $\times$ 550

**Figure 3** The lymphatic capillaries (c) and the lymphatic vessels (L) of the tunica serosa. The constriction (b) presenting the impression of the bicuspid valves. SEM $\times$ 200

Donin reported that only in the curvatura ventriculi minor and major did the lymphatic

The lymphatic, capillaries  
of the tunica mucosa



The lymphatic capillaries of  
the tela submucosa

The lymphatic vessels of  
the tela submucosa



The lymphatic capillaries  
of the tunica muscularis



The lymphatic vessels  
of the tunica muscularis



The lymphatic capillaries  
of the tunica serosa



The lymphatic vessels  
of the tunica serosa



The aggregate lymphatics vessels



The part lymph nodes

The drainage correlation of the lymphatics of all the layers.

capillaries of the tunica serosa exist. Rakhan thought the lymphatic capillaries of the tunica serosa only existed in the parts of pylorus. Ohtani<sup>[3]</sup> pointed out that only the lymphatic vessels existed in the longitudinal muscle layer. In our lymphatic casts and semithin sections we observed both the lymphatic capillaries and the lymphatic vessels existed in the tunica serosa.

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