

Unique tubular structure and the corpuscle-like structures found on the surface of the liver

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Abstract: Unique duct system believed to be Bonghan duct and the corpuscle like structures were found on the surface of the liver from rabbit. Diameter of the duct was about 80 μm and formed of a bundle of tubules whose diameter was about 10-15 μm . Inside each tubules small granules of which the size is about 1 μm could be directly observed. As the granules form very narrow lines inside the tubules, it is possible that there exist another level of tubular structures through which the small granules flow. The granules were also observed to come out from the surface of duct. Stained section of the corpuscle-like structures showed that they were full of blood cells, suggesting hematopoiesis.

Key words: meridian line, Bonghan duct, Sanal, corpuscle like structures, hematopoiesis

1. Introduction

In the early 1960's the North Korean Bonghan Kim showed the anatomical entity of the acupoints, and explained the meridian system as the concrete duct system through which the liquid containing certain granules flows (1,2). Bonghan Kim showed that meridian lines are not confined to under the skin as traditionally believed, but is ubiquitous. They exist inside blood vessel (intravascular Bonghan duct), outside blood vessel (extravascular Bonghan duct), along the surface of internal organ or inside peritonea or mesentery (intra-extravascular Bonghan duct), and along the central and peripheral nervous system (neural Bonghan duct). Kim and Kong

reviewed Bonghan theory (3).

Very recently Bonghan theory was reinvestigated in Korea. Soh and his research team published many data demonstrating the presence of ductal lines inside blood vessel and lymphatic vessel called as 'primo' (4), both of which are mentioned as 'intravascular Bonghan duct' in Bonghan theory. We also isolated Bonghan duct from and from the abdominal wall and the tubular structure of Bonghan duct consisting of 3 different levels of layers was suggested (5).

According to Bonghan theory, the small granules named as Sanal flow (1, 2) through Bonghan duct. The size of the granule is about 1 μm which is too low for the cell size. They contain DNAs and aggregate to form specific type of cells inside Bonghan ducts. In this way the granule itself was suggested to

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function as totipotent stem cells.

In this article we isolated unique ductal system and the corpuscle-like structures from the surface of liver which are believed to be Bonghan duct and Bonghan corpuscle. We also could observe the small granules (Sanal) inside the duct. Their properties will be discussed.

2. Material and Methods

Animals and surgical procedure

Female New Zealand White rabbit weighing 2-2.5kg were used. Ether was used as anesthesia. However, general anesthetic techniques are all applicable. It was even possible to isolate the duct from the surface of the liver even after euthanasia. Ductal lines between lobes of the liver was carefully traced with pincers. They were isolated by removing coagulated blood.

Light microscopic procedures

Isolated corpuscle-like structures were fixed in 10% neutral buffered formalin, dehydrated through a graded ethanol, and embedded in paraplast (Polyscience, USA). The paraffin block was cut by microtome (Richert-Jung, USA), stained with hematoxylin-eosin, and observed under the light microscope (Olympus, Japan)

3. Results and Discussion

Careful observation can find the ductal line between the lobes of the liver. The ductal lines can be easily traced through the surface of the liver with pincers. The corpuscle-like structures could be also found along the ductal line (**Fig. 1**).

During the isolation of the duct it was observed that plenty of the small granules were coming out

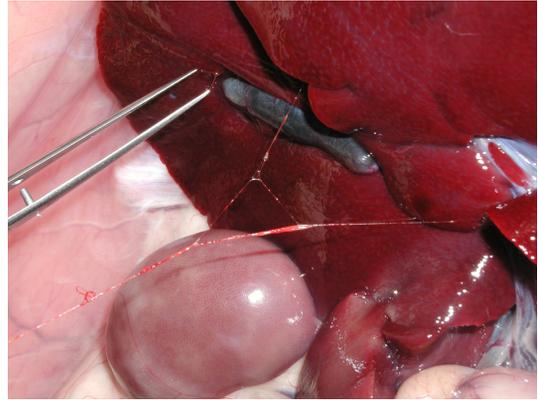


Fig. 1 Bonghan duct isolated from the surface of the liver

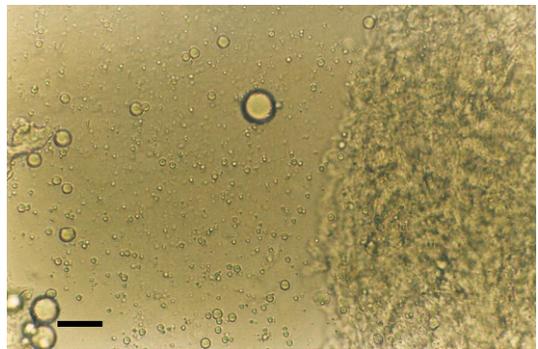


Fig. 2 The small granules are observed during the isolation process. Scale bar=20 μ m.

of the duct near the corpuscle-like structures (**Fig. 2**). According to Bonghan theory, there exist small granules inside the Bonghan duct, and they flow through the duct (2, 3). It is possible that we have accidentally cut the duct and the granules inside were coming out.

Compared to other sources, the duct on the surface of the liver could be obtained relatively pure form. According to Bonghan theory, Bonghan duct was formed of a bundle of tubules through which the small granules flow (1). Isolated duct in the present investigation also showed a bundle of tubules (**Fig. 3**). The diameter of the duct and the tubule was about 80 μ m and is 10-15 μ m, respectively. Their sizes

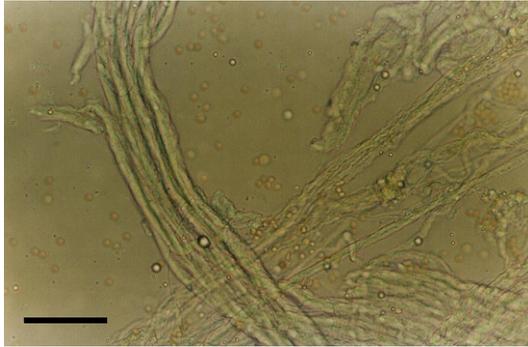


Fig. 3 Bonghan duct isolated from the surface of the liver showed a bundle of tubules inside. Scale bar=100 μ m.



Fig. 4 Isolated Bonghan duct from the surface of the liver. The narrow lines of the small granules could be observed. Scale bar=20 μ m.

match the Bonghan duct and a bundle of tubules of Bonghan theory (1).

The small granules could be even directly observed from the isolated duct (Fig. 4). Presence of the small granules inside the duct might confirm the identity of isolated duct as Bonghan duct. The small granules do not fill up the tubule. They are observed in very narrow lines inside the tubules. It was suggested that there exist another level of tubular structures inside the tubule through which the small granules flow (5).

The corpuscle-like structures were found along the duct. Hematoxylin-eosin stained section of the

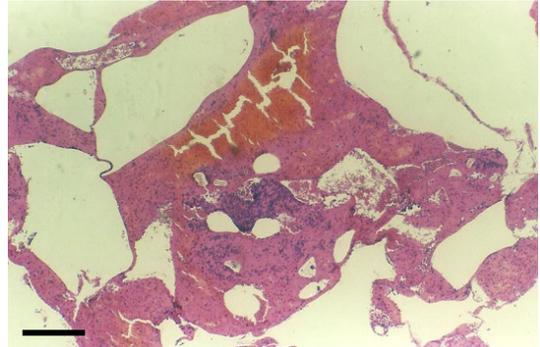


Fig. 5 Hematoxylin-eosin stained section of the corpuscular structure showed that they are full of blood cells. Scale bar=200 μ m.

corpuscular structure showed that they are full of blood cells (Fig. 5), suggesting hematopoiesis. Liver has the blood forming ability during fetal stage. It is believed that after birth hematopoietic ability of liver is ceased, and only bone marrow remains as the source of blood formation. Bonghan theory suggests that the granules flowing through the Bonghan ducts could function as totipotent stem cells(2). The function of Bonghan duct and corpuscle regarding hematopoiesis might be understood in this regard. Further researches are needed.

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