

## Observations on Hepatic Superficial Lymph Flow

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### Summary

Hepatic superficial lymph flow was studied by injecting patent blue V solution into the liver under peritoneoscopy. This procedure enabled detailed observations of the direction of hepatic lymph flow in superficial lymphatic vessels and migration of lymph from these lymphatic vessels to lymphatic vessels of the gallbladder. Increase in this flow was observed in patients with increased liver fibrosis and lobular distortion.

In 1965 my colleague *Hashimoto* (1) succeeded in observing lymph flow at the dog hepatic hilus by injecting patent blue V dye solution into the liver. I have applied this method to examine the superficial lymphatic vessels of human liver under peritoneoscopy. In this paper, the procedure and hepatic lymph flow in several liver diseases are described.

### Materials and Methods

**Materials:** Fig. 1 illustrates the equipment used. The 20 cm needle was especially devised for dye solution injection into the liver. The outer diameter of the needle was adjusted to fit the inner diameter of the cannula of the trocar, which was used in the Vim-Silverman biopsy technique. The needle tip was 24 gauge and 1.5 cm in length. The needle base was designed to be attached to the syringe. The dye solution was 11 % patent blue V (powder from Chroma Co., Stuttgart) stored in amples.

**Methods:** The dye-injection-needle was inserted into the abdominal cavity through the trocar in peritoneoscopy, piercing the liver about 0.5 cm in depth. Then, 0.5 ml of 11 % patent blue V dye solution was injected. The injected dye appeared on the liver surface in a network pattern. The network collected into the linear superficial lymphatic vessels. The phenomenon

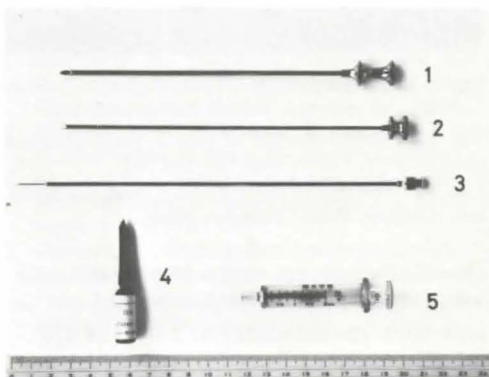


Fig. 1 Instruments and dye solution used in this procedure. 1, hollow cannula of trocar; 2, mandrin of trocar; 3, dye-injection-needle; 4, ampule of 11 % patent blue V solution; 5, syringe

indicated that the dye moved with the tissue fluid. Therefore, observations were possible on the flow of lymph and the patterns of lymphatic vessels on the liver surface.

### Case Presentations

**Case 1.** This patient was a 37-year-old male with Budd-Chiari syndrome. As shown in Fig. 2 A, the liver surface was slightly uneven but no nodule formation was evident. A tip portion of the dye injection needle (0.5 mm diameter) is shown (lower right area). Networks of small lymphatic vessels extend from the injection site (to the upper left region). The width of lymphatic vessels and the distance between neighbouring lymphatic vessels were measured by comparison with the needle diameter. The lymphatic vessels were about 50  $\mu$ m in outer diameter and were classified "small" according to our lymphatic vessel classification (2, 3).

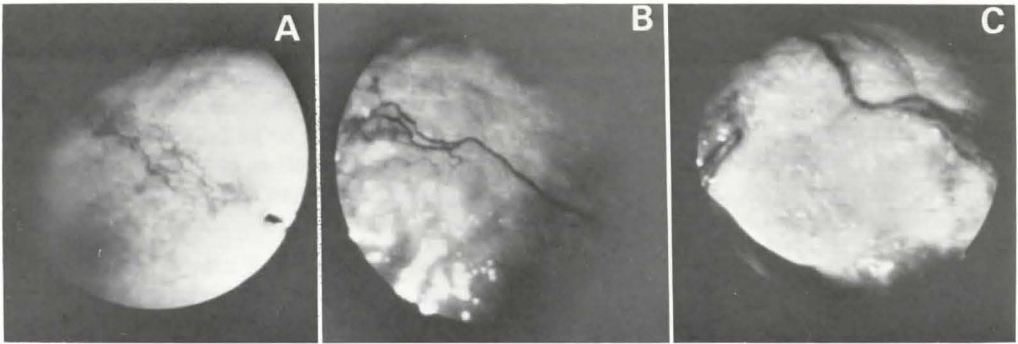


Fig. 2 A Peritoneoscopy of case 1 (Budd-Chiari syndrome). These lymphatic vessels were classified to the "small" size category. Patent blue dye method

Fig. 2 B Peritoneoscopy of case 2 (liver chirrrosis). These lymphatic vessels were classified to the "medium" size category. Patent blue dye method

Fig. 2 C Peritoneoscopy of case 3 (liver cirrhosis). These lymphatic vessels were classified to the "large" size category. Patent blue dye method

*Case 2.* This patient was a 54-year-old male with liver cirrhosis. The liver surface was uneven with fine nodules (Fig. 2 B). The dye solution (injected from the left region) moved to the network of lymphatic vessels and then collected into a linear lymphatic vessel (in the right). This lymphatic vessel was classified "medium" size.

*Case 3.* This patient was a 44-year-old male with liver cirrhosis. Hemispherical nodules were observed on the liver surface (Fig. 2 C). Many vesicles are observed on the hepatic capsule from lymph congestion. A large lymphatic vessel is observed running cranially. This lymphatic vessel was classified in the "large" size category.

*Direction of Hepatic Lymph Flow in Superficial Lymphatic Vessels*

Fig. 3 summarized the lymph flow directions of hepatic superficial lymphatic vessels. Patent

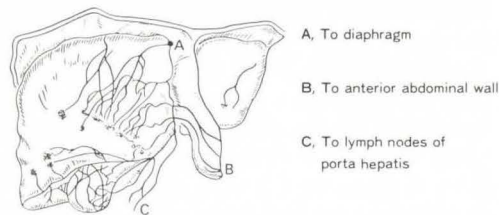


Fig. 3 Direction of superficial lymph flow in liver found by the patent blue dye injection method

blue V solution injected above the line between the gallbladder neck and the right lateral upper margin of the liver flows upward to the base of falciform ligament, whereas solution injected under this line runs downwards to the liver

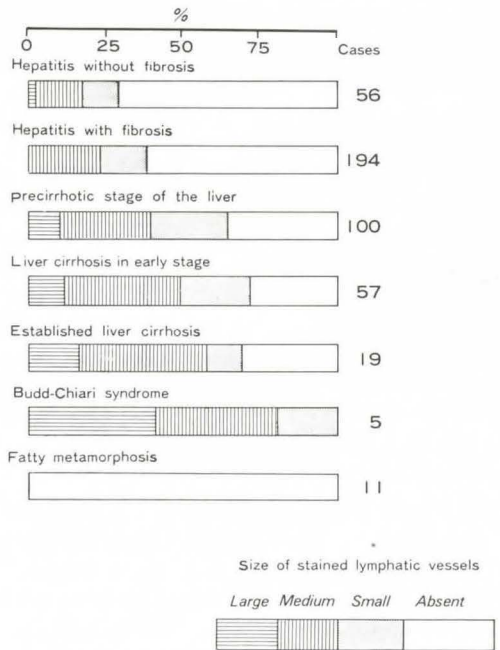


Fig. 4 Frequency and size of superficial lymphatic vessels of liver by the patent blue dye injection method

hilus. At the hilus the superficial lymph confluences with lymph from the deeper lymphatic regions. Then, lymph drains into the chylous cystem. The dye occasionally migrated from the liver surface lymphatic vessels to lymphatic vessels of the gallbladder.

*Hepatic superficial lymph flow in several liver diseases*

Lymph flow was examined in cases of chronic hepatitis, liver cirrhosis, Budd-Chiari syndrome and fatty metamorphosis. Fig. 4 summarizes the percentage and the size of the lymphatic vessels. In normal liver, most hepatic lymph drained into the deeper lymphatic system and a slight amount drained into the superficial lymphatic system. In chronic hepatitis cases without marked hepatic fibrosis, superficial lymphatic vessels were observed in less than 30 % of patients. In liver cirrhosis cases, lymphatic vessels were observed in more than

70 % of patients. That is, lymph production increased and drainage into the deeper lymphatic system was disturbed in cases with increased liver fibrosis, lobular distortion or circulatory disturbances along the hepatic venous system. Thus, the lymph increase in the superficial lymphatic vessels was clearly observed by the present dye injection method.

*References*

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