Pathological Studies on the Liver with Extrahepatic Portal Obstruction

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Received for publication March 31, 1986

Summary: We report pathological features and histometrical analyses of the portal tracts in the liver with extrahepatic portal obstruction in adult. Cavernous transformation was frequently observed in medium-size portal tracts, usually associated with narrowing of the portal vein. The histometrical study showed dilatation of the hepatic artery in extrahepatic portal obstruction, compared with idiopathic portal hypertension and the normal control. It is suggested that the dilatation of the hepatic artery in the medium-size portal tracts may reflect an increased arterial blood flow which serves to compensate for the insufficient portal circulation due to the sclerosed and narrowed portal vein.

Key words: extrahepatic portal obstruction — cavernous transformation — portal vein — idiopathic portal hypertension — histometrical study

Introduction

Extrahepatic portal obstruction (EHPO) is known to be a condition leading to portal hypertension. EHPO is rarely found in Japan. Few autopsy cases of EHPO have been described, and the detailed pathomorphology has not yet been fully elucidated (Arakawa et al. 1983). We have performed a histometrical study of the entire liver in frontal sections to clarify the essential pathological changes of the portal tracts in EHPO in comparison with idiopathic portal hypertension (IPH).

Materials and Methods

The material examined was an autopsy liver obtained from a female patient with

EHPO who had complaints of recurrent ascites and hematemesis from varices since age 16, and died at the age of 32. The detailed history, laboratory data and autopsy findings were already reported (Koga et al. 1986). As a control, we used five livers with IPH and two normal livers. Each frontal liver slice was divided into about 20 tissue blocks. Paraffin sections were stained with hematoxylin eosin and elastica van Gieson. The slides were submitted to histopathological study and histometrical analysis. Dimensions of each portal tract, luminal dimensions of portal vein, hepatic artery and interlobular bile duct were measured, using NEC personal computer. Structures such as vascular branches being seen as oblique or longitudinal section and scar-like portal tract were excluded from the histometrical study.

tracts with area of more than 0.5 mm^2 in area, and were also present in the peripheral portal tracts where the narrowing of the portal vein was prominent.

II. *Histological analysis of cavernous transformation in the medium-size portal tract.*

Study on the histological relationship through serial sections failed to demonstrate anastomoses between cavernous transformation and the branches of the hepatic artery or of the portal vein. However the hepatic arterial branches running in tortuous fashion were getting smaller at the periphery, and finally the most peripheral arterial branches were frequently disappearing within the stroma containing multiple blood channels (Fig. 3).

III. *Histometrical study on the portal triads.*

(1) The dimensional ratio of the lumen of the portal vein to the portal tract (PV/PT).

PV/PT of EHPO showed median values between IPH and normal control in the peripheral portal tract with areas of less than 0.5 mm^2 , but in the portal tract with areas of more than 0.51 mm^2 , the ratio was as low as IPH. (Fig. 4)

(2) The dimensional ratio of the lumen of the hepatic artery to the portal tract (PA/PT).

PA/PT of EHPO was larger than that of IPH (Fig. 5). A dilatation of the hepatic artery was detected.

(3) The dimensional ratio of the lumen of the bile duct to the portal tract (BD/PT).

Fig. 3. A cavernous transformation in a medium-size portal tract. (Serial sections from 1 to 4). Arrows: Peripheral branches of the hepatic artery. c: Cavernous transformation.

Fig. 4. The dimensional ratio of the lumen of the portal vein to the portal tract.

Fig. 5. The dimensional ratio of the lumen of the hepatic artery to the portal tract.

Fig. 6. The dimensional ratio of the lumen of the bile duct to the portal tract.

As shown in Fig. 6, in the portal tracts with areas of less than 0.5 mm², BD/PT of EHPO and IPH was somewhat larger than that of normal controls. BD/PT of EHPO showed the largest value in the more proximal medium-size portal tract with areas of more than 0.51 mm².

Discussion

The present histometrical study of the liver in a case of EHPO revealed narrow-

ing of the portal veins and remarkable dilatation of the hepatic artery in the medium-size portal tracts. It is likely that the increased hepatic arterial bed was a mechanism to compensate for the decreased portal blood flow. The maintenance of the liver function at normal level in spite of the repeated hematemesis might depend on maintained total hepatic blood flow. Aida et al. (1983) observed through histometrical study of the IPH liver that hepatic arterial flow was increased in IPH as well, but this seems not to be necessarily associated with the dilatation of the hepatic arterial branches. They concluded that the increase in arterial vascular bed was due to an increased number of small arterial branches.

In the present case with EHPO, cavernous transformation was observed not only in the portal trunk, but also in the portal tracts within the liver (Koga et al. 1985). The present study has shown that this change was frequently detected in medium-size portal tracts in association with narrowed portal vein, and it was also shown that the change was prominent even in the peripheral portal tracts where the narrowing of the portal vein was prominent. Cavernous transformation in

the portal tract may function as a collateral to compensate for the insufficient portal blood supply caused by sclerosed and narrowed portal vein as illustrated in Fig. 7. Dilatation of the hepatic artery in the liver of the present case probably reflects the fact that arterial blood predominantly flows through the cavernous transformation. It is almost impossible to determine the nature of the multiple channels composing a cavernous transformation. However we would think it possible that the capillary plexus around the bile duct might be implicated in the formation of cavernous transformation, anastomosing the hepatic arterial branches at the level of capillary.

Various etiologies of EHPO such as omphalitis have been suggested so far (Gibson et al. 1965) In the present case, dilatation of bile duct in addition to histological feature of periductal fibrosis suggests that the case had cholangiopathy including cholangitis in the past. It might

be possible to speculate that thrombophlebitis of the portal trunk primarily occurred under a certain condition, resulting cholangitis within the liver. And it is also possible that the primary lesion developed in the biliary system, and then led to phlebitis of the portal trunk and of the intrahepatic portal branches. It is often difficult to determine the etiology of EHPO, and the real pathogenesis remains unknown in many cases of EHPO. Further examination of as many cases with EHPO as possible would be necessary to elucidate the real etiology and pathogenesis of EHPO.

Acknowledgment: This study was supported by a grant from the Ministry of Health and Welfare of Japan.

References

- AIDA, Y., OKUDAIRA, M., OHBU, M. and SASAKI, K. (1983). Pathological features of the liver with idiopathic portal hypertension in Japan: A study on typical autopsy cases. Idiopathic portal hypertension. ed, Okuda, K. and Omata, M. p. 59-72., Tokyo: University of Tokyo Press.
- ARAKAWA, M., KAGE, M., FUKUDA, K., NAKASHIMA, T. and INOKUCHI, K. (1983). Pathology of extrahepatic portal obstruction in Japan. Idiopathic portal hypertension. ed, Okuda, K. and Omata, M. p. 117-127. Tokyo: University of Tokyo Press.
- GIBSON, J. B., JOHNSTON, G. W., FULTON, T. T. and ROGERS, H. W. (1965). Extrahepatic portal venous obstruction. *Brit. J. Surg.* **52**, 129-139.
- KLEMPERER, P. (1928). Cavernous transformation of the portal vein; its relation to Banti's disease. *Arch Path.* **6**, 353-377.
- KOGA, T., KAGE, M., ARAKAWA, M., FUKUDA, K. and TANIKAWA, K. (1986). Extrahepatic portal obstruction in adult. Report of an autopsy case. *Gastroenterologica Jpn.* **21**, 267-272.

Fig. 7. Schematic drawing of hepatic artery, portal vein and cavernous transformation in EHPO in comparison to the normal liver. H.A.: hepatic artery, P.V.: portal vein, dotted area: cavernous transformation. Sclerosed and narrowed portal vein in EHPO lacks of its branches which supply portal blood into hepatic parenchyma. Cavernous transformation may function as a collateral to compensate for the insufficient portal blood supply.