Hepatic Venography in Hepatic Tumors

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In order to establish the diagnosis of hepatic tumors, hepatic venography was performed in 9 cases of primary hepatic tumors and in 17 cases of metastatic hepatic tumors. The deformity of the hepatic veins due to compression by tumors was observed in 42 per cent of the cases. Pathological anastomoses between the hepatic veins were seen in 41 per cent of the cases of metastatic tumors, but in none of the cases of primary tumors. Vascular sack and filling defects of the sinusoidal radio-opacity appeared in 1 and 2 cases of metastatic tumors, respectively. These venographic findings were characteristic of hepatic tumors, and hepatic venography was found useful in the diagnosis in hepatic tumors.

Among various hepatic angiographies, hepatic venography is most helpful in the diagnosis of hepatic cirrhosis. For the diagnosis of hepatic tumors, hepatic arteriography has been most frequently employed, but hepatic venography is also useful.1-7 Compression of the hepatic veins by tumors and filling defects in sinusoidal opacifications have been considered to be the major findings of hepatic tumors,1 but our studies revealed pathological anastomoses between the hepatic veins in one-third of cases of hepatic tumors. Based on these characteristic changes in hepatic venograms, the diagnosis of hepatic tumors was established by hepatic venography in approximately half the cases. This paper describes briefly the results of hepatic venography performed in 26 cases of hepatic tumors.

MATERIALS AND METHODS

Hepatic venography was performed in 9 cases of primary hepatic tumors and 17 cases of metastatic hepatic tumors. Of the 9 cases of primary hepatic tumors, 8 had malignant hepatoma and one had Kupffer cell sarcoma. Three of the 8 cases of malignant hepatoma had hepatic cirrhosis. Diagnosis of hepatic tumors was based on past history, clinical findings, liver function tests and histological examination of biopsy specimens or postmortem examination.

A No. 9 Courmand catheter was introduced into the basilic or cephalic vein and guided into the right hepatic vein (and occasionally into the left hepatic vein) under a fluoroscopic control. The tip of the catheter was placed 5 to 6 cm apart from the orifice of the hepatic vein to the inferior vena cava. About 15 to 30 ml of Urografin (Schering) diluted with physiologic saline to 50 per cent or Conray (Mallincrodt) was manually injected as quickly as possible while the patient was holding his breath. In most cases, the tip of the catheter

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was placed also in a wedged or semi-wedged position, and radio-opacity of the sinusoids and of the intrahepatic portal veins was obtained by injection of the dye. Single film was taken just before the end of the injection of the contrast material, or serial exposures were made with Elema-Schönander film changer.

RESULTS

One of the radiographic characteristics of hepatic tumors is the deformity of the hepatic veins due to compression by tumors (Figs. 1-3). Large branches of the hepatic veins showed rounded indentations bulging into the lumen, and smaller branches curved displacement. In comparison with the deformity of the hepatic veins due to fibrosis and compression by regenerative nodules in hepatic cirrhosis, the deformity due to tumors is not so diffuse, and the radius of the resultant curvature of the hepatic veins is usually larger. This kind of deformity of the hepatic veins was found in 44 per cent of the cases of primary tumors and in 41 per cent of the cases of metastatic tumors (Table 1).

The second venographic feature of hepatic tumors is the appearance of pathological anastomoses between the hepatic veins (Figs. 3-6). Although anastomoses between the hepatic veins are not infrequently found in normal liver, they are few in number and small in caliber. The pathological anastomoses observed in hepatic tumors are large not only in number but also in caliber. They are found at places where normal anastomoses are not expected, and their courses

Fig. 1. Hepatic venogram in a case of primary hepatic carcinoma. Rounded indentations are seen which bulge into the lumen of the right hepatic vein.
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Fig. 2. Hepatic venogram in a case of metastatic hepatic carcinoma. The right hepatic vein shows marked deformity due to compression by tumor. Large and small indentations bulging into the lumen and curved displacement of the branches are observed.

are different from the normal ones. Sometimes they look like meshes of a net, and contrast medium flows through them in all directions (Fig. 5). These pathological anastomoses were found in 41 per cent of the cases of metastatic tumors, but in none of the cases of primary tumors (Table 1).

Vascular sack was found in one case of metastatic tumor (Fig. 3). Filling defect of sinusoidal radio-opacity was observed in 10 per cent of the 21 cases in which the contrast medium was injected through the catheter placed in a wedged or semi-wedged position and sinusoidal radio-opacity was obtained (Table 1).

In 2 of the 3 cases of primary hepatic carcinoma complicated with hepatic cirrhosis, the deformity of the hepatic veins characteristic of hepatic cirrhosis was also observed.

Discussion

Only limited portion of tributaries of the hepatic veins is demonstrable by hepatic venography, and tumors outside of it cannot be visualized. In spite of
Fig. 3. Hepatic venogram in a case of metastatic hepatic carcinoma. The upper and lower branches of the right hepatic vein are curved and displaced. The upper branch also shows pathological anastomoses between the hepatic veins. A vascular sack, which was verified by resin casting after death, is seen as a round shadow in the center.

**Table 1. Hepatic venographic findings in hepatic tumors**

<table>
<thead>
<tr>
<th>Description</th>
<th>Primary tumors</th>
<th>Metastatic tumors</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>9</td>
<td>17</td>
<td>26</td>
</tr>
<tr>
<td>Deformity due to compression</td>
<td>4 (44%)</td>
<td>7 (41%)</td>
<td>11 (42%)</td>
</tr>
<tr>
<td>Pathological anastomoses between hepatic veins</td>
<td>0 (0%)</td>
<td>7 (41%)</td>
<td>7 (37%)</td>
</tr>
<tr>
<td>Vascular sack</td>
<td>0 (0%)</td>
<td>1 (6%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Filling defect of sinusoids</td>
<td>0/7 (9%)</td>
<td>2/14 (14%)</td>
<td>2/21 (10%)</td>
</tr>
<tr>
<td>Normal</td>
<td>4 (44%)</td>
<td>7 (41%)</td>
<td>11 (42%)</td>
</tr>
<tr>
<td>Deformity due to cirrhosis</td>
<td>2 (22%)</td>
<td>0 (0%)</td>
<td>2 (8%)</td>
</tr>
</tbody>
</table>
Fig. 4. Hepatic venogram in a case of metastatic carcinoma. The contrast medium was injected into the lower right hepatic vein. There are many pathological anastomoses between the hepatic veins.

the restriction, hepatic venography has an advantage that the deformity of the blood vessels is more clearly depicted than by hepatic arteriography, when tumor is located within the territory of the radiographed hepatic veins. It is because the hepatic veins are not accompanied by other blood vessels or bile ducts unlike the hepatic arteries and are less resistant to the compression.

This deformity of the hepatic veins due to compression by tumors, which is easily differentiated from the deformity of the hepatic veins caused by fibrosis and regenerative nodules in hepatic cirrhosis, was found in 44 and 41 per cent of the patients with primary and metastatic hepatic tumors, respectively.

The appearance of pathological anastomoses in hepatic venograms of tumors was previously pointed out by us and was confirmed on venous cast obtained by postmortem resin infusion into the hepatic vessels. The present investigation revealed that these pathological anastomoses between the hepatic veins were demonstrable in 41 per cent of the cases of metastatic tumors but in none of the cases of primary tumors. As these anastomoses are clearly different from normal ones and are not seen in hepatic cirrhosis or other hepatic diseases except in obstruction of the hepatic veins, they can be regarded as a radiographic characteristic of hepatic tumors and as having a great diagnostic value.

These pathological anastomoses between the hepatic veins in hepatic tumors are considered to be collateral pathways developing after obstruction of the hepatic veins by tumors. The appearance of similar pathological anastomoses between the
Fig. 5. Hepatic venogram in a case of metastatic hepatic carcinoma. The contrast medium was injected into the left hepatic vein. There are many pathological anastomoses between the hepatic veins. They look like meshes of a net and the contrast medium flows through them to all directions.

hepatic veins in a patient with obstruction of the hepatic veins and the inferior vena cava in the hepatic portion\(^9\) may support this inference.

The reason why the pathological anastomoses between the hepatic veins are more frequently observed in metastatic tumors than in primary tumors is not exactly known at present. Complication of hepatic cirrhosis, rapid clinical course, and diffuse infiltration of tumors may prevent the development of collateral pathways in primary hepatic tumors.

The formation of vascular sack was confirmed on venous cast formed by postmortem resin infusion into the hepatic blood vessels.\(^7\) It may be a result of softening of necrotic tumor tissue.

Based upon the features of hepatic venograms mentioned above, the diagnosis of hepatic tumors was possible in about half the cases. The differential diagnosis between primary and metastatic tumors is not easy. However, when pathological anastomoses between the hepatic veins are seen, hepatic tumors in such cases are most likely metastatic in nature; on the other hand, primary tumors are suggested, when diffuse, small deformity of the hepatic veins, which is characteristic of hepatic cirrhosis, is simultaneously seen.
Fig. 6. Hepatic venogram in a case of metastatic hepatic carcinoma. The tip of the catheter was placed in the lower right hepatic vein. There are many pathological anastomoses between the hepatic veins.

References