Intersegmental Arterial Communication between the Medial and Left Lateral Segments of the Liver

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Introduction

Surgical en-bloc resection has contributed to improved long-term survival in patients with biliary tract malignancies [1–7]. However, the complex anatomy of the hepatic hilum still causes difficulties with curative resection. To safely and satisfactorily excise the hepatic hilum, the anatomy of hilar vessels must be understood [8]. In resection for hilar cholangiocarcinoma, resection of the right side of the liver was more commonly observed than resection of the left side, because the left hepatic duct has a long extrahepatic course and tumor invasion of the right hepatic artery is more likely [9–11]. The purpose of the present study was to evaluate the hepatic arterial system of the left liver, using acrylic corrosion casts.

Materials and Methods

Twelve adult livers from fresh cadavers (3–12 h after death) with no lesions at the hepatic hilum were obtained from the Department of Anatomy, Sapporo Medical University School of Medicine, Sapporo, Japan, and were used for preparation of cast specimens. After ligation of the right hepatic artery near its origin, acrylic resin was injected into the left hepatic artery to create casts of the arterial system of the left liver. The casts were then analyzed for the presence of intersegmental arterial communication between the medial and left lateral segments.

Key Words

Hilar cholangiocarcinoma • Medial segment • Left lateral segment • Umbilical plate • Arterial communication
gin, approximately 20 ml of water-soluble absolute latex resin (Neoplen Latex 601-A; DuPont Dow Elastomers, Tokyo, Japan) was injected into the left hepatic artery until the subcapsular vessels on the liver surface were visualized. After latex injection, the fresh cadaveric livers were fixed in 10% formalin solution. They were then dissected at least 7 days following fixation. The porta hepatis was carefully dissected to visualize the middle and left hepatic arteries and their relationship.

Results

All twelve corrosion casts were of sufficiently good quality to be used to analyze the detailed hepatic arterial anatomy. Seven livers had a conventional proper hepatic artery. The middle hepatic artery arose from the left hepatic artery in five of these livers and from the right hepatic artery in the other two. In three other livers, the right hepatic artery arose from the superior mesenteric artery and the middle hepatic artery arose from the left hepatic artery. In the remaining two livers, the left hepatic artery arose from the left gastric artery and the middle hepatic artery arose from the right hepatic artery. In all 12 casts examined, a communicating arcade between the middle and the left lateral hepatic arteries was observed. The communicating arcade was extrahepatically located in the umbilical plate, consistently crossed the umbilical portion cranially, and gave rise to branches to the bile duct (fig. 1). In the three livers in which the middle hepatic artery arose from the left hepatic artery, the left lateral hepatic artery forked off into branches that crossed the umbilical portion and nourished the liver parenchyma of the medial segment without communicating with the middle hepatic artery (fig. 2).

Discussion

The interlobar arterial collateral of the liver has been thoroughly analyzed using both anatomical [12, 13] and radiological studies [14–16]. Our previous study showed that the communicating arcade between the right and left hepatic arteries was consistently present in the hilar plate and played an important role not only in the interlobar arterial communication of the liver.

Fig. 1. Photographic representation of the left hepatic arterial system in the communicating pattern. After ligation of the right hepatic artery, red-colored resin was injected into the left hepatic artery. The biliary system was filled with green-colored resin. The umbilical portion of the portal vein (UP) was removed. Red-colored resin filled the middle hepatic artery via the intersegmental collateral (arrows) between the medial segment (M) and the left lateral segment (L), which formed the arterial network and gave rise to branches traveling to the bile duct.

Fig. 2. The left lateral hepatic artery gave rise to a branch (arrow) that crossed the umbilical fissure and nourished the liver parenchyma of the medial segment without communicating with the middle hepatic artery. P4 = the portal vein of segment 4; P3 = the portal vein of segment 3; P2 = the portal vein of segment 2.


