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Case Report

Tumor Compression–Induced Portal Obstruction and Selective Transarterial Chemoembolization Increase Functional Liver Volume in the Unobstructed Area, Facilitating Successful Resection of a Large HCC

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A 62-year-old man with hepatitis B was admitted for treatment of a large hepatocellular carcinoma. The right portal vein was completely obstructed by tumor compression. Although we initially planned a right trisectionectomy as curative hepatectomy, the percentage of future remnant liver volume (%RLV) and the percentage of functional liver volume (%RFLV) were 31.2% and 41.3%, respectively. Because %RFLV showed marginal tolerability for curative hepatectomy and %RLV was very low, we opted for transarterial chemoembolization of segment IV and the right lobe containing the tumor as an approach to selectively reduce liver volume and abolish liver function. One month later, %RLV and %RFLV had dramatically increased to 46.6% and 67.2%, resulting in curative hepatectomy. Our results suggest that tumor compression–induced portal obstruction and selective transarterial chemoembolization increase %RFLV much more than %RLV. This may represent a useful approach in preoperative management in patients with large hepatocellular carcinomas to improve %RFLV for hepatic resection.

Key words: Hepatocellular carcinoma – Portal vein obstruction – Transarterial chemoembolization – Functional liver volume

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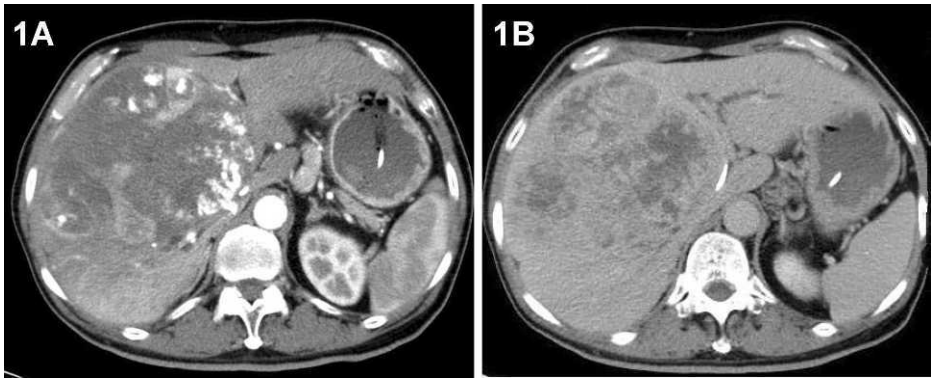

Fig. 1 A large hepatic tumor (16 × 14 cm), with contrast enhancement in the arterial phase (A) and washout in the late phase (B), located in the right lobe and segment IV.

Hepatic resection is the optimum curative treatment for hepatocellular carcinoma (HCC). We often encounter situations in which large HCCs without distant metastasis are treated with transarterial chemoembolization (TACE) or hepatic arterial chemotherapy because of inadequate future remnant liver volume (%RLV) and functional liver volume (%RFLV) for curative hepatectomy. However, the prognosis of patients treated with TACE or hepatic arterial chemotherapy is markedly worse compared with that of patients who underwent hepatectomy,[1–3] indicating that a novel approach is required to enable hepatic resection for large HCCs by improving %RFLV and %RLV. Portal vein embolization (PVE) or obstruction induces hepatic hypertrophy in the nonembolized/unobstructed lobes; hence, it is an option for increasing %RLV and %RFLV.[4–6] On the other hand, there are some cases with borderline or insufficient %RLV and %RFLV for hepatic resection even after PVE or portal vein obstruction. In such cases, an additional approach is required to improve %RLV and %RFLV before hepatic resection. Here, we describe a case where %RFLV increased by a much greater amount than %RLV after induction by tumor compression–induced portal obstruction and selective TACE, resulting in successful resection of a large HCC.

Case Report

A 62-year-old, hepatitis B virus surface antigen–positive man was admitted for the treatment of a large hepatic tumor (16 × 14 cm). Plain computed tomography (CT) showed a heterogenous, hypodense tumor located in segment IV of the right lobe of the liver. The tumor showed contrast enhancement and washout in the arterial and late phases, respectively (Fig. 1). To relieve obstructive jaundice due to bile duct compression resulting from tumor expansion, a metal stent was placed from the right bile duct to the common hepatic duct in the hospital from which the patient had been referred to us. The level of alpha-fetoprotein, the Lens culinaris agglutinin–reactive fraction of alpha-fetoprotein, and the level of protein induced by vitamin K absence/antagonist II were 11.4 ng/mL, 14.2%, and 70,184 mAU/mL, respectively. Indocyanine green retention rate at 15 minutes was 7.5%. The patient was classified as having Child-Pugh class B liver function according to the following parameters: total bilirubin, 1.5 mg/dL; albumin, 3.1 g/dL; prothrombin activity, 68%; ascites, absent; and hepatic encephalopathy, absent. Uptake ratio of the liver to the liver plus heart at 15 minutes by ^{99m}Tc–

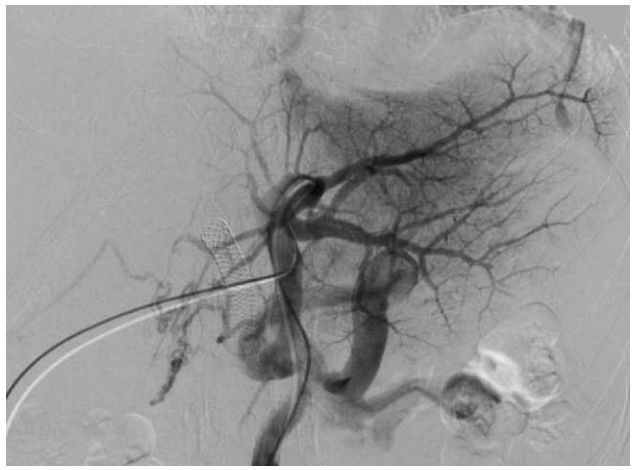

Fig. 2 Portography demonstrated obstruction of the right portal vein by tumor compression.

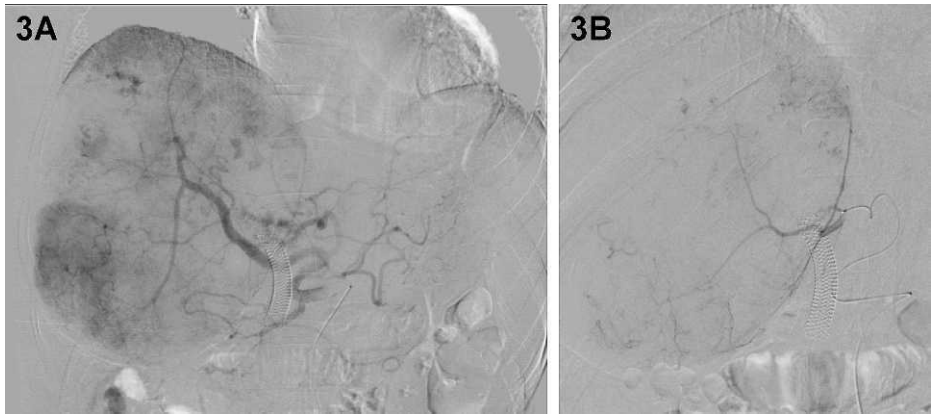

Fig. 3 Digital subtraction angiography before (A) and after (B) selective TACE for the right lobe and segment IV shows absence of tumor staining.

galactosyl human serum albumin (GSA) scintigraphy was 0.93. The HCC was located in segment IV of the right lobe, and a right trisectionectomy was initially planned as curative hepatectomy. We used ^{99m}Tc-GSA scintigraphy single-photon emission computed tomography–computed tomography system (SPECT–CT fusion system AZE Virtual Place Lexus, AZE, Tokyo, Japan), which enables calculation of functional liver volume corresponding to liver volume using conventional CT volumetry.[7] Calculated %RLV and %RFLV for the right trisectionectomy using this system were 31.2% and 41.3%, respectively. %RFLV showed marginal tolerability for curative hepatectomy, whereas %RLV was insufficient. We usually attempt PVE in such a situation according to our PVE criteria.[7] However, portography had already shown that the right portal vein was completely obstructed because of compression by the expanding tumor (Fig. 2). As an alternative strategy, we chose TACE of the right lobe and segment IV including the tumor to selectively abolish liver function and decrease liver volume (Fig. 3). One month later, %RLV and %RFLV had markedly improved to 46.6% and 67.2%, respectively (Fig. 4 and Table 1). Based on the improvement in %RFLV, a right trisectionectomy was performed without any complications. The operation time was 416 minutes, and the intraoperative blood loss was 390 mL. No blood transfusion was required. The patient has recovered well with no recurrence 3 years after the surgery.

Discussion

In this report, we described the successful treatment of a large HCC by tumor compression–induced portal obstruction and additional TACE, which led to a marked increase in %RFLV compared with %RLV. Using the ^{99m}Tc-GSA scintigraphy SPECT–CT fusion system, PVE or portal vein obstruction due to a large tumor has been shown to induce dissociation between %RFLV and %RLV (41.3% and

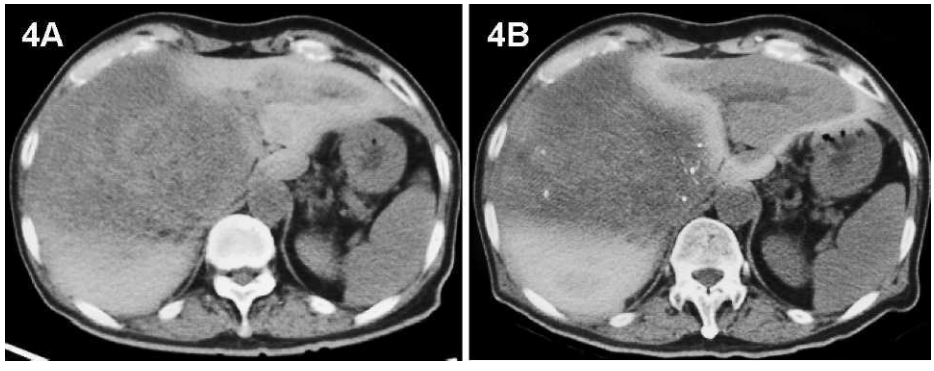

Fig. 4 Changes in uptake of ^{99m}Tc-GSA scintigraphy SPECT–CT fusion in left lateral segment; initial image (A) and after 1 month (B).

Table 1 Changes in liver volume and function before and after TACE

	Before TACE	After TACE
ICG R_{15}, %	7.5	33.2
LHL_{15}	0.93	0.89
RLV, mL	462	668
%RLV	31.2	46.6
%RFLV	41.3	67.2

ICG R_{15}, indocyanine green retention rate at 15 minutes; LHL_{15}, uptake ratio of the liver to the liver plus heart at 15 minutes.

31.2%, respectively, in this patient).[7] Because preoperative %RFLV showed a marginal tolerability, selective TACE was performed to abolish liver function and decrease the volume of the tumor-containing part of the liver. Thereafter, %RFLV remarkably increased to 67.2% at 1 month after TACE. Indeed, PVE and subsequent TACE have been reported to abolish the compensatory increase of hepatic arterial flow in portal-embolized liver, which can be a cause of insufficient hypertrophy or rapid tumor growth in nonembolized liver, as well as reported to prevent the progression of HCC.[8,9]

Although the ^{99m}Tc-GSA scintigraphy SPECT–CT fusion system is available only in a limited number of institutions now, the findings from this study promise to be of great value when planning preoperative management to improve %RFLV in patients with large HCCs waiting for curative hepatectomy.

In conclusion, tumor compression–induced portal obstruction and selective TACE increased %RFLV much more than %RLV using a ^{99m}Tc-GSA scintigraphy SPECT–CT fusion system. The additional use of TACE in portal obstruction caused by large HCCs may be a useful approach in preoperative management to improve %RFLV before curative hepatectomy.

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