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Course before and after percutaneous transhepatic portal vein embolization of a patient with cholangiocarcinoma monitored by scintigraphy with Tc-99m galactosyl human serum albumin

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Percutaneous transhepatic portal vein embolization (PTPE) causes atrophy of the embolized lobe and compensatory hypertrophy of the nonembolized lobe, and improves the safety of hepatectomy. We report a patient with cholangiocarcinoma who underwent embolization of both anterior and posterior branches of the right portal vein before hepatectomy. Scintigraphy with Tc-99m galactosyl human serum albumin was performed before and 4 weeks after PTPE. After PTPE, the right lobe of the liver was atrophied and the left lobe of the liver was enlarged, compared with before PTPE. The receptor index of the entire liver was almost unchanged before and after PTPE, but the right lobe receptor index after PTPE was 23% less than the pre-PTPE value, whereas the left lobe receptor index had increased 37%. Scintigraphy with Tc-99m galactosyl human serum albumin is useful for evaluating segmental functional reserve before and after PTPE.

Key words: Tc-99m GSA, PTPE, cholangiocarcinoma

INTRODUCTION

WE HAVE PERFORMED percutaneous transhepatic portal vein embolization (PTPE) before hepatectomy to improve the safety of hepatectomy and to expand the indications for hepatectomy.[1,2] PTPE causes atrophy of the embolized lobe and compensatory hypertrophy of the nonembolized lobe.[3] It is therefore necessary to accurately evaluate the function of the right and left lobes of the liver before hepatectomy.

Tc-99m galactosyl human serum albumin (GSA) is a radiopharmaceutical that specifically binds to asialoglycoprotein receptors in the hepatic cell membrane. Liver scintigraphy with this agent has been reported to be useful for evaluating hepatic functional reserve.[4–8] There are reports on the use of this agent for the evaluation of hepatic functional reserve in regeneration of the liver after hepatectomy,[9,10] and of hepatic functional reserve before and after transhepatic arterial embolization therapy.[11,12]

There are no reports available on scintigraphy performed with Tc-99m GSA to evaluate hepatic functional reserve before and after PTPE. We report a patient with cholangiocarcinoma for whom scintigraphy with Tc-99m GSA was useful for evaluating segmental functional reserve in the liver before and after PTPE.

CASE REPORT

A 74-year-old man was referred to our hospital after percutaneous transhepatic cholangio drainage because of jaundice. Abdominal ultrasonography revealed a space-occupying lesion in the liver, and the patient was hospitalized.

On admission, the patient was of moderate build and well-nourished. The red blood cell count was $389 \times 10^4/mm^3$, the platelet count $17.3 \times 10^4/mm^3$, serum albumin concentration 3.2 g/dL, aspartate aminotransferase activity 104 IU/L, alanine aminotransferase activity 69 IU/L, cholinesterase activity 350 IU/L, alkaline phosphatase

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Fig. 1 Magnetic resonance imaging revealed dilatation of intrahepatic bile duct and a hypointense tumor in the liver (arrow).

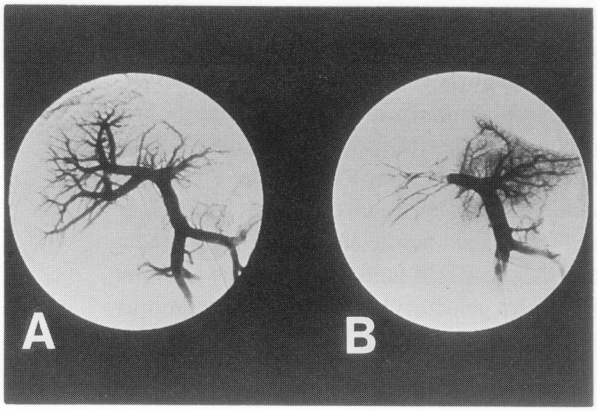

Fig. 2 A. Percutaneous transhepatic portogram obtained before percutaneous transhepatic portal vein embolization (PTPE). B. Percutaneous transhepatic portogram obtained after PTPE shows embolization of both anterior and posterior portions of the right portal branch.

activity 514 IU/L, γ-glutamyl transpeptidase activity 68 IU/L, total bilirubin concentration 19.5 mg/dL (direct bilirubin, 13.5 mg/dL), α-fetoprotein concentration 4 ng/mL, carcinoembryonic antigen 3.8 ng/m*l*, and carbohydrate antigen 19-9 1.0 U/mL.

Magnetic resonace imaging revealed dilatation of the intrahepatic bile duct and a hypointense tumor in the liver (Fig. 1). PTPE was performed in both the anterior and posterior branches of the right portal vein with an adhesive mixture of fibrin with lipiodol. Results of percutaneous transhepatic portography performed before and after PTPE are shown in Figure 2. Scintigrams and time-activity curves for the liver and heart obtained with Tc-99m GSA before and 4 weeks after PTPE are shown in Figures 3 and 4, respectively. After PTPE, the right lobe of the liver was atrophied and the left lobe of the liver was enlarged compared with before PTPE. The right lobe receptor index was calculated by dividing the radioactivity of the right lobe region of interest (ROI) by the

Table 1 Changes in liver volume and receptor index, and laboratory data before to 4 weeks after PTPE

		Before PTPE	4 weeks after PTPE
Liver volume	Both lobes (cm^3)	1484	1390
	Right lobe (cm^3)	1089	924
	Left lobe (cm^3)	395	466
Receptor index	Both lobes	0.919	0.917
	Right lobe	0.572	0.441
	Left lobe	0.347	0.476
Laboratory data	Alb (g/dL)	3.8	3.5
	T. Bil (mg/dL)	5.1	1.3
	AST (IU/L)	94	48
	ALT (IU/L)	100	29
	ALP (IU/L)	307	316
	γ-GTP (IU/L)	90	63

PTPE, percutaneous transhepatic portal vein embolization; Alb, serum albumin; T. Bil, total bilirubin; AST, aspartate aminotransferase; ALT, alanine aminotransferase; ALP, alkaline phosphatase; γ-GTP, γ-glutamyl transpeptidase

radioactivity of the entire liver plus heart ROIs 15 min after injection. The left lobe receptor index was calculated by dividing of the radioactivity of the left lobe ROI by the radioactivity of the entire liver plus heart ROIs 15 min after injection. The changes in liver volume and receptor index before to 4 weeks after PTPE are shown in Table 1. Liver volume was calculated by computed tomography (CT) imaging. The entire liver volume exhibited a 6% decrease from pre-PTPE to 4 weeks after PTPE (1484 to 1390). The right lobe volume at 4 weeks after PTPE was 15% less than pre-PTPE (1089 to 924), whereas left lobe volume had increased 18% increase (395 to 466). The receptor index of the entire liver showed little change from pre-PTPE to 4 weeks after PTPE (0.919 and 0.917, respectively), but the right lobe receptor index at 4 weeks after PTPE was 23% less than the pre-PTPE value (0.572 to 0.441), whereas the left lobe receptor index had increased 37% (0.347 to 0.476).

DISCUSSION

Cholangiocarcinoma is often accompanied by obstructive jaundice. In patients with disruption of the right and left bile ducts at the porta hepatis, the right and left lobes of the liver come to differ in functional capacity. Blood tests such as serum albumin, serum cholinesterase, and indocyanine green retention test have been used to evaluate residual function of the liver after hepatectomy,[13] but these tests are intended for evaluation of the function of the entire liver. It is also difficult to predict residual function of the liver after lobectomy from the results of conventional tests of total hepatic functional reserve. For this reason, it is necessary to correctly evaluate the function of the right and left lobes before the operation.

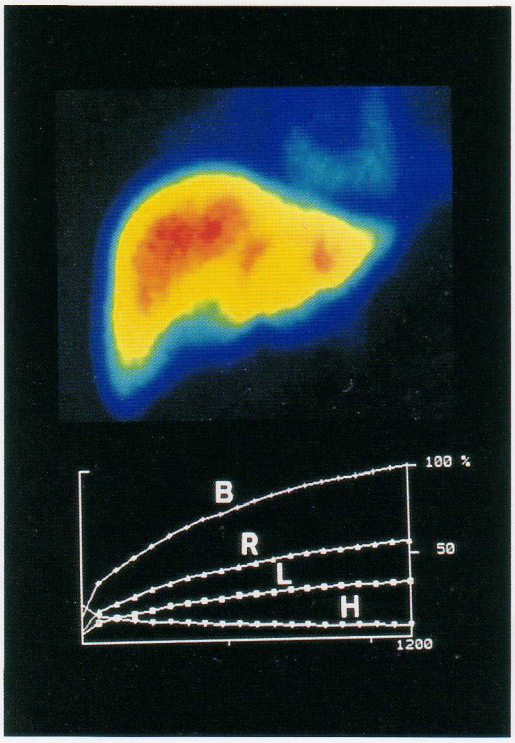

Fig. 3 Scintigram and time-activity curves for liver and heart obtained with Tc-99m GSA before PTPE. B: both lobes, R: right lobe, L: left lobe, H: heart.

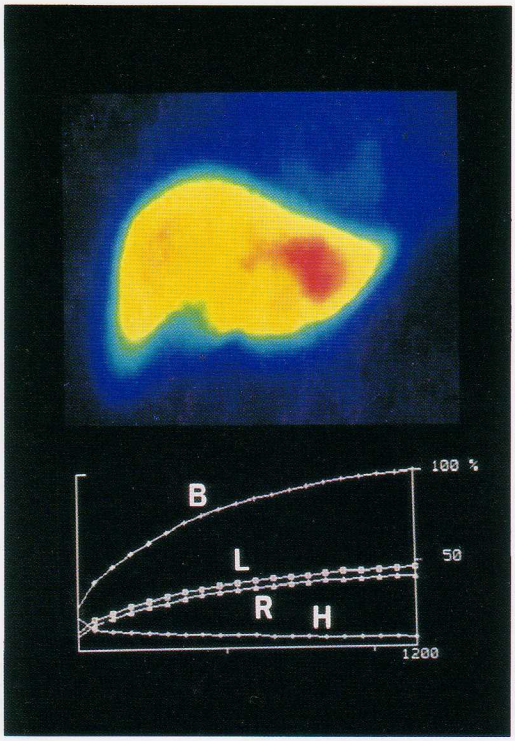

Fig. 4 Scintigram and time-activity curves for liver and heart obtained with Tc-99m GSA 4 weeks after PTPE. B: both lobes, R: right lobe, L: left lobe, H: heart.

Tc-99m GSA is an agent developed as a ligand that binds specifically to asialoglycoprotein receptors on the surface of hepatic cells,[4] and scintigraphy with Tc-99m GSA is a simple, easy-to-use method with few side effects. Lobar hepatic functional reserve can be evaluated with this method.[14,15] It is also possible to evaluate liver function even in patients with marked jaundice by using the same criteria as for evaluation of chronic liver diseases.[16,17] In view of these advantages, we used this method to evaluate segmental function of the liver before and after PTPE, which is expected to change segmental function of the liver.

The receptor index, which reflects the function of the entire liver, exhibited almost no change before to 4 weeks after PTPE, but the right receptor index at 4 weeks after PTPE was 23% less than the pre-PTPE value, whereas the left receptor index had increased 37%. In the images obtained, the left lobe of the liver clearly exhibited an increase in accumulation. Since Tc-99m GSA reflects the cell count for liver parenchyma,[4] PTPE shifted liver function to the non-embolized area while maintaining the reserve capacity of the entire liver. The ratio of the right lobe to left lobe receptor index was not correlated to the ratio of right lobe and left lobe volume calculated from the CT scan. In this case, percutaneous transhepatic bile duct drainage had been performed to treat dilation of the intrahepatic bile ducts before PTPE. Since the dilation was improved 4 weeks after PTPE, the liver volume calculated from CT did not accurately reflect the actual change in its volume. It is therefore necessary to calculate the receptor index for accurate evaluation of hepatic function.

In patients in whom either the anterior or posterior branch is embolized, it is necessary to evaluate the function in each segment of the liver, but this method is unable to accurately evaluate the function of each segment of the liver because of the overlapping images which result from counting before and after PTPE. To solve this problem, it is necessary to use single photon emission computed tomography.

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