Assessment of portosystemic shunting from superior mesenteric vein by duodenal administration of iodoamphetamine I123

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Abstract. Portosystemic shunting (PSS) from the superior mesenteric vein (SMV) was evaluated with the duodenal administration of iodoamphetamine I123 (IMP) in patients with chronic hepatitis and liver cirrhosis. After duodenal intubation, IMP was administered through a tube, and then scintigraphy including the pulmonary and hepatic regions was performed. In all patients, images of the liver and/or lungs were observed within 10 min and became clear with time, due to a good absorption of IMP from the intestine. On the other hand, IMP appears not to be absorbed from the stomach. The portosystemic shunt index was calculated by dividing counts of lungs by counts of liver and lungs. The shunt index (mean±SE) was 1.5%±0.8%, 12.6%±3.7% and 28.3%±4.5% in chronic hepatitis, compensated cirrhosis and decompensated cirrhosis, respectively. This index was significantly higher in cirrhosis, especially in decompensated cirrhosis. Therefore, transintestinal portal scintigraphy with IMP could be a useful method for the non-invasive and quantitative evaluation of PSS from the SMV in portal hypertension.

Key words: Iodoamphetamine I123 – Portosystemic shunting – Portal hypertension – Portal blood flow – Superior mesenteric vein


Introduction

The development of portosystemic shunting (PSS) in portal hypertension causes hepatic insufficiency due to the reduced hepatic blood flow. Therefore, quantitative evaluation of PSS is important for the management of patients with portal hypertension. Transrectal portal scintigraphy is an attractive and relatively simple, non-invasive method for this purpose. Conventionally, technetium-99m (Kuroki et al. 1976; Shiomi et al. 1988) or thallium-201 chloride (Tonami et al. 1982; Urbain et al. 1986) has been used as a radioactive tracer. Recently, we have reported that iodoamphetamine I123 (IMP) is a more useful and reliable tracer for evaluating the degree of PSS (Kashiwagi et al. 1988). However, transrectal portal scintigraphy can estimate PSS from only the inferior mesenteric vein (IMV). In this study, PSS from the superior mesenteric vein (SMV), which constitutes more than half of the portal blood flow, was successfully evaluated with duodenal administration of IMP.

Patients and methods

A total of 42 patients were studied. These included 16 patients with chronic hepatitis, 13 patients with compensated liver cirrhosis and 13 patients with decompensated liver cirrhosis. The diagnosis of liver diseases was made on the basis of clinical findings, liver function tests, liver scintigraphy and/or liver biopsy. Decompensated liver cirrhosis was identified by the presence of jaundice, ascites and/or encephalopathy. Informed consent was obtained from all patients.

After the patient had fasted at least 4 h, duodenal intubation was performed, and 1–2 mCi of IMP (Nihon Medi-Physics Corp, Takarazuka, Japan) was administered through a tube with the patient in the right lateral decubitus position. In order to include both hepatic and pulmonary regions, the patient was then placed supine under a large field-of-view gamma-camera (150DT; Hitachi Medico, Tokyo, Japan) with a low-energy, high-resolution collimator.

Images of the chest and abdomen were obtained with a 5-min exposure per image at 0, 5, 10, 15, 25, 35, 45 and 55 min. In addition, data were collected and stored on a computer (HARP; Hitachi Medico, Tokyo, Japan) every 1 min up to 60 min after IMP administration.

Regions of interest were placed on the liver and lungs (Fig. 1). Time-activity curves over the liver and lungs were then obtained.
Estimation of the portosystemic shunt index (PSI) was carried out by using following formula:

$$\text{Shunt index} = \frac{\text{Counts of lungs}}{\text{Counts of (liver+lungs)}} \times 100\%$$

The PSI was calculated every 5 min. If no lung image was obtained at 60 min, the PSI was given simply as 0%, due to the difficulty of exact selection of the lung region.

In order to examine whether IMP is absorbed from the stomach or not, 2 patients with liver cirrhosis underwent gastric intubation and 2 mCi of IMP was administered through a tube in the supine position, following an intramuscular administration of scopolamine butylbromide (20 mg). This drug was used in order to reduce the gastric motility so that the IMP would be retained in the stomach as long as possible. Scintigraphic examination was performed in the same manner as the examination after duodenal administration. Additional scintigraphy was performed 2 h after the administration of IMP.

Data were presented as mean ± SE, and statistical analysis was performed using Student’s t-test.

**Results**

In all patients, images of the liver or liver and lungs were observed within 5–10 min after duodenal administration of IMP and became clearer with time. In 11 of 16 patients with chronic hepatitis and 3 of 13 patients with compensated liver cirrhosis, only a liver image was observed and a lung image was not demonstrated until 60 min (Fig. 2). In the remaining patients, images of both liver and lungs were observed clearly (Fig. 3). On the other hand, in 2 patients with administration of IMP into the stomach, radioactivity in the stomach was little decreased, and no liver or lung image was observed clearly until 60 min after administration. Then 60 min later, IMP moved into the intestine, and a clear liver image was observed (Fig. 4).

In all patients undergoing duodenal administration of IMP, time-activity curves over the liver and lungs rose rapidly and persistently up to at least 60 min (Fig. 5). In almost all patients, the calculated PSI became almost constant after 45 min (Fig. 6). Thus, the PSI in each patient was calculated from the value in the latest