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Angiographic Management of Massive Hemobilia Due to Iatrogenic Trauma

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Abstract. Ten patients with massive hemobilia in shock or preshock status were treated with angiography. The hemobilia had been induced by iatrogenic trauma: biliary drainage in seven patients, and surgery, liver biopsy, and angiography in one patient each. Angiography was performed on all patients. Embolization was performed in nine, and in the one remaining patient, spasm of the right anterior hepatic artery and catheter manipulation injured the intima and obliterated the artery. In seven patients with hepatic artery pseudoaneurysm, gelfoam particles were injected in five, however, extravasation could not be prevented in four of these patients. Permanent embolic materials were added and complete hemostatis was obtained. Hemobilia never recurred in any patient. Emergency embolization should be considered as the initial treatment of choice for hemobilia and when pseudoaneurysms are discovered, they should be obliterated by permanent embolic materials. Moreover, tumor thrombus in the portal vein is not a contraindication for this procedure.

Key words: Aneurysm, rupture – Hepatic arteries, therapeutic blockade – Bile ducts, hemorrhage – Bile ducts, injuries.

Hemobilia, hemorrhage from the liver into the biliary tree, was once thought to only rarely occur [1], however, the increased use in recent years of diagnostic and therapeutic interventions has increased the incidence of this condition [2]. Hemobilia usually results from a pseudoaneurysm within the liver parenchyma. As pressure builds up in the cavity, the cavity empties into the thin-wall, low-pressure biliary tract, producing either a single or intermittent serious gastrointestinal (GI) hemorrhage [3]. In the past, the treatment of choice for hemobilia was surgery, which involved suturing the liver, ligation of the hepatic artery, and partial resection of the liver [4, 5]. However, surgery carries a high risk of morbidity and mortality in hemobilia [6, 7]. Recently, embolization, a nonsurgical procedure, which is less invasive than surgery, has been utilized for controlling hemobilia [8, 9]. We describe 10 patients in whom life-threatening hemobilia was treated successfully with transcatheter therapy.

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Materials and Methods

From June 1982 through December 1989, emergency angiography was performed on 10 patients with hemobilia. There were six men and four women, ranging in age from 46 to 72 years. All patients presented with clinical manifestations of massive hemobilia and required a blood transfusion before and/or after the embolization. Clinical features of the patients are summarized in Table 1. In six patients (patients 1, 2, 5, 6, 7, and 10), hemobilia was induced by percutaneous transhepatic biliary drainage (PTBD) and in one patient each by operative biliary drainage (patient 3), hepatojejunostomy (patient 4), hepatic angiography (patient 8), and liver biopsy (patient 9).

Initial diagnostic angiography was performed on all patients with a 5.0- or 6.5-French preshaped catheter by the transfemoral route. In all cases, hepatic arteriography was performed following superior mesenteric arterial portography evaluating the patency of the portal vein. In eight patients, the intrahepatic portal vein was visualized clearly with superior mesenteric arterial portography. However, in two patients (patients 1 and 8) with hepatocellular carcinoma (HCC), a tumor thrombus in the main portal vein branch was demonstrated. Hepatic arteriography revealed pseudoaneurysms of the hepatic artery in seven patients (patients 1–7) and peripheral arteriobiliary fistulas in two (patients 8 and 9). In patient 10, hemobilia was evident but no definite bleeding site was demonstrated by hepatic arteriography (Table 2).

Table 1. Clinical features of 10 patients with massive hemobilia treated by angiographic technique

Patient no./ age (yrs)/sex	Underlying disease	Previous intervention	Clinical manifestation
1/57/M	HCC with VP-TT	PTBD	Bleeding from PTBD tube
2/70/F	Common bile duct cancer	PTBD	Bleeding from PTBD tube
3/72/F	Hepatolithiasis	Cholecystectomy and OBD	Bleeding from OBD tube
4/46/F	Anomalous junction of pancreatobiliary duct	Hepatojejunostomy	Melena
5/64/M	Pancreatic head cancer	Pancreatoduodenectomy and PTBD	Bleeding from PTBD tube
6/56/M	Common bile duct cancer	PTBD	Bleeding from PTBD tube
7/55/M	Common bile duct cancer	PTBD	Bleeding from PTBD tube
8/57/M	HCC with VP-TT	Angiography	Bleeding from cholecystostomy
9/55/M	Liver cirrhosis	Liver biopsy	Melena
10/51/F	Acute obstructive suppurative cholangitis	PTBD	Bleeding from PTBD tube

M, male; F, female; HCC, hepatocellular carcinoma; VP-TT, tumor thrombus in the main portal vein; PTBD, percutaneous transhepatic biliary drainage; OBD, operative biliary drainage.

Immediately after diagnostic angiography, hepatic artery embolization with the same catheter was performed in seven patients (patients 3–9). A 3.0-French Tracker-18 catheter (Target Therapeutics, Inc., Mountain View, CA, USA) was utilized in two patients (patients 1 and 2) for embolization of the peripheral hepatic artery (Fig. 1). In patient 10, subintimal injury of the right anterior hepatic artery, which occurred secondary to catheter manipulation, led to the obliteration of this bleeding artery and embolization was not performed. Gelfoam particles alone (Upjohn Co., Kalamazoo, MI, USA) were used as embolic material in three patients, stainless steel coils (Cook, Inc., Bloomington, IN, USA) alone in two patients, and gelfoam particles plus the coils in two patients. Gelfoam particles plus hilal embolization microcoils (Cook, Inc.) and gelfoam particles plus Ivalon (Unipoint, Inc., High Point, NC, USA) were each used in one patient.

Results

Complete cessation of bleeding by angiographic technique was obtained in all patients (Table 2). Five hepatic artery pseudoaneurysms in seven patients were embolized with gelfoam particles initially; however, complete hemostasis was obtained only in patient 7. Further rupture of the pseudoaneurysms was observed in three patients during injection of gelfoam particles. In the one remaining patient (patient 2), the pseudoaneurysm decreased in size, but was not occluded completely by gelfoam embolization. Therefore, additional embolizations with permanent embolic materials, such as hilal embolization microcoils in patient 1, Ivalon in patient 2, and a stainless steel coil in patients 3 and 4 (Fig. 2), were necessitated to completely halt the hemobilia. In the remaining two patients with hepatic artery pseudoaneurysms (patients 5 and 6), superselective embolizations with stainless steel coils resulted in complete hemostasis (Fig. 3). Two of three patients without hepatic artery pseudoaneurysm were treated by embolization with gelfoam particles alone and permanent hemostasis was obtained.

In all 10 patients, the only complication related to the procedure was the subintimal dissection of the right anterior hepatic artery during superselective catheterization, which precluded embolization (patient 10, Fig. 4). In this patient, follow-up hepatic angiography, obtained 3 h after subintimal dissection, revealed obliteration of the right anterior hepatic artery. Hemobilia was stopped and rebleeding has not recurred for the past 5 months. There were no cases of hepatic abscess or sepsis related to the procedure. No remarkable changes in hepatic function were seen after angiographic management in eight patients. Significant but transient elevation of the liver enzymes occurred in patients 1 and 8, who had huge HCC with a tumor thrombus in the main portal vein. Neither rebleeding nor a major complication (e.g., hepatic infarction) occurred in any patient. Nine of the patients were discharged; however, one of them, who had a huge HCC, died of pneumonia 40 days after the emergency embolization.

Discussion

Hemorrhage into the biliary tract was termed "hemobilia" by Sandblom in 1948 [10]. Hemobilia is a relatively rare but serious cause of GI hemorrhage. Angiography is the definitive diagnostic examination for this condition [11–13]. It is not nec-

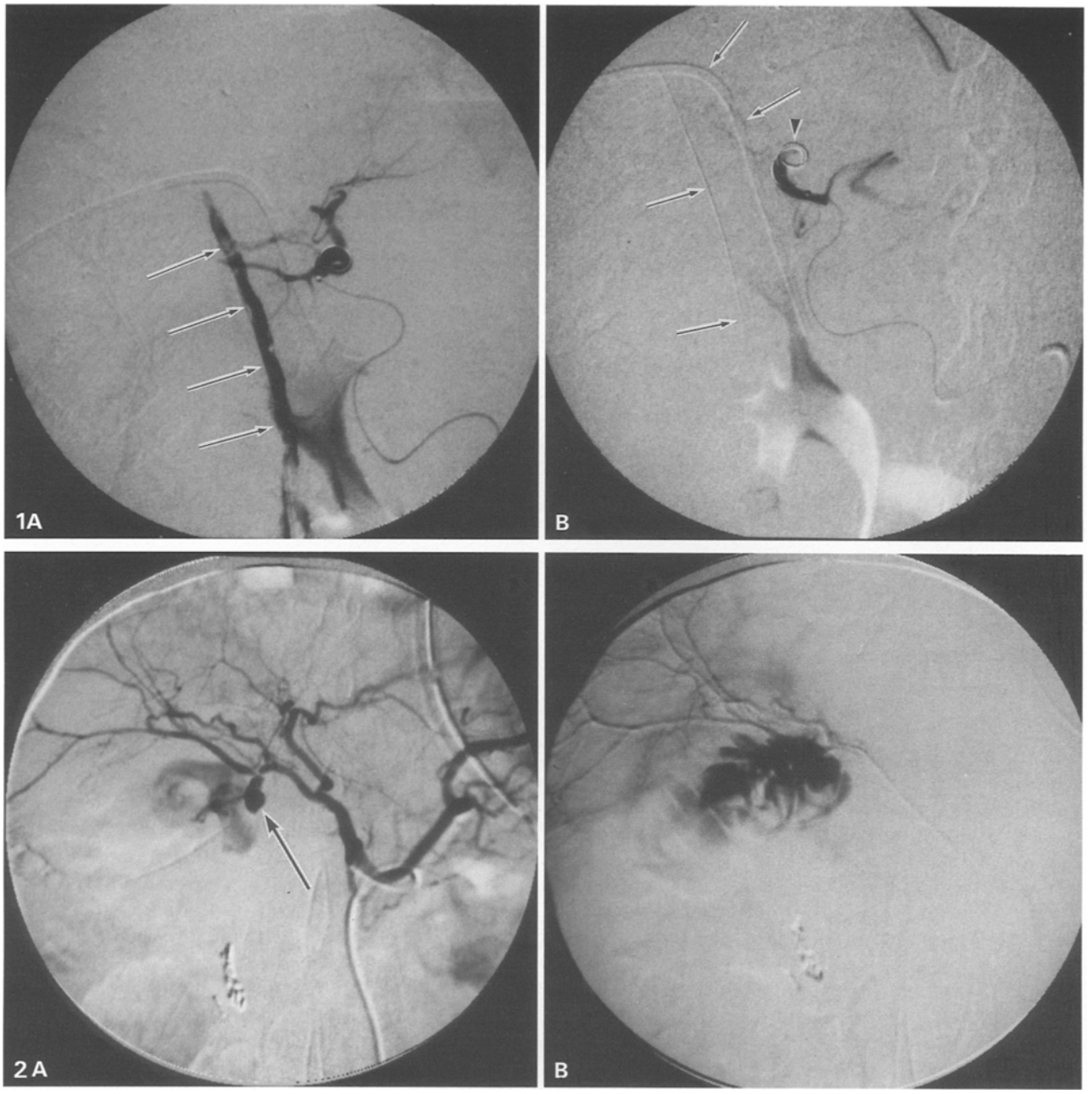

Fig. 1. *Patient 1.* Subsegmental embolization using Tracker-18 catheter. **A** Right anterior superior hepatic arteriography demonstrates extravasation of contrast materials into the PTBD tube (*arrows*) inserted into the right anterior superior bile duct for external drainage. **B** Hepatic arteriography after embolization with gelfoam particles and two hilal embolization microcoils (*arrowhead*) shows occlusion of the right anterior hepatic artery. Arrows indicate two PTBD tubes inserted into the right anterior bile duct for external drainage and the right posterior bile duct for internal drainage.

Fig. 2. *Patient 4.* Further rupture of pseudoaneurysm during injection of gelfoam particles. **A** Celiac arteriography reveals extravasation of contrast medium from the right posterior hepatic artery pseudoaneurysm (*arrow*) to small intestine. **B** Right hepatic arteriography taken just after initial right posterior hepatic arterial embolization with gelfoam particles demonstrates further rupture of pseudoaneurysm and the Kerkring folds of the jejunum. Additional embolization with two stainless steel coils stopped the bleeding.

Table 2. Data of angiography and embolization on 10 patients with massive hemobilia treated by angiographic technique

Patient no./ age(yrs)/sex	Site of bleeding and embolization	Embolic materials	Hemostasis	Outcome
1/57/M	AS-RHA pseudoaneurysm	Gelfoam particles, then hilal embolization microcoils	Re-rupture, successful	Discharged
2/70/F	LS-LHA pseudoaneurysm	Gelfoam particles, then Ivalon	Incomplete, successful	Discharged
3/72/F	P-RHA pseudoaneurysm	Gelfoam particles, then stainless steel coils	Re-rupture, successful	Discharged
4/46/F	RHA pseudoaneurysm	Gelfoam particles, then stainless steel coils	Re-rupture, successful	Discharged
5/64/M	AI-RHA pseudoaneurysm	Stainless steel coils	Successful	Discharged
6/56/M	LHA pseudoaneurysm	Stainless steel coils	Successful	Discharged
7/55/M	RHA pseudoaneurysm	Gelfoam particles	Successful	Discharged
8/57/M	RHA	Gelfoam particles	Successful	Died of pneumonia 40 days later
9/55/M	RHA	Gelfoam particles	Successful	Discharged
10/51/F	A-RHA	None	Successful	Discharged

AS, anterior superior branch; RHA, right hepatic artery; LS, lateral superior branch; LHA, left hepatic artery; P, posterior; AI, anterior inferior; A, anterior.

essary to see active extravasation of contrast material or biliary-tree opacification to establish the diagnosis. The identification of hepatic artery aneurysm, pseudoaneurysm, or an arterioportal fistula is enough to indicate the diagnosis of hemobilia [13–15]. Hepatic artery pseudoaneurysm is the most common angiographic finding of hemobilia.

The widespread use in recent years of diagnostic and therapeutic invasive procedures on the hepatobiliary system, such as percutaneous transhepatic cholangiography, percutaneous transhepatic biliary drainage (PTBD), and needle biopsy of the liver, not only has resulted in an increased incidence of hemobilia but also has changed the etiology and presentation of this condition [2, 16, 17]. The hemobilia in all 10 patients in our series, was induced by iatrogenic trauma. The incidence of hemobilia following PTBD ranges from 3–14% [17, 18]. The close proximity of the intrahepatic bile duct to the hepatic artery and portal vein branches accounts for the relative frequency of hemobilia either immediately or within a few hours after the procedure [19]. Creation of an arteriobiliary fistula may occur at a later stage following rupture of a pseudoaneurysm into the biliary tree [20, 21] or after pressure necrosis of the bile ducts and adjacent vessels from the indwelling biliary catheter [17].

The treatment of hemobilia has also evolved. Until recently direct surgical intervention was the only possible treatment for hemobilia [22]. Surgical intervention has been largely replaced by angiography with therapeutic embolization, which was first reported as an alternative measure in 1976 by Walter et al. [11]. The therapeutic embolization can be done concomitantly with diagnostic angiography. Embolization performed by experienced angiographers has been proven to be safer than immediate surgery in patients with massive hemobilia who are not suitable candidates for surgery. Embolization also is an easier approach to the treatment of hemobilia; surgical intervention would be difficult because of postoperative adhesions in patients with hepatobiliary diseases or the need to identify the site of intrahepatic arterial bleeding [3, 17].

Hepatic artery embolization can be safely performed if the patient has portal vein patency and the routes of the hepatic artery are not altered [23]. Although there are a few reports of fatal hepatic necrosis and intrahepatic abscess formation following hepatic artery embolization [24, 25], this seems a small risk considering the treatment alternatives [17]. Superselective embolization as close as possible to the bleeding site is ideal both to reduce the risk of significant hepatic necrosis and to reduce the recurrence of bleeding caused by the

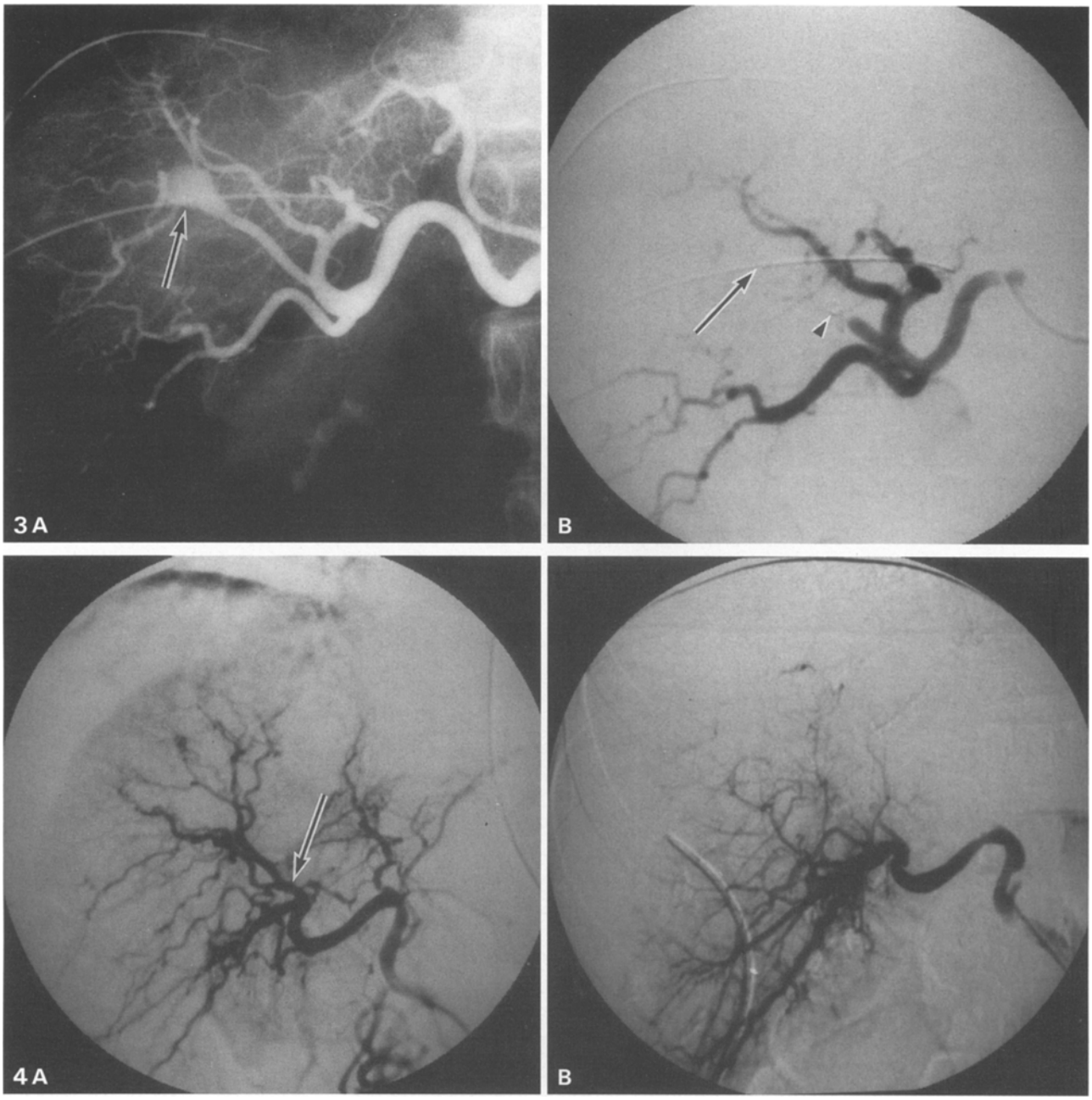

Fig. 3. *Patient 5.* Subsegmental embolization with stainless steel coils. **A** Common hepatic arteriography reveals right anterior inferior hepatic artery pseudoaneurysm (*arrow*). **B** Right hepatic arteriography, obtained just after embolization with two coils, discloses obliteration of the right anterior inferior hepatic artery. *Arrow* shows one coil in the pseudoaneurysm and *arrowhead* indicates the coil in the hepatic artery.

Fig. 4. *Patient 10.* Subintimal dissection of hepatic artery during catheterization. **A** Common hepatic arteriography reveals no hepatic artery pseudoaneurysm or arterioportal shunt and arteriobiliary fistula in spite of hemorrhage from the PTBD tube. *Arrow* indicates the right anterior hepatic artery. **B** Right hepatic arteriography taken 3 h after subintimal dissection of the right anterior hepatic artery by catheter manipulation shows no patency of the occluded right anterior hepatic artery.

development of collateral blood flow. These patients may have diminished or no portal vein flow as a result of obstruction of the portal vein by a tumor or liver cirrhosis. It is essential to evaluate portal vein flow with angiography before hepatic artery embolization for hemobilia. In our series, there were two patients with tumor thrombi caused by a huge HCC in the main portal vein. Superselective anterosuperior right hepatic artery and right hepatic artery embolization was performed in these

two patients. Significant but transient elevation of the liver enzyme levels occurred after these embolizations; however, hepatic necrosis did not occur based on computerized tomography and the clinical course [26]. Therefore, portal vein obstruction by tumor thrombi is not a contraindication for arterial embolization when the catheter is placed superselectively in the segmental or subsegmental hepatic artery.

Various embolic materials have been used for vessel occlusion, the choice of which depends on the number, size, and site of the artery to be embolized, nature of the vessel, characteristics of the lesion (e.g., presence of an arterioportal fistula, aneurysm, or pseudoaneurysm), and severity of the bleeding [9]. The ideal embolic material in patients with hemobilia should be easy to use, permanent, and capable to occlude the bleeding artery with maximum preservation of hepatic arterial flow [9, 13]. In Japan, a great number of patients with HCC were treated by embolization with gelfoam particles, which were easy and safe to use for occlusion of the hepatic artery [23, 27]. This embolic material also may be useful for a small amount of arterial bleeding. But because of the risk of aneurysm wall rupture due to increased intraaneurysm pressure during injection, the application of gelfoam particles to aneurysmal lesions should be limited [9]. In our series, complete cessation of hemobilia was obtained by gelfoam embolization alone in two patients without hepatic artery pseudoaneurysm, and in only one of five patients with hepatic artery pseudoaneurysm. Complete hemostasis was obtained by superselective embolization with stainless steel coils alone in two patients with pseudoaneurysm. These experiences support Uflacker's report describing appropriate steel coils as probably the safest and easiest material for aneurysm treatment in certain vascular areas [9]. Furthermore, our experience suggests that embolization with microcoils under superselective catheterization close to the bleeding pseudoaneurysm, using a new coaxial catheter and steerable guidewire, will be the first choice of embolization methods for hemobilia from the small caliber hepatic artery pseudoaneurysms. In addition, the use of a new coaxial system may prevent complications, such as the subintimal dissection experienced by patient 10 [28].

Our 100% success rate, with no morbid complications of embolization, leads us to conclude that embolization is the initial treatment in the management of hemobilia.

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