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# Percutaneous management of anastomotic bile leaks following liver transplantation

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PURPOSE
To review our experience with percutaneous internal-external biliary drainage in treating biliary anastomotic leaks following orthotopic liver transplantation.

MATERIALS AND METHODS
Between September 1997 and June 2006, 157 liver transplantations were performed in our hospital. Percutaneous transhepatic biliary drainage was performed in 10 patients (9 males, 1 female; mean age, 32.9 years; age range, 2–62 years) with patent hepatic arterial systems to treat clinically significant anastomotic bile leaks.

RESULTS
Bile leaks were resolved and anastomotic patency was restored in all patients. Massive hemobilia occurred in 1 patient due to arterial pseudoaneurysm and was treated with embolization. No major complications were seen in the other patients. During a mean follow-up of 19.5 months, anastomotic stricture occurred in 2 patients (1 in combination with a recurrent leak). Both patients were successfully treated with percutaneous methods. The remaining 8 patients had no biliary problems.

CONCLUSION
When treating anastomotic bile leaks in liver transplant patients, percutaneous procedures may be performed with high technical success and low complication rates.

*Key words:* • *liver transplantation* • *biliary system* • *complication* • *interventional radiology*

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Biliary leaks remain a significant source of morbidity in patients undergoing liver transplantation (1). The most common site for clinically important leakage is the biliary anastomosis (duct-to-duct or biliary-enteric) (2, 3). In some patients with limited and clinically insignificant leaks, percutaneous drainage of the bile is usually sufficient (4); however, most anastomotic leaks require biliary diversion procedures. Surgical correction is the most commonly used means of treating these leaks (5, 6), although in recent years non-surgical percutaneous interventional techniques have become more popular in treating biliary complications following liver transplantation (7, 8). We retrospectively evaluated the outcomes of percutaneous internal-external biliary drainage in the treatment of clinically important anastomotic bile leaks.

## Materials and methods

Between September 1997 and June 2006, 157 orthotopic liver transplantations were performed at our hospital. In 125 grafts, biliary reconstruction was a duct-to-duct (DD) anastomosis over a T-tube or transhepatic catheter. A biliary-enteric (BE) anastomosis (Roux-en-Y hepaticojejunostomy) without an internal stent was performed in the remaining 32 grafts.

During this period, anastomotic bile leakage was diagnosed in 16 patients (10.2%). One patient was treated with endoscopic stenting. Surgical revision was required in 3 patients that had complete anastomotic disruption. In 2 patients, who additionally had multiple intrahepatic bilomas secondary to hepatic artery thromboses, we performed percutaneous procedures for chronic biliary drainage while waiting for retransplantation. In the remaining 10 patients with patent hepatic arterial systems (9 males, 1 female; mean age, 32.9 years; age range, 2–62 years), percutaneous transhepatic biliary drainage was performed for clinically significant anastomotic bile leaks (Table 1). In these patients, mean diagnosis time of the bile leaks was 31.5 days (range, 7–108 days). The diagnosis was suspected due to a perihepatic collection on sonogram (n = 8) or marked bile drainage from the surgical drain (n = 2). We performed percutaneous drainage of a perihepatic biloma in 8 patients. The injection of contrast material through the biloma catheter showed communication of the biloma with the biliary system at the site of anastomosis (Fig. 1). Of these 8 patients, 3 had biliary-enteric anastomosis and the remaining 5 patients had duct-to-duct anastomosis without a T-tube at the time of diagnosis, either because of routine removal or accidental dislodgment. In the remaining 2 patients, a cholangiogram through the T-tube demonstrated the biliary tree and anastomotic leak. The mean time between diagnosis and percutaneous biliary drainage was 12.5 days (range, 2–32 days). During this time, output from the biloma catheter or the surgical drain was high (>200 ml/day) in all cases. In 6 patients, percutaneous therapy was performed after a failed endoscopic stenting procedure.

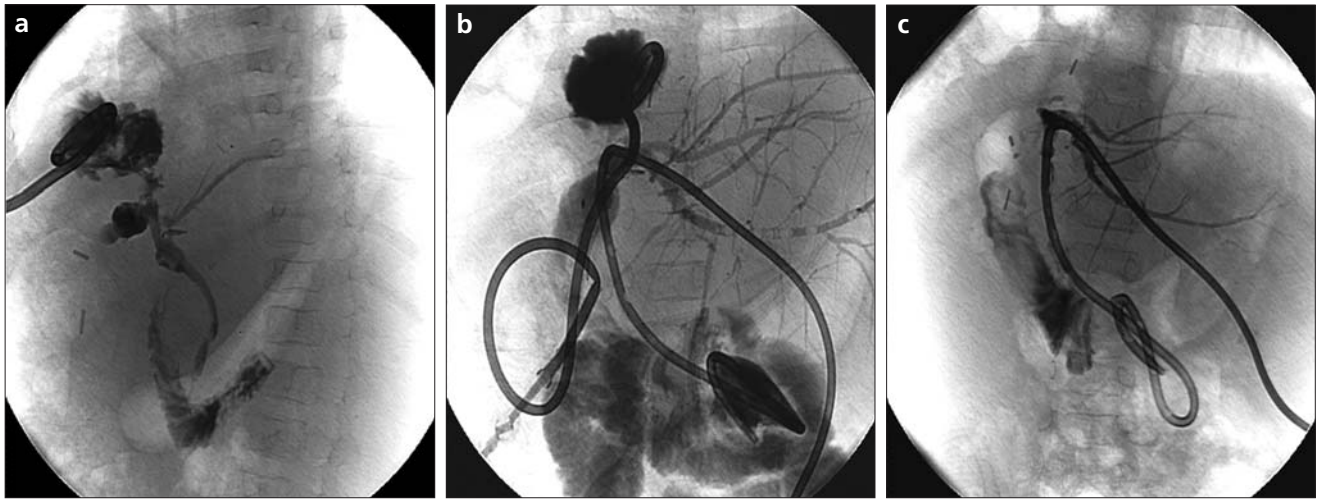


**Figure 1. a–c.** Case 7: Three months after liver transplantation contrast injection through the biloma catheter **(a)** shows an anastomotic bile leak from the choledochocholedochostomy anastomosis. A 10-F internal-external biliary drainage catheter was placed in the biliary system. The biloma catheter is also seen **(b)**. On control cholangiogram 40 days after biliary drainage **(c)**, the leak has disappeared.

All procedures were performed under IV sedation (midazolam) and local anesthesia (prilocaine). In children we also used dissociative anesthesia with ketamine. All patients received broad-spectrum antibiotics (cefazolin) before the procedure. We used different techniques for percutaneous bile duct puncture, depending on the caliber of the peripheral bile ducts. In patients with dilated bile ducts, transhepatic biliary access was achieved with percutaneous puncture of a peripheral duct under ultrasonographic guidance. In patients that sonography did not demonstrate a dilated peripheral bile duct, the puncture was performed under fluoroscopic guidance using cholangiography (obtained via the drainage catheter near the leak site or surgical T-tube). In all cases, we used a 21-gauge needle (AccuStick Introducer System with nitinol guide wire, Boston Scientific, Natick, Massachusetts, USA) to puncture the bile duct.

To confirm the diagnosis, a percutaneous transhepatic cholangiogram was performed with injection of contrast material through the needle. Then, a coaxial dilator (AccuStick Introducer System with nitinol guide wire, Boston Scientific, Natick, Massachusetts, USA) was placed over a 0.018-inch nitinol guide wire. A 0.035-inch guide wire (Terumo, Tokyo, Japan) was advanced through the dilator and a 6-F introducer (Terumo, Tokyo, Japan) was inserted into the duct over the wire. A 5-F catheter (Terumo, Tokyo, Japan) with a guide wire (Terumo, Tokyo, Japan) was used to traverse the defective anastomosis. After reaching the intestine, we placed an internal-external biliary drainage catheter (8- to 12-F Flexima, Boston Scientific, Natick, Massachusetts, USA) over a stiff guide wire (Amplatz Super Stiff Guide Wire, Boston Scientific, Natick, Massachusetts, USA) with multiple side holes positioned on both sides of the anastomosis (Fig. 2). Repeat control cholangiograms were performed to assess the therapy until the leak disappeared (as demonstrated on a radiograph).

**Table 1.** Clinical characteristics of the patients with anastomotic leaks

| Patient number | Age (years) | Sex | Graft type | Biliary anastomosis | Leak diagnosis time (days) |
|---|---|---|---|---|---|
| 1 | 9 | M | Left lobe | Biliary-enteric | 11 |
| 2 | 23 | M | Right lobe | Duct-to-duct | 16 |
| 3 | 49 | M | Right lobe | Duct-to-duct | 27 |
| 4 | 10 | M | Left lobe | Biliary-enteric | 18 |
| 5 | 2 | F | Left lobe | Biliary-enteric | 7 |
| 6 | 59 | M | Right lobe | Duct-to-duct | 49 |
| 7 | 3 | M | Left lateral segment | Duct-to-duct | 108 |
| 8 | 57 | M | Whole liver | Duct-to-duct | 21 |
| 9 | 62 | M | Right lobe | Duct-to-duct | 37 |
| 10 | 55 | M | Right lobe | Duct-to-duct | 21 |

## Results

Percutaneous biliary drainage procedures were successfully performed in all 10 patients. Hemobilia was the most common complication immediately after the procedure, and all instances resolved within 1–3 days. Five weeks after catheter removal, massive hemobilia occurred in 1 patient who had a hepatic artery pseudoaneurysm rupture into the biliary tree. The aneurysm was successfully treated with coil embolization.

Mean duration of percutaneous internal-external biliary drainage was 60.6 days (range, 37–96 days). Bile leaks resolved, and anastomotic patency was restored in all patients (Table

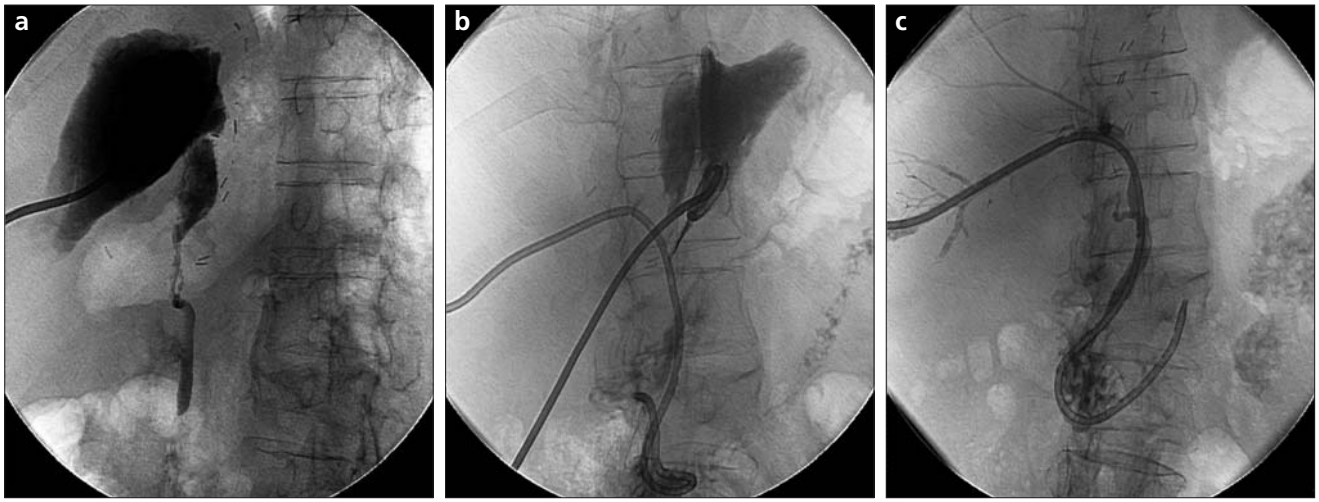


**Figure 2. a–c.** Case 6: Pouchography via a biloma catheter **(a)** shows communication between the biliary tree and the biloma caused by anastomotic defect. A 10-F internal-external biliary drainage catheter was inserted into the biliary system across the anastomosis **(b)**. A cholangiogram obtained 2 months after the biliary drainage **(c)** shows the intact anastomosis.

2). After catheter removal, the mean follow-up was 19.5 months (range, 3–36 months). Clinically symptomatic anastomotic stricture occurred in 2 patients (1 in combination with a recurrent leak) at 3 and 13 months post-treatment. Both patients were successfully treated with percutaneous biliary drainage and balloon dilatation (Blue Max Balloon Catheter, Boston Scientific, Natick, Massachusetts, USA). The remaining 8 patients did not have biliary problems during follow-up.

## Discussion

Post-transplant bile leaks usually occur at the site of the surgical anastomosis (9). Other potential sources for leaks are at the cut edge, the T-tube exit site, and the cystic duct stump (10). Clinical observation and percutaneous drainage of a biloma are usually sufficient for small self-limited leaks; however, in patients with ongoing leaks, usually from the anastomosis, standard management is to divert the bile away from the leak and maintain biliary drainage into the intestine. Although surgical revision of the anastomosis is a commonly used technique in such patients, reoperation is associated with significant morbidity (11). Endoscopic management is the preferred method of treatment (8); however, cannulation of the bile ducts proximal to the leak may be unsuccessful. In 6 patients, we successfully performed percutaneous therapy after failing to cross the anastomosis endoscopically. An endoscopic approach is also not feasible in most patients with hepaticojejunostomy anastomoses.

Successful results of percutaneous therapy for bile leaks have been reported (4, 7). Percutaneous techniques may be used regardless of the biliary anastomosis technique used. Once percutaneous biliary-enteric access is achieved, further interventions, including catheter exchange in cases with cholangitis or balloon dilatation in cases with coexistent stricture, may be easily performed. Additionally, resolution of the leak may be followed by control cholangiograms obtained via the catheter. In our study, all leaks resolved and none of the patients required surgical correction. Stricture at the previous leak site is not a rare complication after successful treatment (4) and may be the result of symptomatic biliary obstruction. In our study, 2 patients experienced biliary obstruction due to anastomotic stricture, and both were treated successfully with percutaneous management.

The most important limitation of percutaneous management is decompression of the bile ducts due to large leaks. In patients with marked leaks, usually from the anastomosis, bile entering the peritoneum prevents dilatation of the bile ducts, which is essential for sonographic guidance. One of the techniques for achieving percutaneous biliary access in patients with non-dilated systems is a

**Table 2.** Duration of percutaneous transhepatic biliary drainage and follow-up

| Patient number | Healing time (days) | Follow-up |
|---|---|---|
| 1 | 50 | No recurrence at 36 months |
| 2 | 86 | No recurrence at 21 months |
| 3 | 73 | Stricture at 3 months (successfully treated), no recurrence at 18 months |
| 4 | 37 | Recurrent leak + stricture at 13 months (successfully treated), no biliary problem at 19 months |
| 5 | 81 | No recurrence at 28 months |
| 6 | 57 | No recurrence at 21 months |
| 7 | 40 | No recurrence at 24 months |
| 8 | 37 | No recurrence at 18 months |
| 9 | 96 | No recurrence at 7 months |
| 10 | 57 | No recurrence at 3 months |

puncture of the main bile duct near the hilum, and then filling the entire biliary tract, including the peripheral bile ducts, with contrast (12). This puncture carries the risk of damage to the hilar vascular structures (13). In such patients, to make the peripheral bile duct fluoroscopically visible, we inject contrast medium through the T-tube located at the choledochus or through the catheter at the perihepatic biloma cavity, which is connected to the biliary system via the defective anastomosis.

The most common complication seen after percutaneous biliary drainage procedures is transient hemobilia (13). Rarely, a pseudoaneurysm may occur secondary to arterial injury. If the aneurysm is connected to the biliary system, massive hemobilia occurs. Cholangitis is another frequent complication of percutaneous biliary intervention and may be treated with catheter exchange and antibiotics.

In conclusion, percutaneous interventional methods are effective therapeutic alternatives for the treatment of bile leaks following liver transplantation. These procedures may be performed with high technical success and low complication rates in liver transplant patients, even in those with serious biliary anastomotic leaks.

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