Long-Term Patency of Metallic Stents in a Patient with Bile Duct Injury Refractory to Long-Term Catheter Placement Following Right Hepatectomy for Liver Metastasis

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Abstract
We report a case of bile duct injury at the bile duct confluence after right hepatectomy for metastatic colonic carcinoma. The leak and stricture failed to heal despite the placement of a 10-16-F transhepatic biliary drainage catheter for 8 weeks to bridge the leak site. Subsequently, two bare metallic stents were placed; however, the leak and stricture recurred 282 days after stent placement. Even a covered metallic stent did not function well because of stent kinking, and an additional bare stent was required to support the kinked stented lumen. After final stent placement, the stents were patent, and the patient had maintained a favorable course for 10 years and 1 month, at the time of writing this manuscript.

Key words: Bile duct injury, hepatectomy, metallic stent

Introduction
Bile duct injury is one of the most serious complications following hepatobiliary surgery. Most bile leaks can be managed solely with percutaneous transhepatic biliary drainage (PTBD) or endoscopic nasobiliary drainage (ENBD) to properly direct the bile duct flow and allow the problem to resolve [1-4]. Temporary placement of a plastic stent is also effective for severe leaks or strictures [5, 6]. However, such a strategy fails to yield satisfactory results in some cases [3-5]. Here, we present a case of bile duct injury after right hepatectomy that could not be healed by PTBD catheter placement, but was successfully repaired after three sessions of metallic stent placement.

Case Report
A 55-year-old man had undergone right hepatectomy for metastatic colonic carcinoma in another hospital. Fifty-four days after hepatectomy, the patient presented with septic shock, and surgical drainage of an abscess at the hepatic hilum was performed. Subsequently, persistent bile leakage from the surgical drain was observed, and endoscopic retrograde cholangiopancreatography (ERCP) showed stenosis and leakage of contrast material at the bile duct confluence (Fig. 1). The patient was transferred to our hospital for treatment of the bile duct injury 117 days after hepatectomy. Percutaneous repair of the lacerated bile duct was planned, and written informed consent was obtained for the procedure from the patient. First, PTBD to the left bile ductal system was performed under sonographic and fluoroscopic guidance (Day 1). Attempts at passing a guidewire across the injured portion were unsuccessful, and the guidewire was only advanced toward the abscess cavity through the laceration of the bile duct. Subsequently, a 7.2-F pigtail drainage catheter (Medico's Hirata, Osaka, Japan) was placed from the left hepatic duct into the abscess.

On Day 5, a second attempt to reconstruct the biliary tree was made. A 0.035-inch guidewire (Jagwire; Boston Scien-
tific, Natick, MA, USA) was advanced into the abscess cavity, using an endoscopic procedure. The guidewire was caught by a snare catheter (Amplatz GooseNeck Microsnare kit; ev3, Plymouth, MN, USA) that was inserted into the abscess cavity through an 8-F sheath (Terumo, Tokyo, Japan) placed in the PTBD route (Fig. 2). The guidewire was pulled out of the sheath, and a 10-F pigtail drainage catheter (Ultrathane; Cook, Bloomington, IN, USA) was advanced into the duodenum over the guidewire. The surgical drain in the abscess cavity was also exchanged for a 14-F pigtail drainage catheter (Ultrathane, Cook) (Fig. 3). On Day 9, the PTBD catheter was exchanged for a 14-F drainage catheter (Ultrathane, Cook) and placed for 10 days. Thereafter, it was exchanged for a 16-F drainage catheter (Ultrathane, Cook) and placed for 42 days. In total, a 10-16-F external-internal drainage catheter was left in place for 56 days (8 weeks) to seal and bougie the injured bile duct. Then, the catheter was exchanged for a 7.2-F straight catheter (Medico’s Hirata) and placed for 1 week. After confirmation of good flow of contrast material without extravasation by cholangiograms, catheters in both the bile duct and the abscess cavity were removed on Day 69 (Fig. 4).

However, the patient presented with fever on Day 84. ERCP showed bile leak and stricture at the same site. Subsequently, a 7.2-F ENBD catheter (Hanako Medical, Kobe, Japan) was placed in the left hepatic duct. Placement of a new catheter via the transhepatic or endoscopic route was considered; however, bile leak and stricture seemed to be refractory to catheter stenting. Therefore, placement of a metallic stent was planned. However, a covered metallic stent that could be endoscopically placed in the bile duct was not commercially available; therefore, two bare metallic stents (a 10 × 40-mm Luminexx [Bard, Tempe, AZ, USA] and a 10 × 40-mm Zilver [Cook]) were endoscopically placed between the left hepatic duct and the common bile duct to cover the leak site on Day 96. During the second admission, a new metastatic liver tumor measuring 2 cm in diameter was discovered in the left hepatic lobe. The tumor was successfully treated using radiofrequency ablation on Day 117.

However, fever recurred on Day 378. ERCP showed bile
leak and stricture in the stented segment, and a 7.2-F ENBD catheter (Hanako Medical) was placed (Fig. 5). At that time, covered metallic stents that could be placed endoscopically were commercially available. Hence, a 10 × 80-mm partially covered metallic stent (Niti-S ComVi Stent; Taewoong Medical, Goyang-Si, Korea) was placed, bridging the left hepatic duct and the common bile duct on Day 389. However, the stent was kinked at the bile duct confluence, and cholangitis recurred from Day 426. An additional 10 × 40-mm stent (Zilver; Cook) was placed into the kinked stented segment on Day 431 (Fig. 6). Computed tomography performed 9 years and 10 months after the final stent placement showed that the stents were patent (Fig. 7). The patient has maintained a favorable course for 10 years and 1 month after final stent placement, although he underwent partial gastrectomy for early gastric carcinoma 1 year ago.

**Discussion**

Iatrogenic bile duct injury, most commonly observed as
bilocama formation from a bile leak, may occur after surgical procedures such as laparoscopic cholecystectomy and hepatic resection [1]. Catheter stenting is the first-line treatment, and subsequent diversion of the fistula by endoscopic or percutaneous transhepatic techniques is necessary in addition to drainage of the biloma cavity [1-6]. Intrabiliary diversion of the biliary system decreases the intrabiliary pressure by rerouting the flow of bile away from the defect in the bile duct. At the same time, continuous drainage of the biloma serves to drain the cavity dry to maximize wound healing [2]. Sandha et al. [5] reported that temporary biliary stenting for 4 to 6 weeks yielded satisfactory results in more than 90% of 207 consecutive patients with severe bile leaks or strictures. However, bile duct injuries, especially bile leaks concomitant with biliary strictures, that cannot be definitively treated with percutaneous or endoscopic techniques require surgical repair [3-5].

Metallic stents have been widely used for malignant biliary strictures; however, they have a limited effect on benign lesions. Maccioni et al. [7] reported that the overall 3-year patency rate of metallic stents in benign biliary strictures was 68.7%, and that occlusion due to mucosal hyperplasia and inflammatory reactive changes of the ductal wall were frequently observed. Therefore, the only indication for the use of metallic stents in benign biliary strictures is failure to respond to percutaneous treatment in non-surgical candidates.

Our first-line treatment for benign bile duct strictures and/or leaks is placement of a large-sized catheter across the lesion for more than 6 weeks. In the present case, a 10-16-F drainage catheter was left in place across the lacerated and stenosed bile duct for 8 weeks, not only to divert the leak but also to bougie the stricture; however, the effect was temporary, and the bile leak and stricture soon recurred. Surgical repair such as a hepaticojejunostomy was considered temporary, and subsequent diversion of the fistula by endoscopic procedures such as laparoscopic cholecystectomy and hepatic resection [1].

In summary, we report a case of bile duct injury following right hepatectomy refractory to catheter stenting successfully treated with metallic stent placement. Metallic stent placement is generally contraindicated for benign biliary stricture and leakage; however, it may be effective in selected patients.

**Conflict of interest:** The authors declare that they have no conflicts of interest to report.

**References**