# Temporary Placement of Retrievable Fully Covered Metallic Stents versus Percutaneous Balloon Dilation in the Treatment of Benign Biliary Strictures

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## ABSTRACT

**Purpose:** To compare retrospectively percutaneous transhepatic primary placement of a retrievable self-expanding metallic stent with percutaneous balloon dilation for the treatment of benign biliary strictures.

**Materials and Methods:** From 2005–2009, 66 patients with benign biliary strictures in whom an endoscopic approach failed or in whom such an approach was inaccessible were evaluated. Of 66 patients, 31 underwent balloon dilation, and 35 underwent temporary metallic stent placement. The etiologies of the benign strictures were anastomotic stricture after surgery (n = 54), stricture secondary to intraoperative injury (n = 9), inflammatory stricture (n = 2), and stricture secondary to trauma (n = 1).

**Results:** The primary patency rates were significantly better in the stent group (87% at 3 years) than in the balloon group (44% at 3 years; $P = .022$). The indwelling period of percutaneous transhepatic biliary drainage (PTBD) catheters after the initial procedure was able to be significantly reduced in the stent group (median 2.5 months) compared with the balloon group (median 4.5 months; $P = .001$). Significant bleeding (associated with PTBD) occurred in one patient in the balloon group. In the stent group, stent migration occurred in two patients, and one patient underwent surgery for stent removal after failure of removal under fluoroscopic guidance.

**Conclusions:** Percutaneous primary placement of a retrievable self-expanding metallic stent showed superior intermediate-term results compared with percutaneous balloon dilation for the treatment of benign biliary strictures. In addition, the indwelling period of PTBD catheters can be significantly reduced using temporary stent placement.

## ABBREVIATION

PTBD = percutaneous transhepatic biliary drainage

Benign biliary strictures have various etiologies, including anastomotic strictures after surgical bile duct repair or liver transplantation, strictures secondary to intraoperative injury (most commonly during laparoscopic cholecystectomy), and other inflammatory strictures (1). Without adequate and prompt management, these strictures can lead to serious consequences, including a deterioration of liver function, jaundice, cholangitis, abscess, and sepsis (1).

The optimal initial management for benign biliary strictures at the present time is endoscopic treatment; however, endoscopic treatment is generally considered to be impossible in patients who have previously undergone bilioenterostomy (2,3). In addition, endoscopic cannulation of the ampulla of Vater or tight biliary strictures is often difficult or impossible (4,5). In such situations, percutaneous transhepatic treatments, including percutaneous transhepatic balloon dilation with or without long-term biliary drainage and stent placement, have been suggested as possible alternatives (2,3,6–8).

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Percutaneous balloon dilation of benign biliary strictures has been the most widely used alternative to endoscopic treatment; however, medium-term data regarding the rate of primary patency after 3 years have varied from 38%–67% (9–12). In contrast, the more recently introduced technique of temporary placement of fully covered metallic stents has shown primary patency rates of 90%–91% at mid-term follow-up (up to 34 months) (7,13). To confirm the promising results of temporary stent placement, we performed a retrospective study comparing percutaneous primary placement of a retrievable self-expanding metallic stent with percutaneous balloon dilation for the treatment of benign biliary strictures in patients in whom the endoscopic approach failed or in whom such an approach was inaccessible.

## MATERIALS AND METHODS

### Patients

This retrospective study was approved by the institutional review board of our hospital, and written informed consent was obtained from each patient or legal guardian. Patients with benign biliary strictures were selected using the following inclusion criteria: *(i)* documented benign biliary strictures, *(ii)* failed endoscopic cannulation of the intrahepatic or common bile duct, *(iii)* previous bilioenterostomy procedures (hepaticojejunostomy, choledojejunostomy), and *(iv)* benign nontransplant strictures. Patients with documented malignant biliary strictures and patients who had undergone previous intervention for the benign biliary stricture were excluded from our study.

### Balloon Dilation and Stent Placement and Removal Technique

Procedures were performed under conscious sedation using intravenous pethidine hydrochloride (Demerol; Keukdong Pharmaceuticals, Seoul, Korea) and local anesthesia using lidocaine (Jeil Pharmaceuticals, Taegu, Korea). All patients underwent percutaneous transhepatic biliary drainage (PTBD) under fluoroscopic guidance. After the intrahepatic bile duct was punctured, a guide wire was advanced, and an 8.5-F drainage catheter (Cook, Inc, Bloomington, Indiana) was placed within the intrahepatic bile duct, not crossing the stricture.

In the balloon group, the percutaneous tracts were dilated to 12-F to 18-F 2–4 days after PTBD. Dilation up to 18-F was required to perform cholangioscopy percutaneously. The stricture was dilated 1–2 weeks after dilation of the percutaneous tract using a balloon catheter under fluoroscopic guidance or under combined cholangioscopic and fluoroscopic guidance through the mature percutaneous tract. Bile duct stones were removed using a basket or were pushed through the bilioenteric anastomosis or ampulla of Vater. A balloon diameter of 6–10 mm (Synergy; Boston Scientific, Galway, Ireland) was chosen, depending on the diameter of the stricture and the bile duct. In patients who had complex (bifurcated or trifurcated) biliary strictures, cannulation of other strictures and subsequent balloon dilations were performed through the initial PTBD route. If use of this route for cannulation and subsequent balloon dilations was impossible, a second PTBD and subsequent balloon dilation were performed. After the procedure, a 12-F, 14-F, or 18-F multi-side-hole catheter was left in place across the strictures. The choice of a 12-F or 14-F catheter was based on the diameter of the bile duct. Follow-up cholangiography was performed 1- to 3-month intervals after initial PTBD on an outpatient basis.

In the stent group, a fully polytetrafluoroethylene-covered, retrievable metallic stent (Niti-S Biliary Covered stent; Taewoong, Kyounggi-Do, Korea) with two drawstrings attached to the upper inner margin of the stent was used. The stent was placed in the stricture under fluoroscopic guidance through the mature percutaneous tract 1–2 weeks after the initial PTBD procedures. A stent diameter of 8–12 mm was chosen depending on the diameter of the bile duct. Two stents were placed in a single session in a single session in cases of complex strictures. Balloon dilation (6–8 mm in diameter) was performed just before and after stent placement. Immediately after stent placement, a 10-F or 12-F multi-side-hole catheter was left in place across the strictures with the pigtail-shaped tip of the catheter located just beneath the distal margin of the stent to prevent distal migration of the stent.

In each patient, the stent was electively removed. The stent was removed under fluoroscopic guidance 0.5–5 months (median 2 months) after stent placement using a retrieval hook as shown in the accompanying video (available online at *www.jvir.org*). The decision regarding the indwelling period of the temporary stent was based on the nature of the stricture; if strictures were resistant to prestent balloon dilation, the indwelling period was $>$ 2 months.

The hook captured and pulled the drawstring of the proximal end of the stent into the sheath, then the proximal end collapsed, and the stent could be removed. A 9-F sheath was used for removal of 8-mm to 10-mm diameter stents, and a 10-F sheath was used for removal of 12-mm diameter stents. Cholangiography was performed after stent removal to evaluate the degree of stricture dilation, and a 10-F or 12-F drainage catheter was placed in the intrahepatic bile duct (proximal to the stricture) to preserve access and to evaluate recurrence of stricture on follow-up cholangiography 2–14 days after stent removal.

### Follow-up

Drainage catheters were removed when a follow-up cholangiogram revealed ready passage of the contrast medium without recurrence of symptoms; otherwise, drainage catheters were not removed. In addition, if cholangiography showed evidence of a residual stricture or slow passage of the contrast medium, or both, additional balloon dilation or temporary stent placement was performed.