

Benign Biliary Strictures: Diagnostic Evaluation and Approaches to Percutaneous Treatment

Nicholas Fidelman, MD

Interventional radiologists are often consulted to help identify and treat biliary strictures that can result from a variety of benign etiologies. Mainstays of noninvasive imaging for benign biliary strictures include ultrasound, contrast-enhanced computed tomography and magnetic resonance imaging, magnetic resonance cholangiopancreatography, and computed tomography cholangiography. Endoscopic retrograde cholangiography is the invasive diagnostic procedure of choice, allowing both localization of a stricture and treatment. Percutaneous biliary interventions are reserved for patients who are not candidates for endoscopic retrograde cholangiography (eg, history of distal gastrectomy and biliary-enteric anastomosis to a jejunal roux limb). This review discusses the roles of percutaneous transhepatic cholangiography and biliary drainage in the diagnosis of benign biliary strictures. The methodology for crossing benign biliary strictures, approaches to balloon dilation, management of recalcitrant strictures (ie, large-bore biliary catheters and retrievable covered stents), and the expected outcomes and complications of percutaneous treatment of benign biliary strictures are also addressed. *Tech Vasc Interventional Rad* 18:210-217 © 2015 Elsevier Inc. All rights reserved.

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Introduction

Patients presenting with clinical signs and symptoms of obstructive jaundice require a multidisciplinary approach for effective clinical management. Cross-sectional imaging using ultrasonography (US), computed tomography (CT), and magnetic resonance (MR) imaging allows detection of biliary ductal dilatation and may point to its cause. Further evaluation with endoscopic retrograde cholangiography (ERC) affords an opportunity to help establish the etiology of a stricture (detection of stones and brush biopsy) and intervene on a stricture by performing balloon dilation and by inserting stents. However, endoscopic access to the bile ducts is not always possible for patients with surgical alteration of gastrointestinal anatomy (ie, patients who previously underwent distal gastrectomy or Roux-en-Y hepaticojejunostomy), narrowing of the bowel lumen preventing endoscope passage, or stenosis at the level of ampulla of Vater precluding bile duct cannulation.

Interventional radiologists play an important role in the diagnosis and treatment of patients with bile duct strictures who cannot be treated by the endoscopic approach by precisely defining bile duct anatomy via percutaneous transhepatic cholangiography, providing access into the biliary system by performing percutaneous transhepatic drainage, and offering a number of therapeutic options including percutaneous treatment of bile duct strictures using catheters, balloons, and stents.

The purpose of this review was to summarize the contemporary approach to diagnosis and treatment of patients with benign bile duct strictures with a focus on percutaneous techniques.

Clinical and Laboratory Evaluation

Taking a careful clinical history may help to elucidate the etiology of a biliary stricture. Typical causes of benign strictures are listed in [Table 1](#). Malignant etiology should be suspected if a patient does not have one of the more common reasons to develop a benign biliary stricture, such as history of biliary surgery, liver transplantation, cholelithiasis, pancreatitis, or cholangitis.^{1,2} Patients with a biliary stricture may be asymptomatic or may present with

Department of Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA.

Address reprint requests to Nicholas Fidelman, MD, Department of Radiology and Biomedical Imaging, University of California San Francisco, 505 Parnassus Ave, Room M-361, San Francisco, CA 94143. E-mail: Nicholas.Fidelman@ucsf.edu

Table 1 Etiologies for Benign Biliary Strictures

Categories	Examples
Typically unifocal	
Iatrogenic	Liver transplantation Partial hepatectomy Bile duct injury with or without subsequent operative repair
Stone disease	Mirizzi syndrome
Pancreatitis	Acute or chronic pancreatitis of any etiology
Trauma	
Radiation therapy	
Portal biliopathy	
Idiopathic	Papillary stenosis
Typically diffuse	
Sclerosing cholangitis	Primary or secondary
Ischemia	Hepatic artery occlusion after liver transplantation
Cholangitis	Recurrent pyogenic cholangitis Other infections (tuberculosis, HIV, and parasitic) Autoimmune IgG4-related cholangiopathy

abdominal pain, nausea, vomiting, anorexia, fatigue, jaundice, and fever (if ongoing infection is present).

Blood tests in patients with biliary strictures should include liver function tests (total and direct bilirubin, aspartate and alanine aminotransferase, alkaline phosphatase, and γ -glutamyl transferase levels), complete blood count (especially if ongoing infection is suspected), serum albumin level, and coagulation profile (to test synthetic liver function and to prepare for possible invasive testing).

Noninvasive Imaging Evaluation

US evaluation of the right upper quadrant (Fig. 1) is a reasonable and inexpensive first-line imaging test for patients with suspected biliary obstruction; this test may not only demonstrate biliary ductal dilation, but it could

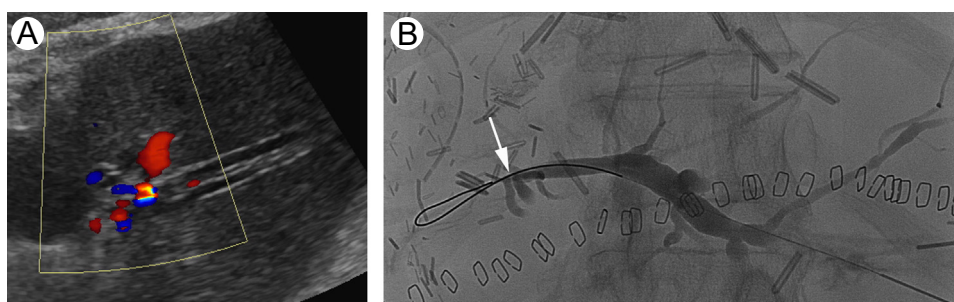


Figure 1 Images from a 68-year-old female recipient of a living donor left lobe liver transplant that was performed 2 years ago who developed an elevated alkaline phosphatase level. US with Doppler image (A) demonstrates intrahepatic biliary ductal dilatation. Percutaneous cholangiogram (B) demonstrates intrahepatic biliary ductal dilatation and narrowing at the site of the biliary-enteric anastomosis (arrow). (Color version of figure is available online.)

also point to its cause, such as choledocholithiasis or a mass. Alternatively, a CT scan with administration of an intravenous contrast agent could be obtained as a first-line imaging test. It is noteworthy that these imaging modalities may show normal-caliber bile ducts for patients with sclerosing cholangitis or a posttransplant biliary stricture. Additional noninvasive imaging workup could include abdominal MR imaging with an MR cholangiopancreatography sequence. MR cholangiopancreatography can be used for definitive diagnosis of conditions that do not require intervention, such as primary sclerosing cholangitis (Fig. 2), or as an intermediate diagnostic step toward invasive imaging evaluation (Fig. 3). Alternatively, CT cholangiogram using Cholografin (Bracco Diagnostics, Monroe Township, NJ) may be used for patients with serum bilirubin levels less than 3 mg/mL (Fig. 4).

Invasive Imaging Evaluation

Endoscopic Retrograde Cholangiography

Patients with suspected biliary obstruction that is occult on cross-sectional imaging and patients requiring biliary decompression usually proceed to invasive testing. For most patients, ERC with or without endoscopic US is used for detection of biliary stricture(s) and determination of their etiology (cholangiographic appearance and brush or endoscopic US-guided biopsy); this technique also provides an opportunity for decompression (balloon dilation and stenting). An endoscopic approach may not be possible for patients with a history of a distal gastrectomy (Billroth II and Whipple procedures), patients with a biliary-enteric anastomosis to a jejunal roux limb (repair of iatrogenic bile duct injury and liver transplantation), or those with duodenal or papillary obstruction that prevents passage of the endoscope or the duct cannula. Such patients are usually referred for percutaneous transhepatic cholangiography (PTC).

Percutaneous Transhepatic Cholangiography

Typical indications and contraindications for PTC and percutaneous transhepatic biliary drainage (PTBD) are

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