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Biliary Endoscopy for Benign and Malignant Biliary Strictures

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Percutaneous endoscopy operated by interventional radiologists has the potential to become an effective tool to both help diagnose and treat benign and malignant biliary strictures. This is particularly true in cases where endoscopic retrograde cholangiopancreatography fails or is not feasible due to surgically-altered anatomy. Both preoperative clinical and technical procedural factors must be taken into consideration when pursuing percutaneous endoscopy. In this article, clinical evaluation, perioperative management, and procedural techniques for biliary endoscopy for benign and malignant strictures are reviewed.
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KEYWORDS Percutaneous endoscopy, benign biliary strictures, malignant biliary strictures, interventional radiology

Introduction

Biliary endoscopy is undoubtedly underutilized by interventional radiologists, with only limited experiences published in literature to date.[1-5] Nonetheless, given its wide array of applications in biliary, genitourinary, and gastrointestinal therapies, the potential for this tool in augmenting image-guided interventions should be explored. Building upon the dexterity of interventional radiologists, the adoption of endoscopy into the interventional radiology toolbox should be uncomplicated, particularly in enhancing image-guided biliary interventions, including the treatment of biliary strictures. While biliary endoscopy has been more commonly utilized for treatment of gallstones with documented excellent results,[1] its role can be expanded for the treatment of benign and malignant biliary strictures, particularly in cases where endoscopic retrograde cholangiopancreatography (ERCP) fails or is not feasible due to surgically-altered anatomy. With the benefit of direct endoscopic visualization, strictures can be readily traversed.[3] Biliary endoscopy operated by the interventional radiologist can thus be beneficial in both the diagnosis and treatment of biliary strictures.

Biliary strictures

Biliary strictures can result from both benign and malignant etiologies. Benign etiologies of biliary strictures can include iatrogenic, inflammatory, autoimmune, or infectious processes, though the most common etiology is iatrogenic with 80% resulting from surgical duct injury during orthotopic liver transplantation or cholecystectomy.[6] Inflammatory autoimmune causes are additional culprits and include primary sclerosing cholangitis and IgG4-related sclerosing cholangitis.[7] Less common etiologies include pyogenic cholangitis, HIV cholangiopathy vasculitis-related ischemia,

Abbreviations: ERCP, endoscopic retrograde cholangiopancreatography; EGD, esophagogastroduodenoscopy; MRCP, magnetic resonance cholangiopancreatography; OLT, orthotopic liver transplantation; PSC, primary sclerosing cholangitis; PTC, percutaneous transhepatic cholangiography

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inflammatory biliary pseudotumors, and radiation-related strictures, among others.[7] While malignant strictures can occur due to any neoplastic biliary invasion, cholangiocarcinoma and pancreatic adenocarcinoma are the most common culprits, accounting for up to 72% of cases.[8]

Preprocedural Evaluation

Employment of novel tools such as endoscopy-guided interventions requires careful preprocedural planning. We recommend interdisciplinary decision-making with consultation of surgical, gastrointestinal, oncological, and primary care teams. Patients' surgical candidacy, alternative treatment options, and ultimate long-term treatment goals must be carefully evaluated. Surgical interventions and ERCP-guided therapies are often the first-line standard of care. However, in patients that are nonoperative candidates or in cases of surgically-altered anatomy, consideration of other treatment modalities should be thoroughly discussed.

Evaluation of biliary strictures and distinguishing benign and malignant etiologies can be challenging, though is important for preprocedural planning and defining goals of care. Cross-sectional imaging—either computer tomography or magnetic resonance cholangiopancreatography—or more invasive diagnostic methods, including tissue sampling, should be considered to help with preintervention planning. If percutaneous endoscopic intervention is pursued, standard preprocedural serology evaluation includes a complete blood count, basic metabolic panel, liver function tests, and coagulation tests. An international normalized ratio value less than 1.5 and a platelet count greater than 50,000/μL are recommended for percutaneous endoscopy.

Procedure and Techniques

While biliary endoscopy and subsequent intervention can be performed under moderate or deep sedation, general anesthesia may also be used to ensure optimal patient comfort, safety, and hemodynamic monitoring. Per the Society of Interventional Radiology guidelines, preprocedural prophylactic antibiotics such as 1 g ceftriaxone or 1.5-3 g ampicillin/sulbactam given intravenously or alternatively, clindamycin and aminoglycoside in the setting of penicillin-allergy are recommended.[9] Intraprocedural monitoring of fluid input/output, electrolytes, and body temperature should be performed. Enteric and rectal tubes are recommended if prolonged intervention is anticipated and can assist with managing fluids infused by the endoscope.

For choledochoscopy, a flexible endoscope is preferred to navigate through the angulations of the biliary tree. These could include a 9.5-Fr flexible disposable (Boston Scientific; Marlborough, MA), a 9-Fr flexible reusable (Olympus America; Center Valley, PA), or a 16.5- Fr flexible reusable (Olympus America) endoscope. It is important to note that reusable devices require significant capital investment for purchasing, sterilizing, and maintaining the equipment, which is cost-prohibitive for some interventional radiology practices, especially if they cannot be borrowed from other departments. Alternatively, newer disposable flexible endoscopes may be used as assistive tools in imaging-guided interventions. These devices are easy to adopt and are cost-effective with an approximate cost of $1500 for a single-use endoscope.[3] Food and Drug Administration approved endoscopes generally range in size from 7.95 to 22.5 French with a variety of inner working channel diameters and can be either rigid to flexible.[1] The scope device setup requires continuous saline fluid infusion for debris clearance. The devices come with either an endoscopy console and monitor or a video processing unit with connection cable to allow direct viewing on the fluoroscopy screen. If pursuing cholecystoscopy, however, the gallbladder should ideally be accessed in long-axis to permit a more direct trajectory intervention. The use of a 22.5-Fr rigid endoscope (Olympus America) is preferred by the authors due to the direct course from skin entry to the gallbladder.

Depending on the size of the endoscope, biliary access should be planned accordingly. While access can be obtained during the procedure, some authors advocate for staging the procedure and obtaining access 4-6 weeks prior to intervention to allow for tract maturation, reducing potential risk of leakage and pain.[1] Of note, tract dilation with a high-pressure balloon may be warranted to allow for introduction of the rigid endoscopes. After obtaining access, we recommend securing the tract with an additional safety guidewire in addition to the working wire. Given the size of the scope and ancillary equipment used for intervention, the wire of choice is any stiff wire such as an Amplatz wire. A sheath sized for the endoscope should be advanced over the wire to serve as the conduit for the device. The endoscope itself has an inner working channel to allow passage of catheters, balloons, or other devices necessary for intervention.[1]

Management of Benign Biliary Strictures

After initial diagnosis of benign etiology, further characterization by endoscopic visualization can be considered. In certain cases, more traditional retrograde endoscopic visualization may not be feasible. Previous surgical intervention—including Roux-en-Y gastric bypass, hepaticojejunostomy, or Whipple procedure—or prohibitive duodenal or papillary stenosis may make traditional endoscopic visualization very difficult. In these instances, percutaneous transhepatic cholangiography (PTC) and adjunctive antegrade endoscopy can be performed for direct visualization of the biliary tree with subsequent intervention.

The management of benign biliary strictures often entails cholangioplasty, internal-external multi-hole biliary drain placement, and/or subsequent stenting in cases of recalcitrant stenosis. In many instances, benign strictures can be effectively treated by cholangioplasty. Typical balloon sizes utilized are 8-10 mm, though this can vary. However, if pronounced edema contributes to the stricture, cholangioplasty alone may not be effective.[7] If stenting is pursued,

plastic or covered self-expanding metal stents are used. Uncovered metal stents are disfavored given the risk of in-stent stenosis and inability to exchange the stent. The goal of the intervention is long-term bile duct patency and decompression of the biliary system.[7]

Direct endoscopic visualization of the stricture permits better evaluation of the severity of stricture and helps direct treatment options. Post cholangioplasty and/or stenting, a biliary drain is left in place and ultimately capped 24 hours postprocedure. If the capping trial is effective, the biliary drain can ultimately be downsized before eventual removal.

Management of Malignant Biliary Strictures

Malignant biliary strictures are commonly secondary to obstruction from pancreatic adenocarcinoma, cholangiocarcinoma, gallbladder carcinoma, hepatocellular carcinoma, lymphoma, or localized metastasis. These patients often present with painless jaundice, dilated bile ducts, and pruritis. Hyperbilirubinemia, leukocytosis, and fevers can be further indicative of cholangitis. If biliary duct obstruction is suspected clinically, magnetic resonance cholangiopancreatography or ERCP can be helpful to differentiate malignant from benign etiologies. Though curative resection is ideal, this unfortunately is not viable in many cases at the time of diagnosis. In these cases, more palliative measures can be taken. Traditional treatment options for malignant strictures include utilization of ERCP or PTC with subsequent angioplasty and stent placement.[10]

Alternatively, in cases of difficult anatomy or based on suspected site of biliary obstruction, percutaneous transhepatic endoscopy can be utilized to quantify the extent of the stricture and thereafter treat the stricture with angioplasty and/or stenting. The treatment of malignant biliary strictures with percutaneous endoscopy is not too dissimilar from that of benign biliary strictures in terms of technique. Initial direct visualization and brush biopsy can be pursued through the working channel of the endoscope (Fig. 1). Initial cholangioplasty can be pursued, though ultimately stenting will be required in the presence of obstructing tumor. The purpose of stent placement is to maintain patency of the biliary system for palliation, though the types of stents to be utilized is debated. Bare-metal stents have been documented to fail secondary to invasion of tumor into the stent. Covered stents have less potential for tumoral invasion and restenosis with historically longer patency rates. Nonetheless, no variability in survival exists between covered and bare-metal and controversy exists in terms of warranting the extra cost of covered stent placement over bare-metal stents.[11]

Conclusion

Interventional radiologists have the potential to utilize percutaneous endoscopy to expand their role in the treatment of benign and malignant biliary strictures with coordination with oncologists, surgeons, radiation oncologists, diagnostic radiologists, and gastroenterologists. When traditional methods of ERCP or PTC are not suitable, percutaneous endoscopic treatment of benign and malignant strictures can be an effective tool for diagnostic evaluation of biliary strictures and for subsequent intervention.

Communication and collaboration with referring providers are critical to grow an endoscopic practice. Interventional radiologists should continue to educate providers on the benefits of percutaneous transhepatic endoscopy in the diagnosis and treatment of biliary strictures.

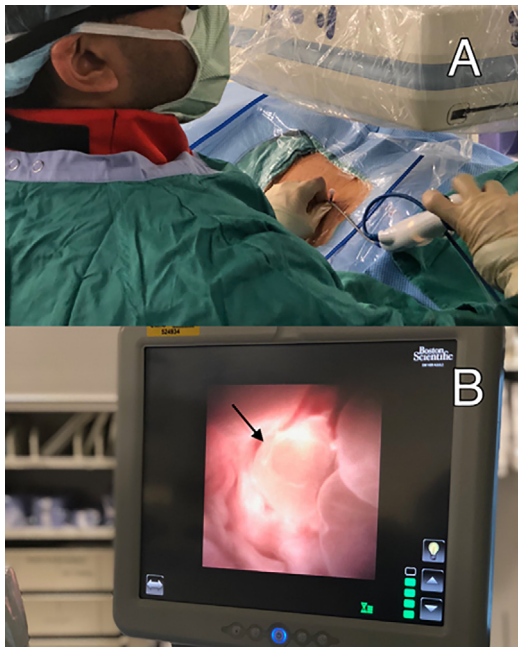

Figure 1 55-year-old female with malignant biliary stricture, confirmed to be locally invasive pancreatic adenocarcinoma on pathology. (A) Image demonstrating operation of a flexible, disposable percutaneous endoscope by an interventional radiologist. (B) Endoscopic image demonstrating pancreatic adenocarcinoma protruding into duodenum.

Conflicts of Interest

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or nonfinancial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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