Direct visualization of the bile duct is now an integral part of standard endoscopic retrograde cholangiopancreatography (ERCP). Besides visual inspection, cholangioscopy makes possible electrohydraulic lithotripsy of large stones, targeted intraductal biopsy of tumors, selective cannulation of bile intrahepatic ducts or removal of inward migrated stents.

The first direct cholangioscopy or intraductal biliary visualization was performed in 1976 with an 8.8 mm scope. Since that time, the technology has evolved and multiple platforms are now available for cholangioscopy.

The traditional mother-daughter system employs a duodenoscope that allows a baby cholangioscope (Fig. 1) to pass through its large instrument channel into the bile duct. This usually requires a sphincterotomy or sphincteroplasty to allow biliary access with the cholangioscope. Two endoscopists are typically required for this procedure, which is limited by the extreme fragility of the cholangioscope. There are various external dimensions of the commercially available cholangioscopes, although the latest scopes are roughly 10 Fr in diameter.

Recently, the partly disposable SpyGlass® system was introduced (Fig. 2). This is a single-operator platform that also uses a mother-daughter design. A disposable 10 Fr spy scope has two working channels. One channel takes a fiber optic probe for visualization, the second accommodates a device (such as lithotripsy probe or biopsy forceps) (Fig. 3, 4).

Direct peroral cholangioscopy (POCS) has also been described. An ultraslim caliber endoscope is directly passed into the bile duct without the use of a mother or large-channel duodenoscope. This can be done directly or over a guidewire, and it again requires a sphincterotomy for access. This form of choledochoscopy utilizes a durable and reusable endoscope, and provides excellent visualization of the biliary mucosa and architecture (Fig. 5).

A recent advancement in technology is the use of an anchoring balloon to assist in POCS. Gastroenterologists at Cedars-Sinai compared outcomes for POCS either directly or with the use of the anchor balloon. The anchoring balloon approach de-
Carcinoid tumors are enterochromaffin cells derived from multipotent gastrointestinal stem cells. These tumors are rare and slow-growing, but have malignant potential. They are most commonly found in the gastrointestinal tract, specifically the ileum followed by the rectum, appendix, jejunum and rarely in the duodenum. By the time small bowel carcinoid tumors have been diagnosed, most (60-80%) have already metastasized, possibly because the classical carcinoid syndrome of sweating, bronchospasm, flushing and diarrhea is relatively uncommon and the disease goes unrecognized at first. The survival rate at five years ranges from 50 to 60 percent if diagnosed at the time of distal involvement. Interestingly, a lesion of any size has the potential to metastasize. In one patient, for example, a 1 mm yellow nodule was found at the proximal ileum and removed completely with biopsy forceps. The primary lesion was localized after it had already metastasized to both lobes of the liver. After complete enteroscopy and running the small bowel in the operating room, this was the only lesion identified (Fig. 1, 2).

Why is identifying the primary lesion important in the setting of metastasis? It has been postulated that by removing the primary lesion, one can not only improve treatment efficacy but also prevent future complications, such as bowel ischemia, obstruction and intussusception. Historically, the search for a primary lesion has relied on abdominal scans, but these have their limitations. Octreotide scans have a high sensitivity for identifying hepatic metastases and primary lesions, but only if the lesion is greater than 2 cm in size. Additionally, the scans cannot reliably differentiate luminal lesions from the mesentery due to its two-dimensional view, making surgical resection less goal-directed, especially for the smaller carcinoid tumors. How then can capsule endoscopy (CE) and double balloon enteroscopy (DBE) play a role, especially for detecting smaller intraluminal lesions? CE can often positively identify small bowel carcinoids, which commonly have a protean enteroscopic presentation ranging from an ulcerated mass to a polyloid lesion to submucosal nodules of high probability (Fig. 3, 4). In a study of 20 consecutive patients with metastatic carcinoid who underwent CE, CT, enteroclysis and nuclear imaging, CE’s diagnostic yield was superior to that of a small bowel follow-through in detecting lesions less greater than 1 cm in size and comparable to octreotide scans. There were no false-positive capsule studies.1

With DBE, one can obtain targeted tissue for confirmation of diagnosis and also tattoo the site of the lesion, making for a super-selective resection for the surgeon. DBE findings have a wide range—including umbilicated mass lesions to polypoid-like masses to flat, laterally spreading lesions to yellow nodules (Fig. 5, 6). Interestingly, even though these are submucosal mass lesions, mucosal biopsies taken with small bowel biopsy forceps are still highly accurate and stain positive for chromogranin and synaptophysin.

There have been only a few studies on DBE and metastatic carcinoid, and they have been limited by patient selection, the appropriate route of enteroscopy and the degree of the depth of insertion.2,3 Therefore, it may be prudent to utilize CE as an adjunct to DBE. CE can identify a small bowel carcinoid and its potential location. DBE can then validate the capsule findings, obtain tissue to confirm diagnosis, and tattoo the exact location of the intraluminal tumor for the surgeon who may not be able to identify a smaller lesion while in the operating room.

At Cedars-Sinai, we are currently performing bidirectional double balloon enteroscopy, as well as total complete enteroscopy, in order to evaluate the entire length of the small bowel. In doing so, we may be able to endoscopically identify the majority of small bowel primary carcinoid lesions before the patient goes to the operating room. This is

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important because more than 30 percent of ileal carcinoid lesions are multifocal in nature.

We are also identifying pancreatic carcinoid lesions using endoscopic ultrasound. If the intestinal search is nondiagnostic for a primary lesion, some patients benefit from an evaluation of the pancreas. A large majority of pancreatic carcinoids are confirmed with histology from a fine needle aspiration of the pancreatic mass (Fig. 7).

There are no current guidelines on the algorithmic workup for identifying the primary carcinoid lesion in the patient who already has metastases, especially to the liver. However, by utilizing all three modalities—CE, DBE and endoscopic ultrasound—it is possible to identify the majority of primary lesions. If potentially a large majority of primary small bowel luminal or pancreatic lesions can be localized in this fashion, then we can establish a more efficient and superselective surgical resection. This in turn may prevent further progression and even metastases of carcinoid tumors in many cases.

References

ERCP in Bariatric Surgery Patients
Simon K. Lo, MD

An alarming 34 percent of Americans are obese. The currently most effective bariatric surgery is Roux-en-Y gastric bypass (RYGB). While this operation is mostly safe and highly effective, it has a 5 percent chance of significant early complications. Abdominal pain long after surgical recovery is common and is often biliary or pancreatic in origin. Whether there is objective evidence (such as abnormal liver enzymes or imaging), confirmation and treatment of a biliary condition in a patient with RYGB is difficult.

The initial approach to a biliary complaint is easily carried out with non-invasive imaging modalities. However, it is very challenging to manage those patients who have a positive study or continue to complain of significant early complications. While many options are available (Table 1), none is convenient or technically easy to perform. The most commonly available method is to perform endoscopic retrograde cholangiopancreatography (ERCP) at the time of surgery by accessing the jejunum or the excluded stomach. However, performing surgery simply to investigate an abdominal symptom is unappealing to patients and their physicians,

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creased the mean time to gain biliary access by approximately four minutes (5.9 vs. 1.8 minutes, p<0.003) and increased the rate of the endoscope reaching the hepatic bifurcation fourfold. Biliary access and visualization increased from 69.6 to 81.8 percent. The anchoring balloon is currently not available in the market for commercial use.

Yet another cholangioscopic advance is confocal laser endomicroscopy, which allows direct and real-time visualization of the bile duct epithelium. The Cellvizio® probe can be passed through the choledochoscope channels of all the platforms mentioned above (baby cholangioscope, ultraslim endoscopes and SpyGlass). Endo-microscopic images can identify abnormal-appearing tissue and target lesions for tissue acquisition. Meining et al. showed prediction of neoplasia using confocal laser microscopy with an accuracy rate of 86 percent, sensitivity of 83 percent and specificity of 88 percent (Clin Gastroenterol Hepatol. Sep 2008; 6(9):1057-60). Benign tissue appears as a fine reticular pattern and malignancy appears as black/dark grey background with fluorescein-filled white lines, which represent blood vessels.

Overall, cholangioscopy is a safe and a feasible technique. Complications have been reported and include cholangitis, likely from irrigation of the bile duct and incomplete drainage of the biliary tree, and hemobilia, usually from sphincterotomy.

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and coordination between an endoscopist and a busy surgeon is often cumbersome and time-consuming. Fluoroscopy or radiographs obtained in the operating room are frequently suboptimal, and making therapeutic decisions in the OR setting is difficult. Therefore, it would be ideal if a one-step, non-operative biliary procedure—similar to a standard ERCP—were possible.

Since late 2005, Cedars-Sinai gastroenterologists have been performing ERCP using double balloon enteroscopy (DBE) (Fig. 1). By April 2010, 51 ERCPs had been attempted on 47 RYGB patients. All these patients had an intact papilla at the time of their original ERCP. Forty-five (88%) procedures resulted in successful cholangiographic imaging and endoscopic therapies (Fig. 2). In addition, virtually all patients had the excluded stomach and duodenum examined to make certain that there was no peptic ulcer or other reasons that would explain their symptoms. The mean procedure time, including DBE scope passage, was 125 minutes. The most common complica-