ADVANCES IN ENDOSCOPY

Current Developments in Diagnostic and Therapeutic Endoscopy

Section Editor: Todd H. Baron, MD

The Past, Present, and Future of Endoscopic Retrograde Cholangiopancreatography

Richard A. Kozarek, MD
Executive Director, Digestive Disease Institute
Virginia Mason Medical Center
Clinical Professor of Medicine
University of Washington
Seattle, Washington

G&H How has endoscopic retrograde cholangiopancreatography evolved since its development?

RK Endoscopic retrograde cholangiopancreatography (ERCP) was initially developed in 1968 as a diagnostic tool. Patients would be injected with a dye and referred, as necessary, to an interventional radiologist or a surgeon for further treatment. Dr William S. McCune, an obstetrician, performed the first successful ERCP using a fiber duodenoscope with an external accessory channel taped to the scope shaft as well as a balloon to cannulate. In 1972, Dr Peter Cotton described cannulation in 60 patients. The following year, Drs Meinhard Classen in Germany and Keiichi Kawai in Japan simultaneously undertook the first biliary sphincterotomy. Since then, ERCP has evolved from a diagnostic to a therapeutic tool.

G&H What are the current indications for ERCP?

RK The main therapeutic indication for ERCP is stones, primarily in the biliary tract. With the advent of laparoscopic cholecystectomy, the previous pattern of open cholecystectomy and open common bile duct exploration has essentially disappeared, or is rare. Further, the majority of general surgeons lack the appropriate experience in removing stones from the common bile duct laparoscopically. Thus, patients with biliary stone disease who have previously undergone a cholecystectomy or are a high surgical risk may benefit from therapeutic ERCP. A decade after removing stones from the bile duct, endoscopists began using ERCP in conjunction with lithotripsy to remove stones from the pancreatic duct.

Another common therapeutic indication for ERCP is malignant strictures in the biliary tree, particularly for patients with malignant obstructive jaundice who are at surgical risk or who are unresectable for cure. ERCP is also beneficial when used preoperatively in patients who are borderline resectable and are undergoing neoadjuvant chemotherapy and/or irradiation to try to make them resectable. Benign biliary strictures, whatever the cause, are also variably endoscopically amenable.

> Training in general, and especially among the procedural aspects of medicine, is no longer driven by the number of procedures, but by competency.

A third therapeutic indication is bile leaks following a laparoscopic cholecystectomy, hepatectomy, or liver

transplant. Patients with pancreatic duct leaks, pancreatic ascites, pancreatic plural effusions, pseudocysts, and walled-off pancreatic necrosis may also undergo therapeutic ERCP.

Diagnostic ERCP, though less common, is indicated for patients with an isolated dilated duct, biliary-type pain with fluctuating liver function test results, intrahepatic duct stones, early cholangiocarcinoma or hepatoma, or sclerosing or autoimmune cholangitis. Some referral centers may still perform diagnostic ERCP in the setting of pancreaticobiliary manometry in patients with acute relapsing pancreatitis for which no other cause is found.

G&H How has the introduction of less-invasive imaging modalities affected the use of ERCP?

RK The use of computed tomography (CT) and, in particular, magnetic resonance cholangiopancreatography (MRCP) has eliminated a vast majority of diagnostic indications for ERCP, resulting in an increase in therapeutic ERCPs. When a semi-invasive procedure is needed in a diagnostic setting (eg, a patient has a tumor and is not jaundiced, or has suspected stone disease that does not show up on a MRCP, CT, or ultrasound), the patient will typically undergo endoscopic ultrasound and possible fine-needle aspiration instead of ERCP.

G&H What other factors are responsible for the decrease in the use of diagnostic ERCPs?

RK The use of diagnostic ERCP has been decreasing by 4% to 5% annually for the last 15 years in the United States. Beyond the introduction of noninvasive imaging modalities, there are now better biomarkers in the blood, often making diagnostic ERCPs unnecessary. This may be particularly true in autoimmune pancreatitis or cholangitis. Further, studies have shown that endoscopic ultrasound in conjunction with fine-needle aspiration better defines the presence or absence of a tumor than brush cytology associated with ERCP, and with lower risk. Three percent to 15% of patients undergoing diagnostic ERCP may develop pancreatitis, and empiric sphincterotomies have associated risks of bleeding and perforation. Results of the EPISOD (Evaluating Predictors and Interventions in Sphincter of Oddi Dysfunction) trial have shown that ERCP has no benefit in treating patients with type 3 sphincter of Oddi dysfunction, thus removing both the disease and the test considered to be the diagnostic gold standard from our lexicon.

G&H Why has ERCP largely shifted from an inpatient to an outpatient procedure?

RK The trend of increasing outpatient procedures is not unique to ERCP; clinicians are now performing laparoscopic cholecystectomies and peroral endoscopic myotomies as outpatient procedures as well. As the risk factors related to these procedures are better understood, clinicians have developed a comfort level regarding invasive procedure performance. If a patient is held 2 to 3 hours following procedural ERCP and is stable and not experiencing pain, he or she is able to go home and is not likely to return to an emergency room hours later. However, a major aspect of the shift to outpatient procedures is that many insurance plans no longer cover simple ERCP with sphincterotomy and stone extraction as an inpatient procedure.

G&H How has training for this procedure changed over the years?

RK When I was in training, the American Society for Gastrointestinal Endoscopy stated that 25 ERCPs were sufficient for qualification and credentialing at the hospital in which a fellow trained. That number has changed due to the expanded inclusion of therapeutic indications. Data suggest that endoscopists now need to complete at least 250 to 300 procedures in order to develop the skillset needed to have a 90% to 95% success rate, particularly for clinicians working in a referral center. There are now also formalized advanced fellowships in therapeutic endoscopy. The majority of clinicians training in advanced therapeutics will complete an additional 1 to 2 years of therapeutic endoscopy training beyond the 3-year gastrointestinal fellowship. This provides clinicians with considerably more experience before they join an individual or multigroup practice.

G&H How might training change in the future?

RK Training in general, and especially among the procedural aspects of medicine, is no longer driven by the number of procedures, but by competency. Several studies have recently been published that suggest that some endoscopists reach 90% to 95% competency for stone retrieval and stent placement after 200 procedures, whereas other endoscopists are not competent after completing 400 procedures. Advanced ERCP is currently divided into grades of difficulty. Grades 1 and 2 procedures include removal of a small common bile duct stone and treatment of a distal bile duct stricture, respectively, which the endoscopist should be able to successfully accomplish 90% to 95% of the time. Grade 3 procedures (eg, treatment of bifurcation lesions, or pancreatic therapies that include treatment for strictures or stones) and Grade 4 procedures (eg, ERCP in Roux-en-Y gastric bypass, papillectomy, or

cannulating the pancreatic duct after conventional Whipple procedure or pylorus-preserving pancreaticoduodectomy) are more complex, and may take an endoscopist a lifetime to develop his or her skillset, as the majority of trainees will see only a few of these procedures during fellowship and may not be the primary endoscopist at the time. Therefore, I predict that training will become just one aspect of competency-based ERCP, and privileging and credentialing may take on more importance. For instance, at my institution, endoscopists need to have performed at least 200 procedures a year in order to gain and maintain privileges to perform ERCP. The number of procedures themselves would be meaningless if they were not also associated with assured procedural success and an acceptable complication rate.

G&H How do you foresee the trends of ERCP utilization changing?

RK Although the use of diagnostic ERCP has declined, it is not likely to go away completely. There is still a place for diagnostic ERCP with direct cholangioscopy and pancreatoscopy in patients who have strictures that are poorly defined or who may have intraductal papillary mucinous tumors, where the surgeon is assessing whether patients have main duct disease and, if so, its extent. Diagnostic ERCP is also beneficial in the setting of bifurcation strictures that may not be clearly defined on MRCP or CT scans or endoscopic ultrasound. There may still be a role for sphincter of Oddi manometry in idiopathic relapsing pancreatitis. However, ERCP is likely to remain a largely therapeutic modality for the reasons listed previously.

G&H What research is needed regarding the future use of ERCP?

RK It would be great to expand the capabilities of ERCP to allow for something to be placed in the pancreatic duct that could dissolve stones instead of using electrohydraulic, laser, or extracorporeal shockwave lithotripsy. There are ongoing studies looking at the use of self-expandable metal stents in the pancreatic duct for refractory strictures. It would also be beneficial to have randomized, controlled trials comparing ERCP- vs endoscopic ultrasound–facilitated biliary drainage in patients with unresectable malignant obstructive jaundice. Although advances have been made, we still need to reduce the rate of pancreatitis post-ERCP. Duodenoscopes should be redesigned to eliminate or minimize infections resulting from difficult-to-clean elevators.

A lot of research is needed, or is ongoing, regarding the future use of ERCP. In large extent, its future depends on the advances of other devices and procedures, as a modality may be developed that precludes the need for ERCP.

Dr Kozarek has received research support from Boston Scientific and book royalties from Springer, Elsevier, and Wiley.

Suggested Reading

Ahmed M, Kanotra R, Savani GT, et al. Utilization trends in inpatient endoscopic retrograde cholangiopancreatography (ERCP): a cross-sectional US experience. *Endosc Int Open*. 2017;5(4):E261-E271.

Buxbaum J, Sahakian A, Ko C, et al. Randomized trial of cholangioscopy-guided laser lithotripsy versus conventional therapy for large bile duct stones (with videos) [published online August 30, 2017]. *Gastrointest Endosc*. doi:10.1016/j.gie.2017.08.021.

Kozarek RA. The future of ERCP. *Endosc Int Open*. 2017;5(4):E272–E274.

Schutz SM. Grading the degree of difficulty of ERCP procedures. *Gastroenterol Hepatol (N Y)*. 2011;7(10):674-676.

Yachimski PS, Ross A. The future of endoscopic retrograde cholangiopancreatography. *Gastroenterology*. 2017;153(2):338-344.