



ERCP core curriculum

PREAMBLE

This document, prepared by the American Society for Gastrointestinal Endoscopy (ASGE) Committee on Training, was undertaken to describe recommendations for ERCP training and was written primarily for those endoscopists involved in teaching ERCP to fellows/trainees and for endoscopy training directors, as well as trainees. This core curriculum was developed as an overview of key components of ERCP that must be learned by trainees before they are able to independently perform the procedure. This will serve as a guide to those undertaking the training of individuals in ERCP and includes techniques currently favored for the performance and training of ERCP. It also lists essential references, videotapes, and other resources available to the trainer. By providing information to endoscopy trainers about the common practices used by experts in performing the technical aspects of the procedure and by delineating the elements that trainees should be required to master, the ASGE hopes to improve the teaching and performance of ERCP.

TRAINING GOALS OVERVIEW AND OUTLINE

The following is to serve as both a table of contents, as well as a simple outline of the topics to be covered by ERCP training programs as recommended by the ASGE.

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I. INTRODUCTION

Acquiring the skills to perform ERCP safely, effectively, and comfortably requires an understanding of the indications, risks, and limitations of the procedure. It also requires competency in the use of a side-viewing endoscope and the ability to selectively cannulate the bile duct and/or the pancreatic duct to allow diagnostic and therapeutic procedures. It further requires competence in the production and the interpretation of cholangiograms and pancreatograms while maintaining patient comfort and safety. The ASGE guideline entitled “Principles of Training of Gastrointestinal Endoscopy” and the section of the Gastroenterology Core Curriculum developed by the Task Force in Gastrointestinal Endoscopy review the overall objectives of endoscopic training, the requirements for endoscopic trainers, and the training process itself. The evolving issues of tracking outcomes and assessing competency during endoscopy training are also reviewed. These core documents are pertinent and are recommended to endoscopic trainers and trainees alike.

II. GOALS OF TRAINING

Programs offering training in ERCP should define their objectives and especially the goals of the training program. Specifically, training programs should determine whether they intend to offer fellows only exposure to ERCP, training to a level of competence sufficient for independent practice, or tertiary level advanced skills, such as that requiring a fourth year of commitment.

What should the level of competence be for fellows undertaking training in ERCP? For individuals seeking credentialing to perform independent ERCP after training, current ASGE guidelines emphasize objective measures over case volume, with a previously accepted benchmark being that trainees are able to cannulate the desired duct with >80% success. However, this level of success may not be acceptable for independent practice upon completion of training. Other guidelines have suggested

that a higher standard of 90% success rate is more appropriate, although this level of competency is seldom achieved within a standard 3-year GI fellowship.

An important consideration in using benchmarks such as cannulation rates to gauge competency is the inherent difficulty of the attempted procedures. In a single-center study, Schutz and Abbot developed a grading scale for ERCP based on difficulty. A modification of this score was adopted by the ASGE as part of their quality-assessment document and is shown in Table 1.

How many cases will trainees need to achieve this level of competency? While it is well recognized that fellows learn at different rates, seldom can trainees achieve adequate selective cannulation rates even after 200 procedures. It is also important for training directors to realize that there can be considerable variation in how much of each procedure logged by a fellow was actually performed independently by the fellow. Where possible, trainee logbook records should specify particular skills completed by the fellow (cannulation, sphincterotomy, stent placement, tissue sampling), as well as indicate complete cases that the trainee performed without assistance. Emphasis should be made within programs that documented achievement of defined threshold standards (eg, cannulation rates) and not only case numbers will form the primary basis for credentialing.

Threshold numbers of ERCP procedures that must be performed by trainees for credentialing were published in the Gastroenterology Core Curriculum in 1996. This document indicated that fellows had to complete 100 ERCPs, including 25 therapeutic cases (20 sphincterotomies and 5 stent placement cases). It should be emphasized that these numbers represent the minimum number of supervised cases that must be completed before competency can be evaluated. The ASGE credentialing guidelines clearly state that a trainee is not considered competent simply by reaching this threshold, and the limited objective published data indicate that most trainees are not competent at this number of procedures. Subsequent ASGE guidelines for advanced endoscopic training state that most fellows require at least 180 cases to achieve competency, with at least half of these cases being therapeutic.

All trainees require some exposure to ERCP to develop an understanding of the diagnostic and therapeutic role of the procedure, including indications, contraindications, and possible complications. This exposure is generally accomplished within the context of a 3-year gastroenterology fellowship training program. However, this level of exposure alone does not confer procedural competence. There is no consensus as to how many cases or how many months of rotation on an ERCP service should be necessary to gain a satisfactory exposure for individuals not intending to perform ERCP.

The decision by a program as to whether to train one or more fellows each year to achieve sufficient

TABLE 1. ERCP Degree of Difficulty Grades*

	Biliary procedures	Pancreatic procedures
Grade 1	Diagnostic cholangiogram Biliary brush cytology Standard sphincterotomy ± Removal stones <10 mm Stricture dilation/stent/NBD for extrahepatic stricture of bile leak	Diagnostic pancreatogram Pancreatic cytology
Grade 2	Diagnostic cholangiogram with BII anatomy Removal of CBD stones > 10 mm Stricture dilation/stent/NBD for hilar tumors or benign intrahepatic strictures	Diagnostic pancreatogram with BII anatomy Minor papilla cannulation
Grade 3	SOM Cholangioscopy Any therapy with BII anatomy Removal of intrahepatic stones or any stones with lithotripsy	SOM Pancreatoscopy All pancreatic therapy, including pseudocyst drainage

NBD indicates nasobiliary drain; BII, Bilioth II; CBD, common bile duct.

*Reference: Johanson JF, Cooper G, Eisen GM, et al. Quality assessment of ERCP. Endoscopic retrograde cholangiopacreatography. *Gastrointest Endosc* 2002;56:165-9.

This table is modified from the grading system proposed by Schutz. Schutz SM, Abbott RM. Grading ERCPs by degree of difficulty: a new concept to produce more meaningful outcome data. *Gastrointest Endosc* 2000;51:535-9.

competency will depend in some measure on the volume of ERCPs performed at the institution and the availability of experts in ERCP to supervise the training of fellows. With data from Jowell et al to suggest that well over 200 cases are required for most trainees to consistently cannulate the desired duct, programs with a limited case volume will have to weigh their training objectives with what is feasible. For example, with an annual volume of 400 cases and 3 fellows, it would be reasonable to have 1 fellow perform 300 or more cases and provide the other 2 with only an exposure to ERCP, rather than have all 3 individuals share the cases equally, with a low likelihood that any would reach competency by the end of the fellowship.

Trainees who elect to pursue additional training in ERCP to attain procedural competence should have completed at least 18 months of a standard gastroenterology training program (as per the Gastroenterology Core Curriculum). The minimum duration of training required to achieve advanced technical and cognitive skills is usually 12 months. This period of advanced training may be incorporated into the standard 3-year fellowship program or may be completed during an additional year dedicated to advanced endoscopic procedures. Those interested in pursuing advanced endoscopic training are referred to the ASGE Guideline on Advanced Training Programs.

III. PERIPROCEDURE MANAGEMENT

A. Preprocedure management fund of knowledge and risk assessment

Technical competence in ERCP must be acquired in association with the cognitive aspects of pancreaticobiliary disease. In addition, the trainee should have a thorough knowledge of the anatomy and physiology of the pancreas and the biliary tree, including common variants in anatomy. The trainee should also have a detailed understanding of indications; contraindications; complications; and issues of informed consent, patient education, sedation, antibiotic prophylaxis, and anticoagulation management. Ideally, these issues should be addressed with the trainee during the initial patient encounter before the procedures are scheduled.

Given the technical and cognitive demands of the procedure, a demonstrated proficiency with the technical and cognitive skills associated with other endoscopic procedures, such as upper endoscopy and colonoscopy and their periprocedural management are important prerequisites. Full reviews of these topics are beyond the scope of this document but are covered in ASGE guidelines referenced, and are also available on the ASGE Web site (www.asge.org).

Trainees should be taught about the complications of ERCP and the rates at which they occur. These

TABLE 2. Complications of ERCP*

Complication	Rate	Prevention and/or management
Pancreatitis	5%-7%	Avoidance of ERCP for equivocal indications; use of temporary pancreatic stent in high-risk situations
Postsphincterotomy hemorrhage	1%-2%	Withholding anticoagulation for up to 3 d after sphincterotomy; endoscopic therapy; angiography (rare); surgery (rare)
Cholangitis	<1%	Obtaining complete and successful biliary drainage
Perforation	<1%	Meticulous sphincterotomy technique; endoscopic therapy and antibiotics for localized post-ES or wire perforation; surgical management for luminal perforations; early recognition is key to good outcome
Sedation related	Minor (transient hypoxemia, hypotension) 5%–10%; major (aspiration, cardiac arrest, death) 0.03%–0.5%	Use of supplemental oxygen; use of electrocardiogram in selected cases; reversal agents; consider anesthesiology-assisted sedation in patients with higher American Society of Anesthesiologists (ASA) classification and/or hemodynamic instability

*References

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complications include but are not limited to pancreatitis, bleeding, infection (biliary or pancreatic), oversedation/respiratory compromise, perforation, impacted devices, and other complications that can occur during upper endoscopy.

The most common adverse events associated with ERCP and their frequencies are summarized in Table 2.

The importance of proper patient selection must be emphasized, because this will lead to the avoidance of marginally indicated procedures, especially in higher-risk patients, by using alternative imaging techniques, eg, MRCP. It is equally important for the trainee to recognize what indications for ERCP carry a higher risk for complications and ensure that appropriate informed consent when reviewing these risks has been obtained.

The trainee should be able to provide informed consent in terms understandable to the patient. The development of good skills in communicating with patients is an extremely important part of training. The preprocedure discussion with patients can be essential in relieving patient

anxiety and improving the fellow's understanding of the indications and objectives of the planned intervention.

Finally, trainees should understand that a candid appraisal of one's own abilities is not a sign of weakness and that one way to avoid ERCP-related complications may be to send selected patients elsewhere where special expertise might be available.

B. Patient consideration and physician behavior during ERCP

Maintenance of patient comfort, dignity, and privacy are of paramount importance during ERCP. These principles are best taught by example, supplemented with feedback.

During the procedure itself, communication between the endoscopist and assistants is essential for patient comfort and safety, but these skills may be underdeveloped by the early trainee focused on the technical aspects of the procedure.

As with upper and lower endoscopy, conscious sedation must also be mastered by trainees. The published

ASGE guidelines are an important resource for this aspect of training. Special consideration must be given to choosing the proper method to sedate patients for ERCP. The procedure generally takes longer to complete than standard upper or lower endoscopy and may need to be performed in patients acutely and severely ill with cholangitis or severe pancreatitis. In addition, because patients are generally placed in a prone position, the airway can be difficult to manage. As such, the endoscopist should carefully consider the patient's overall clinical status and determine the need for the assistance of an anesthesiologist and/or endotracheal intubation.

Special emphasis should be paid to the technical aspects of the procedure to minimize the risk of post-ERCP complications such as pancreatitis, bleeding, and infection. This includes minimizing pancreatic injection/instrumentation, efficient cannulation, and the placement of pancreatic stents in high-risk cases. Other examples would be efforts to minimize bleeding by planning to perform balloon dilation rather than sphincterotomy in patients at high risk for bleeding, eg, individuals with advanced cirrhosis, and to consider stent placement in acute cholangitis rather than making prolonged efforts to remove a stone.

C. Postprocedure management

After ERCP, communication of findings, therapeutic results, and a plan for follow-up must be emphasized to the trainee as an extremely important phase of the procedure. This involves both discussions with the patient and effective communication to the referring health professional. The importance of complete procedure reporting cannot be overemphasized, and the need to use accepted nomenclature to describe findings must be imbued in the trainee. Trainer and trainee alike should use the accepted minimum standard terminology in their computerized procedure reporting system or dictated reports, when possible, to foster standardization of reporting and data collection throughout the endoscopic community.

D. Recognition and management of complications

The risk of complications for ERCP is higher than for upper and lower endoscopy, and some complications, such as pancreatitis, cholangitis, and postsphincterotomy hemorrhage, are unique to the procedure. Severe complications, such as acute pancreatitis and cholangitis, may not clinically manifest for several hours. The trainee should be taught to recognize these complications and to manage them appropriately when they occur.

E. Teamwork

ERCP training directors should emphasize the importance of teamwork in preprocedure planning, during the procedure itself, and in postprocedure management. Fellows need to learn to work with surgeons and with imag-

ing and interventional radiologists, and to appreciate the essential contributions made by nursing, radiologic, and technical staff.

IV. BASIC TECHNIQUES

A. Passage of the duodenoscope and evaluation of the upper-GI tract

Trainees must gain proficiency in passing the duodenoscope through the upper-GI tract into an adequate position to perform ERCP. To do this, they must develop mastery of the various ranges of motion by using the endoscope dials, scope torque, and body movement. In addition, the importance of a thorough visual examination of the upper-GI mucosa and recognition of abnormal findings via the duodenoscope should be emphasized. Along with this, the proper use of fluoroscopy during this part of the examination should be taught. This may include the value of obtaining an initial spot film or at least by using fluoroscopy before contrast injection to look for any radio-opaque structures, contrast in the intestine, etc.

i. Esophageal intubation: Only a trainee who demonstrates competence at esophageal intubation with the forward-viewing gastroscope should attempt esophageal intubation with the side-viewing duodenoscope. The trainee should be able to visualize and pass the standard laryngopharyngeal landmarks. It is important to point out that the rounded tip of the duodenoscope may enter a Zenker's diverticulum or a deep pyriform sinus and that special care needs to be taken to avoid perforation. The trainee should acquire skill in the techniques of esophageal intubation with a duodenoscope in patients positioned prone, semiprone, supine, and those with an endotracheal tube in place.

ii. Traversing the stomach: The trainee must receive instruction on the most efficient method of traversing the stomach, with a focus on minimizing looping of the duodenoscope within the stomach.

iii. Pyloric intubation: The trainer should explain the technique of pyloric intubation with a duodenoscope. This nearly blind maneuver may produce significant anxiety on the part of the trainee, because of the emphasis earlier in training never to pass an endoscope blindly.

iv. Navigating surgically altered GI anatomy: ERCP trainees need to be able to manage patients with surgically altered anatomy. This includes proper preprocedure history taking to identify patients and specific training in techniques of endoscope passage and cannulation in patients who have undergone prior Billroth II gastrectomy, a gastric pull-up, or Whipple resections. ERCP in patients with Roux-en-Y anastomosis should be reserved for individuals receiving tertiary-level training.

B. Proficiency in positioning for cannulation

The importance of proper position of the duodenoscope for successful cannulation should be emphasized

by the trainer. The trainee should learn to achieve a “short” position before attempting cannulation but also understand when a longer scope position is required and how to achieve it.

C. Selective cannulation of the bile and pancreatic ducts

Selective deep cannulation of the intended ductal system is a skill that is difficult to master, even with a normal papilla. Successful cannulation requires coordinated movements of the scope, a catheter, and/or a guidewire. To learn this technique, the trainee will need extensive one-on-one training and should carefully review the references listed below (including both book chapters and training videos).

The trainee should familiarize himself/herself with the various catheters, guidewires, and sphincterotomes available for standard and difficult cannulations, and should develop competence at handling each of the accessories first as the assistant and then as the endoscopist.

The trainee should also acquire the ability to identify a normal papilla in complicated anatomic situations, eg, the presence of a periampullary diverticulum. In addition, the trainee should be able to recognize an abnormal papilla and to understand when a biopsy may be indicated.

Whether in standard or abnormal anatomy, fellows need to understand options for approaching failure to cannulate the desired duct. This would include a subsequent attempt at ERCP at a later date by the same or a second endoscopist, interventional radiologic access with possible rendezvous ERCP techniques, and surgical management, eg, intraoperative cholangiography. Trainees should be expected to make recommendations based on a thorough understanding of the relative merits of each option as well as on the urgency of access based on the particular clinical situation.

D. Cholangiography

The trainee should be familiar with normal biliary anatomy and common anatomical variants. The cholangiogram changes observed in choledocholithiasis, benign and malignant bile-duct strictures, primary sclerosing cholangitis, choledochal cysts, and bile-duct leaks are required knowledge before attempting cholangiography.

Performing contrast injection by oneself is an essential component of ERCP training. The importance of low-pressure injection should be underscored. The trainer should explain the indication and technique of occlusion cholangiography. The trainee should become adept at independent interpretation of the real-time cholangiogram and captured images. This should be facilitated by participation in case conferences with surgeons and radiologists, and by review of radiographs after the procedure with the ERCP instructor.

The trainee should understand the various maneuvers to optimize the fluoroscopic image: adjustments in the position of the duodenoscope, the patient, and the fluoroscopy

equipment to adequately visualize the biliary tree; the use of dilute or undilute contrast; changes in the radiation dose based on patient size; and image magnification.

E. Pancreatography

The trainee should be familiar with normal pancreatic-duct anatomy and common anatomical variants, such as pancreas divisum and annular pancreas. Typical duct changes observed in pancreatic malignancy, chronic pancreatitis, and intraductal papillary mucinous tumors should be studied. Recognition of pancreatic-duct disruption and the associated sequelae of a communicating pseudocyst or a fistula is also important.

The trainee should be well versed in the technique of cholangiography before undertaking pancreatography. Low-pressure injection under continuous fluoroscopic observation is recommended to prevent excessive filling of the pancreatic-duct branches (ie, acinarization). The trainee should become adept at independent interpretation of the real-time pancreatogram and captured images.

As with cholangiography, the trainee should understand the maneuvers available to optimize the fluoroscopic image during pancreatography. The trainee should also learn how to place small-caliber pancreatic-duct stents to prevent pancreatitis after pancreatography in patients at high risk for post-ERCP pancreatitis.

V. TISSUE SAMPLING

During the performance of ERCP, biliary or pancreatic strictures may be encountered. To determine whether the stricture is benign or malignant, tissue sampling is commonly performed under fluoroscopic guidance. Various tissue-sampling techniques include brush cytology, fluoroscopic-guided biopsy, stent cytology, and bile/pancreatic juice aspiration for cytology. The trainees need to be familiar with the indications, techniques, and likelihood of an accurate diagnosis with each technique. Prompt in-room processing of the specimen by placing it into cytology solution or directly putting it onto slides is crucial. This may be performed by the ERCP personnel; alternatively, if a cytotechnologist is present in the ERCP unit, slides may be prepared by the cytotechnologist to optimize the quality of the slides and to aid in subsequent interpretation. It is important for the trainee to understand the importance of the cytologist in this process, because clinical decisions are based on this interpretation. The trainee should be well aware of the limitations of each tissue-sampling technique and the limitations of the cytologic interpretation.

VI. THERAPEUTIC TECHNIQUES

A. Sphincterotomy

Developing competence in endoscopic sphincterotomy is one of the most exciting and challenging aspects for the

trainee in ERCP. Because ERCP has become an increasingly therapeutic rather than diagnostic modality, the instruction of sphincterotomy should be an integral part of ERCP training and a skill the trainee must master before independently performing ERCs. Sphincterotomy should be taught and performed by the trainee only after the trainee has shown proficiency in the above-mentioned basic techniques of ERCP and ductal cannulation. The trainee should have an understanding of the principles of electrocautery that underlie the use of cutting and/or blended current to perform sphincterotomy, and to be aware of the differences in performing sphincterotomy with the various electrosurgical current generators. The trainee should be aware of the differences found with the various types of sphincterotome devices that are available and understand the positive and negative aspects of working over various guidewires during sphincterotomy.

i. Biliary sphincterotomy: Trainees should have an understanding of the indications for performing a biliary sphincterotomy and the technical principles of performing sphincterotomy. Furthermore, they should have a full understanding of the risks of sphincterotomy, such as bleeding and perforation, and the specific patient-, procedure-, and endoscopist-related factors that influence risk. They should be aware of alternatives to sphincterotomy in certain clinical situations, such as temporary stent placement and balloon dilation of the sphincter and orifice.

A discussion of the specific techniques of sphincterotomy is available in a number of text and media references provided below and is beyond the scope of this discussion. The importance of good endoscopic position and steady instrument control during the performance of a sphincterotomy needs to be emphasized.

With regard to postsphincterotomy bleeding, fellows need to know when hemostasis is indicated and be able to successfully perform it via the duodenoscope. Particular emphasis should be given to provide trainees with an appreciation for the management of the postsphincterotomy bleeding risk in the patient with ongoing anticoagulation requirements.

The endoscopist should be aware that, in certain situations, it may be appropriate to establish cannulation after first performing an access (pre-cut) sphincterotomy. The trainee should understand the indications for this procedure, its increased risks, and potential benefits. The access sphincterotomy can be performed in a variety of ways with several types of accessories that include different types of needle-knife devices and techniques. Trainees should also be aware of the option of rendezvous techniques of obtaining deep biliary access by using percutaneous transhepatic cholangiography.

The trainee should be aware of the potential benefit of short-term, pancreatic-duct stent placement to reduce the risk of pancreatitis in patients who require a needle-knife-access sphincterotomy. This procedure is

potentially dangerous in inexperienced hands but can be performed safely by skilled endoscopists. Trainees should be instructed in needle-knife sphincterotomy only after they have shown a proper understanding of biliary anatomy and displayed adequate cannulation skills and skills in standard biliary sphincterotomy. It should not be viewed as a way to compensate for inadequate cannulation skills.

ii. Pancreatic sphincterotomy: The trainee should be aware of the indications for this procedure and have an understanding of the additional challenge and potential risks associated with it. The trainee should have knowledge of the technical differences in performing pancreatic sphincterotomy as opposed to biliary sphincterotomy. They should also be aware of the potential benefit of short-term, pancreatic-duct stent placement after pancreatic sphincterotomy to reduce the risk of pancreatitis. The trainee should be aware of the indications for and various techniques in performing minor papilla papillotomy/sphincterotomy.

Most therapeutic pancreatic endotherapies should be reserved for advanced trainees who have mastered biliary therapeutic techniques. Furthermore, minor papilla cannulation and sphincterotomy should be limited to trainees who have already demonstrated adequate proficiency with biliary and pancreatic sphincterotomy of the major papilla.

B. Dilation

Dilation of the biliary or pancreatic sphincter by using hydrostatic balloons is an available technique to perform therapy (usually stone retrieval) in the biliary or pancreatic ducts in highly selected situations. The trainee should be aware of the controversies surrounding this technique, specifically with regard to the potential risk of pancreatitis.

Dilation is more commonly performed within the bile or pancreatic ducts to treat strictures. The procedure can be performed with either dilating catheters with increasing diameters passed over a guidewire or with hydrostatic, wire-guided balloons. The trainee should understand indications for dilation of biliary and pancreatic strictures and basic techniques in performing either catheter or balloon dilation.

C. Stent placement

The trainee should understand the importance of providing adequate drainage after contrast injection in cases of obstruction, the indications for stent placement, and the different types of stents available. Currently, stents are composed of either plastic or metal materials. The trainee should understand the importance of properly selecting the appropriate type, size, and length of stent for a given situation. The trainee must also understand the endoscopic techniques required for optimal stent placement and know that the technique for placement will vary with the type of stent used. Familiarity with the technique of nasobiliary drain placement is also

recommended. With the possible exception of prophylactic placement of small-diameter stents to prevent post-ERCP pancreatitis, most pancreatic-stent placements will be performed by advanced trainees.

D. Extraction techniques

Stone extraction has remained a major indication for ERCP. The procedure can be performed by using balloons or baskets, and may occasionally require the use of mechanical, electrohydraulic, or laser lithotripsy. However, these latter 2 techniques will generally be reserved for more advanced trainees and practitioners. The technical aspects of biliary-stone extraction should be mastered by the trainee. The risks of impacting a stone or a basket/stone combination at the ampulla should be emphasized to the trainee.

It is essential that any trainee intending to perform basic ERCP be competent to extract stones as well as perform rescue mechanical lithotripsy in the event of a basket getting stuck on a stone.

The management of pancreatic-duct stones is generally best reserved for the advanced trainee.

VII. DIAGNOSTIC TECHNIQUES FOR ADVANCED ERCP TRAINEES

The diagnostic ERCP techniques listed below may be performed at the time of diagnostic ERCP in select specialty centers. These techniques are complementary to routine ERCP and require additional training after basic ERCP techniques are mastered by the trainee. The trainee should understand that these techniques will be taught in specialized centers with a high volume of ERCP and will be taught by faculty accomplished in these techniques. To receive training in these techniques, the trainee should seek out specialized advanced ERCP training upward of 12 months in duration.

A. Sphincter of Oddi manometry

At the time of ERCP, definitive measurements of sphincter of Oddi pressures can be obtained with sphincter of Oddi manometry (SOM). SOM is an advanced technique with a high degree of difficulty and should only be performed by dedicated trainees who commit time to learning the technical and cognitive aspects of sphincter manometry. The trainee should be aware that the patient population that presents with unexplained disabling pancreatobiliary-type pain with or without abnormalities in liver function tests or amylase/lipase comprises a high-risk population for post-ERCP pancreatitis, in some studies approaching 30%. Patients undergoing ERCP with SOM must be fully informed of the higher risk in this patient population. Before embarking on SOM, the trainee must exhibit a thorough understanding of the manometry system used and must be familiar with the accurate inter-

pretation of the pressure tracing. In addition, SOM has specific issues regarding sedation, and these considerations need to be understood.

B. Cholangioscopy and pancreatoscopy

Direct visualization of the biliary and pancreatic ductal system with thin-caliber endoscopes that measure 8F to 10F in diameter is technically possible. The frequent use of this technique has been hampered by suboptimal imaging and the fragile nature of the cholangiopancreatoscopes. With the development of thinner, more durable scopes capable of digital imaging, the visualization of the ductal system has markedly improved. Increased application of this technique by the advanced ERCP endoscopist is anticipated. The trainee should understand the potential applications of this advanced technique in indeterminate biliary and pancreatic strictures, localization of intraductal papillary mucinous tumors of the pancreas, and direct visualization of bile-duct stones to allow for fragmentation by electrohydraulic lithotripsy. Advanced training in direct cholangioscopy and pancreatoscopy would require excellent skills in the performance of ERCP and in the interpretation of pancreatobiliary imaging.

C. Intraductal US

Intraductal US is a relatively new technique that is being used by the ERCP endoscopist in the evaluation of patients with biliary and pancreatic strictures indeterminate for malignancy. The device consists of a thin probe inserted through the working channel of the ERCP scope over a guidewire and advanced under fluoroscopy into the stricture to be interrogated. Real-time radial US images are obtained by the 20-MHz transducer to view the tissues in the immediate vicinity of the stricture. This technique will undoubtedly be limited to high-volume tertiary referral centers specializing in ERCP and EUS. Training in intraductal US would require excellent ERCP skills and the added understanding of the generation and interpretation of US imaging.

VIII. THERAPEUTIC TECHNIQUES FOR ADVANCED ERCP TRAINEES

Therapeutic ERCP techniques listed below may be performed at the time of ERCP in select specialty centers. These techniques are complementary to routine ERCP and require additional training after basic ERCP techniques are mastered by the trainee. The trainee should understand that these techniques will be taught in specialized centers with a high volume of ERCP and taught by faculty accomplished in these techniques. To receive training in these techniques, the trainee should seek out specialized advanced ERCP training upward of 12 months in duration.

A. Complicated bile-duct stone management: mechanical, electrohydraulic, laser, and extracorporeal shock-wave lithotripsy

Specialized stone-management procedures include mechanical lithotripsy, laser lithotripsy, electrohydraulic lithotripsy, and extracorporeal shock-wave lithotripsy (ESWL). Trainees should become familiar with the indications for, and the limitations of, each of these techniques. Mechanical lithotripsy should be considered part of the armamentarium of any biliary endoscopist and should be taught to any fellows learning basic ERCP skills. The other more-advanced techniques are best reserved for fellows at high-volume centers during third-tier training. While ESWL is not usually performed by the endoscopist, the advanced trainee needs to know when to incorporate this modality in patient management.

B. Pancreatic-duct stone and stricture management

Trainees should understand the sequelae and findings of chronic pancreatitis. They should be familiar with the indications and techniques of endoscopic management of pancreatic-duct stones and strictures, including the use of ESWL, which is often required for the removal of pancreatic-duct stones. The importance of coordinating management decisions and care with radiologists and surgeons is essential for such patients, and this team approach must be emphasized during training. Most pancreatic endotherapies, including pancreatic sphincterotomy, should be reserved for advanced trainees, usually at high-volume tertiary centers.

C. Pseudocyst drainage

The trainee should be cognizant of the natural history of pseudocysts and the importance of other coexisting pancreatic pathology, such as duct leaks/pancreatic-duct disruption, pancreatic strictures, and stones, and understand the role for ERCP to define pancreatic ductal anatomy. The trainee should understand the risks, as well as the technique of endoscopic pseudocyst drainage by either the transpapillary or transmural route. Indications for drainage, as well as contraindications for drainage must be understood along with the technical aspects of the procedure. The trainee should understand the role of EUS in the characterization of the pseudocyst before transmural drainage at ERCP and the potential therapeutic role of EUS drainage for pseudocysts without luminal impaction. The role for surgical and percutaneous management of pseudocysts should also be understood.

D. Ampullectomy

The trainee should be aware of the appearance of ampullary neoplasms, which can range from a small villiform lesion, with or without involvement of the vertical fold, to a large fungating mass. The advanced ERCP trainee must

be able to weigh the therapeutic options, including stent placement, sphincterotomy, ampullectomy, and surgery. They should recognize that ampullectomy is generally not indicated in the setting of cancer. Ampullectomy should be reserved for the experienced endoscopist who should consider the role of biliary and pancreatic sphincterotomy, as well as the role of pancreatic-duct stent placement during or after resection.

E. Miscellaneous: photodynamic therapy, brachytherapy, minor papilla therapy, needle-knife sphincterotomy, and rendezvous techniques

Trainees should be taught about the role of specialized procedures, such as brachytherapy and photodynamic therapy as an adjunct to the conventional management of pancreaticobiliary malignancies.

Certain diagnostic and therapeutic ERCP procedures require considerable expertise before fellows can safely attempt to learn how to perform them. These would include entry cut techniques for biliary access by using instruments, for example, a needle knife, and diagnosis and therapy of the minor papilla.

In some cases, especially when a biliary T-tube is already present or when a percutaneous biliary drain is in place, a so-called rendezvous procedure may be useful to effect additional therapy. Safety considerations and techniques of guidewire passage should be taught. Fellows should be trained to recognize that the presence of indwelling biliary drains represents an opportunity for the endoscopist and not an impediment. Instructors should demonstrate, by example, that complex biliary cases are sometimes best managed by fostering a team approach in concert with interventional radiology and surgery. Effective communication with surgical and radiologic counterparts should be emphasized to the trainee.

IX. RADIATION SAFETY

Fluoroscopy is a necessary component of ERCP that exposes the patient, the endoscopist, and the assistant to electromagnetic radiation. The trainee should be aware of the possible deterministic and stochastic effects of ionizing radiation exposure and realize the main defense is by practicing the ALARA (as low as reasonably achievable) principle with respect to radiation dose. The effect of multiple fluoroscopic procedures is additive, and it is essential to obtain a history of any recent fluoroscopic procedures.

Trainees should ensure that the patient is shielded; special consideration is necessary when performing ERCP on a pregnant patient. Trainees should understand and adhere to the proper procedures for personal shielding and monitoring.

Many institutions offer courses in radiation protection and completion should be mandatory for endoscopists who use fluoroscopy.

X. SIMULATORS AND MODELS

Endoscopy simulators can provide trainees with the ability to practice specific ERCP techniques in a controlled environment with ample opportunity for expert feedback and without risk to patients. Simulators may be strictly mechanical devices or may be computer based. In addition, animal models (either in vivo or ex vivo) are sometimes used for training purposes. Work on any of these models is best integrated into a curriculum that incorporates didactic material, demonstration of proper technique, hands-on practice, and expert feedback. Despite the theoretical advantages to simulator-based training, an objective benefit of such activity for ERCP has not yet been demonstrated. It should be emphasized that no amount of training on a simulator or a model alone will confer competence in ERCP or substitute for the performance of supervised real cases. However, hands-on simulator work may supplement the clinical experience provided by the training program. ERCP trainers should be encouraged to gain familiarity by using available models and learn how to teach by using these new methods.

XI. SUMMARY

This ERCP core curriculum was developed as an overview of the key components of the procedure in current practice. While all fellows should have exposure to these techniques, comprehensive ERCP training to a level of competence for independent practice should be limited to programs with sufficient case volume, expertise, and trainee interest. Efforts should be made to record objective measures of competency during the training process.

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ERCP CORE CURRICULUM

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Videotapes

The following videotapes are available as part of the ASGE Endoscopic Learning Library. A portion of each videotape may be viewed online, and purchase information is available at www.asge.org/library or by calling ASGE at 866-353-ASGE (2743).

DV006—Essentials of Therapeutic ERCP:

- Carr-Locke DL. *An Introduction to Therapeutic ERCP* [48:37] [videotape].
- Noar M, Soehendra N, Grimm H, et al. *Endoscopic Therapy of Biliary and Pancreatic Disorders* [34:00] [videotape].
- Monroe P. *Pre-Cut Sphincterotomy* [16:38] [videotape].
- Geenen J, Baillie J. *Endoscopic Sphincterotomy, Stone Extraction, and Biliary Stent Placement* [40:00] [videotape].

DV007—Diagnostic ERCP:

- Kim M-H, Lee S-L. *Duodenoscopic Differentiation of Various Ampullary Lesions* [10:00] [videotape].
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