What Every Radiologist Should Know about Endoscopic Retrograde Cholangiopancreatography: A Pictorial Review

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INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is a procedure that uses endoscopy and commonly fluoroscopy to primarily treat and also to diagnose disease processes associated with the biliary and pancreatic ductal system. With its dependence on real-time image guidance, it helps the inherent risk of radiation exposure. Therefore, it is crucial that radiologists be aware of the technique, indications, and complications of ERCP, which will be discussed in this poster presentation.

CLINICAL INDICATION

According to the American Society of Gastrointestinal Endoscopy (ASGE), indications for ERCP include:

- Jaundice thought to be the result of biliary obstruction
- Clinical and biochemical imaging suggestive of pancreatic or biliary tract disease
- Signs or symptoms suggesting pancreatic malignancy when direct imaging results are equivocal or normal
- Pancreatitis of unknown etiology
- Peroperative evaluation of chronic pancreatitis or pancreatic pseudocyst
- To achieve access to and throughout the biliary/pancreatic ductal system
- Always monitor patient’s cumulative radiation dose during ERCP and record
- Review of imaging studies
- Following cannulation of the ducts, contrast (usually non-ionic low osmolarity) sparingly,
- Access to the bile duct to recover migrated stents, facilitate combined
- Preoperative evaluation of chronic pancreatitis or pancreatic pseudocyst
- Pancreatic therapeutics
- Transenteric pseudocyst drainage
- Pseudocyst drainage in appropriate cases
- Clinical and biochemical or imaging data suggestive of pancreatic or biliary

CASE 4: PANCREATIC ADENOCARCINOMA

Pancreatic adenocarcinoma is a malignant tumor derived from ductal epithelia. Pancreatic carcinoma is the fourth leading cause of cancer-related death in the United States with pancreatic ductal adenocarcinoma representing 90% of all pancreatic neoplasms. Individuals 60-70 years of age are most commonly affected.

CASE 3: CHOLEDOCHOLITHIASIS

Cholelithiasis refers to the presence of gallstones within the common bile duct. It has been estimated that 75-80% of patients with gallstones will have choledocholithiasis at the time of cholecystectomy, with the incidence increasing with age. Symptoms associated with choledocholithiasis include right upper quadrant pain, nausea, vomiting, and jaundice. Choledocholithiasis is not seen with typical biliary colic. Complications of choledocholithiasis include acute pancreatitis and acute cholangitis. Patients with chronic disease are believed to increase the risk of cholangiocarcinomas. Transabdominal imaging is first-line imaging modality. Patients at low risk for having common bile duct stones and with direct cholangiography generally proceed to ERCP which is the “gold standard” for diagnosis and therapeutic with stone removal.

CASE 2: CAROLI DISEASE

Caroli disease is a congenital disorder characterized by multilocal, segmental dilatation of large intraductal bile ducts. Pathogenesis not completely understood, it is characterized by bile ducts that are less common in bile ducts than in bile ducts with a normal common bile duct. Treatment is largely supportive, although biliary decompression and surgery, is warranted for select patients.

ERCP TECHNIQUE (CONT)

Real-time image guidance for ERCP is most commonly provided by fluoroscopy. Although the risk injury is low, deterministic effects (including skin burns and cutaneous formation) and stochastic effects (increased risk of cancer) can be reduced by certain modifications to the procedure. These include a list of guidelines designed to reduce radiation exposure:

- Limiting fluoroscopic time is the most direct dose reduction technique.
- Use of low-dose fluoroscopy modes should be avoided whenever possible.
- Dose modulation fluoroscopy mode with a low frame rate is generally the best selection for dose reduction.
- The location of the patient relative to the x-ray tube and image receptor also affects radiation dose levels. Therefore, providers should place the patient as far away as possible from the x-ray tube and as close as possible to the image receptor.
- Use the collimator to shield the area of interest.
- Use magnification modes sparingly, since increase in magnification will increase the dose rate.
- Always monitor patient’s cumulative radiation dose during ERCP and record in patient medical record.

CASE 1: INTRADUCTAL PAPILLARY NEOPLASM (IPMN)

Intraductal papillary neoplasm (IPMN) is defined as an endoluminal proliferation of mucin-producing neoplastic cells arranged in papillary formations. Duct dilatation is also noted (yellow arrow), compatible with “double duct” sign. The mass was proven from performance of endoscopic sphincterotomy the duodenal head (red arrow). The mass was proven resection head (red arrow). Reformat shows saccular dilatation of the intrahepatic ducts (purple arrow) in the right hepatic lobe. Typical presentation includes pain, jaundice and weight loss. Unfortunately, the diagnosis of Pancreatic ductal adenocarcinoma is a malignant tumor derived from ductal epithelia. Pancreatic carcinoma is the fourth leading cause of cancer-related death in the United States with pancreatic ductal adenocarcinoma representing 90% of all pancreatic neoplasms. Individuals 60-70 years of age are most commonly affected.

ERCP TECHNIQUE

Prior to initiating the procedure sedation medication (usually meperidine) will be given.

The patient is then typically placed either prone or left lateral decubitus position and may be adjusted throughout the procedure to facilitate passage of the endoscope.

Next the endoscopist must decide which type of endoscope to use. For ERCP the most commonly used endoscope is the duodenoscope which has a side viewing capability that facilitates visualization within the more vertically oriented 2nd portion of the duodenum.

While the duodenum the major and minor papilla need to be identified to determine the best technique for ductal cannulation as well as the extent of sphincterotomy if one is to be performed. If the papilla are not readily identified a number of endoscopic maneuvers as well as glucagon (decreases duodenal motility) may be used to facilitate identification.

To achieve access to and throughout the biliary pancreatic ductal system a number of imaging equipment has been developed including a variety of endoluminal devices, guidewires, and stent catheters (used to access sphincter). The catheter or guidewire is generally placed inside the lumen of the endoscope then can be used for cannulation of the biliary tract.

The most common specific complications of ERCP include:

- Pancreatitis. Pancreatitis is the most common serious complication of ERCP and occurs in roughly 1%. It is usually mild and self-limited.
- Hemorrhage (most commonly related to sphincterotomy).
- Perforation of viscus.
- Infection including cholangitis and septicemia.
- Cardiac and pulmonary complications such as aspiration, arrhythmia, and hypoxemia.

COMPLICATIONS

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RADIATION SAFETY ASPECT OF ERCP

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EVALUATION OF PATIENT

- History and physical examination
- Laboratory: complete blood count, coagulation panel, fasting glucose, and pregnancy test when appropriate, and ECG
- Review of imaging studies

PERI-OPERATIVE PATIENT PREPARATION

- Informed consent
- Patient must be NPO for at least 8-9 hours
- Use of prophylactic antibiotics recommended for the following clinical scenarios:
  - Predicted incomplete biliary drainage (e.g., Klatskin tumor or primary sclerosing cholangitis)
  - Acute incomplete biliary drainage
  - Immunosuppression, particularly post liver transplantation
  - Communicating pancreatic pseudocyst
  - Transient pancreatitis
  - Anticoagulants should be held while other medications may be taken with a sip of water per normal routine.
  - Patients on insulin will need proper dose adjustment to reflect duration of time without meals.

Fluoroscopy should never be activated unless the operator is looking at the image display.

Loose dose fluoroscopy modes should be avoided whenever possible.

Lung dose fluoroscopy mode with a low frame rate is generally the best selection for dose reduction.

The location of the patient relative to the x-ray tube and image receptor also affects radiation dose levels. Therefore, providers should place the patient as far away as possible from the x-ray tube and as close as possible to the image receptor.

Use the collimator to shield the area of interest.

Use magnification modes sparingly, since increase in magnification will increase the dose rate.

Always monitor patient’s cumulative radiation dose during ERCP and record in patient medical record.

TAKE-HOME POINTS

- ERCP is now a primarily therapeutic procedure for the management of pancreatic-biliary disorders.
- Critical question for the strength of the indication for ERCP is the first step in planning for the procedure.
- The endoscopist must be properly trained in ERCP
- Review of other imaging studies is often helpful in planning the case.
- The risk for critically relevant bleeding at ERCP is almost entirely derived from performance of endoscopic sphincterotomy.
- Major adverse effects of ERCP include: Pancreatitis, hemorrhage, perforation, cholangitis, choledocholithiasis and non-related adverse event.
- The endoscopist should be aware of radiation dose effects on the patient and personnel working in the fluoroscopy suite.

REFERENCES

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